

**EAS 570**  
**Environmental Economics:**  
**Principles, Methods, and Tools**  
**Fall 2019**

Time: Tuesday and Thursday, 11:30am-1:00pm  
Room: 1028 Dana

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If you are contacting the instructors via email, please write in the Subject line: EAS 570 *topic of message*. We will reply within 24 hours during the week.

**Overview:** This course develops the conceptual frameworks of microeconomics and environmental economics that are essential for an environmental professional. It also introduces the quantitative methods for applying the frameworks along with a Microsoft Excel toolkit for the applications. Topics covered include markets and market failures; nonmarket valuation of environmental goods and services; benefit-cost analysis; environmental regulation; and natural resource allocation.

**Evaluation:** The final grade will be based on: six-to-seven homework assignments (40%), the in-class mid-term exam (15%), the take-home mid-term exam (20%), and the final exam (25%). The final exam is not cumulative.

**Prerequisites:** None.

**Student Support:** If any student feels that they may need an accommodation for any type of disability, please make an appointment to talk with the instructor or stop by during office hours. The on-campus office of Services for Students with Disabilities (<https://ssd.umich.edu/>) is available to assist anyone with determining appropriate and helpful academic accommodations.

**Academic Integrity:** Students are expected to take personal responsibility for understanding and observing the Rackham Academic and Professional Integrity Policy. Read it at: <https://rackham.umich.edu/academic-policies/section8/>.

**Learning Goals:** To develop an ability to use economic principles for diagnosing environmental issues and prescribing policy interventions; to develop a general understanding of the main quantitative methods of economics; and to develop expertise in Excel as a quantitative toolkit.

**Learning Mechanisms:** (i) six-to-seven homework assignments, (ii) two mid-term exams and a final exam, (iii) lectures and in-class exercises, (iv) reading assignments, (v) optional Excel skills sessions. Readings and assignments will be distributed through the Canvas website.

**Evaluation (*repeated*):** The final grade will be based on: six-to-seven homework assignments (40%), the in-class mid-term exam (15%), the take-home mid-term exam (20%), and the final exam (25%). The final exam is not cumulative.

**Late Policy:** A 5% loss of points per day will be assessed to all assignments and take-home exams submitted after the date and time when they are due. Assignments will not be accepted more than one week past the due date.

**Student Competencies.** The **Learning Goals** translate into a set of **Knowledge Competencies** and **Skill Competencies** that you will achieve in the course.

### **Knowledge Competencies**

#### **(1) *Microeconomic principles of markets***

How markets work well to distribute goods and services; how they work poorly in accounting for pollution, nature's services, and the future; how to intervene to make them work better

#### **(2) *Principles and applications of environmental economics***

Economic valuation of unpriced goods and services of nature; policy instruments for environmental regulation; evaluation frameworks (benefit-cost and cost effectiveness); valuing the future through discounting

#### **(3) *Quantitative methods for applying the principles, and their application to environmental topics***

Algebra; regression statistical analysis; financial analysis; optimization analysis

### **Skill Competencies**

#### **(1) *Quantitative reasoning and quantitative skills***

Graphs; algebra; quantitative methods

#### **(2) *Excel toolkit for quantitative applications***

Algebra; regression statistical analysis; Net Present Value financial analysis; Goal Seek module for solving allocation problems

#### **(3) *Professional standards in presenting quantitative results***

Reporting procedures versus reporting results; professionally rendered graphs

**Optional Excel skills sessions:** Mike and Christian will lead optional sessions on selected Thursdays, 10:00-10:50am, Room 3556 Dana.

**In-class Mid-Term Exam:** Thursday, October 10.

**Take-home Mid-term Exam:** due Tuesday, November 5.

**Take-home Final Exam (noncumulative):** due Tuesday, December 17.

**Merging Principles, Methods, and Tools:** most courses in economics separate content based on *principles and conceptual frameworks* versus *quantitative methods and their application tools*. This course is designed differently with two ideas in mind. First, environmental professionals need only a limited set of microeconomic principles to function effectively in the field, such that comprehensive instruction in microeconomics is unnecessary for most individuals. Second, the best time to learn quantitative methods and tools is in the context of the underlying economic principles, rather than in stand-alone courses on quantitative methods (such as mathematical economics and econometrics).

