Ec 970: The Economics of Climate Change

Harvard University Department of Economics

Spring, 2025

Instructor: Coly Elhai
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Office Hours: By appointment
Class Hours: T/Th 10:30-11:45am
Stata/R Office Hours: Mini Course Site
Classroom: Sever 204

Last updated: 04/21/2025

1 Course Description

In this course, we will explore the economics of climate change, one of the most pressing issues facing the world today. We will begin by learning about the many costs imposed by climate change, and the challenges of measuring those costs. We will then explore the different tools available to policymakers for reducing carbon emissions, from carbon pricing to subsidies to regulation. What factors influence the effectiveness of these policies in different contexts? Finally, we will discuss how adaptation can blunt the impacts of climate change. To what extent can behavioral changes, infrastructure, and innovation reduce damages from natural disasters and rising temperatures? How can policymakers fund adaptation without increasing exposure to climate risks? By the end of the course, students will be prepared to apply core concepts from economics (externalities, adverse selection, etc.) to design solutions for a range of climate-related issues.

2 Prerequisites

A course in intermediate microeconomics is a prerequisite for this class, as is a course in introductory statistics. A course in econometrics and some background in calculus are strongly recommended.

3 Course Requirements

1. *Participation*: 20%

    - **Attendance and participation, 15% of grade:** Since in-class discussion is the central component of this course, class attendance and participation are mandatory. Participation involves proper preparation for and respectful, active involvement in class

discussions. You are expected to have read all required readings before each class, and to come to class prepared to discuss these readings.

- **Lead class discussion, 5% of grade:** You will sign up to lead class discussion twice throughout the semester. As the discussion leader, you will prepare a brief (3-5 minute) oral presentation about the assigned reading, but your primary responsibility will be to prepare questions and facilitate an active discussion during the class about the reading. Sign up for your discussion dates here.

2. *Writing assignments*: 65%

- **Introduce yourself (≈ 1 page, ungraded):** In this assignment, you will write a brief description of yourself, your background, and what interests you most about economics.
- **Reading responses (≈ 1 page each, 10% of grade in total):** You will write many short responses to the papers assigned for class. These responses will be due before class discussion. I will drop your lowest 3 grades on this assignment.
- **Abstract, intro, and conclusion (3-5 pages, 5% of grade):** For this assignment, you will be given the body of pre-existing research paper. You will write the abstract, introduction, and conclusion for it.
- **Referee report with GenAI (3-5 pages, 5% of grade):** You will select one of a few options of unpublished research papers to critically evaluate. You will then prompt a generative AI tool of your choice to write a referee report that summarizes the paper, evaluates its strengths and weaknesses, and provide constructive feedback to the authors. Then, you will critique the AI's report, and discuss what you've learned about how AI is or isn't helpful in this context.
- **Short essay (5-7 pages, 10% of grade):** For this assignment, you will choose one of the topics from class and conduct an extended literature review. Beyond simply summarizing the literature on your chosen topic, you will critique ideas, synthesize classroom discussion, and propose directions for future research.
- **Prospectus, (1-2 pages, 5% of grade):** About halfway through the semester, you will submit a 1-2 page prospectus for your final paper outlining what you would like to work on. Before submitting your prospectus, I require that we meet one-on-one in office hours and discuss your ideas.
- **Final paper (15-20 pages, 30% of grade):**
  - **Methods and results, (3-5 pages, 2% of grade):** To ensure that you're making progress on your final project, you will submit a draft of your methods and results section before you write your first draft. This will allow me to give you feedback on the core of your project while you still have time to make changes.
  - **First draft (3% of grade):** Two weeks before your final draft is due, you'll submit a first draft that has all the components of your final paper except for the abstract. Your conclusion can be very brief, since your analysis may still be subject to changes. I will review this first draft and provide you with detailed feedback at least a week before your final draft is due.
  - **Final draft (25% of grade):** This will be a polished research paper that uses empirical methods to provide insight into an interesting problem in climate change economics.

3. *Presentation*: 5%

    - **Final project presentation (4% of grade):** During the final week of class, all students will give a short presentation on their final research paper. This will be a low-stakes opportunity to practice presenting your work and receive feedback.
    - **Feedback for your peers (1% of grade):** You are expected to pay attention to your peers' presentations and provide constructive feedback. You will also be randomly assigned a classmate for whom you will take notes during their presentation and provide with a written synthesis of feedback after class.

4. *Problem Sets (10%)*: All Ec 970 students are expected to complete empirical problem sets in Stata or R as part of the Stata/R mini-course hosted on a separate Canvas site. This course consists of video tutorials and four problem sets due in the first half of the semester. These problem sets will help prepare you to conduct your own empirical analysis as part of your final project. They will also give you the skills necessary to work with data more broadly.

