AAEC 3324: Environmental & Sustainable Development Economics

Virginia Tech
Spring 2022

Instructor: Professor Benami (Office: 540-231-1147)
Teaching Assistant: Sydney Schake
Course Meeting Time: Tuesdays & Thursdays 3:30 – 4:45PM in Litton Reaves 1770
Student (Office) Hours: Mon. 4-5pm (Sydney); Wed. 4:30-5:30pm (Elinor); or by appointment.
Final Exam Tuesday, May 10 from 7.45-9.45AM
Credits: 3

1 Course Summary and Objectives

Economics is the study of scarcity and choice. This course examines how economics can be used to manage scarce environmental resources, with a focus on approaches used to assess the costs and benefits of various policy designs. We can then apply these concepts to address a series of current policy questions, such as what are the impacts of strengthening or relaxing air and water pollution regulations, and how are those impacts distributed? What are the costs of climate change in the U.S. and abroad, and what are the trade-offs of different policy options to manage those costs? What is "sustainable development," and how may environmental problems differ in developing countries? By the end of this course, you should be able to:

1. Demonstrate an understanding of core economic concepts such as externalities, social cost, willingness to pay, time value of money (discount rates), and efficiency
2. Develop basic data wrangling, visualization, and communication skills that you can apply in evaluating policy decisions
3. Apply an economic framework and your data analysis skills to analyze policy trade-offs related to environmental protection and agricultural sustainability.

2 Readings and Course Materials

Course Readings

Environmental Economics: The Essentials by Tietenberg and Lewis is required (abbreviated in the course outline as *TL*). You may also find the free, open source CORE Economics virtual textbook helpful to solidify some of the concepts we discuss in class.

I will also share some additional readings – including free academic journal articles, select book chapters, news articles, as well as policy briefs or reports – to provide more context. You may also find these resources valuable for our class discussions and/or the course final project. As with most courses, this reading list captures but a small slice of the interesting literature related to our course topics. If you are interested in additional readings, please contact the instructional team or search for relevant topics on EconLit. Many of the topics we discuss are lively areas of research about which much is still being discovered today.

Course Website

This term we will be using Piazza for class discussion, sharing announcements, and file organization. Piazza was designed by a team of engineers to simulate real class discussion and encourage class equity by ensuring all students to have access to the same information and collaboration opportunities. Importantly for our class, Piazza offers great threading and searching functions, and it also offers the ability to easily share code snippets to help

you debug issues you may be running into with your empirical projects. We've also enabled an anonymous posting option on the discussion thread in case anyone prefers to ask questions or respond to queries without attribution.

You can access Piazza through here *or* through the VT Canvas website, although you need to register for Piazza separately with your VT email. The Piazza system is designed to help you get help quickly and efficiently by leveraging the knowledge of your classmates, the TA, and myself. *The best way to get a response from the instructional team is by posting on Piazza; emails may be (unintentionally) silently dropped.*

Gradescope
We will use Gradescope to submit assignments and provide feedback due to additional features it offers over Canvas, including easily-updatable rubrics and anonymous grading that allow for faster, more consistent, and fairer evaluations. You should receive an invitation to your vt email address in the first week, though if you would like to self-register for gradescope for our class, use the entry code "N8VDJX."

Student Appointments (Open Question Hours)
I'm happy to meet with my students and encourage you to come by and say hello *at least* once in the semester. You can meet with me in groups or individually to discuss a number of things, such as clarifying a reading or topic, asking for feedback on a project, discussing accommodations you might need if you're having challenges in your personal life, discussing future plans, seeking out research opportunities related to the class or work I do, etc.

I have reserved time for students in this class from 4.30-5.30pm on Wednesdays on zoom here: `https://virginiatech.zoom.us/j/81929373855?pwd=MW8zOUhibHgrYldHcE5xVUpjR2w2Zz09`. You can also reserve twenty minutes at a time here on Fridays from 9-10am here `https://calendly.com/elinor_vt/student-times`, and if none of these times work for you, feel free to contact me via a private post on Piazza with 2-3 alternative times that do.

Prerequisites
This course is oriented towards upper level undergraduate students of the social or physical sciences who are interested in delving into the human dimensions of global environmental change. Students with previous exposure to econometric methods, microeconomic theory, and/or causal inference will find this course most accessible, though curiosity, diligence, and pro-active behavior in asking your peers and instructors about your questions can help fill in specific gaps.

