

Env. Stud. 539: Air Resources Science & Policy

Syllabus, Fall, 2010

University of Wisconsin-Madison

Monday & Wednesday, 1:00–2:15 PM

Instructor: T. Holloway

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Office Hours by appointment

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Course webpage: learnuw.wisc.edu

PURPOSE

The purpose of the course is to familiarize students with key issues involved in connecting science and decision-making around air issues: air pollution, climate change, and extreme weather. Because regulation of air quality and climate typically involves regulation of fossil fuel burning, we devote the first part of the class to a discussion of energy use.

Class projects will employ and develop both quantitative and qualitative skills through computer-based assignments, problem-solving, writing, presentations, and in-class discussion. A term paper will allow students to bring their own expertise to class, and relate issues in class to a particular area of interest.

Term Papers You will be required to develop a paper over the course of the semester **discussing the role of science and/or quantitative assessment method in a particular air resource policy or law issue of your choice**. I am happy to discuss term paper topic ideas on an individual basis. There are 4 due-dates you should keep in mind relating to the paper:

1) Monday 10/11: 5-page literature review. This is an early opportunity for you to investigate and lay the groundwork for your term paper. Please provide an overview of the issue and the major players involved your chosen topic. I will provide feedback on your writing and ideas. The paper will be graded based *only* on your completion of minimum standards, e.g. length of paper, number of references, etc. (These objective standards will be outlined in a class handout.) Grades will thus reflect completion of standards, while the ideas of the paper receive non-graded feedback.

2) Monday, 11/1: Rough draft of paper. These papers will be exchanged for in-class peer review, and submitted to me for additional comments. Again, grades will only be given for “effort,” as measured by completion of specified minimum standards.

3) Tuesday, 12/8: Final paper due (20 ± 1 pages of text, double-spaced) + 10 minute film on paper topic

EVALUATION

Students will be graded on homework problem sets, paper prospectus, paper rough draft, in-class presentation, i>clicker quizzes (55%), final paper and video (30%), class participation including attendance (15%).

Nothing will be accepted past noon on the day due.

All requests for grade re-evaluation must be submitted in written form within 2 days of receiving original grade.

TEXTS

- Readings available through [Learn@UW \(https://learnuw.wisc.edu/\)](https://learnuw.wisc.edu/) with the exception of the Pielke Book
- Pielke, Jr., Roger S., The Honest Broker: Making Sense of Science in Policy and Politics, Cambridge, Cambridge University Press, 2007

UNIT 1: *FRAMEWORKS FOR UNDERSTANDING THE ROLE OF SCIENCE IN POLICY*

September 8th

Class 1.1: introductions, review of syllabus, and “bookend” activity

Assigned reading:

- None

September 13th

Class 1.2: Why is environmental risk so hard to quantify?

Assigned reading (20 pages):

- Richardson, J. R. and G. W. Miller (2010), Toxicology. Chapter Two of Environmental Health: from global to local, Howard Frumkin, Editor. John Wiley and Sons, San Francisco, CA (29 pages).
- Steenland, K., and C. Moe (2010) Environmental and Occupational Epidemiology. Chapter Three of Environmental Health: from global to local, Howard Frumkin, Editor. John Wiley and Sons, San Francisco, CA (29 pages).
- Novella, S. (2010) Bisphenol A in Plastics – Should We Worry? Accessed at <http://www.sciencebasedmedicine.org/?p=209> on 8/6/2010 (3 pages)

September 15th

Paul Denholm Guest Lecture

Assigned reading:

- None (note: full Pielke book is due on Sept. 29th)

Supplemental Reading:

- Denholm Bio

- Denholm, P., E. Ela, B. Kirby, and M. Milligan (2010), The role of energy storage with renewable electricity generation. *Technical Report NREL/TP-6A2-47187*, Available electronically at <http://www.osti.gov/bridge>

September 20th

Class 1.3: managing risk: the precautionary principle vs. cost-benefit analysis

Assigned reading:

- Smith, Carl. (2000) The Precautionary Principle and Environmental Policy: Science, Uncertainty and Sustainability – Introduction, *International Journal of Occupational Health, Vol.6* no. 3, p.263-264.
- Moore, C. (2003) “The Best Science, Values, and the Precautionary Principle to Protect Children,” in *Silent Scourge* (Oxford University Press) p. 246-261.
- Heinzerling, L. and F. Ackerman (2002) Pricing the priceless: Cost-Benefit Analysis of environmental protection. *Georgetown University Law and Policy Institute*

Supplemental readings for Class 1.3:

- Wildavsky, A. (1995) “Conclusion: Rejecting the Precautionary Principle” in *But Is It True?* (Harvard University Press) Cambridge, MA. p. 425-447.

