

Economics 2688: Environmental & Climate Economics**Instructors**

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Class Times

Class time: Tuesday and Thursdays 10.30am – 11:45am

Room: Littauer M-15

Course Objective

This course will prepare graduate students for research in the field of climate and environmental economics, including providing students with the core theoretical frameworks of climate, environment, and resource economics, creating competence in the econometric methods used in the field, and providing an introduction to frontier research questions.

This course is part of a two-semester sequence, with Jacob Moscona and Ben Olken teaching 14.475: Environmental Economics at MIT in spring 2025 (Tuesday – Thursday 4-5.30pm).

If you are interested in climate finance, the Salata Institute is hosting a hybrid [class](#) in spring 2025 on Tuesdays from 11am-1pm.

Assignments

Assignment	Handed Out	Due On
PS 1	Sep 12	Sep 26
RR 1	Sep 26	Oct 10
PS 2	Oct 10	Oct 24
PS 3	Oct 24	Nov 7
RR 2	Nov 7	Nov 21
PS 4	Nov 21	Dec 3
Paper		Dec 10

Grading

Your grade will be average grade of the four problem sets (40% total, or 10% each), the two referee reports 20% total, or 10% each) and a class paper (40%). You are encouraged to work together on the problem sets but please hand in your individual answers. Both the referee reports and the class paper should be your own individual work.

Summary

Class	Date	Topic	Instructor
1	Sept. 3	Introduction to Environmental Economics. Externalities and Public Goods	WS
2	Sept. 5	Optimal Pigouvian Taxes, Double Dividend, and Coase	WS
3	Sept. 10	Cost-benefit analysis, cost-effectiveness analysis, marginal abatement costs, and MVPF	JS
4	Sept. 12	Resource Economics	WS
5	Sept. 17	The Green Paradox: Incidence of taxing exhaustible resources	WS
6	Sept. 19	Renewable Resource Economics - Forest, Fisheries	WS
7	Sept. 24	Hedonics	WS
8	Sept. 26	Pollution damages I: Local effects	WS
9	Oct. 1	Pollution damages II: Transport models, environmental justice	WS
10	Oct. 3	Climate damages I: Mortality, learning, productivity	WS
11	Oct. 8	Climate damages II: Agriculture	WS
12	Oct. 11	Climate damages III: GDP	JS
13	Oct. 15	IAMs & the SCC I: climate models, socioeconomics, and damages	JS
14	Oct. 17	IAMs & the SCC II: Discounting, uncertainty, and the climate beta	JS
15	Oct. 22	Env. & climate policy I: Carbon pricing	JS
16	Oct. 24	Env. & climate policy II: Standards & subsidies	JS
17	Oct. 29	Env. & climate policy III: Technology policy, learning-by-doing, & subsidies	JS
18	Oct. 31	Env. & climate policy IV: Macroeconomics of climate policy	JS
19	Nov. 5	Energy transition I: Power sector and the grid	JS
20	Nov. 7	Energy transition II: Transportation	JS
21	Nov. 12	National Accounts	WS
22	Nov. 14	Ecosystem services	WS
23	Nov. 19	Offset markets and voluntary net zero targets	JS
24	Nov. 21	Biodiversity	Guest
25	Nov. 26	International agreements, climate clubs and CBAMs	JS
26	Dec. 3	Political economy of climate legislation	WS

Readings by Class

September 3 - Introduction to Environmental Economics. Externalities and Public Goods

Main readings:

- Tresch, Richard W. 2002. *Public Finance (2nd Edition): A Normative Theory* - Chapters 5-8.
- Carlton, Dennis W. and Glenn C. Loury. 1980. "The Limitations of Pigouvian Taxes as a Long-Run Remedy for Externalities." *Quarterly Journal of Economics*, 95(3):559-566. <https://doi.org/10.2307/1885093>
- Davis, Lucas W. and Erich Muehlegger. 2010. "Do Americans consume too little natural gas? An empirical test of marginal cost pricing." *Rand Journal of Economics*, 41(4):791-810. <https://doi.org/10.1111/j.1756-2171.2010.00121.x>

Further readings:

- Barnett, A. H. 1980. "The Pigouvian Tax Rule Under Monopoly." *American Economic Review*, 70(5):1037-1041. <https://www.jstor.org/stable/1805784>
- Holtermann, Sally. 1976. "Alternative Tax Systems to Correct for Externalities, and the Efficiency of Paying Compensation." *Economica*, 43(169):1-16. <https://doi.org/10.2307/2553012>
- Young, Leslie. 1977. "Alternative Tax Systems to Correct for Externalities and the Technical Options of Firms" *Economica*, 44(176):415-460. <https://doi.org/10.2307/2553574>
- Fishburn, Peter C. 1970. "Arrow's Impossibility Theorem: Concise Proof and Infinite Voters." *Journal of Economic Theory*, 2(1):103-106. [https://doi.org/10.1016/0022-0531\(70\)90015-3](https://doi.org/10.1016/0022-0531(70)90015-3)
- Schmalensee, Richard, and Robert N. Stavins. 2019. "Policy Evolution under the Clean Air Act." *Journal of Economic Perspectives*, 33(4): 27-50. <https://doi.org/10.1257/jep.33.4.27>