3 Evaluation

Grading Scale

We will sum your scores of the various course components listed below to compute your final grade, out of 100, which will then translate into a letter grade based on VT's grading scale below. *Note that this scale defines the minimum letter grade you will receive; the instructor may revise letter grade ranges, but will only do so such that your final letter grade remains the same or better than it would under this published scale.* That said, to encourage you all to to collaborate rather than compete against each other, grades will not be "curved."

$\geq$ 93 A	90–92 A−	87–89 B+	83–86 B	80–82 B−	77–79 C+
73–76 C	70–72 C−	67–69 D+	63–66 D	60–62 D−	$<$ 60 F

We've also generated a course grade simulator here to help you keep track of the conversion from points to letter grades. Fundamentally, we believe that with some planning, everyone can master the essential components of this class. Reach out to the instructional team and your classmates to overcome stumbling blocks you perceive in the path to content mastery. The earlier you connect, the more options are available to address your questions.

Assignments

Your final grade will be based on the below four sets of inputs.

1. **Engagement (20%)**: Throughout the course I expect you to engage in the course content and share your learning with your classmates. This will be evaluated as follows:

Category	Value
Intro Survey, Office Hours Visit	2%
Questions in Class or on Class Discussion Board	5%
SDG Presentations	3%
Exit Tickets/Day's Reflection	10%

   2% of your overall grade will derive from filling out a syllabus reflection and attending office hours to introduce yourself and discuss your comments to the syllabus reflection and/or the course content in the first month of class.

   The exit tickets will constitute (a very easy) 10% of your grade and will be evaluated based on completion. You can miss up to 5 exit tickets. Thereafter your grade will be evaluated based on the share of completed relative to the total number of exit tickets asked of students.

2. **Assignments (25%):** An important part of this course involves becoming comfortable interacting and engaging with scientific research and applying it to real-world problems. Therefore, a portion of this grade will also come from:

   - *Submitting two reading responses*, whereby I expect you to demonstrate that you've engaged with and deconstructed the papers. I will post a template to help guide you through this process. We will also have a few opportunities throughout the course to discuss relevant papers, for which these reading summaries and responses will be helpful guides. The two papers we will deconstruct are
     - Currie & Walker 2019 "What do economists have to say about the Clean Air Act 50 years after the establishment of the Environmental Protection Agency?" (C&W 2019)
     - Keiser & Shapiro 2019 "US Water Pollution Regulation over the Past Half Century: Burning Waters to Crystal Springs?" (K&S 2019)
   - *Synthesis Memo and Live Report on Course Readings* We will ask students to pair up in the semester and **read 1-2 additional papers** to advance our conversation on the weekly topics. Student experts will generate a brief synthesis memo (no more than a page) that brings together the main ideas and the new material for that week that will be shared at least 24 hours before class. Student experts will also be responsible for a brief **5-minute report** at the beginning of class. Students will sign up for their week to "advancing the conversation" at the beginning of the quarter.

     The synthesis should be uploaded to Piazza as a "Discussion." This will make the synthesis memo available to other class participants prior to our class. Other students in the course are invited and encouraged to respond to this memo and/or other dimensions of the reading, sharing *briefly* about one aspect of the reading that you found to be very important, positive or exciting (the good stuff), or one aspect of the reading that you found to be problematic, negative or confusing (the bad stuff).
   - *Conducting two guided empirical projects* developed by the CORE Economics "Doing Economics" team. These projects will enable you to work with real data relating to various dimensions of climate change and relate them back to course concepts. You can conduct these assignments using Google Sheets or Excel for full credit, and demonstrating that you fruitfully used R will gain you bonus points in the course overall. We will provide additional instructions in the first weeks of class on how to get started as well as offer a dedicated office hours for getting started using `R` for these assignments for those interested. The first assignment (#1 on the course outline) is linked here; the second empirical project (#3 in the course outline) is linked here.

While I encourage you to find a study buddy test your understanding of all of these assignments and resolve issues you encounter, you must submit your own responses and indicate who, if anyone, you worked with at the top next to your name. I also recommend you start early on these assignments.

3. **Exams (20%)**: We will have a midterm and a final, which will be weighted either at 10% and 10%, or at 0% and 20% if your final exam score is higher than your midterm. These are intended to serve as mechanisms to help you independently reflect on and synthesize the course material.

4. **Cumulative Course Project (35%)**. The most important part of class will come from a course project where you can demonstrate skills and content knowledge from throughout the course and apply it to a particular case of managing environmental challenges that is of interest to you (as a few non-exhaustive examples, one could consider the Clean Power Plan, the Endangered Species Act and the Northern Spotted Owl, Managed Retreat in a given location, the CA or EU Emissions Trading Scheme).

