

**University of Waterloo**  
**Department of Economics**  
**Economics 255, Fall 2020**  
**Introduction to the Economics of Natural Resources**

***Instructor Information***

Instructor: Margaret Insley

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***Virtual office hours or optional live sessions***

I will hold twice a week live sessions for either office hours or some additional discussion/review of course materials. These sessions are optional. Scheduled times are Tuesdays from 9 to 10 am and Thursdays from 3 to 4 pm. The link to the WebEx sessions is in LEARN. Additional office hours are also available 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 world economy is highly dependent on fossil fuels such as coal, oil and natural gas, which are a major source of greenhouse gas emissions. 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 natural resources such as energy resources, fisheries, 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 the sustainable use of natural resources.

Upon completion of the course students should be able to:

- Explain the determination of the efficient level of resource use over time for renewable and non-renewable resources and distinguish between efficiency and equity
- Explain the importance of property rights in the management of natural resources
- Demonstrate the significance of discounting in economic decisions about natural resources and explain the associated ethical dilemmas
- Analyze market failures in specific examples and the need for government intervention to support a more efficient allocation of natural resources
- Evaluate natural resource policies for efficiency, equity and societal welfare.

## ***Textbooks***

- Tom Tietenberg and Lynne Lewis (**T&L**), *Environmental and Natural Resource Economics*, Pearson, eleventh edition, 2018. An online version of the text is available through Course Reserves on the Library's website. The tenth edition of the book is also acceptable.
- A basic first year microeconomics textbook to provide a review of first year concepts. Some examples that are freely available include:
  - Douglas Curtis and Ian Irvine. Principles of Microeconomics (Lyryx) (<https://openlibrary.ecampusontario.ca/catalogue/item/?id=2c524756-e7fd-47e1-9dc8-e9398a935150>)
  - Timothy Taylor, Steven A. Greenlaw and David Shapiro. Principles of Microeconomics - 2e: OpenStax (<https://openlibrary.ecampusontario.ca/catalogue/item/?id=92a5668c-a33b-4521-9853-6c06dbb38699>)

## ***Course Assessment***

<b>Evaluation</b>	<b>Percent of final grade</b>	<b>Due Date</b>
Assignment 1	5%	Monday, September 21
Midterm 1	20%	Friday October 9
Assignment 2	25%	Friday November 6
Midterm 2	25 %	Friday November 27
Assignment 3	25 %	Monday Dec. 14

## ***Schedule and outline of topics to be covered:***

### **1. Introduction**

#### ***Week 1 (Sept 8)***

##### **Notes:**

- 1.1. The adequacy of the earth's resources: pessimists and optimists
- 1.2. Natural resources and the economy

##### **Readings:**

- T&L, Ch 1

**The following readings are used in Assignment 1:**

- Gee, Marcus (2018) 'Even without rose-tinted glasses, life's till a lot rosier,' *Globe and Mail*, August 25, 2018. Available on Learn.
- Kopecky, Arno (2018) 'Things have never been so good for humanity, nor so dire for the planet', *Globe and Mail*, August 25, 2018. Available on Learn.
- Lomborg, Bjorn (2020) 'The alarm about climate change is blinding us to sensible solutions,' *Globe and Mail*, July 17, 2020.
- European Environmental Agency (2019) 'The European environment – state and outlook 2020'.

## 2. Static efficiency: a normative criteria for decision making

### Week 2 (Sept 14)

#### Notes:

- 2.1. Review of basic concepts: willingness-to-pay, marginal, average and total cost, consumer and producer surplus, Pareto optimality

### Week 3 (Sept 21)

#### Notes:

- 2.2. Property rights and efficient market allocations  
 2.3. Externalities as a source of market failure

### Week 4 (Sept 28)

#### Notes:

- 2.4. Public goods  
 2.5. The pursuit of efficiency

#### Readings:

- T & L, Ch 2 and Ch 3
- Optional: A first year microeconomics text for review of concepts such as willingness to pay, cost curves in the short and long run, efficiency and market failure. Relevant chapters in the suggested online textbooks include:
  - Curtis and Irvine, Chapters 3, 5 and 8
  - Timothy Taylor, Steven A. Greenlaw and David Shapiro, Chapters 3, 7
- *The Economist*, "Schools Brief: Externalities, Pigouvian taxes", August 19, 2017.

