History of Science 133VD

Environmental Science and Its History:
Big Problems and Debates

Harvard University
Spring 2020
Mondays and Wednesdays, 9:00am-10:15am

Course Instructor:
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How was the high-energy technological society of today created – and how can it be maintained in a civilizationally-responsible way? In this lecture course, we will address the human goals, expectations, and confrontations interfacing with weather, climate, and energy resources across history. Among these are the tumultuous history of fossil fuels and "peak oil," the birth of the environmental movement, debates about pollution and acid rain, and the contentious and conflicted relationship between technology development and environmental concerns. Students will explore the history of climate change from its origin in nineteenth-century science through the most recent catastrophic environmental effects and contemporary attempts at mitigation.

While primarily historical in methodology and focus, we will continually find ourselves relating historical examples, debates, and scientific approaches to our world today. Given the topics covered in this course, this is an appropriate vantage point, as long as we learn to be thoroughly historicist: to distinguish clearly past knowledge and practices and circumstances from those of today. To aid in this process, we encourage you to be alert to **articles, images, or other media** (in news sources, periodicals, or scientific journals – no blogs) **accessible online publicly or through Harvard** that address current topics in environmental science, environmental problems and mitigations, climate change, and environmental policy, that you would like to post to the **online discussion boards** on the course website. **You will post three articles or images** with a **short (about 100-300 word) analytic summary in each posting**. **Please also respond to other posts** to get discussions going about how these contemporary issues are connected to or differ from examples in the course.

Each week you will discuss the course readings in Section. Our sources (primary and secondary) will be diverse: scientific, historical, philosophical, literary, artistic, religious, and more. Your activities in Section will likewise be diverse: sometimes you will carry out close analysis of particular readings, sometimes you will hold debates, sometimes you will study visual and video materials. Remember to always be polite in discussions and debates, and if critiquing someone's argument, be constructive. **Arguments in this course – in class, in Section, on the discussion boards, in projects – must be based on evidence, reason, and analysis.** Our goal as a class is to come together to increase our understanding of the development and role of environmental science in addressing pressing scientific and societal questions about humanity's interaction with nature from the past two centuries to today.

The night before each section, you will **post a question or comment to the Question Box** on the course website. Ask about any of the course material from the lectures, the readings, the discussion boards, or previous section discussions. Your questions and comments will be visible only to the course teaching staff, so please be honest about any confusions or concerns you have about the course material, or offer suggestions for topics that you would be interested in exploring in section.

The final assessment for the course is to produce **creative synthetic projects** that can be shared on the course Scalar website. These may take the following forms (among others):

- digital essays with hyperlinks and embedded media (instead of traditional papers), or
- online exhibits drawing upon digital materials as well as objects in the Harvard Museums of Science and Culture, or
- videos (documentary or fiction-based) on pertinent environmental questions and locations discussed in the course.

Mid-semester, you will submit a summary of the proposed topic, argument, and format of your project, and you will give a short presentation about your project on the last day of class. The Final Synthetic Project will be due on the last day of Reading Period.

Course Assignments and Grading:

Lecture and Section Attendance and Participation:	20%
Contributions to the 3 online discussion boards:	15%
Weekly Question Box posts about course reading/content	10%
Proposal for Synthetic Project:	10%
In-Class Midterm Exam:	15%
Short Presentation on Synthetic Project:	10%
Synthetic Project:	20%

Required Books and Readings:

The following four books are required for the course. New and used copies are available for rent or purchase at the **COOP** (https://tinyurl.com/300-W20-HSCI-133VD-1), and copies are also on **reserve at Lamont Library** https://canvas.harvard.edu/courses/67813/external_tools/33436.

1. Rachel Carson, *Silent Spring* (Boston: Mariner Books, 2002; orig. pub. 1962). ISBN 0-618-24906-0.
2. Martin J. S. Rudwick, *Earth's Deep History: How It Was Discovered and Why It Matters* (Chicago: University of Chicago Press, 2014). ISBN 978-0-226-42197-1. [Rudwick's book is also available as an **online e-book in the library reserves**: https://canvas.harvard.edu/courses/67813/external_tools/33436].
3. Paul Warde, Libby Robin, and Sverker Sörlin, *The Environment: A History of the Idea* (Baltimore: Johns Hopkins University Press, 2018). ISBN 978-1-421-42679-2.
4. Spencer R. Weart, *The Discovery of Global Warming*, Revised and Expanded Edition (Cambridge: Harvard University Press, 2008). ISBN 978-0-674-03189-0.

