People and the Planet: Environmental Governance and Science
12.387J/IDS.063J/15.874J
DRAFT Syllabus, 8/31/17
Fall 2017

Class Time: Fridays 10am-1pm
Classroom: 36-112
Grading: Regular
Units: 3-0-6
Prerequisites: None

Instructors:
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Description of the Course

Catalog description: Introduces governance and science aspects of complex environmental problems and approaches to solutions. Introduces quantitative analyses and methodological tools to analyze environmental issues that have human and natural components. Concepts are introduced through three in-depth case studies of environmental governance and science problems. Students develop writing, quantitative modeling, and analytical skills in assessing environmental systems problems and developing solutions. Through hands-on activities including modeling and policy exercises, students engage with the challenges and possibilities of governance in complex, interacting systems including biogeophysical processes and societal and stakeholder interactions.

For the initial offering in 2017, the case studies will be ozone depletion, mercury pollution, and climate change. Cases will follow a common format, where the environmental problem will be introduced, including scientific and societal dimensions. Interactive activities will give students hands-on experience in both the governance and scientific aspects of the problem. Finally, students will design solutions and interventions, and explore strategies to assess and evaluate them. In future years, we envision new cases being added, with additional faculty participation, and with each case designed as a 9-hour module addressing some common themes.

Learning objectives and concepts covered

Through the case studies, students completing the course will:

- Understand the importance of relationships among population growth, economic growth, natural resources, technology and environmental challenges, including the drivers and impacts of environmental damages;
- Identify and understand the scientific principles and interactions that influence environmental systems in the cases presented;
- Identify and assess individual, collective, public, and private strategies to deal with environmental challenges, and their advantages and disadvantages;
- Use quantitative modeling tools to simulate environmental systems, including the impact of human activities;
- Compare different analytical lenses through which differing environmental problems can be viewed and assessed, including risk, economics, ethics, ecology, and policy analysis;
- Design potential solutions to address complex environmental challenges, incorporating both technical and policy constraints.

Topics introduced by the suite of cases will include (but are not limited to): sustainability; biogeochemical cycling; coupled human-natural systems; cross-scale dynamics (local, regional, global); commons issues; stakeholder analysis; policy evaluation; legal perspectives; risk perception, economic analysis; environmental justice. Specific topics introduced in each case are listed below.

Course Requirements

This course involves extensive participation by students, so attendance is mandatory, and students must come to class prepared to contribute thoughtfully to a discussion of the assigned readings and topics for all classes. To that end, we will designate class participants to serve as the student experts for a particular day. They will typically raise questions about the readings and lead small-group discussions on their assigned day(s).

Students will complete an assignment for each class topic (in 2017: ozone, mercury and climate change). For each case, students will have the option of completing an essay-based writing assignment or a quantitative problem set. Each student must complete at least one assignment of each type during the semester (i.e. either two essays and one quantitative problem set, or two problem sets and one essay). All essays should focus on an argument, i.e., an original position or viewpoint that is then defended. Guidelines will be distributed regarding content, style, and format.

Students will also complete a final project that will draw lessons from across the course topic areas to provide insights about environmental problems and their solutions. The project will incorporate a (group) presentation and an (individual) writing component. Students will form small teams and prepare a group presentation on a given case study. They will also write individual papers on the same topic. A preliminary list of potential topics is provided below. Each student group is encouraged to choose from the list; in exceptional cases an additional topic can be proposed for consideration by the professors. For the group presentation, groups will (i) provide selected readings for the class, (ii) present a summary of the case to the class, and (iii) lead an in-class discussion on the case. In addition, students will provide individual written essays on their case study. One option is to discuss how their case compares and contrasts to a particular aspect or aspects of earlier case studies covered in the class.

Evaluations of Student Achievement

Students will be evaluated on the quality of their contribution to the class as well as on their written work.

Grades will be based on the following, *approximate* formula:

Class participation	15%
Case Study Problem Sets/Essays (3 total @ 20% each)	60%
Final Project:	
Individual paper	15%
Group presentation	10%

Reading Material

The readings will all be available on the Stellar site for the course: https://learning-modules.mit.edu/class/index.html?uuid=/course/12/fa17/12.387

Semester Schedule

September 8: Introduction: Achieving a Sustainable Ecological Footprint
Concepts introduced include sustainability; ecological footprint; I=PAT (Impact = Population*Affluence*Technology) and related frameworks; historical data and projections for population, economic output, and technology; stocks and flows; system dynamics

September 15: Development of Environmental Policy in the US
Students will learn about the development of environmental policy in the US in the 1960s and 1970s and its role in setting the stage for dealing with current challenges. A focused discussion will cover the concept of perception of risk. Concepts introduced include the history of environmental action in the US and comparison to some other countries; the influence of social movements; the development of scientific and societal understanding of potential ozone depletion in the 1970s and early national actions to reduce emissions of ozone depleting substances.

