

Econ 581. Advanced Environmental Economics
Department of Economics, Iowa State University

Syllabus

Instructors: Professors Gil DePaula and Wendong Zhang

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Office Hours: TBD (online schedule)

Class Lectures: MWF 8:50am-9:40am; Kildee 0107; Face to Face

Credit Hours: 3

Course Description:

Catalog Description

Interrelationships of natural resource use and the environment. Applied welfare and benefit-cost analyses. Externalities and pollution abatement. Nonmarket valuation of resources. Property rights. Legal and social constraints. Policy approaches.

Course Summary

This course serves as one of two classes that comprise the Ph.D. field in Environmental and Resource Economics. This course focuses on the theory of pollution externalities and the empirical approaches used to apply this theory to policy. The theoretical component of the course will cover pollution as a public good, the advantages / disadvantages of various policy approaches (standards, taxes, cap and trade programs), and extend this theory to cover spatial (local vs. global) and temporal (stock vs. flow) considerations. Structural and reduced form empirical methodologies will be discussed. Both classic and recent papers will be discussed.

Prerequisites

Graduate-level microeconomics (Econ 501 or 601). I also suggest a graduate-level course in econometrics.

Course Goals and Learning Outcomes:

- (1) Theoretical Foundations in Environmental Economics: Econ 581 students should have a solid foundation in the theory of pollution as a public good and the policy mechanisms (standards, taxes, cap and trade) designed to correct corresponding market failures. Students should also understand how this theory applies with spatial (local versus global) and temporal (stock versus flow) considerations. Students should be able to explain the criteria of efficiency and cost-effectiveness and why certain policies meet these criteria. Student should understand how they can motivate their own research with this theory.
- (2) Empirical Methods in Environmental Economics: Students should have a solid grasp on empirical methods used to test environmental economic theories and the effectiveness of environmental policies. This includes understanding the assumptions that drive identification in structural and reduced form methodologies and the strengths and weaknesses of these approaches. Student should understand how they can apply these methods to their own research.
- (3) Independent Research in Environmental Economics: Students should be able to develop a unique research idea in environmental economics. Students should be able to place this idea within the literature, be able to describe the theory that motivates this research, and be able to discuss the pros and cons of empirical methods that can be used to test the research question. Students should be able to identify potential data sources to help answer the research question.

Course Requirements and Grading:

Students are expected to attend normal class time lectures for the entire semester. In addition, students are expected to prepare for class, complete course assignments, complete a research proposal outside of class, and participate in a proposal review workshop at the end of the course. This work outside of class is typically six hours per week. Grading for the class will be as follows:

Students will be expected to participate in class discussion, which includes weekly reading summaries (**20%**). In particular, students is required submit on canvas a summary of the required reading before each class. Students must also complete three homework assignments (**20%**), including a referee report, a stated-preference survey design and an DICE climate change modeling exercise. PhD students must complete a proposal for an original research paper in environmental and natural resource economics (**four deliverables: first draft (5 pages): 10%; preliminary proposal (10 pages): 10%; final proposal (10 pages): 30%; proposal reviews: 10%**). The idea is that this proposal may ultimately serve as a basis for a dissertation chapter

and/or draft of your job market paper. Master's students may choose 1) the research paper option or 2) write a literature review/critique of a particular research topic.

We will use the following grading-scale:

- A : 94 – 100; A- : 90 – 93
- B+ : 88 – 89; B : 84 – 87; B- : 80 – 83
- C+ : 78 – 79; C : 74 – 77; C- : 70 – 73
- D+ : 68 – 69; D : 64 – 67; D- : 60 – 63
- F : < 60

We encourage feedback throughout the semester to make sure our goals and your expectations are being met. We will distribute evaluations mid-semester.

Course Materials: Most of the readings for the class are easily accessible journal articles. We also recommend the following texts:

Phaneuf, Daniel J. and Till Requate. *A Course in Environmental Economics: Theory, Policy, and Practice*. 2017. Cambridge University Press.

Angrist, Joshua D. and Jörn-Steffen Pischke. *Mostly Harmless Econometrics*. 2009. Princeton University Press. Princeton, New Jersey.

Freeman, A. Myrick, Joseph A. Herriges, and Catherine L. Kling. *The Measurement of Environmental and Resource Values: Theory and Methods*. 2014. Resources for the Future. Washington, DC.

Hansen, B. E.. Econometrics. Available online at <https://www.ssc.wisc.edu/~bhansen/econometrics/>

Keohane, M.N.O. and Olmstead, S.M., 2016. *Markets and the Environment*. Island Press.