September 5: Optimal Pigouvian Taxes, Double Dividend, and Coase

Main readings:

- Muller, Nicholas Z., and Robert Mendelsohn. 2009. "Efficient Pollution Regulation: Getting the Prices Right." *American Economic Review*, 99 (5): 1714-39. <https://doi.org/10.1257/aer.99.5.1714>
- Fullerton, Don. 1997. "Environmental Levies and Distortionary Taxation: Comment." *American Economic Review*, 87(1): 245-251. <https://www.jstor.org/stable/2950868>
- Coase, Ronald C. 1960. "The Problem of Social Cost." *Journal of Law and Economics*, 3:1-44. <https://www.jstor.org/stable/724810>

Further readings:

- Christopher W. Tessum, Joshua S. Apte, and Andrew L. Goodkind. 2019. "Inequity in consumption of goods and services adds to racial-ethnic disparities in air pollution exposure." *Proceedings of the National Academy of Sciences*, 116(13): 6001-6006. <https://doi.org/10.1073/pnas.1818859116>
- Williams III, RC. 2003. "Health Effects and Optimal Environmental Taxes." *Journal of Public Economics*, 87: 323-35. [https://doi.org/10.1016/S0047-2727\(01\)00153-0](https://doi.org/10.1016/S0047-2727(01)00153-0)
- Goulder, Lawrence H., Marc A.C. Hafstead, Gyu Rim Kim, and Xianling Long. 2019. "Impacts of a carbon tax across US household income groups: What are the equity-efficiency trade-offs?" *Journal of Public Economics*, 175: 44-64. <https://doi.org/10.1016/j.jpubeco.2019.04.002>
- Hoffmann, Elizabeth and Matthew L. Spitzer. 1982. "The Coase Theorem: Some Experimental Tests." *Journal of Law and Economics*, 25(1):73-98. <https://www.jstor.org/stable/725226>

September 10: Cost-benefit analysis, cost-effectiveness analysis, marginal abatement costs, and the marginal value of public funds

Main readings:

- Arrow, Kenneth J., Maureen L. Cropper, George C. Eads, Robert W. Hahn, Lester B. Lave, Roger G. Noll, Paul R. Portney, et al. 1996. "Is There a Role for Benefit-Cost Analysis in

Environmental, Health, and Safety Regulation?” *Science* 272(5259): 221–22.

<https://doi.org/10.1126/science.272.5259.221>.

- Hahn, Robert W., Nathaniel Hendren, Robert D. Metcalfe, and Ben Sprung-Keyser. 2024. “A Welfare Analysis of Policies Impacting Climate Change.” *NBER Working Paper* 32728. <https://www.nber.org/papers/w32728>
- Gillingham, K. & J.H. Stock. 2018, “The cost of reducing greenhouse gas emissions.” *Journal of Economic Perspectives* 32(4), 53–72. <https://doi.org/10.1257/jep.32.4.53>
- Shapiro, Joseph and W. Reed Walker. Forthcoming. “Is Air Pollution Regulation Too Lenient? Evidence from US Offset Markets.” *American Economic Review*. ([article](#))

Further readings:

- Hanemann, W. Michael. 1991. “Willingness to Pay and Willingness to Accept: How Much Can They Differ?” *The American Economic Review* 81(3): 635–47. <https://www.jstor.org/stable/2006525>
- US Office of Management and Budget. 2023. [Circular No. A-4](#).
- U.S. EPA, 2024. “Regulatory Impact Analysis for the New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions from Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule.” ([manuscript](#))

September 12: Resource Economics

Main readings:

- Hotelling, Harold. 1931. “The Economics of Exhaustible Resources.” *Journal of Political Economy*, 39(2): 137-175. <https://doi.org/10.1086/254195>
- Anderson, Soren T., Ryan Kellogg, and Stephen W. Salant. 2018. “Hotelling under Pressure.” *Journal of Political Economy*, 126(3): 984-1026. <https://doi.org/10.1086/697203>

Further readings:

- Pindyck, Robert S. 1978. “The Optimal Exploration and Production of Nonrenewable Resources.” *Journal of Political Economy*. 86(5): 841–61. <https://doi.org/10.1086/260714>.
- Pindyck, Robert S. 1980. “Uncertainty and Exhaustible Resource Markets.” *Journal of Political Economy*, 88(6): 1203–25. <https://doi.org/10.1086/260935>.
- Arrow, Kenneth J, and Sheldon Chang. 1982. “Optimal Pricing, Use, and Exploration of Uncertain Natural Resource Stocks.” *Journal of Environmental Economics and Management*, 9(1): 1–10. [https://doi.org/10.1016/0095-0696\(82\)90002-X](https://doi.org/10.1016/0095-0696(82)90002-X).
- Miller, Merton H., and Charles W. Upton. 1985. “A Test of the Hotelling Valuation Principle.” *Journal of Political Economy*, 93(1): 1–25. <https://doi.org/10.1086/261284>.
- Halvorsen, Robert, and Tim R. Smith. 1991. “A Test of the Theory of Exhaustible Resources.” *The Quarterly Journal of Economics*, 106(1): 123–40. <https://doi.org/10.2307/2937909>.
- Livernois, John, Henry Thille, and Xianqiang Zhang. 2006. “A Test of the Hotelling Rule Using Old-Growth Timber Data.” *Canadian Journal of Economics*, 39(1): 163–86. <https://doi.org/10.1111/j.0008-4085.2006.00343.x>.
- Ekeland, Ivar, Wolfram Schlenker, Peter Tankov, and Brian Wright. 2022. “Optimal Exploration and Price Paths of a Non-Renewable Commodity with Stochastic Discoveries.” *NBER Working Paper* 29934. <https://doi.org/10.3386/w29934>.

