

University of Waterloo
Department of Economics
Economics 355
Economics of Energy and Natural Resources
Fall 2014
8:30-9:50 am, Tues/Thurs, EV3 3412

Instructor Information

Instructor: Margaret Insley
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Office Hours:
Mon/Wed 3-4 pm, or by appointment

Course description

Humanity depends on natural resources for survival; yet increasing population and economic growth have put pressure on key natural resources such as forests, fisheries, and water. In addition, the economies of the world's wealthier countries are highly dependent on depletable natural resources - oil and natural gas, in particular. In this course we will use the theory and tools of economics to explore key issues of natural resource use and management. We will seek to understand the meaning and implications of natural resource scarcity and how the insights of economics might be used to promote a more sustainable path for our future. We begin with basic economic concepts such as static and dynamic efficiency, property rights and market failure. We then apply these concepts to the management of key resources such as energy resources, fisheries, forestry, and water.

Course objectives and learning outcomes

The objective of the course is to apply the normative economic concepts of static and dynamic efficiency to questions concerning society's exploitation of natural resources.

Upon completion of the course students should be able to:

- Explain the determination of the efficient level of extraction over time for renewable and non-renewable resources and distinguish between efficiency and equity
- Describe the determinants of natural resource prices over time
- Explain the significance of discounting in economic decisions about natural resources and the associated ethical dilemmas
- Analyze market failures and the need for government intervention to ensure an efficient allocation of natural resources in specific examples
- Evaluate government natural resource policies for efficiency, equity and societal welfare.

Textbook

Tom Tietenberg and Lynne Lewis, *Environmental and Natural Resource Economics*, Pearson, tenth edition, 2015. (Note: If you use an earlier edition (8th or 9th) you are responsible for determining the correspondence of chapters and page numbers between the older and most recent editions.)

Other References

(Note that some of the links will only work if you are on campus or logged into your library account from home. Articles without links are available through the library.)

K. Arrow *et al* (2005) Economic growth, carrying capacity, and the environment, *Ecological Economics*, 15, 91-95.

Severin Borenstein (2012) 'The Private and Public Economics of Renewable Electricity Generation', *Journal of Economic Perspectives*, 26, 67-92.5.3

Christopher Costello, S. Gaines, and J. Lynham (2008) '[Can catch shares prevent fisheries collapse?](#)', *Science*, **321**: 1678-1681.

S. Olmstead and R. Stavins (2009) 'Comparing price and nonprice approaches to urban water conservation', *Water Resources Research*, 45.

D. Pearce, B. Groom, C. Hepburn, and P. Koundouri (2003) '[Valuing the future" recent advances in social discounting](#)', *World Economics* 4(2): 121-41.

James Smith (2009) 'World oil: market or mayhem?', *Journal of Economic Perspectives*, **23**(3): 145-164.

James Smith (2012) '[Does speculation drive oil prices?](#)', *Resources Magazine*, 181, Resources for the Future.

Sustainable Prosperity (2011) '[Economic instruments for water management in Canada: Case studies and barriers to implementation](#)', Policy Brief, Sept. 2011,

Course Assessment

Evaluation	Percent of final grade	Date
Assignment 1	10%	October 9, in class
Midterm	25%	Thursday Oct 23 during class time, location PAS 2083
Assignment 2	20%	November 20, in class
Final Exam	45%	Scheduled by the registrar

Outline of topics to be covered

1. Introduction
 - 1.1. Scarcity and limits to growth
 - 1.2. Natural resources and the economy
2. Static efficiency: a normative criteria for decision making
 - 2.1. Review of basic concepts: willingness-to-pay, marginal and total cost, consumer and producer surplus, Pareto optimality
 - 2.2. Property rights and efficient market allocations
 - 2.3. Externalities as a source of market failure
 - 2.4. Public goods
 - 2.5. Public policy and the pursuit of efficiency
3. Dynamic efficiency and discounting
 - 3.1. What is dynamic efficiency?
 - 3.2. How should the discount rate be chosen for public policy decisions?
 - 3.3. Dynamic efficiency and sustainable development
4. The efficient extraction of depletable natural resources over time
 - 4.1. Characterizing the reserve base
 - 4.2. Optimal extraction over multiple periods in a competitive industry
 - 4.3. Optimal extraction by a monopolist
5. Energy economics: non-renewable and renewable energy sources
 - 5.1. World oil markets: what drives the price of oil?
 - 5.2. How will future energy demands be met?
 - 5.3. Government policy and energy markets
6. Forest economics: a renewable, but depletable, resource
7. Fisheries: a common pool resource
8. Water economics: a renewable, but depletable, resource
9. Controversies with Alberta's oil sands

Tentative course schedule

Note: I will not follow this schedule rigidly, but will adapt the timing of topics as needed to best make use of class time. Additional readings may be assigned throughout the term. Check LEARN regularly for an up-to-date reading list.

Lec	Date	Topics	Readings
1	Sept 9	Scarcity and the limits to growth	Text, Ch 1 K. Arrow <i>et al</i> (2005)
2	Sept 11	Natural resources and the economy Normative criteria: Static efficiency	Text, Ch2; Ch3, pp 46-51