Questions about Course Materials and Email Policy

We strongly encourage you to contact us before or after lecture or during office hours. We will make every attempt to respond promptly to questions through email, but we cannot guarantee that your questions will be resolved quickly. The best way to discuss any questions/concerns you may have is during office hours or personal appointments.

Key Dates:

Aug. 17.....Start of Class
Sept. 7 (Week 5).....First draft of research proposal due
Oct. 5 (Week 8)..... Preliminary research proposal due
Nov. 9 (Week 13)..... Final research proposal due
Nov. 20 (Week 14)..... Peer reviews of proposals due
Nov. 23 – 25 (Finals week).....Research proposal review workshop

Electronic Devices in Class

We do not forbid the use of electronic devices in the classroom during normal lectures. If a student’s use of an electronic device is disruptive to teaching and/or learning, we will ask that the student discontinue the use of that device. Please be considerate of those around you.

Late Assignments and Absences

Assignments will not be accepted after their due date unless prior arrangements have been made with the instructor. You must contact us in writing (email) prior to the due date and time with an explanation as to why you request an extension. It will be up to our discretion to grant this extension.

COVID-19 health and safety requirements

Students are responsible for abiding by the university’s COVID-19 health and safety expectations. All students attending this class in-person are required to:

- properly wear a face covering and/or face shield, covering the nose and mouth, while in classrooms, laboratories, studios, offices, and other learning spaces. It is important to remember that a face covering and/or face shield is required to be worn whenever you are on campus, in the presence of others, and unable to maintain physical distance.
- practice physical distancing to the extent possible;
- assist in maintaining a clean and sanitary environment;
- not attend class if you are sick or experiencing symptoms of COVID-19;
- not attend class if you have been told to self-isolate or quarantine by a health official.
- follow the faculty member’s guidance with respect to these requirements.

Failure to comply constitutes disruptive classroom conduct. Faculty and teaching assistants have the authority to deny a non-compliant student entry into a classroom, laboratory, studio, conference room, office, or other learning space. These requirements extend outside of scheduled class time, including coursework in laboratories, studios, and other learning spaces, and to field trips. These requirements may be revised by the university at any time during the semester.

For updated information about Covid-19 response and face covering, visit <https://web.iastate.edu/safety/updates/covid19/planning>

Student Accommodations

Students who are at high risk for severe illness from COVID-19 and students who cannot tolerate wearing a face covering due to underlying medical or mental health conditions should carefully review the options presented on the [Student Accessibility Services website](#). For additional questions, please call 515-294-7220 or email accessibility@iastate.edu.

Prep Week

This class follows the Iowa State University Prep Week policy as noted in section 10.6.4 of the [Faculty Handbook](#).

Discrimination and Harassment

Iowa State University does not discriminate on the basis of race, color, age, ethnicity, religion, national origin, pregnancy, sexual orientation, gender identity, genetic information, sex, marital status, disability, or status as a U.S. Veteran. Inquiries regarding non-discrimination policies may be directed to Office of Equal Opportunity, 3410 Beardshear Hall, 515 Morrill Road, Ames, Iowa 50011, Tel. 515-294-7612, Hotline 515-294-1222, email eooffice@iastate.edu

Religious Accommodation

Iowa State University welcomes diversity of religious beliefs and practices, recognizing the contributions differing experiences and viewpoints can bring to the community. There may be times when an academic requirement conflicts with religious observances and practices. If that happens, students may request the reasonable accommodation for religious practices. In all cases, you must put your request in writing. The instructor will review the situation in an effort to provide a reasonable accommodation when possible to do so without fundamentally altering a course. For students, you should first discuss the conflict and your requested accommodation with your professor at the earliest possible time. You or your instructor may also seek assistance from the [Dean of Students Office](#) at 515-294-1020 or the [Office of Equal Opportunity](#) at 515-294-7612.

Accessibility Statement

Iowa State University is committed to assuring that all educational activities are free from discrimination and harassment based on disability status. Students requesting accommodations

for a documented disability are required to work directly with staff in Student Accessibility Services (SAS) to establish eligibility and learn about related processes before accommodations will be identified. After eligibility is established, SAS staff will create and issue a Notification Letter for each course listing approved reasonable accommodations. This document will be made available to the student and instructor either electronically or in hard-copy every semester. Students and instructors are encouraged to review contents of the Notification Letters as early in the semester as possible to identify a specific, timely plan to deliver/receive the indicated accommodations. Reasonable accommodations are not retroactive in nature and are not intended to be an unfair advantage. Additional information or assistance is available online at www.sas.dso.iastate.edu, by contacting SAS staff by email at accessibility@iastate.edu, or by calling 515-294-7220. Student Accessibility Services is a unit in the Dean of Students Office located at 1076 Student Services Building.