September 17: The Green Paradox: Incidence of taxing exhaustible resources

Main readings:

- Norman, Maya A., and Wolfram Schlenker. 2024. “Empirical Tests of the Green Paradox for Climate Legislation.” *NBER Working Paper* 32405. <https://doi.org/10.3386/w32405>.

- Heal, Geoffrey and Wolfram Schlenker. 2020. “The Incidence of a Carbon Tax and CO2 Emissions.” *NBER Working Paper* 26086. <https://www.nber.org/papers/w26086>
- Kellogg, Ryan (Working paper)

Further readings:

- Lemoine, Derek. 2017. “Green Expectations: Current Effects of Anticipated Carbon Pricing.” *Review of Economics and Statistics*, 99 (3): 499–513. https://doi.org/10.1162/REST_a_00627
- Sinn, Hans-Werner. 2008. “Public Policies against Global Warming: A Supply Side Approach.” *International Tax and Public Finance*, 15(4): 360–94. <https://doi.org/10.1007/s10797-008-9082-z>.
- van der Ploeg, Frederick, and Cees Withagen. 2012. “Is There Really a Green Paradox?” *Journal of Environmental Economics and Management*, 64(3): 342–63. <https://doi.org/10.1016/j.jeem.2012.08.002>.
- van der Ploeg, Frederick, and Cees Withagen. 2015. “Global Warming and the Green Paradox: A Review of Adverse Effects of Climate Policies.” *Review of Environmental Economics and Policy*, 9(2): 285–303. <https://doi.org/10.1093/reep/rev008>.
- Harstad, B. (2012). “Buy Coal! A Case for Supply-Side Environmental Policy.” *Journal of Political Economy*, 120(1), 77-115.
- Prest, Brian C., and James H. Stock. 2023. “Climate Royalty Surcharges.” *Journal of Environmental Economics and Management* 120: 102844. <https://doi.org/10.1016/j.jeem.2023.102844>.

September 19: Renewable Resource Economics: Forest, Fisheries

Main readings:

- Gordon, H. Scott. 1954. “The Economic Theory of a Common-Property Resource: The Fishery.” *Journal of Political Economy*, 62(2): 124–42. <https://doi.org/10.1086/257497>.
- Frank, Eyal and Kimberly Oremus. 2023. “Regulating Biological Resources: Lessons from Marine Fisheries in the United States.” *Becker Friedman Institute for Economics Working Paper No. 2023-63*. <https://bfi.uchicago.edu/working-paper/2023-63/>

Further readings:

- Stavins, Robert N. 2011. “The Problem of the Commons: Still Unsettled after 100 Years.” *American Economic Review*, 101(1): 81–108. <https://doi.org/10.1257/aer.101.1.81>.
- Costello, Christopher, Steven D. Gaines, and John Lynham. 2008. “Can Catch Shares Prevent Fisheries Collapse?” *Science*, 321(5896): 1678–81. <https://doi.org/10.1126/science.1159478>.
- Sala, Enric, Juan Mayorga, Darcy Bradley, Reniel B. Cabral, Trisha B. Atwood, Arnaud Auber, William Cheung, et al. “Protecting the Global Ocean for Biodiversity, Food and Climate.” *Nature* 592(7854): 397–402. <https://doi.org/10.1038/s41586-021-03371-z>.
- Faustmann, M. 1849. Berechnung des Werthes welchen Waldboden, sowie noch nicht haubare Holzbestände für die Waldwirtschaft besitzen. *Allgemeine Forst- und Jagd-Zeitung* 25: 441– 455.