September 22nd

Class 1.4: science for decision-making and the politics of science funding

Assigned reading:

- Bush, Vannevar (1945), *Science: The Endless Frontier*. United States Government Printing Office (27 pages).
- Timeline of the National Science Foundation. Available at: http://www.nsf.gov/news/special_reports/history-nsf/timeline/index.jsp

Supplemental readings for Class 1.4:

- Stokes, D. E. 1997. “Stating the Problem” and “Transforming the Paradigm” in *Pasteur’s Quadrant, Basic Science and Technological Innovation* Chapter 1 (p. 1-25); Chapter 3 (p. 58-89)

September 27th

Guest Lecture by Dr. Paul Meier: Resources and limitations of electrical system technologies

Readings:

- US Energy Information Association (2010) *International Energy Outlook 2010* (8 pages)

Supplemental readings for Class 2.1:

- Paul Meier bio
- Paul Meier articles

September 29th

Class 1.5: Science ethics and science communication

Assigned reading:

- Pielke book

Supplemental readings for Class 1.4:

- <http://rogerpielkejr.blogspot.com/>

UNIT 2: ENERGY AND EMISSIONS OVERVIEW

October 4th

Class 2.1: Fueling Transportation

Readings:

- EPRI: Environmental Assessment of Plug-in Hybrid Electric Vehicles, Executive Summary (10 pages)
- Hill, J. et al. (2006) Environmental, economic, and energetic costs and benefits of biodiesel and ethanol biofuels. *PNAS* 103; 11206-11210.
- Belson, Ken (4/27/2008) The Greening of the Yellow Fleet. *The New York Times*, April 27th, 2008.
- Wald, Matthew (4/27/2008) After Initial Promise, Hybrid Trucks Stall. *The New York Times*, April 27th, 2008.

Supplemental readings for Class 2.1:

- Read through the following web page: <http://www.epa.gov/BPSpill/>
- Kunstler, J. H. (2005) "The Long Emergency", *Rolling Stone Magazine*, Mar. 24, 2005 (6 pages).
- Gibbs, H. K. et al. (2008) Carbon payback times for crop-based biofuel expansion in the tropics: the effects of changing yield and technology. *Env. Res. Let. Vol 3*, num. 3.

October 6th

Class 2.2: 40 years of emissions changes

Readings:

- Streets, D. G. and S. T. Waldhoff (2000) Present and future emissions of air pollutants in China: SO₂, NO_x, and CO. *Atmos. Env.* 34, 363-374.
- Bond, T. et al. (2004) A technology-based global inventory of black carbon and organic carbon emissions from combustion. *Journ. Geophys. Res. Vol. 109* D14203.

Supplemental readings for Class 2.3:

- <http://www.epa.gov/greenvehicles/Index.do>

October 11th

Class 2.3: International energy use

Readings:

- Dasgupta, S., et al. (2002) Confronting the Environmental Kuznets Curve. *Journ. Of Economic Perspectives, Vol. 16I*, num. 1. 147-168.
- Developing country electrification
- Cookstoves
- Ezzati, M. et al. (2004) Energy Management and Global Health. *Annu. Rev. Environ. Resour. 29*:383–419

Supplemental readings for Class 2.3:

- World Health Organization (2004) Health Aspects of Air Pollution: Results from the WHO project “systematic review of health aspects of air pollution in Europe” (30 pages).

UNIT 3: RESPONDING TO WEATHER AND CLIMATE VARIABILITY

October 13th

5-page literature review DUE

Class 3.0: Weather, Climate, and Decisions...

October 18th

Class 3.1: Understanding Predictability

Readings:

- Meehl, G., T. Karl, D. Easterling, S. Changnon, R. Pielke Jr., D. Changnon, J. Evans, P. Groisman, T. Knutson, K. Kunkel, L. Mearns, C. Parmesan, R. Pulwarty, T. Root, R. Sylves, P. Whetton, and F. Zwiers (2000). An Introduction to Trends in Extreme Weather and Climate Events: Observations, Socioeconomic Impacts, Terrestrial Ecological Impacts, and Model Projections . *Bulletin of the American Meteorological Society*, 81: 413-416
- Changnon, Stanley (2005), Applied Climatology: The golden era. *Bulletin of the American Meteorological Society*, 86, 915-919.
- Pfaff, A. et al. (1999) Who benefits from climate forecasts? *Nature* 397, 645-646.

