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## GEOGRAPHY/SOILS 526: HUMAN TRANSFORMATIONS OF EARTH SURFACE PROCESSES

Schedule: Mondays and Wednesdays 2:30-3:45 pm in Science Hall 350

Credits: 3

Counts toward the Natural Science requirement

Instructor: Prof. Erika Marín-Spiotta, marinspiotta@wisc.edu

Office Hours: Tuesdays 4-6 pm; Wednesdays 12-1 pm and by appointment

### **SYNOPSIS**

This course takes an earth systems approach to explore the role of human societies in shaping earth surface processes from local to global scales. We address how alterations to our landscapes and waterways affect biological, physical and chemical interactions among our biosphere, geosphere, hydrosphere and atmosphere. We discuss methods used to distinguish the "human impact" from background variability.

### **FULL COURSE DESCRIPTION**

The influence of human activities is now recognized to extend all over the globe, which has led some researchers to propose renaming our current geologic epoch the Anthropocene, for the "Age of Humans." This course takes an earth systems approach to explore the role of human societies in shaping earth surface processes. We address how alterations to our landscapes and waterways affect biological, physical and chemical interactions among our biosphere, geosphere, hydrosphere and atmosphere. In particular, we focus on the methods use to distinguish the "human impact" from background variability. Topics covered include: approaches to understand earth system interactions, major alterations to biogeochemical cycles and geomorphic processes, biophysical consequences of changes in land cover and land use, urban biogeochemistry, and emergence of novel environmental conditions. For each topic, we delve into the biophysical science behind each relevant process and discuss different approaches for characterizing and quantifying changes due to human activities. We explore the recent literature to evaluate how biogeochemical and earth system models incorporate human influences to better understand feedbacks between the earth surface, atmosphere and climate.

### **COURSE GOALS**

- (1) To understand how major global biogeochemical cycles and geomorphic processes have changed due to human activities;
- (2) To identify positive and negative feedbacks among the biosphere, geosphere and atmosphere at different spatial and temporal scales; and
- (3) To learn different methods used to characterize and quantify human effects on the earth system.

### **DELIVERABLES**

The final products for this course will be:

- (1) an annotated bibliography;
- (2) an opinion to the editor essay;
- (3) a methods tool-box; and
- (4) a research pre-proposal (graduate students only).

### **READINGS**

All required readings will be posted on Learn@UW. There is no required textbook for this course.

Supplementary texts (on reserve in the Geography library, Science Hall 2nd floor):

Cornell et al. (eds). Understanding the Earth System: Global Change Science for Application. Cambridge University Press.

Jacobson et al. (eds). 2000. Earth System Science: From Biogeochemical Cycles to Global Change. Academic Press.

Schlesinger and Bernhardt. 2013. Biogeochemistry: An Analysis of Global Change, Third Edition. Elsevier, Inc.

Tips on How to Read a Scientific Paper

<http://cbc.arizona.edu/classes/bioc568/papers.htm>

**COURSE POLICY:**

This course has a large in-class discussion component and I expect you to attend all class meetings and come prepared to ask questions, share your reactions and engage in the conversation. Forty-six percent of your grade is based on coming to class, completing the readings to answer the quizzes and participating in discussion. Please respect your fellow students, professor and guest speakers and turn off the ringers on your cell phones and refrain from texting during class time. Only class-related internet and computer use is allowed during the class period. There will be no extra credit.

**EVALUATION:**

- Discussion facilitation #1: 15 points
- Discussion facilitation #2: 15 points
- In-class quizzes (six): 5 points each for a total of 30 points
- Op-Ed essay: 25 points (10 points first draft and 15 points final draft)
- Peer-review #1 of Op-Ed: 2.5 points
- Peer-review #2 of Op-Ed: 2.5 points
- Methods tool-box: 40 points (10 points outline and 30 points final)

**Undergraduate Students:** 130 points total.

**Graduate Students:** Total of 170 points. All of the above plus:

- Pre-proposal: 30 points (5 points for the outline, 10 points first draft and 20 points final draft)
- Peer-review of pre-proposal: 5 points

Final letter grades will be determined out of 100 % following these guidelines: (A (100-93); AB (92-88), B (87-81), BC (81-78), C (77-70), D (69-60), F ( $\leq$  59)).