September 24: Hedonics

Main readings:

- Rosen, Sherwin. 1974. “Hedonic Prices and Implicit Markets: Product Differentiation in Pure Competition.” *Journal of Political Economy*, 82(1):34-55. <https://doi.org/10.1086/260169>
- Davis, Lucas. 2004. “The Effect of Health Risk on Housing Values: Evidence from a Cancer Cluster.” *American Economic Review*, 94(5):34-55. <https://doi.org/10.1257/0002828043052358>
- Ayres, Andrew B., Kyle C. Meng, and Andrew J. Plantinga. 2021. “Do Environmental Markets Improve on Open Access? Evidence from California Groundwater Rights.” *Journal of Political Economy*. 129(10): 2817-2860. <https://doi.org/10.1086/715075>

Further readings:

- Stock, J.H., 1991. “Nonparametric policy analysis: an application to estimating hazardous waste cleanup benefits.” *Nonparametric and Semiparametric Methods in Econometrics and Statistics*: 77-98.([article](#))
- Gamper-Rabindran, Shanti and Christopher Timmins. 2013. “Does Cleanup of Hazardous Waste Sites Raise Housing Values? Evidence of Spatially Localized Benefits.” *Journal of Environmental Economics and Management*, 65(3): 345-360. <https://doi.org/10.1016/j.jeem.2012.12.001>
- Greenstone, Michael and Justin Gallagher. 2008. “Does Hazardous Waste Matter? Evidence from the Housing Market and the Superfund Program.” *Quarterly Journal of Economics*, 123(3):951-1003. <https://doi.org/10.1162/qjec.2008.123.3.951>
- Gamper-Rabindran, Shanti and Christopher Timmins. 2011. “Hazardous Waste Cleanup, Neighborhood Gentrification, and Environmental Justice: Evidence from Restricted Access Census Block Data.” *American Economic Review*, 101(3):620-624. <https://doi.org/10.1257/aer.101.3.620>
- Chay, Kenneth Y. and Michael Greenstone. 2005. “Does Air Quality Matter? Evidence from the Housing Market.” *Journal of Political Economy*, 113(2):376-424. <https://doi.org/10.1086/427462>
- Smith, V. Kerry and Ju-Chin Huang. 1995. “Can Markets Value Air Quality? A Meta-Analysis of Hedonic Property Value Models.” *Journal of Political Economy*, 103(1): 209-227. <https://doi.org/10.1086/261981>

September 26: Pollution damages I: Local effects

Main readings:

- Chay, Kenneth Y. and Michael Greenstone. 2003. “The Impact of Air Pollution on Infant Mortality: Evidence from Geographic Variation in Pollution Shocks Induced by a Recession.” *Quarterly Journal of Economics*, 118(3):1121-1167. <https://doi.org/10.1162/00335530360698513>
- Neidell, Matthew. 2009. “Information, Avoidance Behavior, and Health The Effect of Ozone on Asthma Hospitalizations.” *Journal of Human Resources*, 44(2): 450-478. <https://doi.org/10.3368/jhr.44.2.450>
- Schlenker, Wolfram and W. Reed Walker. 2016. “Airports, Air Pollution, and Contemporaneous Health.” *Review of Economic Studies*, 83(2): 768-809. <https://doi.org/10.1093/restud/rdv043>
- Deryugina, Tatyana, Garth Heutel, Nolan H. Miller, David Molitor, and Julian Reif. “The Mortality and Medical Costs of Air Pollution: Evidence from Changes in Wind Direction.” *American Economic Review*, 109(12): 4178–4219. <https://doi.org/10.1257/aer.20180279>.

Further readings:

- Currie, Janet and Matthew Neidell. 2005. “Air Pollution and Infant Health: What Can We Learn from California's Recent Experience?” *Quarterly Journal of Economics*, 120(3):1003-1030. <https://doi.org/10.1093/qje/120.3.1003>
- Almond, Douglas, Lena Edlund and Martin Palme. 2009. “Chernobyl's Subclinical Legacy: Prenatal Exposure to Radioactive Fallout and School Outcomes in Sweden.” *Quarterly Journal of Economics*, 124(4): 1729-1772. <https://doi.org/10.1162/qjec.2009.124.4.1729>
- Stephen Jarvis, Olivier Deschenes and Akshaya Jha. 2022. “The Private and External Costs of Germany's Nuclear Phase-Out.” *Journal of the European Economic Association*, 20(3): 1311–1346. <https://doi.org/10.1093/jeea/jvac007>

October 1: Pollution damages II: Transport models, environmental justice

Main readings:

- Hernandez-Cortes, Danae, and Kyle Meng. 2020. "Do Environmental Markets Cause Environmental Injustice? Evidence from California's Carbon Market." *Journal of Public Economics*, 217: 104786. <https://doi.org/10.1016/j.jpubeco.2022.104786>
- Currie, Janet, John Voorheis, and W. Reed Walker. 2023. "What Caused Racial Disparities in Particulate Exposure to Fall? New Evidence from the Clean Air Act and Satellite-Based Measures of Air Quality." *American Economic Review*, 113 (1): 71-97. <https://doi.org/10.1257/aer.20191957>
- Tanaka, Shinsuke, Kensuke Teshima, and Eric Verhoogen. 2022. "North-South Displacement Effects of Environmental Regulation: The Case of Battery Recycling." *American Economic Review: Insights* 4(5): 271–88. <https://doi.org/10.1257/aeri.20210201>.
- Banzhaf, Spencer H. and Randall P. Walsh. 2008. "Do People Vote with Their Feet? An Empirical Test of Tiebout's Mechanism." *American Economic Review*, 98(3):843-863. <https://doi.org/10.1257/aer.98.3.843>