Any additional readings will be available on the course Canvas website: https://canvas.harvard.edu/courses/67813.

SCHEDULE AND READINGS

WEEK 1

January 27 – Lecture 1: Introduction to the History of Environmental Science

January 29 – Lecture 2: Eras of Coal, Steam, Oil: The Industrial Revolution and the Science of Heat

Week 1 Reading:

- Warde et al., *The Environment*, Prologue (pp. 1-5).

- Rudwick, *Earth's Deep History*, Introduction (pp. 1-7) and Chapter 9: Eventful Deep History (pp. 207-233).
- J.R. McNeill and Peter Engelke, *The Great Acceleration: An Environmental History of the Anthropocene since 1945* (Cambridge: Harvard University Belknap Press, 2014), pp. 63-72.
- Dan Tamïr, "Something New under the Fog of War: The First World War and the Debut of Oil on the Global Stage," in *Environmental Histories of the First World War*, ed. Richard Tucker et al. (Cambridge: Cambridge University Press, 2018), pp. 117-135.

January 31 – Course Registration and Sectioning

WEEK 2

February 3 – Lecture 3: Studies of Weather and Climate in the 19th and Early 20th Centuries

February 5 – Lecture 4: Graphical Analysis: The Geological Long-View, Ecology, and Time-Series

Week 2 Reading:

- Rudwick, *Earth's Deep History*, Chapter 10: Global Histories of the Earth (pp. 235-261) and Chapter 11: One Planet Among Many (pp. 263-291).
- McNeill and Engelke, *The Great Acceleration*, "History of Climate Science" (pp. 72-76).
- Look at the Figures in M. King Hubbert, "Energy from Fossil Fuels," *Science* vol. 109, no. 2823 (February 4, 1949), pp. 103-109.

February 5 – First Section(s) – time/location TBA

By February 9 – FIRST Online Discussion Posts DUE

WEEK 3

February 10 – Lecture 5: M. King Hubbert and Peak Oil: "Where is this taking us?"

February 12 – Lecture 6: Neo-Malthusian Doomsters versus Cornucopian Growthists: Economics, Energy, Population

Week 3 Reading:

- M. King Hubbert, "Energy from Fossil Fuels," *Science* 109 (1949), pp. 103-109.
- Warde et al., *The Environment*, Chapter 3: Resources for Freedom (pp. 47-72).
- McNeill and Engelke, *The Great Acceleration*, "Population and Environment" (50-61).

Students sign up for individual meetings next week with TF (and optionally with instructor)

WEEK 4

February 17 – NO CLASS – President's Day Holiday

February 19 – *Guest Lecture*: Space Weather – Dr. Gregory Good (American Institute of Physics)

Week 4 Reading:

- Begin reading Rachel Carson, *Silent Spring* (1962).

Individual meetings with TF to plan Final Synthetic Project topic

WEEK 5

February 24 – Lecture 7: Ecology, Oceanography, and the Birth of Environmentalism

February 26 – Lecture 8: Policy, Law, and Science in Environmental Pollution Debates: Local, National, International

Week 5 Reading:

- Complete reading Rachel Carson, *Silent Spring* (1962).
- Rachel Carson, *The Sea Around Us* (Oxford: Oxford University Press, 1989; orig. pub. 1950), "Preface to 1961 edition" (pp. vii-xiii), "The Shape of Ancient Seas" (97-107), and "The Global Thermostat" (pp. 167-184).
- Warde et al., *The Environment*, Chapter 4: Ecology on the March (pp. 73-95).

By March 1 – SECOND Online Discussion Posts DUE

WEEK 6

March 2 – Film and Discussion: *A Civil Action* (Steven Zaillian, 1998, excerpts)

March 4 – Lecture 9: NASA and Global Data: The Ozone Layer and Climate

Week 6 Reading:

- McNeill and Engelke, *The Great Acceleration*, "Climate Science Meets Climate Politics" (pp. 76-83).
- Naomi Oreskes and Erik M. Conway, *Merchants of Doubt* (New York: Bloomsbury, 2010), Chapter 4: Constructing a Counternarrative: The Fight over the Ozone Hole (pp. 107-135).
- In consultation with your TF, read and draw upon the sources on this site to prepare a "mock trial" discussion in Section based on the Woburn water pollution case portrayed in the film: https://serc.carleton.edu/woburn/resources/index.html