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## Condensed Outline

### Positive and Normative Analysis of Markets

- The problem of the consumer. Demand functions.
- The problem of the firm. Supply functions.
- Market equilibrium (competition)
- Normative analysis: Economic efficiency using consumer's surplus & producer's surplus

### Market Failures and the Theory of Environmental Policy

- Externalities, public goods, and common pool resources
- Game theory and strategic behavior
- Policy instruments of environmental regulation

### Intertemporal Decision-Making

- Time discounting

### Public Decision-Making Frameworks

- Benefit-cost analysis
- Cost-effectiveness analysis
- Economic impact analysis

### Natural Resource Allocation with a Fixed Quantity

- Cap-and-trade pollution
- River water
- Nonrenewable energy (fossil fuels)
- Atmospheric concentration of greenhouse gases

### National Income Accounting and Macroeconomics

- Environmental (green) accounting

## Course Details

Week	Dates	Topic	Method/Tool	Reading
1	Sept. 3, 5	<ul style="list-style-type: none"> <li>National income accounting (part 1)</li> <li>Consumer demand</li> </ul>		1, 2, 3
2	Sept. 10, 12	<ul style="list-style-type: none"> <li>Application to the <i>rebound effect</i></li> <li><i>Smarting over Smart Meters</i> case</li> </ul>	Algebraic operations	4, 5
3	Sept. 17, 19	<ul style="list-style-type: none"> <li>Producer supply</li> <li>Competitive market equilibrium</li> </ul>		6, 7, 8, 9
4	Sept. 24, 26	<ul style="list-style-type: none"> <li>Regression: statistical estimation of consumer demand functions</li> </ul>	Regression statistical model	10, 11
5	Oct. 1, 3	<ul style="list-style-type: none"> <li>Program evaluation: randomized controlled trials &amp; natural experiments</li> <li>Application to <i>Opower's</i> electricity demand management program</li> </ul>	Regression statistical model	12, 13, 14
6	Oct. 8, 10	<ul style="list-style-type: none"> <li>Economic valuation of nonmarket environmental goods and services</li> <li>Recreation &amp; water quality applications</li> <li><b>In-class Mid-Term Exam; Thurs, Oct. 10</b></li> </ul>	Regression statistical model	15
7	Oct. 17 (October 15 – Fall Break)	<ul style="list-style-type: none"> <li>Economic efficiency</li> </ul>		16
8	Oct. 22, 24	<ul style="list-style-type: none"> <li>Externality and market failure</li> <li>Environmental regulation</li> </ul>		17, 18, 19
9, 10	Oct. 29, 31 Nov. 5, 7	<ul style="list-style-type: none"> <li><b>Take-home Mid-term Exam due Tuesday, Nov. 5</b></li> <li>Discounting</li> <li>Benefit-cost analysis</li> <li>Cost-effectiveness analysis</li> </ul>	Excel's tools for financial analysis	20, 21, 22, 23
11	Nov. 12, 14	<ul style="list-style-type: none"> <li>Public goods &amp; common pool resources</li> <li>Game theory</li> </ul>		24, 25, 26
11	Nov. 19, 21	<ul style="list-style-type: none"> <li>Allocation problems: the common structure of applying the equimarginal principle to allocate a fixed supply (of anything) among entities or over time</li> </ul>	Excel's Goal Seek	27, 28
12	Nov. 26 (November 28 – Thanksgiving)	<ul style="list-style-type: none"> <li>Application to Colorado River</li> <li>Application to sulfur dioxide cap-and-trade program</li> </ul>	Goal Seek	29, 30
13, 14	Dec. 3, 5	<ul style="list-style-type: none"> <li>Allocation problems: energy and climate as intertemporal problems</li> <li>Applications to energy and climate</li> </ul>	Goal Seek	31, 32
15	Dec. 10 (last day of class)	<ul style="list-style-type: none"> <li>National income accounting (part 2)</li> <li>Environmental (green) accounting</li> </ul>		33, 34
16	Dec. 17	<ul style="list-style-type: none"> <li><b>Final Exam due Tuesday, Dec. 17</b></li> </ul>		

## Readings

Several readings are chapters from *Principles of Economics* by Gregory Mankiw (4<sup>th</sup> Edition, 2007).

