Course Content and Objectives

This course has two main objectives:

- To acquaint you with the major issues and seminal literature in natural resource economics. We will cover issues related to the use of renewable resources such as fisheries, aquifers, and timber, and non-renewable resources such as oil and minerals. We will also cover issues related to the conservation of biodiversity and provision of ecosystem services, climate change, and sustainability. We will analyze the issue of efficient use of resources over time and under what conditions market equilibrium achieves an efficient outcome, intergenerational equity and discounting, common property resources, imperfect competition, spatial modeling, uncertainty, and irreversible decisions.

- To increase your ability to do economic research. We will do a set of activities to increase your ability to think critically and formulate specific researchable questions, as well as improving your modeling and analytical skills.

Prerequisites

APEC 8000-8004 or equivalent (graduate level microeconomic theory). It is possible to take microeconomic theory concurrently. If you haven’t had such classes (or are taking them concurrently) please talk to me about what you will need to do to keep up. It is also desirable to have taken APEC 8206 – Dynamic Optimization. We will adjust the course based on how familiar students are with the techniques of dynamic optimization (optimal control theory and dynamic programming). If you do not have an adequate background in dynamic optimization or microeconomic theory but feel you can handle the material please talk with me and we will arrange a way for you to catch up on what you need to know.
Course Requirements

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<td>Class participation</td>
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<td>Weekly insights</td>
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<td>Problem sets</td>
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<td>Research paper first draft</td>
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<td>Research paper final draft</td>
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<td>Midterm 1</td>
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We will read and discuss major articles that have helped define the field of natural resource economics and recent articles on the frontier. Readings for the course will be made available on the Moodle website for the course: https://ay16.moodle.umn.edu/course/view.php?id=2897.

Reading the literature is important for gaining literacy and understanding the evolution of ideas and analytical techniques. Class time will be largely devoted to lecture and discussion of this material. For good discussion it is important to come to class prepared. Please do the readings assigned ahead of the class period when they will be discussed. Doing so will make the class more rewarding and more enjoyable. I will try to be clear on what I expect you to read and when.

Each week you will write up a question or insight arising from lecture, class discussion, class readings, other readings, or recent events. These will be due at 6 pm on Wednesday and can be submitted electronically on the course Moodle website. These insights/questions are meant to be short (several sentences is sufficient) and focused on a particular question or issue that you would like to know more about. At the start of class on Thursday we will spend some time discussing selected issues raised by your submissions. We will use this time to think critically about the issue, formulate specific researchable questions, and potential modeling strategies. Often these sessions turn into a quick “how to model” or “how to design research” on the question. I would be happy if one or more of these blossomed into research papers for the course or full-fledged research projects.

There will be periodic problem sets. The best way to learn natural resource economics (or any branch of economics) is to solve problems. The problem sets will be mostly analytical but will also include some numerical problems. Some problem sets will require proficiency in the use of Matlab and we will spend time to learn Matlab skills as needed. I encourage you to work together on problem sets but each of you must hand in your own assignment.

The best way to learn to do research is to do it. Each student will write a research paper in the course. The research paper will be short, on the order of 5 – 8 pages double-spaced, and focused on a specific research question (you only have 5-8 pages so you really do need to be focused). For the paper please pick a well-defined problem and develop an analytical or simulation model, or conduct an empirical analysis, to address the problem. A good way of thinking about this assignment is to have a topic along the lines of a problem for a problem set, but one that hasn’t been formulated previously, or an extension of an existing paper in the literature. To help you get to a good final product, you will first hand in an outline. After receiving comments on the outline, you will then write a first draft. The first draft will be read by two classmates who will serve as peer reviewers (as is done at a professional journal). The peer reviewers will provide you with written comments on the strength and weaknesses of the draft and suggestions for improvement. I will also read and comment on the first draft. You will then “revise and resubmit” the paper taking account of the three sets of comments. More details on the paper assignment and peer reviewing will be handed out later in the course.

There will be two tests on the material, one around midterm and the other near the end of the semester.
The two tests will be equally weighted except in the case where a student does much better on the second test in which case the second test will get greater weight.

**Texts**

There are three books that we will reference fairly extensively in the course (only one of which I have asked you to purchase – Conrad and Clark):


Clark (1990) contains useful discussion of renewable resource models (but is really expensive so I’m not asking you to buy it). Conrad and Clark (1987) contain a summary of important concepts and a set of exercises that will allow you to apply the concepts to resource problems. I will assign some exercises from this book on problems set. Dasgupta and Heal (1979) contains useful discussion of non-renewable resource models. Most of the readings for the course are journal articles. These articles will be available on the course Moodle website.