Further readings:

- Bayer, Patrick, Nathaniel Keohane and Christopher Timmins. 2009. "Migration and hedonic valuation: The case of air quality." *Journal of Environmental Economics and Management*, 58: 1-14. <https://doi.org/10.1016/j.jeem.2008.08.004>
- Sieg, Holger, V. Kerry Smith, H. Spencer Banzhaf and Randy Walsh. 2004. "Estimating the General Equilibrium Benefits of Large Changes in Spatially Delineated Public Goods." *International Economic Review*, 45(4):1047-1077. <https://doi.org/10.1111/j.0020-6598.2004.00297.x>
- Kuminoff, Nicolai V., V. Kerry Smith and Christopher Timmins. 2013. "The New Economics of Equilibrium Sorting and its Transformational Role for Policy Evaluation." *Journal of Economic Literature*, 51(4): 1007-1062. <https://doi.org/10.1257/jel.51.4.1007>

October 3: Climate damages I: Mortality, learning, productivity

Main readings:

- Carleton, Tamma, Amir Jina, Michael Delgado, Michael Greenstone, Trevor Houser, Solomon Hsiang, Andrew Hultgren, Robert E Kopp, Kelly E McCusker, Ishan Nath, James Rising, Ashwin Rode, Hee Kwon Seo, Arvid Viaene, Jiacan Yuan, and Alice Tianbo Zhang 2022. "Valuing the Global Mortality Consequences of Climate Change Accounting for Adaptation Costs and Benefits." *Quarterly Journal of Economics*, 137(4): 2037–2105. <https://doi.org/10.1093/qje/qjac020>
- Albouy, D., W. Graf, R. Kellogg, and H. Wolff (2016). "Climate Amenities, Climate Change, and American Quality of Life." *Journal of the Association of Environmental and Resource Economists*, 3(1): 205-246. <https://doi.org/10.1086/684573>
- Park, R. Jisung, Joshua Goodman, Michael Hurwitz, and Jonathan Smith. 2020. "Heat and Learning." *American Economic Journal: Economic Policy*, 12(2): 306–39. <https://doi.org/10.1257/pol.20180612>.
- Shrader, Jeffrey G., Laura Bakkensen, and Derek Lemoine. 2023. "Fatal Errors: The Mortality Value of Accurate Weather Forecasts." NBER Working Paper31361. <https://doi.org/10.3386/w31361>.

Further readings:

- Barreca, Alan, Karen Clay, Olivier Deschenes, Michael Greenstone, and Joseph S. Shapiro. 2016. "Adapting to Climate Change: The Remarkable Decline in the US Temperature-Mortality Relationship over the Twentieth Century." *Journal of Political Economy*, 124(1): 105–59. <https://doi.org/10.1086/684582>.

- Mullins, Jamie T., and Corey White. 2020. “Can Access to Health Care Mitigate the Effects of Temperature on Mortality?” *Journal of Public Economics* 191: 104259. <https://doi.org/10.1016/j.jpubeco.2020.104259>.
- Seretakakis, D., P. Lagiou, L. Lipworth, L. B. Signorello, K. J. Rothman, and D. Trichopoulos. 1997. “Changing Seasonality of Mortality from Coronary Heart Disease.” *JAMA* 278(12): 1012–14. <https://doi.org/10.1001/jama.1997.03550120072036>
- Rode, Ashwin, Rachel E. Baker, Tamma Carleton, Anthony D’Agostino, Michael Delgado, Timothy Foreman, Diana R. Gergel, et al. 2022. “Labor Disutility in a Warmer World: The Impact of Climate Change on the Global Workforce.” SSRN Scholarly Paper 4221478. <https://doi.org/10.2139/ssrn.4221478>.
- Wilson, Andrew J, R Daniel Bressler, Casey Ivanovich, Cascade Tuholske, Colin Raymond, Radley M Horton, Adam Sobel, Patrick Kinney, and Jeffrey G Shrader. 2024. “Age-Dependent Vulnerability to Humid Heat: Evidence from Wet-Bulb Temperature Exposure” ([working paper](#))
- Colmer, Jonathan, and Jennifer L. Doleac. 2023. “Access to Guns in the Heat of the Moment: More Restrictive Gun Laws Mitigate the Effect of Temperature on Violence.” *The Review of Economics and Statistics*: 1–40. https://doi.org/10.1162/rest_a_01395.
- Viscusi, W. Kip, and Joseph E. Aldy. 2003. “The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World.” *Journal of Risk and Uncertainty*, 27(1): 5–76. <https://doi.org/10.1023/A:1025598106257>.

