USC Dornsife
Dana and David Dornsife
College of Letters, Arts and Sciences

ECON 487

Environmental Economics

Section 26166

Units: 4 Units

Spring 2025

Mon, Wed—12:00 pm-1:20 pm

Location: THH 116

Instructor: Hao Yin

Office: Kaprielian Hall (KAP) 330A

Office Hours: Flexible

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Contact Info: TBD

Course Description

Environmental pollution and climate change contribute to millions of deaths each year, underscoring the urgent need for effective solutions. Tackling these challenges requires our understanding of the intricate relationship between the economy and the environment through the lens of economic theories and models.

This course examines how human decisions impact environmental quality, how economic principles can guide optimal environmental outcomes, and how society values the environment. Most importantly, it explores how well-designed environmental policies can drive improvements in environmental quality.

Students will study key topics including market efficiency, externalities, decision-making processes related to the environment, environmental valuation, and regulatory policies aimed at enhancing environmental efficiency.

The course also introduces modern empirical research in environmental and climate economics, providing students with practical insights into real-world challenges and strategies for achieving sustainable solutions.

Learning Objectives

By the end of the course, you should be able to:

1. **Explain the Causes of Environmental Pollution**: Analyze the economic and behavioral factors contributing to environmental degradation and how these interactions lead to pollution.
2. **Evaluate Social Choice Rules**: Compare the implications of various social choice frameworks for shaping environmental outcomes, considering the trade-offs and priorities they reflect.
3. **Identify Sources of Inefficiency in Environmental Outcomes**: Diagnose inefficiencies, such as market failures or externalities, that result in suboptimal environmental quality, and understand their root causes.
4. **Apply Cost-Benefit Analysis to Environmental Policies**: Conduct cost-benefit analyses to assess the economic and social effectiveness of environmental policies, identifying their potential impacts on welfare.
5. **Measure Social Demand for Environmental Goods**: Explain and evaluate economic methodologies, such as revealed and stated preference approaches, to quantify the social value of environmental goods and services.
6. **Evaluate Policy Instruments for Environmental Goals**: Compare and assess the effectiveness of policy tools—including taxes, subsidies, cap-and-trade systems, and regulations—in achieving specific environmental objectives.
7. **Understand Empirical Research in Environmental Economics**: Explore and interpret findings from modern empirical research, applying them to contemporary debates on environmental policies and practices.

Prerequisite(s): Econ 303

Required Readings and Supplementary Materials

Charles D. Kolstad, *Environmental Economics, 2nd Edition* (Oxford University Press, 2010)

Students are required to read *before* lecture the assigned Sections from the textbook (see above for reference) *and* the supplemental readings posted each week. There will be in-class quizzes or discussion for the supplemental readings. Answering the questions during class will count towards your participation grade. All readings will be listed in the Syllabus and supplemental readings will be accessible through links in the syllabus or through Brightspace.

Description and Assessment of Assignments

The final grade in this course will be based on 2 homework assignments (will be assigned for every 5-6 weeks approximately), one midterm and one final exam. The due dates of assignments can be found in the course plan below, which are marked with asterisks. These tests will include short answer questions that are designed to test your ability to concisely and effectively articulate your understanding of the course material, and analytical problems that are designed to test your mathematical and analytical understanding of the course material. A legible and organized deliverable of the assignment will need to be submitted one week after they are assigned. Late submissions will not be accepted.

Grading Breakdown

Assignments & exams	% of Grade
In-class quizzes	10%
2 assignments	20%
Research project	20%
Midterm exam	20%
Final exam	30%
Total	**100%**

Grading Scale

Course final grades will be determined using the following scale

Grade	**A**	**A-**	**B+**	**B**	**B-**	**C+**	**C**	**C-**	**D+**	**D**	**D-**	**F**
Percentage	≥90	≥85	≥80	≥75	≥70	≥65	≥60	≥55	≥50	≥45	≥40	<40

Additional Policies

Grade Appeal Policy

Students that disagree with their exam grade may submit a written request of a *full* exam grade review within the first 48 hours of receiving their graded exam. This request should consist of a written letter and should be given to me in person (see office location and office hours schedule). The grade review will consist of a careful reassessment of *all* graded questions and may result in no change, or an overall higher or lower grade than the original contested grade.