4 Course Logistics

Contacting Me

Sign up for my office hours here if you have any questions! If you can't make any of the available times, please email me to set up an appointment. You're also welcome to email me questions directly. I will do my best to respond quickly.

Office Hours

I encourage you to meet with me regularly throughout the semester. I am happy to discuss any aspect of the course, economics more broadly, or your own research interests. Sign up for office hours here.

Separately, the department offers office hours to help you with the Stata/R problem sets. You can sign up for these office hours here.

Attendance

You are permitted 2 free absences throughout the semester. Beyond this, each additional absence without a note from your resident dean will result in a reduction in your participation grade. In all cases, please notify me ahead of time if you will be missing class.

Late Assignments

You will have a total of 3 late days to use throughout the semester. You may use these late days on any assignment except the final draft of your research paper, for which the deadline is coursewide and cannot be extended. Beyond these three late days, you will need to ask for a formal extension, which will require a note from your resident dean. Late assignments will be penalized 10% per day late.

Resources

This will be a challenging (though hopefully rewarding!) class. If you are struggling, please talk to me or use any of the other resources provided by the university. The Academic Resource Center (ARC) offers tutoring services, workshops, and coaching, among other services. Mental health resources include Harvard University Health Services (HUHS), Counseling and Mental Health Services (CAMHS), and the Center for Wellness and Health Promotion.

Academic Integrity

Discussing ideas and work-in-progress with others is an important and desirable part of the research process, but in the end, your assignments must be your own effort, written by you, and ultimately based on your own thinking. All written assignments must use appropriate citation practices. For questions about Harvards stance on academic honesty, consult the Academic Integrity section in the Harvard College Handbook for Students.

AI Use Policy

Use of AI tools on the problem sets is strictly prohibited. You are permitted to use AI tools on other assignments, but you must note when and how you use it (including what prompts you gave). You must also ensure that the final product is your own work, not simply copied.

Key Dates

- January 30: Introduce yourself due
- February 7: Abstract, intro, and conclusion due
- February 14: Stata/R Problem Set #1 due
- February 21: Referee report due
- February 28: Stata/R Problem Set #2 due
- March 7: Prospectus due
- March 14: Stata/R Problem Set #3 due
- March 28: Short essay due
- April 4: Stata/R Problem Set #4 due
- April 11: Methods and results due
- April 22: First draft due
- May 7: Final research paper due [NO EXTENSIONS]

5 Course Schedule

This schedule is subject to change.

Week 1, 01/27 - 01/31: Introduction to climate change economics

- Class 1: Introduction
  - Gowen, Annie, Niko Kommenda and Saiyna Bashir. (2023) Climate-Linked Ills Threaten Humanity. Washington Post. Link.
  - Burke, Marshall, Melanie Craxton, Charles D. Kolstad, Chikara Onda, Hunt Allcott, Erin Baker, Lint Barrage et al. "Opportunities for advances in climate change economics." Science 352, no. 6283 (2016): 292-293.
  - Sections 0-2 of Writing Economics
- Class 2: How do we measure the costs of climate change?
  - Auffhammer, Maximilian. "Quantifying economic damages from climate change." Journal of Economic Perspectives 32, no. 4 (2018): 33-52.
  - Carleton, Tamma A., and Solomon M. Hsiang. "Social and economic impacts of climate." Science 353, no. 6304 (2016): aad9837. (Reading response)
  - Introduce Yourself due 1/30

Week 02, 02/03 - 02/07: Quantifying the costs of climate change by sector, part 1

- Class 1: Mortality and morbidity
  - Gould, Carlos F., Sam Heft-Neal, Alexandra K. Heaney, Eran Bendavid, Christopher W. Callahan, Mathew Kiang, Joshua S. Graff Zivin, and Marshall Burke. Temperature Extremes Impact Mortality and Morbidity Differently. No. w32195. National Bureau of Economic Research, 2024.
  - Burgess, Robin, Olivier Deschenes, Dave Donaldson, and Michael Greenstone. "Weather, climate change and death in India." University of Chicago (2017): 577-617. (Reading response)
- Class 2: Economic activity
  - Graff Zivin, Joshua, and Matthew Neidell. "Temperature and the allocation of time: Implications for climate change." Journal of Labor Economics 32, no. 1 (2014): 1-26.
  - Hsiang, Solomon M., and Amir S. Jina. The causal effect of environmental catastrophe on long-run economic growth: Evidence from 6,700 cyclones. No. 20352. National Bureau of Economic Research, 2014.
  - Abstract, intro, and conclusion due 2/6 at 10:30am

Week 03, 02/10 - 02/14: Quantifying the costs of climate change by sector, part 2