October 8: Climate damages II: Agriculture

Main readings:

- Schlenker, Wolfram and Michael J. Roberts. 2009. “Nonlinear Temperature Effects Indicate Severe Damages to U.S. Crop Yields under Climate Change.” *Proceedings of the National Academy of Sciences*, 106(37):15594-15598. <https://doi.org/10.1073/pnas.0906865106>
- Burke, Marshall, and Kyle Emerick. 2016. “Adaptation to climate change: Evidence from US agriculture.” *American Economic Journal - Economic Policy*, 8(3), 106-140. <https://doi.org/10.1257/pol.20130025>
- Schlenker, Wolfram, Michael J. Roberts, and David B. Lobell. 2013. “US maize adaptability.” *Nature Climate Change*, 3:690–691. <https://doi.org/10.1038/nclimate1959>
- Moscona, Jacob and Karthik A Sastry. 2023. “Does Directed Innovation Mitigate Climate Damage? Evidence from U.S. Agriculture.” *Quarterly Journal of Economics*, 138(2): 637–701. <https://doi.org/10.1093/qje/qjac039>

Further readings:

- Fisher, Anthony C., W. Michael Hanemann, Michael J. Roberts and Wolfram Schlenker. 2012. “The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather: Comment” *American Economic Review*, 102(7): 3749-3760 <https://doi.org/10.1257/aer.102.7.3749>
- Roberts, Michael J., and Wolfram Schlenker. 2013. “Identifying Supply and Demand Elasticities of Agricultural Commodities: Implications for the US Ethanol Mandate.” *American Economic Review* 103(6): 2265–95. <https://doi.org/10.1257/aer.103.6.2265>.
- Deschenes, Olivier and Michael Greenstone. 2007. “The Economic Impacts of Climate Change: Evidence from Agricultural Output and Random Fluctuations in Weather.” *American Economic Review*, 97(1):354-385. <https://doi.org/10.1257/aer.97.1.354>
- Butler, Ethan E. and Peter Huybers. 2013. “Adaptation of US maize to temperature variations.” *Nature Climate Change*, 3: 68–72. <https://doi.org/10.1038/nclimate1585>
- Asseng, S., F. Ewert, P. Martre, R. P. Rötter, D. B. Lobell, D. Cammarano, B. A. Kimball, et al. 2015. “Rising Temperatures Reduce Global Wheat Production.” *Nature Climate Change* 5(2): 143–47. <https://doi.org/10.1038/nclimate2470>.

- Tack, Jesse, Andrew Barkley, and Lawton Lanier Nalley. “Effect of Warming Temperatures on US Wheat Yields.” *Proceedings of the National Academy of Sciences* 112(22): 6931–36. <https://doi.org/10.1073/pnas.1415181112>.

October 10: Climate damages III: GDP

Main readings:

- Dell, Melissa, Benjamin F. Jones and Benjamin A. Olken. 2012. “Temperature Shocks and Economic Growth: Evidence from the Last Half Century.” *American Economic Journal: Macroeconomics*, 4(3): 66-95. <https://doi.org/10.1257/mac.4.3.66>
- Marshall Burke, Solomon M. Hsiang, and Edward Miguel. 2015. “Global non-linear effect of temperature on economic production.” *Nature*, 527, 235-239. <https://doi.org/10.1038/nature15725>
- Ishan B. Nath, Valerie A. Ramey & Peter J. Klenow. 2024. “How Much Will Global Warming Cool Global Growth?” *NBER Working Paper 32761*. <https://www.nber.org/papers/w32761>
- Bilal, Adrien, and Diego R. Känzig. 2024. “The Macroeconomic Impact of Climate Change: Global vs. Local Temperature.” *NBER Working Paper 32450*. <https://doi.org/10.3386/w32450>.

Further readings:

- Newell, Richard G., Brian C. Prest, and Steven E. Sexton. 2021. “The GDP-Temperature Relationship: Implications for Climate Change Damages.” *Journal of Environmental Economics and Management*, 108: 102445. <https://doi.org/10.1016/j.jeem.2021.102445>.
- Büntgen, Ulf, Willy Tegel, Kurt Nicolussi, Michael McCormick, David Frank, Valerie Trouet, Jed O. Kaplan, et al. 2011. “2500 Years of European Climate Variability and Human Susceptibility.” *Science*, 331(6017): 578–82. <https://doi.org/10.1126/science.1197175>.

October 15: IAMs & the SCC I: Climate models, socioeconomics, and damages

Main readings:

- Nordhaus, William D. 1992. “An Optimal Transition Path for Controlling Greenhouse Gases.” *Science* 20 1315-1319. <https://doi.org/10.1126/science.258.5086.1315>
- Dietz, Simon, Frederick van der Ploeg, Armon Rezai, and Frank Venmans. 2021. “Are Economists Getting Climate Dynamics Right and Does It Matter?” *Journal of the Association of Environmental and Resource Economists* 8(1), 895-921. <https://doi.org/10.1086/713977>
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October 17: IAMs & the SCC II: Discounting, uncertainty, the climate beta

Main readings:

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October 22: Environmental and climate policy I: carbon pricing

Main readings:

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October 24: Environmental and climate policy II: Standards

Main readings:

- Borenstein, Severin and Ryan Kellogg. 2023. “Carbon Pricing, Clean Electricity Standards, and Clean Electricity Subsidies on the Path to Zero Emissions.” *Environmental and Energy Policy and the Economy* 4, 125-176. <https://doi.org/10.1086/722675>.
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October 29: Environmental and climate policy III: Technology policy, learning-by-doing, & subsidies

Main readings:

- Way, Rupert, Matthew C. Ives, Penny Mealy, and J. Doyne Farmer. 2022. “Empirically Grounded Technology Forecasts for the Energy Transition.” *Joule* 6, 2057-2082. <https://doi.org/10.1016/j.joule.2022.08.009>.
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- Bistline, John, Neil Mehrotra, and Catherine Wolfram. 2023. “Economic Implications of the Climate Provisions of the Inflation Reduction Act.” *Brookings Papers on Economic Activity*, Spring 2023, 77-182 ([article](#)).