POLICY ON ACADEMIC DISHONESTY

Please see the University's rules and procedures concerning academic dishonesty in the Iowa State University Catalog.

Examples of things you SHOULD NOT DO are the following:

- Engage in cheating on any quiz or test.
- Cut and paste verbatim from the internet or other texts unless you are drawing a direct quote (to be placed inside quotation marks) and giving the author(s) credit for their material in the form of parenthetical citation and bibliographical reference.
- Paraphrase the words of the author(s) without giving credit – changing the author's words without crediting the source is still a form of plagiarism as the ideas behind the words are not being credited.
- It is also considered academic dishonesty if any part of your work is written or edited by someone else (beyond the context of peer editing in class), or if you use human or electronic translation services. Translation programs are strictly prohibited. Given that these programs function on the basis of providing literal translations of individual words or short phrases at best, they are not reliable as a means of translating idioms, complex sentences and paragraphs. The errors that these programs make are easily recognizable to the trained eye.

In the event that a student is found to have committed plagiarism or other forms of academic dishonesty, he/she will receive a ZERO on the assignment. Furthermore, under University policy, I am obligated to report the incident to the Office of the Dean of Students, whose office will investigate the incident and decide what additional sanctions will be applied.

EMERGENCY AWARENESS

- For an immediate emergency, call [ISU Police](http://www.isu.edu/police) at 515-294-4428.

- During a campus emergency, go to www.iastate.edu for additional information.
- Classroom management emergencies
 - For immediate health/safety concerns, call ISU Police at 515-294-4428
 - For other concerns regarding classroom management, contact the instructor and/or the chair of the academic department for guidance
- Know the following information posted in your building [Emergency Map](#)
 - Locate the evacuation routes
 - Locate the [severe weather shelter areas](#)
- Keep your contact information up-to-date in the [ISU Alert](#)
- Additional emergency information is available at www.ehs.iastate.edu/prep/students.
- ISU PD Facebook (www.facebook.com/ISUPD) and Twitter (www.twitter.com/ISUPD)
- To be better prepared during an act of violence on campus and understand the principles of A-D-D (Avoid Deny Defend), please attend [Violent Incident Response Training \(VIRT\)](#).

Course Outline and Reading List (Instructor in Parenthesis)

Note: Required readings for the class are listed below. We have also included additional readings if you would like to delve further into a topic (now or in the future). You can certainly find more exhaustive reading lists in environmental and natural resource economics. For example, Pfaff and Stavins (1999) provide a list of classic papers (available here: <http://people.duke.edu/~asp9/files/readingsend.pdf>). The Handbook of Environmental Economics also provides a helpful review of the literature. In addition, NBER working papers provide a good sample of current topics/papers in the field (<http://www.nber.org/papersbyprog/EEE.html>).

Week 1: Theoretical Foundations & Environmental Policy Instruments Choices (DePaula)

Required Readings

- Monday: Coase, R.H., 1960. The problem of social cost. In *Classic papers in natural resource economics* (pp. 87-137). Palgrave Macmillan, London.
- Wednesday: Baumol, W.J., 1972. On taxation and the control of externalities. *The American Economic Review*, 62(3), pp.307-322.
- Friday: Weitzman, M.L., 1974. Prices vs. quantities. *The review of economic studies*, 41(4), pp.477-491.

Supplemental Readings

- Samuelson, Paul A. 1954. "The Pure Theory of Public Expenditure." *The Review of Economics and Statistics*. 36 (4): 387-389.
- Muller, Nicholas Z. and Robert Mendelsohn. 2009. "Efficient Pollution Regulation: Getting the Prices Right." *American Economic Review*. 99 (5): 1714-1739.
- Phaneuf and Requate: Chapters 1, 2, and 3

Week 2: Empirical Methods (DePaula)

Required Readings

- Monday: Lewbel, A., 2019 (Sections 1 to 3). The identification zoo: Meanings of identification in econometrics. *Journal of Economic Literature*, 57(4), pp.835-903.
- Wednesday: Lewbel, A., 2019 (Sections 4 and 5). The identification zoo: Meanings of identification in econometrics. *Journal of Economic Literature*, 57(4), pp.835-903.
- Friday: Lewbel, A., 2019 (Sections 6 to 9). The identification zoo: Meanings of identification in econometrics. *Journal of Economic Literature*, 57(4), pp.835-903.