- Class 1: Crime and conflict
  - Ranson, Matthew. "Crime, weather, and climate change." Journal of Environmental Economics and Management 67, no. 3 (2014): 274-302. (Reading response)
  - Hsiang, Solomon M., Kyle C. Meng, and Mark A. Cane. "Civil conflicts are associated with the global climate." Nature 476, no. 7361 (2011): 438-441.
- Class 2: Agriculture
  - Schlenker, Wolfram, and Michael J. Roberts. "Nonlinear temperature effects indicate severe damages to US crop yields under climate change." Proceedings of the National Academy of sciences 106, no. 37 (2009): 15594-15598.
  - Hultgren, Andrew, Tamma Carleton, Michael Delgado, Diana R. Gergel, Michael Greenstone, Trevor Houser, Solomon Hsiang et al. "Estimating global impacts to agriculture from climate change accounting for adaptation." Available at SSRN 4222020 (2022).
  - Problem Set #1 due 2/14

Week 04, 02/17 - 02/21: Mitigation overview

- Class 1: Abatement costs
  - Gillingham, Kenneth, and James H. Stock. 2018, The cost of reducing greenhouse gas emissions. Journal of Economic Perspectives 32(4), 5372. https://doi.org/10.1257/jep.32.4.53
  - Lade, Gabriel E., and Ivan Rudik. "Costs of inefficient regulation: Evidence from the Bakken." Journal of Environmental Economics and Management 102 (2020): 102336. (Reading response)
- Class 2: Mitigation policy options
  - Blanchard, Olivier, Christian Gollier, and Jean Tirole. "The portfolio of economic policies needed to fight climate change." Annual Review of Economics 15, no. 1 (2023): 689-722.
  - Stavins, Robert. Carbon Taxes vs Cap and Trade: Theory and Practice. Discussion Paper ES 2019-9. Cambridge, Mass.: Harvard Project on Climate Agreements, November 2019. Link.
- Referee report due 2/21

Week 05, 02/24 - 02/28: Taxes, caps, and standards

- Class 1: Carbon taxes and cap/trade
  - Colmer, Jonathan, Ralf Martin, Mirabelle Muûls, and Ulrich J. Wagner. "Does Pricing Carbon Mitigate Climate Change? Firm-Level Evidence from the European Union Emissions Trading System." Review of Economic Studies (2024): rdae055. (Reading response: skip section 5.3)

  - Pretis, Felix. "Does a carbon tax reduce CO2 emissions? Evidence from British Columbia." Environmental and Resource Economics 83, no. 1 (2022): 115-144.
  - Section 3 of Writing Economics

- Class 2: Emissions standards
  - Levinson, Arik. "Energy efficiency standards are more regressive than energy taxes: Theory and evidence." Journal of the Association of Environmental and Resource Economists 6, no. S1 (2019): S7-S36.

- Problem Set #2 due 2/28

Week 06, 03/03 - 03/07: Subsidies and credit

- **Office hours to discuss prospectus**

- Class 1: U.S.
  - Fowlie, Meredith, Michael Greenstone, and Catherine Wolfram. "Do energy efficiency investments deliver? Evidence from the weatherization assistance program." The Quarterly Journal of Economics 133, no. 3 (2018): 1597-1644. (Reading response)
  - Borenstein, Severin, and Lucas W. Davis. The distributional effects of US tax credits for heat pumps, solar panels, and electric vehicles. No. 32688. National Bureau of Economic Research, 2024. (Abstract, intro, and figures only)

- Class 2: Developing world
  - Berkouwer, Susanna B., and Joshua T. Dean. "Credit, attention, and externalities in the adoption of energy efficient technologies by low-income households." American Economic Review 112, no. 10 (2022): 3291-3330.
  - Jayachandran, Seema, Joost De Laat, Eric F. Lambin, Charlotte Y. Stanton, Robin Audy, and Nancy E. Thomas. "Cash for carbon: A randomized trial of payments for ecosystem services to reduce deforestation." Science 357, no. 6348 (2017): 267-273. (Abstract and intro only)

- Prospectus due 3/7

Week 07, 03/10 - 03/14: Technology

- Class 1: Innovation
  - Aghion, Philippe, Antoine Dechezleprêtre, David Hemous, Ralf Martin, and John Van Reenen. "Carbon taxes, path dependency, and directed technical change: Evidence from the auto industry." Journal of Political Economy 124, no. 1 (2016): 1-51. (Reading response, in section II read only the predictions part, skip details of econometric techniques on page 10)

- Class 2: Electricity

  - Davis, Lucas W., Catherine Hausman, and Nancy L. Rose. "Transmission impossible? Prospects for decarbonizing the US grid." Journal of Economic Perspectives 37, no. 4 (2023): 155-180.
  - Borenstein, Severin. "The Electricity Price Isnt Right." Energy Institute Blog, UC Berkeley, September 17, 2018, link.