Lec	Date	Topics	Readings
3	Sept 16	Review of basic concepts	
4	Sept 18	Property rights and efficient market allocations	
5	Sept 23	Externalities as a source of market failure	
6	Sept 25	Public goods and common property resources; Pursuit of Efficiency	
7	Sept 30	Dynamic efficiency and discounting What is dynamic efficiency? Choice of discount rate	Text, Ch 3, pp 51 - 71 D. Pearce, <i>et al</i> , (2003)
8	Oct 2	Dynamic efficiency and sustainable development	Text, chapter 5
9	Oct 7	Efficient extraction of depletable natural resources	Text, chapter 6
10	Oct 9	Depletable resource extraction, continued Assignment 1 due	
11	Oct 14	Depletable resource extraction, continued	
12	Oct 16	Energy economics; World oil markets: what drives the price of oil?	Text, Chapter 7 James Smith (2009) James Smith (2012)
13	Oct 21	Energy (continued)	
14	Oct 23	Midterm, during class time, location PAS 2083	
15	Oct 28	How will future energy demands be met?	Text, pp 160-171
16	Oct 30	Government involvement in energy markets	Borenstein (2013)
17	Nov 4	Forest Resources	Text, Chapter 11 (including appendix)
18	Nov 6	Forests (continued)	
19	Nov 11	Fisheries	Text, Chapter 12 (including appendix)
20	Nov 13	Fisheries (continued)	Costello, <i>et al</i> (2008)

Lec	Date	Topics	Readings
21	Nov 18	Water	Text, chapter 9 S. Olmstead and R. Stavins (2009) Sustainable Prosperity (2011)
22	Nov 20	Water (continued) Assignment 2 due	
23	Nov 25	Alberta's oil sands – Should the Keystone XL pipeline be approved?	
24	Nov 27	Review and course wrap up	

Required Background

- The prerequisite is Econ 201.
- Students are expected to be competent with skills in basic algebra, such as solving two linear equations in two unknowns, and working with exponents and logarithms.

Readings and notes on LEARN

- Course notes, announcements etc can be found on LEARN.
- The course notes provide an outline of important points, but leave out many details. It is recommended that you bring the relevant notes to class each week so that you can fill in missing sections.

Midterm

- A student who misses the midterm due to illness or other extenuating circumstances may seek approval from me to have the weighting of the test shifted to the final exam. Approval will be granted only if appropriate documentation is submitted. If the student does not receive my approval, then a mark of zero will be assigned for the missed midterm. Appropriate documentation in the case of illness is the University's Verification of Illness Form completed by the University of Waterloo Health Services or an Ontario physician. **Students must submit their documentation within one week of the missed midterm.** No make up midterms will be granted.
- Students with a concern about the marking of the midterm must consult with me within two weeks of the date that it is returned in class. After two weeks I will not make any adjustments to a midterm mark.

Assignments

- Assignments will involve problem solving as well as essay questions requiring reading and analysis.
- Assignments may be completed individually or in groups of two. For group assignments, each student will receive the same mark. It is very important that each student in a group contributes equally to the assignment and understands the solutions. Exam questions will draw on assignment materials.

Policy on late assignments

- A deduction of 5% per day will be applied to an assignment handed in late.

Final Exam

- The final exam is cumulative.
- Students are responsible for material covered in lectures and assigned readings.

Electronic Device Policy

Students are welcome to bring laptop computers or other electronic devices to class for note taking. Browsing the internet during class is not permitted. Please turn off cell phones during class time.

Attendance Policy

Consistent attendance is highly recommended. Course notes available on LEARN are intended as an aid to understanding, not a substitute for classes.

Economics Department Deferred Final Exam Policy

Deferred Final Exam Policy found at <https://uwaterloo.ca/economics/current-undergraduates/policies-and-resources/deferred-final-exam-policy>.

Cross-listed courses

Please note that a cross-listed course will count in all respective averages no matter under which rubric it has been taken. For example, a PHIL/PSCI cross-list will count in a Philosophy major average, even if the course was taken under the Political Science rubric.

Academic Integrity

Academic Integrity: In order to maintain a culture of academic integrity, members of the University of Waterloo are expected to promote honesty, trust, fairness, respect and responsibility. See the [UWaterloo Academic Integrity Webpage \(https://uwaterloo.ca/academic-integrity/\)](https://uwaterloo.ca/academic-integrity/) and the [Arts Academic Integrity Office Webpage \(http://arts.uwaterloo.ca/current-undergraduates/academic-responsibility\)](http://arts.uwaterloo.ca/current-undergraduates/academic-responsibility) for more information.

Discipline: A student is expected to know what constitutes academic integrity, to avoid committing academic offenses, and to take responsibility for his/her actions. A student who is unsure whether an action constitutes an offense, or who needs help in learning how to avoid offenses (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course professor, academic advisor, or the Undergraduate Associate Dean. When misconduct has been found to have occurred, **including writing exams in a section that you are not registered in**, disciplinary penalties will be imposed under [Policy 71 – Student Discipline](#). For information on categories of offenses and types of penalties, students should refer to [Policy 71 - Student Discipline](#). For typical penalties check Guidelines for the Assessment of Penalties found at <http://www.adm.uwaterloo.ca/infosec/guidelines/penaltyguidelines.htm>.

Grievance: A student who believes that a decision affecting some aspect of his/her university life has been unfair or unreasonable may have grounds for initiating a grievance. Read [Policy 70 - Student Petitions and Grievances, Section 4](#). In addition, read [the Student Grievance Process](#) for the Faculty of Arts found at <https://uwaterloo.ca/arts/current-undergraduates/student-support/student-grievances-faculty-arts-processes>.

Appeals: A student may appeal the finding and/or penalty in a decision made under Policy 70 - Student Petitions and Grievances (other than regarding a petition) or Policy 71 - Student Discipline if a ground for an appeal can be established. Read [Policy 72 - Student Appeals](#).

Other sources of information for students

[Academic integrity \(Arts\) Academic Integrity Office \(uWaterloo\)](#)

Accommodation for Students with Disabilities

Note for students with disabilities: The [AccessAbility Services office](#), located in Needles Hall Room 1132, collaborates with all academic departments to arrange appropriate accommodations for students with disabilities without compromising the academic integrity of the curriculum. If you require academic accommodations to lessen the impact of your disability, please register with the AS office at the beginning of each academic term.