1. Mankiw textbook, Chapter 4, The Market Forces of Demand and Supply. Read materials on “Demand” from this chapter.
2. Mankiw textbook, Chapter 5, Elasticity and Its Application. Read materials related to “The Elasticity of Demand” from this chapter.
3. Mankiw textbook, Chapter 7, Consumers, Producers, and the Efficiency of Markets. Read material on “Consumer Surplus” from this chapter.
4. Gillingham and others, “The Rebound Effect is Overplayed,” *Nature*, 2013.
5. Petito and others, “Smarting over Smart Meters: Does Smart Grid Technology have a Home in Maryland.” Teaching case.
6. Mankiw textbook, Chapter 4, The Market Forces of Demand and Supply. Read materials on “Supply” from this chapter.
7. Mankiw textbook, Chapter 5, Elasticity and Its Application. Read materials related to “The Elasticity of Supply” from this chapter.
8. Mankiw textbook, Chapter 7, Consumers, Producers, and the Efficiency of Markets. Read material on “Producer Surplus” from this chapter.
9. Mankiw textbook, Chapter 4, The Market Forces of Demand and Supply. Read materials on “Supply and Demand Together” from this chapter.
10. Loomis and Helfand, Chapter 8, “Statistical Analysis Using Regression,” in *Environmental Policy Analysis for Decision-Making*.
11. Sykes, “An Introduction to Regression Analysis.” University of Chicago Working Paper in Law and Economics, 1992.
12. Sunstein, “Making Government Logical,” *New York Times* article, Sept. 19, 2015.
13. Haynes and others, “Test, Learn, Adapt: Developing Public Policy with Randomized Controlled Trials.” UK Cabinet Office, Behavioral Insights Team, 2012.
14. Allcott, “Social Norms and Energy Conservation,” *Journal of Public Economics*, 2011.
15. Berck and Helfand, Chapter 6, “Revealed Preference Methods,” in *The Economics of the Environment*.
16. Mankiw textbook, Chapter 7, Consumers, Producers, and the Efficiency of Markets. Read material on “Market Efficiency” from this chapter.
17. Mankiw textbook, Chapter 10, Externalities.

18. Greenstone and Looney, "Paying Too Much for Energy? The True Cost of Our Energy Choices," *Daedalus*, 2012.
19. Keohane and Olmstead, Chapter 8, "Principles of Market-Based Environmental Policy," in *Markets and the Environment* (Island Press, 2007).
20. Berck and Helfand, "Chapter 14: The Time Factor – Discounting," in *The Economics of the Environment*.
21. Stokey and Zeckhauser, Chapter 9, "Project evaluation: benefit-cost analysis" in *A Primer for Policy Analysis* (W.W. Norton & Co, 1978), pp. 134-158.
22. U.S. Army Corps of Engineers, "Estimating Economic Impacts of Corps of Engineers Visitors on Regional Economies," undated.
23. U.S. Environmental Protection Agency, Regulatory Impact Analysis, "Executive Summary: Final Rulemaking to Establish Light-Duty Vehicle Greenhouse Gas Emissions Standards and Corporate Average Fuel Economy Standards," 2010.
24. Mankiw textbook, Chapter 11, Public Goods and Common Resources.
25. Mankiw textbook, Chapter 16, Game Theory and the Economics of Cooperation (a portion of Chapter 16).
26. Costello, Gains, and Lynham, "Can Catch Shares Prevent Fisheries Collapse?" *Science*, 2008.
27. Variations on textbook developments of the equimarginal principle solution to allocating a fixed supply (handout).
28. Stokey and Zeckhauser, Chapter 9, "Project evaluation: benefit-cost analysis" in *A Primer for Policy Analysis* (W.W. Norton & Co, 1978), pp. 134-158. "Case 4" of Subsidiary Choice Criteria.
29. Booker and Young, "Modeling Intrastate and Interstate Markets for Colorado River Water Resources," *Journal of Environmental Economics and Management*, 1994.
30. Carlson and others, "Sulfur Dioxide Control by Electric Utilities: What are the Gains from Trade?" *Journal of Political Economy*, 2000.
31. Keohane and Olmstead, Chapter 6, "Managing Stocks: Natural Resources as Capital Assets," in *Markets and the Environment*.
32. Chakravorty and others, "Endogenous Substitution among Energy Resources and Global Warming," *Journal of Political Economy*, 1997.
33. Mankiw textbook, Chapter 23, "Measuring a Nation's Income."
34. Muller, Mendelsohn, and Nordhaus, "Environmental Accounting for Pollution in the United States Economy," *American Economic Review*, 2011.