October 20th

Class 3.2: Communicating uncertainty in weather forecasts

Readings:

- Stewart, T. (2000) Uncertainty, Judgement and Error in Prediction. Chapter 3 in Sarewitz, D., R. A. Pielke Jr., and R. Byerly Jr., (eds.), *Prediction: Science Decision Making and the Future of Nature*. Island press: Washington, DC.
- Glantz, M. (2005), How much weather news can America stand?
- Gigerenzer, G., R. Hertwig, E. van den Broek, B. Fasolo, and K. Katsikopoulos (2003), A 30% Chance of Rain Tomorrow: How Does the Public Understand Probabilistic Weather Forecasts? *Risk Analysis Vol. 25, 3*, 623-629.

Supplemental readings for Class 3.1:

- Pielke Jr., R., D. Sarewitz, and R. Byerly Jr., 2000: Decision Making and the Future of Nature: Understanding and Using Predictions. Chapter 18 in Sarewitz,

- D., R. A. Pielke Jr., and R. Byerly Jr., (eds.), Prediction: Science Decision Making and the Future of Nature. Island press: Washington, DC.
- <http://www.cawcr.gov.au/projects/verification>
 - <http://vimeo.com/13523892>

October 25th

Class 3.3: Prediction of extreme events

OPTIONAL Readings:

- *Dow and Cutter (2002) Emerging Hurricane Evacuation Issues: Hurricane Floyd and South Carolina. Natural Hazards Rev. Volume 3, Issue 1, pp. 12-1*
- *Linda B. Bourque, Judith M. Siegel, Megumi Kano and Michele M. Wood (2006), Weathering the Storm: The Impact of Hurricanes on Physical and Mental Health The ANNALS of the American Academy of Political and Social Science 604: 129 DOI: 10.1177/0002716205284920.*
- *Rayner, S. et al. (2005) Weather forecasts are for wimps: why water resource managers do not use climate forecasts. Climate Change 29: 197-227.*
- *Martin, S. (2005) Can We Learn From Cuba's Lesson? St. Petersburg Times, Sept. 9th, 2005.*

UNIT 4: GLOBAL CLIMATE CHANGE SCIENCE AND POLICY

October 27th

... In class exercise...

November 1st

Class 4.1: Basics and history of climate change science

Assigned reading (20 pages):

- IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. (read full document; 18 Pages; **note: as you are reading, please jot down any questions about climate change that may emerge**)
- Climate Modeling, A publication of the Geophysical Fluid Dynamics Laboratory, Princeton, NJ. Available at <http://www.gfdl.noaa.gov/climate-modeling>. (2 pages).

Supplemental readings for Class 4.1:

- Schmidt, Gavin (2007). The physics of climate modeling, *Physics Today*, January, 2007, Page 72-73 (2 pages).

November 3rd

Class 4.2: Climate change mitigation policies and politics

Assigned reading (17 pages):

- Krugman, Paul (4/5/2010), Building a Green Economy. *The New York Times Magazine*, New York, NY (read full article, 17 pages).
- US Environmental Protection Agency (2009), Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act (2 pages).
- Pacala, S. and P. Socolow (2004) Stabilization wedges: solving the climate problem for the next 50 years.

Supplemental readings for Class 4.2:

- Federal Register Vol. 74, No. 239 (Tuesday, December 15, 2009) Endangerment and Cause or Contribute Findings for Greenhouse Gases Under Section 202(a) of the Clean Air Act (52 pages).
- The Editorial Staff of *The Hindu* (1/26/2010). Strengthening Kyoto, *The Hindu*, Madras, India (1 page).
- More international perspective

November 8th

Term Paper rough draft DUE

- Video Communication Day

UNIT 5: MANAGING AIR QUALITY

November 10th

Class 5.1: Air pollution chemical & physical processes overview

Readings:

- US Environmental Protection Agency (2007) Plain English Guide to the Clean Air Act, EPA Publication No. EPA-456/K-07-001, Office of Air Quality Planning and Standards, Research Triangle Park, NC (27 pages).
- Holloway T., and C. Littlefield. Environmental health – links with intercontinental air pollution transport. *Encyclopedia of Environmental Health*, published by Elsevier, Amsterdam, The Netherlands, in press
- Pope, C. A. III, et al. (2009), Fine-Particulate Air Pollution and Life Expectancy in the United States. *The New England Journal of Medicine* 2009;360:376-86. (12 pages)