WEEK 7

March 9 – Lecture 10: The Fracking Revolution and Peak Demand: Electric Vehicles and Renewable Energy Resources and Innovation in an Age of Global Warming

March 11 – Documentary Film and Discussion: *Behemoth* (Zhao Liang, 2015, excerpts)

March 11: Proposal for Final Synthetic Project DUE

Week 7 Reading:

- Warde et al., *The Environment*, Chapter 5: Climate Enters the Environment (pp. 96-121).
- Dante Alighieri, *Inferno* I and III, transl. Robert and Jean Hollander (New York: Anchor Books, 2000), pp. 2-11 and 46-55.

March 16 & 18 – NO CLASS – SPRING BREAK

WEEK 8

March 23 – Review and Practice Session

March 25 – In-Class Midterm Exam

WEEK 9

March 30 – Documentary Film: *Containment* (Peter Galison and Robb Moss, 2015)
Note: This class begins five-minutes early at 8:55am to see the full 1-hour, 20-min film

April 1 – Lecture 11 and Discussion: Nuclear Energy, Nuclear Waste, Nuclear Security in an Age of Global Warming

Week 9 Reading:

- Read this brief Frontline report by Jon Palfreman on French use of nuclear energy: https://www.pbs.org/wgbh/pages/frontline/shows/reaction/readings/french.html.
- James M. Acton and Mark Hibbs, "Why Fukushima Was Preventable," Carnegie Endowment for International Peace (2012): https://carnegieendowment.org/2012/03/06/why-fukushima-was-preventable-pub-47361.

Possible optional activity: Tour of MIT Nuclear Reactor

WEEK 10

April 6 – Lecture 12: Climate History and Global Warming: Pre-Argo

April 8 – Lecture 13: Climate History and Global Warming: Argo and Post-Argo

Week 10 Reading:

- Weart, *The Discovery of Global Warming* (2008), pp. vii-x and pp. 1-113.
- Global Warming 101, *The Economist* (2019)

WEEK 11

April 13 – Lecture 14: Climate Data, Graphical Methods: Evidence and Epistemic Considerations

April 15 – Lecture 15: Discovery and Debates in Climate Science, Sustainability, and Renewable Energy

Week 11 Reading:

- Weart, *The Discovery of Global Warming* (2008), pp. 114-196.
- Oreskes and Conway, *Merchants of Doubt*, Chapter 6: The Denial of Global Warming (pp. 169-215).

- Read this New York Times opinion piece by Berkeley physicist Richard Muller: https://www.nytimes.com/2012/07/30/opinion/the-conversion-of-a-climate-change-skeptic.html.
- Read the transcript (or listen to the audio) of this interview with Muller: https://www.climateone.org/audio/richard-muller-skeptical-climate-science.

By April 19 – THIRD Online Discussion Posts DUE

WEEK 12

April 20 – Tour of Climate Change exhibit at Harvard Museum of Natural History

April 22 – Debate & Discussion (*50th Anniversary of Earth Day!*)
Student Debate about renewables, nuclear energy, fossil fuels – representing different companies, nations, regions of the US, and industries

Week 12 Reading:
- Weart, *The Discovery of Global Warming* (2008), pp. 197-212.

WEEK 13

April 27 – Lecture 16 and Discussion: The Anthropocene: Humans in control?
[Will screen excerpts of the documentary films *Koyaanisqatsi* ("Life out of balance," 1982) and *Anthropocene: The Human Epoch* (2019)]

April 29 – Wednesday Wrap-Up: Student Presentations on their Synthetic Projects

Week 13 Reading:
- Warde et al., *The Environment*, Chapter 7: Seeking a Safe Future (pp. 151-181).
- McNeill and Engelke, *The Great Acceleration*, Conclusion (pp. 207-211).
- Explore the website *The Anthropocene Project*: https://theanthropocene.org/
- Read this news article "Carbon dioxide levels hit landmark at 415 ppm, highest in human history": https://www.usatoday.com/story/news/world/2019/05/13/climate-change-co-2-levels-hit-415-parts-per-million-human-first/1186417001/

Reading Period April 30-May 6
Wednesday, May 6, by 8:00pm: Synthetic Projects Due