Supplemental Readings

- Angrist, Joshua D. and Jorn-Steffen Pischke. 2010. "The Credibility Revolution in Empirical Economics: How Better Research Design is Taking the Con out of Econometrics." *Journal of the Economic Perspectives*. 24 (2): 3-30.
- Michael Keane. A structural perspective on the experimentalist school. *Journal of the Economic Perspectives*, 24(2):47-58, 2010
- Timmins, Christopher and Wolfram Schlenker. 2009. "Reduced Form Versus Structural Modeling in Environmental and Resource Economics." *Annual Review of Resource Economics* 1 (1): 351-380.
- Michael Greenstone and Ted Gayer. Quasi-experimental and experimental approaches to environmental economics. *Journal of Environmental Economics and Management*, 57(1):21-44, 2009
- Chapter 2 in: Angrist and Pischke (2009)

Week 3: Non-Market Valuation I: Stated Preference Methods (Zhang)

Required Readings

- Monday: Johnston, R. J. et al. 2017. Contemporary guidance for stated preference studies. *Journal of the Association of Environmental and Resource Economists* 4(2), 319-405.
- Wednesday: Vossler, Christian A., Maurice Doyon, and Daniel Rondeau. 2012. "Truth in Consequentiality: Theory and Field Evidence on Discrete Choice Experiments." *American Economic Journal: Microeconomics*, 4 (4): 145-71.
- Friday: Carson, R. T., Mitchell, R. C., Hanemann, M., Kopp, R. J., Presser, S., and Ruud, P. A. 2003. Contingent valuation and lost passive use: damages from the Exxon Valdez oil spill. *Environmental and Resource Economics* 25(3):257-286.

Supplemental Readings

- Kling, Catherine L., Daniel J. Phaneuf, and Jinhua Zhao. 2012. "From Exxon to BP: Has Some Number Become Better than No Number?" *Journal of Economic Perspectives*. 26(4): 3-26.
- Palm-Forster, Leah H., Paul J. Ferraro, Nicholas Janusch, Christian A. Vossler, and Kent D. Messer. 2019. Behavioral and experimental agri-environmental research: Methodological challenges, literature gaps, and recommendations. *Environmental and Resource Economics* 73(3): 719-742.
- Adamowicz, P. Boxall, M. Williams and J. Louviere. 1998. Stated preference approaches for measuring passive use values: Choice experiments and contingent valuation. *American Journal of Agricultural Economics* 80(1): 64-75.
- Freeman et al. 2014. *The Measurement of Environmental and Resource Values*. 3rd edition. Washington, DC: Resources for the Future. Chapter 12, pp. 383-418.
- Adamowicz, Wiktor, Diane Dupont, Alan Krupnick, and Jing Zhang. 2011. Valuation of cancer and microbial disease risk reductions in municipal drinking water. *Journal of Environmental Economics and Management* 61: 213-226.

- Cummings, G. and Taylor, L.O. 1999. Unbiased value estimates for environmental goods: A cheap talk design for the contingent valuation method. *American Economic Review* 89(3): 649-665.
- Zawojcka, E., Bartczak, A. and Czajkowski, M., 2019. Disentangling the effects of policy and payment consequentiality and risk attitudes on stated preferences. *Journal of Environmental Economics and Management* 93: 63-84.

Week 4: Non-Market Valuation II: Revealed Preference Methods – Hedonics & Recreational Demand Models (Zhang)

Required Readings

- Monday: Keiser, David, and Joe Shapiro. 2017. Consequences of the Clean Water Act and the Demand for Water Quality. *Quarterly Journal of Economics*, forthcoming.
- Wednesday: Timmins, Christopher and Jennifer Murdoch. 2007. A revealed preference approach to the measurement of congestion in travel cost models. *Journal of Environmental Economics and Management* 53(2): 230-249.
- Friday: Currie, Janet, Lucas Davis, Michael Greenstone, and Reed Walker. 2015. "Environmental Health Risks and Housing Values: Evidence from 1,600 Toxic Plant Openings and Closings." *American Economic Review*. 105 (2): 678-709.