September 22: Global Politics and Science ("The Mercury Game") *Students will play "The Mercury Game," a role-play simulation designed to illustrate the interactions between science and governance in a global setting.* Concepts introduced include global governance frameworks (legally-binding vs. voluntary approaches); international law and treaty-making; global environmental assessments; science-policy boundaries and their negotiation; the influence of politics, economics, and scientific uncertainty on decision-making; developed and developing country perspectives (north-south dynamics); financing and capacity-building

September 29 (No Class: Student Holiday; Students will have the opportunity to follow the internet coverage of negotiations on the global mercury convention)

October 6: Ozone Science and Politics – Part 1
Students will learn about ozone science and will build a two-box model to simulate how emissions of ozone depleting substances can spread throughout the globe. Concepts include scientific background of ozone depletion up to the discovery of the Antarctic ozone hole; how ozone is monitored, development of a framework for understanding the spread of chemical contaminants between the hemispheres and interpretation of observations (using a box model).

October 13: Ozone Science and Politics – Part 2
Students will learn how the international Montreal Protocol was designed by governments and amended over time to progressively address ozone-depleting substances in applications ranging from spray cans to fire extinguishers. Concepts include: how the Antarctic ozone hole was discovered; how scientific evidence was gathered to attribute its cause; the role of science, technology, and assessments in the Montreal Protocol; how different national interests influenced the structure and development of the Montreal Protocol over time.

October 20: Mercury: Biogeochemical cycling and scientific processes
Students will learn about mercury science, and build a model of the global biogeochemical cycle of mercury, evaluating different policy scenarios.
Concepts include land-atmosphere interactions, atmospheric chemical processes, global biogeochemical cycling, sources-sinks, scale issues (local to global), ecosystem processes, biological processes (methylation, bioaccumulation), human and environmental toxicology.

October 27: Mercury: Regulatory challenges and environmental justice
Students will learn about and discuss strategies to address mercury contamination at a local scale, with an emphasis on legal processes and environmental justice through examining mercury regulation and community responses.
Concepts covered include cost-benefit analysis, risk assessment, environmental justice, regulatory analysis, legal perspectives, environmental ethics.

November 3 Climate change

World Climate role-play simulation. One week prior to COP23, during the 2017 UN climate summit to be held in Bonn, Germany, students will take the roles of delegates to the COP and negotiate a climate agreement designed to limit global warming "well below 2°C... and pursuing efforts to limit the temperature increase to 1.5°C," as called for in the 2015 Paris Accord. Students will evaluate the impacts of their proposals using a dynamic simulation model that has been used by senior policymakers and negotiators from the UN, US, China, France, Brazil and other nations.

November 10 (No Class: Veterans' Day)

November 17 Climate change
Students will learn about the science of global warming and climate change, including the sources and impacts of different greenhouse gases (GHGs), the carbon cycle and other biogeochemical cycles, and the physical processes implicated in climate change. Additional topics include technologies for GHG mitigation and adaptation, including renewable energy, energy efficiency, deforestation and land use, and the economics of these approaches. We will debrief the outcome of COP23, the UN climate conference.

November 24 (No Class: Thanksgiving break)

December 1 Climate change
We address the psychological, social and political issues arising in climate change. How have the nations of the world sought to address the problem? What accounts for the gap between scientific knowledge of climate change and public understanding of the issue? How can the policy process be improved so that actions to address climate change are grounded in the best available scientific knowledge?

December 8 Student presentations and wrap-up

Assignments and Logistics

<u>**Due Dates**</u>
October 20: Ozone assignment due (can be an essay on the readings, with a novel clear argument and support for the argument; or can be a technical problem set building off of the box model concepts developed during class).
Nov 3: Mercury assignment due
Nov 17: Description of final project due (1 page; covers what the project is, what literature will be used, how group will work together, including roles of individual members and tentative schedule for how the group will work)
December 1: Climate assignment due
December 8: Final project due: Student Case Studies (see appendix)

Readings will be released one week before class
Solution sets will be released one week after assignment is due (late assignments will be penalized 20% per calendar day, zero after one week).

Appendix:Possible student case study topics
- Deforestation
- The Deepwater Horizon accident and oil spill
- Public communication and understanding of a specific science issue (e.g., ice sheets/sea level/timescales issue)
- Fracking
- Bees and pesticides
- Genetically modified foods, genetic manipulation of environmental risks
- Nuclear power
- Geoengineering
- Fisheries management
- Whaling
- A specific endangered species (e.g., wolves, seals, specific birds, invertebrates)
- The rights of non-human species to exist independent of their utility to humans
- Ocean acidification
- Love canal and remediation of toxic waste dumps
- Use of public lands/public parks (e.g., logging, mineral rights)
- Persistent organic pollutants/Stockholm convention
- Endocrine disruptors
- Lead in paints, gasoline, and/or plumbing
- The promise and limits of industry self-regulation of environmental challenges
- Plastic and the oceans/impacts on food webs and ocean life
- Eutrophication and riverine, lake and ocean deadzones from fertilizer runoff