   I encourage you to work in groups of about 4 people with diverse skills on this project, as science is often a team sport, and each of us can a learn a lot from each other. I will set up a space on Piazza for you to make your team and provide more guidance as we approach project milestones.

   In short, the project involves advising a potential regulator who is trying to decide how to most appropriately address an environmental problem in their jurisdiction by learning from the past experience(s) of another place that has addressed that problem. To do so, your group will compose a succinct (3-5 page single spaced) memo and (10-15 slide) presentation that should cover the following features:

   (a) Describe the social problem(s) the past policy sought to address: what is/was the extent and distribution of the problem it was seeking to manage?
   (b) How was the past policy designed and what are its most salient features?
   (c) How has the problem changed since the launch of the policy/program, and what, if any, do we know about the realized costs and benefits that can be attributed to the policy?
   (d) (Briefly) what are alternative possible policy designs that the policymaker could use to also address this problem, and what trade-offs do they present relative to the past policy?
   (e) Building on these lessons, what recommendations emerge about policy design or implementation that would help achieve the new regulator's goals?

   The 35% will be cumulative, generated from the following milestones:

Milestone	Value	Due
Submit topic ideas	Direction	Tues, Feb 1
Group, topic, and workplan	5%	Tues, Feb 10
Outline with at least six references	5%	Tues, March 1
Preliminary results	5%	Tues, March 22
Paper	10%	Tues, April 12
Presentation	10%	Tues, April 26 & Thurs, April 28

   All group members will receive the same grade for the group project unless there are major discrepancies in individuals contributions indicated during self-evaluations. Given the large number of interim milestones we will have, we will notify group members at risk of receiving a lower grade than the group so that they have enough time to change their contribution, if possible.

4 Course Policies

Guidelines for Constructive Course Discussion and Debate

This course is focused on examining ideas that include the role of policy in managing market failure. These ideas have some very real world implications, and even people reviewing the same evidence base may disagree on what

policies are implied. My goal in this course is to support you in clearly identifying and communicating some of the central concepts, data, and methodological choices that can affect policy making and design. In this spirit, when debates arise in this course, let us be respectful to one another by focusing our critiques only on ideas (and their assumptions, evidence, and implications) and not people. Additional ways to help us all achieve a classroom climate conducive for everyone to participate and learn include:

- Be ready to share and explain your perspectives. Disagreement can help us all learn if we agree to provide specific assertions backed with evidence.
- Listen carefully and respond to other members of the group. Be open to changing your mind if someone spots an error in your logic or use of evidence.
- Do not hesitate to ask for clarification of any point or term that you do not understand.
- Make your point succinctly, avoid repetition, and stick to the subject.

Class Attendance

Regular attendance is expected as well as beneficial to course discussion. Although we will not formally be taking attendance in every class, notable lack of participation can affect your 'engagement' grade.

Late Submissions

Prompt submission of assignments allows the instructor team to provide guidance and timely feedback. Due dates for each assignment are noted on the course calendar.

You have four "slip days" that can be used throughout the semester for homework assignments (not exams) – you do not need to contact the instructor to use a slip day, just turn in your assignment late. Once you are out of slip days, assignments submitted after the due date will receive a 10% grade deduction per day past the due date. **No assignments are accepted beyond 48hrs after the deadline, regardless of the number of slip days you have.**

If an emergency arises that prevents you from completing your work on time, please contact the instructors as soon as possible so that arrangements can be made for you to keep up in the class. The late policy may be waived at the instructor's discretion in case of an emergency.

Honor Code

While I strongly encourage you to work in groups and help tutor each other on concepts and examples, all work submitted in this course must be of your own production, and all sources must be properly acknowledged and documented. Failure to acknowledge your sources, whether deliberate or not, constitutes plagiarism. If you have questions about this policy, please reach out. I will appreciate your efforts to behave with integrity and will be happy to help. Each student enrolled at Virginia Tech is responsible for abiding by the Honor Code. A student who has doubts about how the Honor Code applies to any graded assignment is responsible for obtaining specific guidance from the instructor before submitting the assignment for evaluation. Ignorance of the rules does not exclude any member of the University community from the requirements and expectations of the Honor Code.

"As a Hokie, I will conduct myself with honor and integrity at all times. I will not lie, cheat, or steal, nor will I accept the actions of those who do."

For more info, visit the Office of Undergraduate Academic Integrity at https://honorsystem.vt.edu/.