Supplemental Readings

- Aldy, Joe, and W. Kip Viscusi. 2008. Adjusting the value of a statistical life for Age and Cohort Effects. *Review of Economics and Statistics* 90(3): 573-581.
- Muehlenbachs, Lucija A., Elisheba Beia Spiller and Christopher Timmins. 2015. The housing market impacts of shale gas development. *American Economic Review* 105(12): 3633-3659.
- Bayer, Patrick, Nathaniel Keohane, and Christopher Timmins. 2009. "Migration and Hedonic Valuation: The Case of Air Quality." *Journal of Environmental Economics and Management*. 58 (1): 1-14.
- Chay, Kenneth Y. and Michael Greenstone. 2005. "Does Air Quality Matter? Evidence from the Housing Market." *Journal of Political Economy*. 113 (2): 376-424.
- Kuminoff, Nicolai V., V. Kerry Smith, and Christopher Timmins. 2012. "The New Economics of Equilibrium Sorting and Policy Evaluation Using Housing Markets." *Journal of Economic Literature*. 51(4): 1007-1062.
- Abbott, JK and Klaiber, HA, "An Embarrassment of Riches: Confronting Omitted Variable Bias and Multiscale Capitalization in Hedonic Price Models." *REVIEW OF ECONOMICS AND STATISTICS*. Vol. 93, no. 4: 1331-1342. 2011.
- Spencer Banzhaf, "Difference-in-Difference Hedonics," Aug 2019, 2nd revision requested from *Journal of Political Economy*.
- Spencer Banzhaf, "Panel-Data Hedonics: Rosen's First Stage as a 'Sufficient Statistic,'" *International Economic Review*, forthcoming.
- Andrew Goodman-Bacon. Difference-in-Differences with Variation in Treatment Timing. **2019**. https://cdn.vanderbilt.edu/vu-my/wp-content/uploads/sites/2318/2019/07/29170757/ddtiming_7_29_2019.pdf

- Kelly Bishop, Nick Kuminoff, Kathrine von Graevenitz, Spencer Banzhaf, Kevin Boyle, Jaren Pope, V. Kerry Smith, and Christopher Timmins, 2019. "Best Practices in Using Hedonic Property Value Models for Welfare Measurement," *Review of Environmental Economics and Policy*
- Kelly Bishop and Christopher Timmins, 2018. "Using Panel Data to Easily Estimate Hedonic Demand Functions," *Journal of the Association of Environmental and Resource Economists*
- Kelly Bishop and Alvin Murphy. 2019. "Valuing Time-Varying Attributes using the Hedonic Model: When is a Dynamic Approach Necessary?" *Review of Economics and Statistics*

Week 5: Water Pollution & Integrated Assessment Models (Zhang)

Required Readings

- Monday: Segerson, Kathleen. 1988. Uncertainty and incentives for nonpoint pollution control. *Journal of Environmental Economics and Management* 15: 87-98.
- Wednesday: Guojun He, Shaoda Wang, Bing Zhang, Wendong, forthcoming, Watering Down Environmental Regulation in China, *The Quarterly Journal of Economics*
- Friday: Rabatyagov et al. 2014. "Cost-effective Targeting of Conservation Investments to Reduce the Northern Gulf of Mexico Hypoxic Zone." *PNAS*. 111 (52): 18530-18535.

Supplemental Readings

- David Keiser, Cathy Kling and Joe Shapiro, The Low but Uncertain Measured Benefits of U.S. Water Quality Policy, *Proceedings of the National Academy of Sciences*, 2019, 116(12): 5262-5269.
- David Keiser, Joseph Shapiro. US Water Pollution Regulation over the Last Half Century: Burning Waters to Crystal Springs? *Journal of Economic Perspectives*, 2019, 33(4): 51-75.
- Grant and Grooms (2017). "Do nonprofits encourage environmental compliance?" *Journal of the Association of Environmental and Resource Economists* 4: S261-S288.
- Smith, M.D., A. Oglend, A.J. Kirkpatrick, F. Asche, L.S. Benneer, and J.K. Craig. 2017. "Seafood prices reveal impacts of a major ecological disturbance." *Proceedings of the National Academy of Sciences* 114(7):1512–1517.
- Liu, Hongxing, Wendong Zhang, Elena Irwin, Jeffery Kast, Noel Aloysius, Jay F. Martin, and Margaret Kelcic. April 2020, Best Management Practices and Nutrient Reduction: An Integrated Economic-Hydrological Model of the Western Lake Erie Basin, *Forthcoming at Land Economics*
- Keeler et al. 2016. The Social Costs of Nitrogen. *Science Advances*
- Bonnie L. Keeler, Stephen Polasky, Kate A. Brauman, Kris A. Johnson, Jacques C. Finlay, Ann O'Neill, Kent Kovacs, Brent Dalzell, Water-quality related ecosystem services, *Proceedings of the National Academy of Sciences* Nov 2012, 109 (45) 18619-18624; DOI: 10.1073/pnas.1215991109
- Weitzman, Martin. 1974. Prices vs. quantities. *Review of Economic Studies* 41: 477-491.
- Will Rafey. "Droughts, deluges, and (river) diversions: Valuing market-based water reallocation" (Job Market Paper)

Week 6: Trade and the Environment (Zhang)