There are several other useful books that are good reference books that you may wish to purchase or have access to:

1. **Natural Resource Economics**
   
   
   
   
   
   
   

2. **Dynamic Optimization**
   
   
   
   
Policies

Late Assignments
All assignments are due at the beginning of class on the due date. If you have extenuating circumstances that will prevent you from turning in an assignment on time please arrange for an extension ahead of time. Putting off assignments until the very end and then having a last minute crisis is your problem not mine. Students who turn in assignments after the due date without a valid excuse will have their grades reduced by one grade (e.g. A- to B+) for each day the assignment is late.

Academic Dishonesty and Plagiarism
The University of Minnesota defines academic dishonesty as “Submission of false records of academic achievement; cheating on assignments or examinations; plagiarizing; altering, forging, or misusing a University academic record; taking, acquiring, or using test materials without faculty permission; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement” (University of Minnesota’s Board of Regents Student Conduct Code). Plagiarism is the “use the words or ideas of another person as if they were your own words or ideas” (Merriam Webster Dictionary). If you want to use the exact wording from a previously published work in your own work you must put the wording in quotation marks and cite the source (as shown by example in the prior sentence). If you use ideas or specific facts from a source but do not use the exact words then you still must cite the source of the original ideas or facts. Evidence of academic dishonesty will be forwarded to the Student Scholastic Conduct Committee. TurnItIn is used to check for plagiarism on written assignments.

Credits and Workload Expectations
One credit is defined as equivalent to an average of three hours of learning effort per week (over a full semester) necessary for an average student to achieve an average grade in the course. For example, a student taking a three credit course that meets for three hours a week should expect to spend an additional six hours a week on coursework outside the classroom.

Students with Disabilities
The University of Minnesota is committed to providing equitable access to learning opportunities for all students. Disability Services (DS) is the campus office that collaborates with students who have disabilities to provide and/or arrange reasonable accommodations. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations. If you are registered with DS and have a current letter requesting reasonable accommodations, please let me know early in the semester so we can agree on accommodations that will be applied in the course.
**Students with Mental Health Issues**
As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating, and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce your ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via www.mentalhealth.umn.edu.

**Reading List**

I. The Big Picture: Resources and Sustainable Development


II. Intertemporal Optimization, Growth Theory, and Discounting

A. Dynamic Optimization Using Optimal Control Theory
Conrad and Clark, chapter 1.
Kamien and Schwartz, Part II Optimal Control, Sections 1 - 4.

B. Growth Theory and Intertemporal Optimization

C. Discounting


III. Renewable Resources

A. Bioeconomic Models of Fisheries and Optimal Harvesting

Clark, chapters 1-4, 7.
Conrad and Clark, chapter 2.
Hanley, Shogren and White, chapter 10.
Hartwick and Olewiler, chapter 11.

B. Open Access

Clark, chapter 8.

C. Regulating Access to Common Property Resources


D. Game Theoretic Models of Common Property Resources


E. Forestry: Age Dependent Growth and Timing of Harvest

Clark, chapter 9.

Hanley, Shogren and White, chapter 11.

Hartwick and Olewiler, chapter 10.


F. Spatially Explicit Harvest Models


Sanchirico, J. and J. Wilen. 2005. Optimal spatial management of renewable resources: Matching


G. Renewable Resource Management with Uncertainty

Clark, chapter 11.

Conrad and Clark, chapter 5.


H. Regime Shift


I. Irreversibility, Uncertainty, and Option Value

Dixit and Pindyck, chapter 2 and chapter 4, pp. 93-103.
Conrad and Clark, chapter 5, sections 5.1 and 5.7.

IV. Non-Renewable Resources

A. The Basic Hotelling Model and Extensions

Conrad and Clark, chapter 3.
Dasgupta and Heal, chapter 6.
Hanley, Shogren and White, chapter 9.
Hartwick and Olewiler, chapter 8.

B. Non-renewable Resources, Capital, and Growth Theory
Dasgupta and Heal, chapters 7 – 8.


C. Empirical Tests


D. Oil Prices


E. Exploration and Uncertainty


F. Imperfect Competition

Hartwick and Olewiler, chapter 9.

V. Biodiversity and Ecosystem Services

A. Biodiversity Measures and the Value of Biodiversity


B. Strategies to Conserve Biodiversity


C. Ecosystem Services


VI. Climate Change

A. Optimal Abatement


B. Climate Change Uncertainty


Pindyck, R.S. 2013. Climate change policy: What do the models tell us? Journal of Economic Literature 51(3): 860-872.


C. Climate Change Policy and International Agreements

D. Climate Change Impacts, Deforestation, Land Use and Carbon Sequestration


VII. Sustainable Development

Hanley, Shogren and White, chapter 2.
Hartwick and Olewiler, chapters 2, 12.
Dasgupta and Heal, chapters 7-8.