Accessibility

Virginia Tech welcomes students with disabilities into the University's educational programs. The University promotes efforts to provide equal access and a culture of inclusion without altering the essential elements of coursework. If you anticipate or experience academic barriers that may be due to disability, including but not limited to ADHD, chronic or temporary medical conditions, deafness or hearing impairment, learning disabilities,

mental health, or vision impairment, please contact the Services for Students with Disabilities (SSD) office (540-231-3788, ssd@vt.edu, or visit www.ssd.vt.edu). If you have an SSD accommodation letter, please meet with me privately during office hours as early in the semester as possible to deliver your letter and discuss your accommodations. You must give me reasonable notice to implement your accommodations, which is 5 business days generally and 10 business days for exams.

Other University Resources

Virginia Tech has an array of resources available to students at low or no additional cost, including writing support, mental health services, or career counseling. I've included some of these resources below, and I ask that you please help share others in our class discussion page that you've found helpful and that your classmates might, too.

- Writing Center: https://lib.vt.edu/study-learn/writing-center.html
- Cook Counseling Center: https://ucc.vt.edu/
- Career and Professional Development Advising: https://career.vt.edu/advising.html

Emergency Well-Being Resources (Lauren's Promise)

I will listen and believe you if someone is threatening you. Any form of harassment or violence will not be excused or tolerated at VT. If you are in immediate danger, call 911. If you are experiencing harassment, relationship violence, or stalking, you can report it to me, and I will (and am obligated to) connect you to resources such as VT's Office of Equity and Accessibility, which has established procedures and resources for Sexual Misconduct Response and Prevention, detailed here: https://oea.vt.edu/title-ix-vawa.html. You may also contact a 24-7 emergency evaluation and crisis intervention team from the NRVCS (New River Valley Community Services) Emergency Services line at 540-961-8400.

Virginia Tech Well-Being Commitment

Virginia Tech is committed to protecting the health and safety of all members of its community. By participating in this class, all students agree to abide by the Virginia Tech Wellness principles (https://ready.vt.edu/public-health-guidelines.html#wellness) and the guidance stated in the Fall 2021 plans (https://ready.vt.edu/fall-2021-plans.html). To adhere to these, you must do the following in this class:

- Wear a mask at all times while in class.
- Wear a mask during all other activities conducted for the class in public indoor areas.
- Isolate yourself from campus if you test positive for COVID or begin to feel symptoms that might be related to COVID (see: https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html).
- Be respectful of the well-being of others by practicing appropriate personal hygiene and by providing appropriate physical distance when feasible.
- Masks may be reusable or homemade cloth masks, dust masks, or surgical masks and should fit close to the face to provide thorough filtration of breathed air. Face shields that are open around the sides do not satisfy this requirement and are currently not accepted as a viable alternative by the university (see: https://ready.vt.edu/faq.html). If a student feels that they cannot wear a mask for health concerns and must use an alternative form of face covering such as a face shield, they should contact Services for Students with Disabilities to request an accommodation. No exceptions for masks will be provided unless there is an official accommodation notice provided by SSD to the instructor.

These requirements will not be waived. The instructor has the authority to terminate the class session early if the health and safety requirements are not maintained. Students who fail to follow the requirements will be reported to the Office of Student Conduct. If a student will miss significant class activities because of the need to self-isolate, then the Dean of Students Office should be contacted for an official absence verification. Prolonged absences may be difficult to make-up. Students should consult with their advisor about possible options if too much course work is missed to feasibly make-up. As pandemic conditions continue to evolve through the semester,

these requirements may need to change. The guidance posted by the university at VT Ready should represent the most up-to-date requirements of the university and should be checked periodically for changes.

Changes to this syllabus

This syllabus may be updated at the discretion of the instructor at any time. We'll post on Piazza if there are any substantive changes, and the most recent version will be made available on the course website.

Copyright

5 Words of Wisdom From Previous Students

In response to the end of the semester survey prompt "What advice would you give to future students to help them be the most successful in this class?", students from Spring 2021 responded:

"Do the readings and go to office hours. Stay engaged with the course during class because it makes for a more interesting course"

"Pay attention in class, be prepared to be called on."

"Start on the [empirical] assignment early. Make a class group chat at the beginning of the semester."

"Start the assignments as early as you can because they are useful and not impossible, but if you start them the day they're due you're gonna have a hard time!"

"I would suggest going to office hours to ask about assignments or concepts, that was super helpful. Also start your paper earlier to get more intermittent feedback!!"