November 15th

Peer Reviews DUE

Class 5.2: Todd Palmer Guest Lecture

November 17th

Class 5.3: Al Shea Guest Lecture

November 22nd

Class 4.3: The politicization of climate science

Assigned reading (42 pages):

- Become familiar with the specific challenges that confront the state you represent (e.g. vulnerability to climate change, natural energy resources – or lack thereof, state-level political atmosphere)
- Chrichton, Michael (2004), *State of Fear*, Harper Collins Publishers, New York, NY. (read Author’s Message, pg. 625-630, and Appendix I: Why Politicized Science is Dangerous p. 631-638; 13 pages total)
- Mooney, Chris (2007), *Storm World*, Harcourt Books, Orlando, FL. (read Chapter 4: “Lay that Matrix Down” p. 59-79, and Appendix IV: Consensus Statements by Participants in the World Meteorological Organization’s 6th International Workshop on Tropical Cyclones, San Jose, Costa Rica, November 2006, pg 293-294; 22 pages total).
- Anderegg, W. R., J. W. Prall, J. Harold and S. H. Schneider (2010), Expert credibility in climate change. *Proceedings of the National Academy of Science*, doi:10.1073/pnas.1003187107 (read full article, 3 pages).
- Pielke Jr., Roger (2010) A New Black List, <http://rogerpielkejr.blogspot.com/2010/06/new-black-list.html> (read full article, 3 pages)

Supplemental readings for Class 4.3:

- Kaufman, Leslie (3/29/2010) Among Weathercasters, Doubt on Warming. *The New York Times*, New York, NY (4 pages).
- Doran, Peter T. and Maggie Kendal (2009). Examining the scientific consensus on climate change. *EOS*, vol. 90, num. 3 (1 page).
- Maibach, E., Wilson, K & Witte, J. (2010) A National Survey of Television Meteorologists about Climate Change: Preliminary Findings. George Mason University. Fairfax, VA: Center for Climate Change Communication. (read Methods, p. 2 and Summary of Findings and Interpretation, p. 3-5; 4 pages total).

November 24th –

Pre-Thanksgiving Discussion Session
 Optional discussion/workshop on topics related to class, including help with papers, videos, climate change, air pollution, etc.
 Please RSVP – lunch will be provided.

November 29th –

Class 3.4: Vulnerability

- Changnon, S., R. Pielke Jr., D. Changnon, R. Sylves, and R. Pulwarty, 2000: Human Factors Explain the Increased Losses from Weather and Climate Extremes. *Bulletin of the American Meteorological Society*, 81: 437-442.
- Cutter, S., B. Boruff, and W. Shirley, 2003: Social Vulnerability to Environmental Hazards. *Social Science Quarterly*, 84: 242-261

Class 4.4: Alternative responses to climate and air pollution: adaptation and geoengineering

Readings:

- Biello, David (2010) What Is Geoengineering and Why Is It Considered a Climate Change Solution? *Scientific American*, April 6th, 2010 (read full article, 5 pages).
- USAID (2007) Adapting to climate variability and change: A guidance manual for development planning, *US Agency for International Development*, Washington, DC. (read full document, 30 pages).
- Lovins, Amory (1989) The negawatt revolution – solving the CO2 problem. Keynote Address at the Green Energy Conference, Montreal, 1989.

December 1st –

Class 5.3: Its all one system: linkages between climate, tropospheric air pollution and the ozone hole.

- Jaffe, D. et al. (1999), Transport of Asian Air Pollution to North America, *Geophysical Research Letters*, Vol. 26, No. 6, Pg. 711-714.
- National Research Council (NRC) Committee on the Significance of International Transport of Air Pollutants (forthcoming, 2009), Global Sources of Local Pollution: An Assessment of Long-Range Transport of Key Air Pollutants to and from the United States, ISBN: 0-309-14402-7.
- Nemet, G.F., T.A. Holloway, and P. Meier (2010). Implications of incorporating air-quality co-benefits into climate change policymaking. *Environmental Research Letters* 5 (January-March 2010) 014007, doi:10.1088/1748-9326/5/1/014007
- Jacob, D. and D. Winner (2009), Effect of climate change on air quality, *Atmospheric Environment* 43, 51-63.

December 6th – Film festival day 2

December 8th – Film festival day 3
Final term paper DUE

December 13th AGU – TBD

December 15th AGU – TBD