#### The following readings are used in Assignment 2:

- Bergstrom, Theodore (2010) 'The Uncommon Insight of Elinor Ostrom,' *Scandinavian Journal of Economics*, 112(2), 245-261.
- Garrett Hardin (1968) "The Tragedy of the Commons", *Science*, 162, pp 1243-1248.
- Brett M. Frischmann, Alain Marciano and Giovanni Battista Ramello (2019) "Tragedy of the Commons after 50 Years," *Journal of Economic Perspectives*, 33(4), pp 211-228.

## 3. Discounting and dynamic efficiency

### Week 5 (Oct 5)

#### Notes:

- 3.1. What is dynamic efficiency?

- 3.2. How should the discount rate be chosen for public policy decisions?
- 3.3. Discounting over long time periods

**Readings:**

- \*Cropper, M (2013) '[How should benefits and costs be discounted in an intergenerational context?](#)' *Resources Magazine*: 183, Resources for the Future.
- \*Pearce, D.; B. Groom; C. Hepburn; and P. Koundouri (2003) '[Valuing the future: recent advances in social discounting](#)', *World Economics* 4(2): 121–41.

## 4. Dynamic efficiency and sustainability

*Week 6 (Oct 19) and Week 7 (Oct 26)*

**Notes:**

- 4.1. Characterizing the resource stock
- 4.2. Optimal extraction in a two period model
- 4.3. Intertemporal fairness and the sustainability criterion

**Readings:**

- T & L, Ch. 5
- Geoffrey Heal (2012) "Defining and measuring sustainability." *Review of Environmental Economics and Policy*, 6(1), pp. 147-163.

## 5. Non-renewable resource allocation: efficient extraction over a long time horizon

*Week 8 (Nov 2)*

- 5.1. Case I: Competitive industry, constant cost, no backstop
- 5.2. Case II: A change in the discount rate
- 5.3. Case III: Presence of a backstop technology
- 5.4. Case IV: Increasing marginal extraction costs
- 5.5. Case V: Exploration and new discoveries
- 5.6. Case VI: Optimal extraction with environmental costs

**Readings:**

- T&L, Ch 6 (including appendix)

## 6. Transitioning from fossil fuels to renewable energy sources

*Week 9 (Nov 9)*

**Notes:**

- 6.1. Are fossil fuels becoming more scarce?
- 6.2. Transitioning power generation away from fossil fuels

**Readings:**

- T&L, Ch 7, (Electricity, the role of depletables; Electricity: transitioning to renewables) pp 158-163
- Bassi, Samuela; Maria Carvalho, Baran Doda and Sam Fankhauser (2017) 'Credible, effective and publicly acceptable policies to decarbonise the European Union, Final Report', Grantham Research

Institute on Climate Change and the Environment, Chapter 2 “The effectiveness of decarbonisation policies”.

- National Energy Board (NEB) (2017) ‘Canada’s Adoption of Renewable Power Sources Energy Market Analysis,’ May 2017. <https://www.neb-one.gc.ca/nrg/sttstc/lctrct/rprt/2017cnddptnrnwblpwr/2017cnddptnrnwblpwr-eng.pdf>
- Covert, T.; M. Greenstone; C. Knittel (2016) ‘Will we ever stop using fossil fuels?’, *Journal of Economic Perspectives*, 30, p. 117-138.

## 7. Fisheries

### *Week 10 (Nov 16) and Week 11 (Nov 23)*

#### **Notes:**

- 7.1. Introduction
- 7.2. A model of the fishery
- 7.3. Dynamics of open access
- 7.4. Determining the socially optimal harvest level
- 7.5. Extinction in a steady state model
- 7.6. Regulation of the fishery
- 7.7. Case study: Pacific halibut

#### **Readings:**

- T&L, Chapter 12
- *The Economist*, (2016) ‘Unbalancing the Scales,’ Print edition, July 16, 2016.

## 8. Water economics

### *Week 12 (Nov 30)*

#### **Notes:**

- 8.1. Introduction
- 8.2. Efficient water allocation
- 8.3. Property rights
- 8.4. Sources of inefficiency
- 8.5. Water pricing in practice

#### **Readings**

- T&L, Ch 9
- Renzetti, S. (2017) “Water Pricing in Canada”, in *Water Policy and Governance in Canada*, S. Renzetti and D.P. Dupont (eds).

## 9. Required Background

- The prerequisite is Econ101.
- 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.

## 10. Readings and notes on LEARN

- Course notes, announcements, videos etc. can be found on LEARN.

## 11. Midterm

- The midterm exams will be administered through LEARN.
- A student who misses the midterm due to illness or other extenuating circumstances may seek my approval to write a deferred midterm. 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. **Students must submit their documentation within one week of the missed midterm.**
- Students with a concern about the marking of a midterm must consult with me **within two weeks** of the date that it is returned to the class. After two weeks, I will not make any adjustments to a midterm mark.