Required Readings

- Monday: Levinson, A. (2009). Technology, international trade, and pollution from us manufacturing. *American Economic Review*, 99(5):2177-2192
- Wednesday: Joseph Shapiro, and Reed Walker. Why is Pollution from U.S. Manufacturing Declining? The Roles of Environmental Regulation, Productivity, and Trade. *American Economic Review*, 2018, 108(12): 3814-54.
- Friday: Jeffrey A. Frankel and Andrew K. Rose. Is Trade Good or Bad for the Environment? Sorting Out the Causality, *The Review of Economics and Statistics* 2005 87:1, 85-91

Supplemental Readings

- Jevan Cherniwchan, Brian R. Copeland, M. Scott Taylor. Trade and the Environment: New Methods, Measurements, and Results. *Annual Review of Economics* 2017 9:1, 59-85
- Joseph Shapiro. 2020. The Environmental Bias of Trade Policy. NBER Working Paper 26845.
- Jonathan I. Dingel, Kyle C. Meng, Solomon M. Hsiang, 2019. Spatial Correlation, Trade, and Inequality: Evidence from the Global Climate, NBER Working Paper No. 25447
- Shapiro, Joseph S. 2016. "Trade Costs, CO₂, and the Environment." *American Economic Journal: Economic Policy*, 8 (4): 220-54.

Week 7: Pollution, Health and Productivity (Zhang)

Required Readings

- Monday: Greenstone, Michael, and Rema Hanna. 2014. Environmental regulations, air and water pollution, and infant mortality in India. *American Economic Review* 104(10): 3038-2072.
- Wednesday: Isen, Adam, Maya Rossin-Slater, and W. Reed Walker. 2017. Every breath you take, every dollar you'll make: The long-term consequences of the Clean Air Act of 1970. *Journal of Political Economy* 125(3): 848-902.
- Friday: Ebenstein, Avraham, Maoyong Fan, Michael Greenstone, Guojun He, and Maigeng Zhou. 2017. New evidence on the impact of sustained exposure to air pollution on life expectancy from China's Huai River Policy. *Proceedings of the National Academy of Sciences* 114(39): 10384-10389.

Supplemental Readings

- Walker, Reed. 2013. The transitional costs of sectoral reallocation: evidence from the Clean Air Act and the workforce. *Quarterly Journal of Economics* 128(4): 1787-1835.

- Tomás Rau, Sergio Urzúa, and Loreto Reyes, “Early Exposure to Hazardous Waste and Academic Achievement: Evidence from a Case of Environmental Negligence,” *Journal of the Association of Environmental and Resource Economists*, 2 (4), 2015.
- Ebenstein, A. (2012). The consequences of industrialization: evidence from water pollution and digestive cancers in China. *Review of Economics and Statistics*, 94(1):186-201
- Alsan M, Goldin C. Watersheds in Child Mortality: The Role of Effective Water and Sewerage Infrastructure, 1880 to 1920. *Journal of Political Economy*. 2019;127 (2) :586-638.
- Guojun He, Tong Liu and Maigeng Zhou. 2020. Straw Burning, PM2.5 and Death: Evidence from China. *Journal of Development Economics*, 2020, 145: 102468.
- Deschenes, O. et al. (2017). “Defensive investments and the demand for air quality: evidence from the NOX budget program.” *American Economic Review* 107: 2958-89.
- Panle Jia Barwick, Shanjun Li, Deyu Rao, Nahim Bin Zahur. 2018. The Morbidity Cost of Air Pollution: Evidence from Consumer Spending in China. NBER Working Paper No. 24688
- Lee, Jonathan M., and Laura O. Taylor. 2019. "Randomized Safety Inspections and Risk Exposure on the Job: Quasi-experimental Estimates of the Value of a Statistical Life." *American Economic Journal: Economic Policy*, 11 (4): 350-74.
- Aragon et al. (2017). “Particulate matter and labor supply: the role of caregiving and non-linearities.” *Journal of Environmental Economics and Management* 86: 295-309.
- Bharadwaj et al. (2017). “Gray matters: fetal pollution exposure and human capital formation.” *Journal of the Association of Environmental and Resource Economists*” 4: 505-542.
- Kelly Bishop, Jonathan Ketcham and Nick Kuminoff, 2019. "Hazed and Confused: The Effect of Air Pollution on Dementia," NBER Working Paper No. Paper 24970

Week 8: Development and the Environment (Zhang)