"[T]ake notes from the PowerPoints or review the slides for about 20 minutes for 3-4 days per week. I would also recommend to review any resources (textbooks, videos on topics) and attend office hours if unclear. Also, start on assignments much earlier than expected!"

"Please go to office hours when you are confused or not quite understanding the information in the class. I believe Dr. Benami genuinely wants to help you understand the information. Don't be afraid to speak up if there is anything wrong with [your] grades. Dr. Benami will look into it and get it fixed as soon as possible. She responds very fast to [messages]."

6 Course Schedule and Outline

Note this schedule is subject to change at the discretion of the instructor. Changes will be shared in class and on the class website. Under assignments, the project milestone due dates are italicized.

Date	Lecture Topic	Assignments	Supplemental Readings
Economics & the Environment			
Jan 18	Introductions, Positive and Normative Economics, Externalities	Intro survey	TL 2; CORE 20.1; Fullerton & Stavins 1998
Jan 20	PV calculations; total versus marginal costs & benefits, discount rates		TL 2-3; Romm 2007; Tirole 2017 Intro & Ch. 1
Valuing the Environment: Taxonomy of Methods			
Jan 25	Environmental demand and marginal WTP; use, non-use, and option values		TL 2-3
Jan 27	Existence, altruistic and bequest values; stated preferences	#1 Evaluating Evidence of Change	TL 4; Carson 2012; Hausman 2012
Feb 1	Revealed preferences	*Topics*	TL 4
Feb 3	Hedonic prices, risk, and elasticities and virtual visit with the University Librarian		TL 4; CORE 20.6; Taylor 2003, Chay & Greenstone 2005
Feb 8	Expected damage (functions)	#2 (C&W 2019)	TL 4
Feb 10	Valuation of reduced mortality risk (/statistical life) and valuation summary	*Group, topic, & plan*	TL 4
Property Rights, Public Goods, and Externalities			
Feb 15	Revisiting Property Rights; Public vs. Common Pool Resources		TL 2; Ostrom 1990
Feb 17	Consumer vs. firm benefits and costs; Social vs private optimization. Coase Theorem		TL 2; Coase 1960; Turvey 1963; Deryugina 2021
Feb 22	Revisiting Externalities, Efficiency, Cost Benefit.		TL 3; Arrow 1996; Pearce 2008
Feb 24	The economics of pollution control: pollutant types, mixing, standards vs. charges	*Outline*	TL 5
Mar 1	Tradeable Permits, Free and sold		CORE 20.5; Tietenberg 2003; Weitzman 1974
Mar 3	**Midterm**		
	Spring Break March 5 - 13		

Date	Lecture Topic	Assignments	Supplemental Readings
Air Pollution & Managing Emissions			
Mar 15	Local Stationary Sources of Pollution: SOx, NOx, and the Acid Rain Program	TL 6; Schmalensee 2013	
Mar 17	Ozone layer depletion, Chlorofluorocarbons, and the Montreal Protocol		
Mar 22	Global Air Pollutants: GHGs & Climate Change	*Prelim. findings*	TL 8; Hsiang & Kopp 2018; Weitzman 2011
Mar 24	Carbon taxes versus cap and trade debate; offsets and the double dividend	#3 Estimating German WTP	TL 5 and 8; Stern 2007
Environment and Development			
Mar 29	Defining Sustainable Development, Environmental Kuznets Curve		TL 11; Solow 1991, Grossman 1995, Dasgupta 2002; Blackman 2018
Mar 31	Green Growth, The role of agriculture in economic development	Submit questions for Speaker/Select SDG's	Barrett 2010, Hallegate 2011
Apr 5	International Trade & the Environment (GATT, WTO, CITES)		TL 11; Frankel and Rose 2005; Copeland 2013
Apr 7	Subset of Sustainable Development Goals + possible Guest Speaker		CGDev 2018
Topical Issues: Environment & Agriculture, Water Quality, and Environmental Justice			
Apr 12	Environmental Justice, Place, and Space.		LT 10; BMT 2019; Hausman & Stolper 2020
Apr 14	*Guest Speaker Mike Ellerbrock*		Gardiner Clip
Apr 19	Water Quality, Point, and Nonpoint Source Pollution	#4 (K & S 2019)	LT 9; Keiser & Shapiro 2019
Apr 21	Open/Catch-up Day OR Land for Food, Feed, Fuel, and Fiber		Angelsen & Kaimowitz 1999; Hosonuma et al 2012; Alix-Garcia 2013
Apr 26	*Presentations*		
Apr 28	*Presentations*		
May 3	Course Wrap-Up and Review		Morgenstern 2020
	Tuesday, May 10: Final Exam 7.45-9.45am		