Exam Taking

Bring only pencil and pen. No need to bring bluebooks or scantrons. You may bring a simple calculator, but no other electronic devices are allowed (even if you forgot your calculator!). Come early to the classroom, as we will start right on time. Students will be seated in rows from front to back, with and empty space between rows. I may ask some students to change seats in the middle of the exam. This is a preventive measure and does not mean the student has been caught cheating.

Missed exams and incomplete grades.

No makeup midterms or finals will be given for any reason (excused or unexcused). If a student misses a midterm exam and submits a valid excuse, then the midterm's grade will constitute 0% of her/his grade and its weight will be assigned to the final exam. If a student misses the final exam with a valid excuse, the student will have to take an incomplete for the course provided.

Academic Dishonesty

To maintain a fair and just learning environment for all students, I have a strict policy against academic dishonesty. Any cases of cheating or plagiarism will be reported to the Office of Student Judicial Affairs and Community Standards. You can find further details regarding academic integrity and the university's policies in the section below.

Course Schedule: A Weekly Breakdown

	Topics/Daily Activities	Readings and Homework	Deliverable/ Due Dates
Week 1	Lecture 1 - Introduction of the Course and of Students	Chapter 1	January 13
	Lecture 2 – Normative and Positive Analysis	Chapter 2	January 15
Week 2		Chapter 3, Parts I and II	January 20 (No Class, MLK Day)
	Lecture 3 - Individual Preferences	Chapter 3, Part III, IV and V	January 22
Week 3	Lecture 4 - Social Choice from Individual Values	Chapter 4, Part I and II	January 27
	Lecture 5 - Efficiency and Markets I	Chapter 4, Part III	January 29
Week 4	Lecture 6 - Efficiency and Markets II	Chapter 5, Parts I, II	February 3
	Lecture 6 - Market Failures	Chapter 5, Parts I, III and IV	February 5
Week 5	Lecture 7 - Public Goods	Chapter 5, Part II, IV and V	February 10
	Lecture 8 - Market Provision of Public Goods and Open Access Goods	Chapter 5, Part II	February 12 *
Week 6		Chapter 6, Part I	February 17 (No class, President's Day)
	Lecture 9 - Externalities	Chapter 6, Part II-III	February 19
Week 7	Lecture 10 – Making Decisions about the Environment	Chapter 7, Parts I-IV	February 24
	Lecture 11 – Measuring the Demand for Public Goods	Chapter 8, Part I and Part IV	February 26
Week 8	Lecture 12 – Hedonics and Value of a Statistical Life	Chapter 9, Part I	March 3
	Lecture 13 – Defensive Expenditures	Chapter 9, Part I	March 5
Week 9	Lecture 14 – Review for Midterm	Chapter 1-9	March 10
	Midterm (See exam taking policy in syllabus)		March 12
Spring Recess			March 16-23
Week 10	Lecture 15 - Cost Aggregation or Cost of Illness and Adaptation I	Supplementary readings	March 24

	Lecture 16 - Cost Aggregation or Cost of Illness and Adaptation II	**Supplementary readings**	**March 26**
Week 11	**Lecture 17– Travel Cost Method**	**Chapter 9, Part II**	**March 31**
	Lecture 18 – Constructed Markets	**Chapter 10**	**April 2 ***
Week 12	**Lecture 19 – Environmental Regulation and Liability I**	**Chapter 11, Parts I, II and III**	**April 7**
	Lecture 20 – Environmental Regulation and Liability II	**Chapter 11, Parts I, II and III**	**April 9**
Week 13	**Lecture 21 – Emission Prices and Fees**	**Chapter 12, Parts I, II and III**	**April 14**
	Lecture 22 – Coase Theorem and Tradable Permits	**Chapter 13**	**April 16**
Week 14	**Lecture 23 – Uncertainty and Quotas vs. Fees**	**Chapter 15, Parts I and II**	**April 21**
	Lecture 24 – Double Dividend and Policy Comparison	**Supplementary readings**	**April 23**
Week 15	**Lecture 25 – Energy Efficiency and the Environment: Is there a Win-Win Solution?**	**Supplementary readings**	**April 28**
	Lecture 26 - Review for Final		**April 30 ***
Final Exam	See exam policy in syllabus	**Chapter 1-15**	**Thursday, May 9, 11 a.m.-1 p.m.**

Red * represents the due dates of 3 assignments in the course.