Required Readings

- Monday: Koichiro Ito and Shuang Zhang. Willingness to Pay for Clean Air: Evidence from Air Purifier Markets in China. *Journal of Political Economy* 2020 128:5, 1627-1672
- Wednesday: Michael Greenstone, Esther Duflo, Rohini Pande and Nicholas Ryan. The Value of Regulatory Discretion: Estimates from Environmental Inspections in India, *Econometrica*, 2018, 86(6): 2123-2160.
- Friday: Anand Roopsind, Brent Sohngen, Jodi Brandt. 2019. Evidence that a national REDD+ program reduces tree cover loss and carbon emissions in a high forest cover, low deforestation country. *Proceedings of the National Academy of Sciences* 116 (49) 24492-24499; DOI: 10.1073/pnas.1904027116

Supplemental Readings

- Guiteras, Raymond, James Levinsohn, Ahmed Mushfiq Mobarak, 2015. “Encouraging sanitation investment in the developing world: A cluster-randomized trial.” *Science*. 348 (6237): 903-906

- Lipscomb, M. and Mobarak, A. M. (2017). Decentralization and pollution spillovers: evidence from the re-drawing of county borders in Brazil. *The Review of Economic Studies*, 84(1):464-502
- Oliva, P. (2015). Environmental regulations and corruption: Automobile emissions in Mexico City. *Journal of Political Economy*, 123(3)
- Sims, K.R.E., and J.M. Alix-Garcia. 2016. "Parks versus PES: Evaluating direct and incentive-based land conservation in Mexico." *Journal of Environmental Economics and Management*.
- Guojun He, Yang Xie and Bing Zhang, Expressways, GDP, and the Environment: The Case of China, *Journal of Development Economics*, 2020, 145: 102485.
- Jacob P. Hochard, Stuart Hamilton, Edward B. Barbier, Mangroves shelter coastal economic activity from cyclones, *Proceedings of the National Academy of Sciences* Jun 2019, 116 (25) 12232-12237; DOI: 10.1073/pnas.1820067116
- Davis, Lucas W., Alan Fuchs, and Paul Gertler. 2014. Cash for coolers: evaluating a large-scale appliance replacement program in Mexico. *American Economic Journal: Economic Policy* 6(4): 207-238.
- Dominic P. Parker and Bryan Vadheim, "Resource Cursed or Policy Cursed? US Regulation of Conflict Minerals and Violence in the Congo," *Journal of the Association of Environmental and Resource Economists*, 4(1), pp. 1-49, 2017.
- Joseph Goeb, Andrew Dillon, Frank Lupi, and David Tschirley. Pesticides: What You Don't Know Can Hurt You. *Journal of the Association of Environmental and Resource Economists* 2020 7:5, 801-836

Week 9: Distributional Effects of Regulation and Environmental Justice (Zhang)

Required Readings

- Monday: Banzhaf, Spencer, and Randall Walsh. 2008. Do people vote with their feet? An empirical test of Tiebout's mechanism. *American Economic Review* 98(3): 843-863.
- Wednesday: Fowlie, Meredith, Stephen Holland, and Erin Mansur. 2012. What do emissions markets deliver and to whom? Evidence from southern California's NOx trading program. *American Economic Review* 102(2): 965-993.
- Friday: Lee and Lin (2018). "Natural amenities, neighborhood dynamics, and persistence in the spatial distribution of income." *Review of Economic Studies* 85: 663-694.

Supplemental Readings

- Lyon, T.P. and Maxwell, J.W. 2003. Self-regulation, taxation and public voluntary environmental agreements. *Journal of Public Economics* 87(7-8): 1453-1486.
- Banzhaf, Spencer, Lala Ma, and Christopher Timmins. 2019. "Environmental Justice: The Economics of Race, Place, and Pollution." *Journal of Economic Perspectives*, 33 (1): 185-208.
- Lucas W. Davis & Christopher R. Knittel, 2019. "Are Fuel Economy Standards Regressive?," *Journal of the Association of Environmental and Resource Economists*, vol 6(S1), pages S1-S27.

- Linn, J., E. Mastrangelo, and D. Burtraw, (2014). “Regulating greenhouse gases from coal power plants under the Clean Air Act,” *Journal of the Association of Environmental and Resource Economists* 1: 97-134.
- Fullerton, Don. 2011. Six distributional effects of environmental policy. *Risk Analysis* 31(6): 923-929.
- Depro et al. (2015). “White flight or coming to the nuisance: can residential mobility explain environmental injustice?” *Journal of the Association of Environmental and Resource Economists* 2: 439-468.
- Williams, Rob, Hal Gordon, Dallas Burtraw, Jared Carbone, and Dick Morgenstern. 2014. The initial incidence of a carbon tax across U.S. States. *National Tax Journal* 67(4): 807–30.
- David Albouy, Walter Graf, Ryan Kellogg, Hendrik Wolff. 2016. Climate amenities, climate change, and American quality of life. *Journal of the Association of Environmental and Resource Economists*