7 Detailed Outline

Introduction: Economics and the Environment

Tues, Jan 18

How Economists View the Environment, Introductions, positive and normative economics, externalities

- TL Ch 2
- Fullerton, Don and Robert Stavins (1998). "How Economists See the Environment". *Nature* 395.6701, pp. 433–434

Thurs, Jan 20

Present value calculations; total versus marginal costs and benefits

- TL Ch 2-3
- Tirole, Jean (2017). *Economics for the common good*. Princeton University Press – *Introduction "Whatever happened to the common good?" and Chapter 1 "Do You Like Economics?"*
- Romm, Joseph (June 2007). *Discount Rates: Boring but Important*. https://grist.org/article/dont-discount-the-stern-review/. (Accessed on 01/03/2021)
- Roberts, David (Sept. 2012). *Discount rates: A boring thing you should know about (with otters!)* URL: https://grist.org/article/discount-rates-a-boring-thing-you-should-know-about-with-otters/

Valuing Environmental Amenities and Disamenities

Tues, Jan 25

Environmental demand and marginal willingness to pay; use, non-use, and option values

- TL Ch 2-3

Thurs, Jan 27

Existence, altruistic and bequest values; stated preferences

- TL Ch 4
- Carson, Richard T (2012). "Contingent Valuation: A Practical Alternative When Prices Aren't Available". *Journal of Economic Perspectives* 26.4, pp. 27–42
- Hausman, Jerry (2012). "Contingent Valuation: From Dubious to Hopeless". *Journal of Economic Perspectives* 26.4, pp. 43–56

Tues, Feb 1

Revealed preferences: travel cost, defensive expenditures

- TL Ch 4
- Deschênes, Olivier, Michael Greenstone, et al. (2017). "Defensive investments and the demand for air quality: Evidence from the NOx budget program". *American Economic Review* 107.10, pp. 2958–89

Thurs, Feb 3

Hedonic prices and examples; risk and elasticities

- TL Ch 4
- Taylor, Laura O (2003). "The Hedonic Method". *A Primer on Nonmarket Valuation*. Springer, pp. 331–393
- Chay, Kenneth Y and Michael Greenstone (2005). "Does Air Quality Matter? Evidence From the Housing Market". *Journal of Political Economy* 113.2, pp. 376–424
- Currie, Janet and Reed Walker (2019). "What do economists have to say about the Clean Air Act 50 years after the establishment of the Environmental Protection Agency?" *Journal of Economic Perspectives* 33.4, pp. 3–26

Tues, Feb 8

Expected damages, Valuation of reduced mortality risk (formerly/alternately valuation of a statistical life

- TL Ch 4

Thurs, Feb 10

Summary of valuation methods

- TL Ch 4
- Baker, Rick and Brad Ruting (2014). *Environmental Policy Analysis: A Guide to Non-Market Valuation*. Tech. rep. Australian Government Productivity Commission Staff Working Paper

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Revisiting Property Rights, Public vs. Common Pool Resources

Tues, Feb 15

Revisit Externalities, Excludability and Rivalry, Debates on 'Tragedy of the Commons', and Ostrom's perspectives on governing the commons

- TL Ch 2
- Ostrom, Elinor (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press
- Salmon Beyond Boundaries (2015). *Xboundary on Vimeo*. https://vimeo.com/119170132. (Accessed on 01/10/2021)

Thurs, Feb 17

Consumer vs. firm benefits and costs; Social vs privately optimal levels of externalities, Coase Theorem

- TL Ch 2
- Coase, Ronald H (1960). "The Problem of Social Cost", pp. 1–44
- Turvey, Ralph (1963). "On Divergences Between Social Cost and Private Cost". *Economica* 30.119, pp. 309–313
- Deryugina, Tatyana, Frances Moore, et al. (2021). "Applications of the Coase Theorem". *Environmental Science and Policy* 120, pp. 81–88

Tues, Feb 22

Pecuniary vs technological externalities, Revisit Benefit Cost Analysis

- TL Ch 3
- Arrow, Kenneth J, Maureen L Cropper, et al. (1996). "Is There a Role for Benefit-Cost Analysis in Environmental, Health, and Safety Regulation?" *Science* 272.5259, pp. 221–222
- Pearce, David (1998). "Cost Benefit Analysis and Environmental Policy". *Oxford Review of Economic Policy* 14.4, pp. 84–100