Supplemental Readings

Week 1

- Tim Hyde *on* Burke, Marshall and Kyle Emerick, "Adaptation to Climate Change: Evidence from US Agriculture", *American Economic Journal: Economic Policy,* 8:106-40 (2016).

  https://www.aeaweb.org/research/can-american-agriculture-adapt-hotter-climate

- Bushnell, James, "How can zero (net energy) be a hero?"

  https://energyathaas.wordpress.com/2015/10/11/how-can-zero-net-energy-be-a-hero/

Guiding questions for Supplemental Readings

Questions from Hyde on Burke and Emerick 2016**:**

1. In their baseline estimation (without accounting for adaptation), how do authors estimate the effect of 24 additional hours of heat above 84oF on corn yields?
2. What are some examples of things farmers can do to adapt to permanent changes in weather?

Question from Bushnell, "How can zero net energy be a hero?"

3. What does this economist prescribe as a preferred goal rather than zero net-carbon emissions?

Week 2

- Richard Conniff, "Useless Creatures", *New York Times,* The Opinion Pages, September 13, 2014

Questions for Supplemental Readings

1. What is an advantage of determining the use value of a species or an ecosystem according to Richard Conniff in his opinion piece at the NY Times?
2. In his view, what is a disadvantage of emphasizing usefulness?
3. How would you characterize Richard Coniff's preferences for the environment: biocentric, anthropocentric, consistent with the precautionary principle or consistent with the principle of sustainability in either its weak or its strong form? Why? (Hint 1: You need to read Chapter 3 of the textbook to answer this.) (Hint 2: It can be more than one type.)

Week 3

- Ballot Measures in California:

https://ballotpedia.org/California_Proposition_56,_Tobacco_Tax_Increase_(2016)

https://ballotpedia.org/California_Proposition_37,_Mandatory_Labeling_of_Genetically_Engineered_Food_(2012)

https://ballotpedia.org/California_Proposition_30,_Sales_and_Income_Tax_Increase_(2012)

Questions for Supplemental Readings

1. Describe broadly each of the three initiatives assigned for reading?
2. Which ones passed?
3. Why do the Sales and Income Tax increase initiative bundled together some preceding initiatives that were withdrawn from the ballot? (Hint: Follow the link to the "Millionaire's Tax Initiative" in the fourth line of the Sales and Income Tax initiative to find out.)

- Fullerton, Don and Rob Stavins, "How economists see the environment", *Nature*, 395:433-434, 1998.

Questions for Supplemental Reading

Questions from Fullerton and Stavins, 1998:

4. What do economists mean by "efficiency of competitive markets"?
5. What is the role of government in the presence of market failures?

Week 4

- Poteete and Ostrom (2004), "Heterogeneity, Group Size and Collective Action: The Role of Institutions in Forest Management", *Development and Change*, 35:435-461
- https://energyathaas.wordpress.com/2014/05/27/chumps-or-champs-california-leads-on-climate/

Questions for Supplemental Readings

1. Name two characteristics of groups that can affect collective action (or coordination) and have been widely studied by the literature.

2. According to Poteete and Ostrom, is there consensus on how these factors affect collective action? Give an example that supports your answer.
3. Describe a concrete measure of heterogeneity that has been explored in the literature. (Hint: One of them was used by Varugheese in his 1999 study.)

Week 5

- Robert Stavins' summary of his article "The Problem of the Commons: Still Unsettled After 100 Years", *American Economic Review,* 101:81-108 (2011)

http://www.robertstavinsblog.org/2011/02/21/reflecting-on-a-century-of-progress-and-problems/

Questions for Supplemental Reading:

1. Which set of "problems of the commons" has been addressed by economic research only in the last thirty years?
2. How successful have been conventional regulatory policies at addressing the problem of the commons according to Stavins?
3. What is a key contribution of economics to the problem of the commons according to Stavins?

