Natural Resource Economics and Policy (ESM 242)

Bren School of Environmental Science & Management
University of California, Santa Barbara
Fall 2024

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Course Objectives

This course examines the use of natural resources such as fish, forests, and minerals. An emphasis will be placed on how to use resources over time in a way that maximizes their value. We will also consider whether markets for these resources are optimal in this sense, whether policy interventions are required, and environmental justice implications of natural resource use. After an introduction to basic concepts, we will study how dynamic problems can be solved numerically using an optimization algorithm in R. This will be the primary tool that students use throughout the class. Specific topics examined with include fisheries, forests, nonrenewable resources, land, water, and wildfire. In addition to regular homework assignments, students will formulate and solve a dynamic resource problem of their own design.

Course Materials

Many of the readings for the course will be from *Resource Economics, Second Edition* by Jon M. Conrad (Cambridge University Press, 2010). I will make available the following additional readings:

1. Berkes, F., Colding, J., and C. Folke. 2000. Rediscovery of Traditional Ecological Knowledge as Adaptive Management. Ecological Applications 10(5): 1251-62.
2. Pasternak, J. 2010. Yellow Dirt: An American Story of a Poisoned Land and the Betrayal of the Navajos. Free Press. (Excerpts)
3. Cain, L., Hernandez-Cortes, D., Timmins, C., and P. Weber. 2024. Recent Findings and Methodologies in Economics Research in Environmental Justice. Review of Environmental Economics and Policy 18(1), winter.
4. Sadler, R.C., and A.R. Highsmith. 2016. Rethinking Tiebout: The Contribution of Political Fragmentation and Racial/Economic Segregation to the Flint Water Crisis. Environmental Justice 9(5): 143-151.
5. Anderson, S., Plantinga, A.J., and M. Wibbenmeyer. 2023. Unequal Treatments: Federal Wildfire Fuels Projects and Socioeconomic Status of Nearby Communities. Environmental and Energy Policy and the Economy, vol 4, 177-201.

Course Requirements

Readings: The readings in Conrad (2010) and the additional readings I provide are optional but strongly encouraged. They will help you to better understand the material presented in class and to build a deeper understanding of resource economics.

Homework assignments: There will be five homework assignments. You may work on the assignments in groups; however, you are responsible for writing your own answers, in your own words. Assignments 1-4 will be available on Tuesday and due the following week on Wednesday. The class period on Wednesday will be used to answer any remaining questions about the homework assignment due on

that day and to discuss the new homework. Assignment 5 will be based on the group presentations and be made available after the last group presentation.
Mid-term exam: There is a take-home mid-term exam.
Group projects: Students will work in groups on projects of their own design. Each team must identify an interesting dynamic natural resource problem, formulate a research question, develop a mathematical statement of the problem, find a numerical solution to the problem, and report on their findings. There are three deliverables: 1) a one-page description of the problem due on October 16, 2) a presentation to the class during Weeks 9, 10 & 11, 3) a final slide deck due by Wednesday, December 4.

Times and Dates
Class meets Monday and Wednesday, 9:30-10:45 am, in Bren 1510
Homework assignments are due on **October 16, October 23, October 30, November 6,** and **December 11.**
A one-page description of your group project is due on **Wednesday, October 16**.
The mid-term exam will be handed out on or before **Thursday, November 7,** and due at the **beginning of class** on **Wednesday, November 13.** There is no final exam.
The final slide decks for your group presentation are due on **Wednesday, December 4**.

Course Grades
Course grades will be based on homework assignments (40%), the mid-term exam (30%), and the group presentation and final slide deck (30%).

Schedule

Week 2 (Conrad, Chapter 1; Berkes et al. 2000)

September 30. Course overview

October 2. Introduction to basic concepts

- Natural resources
- Dynamics
- Discounting
- Optimization
- Indigenous Knowledge

Week 3 (Conrad, Chapter 2)

October 7. Numerical optimization

- Using nloptr in R

October 9. Introduction to Homework #1

Week 4 (Conrad, Chapter 3)

October 14. Fisheries

- Biological growth
- Yield-effort relationships
- Static fisheries models
- Dynamic fisheries models
- Fisheries policy

October 16. Introduction to Homework #2

ONE-PAGE DESCRIPTION OF YOUR GROUP PROJECT - Due today

Week 5 (Conrad, Chapter 4)

October 21. Forestry

- Yield function
- Optimal rotations
- Non-timber benefits

October 23. Introduction to Homework #3

Week 6 (Conrad, Chapter 5; excerpts from Pasternak, 2010)

October 28. Nonrenewable resources

- Hotelling's rule
- Price and extraction paths
- Reserve dependent costs
- The Green Paradox

October 30. Introduction to Homework #4

Week 7 (Cain et al. 2024)

November 4. Guest Lecture on Sustainable Fishery Management Reforms, Christopher Costello

November 6. Land use and land value

- Economic rent
- Heterogeneity in land quality
- Price of land
- Land use patterns
- Land-use policy
- Environmental justice and land markets

MID-TERM EXAM – A take-home exam will be made available on or before November 7. It is due at the beginning of class on November 13.

Week 8 (Sadler and Highsmith 2016)

November 11. Veterans' Day (no class)

November 13. Water

- Open access use of an aquifer
- Optimal use of an aquifer
- Flint water crisis
- Water policy

Week 9 (Anderson, Plantinga, and Wibbenmeyer 2023)

November 18. Economics of Wildfire

- Wildfire trends in California
- Fuels treatments
- Fire suppression
- Insurance markets

November 20. Water and wildfire continued, or group presentations

Week 10 (No readings this week)

November 25. Group presentations

November 27. Office hours, or group presentations

Week 11 (No readings this week)

December 2. Group presentations

December 4. Group presentations

FINAL EXAM – In lieu of a final exam, students will do a final homework assignment that will be based on the group presentations. The assignment will be due on Wednesday, December 11.