Thurs, Feb 24

Revisiting efficiency, the economics of pollution control: types of pollutants and mixing, Emissions standards versus charges

- TL Ch 5

Tues, Mar 1

Tradable permits (free and sold)

- Tietenberg, Tom (2003). "The Tradable-Permits Approach to Protecting the Commons: Lessons for Climate Change". *Oxford Review of Economic Policy* 19.3, pp. 400–419
- Weitzman, Martin L (1974). "Prices vs. Quantities". *The Review of Economic Studies* 41.4, pp. 477–491

Thurs, Mar 3
MIDTERM

March 5 - 15
Spring Break

Air Pollution and Managing Emissions

Tues, Mar 15
Local Stationary Sources of Pollution: Sulfur Dioxide, Nitrogen Oxides, Coal, and the Acid Rain Program

- TL Ch 6
- Schmalensee, Richard and Robert N Stavins (2013). "The SO 2 Allowance Trading System: The Ironic History of a Grand Policy Experiment". *Journal of Economic Perspectives* 27.1, pp. 103–22

Thurs, Mar 17
Ozone layer depletion, Chlorofluorocarbons, Public Policy, and the Montreal Protocol

- Whitesides, Greg (2020). *Learning From Success: Lessons in Science and Diplomacy From the Montreal Protocol*. URL: https://www.sciencediplomacy.org/article/2020/learning-success-lessons-in-science-and-diplomacy-montreal-protocol
- Pytel, Brandon (Sept. 2019). *What Can We Learn From the Montreal Protocol? — Earth Day*. (Accessed on 01/13/2021). URL: https://www.earthday.org/what-can-we-learn-from-the-montreal-protocol/

Tues, Mar 22
Global Air Pollutants: Greenhouse Gases

- TL Ch 8
- Hsiang, Solomon and Robert E Kopp (2018). "An Economist's Guide to Climate Change Science". *Journal of Economic Perspectives* 32.4, pp. 3–32
- Weitzman, Martin L (2011). "Fat-Tailed Uncertainty in the Economics of Catastrophic Climate Change". *Review of Environmental Economics and Policy* 5.2, pp. 275–292

Thurs, Mar 24
Carbon taxes versus fees, Offsets and the Double Dividend

- TL Ch 5,8
- Stern, Nicholas (2008). "The Economics of Climate Change". *American Economic Review* 98.2, pp. 1–37
- Hausman, Catie (Sept. 2020). *Understanding Carbon Tax with Professor Catherine Hausman*. (Accessed on 2/2/2021). URL: https://www.youtube.com/watch?v=xxtElseSkZM

Environment and Development

Tues, Mar 29
Defining Sustainable Development, Environmental Kuznets Curve

- TL Ch 11
- Solow, Robert Merton (1991). *Sustainability: An Economist's Perspective*
- Grossman, Gene M and Alan B Krueger (1995). "Economic Growth and the Environment". *The Quarterly Journal of Economics* 110.2, pp. 353–377
- Dasgupta, Susmita, Benoit Laplante, et al. (2002). "Confronting the Environmental Kuznets Curve". *Journal of Economic Perspectives* 16.1, pp. 147–168

- Blackman, Allen, Zhengyan Li, et al. (2018). "Efficacy of Command-And-Control and Market-Based Environmental Regulation in Developing Countries". *Annual Review of Resource Economics* 10, pp. 381–404

Thurs, Mar 31

Green Growth/Natural Capital Accounting, Agricultural and Economic Development

- Barrett, Christopher B, Michael R Carter, et al. (2010). "A Century-Long Perspective on Agricultural Development". *American Journal of Agricultural Economics* 92.2, pp. 447–468
- Hallegatte, Stéphane, Geoffrey Heal, et al. (2011). *From Growth to Green Growth-A Framework*. The World Bank
- Herrendorf, Berthold, Richard Rogerson, et al. (2014). "Growth and Structural Transformation". *Handbook of Economic Growth*. Vol. 2. Elsevier, pp. 855–941
- Greenstone, Michael and B Kelsey Jack (2015). "Envirodevonomics: A Research Agenda for an Emerging Field". *Journal of Economic Literature* 53.1, pp. 5–42