- Maximilian Auffhammer, "The Crazy History of Lead in Gasoline." Energy Institute Blog, UC Berkeley, March 2, 2020 https://energyathaas.wordpress.com/2020/03/02/the-crazy-history-of-lead-in-gasoline/

Questions for Supplemental Reading

1. What was the purpose of including lead in gasoline as an additive?
2. What led to the eventual elimination of lead in the gasoline we use for private and commercial vehicles?
3. What is a difference-in-difference design?
4. What are the estimated costs of lead in NASCAR and ARCA races?

Week 6

- Nordhaus, William, Chapter 18: Climate Policy by Balancing Costs and Benefits, *Climate Casino*, Yale University Press, 2013

Questions for Supplemental Reading

1. Why is the climate change total cost curve (the sum of the cost and damage curves) U-shaped?
2. What assumption makes the biggest difference in the optimal level of warming degrees that we should aim for according to cost benefit analysis: discounting, or the number of countries participating in abatement?
3. What are some classes of climate damages that are often omitted from the damage calculation?

- Arrow, Kenneth, et al. "Is there a Role for Benefit-Cost Analysis in Environmental Health, and Safety Regulation?" Science 272 (1996): 221-222.
- Farrow, Scott, and Michael Toman. "Using Benefit-Cost Analysis to Improve Environmental Regulation." Environment 2, no. 41 (1999): 12-15, and 33-37.

- Greenstone, Michael. "Effective Regulation through Credible Cost-Benefit Analysis." Mimeograph, MIT, 2008.
- Kelman, Steven. "Cost-Benefit Analysis: An Ethical Critique." Chapter 15 in EESR.
- Revesz, Richard, and Michael Livermore. Retaking Rationality: How Cost Benefit Analysis Can Better Protect the Environment and Our Health. Oxford University Press, 2008. ISBN: 9780195368574.
- Viscusi, W. Kip. "Regulating the Regulators." University of Chicago Law Review 63 (1996): 1423-1461.

Questions for Supplemental Reading

1. What is the role of benefit-cost analysis in environmental regulation?
2. What can be done to improve environmental regulation?

Week 7

- Aldy, Joseph and Kip Viscusi, Adjusting the Value of Statistical Life for Age and Cohort Effects, *The Review of Economics and Statistics,* 2008, 90:573-581. [**Sections I, II, III, V, and understanding Figure 1 and Figure 2**].

Questions for Supplemental Reading

1. What is the relationship between the value of statistical life and age according to Aldy and Viscusi (2008)?
2. In equation (1), what is the parameter that measures the tradeoff between fatality risk and income (or the compensating differential)?
3. What is the difference between Figure 1 and Figure 2?

Week 8

- Ito and Zhang 2016, "How Much Chinese are Willing to Pay for Cleaner Air" (Note: You may read only the summary at the WSJ, but the intro to the full article is much clearer about what the methodology is.)
    - Full paper can be found in the Supplemental Readings folder.
    - Summary article in the WSJ can be found at the link below. https://blogs.wsj.com/chinarealtime/2016/07/13/how-much-chinese-are-willing-to-pay-for-cleaner-air/

Questions for Supplemental Reading

1. In this study, what is the private good whose purchases reveal the willingness to pay for air quality in China?
2. According to Ito and Zhang's results, how much are Chinese willing to pay to remove one microgram per cubic meter of pollution (PM2.5) for five years?
3. How is pollution different north and south of the Huai river and why?

Week 10

- Maximilian Auffhammer 2018, "Quantifying Economic Damages from Climate Change" *Journal of Economic Perspectives* 32:33-52

- Carleton, Tamma and Michael Greenstone 2022, "A Guide to Updating the US Government's Social Cost of Carbon". *Review of Environmental Economics and Policy* 16, no. 2: DOI: https://doi.org/10.1086/720988

Questions on Supplemental Reading

From Auffhammer 2018

1. What are the three integrated assessment models that have been used to compute the Social Cost of Carbon by the Interagency Working Group?
2. What are the properties that damage functions should possess in order to account for the intensive and extensive margins of adaptation?
3. What are the two counterfactuals researchers need to be concerned with when projecting damages from climate change?