## 12. Assignments

- It is permitted to consult with other students regarding the assignment questions. However the final work submitted must be your own. Students who submit identical (or nearly identical) assignments will receive a grade of zero.
- Assignments are to be submitted to the designated Dropbox on LEARN. Assignments may be handwritten or typewritten.
- Students with a concern about the marking of an assignment must consult with me **within two weeks** of the date that it is returned to the class. After two weeks I will not make any adjustments to a assignment mark.

## 13. Policy on late assignments

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

## 14. Final Exam

- There is no final exam in this course.

### ***Statements from the University included on all course outlines :***

**Academic integrity:** In order to maintain a culture of academic integrity, members of the University of Waterloo community are expected to promote honesty, trust, fairness, respect and responsibility. [Check [the Office of Academic Integrity](#) for more information.]

**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](#). When in doubt, please be certain to contact the department's administrative assistant who will provide further assistance.

**Discipline:** A student is expected to know what constitutes academic integrity to avoid committing an academic offence, and to take responsibility for his/her actions. [Check the [Office of Academic Integrity](#) for more information.] A student who is unsure whether an action constitutes an offence, or who needs help in learning how to avoid offences (e.g., plagiarism, cheating) or about “rules” for group work/collaboration should seek guidance from the course instructor, academic advisor, or the undergraduate associate dean. For information on categories of offences and types of penalties, students should refer to [Policy 71, Student Discipline](#). For typical penalties, check [Guidelines for the Assessment of Penalties](#).

**Appeals:** A decision made or penalty imposed under [Policy 70, Student Petitions and Grievances](#) (other than a petition) or [Policy 71, Student Discipline](#) may be appealed if there is a ground. A student who believes he/she has a ground for an appeal should refer to [Policy 72, Student Appeals](#).

**Note for students with disabilities:** [AccessAbility Services](#), located in Needles Hall, Room 1401, 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 AccessAbility Services at the beginning of each academic term.

## ***Other Information***

### **Mental Health Support**

All of us need a support system. The faculty and staff in Arts encourage students to seek out mental health support if they are needed.

#### **On Campus**

***Due to COVID-19 and campus closures, services are available only online or by phone.***

- Counselling Services: [counselling.services@uwaterloo.ca](mailto:counselling.services@uwaterloo.ca) / 519-888-4567 ext. 32655
- [MATES](#): one-to-one peer support program offered by the Waterloo Undergraduate Student Association (WUSA) and Counselling Services

#### **Off campus, 24/7**

- [Good2Talk](#): Free confidential help line for post-secondary students. Phone: 1-866-925-5454
- Grand River Hospital: Emergency care for mental health crisis. Phone: 519-749-4300 ext. 6880
- [Here 24/7](#): Mental Health and Crisis Service Team. Phone: 1-844-437-3247
- [OK2BME](#): set of support services for lesbian, gay, bisexual, transgender or questioning teens in Waterloo. Phone: 519-884-0000 extension 213

Full details can be found online on the Faculty of Arts [website](#)

Download [UWaterloo and regional mental health resources \(PDF\)](#)

Download the [WatSafe app](#) to your phone to quickly access mental health support information.

## **Territorial Acknowledgement**

We acknowledge that we are living and working on the traditional territory of the Attawandaron (also known as Neutral), Anishinaabe and Haudenosaunee peoples. The University of Waterloo is situated on the Haldimand Tract, the land promised to the Six Nations that includes ten kilometres on each side of the Grand River.

For more information about the purpose of territorial acknowledgements, please see the [CAUT Guide to Acknowledging Traditional Territory](#).

## **Academic freedom at the University of Waterloo**

[Policy 33, Ethical Behaviour](#) states, as one of its general principles (Section 1), “The University supports academic freedom for all members of the University community. Academic freedom carries with it the duty to use that freedom in a manner consistent with the scholarly obligation to base teaching and research on an honest and ethical quest for knowledge. In the context of this policy, 'academic freedom' refers to academic activities, including teaching and scholarship, as is articulated in the principles set out in the Memorandum of Agreement between the FAUW and the University of Waterloo, 1998 (Article 6). The academic environment which fosters free debate may from time to time include the presentation or discussion of unpopular opinions or controversial material. Such material shall be dealt with as openly, respectfully and sensitively as possible.” This definition is repeated in Policies 70 and 71, and in the Memorandum of Agreement, Section 6