Tues, Apr 5

International Trade and the Environment, GATT, WTO rules, CITES

- TL Ch 11
- Frankel, Jeffrey A and Andrew K Rose (2005). "Is Trade Good or Bad for the Environment? Sorting Out the Causality". *Review of Economics and Statistics* 87.1, pp. 85–91
- Kim, Hajin (2013). "Do Trade Liberalization and International Trade Law Constrain Domestic Environmental Regulation?" *Envtl. L. Rep. News & Analysis* 43, p. 10823
- Cherniwchan, Jevan, Brian R Copeland, et al. (2017). "Trade and the Environment: New Methods, Measurements, and Results". *Annual Review of Economics* 9, pp. 59–85

Thurs, April 7

Egg-timer presentations on the Sustainable Development Goals

(1) What is the motivation for the goal and how is progress measured? (2) How much progress has been made so far? Any notable successes and challenges? (3) How may the topics we've discussed in this course apply or contribute to managing the issues raised by this SDG?

Complementary Papers:

- Sachs, Jeffrey D (2012). "From millennium development goals to sustainable development goals". *The lancet* 379.9832, pp. 2206–2211
- Kenny, Charles (2018). *Speeding sustainable development: integrating economic, social, and environmental development*. Working Paper 484. URL: https://www.cgdev.org/sites/default/files/speeding-sustainable-development-integrating-economic-social-and-environmental.pdf

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Topical issues, e.g., Environmental Justice, Agriculture, Water Quality and Land Use

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Tues, April 12

Environmental Justice, Place, and Space

- TL Ch 10
- Banzhaf, Spencer, Lala Ma, et al. (2019). "Environmental Justice: The Economics of Race, Place, and Pollution". *Journal of Economic Perspectives* 33.1, pp. 185–208
- Rothstein, Richard (2017). *The Color of Law: A Forgotten History of How Our Government Segregated America*. Liveright Publishing – *Focus on introduction.*
- Hausman, Catherine and Samuel Stolper (2020). *Inequality, information failures, and air pollution*. Working Paper 26682. National Bureau of Economic Research
- Hernandez-Cortes, Danae (Nov. 2021). *A Primer on Environmental Justice for Economists*. (Accessed on 11/24/2021. Focus on the first 25 minutes background. Access password "V!5h5Jk1". URL: https://t.co/GPTwSjbKOW

Thurs, April 14
Environmental Justice, Place, and Space, Continued
Special Guest Speaker (and VT AAEC Professor) Mike Ellerbrock, member of the Virginia Natural Resources Leadership Institute and former member of EPA's National Environmental Justice Advisory Council

Tues, Apr 19
Water Quality, Point and Nonpoint Source Pollution

- TL Ch 9
- Keiser, David A and Joseph S Shapiro (2019). "US Water Pollution Regulation over the Past Half Century: Burning Waters to Crystal Springs?" *Journal of Economic Perspectives* 33.4, pp. 51–75

Thurs, April 21
Open/Catch Up Day OR Land for Food, Feed, Fuel, and Fiber; Telecoupling, and the Economics of Deforestation

- Angelsen, Arild and David Kaimowitz (1999). "Rethinking the Causes of Deforestation: Lessons From Economic Models". *The World Bank Research Observer* 14.1, pp. 73–98
- Hosonuma, Noriko, Martin Herold, et al. (2012). "An Assessment of Deforestation and Forest Degradation Drivers in Developing Countries". *Environmental Research Letters* 7.4, p. 044009
- Alix-Garcia, Jennifer, Craig McIntosh, et al. (2013). "The Ecological Footprint of Poverty Alleviation: Evidence From Mexico's Oportunidades Program". *Review of Economics and Statistics* 95.2, pp. 417–435
- FAO (2020). *The State of the World's Forests 2020*. Report. URL: http://www.fao.org/3/ca8642en/CA8642EN.pdf

Tues, April 26
Group Presentations

Thurs, April 28
Group Presentations

Tues, May 3
Advances in environmental quality monitoring, behavioral econ, and impact evaluation

- Morgenstern, Richard D. (2020). *A Half Century of Economics at EPA*. (Accessed on 01/13/2021). URL: https://www.resourcesmag.org/archives/half-century-economics-epa/
- Benami, Elinor, Daniel E Ho, et al. (2020). *Innovations for Environmental Compliance: Emerging Evidence and Opportunities*. Report. URL: https://siepr.stanford.edu/research/publications/innovations-environmental-compliance-emerging-evidence-and-opportunities
- Polasky, Stephen, Catherine L Kling, et al. (2019). "Role of economics in analyzing the environment and sustainable development". *Proceedings of the National Academy of Sciences* 116.12, pp. 5233–5238

Tues, May 10
Final Exam from 7.45-9.45am