Week 11

- Kremer, Michael, Jessica Leino, Edward Miguel and Alix P. Zwane, "Spring Cleaning: Rural Water Impacts, Valuation and Property Rights Institutions", QJE, 2011

Questions for Supplemental Reading

1. Describe the field experiment in this study. What did they randomize?
2. Why is distance to the source relevant for understanding how much families value protection of the spring?
3. Menkhaus, Susan and Douglas J. Lober, "International Ecotourism and the Valuation of Tropical Forests in Costa Rica", *Journal of Environmental Management*, 47:1-10 1996
4. Daniel Benjamin, "Cheap Water, Deadly Water", 29:2, 2011 https://www.perc.org/articles/cheap-water-deadly-water

Questions for Supplemental Readings:

Questions on Menkhaus and Lober reading:

1. Travel cost methods often use distance to the site as a source of variation in total expenditures paid to travel. Does this work with international visitors to Costa Rica? Why or why not?

Questions on Daniel Benjamin's reading:

2. Given that water is not priced in rural Kenya, what is the main cost of consuming water?
3. How do households reveal their preferences for clean water in the Michael Kremer et al. (2011) study?

Week 12

- Michael Greenstone's testimony before congress on "Liability and Financial Responsibility for Oil Spills Under the Oil Pollution Act of 1990 and Related Statutes" https://www.brookings.edu/testimonies/liability-and-financial-responsibility-for-oil-spills-under-the-oil-pollution-act-of-1990-and-related-statutes/
- On voluntary contributions: "Corporate Climate Responsibility Monitor Report February 2023" https://newclimate.org/sites/default/files/2023-02/NewClimate_CorporateClimateResponsibilityMonitor2023_Feb23.pdf

Questions for Supplemental Reading (Greenstone only)

1. How does a cap on liability from oil spills creates incentives for spills?
2. Did the Deepwater Horizon spill damages exceed the existing liability cap?
3. Why is the government at an informational disadvantage when it comes to regulating oil producers?

Week 13

- Economists' Statement on Carbon Dividends. The Largest Public Statement of Economists in History. https://clcouncil.org/economists-statement/
- Meredith Fowlie, "The trouble with carbon pricing", Energy Institute Blog https://energyathaas.wordpress.com/2019/04/29/the-trouble-with-carbon-pricing/

Questions for Supplemental Reading

1. According to the "Economists Statement on Carbon Dividends" published in January of 2019 in the Wall Street Journal, name two advantages of a carbon tax over other regulations.
2. How do the authors of the statement address fairness concerns related to a carbon tax?
3. What is the main issue with carbon pricing that Meredith Fowlie highlights in her Blog article?

- Severin Borenstein, "Learning and Forgetting the Wisdom of Coase", Energy Institute Blog https://energyathaas.wordpress.com/2013/09/09/learning-and-forgetting-the-wisdom-of-coase/
- U.S. Energy Information Administration, "California plans to reduce greenhouse gas emissions 40% by 2030" Today in Energy, February 2, 2018

  https://www.eia.gov/todayinenergy/detail.php?id=34792
- Costello, Christopher and Steven Gaines, "A market approach to saving whales", *Nature,* 481:139-140 (2012)
- Greenstone, Pande, Ryan, "Can Pollution Markets Work in Developing Countries: Experimental Evidence from India" https://bpb-us-w2.wpmucdn.com/campuspress.yale.edu/dist/5/91/files/2022/09/gpsr_emissions_trading_20220919.pdf

Questions for Supplemental Readings:

1. What is the misunderstanding of Coase's lessons by the writers of the WSJ editorial highlighted by Severin Borenstein in his blog article?
2. Who is professor Ostrich?
3. From the EIA online reading: Which are the affected emission sources under California's current cap-and-trade program?