- Problem Set #3 due 3/14

Week 08, 03/17 - 03/21: Spring Break

Week 09, 03/24 - 03/28: Adaptation overview and migration

- Class 1:
  - Barreca, Alan, Karen Clay, Olivier Deschenes, Michael Greenstone, and Joseph S. Shapiro. "Adapting to climate change: The remarkable decline in the US temperature-mortality relationship over the twentieth century." Journal of Political Economy 124, no. 1 (2016): 105-159. (Reading response)
  - Carleton, Tamma, Amir Jina, Michael Delgado, Michael Greenstone, Trevor Houser, Solomon Hsiang, Andrew Hultgren et al. "Valuing the global mortality consequences of climate change accounting for adaptation costs and benefits." The Quarterly Journal of Economics 137, no. 4 (2022): 2037-2105. (Abstract and intro only)
  - Section 4 of Writing Economics
- Class 2: Migration
  - Deryugina, Tatyana, Laura Kawano, and Steven Levitt. "The economic impact of Hurricane Katrina on its victims: Evidence from individual tax returns." American Economic Journal: Applied Economics 10, no. 2 (2018): 202-233.
  - Missirian, Anouch, and Wolfram Schlenker. "Asylum applications respond to temperature fluctuations." Science 358, no. 6370 (2017): 1610-1614.

- Short essay due 3/28

Week 10, 03/31 - 04/04: Insurance

- Class 1: Housing
  - Baylis, Patrick, and Judson Boomhower. "The economic incidence of wildfire suppression in the United States." American Economic Journal: Applied Economics 15, no. 1 (2023): 442-473. (Reading response)
  - Gallagher, Justin. "Learning about an infrequent event: Evidence from flood insurance take-up in the United States." American Economic Journal: Applied Economics (2014): 206-233.
- Class 2: Agriculture

  - Karlan, Dean, Robert Osei, Isaac Osei-Akoto, and Christopher Udry. "Agricultural decisions after relaxing credit and risk constraints." The Quarterly Journal of Economics 129, no. 2 (2014): 597-652. (Abstract and intro only)
  - Lane, Gregory. "Adapting to climate risk with guaranteed credit: Evidence from Bangladesh." Econometrica 92, no. 2 (2024): 355-386.

- Problem Set #4 due 4/4

Week 11, 04/07 - 04/11: Technology

- Class 1: Practices **[GUEST LECTURER]**
  - McGuirk, Eoin F., and Nathan Nunn. "Transhumant pastoralism, climate change, and conflict in Africa." Review of Economic Studies 92, no. 1 (2025): 404-441.
- Class 2: Forecasts **[ON ZOOM]**
  - Molina, Renato, and Ivan Rudik. "The social value of hurricane forecasts." No. 32548. National Bureau of Economic Research, 2024. Available at: https://www.nber.org/papers/w32548. (Reading response) (Skim theory in section 2.3)
  - Burlig, Fiona, Amir Jina, Erin M. Kelley, Gregory V. Lane, and Harshil Sahai. Long-range forecasts as climate adaptation: Experimental evidence from developing-country agriculture. No. 32173. National Bureau of Economic Research, 2024. Available at: https://www.nber.org/papers/w32173. (Abstract, intro, and figures 4-5 only)
- Methods and results due 4/11

Week 12, 04/14 - 04/18: Policy

- Class 1: Regulation
  - Baylis, Patrick W., and Judson Boomhower. Mandated vs. voluntary adaptation to natural disasters: the case of US wildfires. No. 29621. National Bureau of Economic Research, 2022. Available at https://www.nber.org/system/files/working_papers/w29621/w29621.pdf. (Abstract, intro, figures 4-5, Equations 1-2)
  - Grosset-Touba, Florian, Anna Papp, and Charles A. Taylor. "Rain Follows the Forest: Land Use Policy, Climate Change, and Adaptation." SSRN (2024). Available at https://ssrn.com/abstract=4333147. (Reading response)
  - Section 5 of Writing Economics
- Class 2: Investment
  - Bradt, Jacob T., and Joseph E. Aldy. "Private Benefits from Public Investment in Climate Adaptation and Resilience." Unpublished Manuscript (2023). Available at https://jacobbradt.com/assets/pdf/papers/BradtAldy_ClimateAdaptation_230714.pdf (Read in full, with particular attention to Figure 2 and Equations 1-2)
  - Balboni, Clare. "In harm's way? infrastructure investments and the persistence of coastal cities." American Economic Review 115, no. 1 (2025): 77-116. (Abstract and intro only)

Week 13, 04/21 - 04/25: Student presentations

- Class 1: Sabrina, Preston, Taybah, Ben
- First draft due 4/22
- Class 2: Mukta, Sanders, Silvana, Sarah

Week 14, 04/28 - 05/02: Presentations

- Class 1: Alex, Oneli, Brian

Week 15, 05/05 - 05/09:

- Final research paper due 5/7 at 5pm [NO EXTENSIONS]