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- Fisher, Carolyn and Richard G. Newell. 2008. “Environmental and technology policies for climate mitigation.” *Journal of Environmental Economics and Management* 55, 142-162. <https://doi.org/10.1016/j.jeem.2007.11.001>
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October 31: Environmental and climate policy IV: Macroeconomics and climate policy

Main readings:

- Acemoglu, Daron, Philippe Aghion, Leonardo Bursztyn, and David Hemous. 2012. “The Environment and Directed Technical Change.” *American Economic Review* 102(1), 131-166. <http://dx.doi.org/10.1257/aer.102.1.131>.
- Mehrotra, Neil. 2024. “The Macroeconomics of Net Zero.” Federal Reserve Bank of Minneapolis. ([working paper](#))
- Van der Ploeg. 2018. “The Safe Carbon Budget.” *Climatic Change* 147, 47-59. <https://doi.org/10.1007/s10584-017-2132-8>.
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Further readings:

- Känzig, Diego and Maximilian Konradt. 2023. “Climate Policy and the Economy: Evidence from Europe’s Carbon Pricing Initiatives.” *NBER Working Paper 31260*. <https://www.nber.org/papers/w31260>
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November 5: Energy transition I: Power sector and the grid

Main readings:

- Davis, Lucas W., Catherine Hausman, and Nancy L. Rose. 2023. “Transmission Impossible? Prospects for Decarbonizing the US Grid.” *Journal of Economic Perspectives* 37(4), 155-180. <https://doi.org/10.1257/jep.37.4.155>
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Further readings:

- Fell, Harrison, Daniel T. Kaffine, and Kevin Novan. 2021. “Emissions, Transmission, and the Environmental Value of Renewable Energy.” *American Economic Journal: Economic Policy* 13(2): 241–72. <https://doi.org/10.1257/pol.20190258>.
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November 7: Energy transition II: Transportation

Main readings:

- Cole, Cassie, Michael Droste, Christopher R Knittel, and JH Stock. 2023. “Policies for Electrifying the Light-Duty Vehicle Fleet in the United States,” *American Economic Association Papers & Proceedings*, 2023, 113: 316-322. <https://doi.org/10.1257/pandp.20231063>
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- Li, Shanjun, Lang Tong, Jianwei Xing, and Yiyi Zhou. 2017. “The Market for Electric Vehicles: Indirect Network Effects and Policy Design.” *Journal of the Association of Environmental and Resource Economists* 4(1), 89-133. <http://dx.doi.org/10.1086/689702>.

Further readings:

- Forsythe, Connor R., Kenneth T. Gillingham, Jeremey J. Michalek, and Katie S. Whitefoot. 2023. “Technology Advancement is Driving Electric Vehicle Adoption.” *Proceedings of the National Academy of Sciences*, 120(23). <https://doi.org/10.1073/pnas.2219396120>.
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November 12: National Accounts

Main readings:

- Muller, Nicholas Z., Robert Mendelsohn, and William Nordhaus. 2011. “Environmental Accounting for Pollution in the United States Economy.” *American Economic Review*, 101(5): 1649–75. <https://doi.org/10.1257/aer.101.5.1649>.
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Further readings:

- Fenichel, Eli P., Ethan T. Addicott, Kristine M. Grimsrud, Glenn-Marie Lange, Ina Porras, and Ben Milligan. 2020. “Modifying National Accounts for Sustainable Ocean Development.” *Nature Sustainability*, 3(11): 889–95. <https://doi.org/10.1038/s41893-020-0592-8>.
- Weitzman, Martin L. 1976. “On the Welfare Significance of National Product in a Dynamic Economy.” *The Quarterly Journal of Economics* 90(1): 156–62. <https://doi.org/10.2307/1886092>

November 14: Ecosystems

Main readings:

- Frank, Eyal G. 2023. “The Economic Impacts of Ecosystem Disruptions: Costs From Substituting Biological Pest Control” *Working Paper*. <https://www.eyalfrank.com/research/>
- Taylor, Charles A. and Hannah Druckenmiller. 2022. “Wetlands, Flooding, and the Clean Water Act.” *American Economic Review*. 112(4): 1334-1363. <https://doi.org/10.1257/aer.20210497>
- Taylor, Charles. 2023. “Cicadian Rhythm: Insecticides, Infant Health and Long-term Outcomes.” ([working paper](#)) .
- Aspelund, Karl and Anna Russo. 2024. “Additionality and Asymmetric Information in Environmental Markets: Evidence from Conservation Auctions.” ([working paper](#))

Further readings:

- Weitzman, Martin L. 1998. “The Noah’s Ark Problem.” *Econometrica*, 66(6): 1279–98. <https://doi.org/10.2307/2999617>.