**1. Participation**

- Discussion: Every week, you are expected to read all the assigned readings prior to class and to think about them critically in preparation for participation in class discussions.
- Written discussion questions: By 5 pm the day prior to each class, you will be responsible for posting one question on the discussion board to help steer the discussion.

**2. Discussion Facilitation (15 points each):** Each student will lead two class discussions in pairs. Leaders will prepare an introduction to the paper topics and summarize required readings, addressing appropriate questions that the other participants will have posted on the discussion board. You may use activities to help promote deeper understanding of the material being explored.

- **Annotated bibliography:** One of the products of this seminar will be an annotated bibliography. Discussion facilitators will be responsible for writing (in your own words- do not just rewrite the paper abstract) an abstract for each assigned paper *the day you lead seminar discussion only*. At the end of the semester, abstracts for each weekly topic will be compiled and shared with the rest of the seminar participants. Abstracts should be around 100 words and provide a brief review of the major themes and/or questions brought up in the reading. The abstract should distill the main ideas of the paper. All reading summaries are due on Monday, May 2<sup>nd</sup> although I encourage you to submit them while the papers are still fresh on your mind.

**3. Op-Ed essay (25 points):** Choose a venue (magazine, newspaper, blog) and write a short essay (500-600 words only). I will hand out separate writing guidelines for the op-ed.

- First draft (10 points) due on Wednesday, March 9<sup>th</sup>.
- Final draft (15 points) and presentations due on Monday, April 4<sup>th</sup>.

**4. Peer-Review of Op-Ed essay (2.5 points each):** Each op-ed essay will be peer-reviewed by two other class participants. Reviews are due on Wednesday, March 16<sup>th</sup>.

**5. Methods Tool-box (40 points):** Compile an annotated list of methods (experimental, observational, inferential, modeling...) from different disciplines to compare and contrast approaches. We will discuss this project in more detail.

- Outline (10 points) due on Monday, February 29<sup>th</sup>.
- Presentations in class on Wednesday, April 27<sup>th</sup>.
- Final draft (30 points) due on Wednesday, May 4<sup>th</sup>.

**6. Quizzes (30 points total):** We will have six in-class quizzes, each worth 5 points, to test understanding of concepts discussed in the readings and in class. These will occur during class-time every two weeks or so as noted on the schedule and will consist of short answer essays, multiple-choice questions or interpretation of a figure. There are no full-length examinations and there will be no exam during finals week.

#### **GRADUATE STUDENTS:**

**7. Pre-proposal:** Write a 5-page (single-spaced) pre-proposal to fund research on a topic related to the course. Please consult your final topic with me. I will hand out writing guidelines for the pre-proposal.

- Outline (5 points) due on Monday, March 28<sup>th</sup>.
- First draft (10 points) due on Monday, April 11<sup>th</sup>.
- Final draft (20 points) due on Monday, May 2<sup>nd</sup>.

**8. Peer-Review of Pre-proposal (5 points):** Each pre-proposal will be peer-reviewed by one other class participant. Due on Monday, April 18<sup>th</sup>.

#### **COMMENTS:**

At the beginning of each class period I will devote time for questions on any material from previous class meetings. I expect you to let me know if any of the material is confusing either in person before or after class, by email or in my office hours. Comments are welcome at any time. I encourage you to come to office hours. Anecdotal evidence suggests that asking questions in class and coming to

office hours helps students assimilate course material. Please let me know in person or via email if you need any special accommodations throughout the semester. I'm happy to work with you to make this a productive learning experience.

**ACADEMIC INTEGRITY:**

Academic honesty requires that all course work a student presents to an instructor honestly and accurately indicates the student's own academic efforts. Please review the university's guidelines on proper conduct: <http://students.wisc.edu/saja/misconduct/UWS14.html>

Some examples of academic misconduct include: cutting and pasting text from articles or from the web without quotation marks or proper citation and paraphrasing without crediting the source. When in doubt about how to properly cite something, come talk to me.