Week 10: Economics of Climate Change (DePaula)

Required Readings

- Monday: Nordhaus, W.D., 1991. To slow or not to slow: the economics of the greenhouse effect. *The economic journal*, 101(407), pp.920-937.
- Wednesday: Weitzman, M.L., 2011. Fat-tailed uncertainty in the economics of catastrophic climate change. *Review of Environmental Economics and Policy*, 5(2), pp.275-292.
- Friday: Nordhaus, W.D., 2011. The economics of tail events with an application to climate change. *Review of Environmental Economics and Policy*, 5(2), pp.240-257.

Supplemental Readings

- Weitzman, M.L., 2009. On modeling and interpreting the economics of catastrophic climate change. *The Review of Economics and Statistics*, 91(1), pp.1-19.
- Phaneuf and Requate: Chapter 13

Week 11: Climate Change Impacts (DePaula)

Required Readings

- Monday: Mendelsohn, R., Nordhaus, W.D. and Shaw, D., 1994. The impact of global warming on agriculture: a Ricardian analysis. *The American economic review*, pp.753-771.
- Wednesday: Deschênes, O. and Greenstone, M., 2007. The economic impacts of climate change: evidence from agricultural output and random fluctuations in weather. *American Economic Review*, 97(1), pp.354-385.
- Friday: Lemoine, D., 2018. *Estimating the consequences of climate change from variation in weather* (No. w25008). National Bureau of Economic Research.

Supplemental Readings

- Schlenker, W. and M.J. Roberts. “Nonlinear Temperature Effects Indicate Severe Damages to US Crop Yields Under Climate Change.” *Proceedings of the National Academy of Sciences*. 106 (37): 15594-15598.
- Dell, M., Jones, B.F. and Olken, B.A., 2014. What do we learn from the weather? The new climate-economy literature. *Journal of Economic Literature*, 52(3), pp.740-98.
- Fisher, A.C., Hanemann, W.M., Roberts, M.J. and Schlenker, W., 2012. The economic impacts of climate change: evidence from agricultural output and random fluctuations in weather: comment. *American Economic Review*, 102(7), pp.3749-60.
- Auffhammer, Maximilian, Solomon M. Hsiang, Wolfram Schlenker, and Adam Sobel. 2013. “Using Weather Data and Climate Model Output in Economic Analyses of Climate Change.” *Review of Environmental Economics and Policy*. 7(2): 181-198.

Week 12: Climate Change Adaptation (DePaula)

Required Readings

- Monday: Barreca, A., Clay, K., Deschenes, O., Greenstone, M. and Shapiro, J.S., 2016. Adapting to climate change: The remarkable decline in the US temperature-mortality relationship over the twentieth century. *Journal of Political Economy*, 124(1), pp.105-159.
- Wednesday: Deschenes, O., Greenstone, M. and Shapiro, J.S., 2017. Defensive investments and the demand for air quality: Evidence from the NOx budget program. *American Economic Review*, 107(10), pp.2958-89.
- Friday: Acemoglu, D., Hemous, D., Barrage, L. and Aghion, P., 2019. Climate change, directed innovation, and energy transition: The long-run consequences of the shale gas revolution. In *2019 Meeting Papers* (No. 1302). Society for Economic Dynamics.

Supplemental Readings

- Hornbeck, R. and Keskin, P., 2014. The historically evolving impact of the Ogallala aquifer: Agricultural adaptation to groundwater and drought. *American Economic Journal: Applied Economics*, 6(1), pp.190-219.
- Zilberman, D., Zhao, J. and Heiman, A., 2012. Adoption versus adaptation, with emphasis on climate change. *Annu. Rev. Resour. Econ.*, 4(1), pp.27-53.

Week 13: Economics of Environmental Disasters (DePaula)

Required Readings

- Monday: Barro, R.J., 2015. Environmental protection, rare disasters and discount rates. *Economica*, 82(325), pp.1-23.
- Wednesday: Hornbeck, R., 2012. The enduring impact of the American Dust Bowl: Short-and long-run adjustments to environmental catastrophe. *American Economic Review*, 102(4), pp.1477-1507.

- Friday: Wagner, K., 2019. Adaptation and Adverse Selection in Markets for Natural Disaster Insurance. *Available at SSRN 3467329*.

Supplemental Readings

- Kellenberg, D. and Mobarak, A.M., 2011. The economics of natural disasters.

Week 14: COVID-19 and Environmental Economics (reading list TBD) (DePaula)