November 21: Offset markets and voluntary net zero targets

Main readings:

- Groom, Ben and Frank Venmans. 2022. “The Social Value of Offsets.” *Nature* 619, 768-776. <https://doi.org/10.1038/s41586-023-06153-x>.
- West, Thales A.P. et al. 2023. “Action needed to make carbon offsets from forest conservation work for climate change mitigation.” *Science* 381(6660). <https://doi.org/10.1126/science.ade3535>.
- Sastry, Parinitha R., Emil Verner & David Marques Ibanez. 2024. “Business as Usual: Bank Net Zero Commitments, Lending, and Engagement.” *NBER Working Paper* 32402. <https://www.nber.org/papers/w32402>
- Calé, Raphael, Jonathan Colmer, Antoine Dechezleprêtre, and Matthieu Glachant. Forthcoming. “Do Carbon Offsets Offset Carbon.” *American Economic Journal: Applied Economics*. ([old version](#))

Further readings:

- Balmford, A., Keshav, S., Venmans, F. et al. 2023. Realizing the social value of impermanent carbon credits. *Nature Climate Change* 13, pages 1172–1178. <https://doi.org/10.1038/s41558-023-01815-0>.
- Bolton, P. and M. Kacperczyk. 2021. “Do investors care about carbon risk? *Journal of Financial Economics* 142(2), 517-549. <https://doi.org/10.1016/j.jfineco.2021.05.008>.

November 21: Biodiversity.

Guest lecture: [Prof. Jeannine Cavender-Bares](#), (FAS/Organismic and Evolutionary Biology)

Readings TBD

November 26: International agreements, climate clubs and CBAMs

Main readings:

- Nordhaus, William D. 2015. “Climate Clubs: Overcoming Free-riding in International Climate Policy.” *American Economic Review* 105(4): 1339–1370. <http://dx.doi.org/10.1257/aer.15000001>.
- Campolmi, Alessia, Harald Fadinger, Chiara Forlati, Sabine Stillger, and Ulrich J. Wagner. 2024. “Designing Effective Carbon Border Adjustment with Minimal Information Requirements. Theory and Empirics.” SSRN Scholarly Paper. <https://doi.org/10.2139/ssrn.4644941>.
- Barrett, Scott, and Astrid Dannenberg. 2022. “The Decision to Link Trade Agreements to the Supply of Global Public Goods.” *Journal of the Association of Environmental and Resource Economists* 9(2): 273–305. <https://doi.org/10.1086/716902>.

Further readings:

- Clausen, Kimberly A., and Catherine Wolfram. 2023. “Carbon Border Adjustments, Climate Clubs, and Subsidy Races When Climate Policies Vary.” *Journal of Economic Perspectives* 37(3): 137–62. <https://doi.org/10.1257/jep.37.3.137>.
- Stavins, Robert. “Paris Agreement — A Good Foundation for Meaningful Progress“ ([post](#))
- Bollinger, Bryan, Todd Gerarden, Kenneth Gillingham, Drew Vollmer, and Daniel Yi Xu. 2024. “Strategic Avoidance and the Welfare Impacts of Solar Panel Tariffs. ([working paper](#))

December 3: Political economy of climate legislation

Main readings:

- Bombardini, Matilde, Frederico Finan, Nicolas Longuet Marx, Suresh Naidu, and Francesco Trebbi. 2024. “Climate Voting in the United States“ (working paper)
- Moore, Frances C., Nick Obradovich, Flavio Lehner, and Patrick Baylis. 2019. “Rapidly Declining Remarkability of Temperature Anomalies May Obscure Public Perception of Climate Change.” *Proceedings of the National Academy of Sciences* 116(11): 4905–10. <https://doi.org/10.1073/pnas.1816541116>.

Further readings:

- Dechezleprêtre, Antoine, Adrien Fabre, Tobias Kruse, Bluebery Planterose, Ana Sanchez Chico, and Stefanie Stantcheva. 2022. “Fighting Climate Change: International Attitudes Toward Climate Policies.” *NBER Working Paper* 30265. <https://www.nber.org/papers/w30265>.
- Parry, Ian, Chandara Veung, and Dirk Heine. 2015. “How Much Carbon Pricing Is in Countries’ Own Interests? The Critical Role of Co-Benefits.” *Climate Change Economics* 6(4): 1550019. <https://doi.org/10.1142/S2010007815500190>.
- Kaufmann, Robert K., Michael L. Mann, Sucharita Gopal, Jackie A. Liederman, Peter D. Howe, Felix Pretis, Xiaojing Tang, and Michelle Gilmore. 2017. “Spatial Heterogeneity of Climate Change as an Experiential Basis for Skepticism.” *Proceedings of the National Academy of Sciences* 114(1): 67–71. <https://doi.org/10.1073/pnas.1607032113>.