Week 14

- Goulder, Laurence and Ian Parry, "Instrument Choice in Environmental Policy, *Discussion Paper,* Resources for the Future,/RFF DO 08-07 (2008)
- Maximilian Auffhammer, "The Yoga Theorem", Energy Institute Blog https://energyathaas.wordpress.com/2014/06/03/the-yoga-theorem/
- Robinson Meyer, "Carbon Tax, Beloved Policy to Fix Climate Change, Is dead at 47." Obituary: Carbon Tax, Beloved Climate Policy, Dies at 47 - The Atlantic
- https://foreignpolicy.com/2021/08/06/climate-conflict-europe-us-green-trade-war/

Questions from Supplemental Readings

1. (From Auffhammer's blog entry on The Yoga Theorem) What is the Yoga Theorem? (Optional: How does it apply to environmental policy instruments?)
2. (From Auffhammer's blog entry on China's Cap-and-Trade) What are some advantages of a tax vs. a cap-and-trade system?
3. (From Auffhammer's blog entry on China's Cap-and-Trade) Why are some of the advantages of the cap-and-trade system are not really at play in China?

Week 15

- Meredith Fowlie, "Energy efficiency is a tough sale -even when it is free!", Energy Institute Blog https://energyathaas.wordpress.com/2015/01/12/energy-efficiency-is-a-tough-sell-even-when-it-is-free/
- Catherine Wolfram, "If Someone replaced your car with a Prius, Would you drive more?" Energy Institute Blog https://energyathaas.wordpress.com/2015/08/10/if-someone-replaced-your-car-with-a-prius-would-you-drive-more/
- Mooney, Chris, "Virgin Atlantic just used Behavioral Science to `nudge' its pilots into using less fuel. It worked.", *Washington Post,* June 22, 2016.

Questions from readings

1. Can you describe the Weatherization Assistance Program mentioned in the first article?
2. What was the experiment that the researchers did (in the first article)?
3. Were the encouragement efforts "successful" (in the first article)?
4. Do people with a Prius drive more because of having a more fuel-efficient car according to the second article?

Statement on Academic Conduct and Support Systems

Academic Conduct:

Plagiarism – presenting someone else's ideas as your own, either verbatim or recast in your own words – is a serious academic offense with serious consequences. Please familiarize yourself with the discussion of plagiarism in *SCampus* in Part B, Section 11, "Behavior Violating University Standards" policy.usc.edu/scampus-part-b. Other forms of academic dishonesty are equally unacceptable. See additional information in *SCampus* and university policies on scientific misconduct, http://policy.usc.edu/scientific-misconduct.

Support Systems:

Student Counseling Services (SCS) – (213) 740-7711 – 24/7 on call

Free and confidential mental health treatment for students, including short-term psychotherapy, group counseling, stress fitness workshops, and crisis intervention. engemannshc.usc.edu/counseling

National Suicide Prevention Lifeline – 1 (800) 273-8255

Provides free and confidential emotional support to people in suicidal crisis or emotional distress 24 hours a day, 7 days a week. www.suicidepreventionlifeline.org

Relationship and Sexual Violence Prevention Services (RSVP) – (213) 740-4900 – 24/7 on call

Free and confidential therapy services, workshops, and training for situations related to gender-based harm. engemannshc.usc.edu/rsvp

Sexual Assault Resource Center

For more information about how to get help or help a survivor, rights, reporting options, and additional resources, visit the website: sarc.usc.edu

Office of Equity and Diversity (OED)/Title IX Compliance – (213) 740-5086

Works with faculty, staff, visitors, applicants, and students around issues of protected class. equity.usc.edu

Bias Assessment Response and Support

Incidents of bias, hate crimes and microaggressions need to be reported allowing for appropriate investigation and response. studentaffairs.usc.edu/bias-assessment-response-support

The Office of Disability Services and Programs

Provides certification for students with disabilities and helps arrange relevant accommodations. dsp.usc.edu

Student Support and Advocacy – (213) 821-4710

Assists students and families in resolving complex issues adversely affecting their success as a student EX: personal, financial, and academic. studentaffairs.usc.edu/ssa

Diversity at USC

Information on events, programs and training, the Diversity Task Force (including representatives for each school), chronology, participation, and various resources for students. diversity.usc.edu

USC Emergency Information

Provides safety and other updates, including ways in which instruction will be continued if an officially declared emergency makes travel to campus infeasible. emergency.usc.edu

USC Department of Public Safety – UPC: (213) 740-4321 – HSC: (323) 442-1000 – 24-hour emergency or to report a crime.

Provides overall safety to USC community. dps.usc.edu