**ADDITIONAL CAMPUS RESOURCES FOR STUDENTS:**

- McBurney Disability Resource Center. I am happy to work with students who need additional accommodations. <http://www.mcburney.wisc.edu/>
- Multicultural Student Center. The MSC exists to make sure students of all backgrounds are successful at UW. <https://msc.wisc.edu>
- Greater University Tutoring Service. See their homepage to inquire about individual tutors/general tutoring sessions - <http://guts.studentorg.wisc.edu/>
- UW Writing Center. See their website for information about drop-in or scheduled appointments with expert writers. They will help with just about any type of writing assignments/needs - <http://www.writing.wisc.edu/>
- L&S Student and Academic Affairs. See their website for issues regarding medical absences and other emergencies that may affect your ability to attend courses and complete coursework - <http://saa.ls.wisc.edu>

**Geography 526**
**Spring 2016 Schedule**

Week				Topics	Readings	Assignments
Jan	20	W	1	<i>Introductory meeting</i>		
	25	M	2	Measuring the Anthropocene	Waters et al. 2016	
	27	W		Critiques of the Anthropocene	Autin and Holbrook 2012; Balter 2013; Ruddiman et al. 2015; Mal and Hornborg 2014	
Feb	1	M	3	Earth systems approach I	Jacobson et al. 2000	
	3	W		Earth systems approach II	Chin et al. 2014	Quiz 1
	8	M	4	Carbon cycle I	WG1AR5_Chapter 6	
	10	W		Carbon cycle II	<a href="http://www.esrl.noaa.gov/gmd/outreach/isotopes/">http://www.esrl.noaa.gov/gmd/outreach/isotopes/</a>	
	15	M	5	Nitrogen cycle I	Jaffe 2000	
	17	W		Nitrogen cycle II	McLauchlan et al. 2007; Baron et al. 2013	Quiz 2
	22	M	6	<i>Methods toolbox workshop</i>		
	24	W		Land-atmosphere interactions I	Friedlingstein et al. 2012 p. 102-108 only	
	29	M	7	Land-atmosphere interactions II	Kirschbaum et al. 2011; Hartman et al. 2011	<i>Toolbox outline due</i>
Mar	2	W		Earth System Models	Heavens et al. 2013; Scholze et al. ESM chapter	Quiz 3
	7	M	8	Early anthropogenic hypothesis	Ruddiman et al. 2014	
	9	W		Land cover reconstructions	Gaillard et al. 2010; Houghton et al. 2012	<i>Op-ed draft due</i>
	14	M	9	Phosphorus cycle	Vitousek et al. 2010	
	16	W		Soil erosion	Anselmetti et al. 2007; McWethy et al. 2010	Quiz 4; <i>Op-ed reviews due</i>
	21	M		<i>No class- Spring break</i>		
	23	W		<i>No class- Spring break</i>		
	28	M	10	Mining I	Zalasiewicz et al. 2014; Stinchcomb et al. 2013	<i>(Pre-proposal outline due)</i>
	30	W		Mining II	Van der Elst et al. 2013	
Apr	4	M	11	<i>Op-Ed presentations</i>		<i>Final Op-ed due</i>
	6	W		Urbanization I	TBD	
	11	M	12	Urbanization II	TBD	Quiz 5 <i>(Pre-proposal draft due)</i>

	13	W		Fluvial processes	Knox 2006; Syvitski et al. 2005	
	18	M	13	Land-water interface	Woodward et al. 2014; Brauman et al. 2015	<i>(Proposal reviews due)</i>
	20	W		Coastal processes	Ingebritsen and Galloway 2014; Erban et al. 2014	Quiz 6
	25	M	14	<i>Synthesis</i>	TBD	
	27	W		<i>Methods Toolbox presentations</i>		
May	2	M	15	<i>Methods toolbox workshop</i>		<i>Reading summaries due (Final proposal due)</i>
	4	W		<i>No class</i>		<i>Final Toolbox due</i>