Economics of Natural Resources

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COURSE OUTLINE

We analyze some of the main problems regarding the exploitation of natural resources. The course is primarily theoretical and is intended to be relevant to both developed and developing countries.

A first objective is to better understand what leads agents to act in such a way that resources are not put to their socially most desirable use. We will then be in a position to look at what may impede collective action to redress the situation at the community level, or policy interventions at the state level. The approach builds on the interplay between institutions, economic behavior and transaction costs. Political-economic issues of cooperation, conflict and redistribution are recurrent themes.

We first consider static models of resource use with basic institutional arrangements. This provides simple analytical frameworks that help apprehend the fundamental role played by institutions and some policy implications.

Dynamic models of natural-resource use are introduced in the second part. We consider explicitly the cases of fisheries and non-renewable resources, such as mineral and oil deposits. Extensions to other resources, such as water, forest, game, land or pastures, may be introduced along the way. Policy measures are discussed.

In the final part, we analyze specific topics of institutional arrangements, economic behavior, conflict and cooperation.

Evaluation: There will be two mid-term tests and one final exam counting for 20% and 40% respectively. The final exam is cumulative.

Although a course in natural-resource economics can be somewhat technical, it remains a course in economics as a <u>social science</u>. Much emphasis is thus put on interpreting the results and discussing their implications for society and economic policy. <u>The evaluation will reflect this.</u>

The ability to interpret and discuss results can only be properly achieved through longterm maturation of ideas. Students are thus expected to be up-to-date in their weekly material. To this end, exercises will be assigned every week. An <u>individual and hand-written</u> copy is to be submitted the following week <u>in person</u> during the class break. Detailed solutions will be provided but individual copies will not be corrected in detail. I will look only at honest attempts to solve and interpret the problems. It goes without saying that class attendance is mandatory. Assiduous attendance and assignment completion will make up for the last 20%.

N.B. My Office hours are on Tuesdays 15h00-17h00 (please double-check the course's website for eventual changes of hours). Students are expected to consult the courses' web page on a weekly basis for up-to-date information regarding assignments, mid-term dates, changes to office hours, etc.

\mathbf{THEMES}^1

A. Introduction

- B. Property arrangements and resource use: An introduction to the main issues
 - 1. **Review:** Elements of game theory
 - References: (Varian 1992, 15.1 to 15.4)
 - 2. Natural resources and the concept of rents
 - References: (Hartwick and Olewiler 1998, ch 3)
 - 3. Canonical property regimes: Exclusive property and free access
 - Read: (Dasgupta and Heal 1979, ch 3, except section 6) (Gordon 1954, Hardin 1968)
 - References: (Eggertsson 1990, chap 4)(Hartwick and Olewiler 1998, ch 3)(Smith 1968, Brooks, Murray, Salant and Weise 1999, Hardin 1968, Cheung 1970)
 - 4. Rights of exclusion: The law and economics of resource over-use and under-use
 - Ref (Buchanan and Yoon 2000, Heller 1998, Alchian and Demetz 1973)
 - 5. Analyzing property regimes in a general equilibrium framework: A first look at the political economy of property arrangements
 - Read: (Cohen and Weitzman 1975)
 - References: (Samuelson 1974)
 - 6. Costly exclusion: Explaining the persistence of inefficient exclusive property
 - References: (Samuelson 1974, de Meza and Gould 1992)
- C. The dynamics of resource use
 - 1. **Review:** Elements of capital theory
 - Ref (Hanley, Shogren and White 1997, ch 7)(Clark 1976, chapter 3)(Nicholson 1992, chapter 24)
 - 2. Introduction to optimal control and the maximum principle

¹Themes, references, and their timing are subject to change.

- Read: (Chiang and Wainwright 2005, chapter 20)
- References: (Perman, Ma, McGilvray and Common 2003, ch 14 and website)(Chiang 1992)
- 3. Resources, population growth and Malthusian growth: An overview
 - Read:
 - References:
- 4. The economics of the fishery
 - i. Steady-State Analysis
 - Read: (Perman et al. 2003, ch 17, sections ??)
 - References: (Hartwick and Olewiler 1998, ch 4)(Pearce and Turner 1990, ch 17)
 - ii. The Industry Supply Curve
 - References: (Hartwick and Olewiler 1998, ch 4)
 - iii. Dynamics and present-value maximizing
 - Read: (Perman et al. 2003, ch 17)
 - iv. Regulation of the Fishery
 - References: (Perman et al. 2003, ch 17)(Hartwick and Olewiler 1998, ch 5)(Conrad and Clark 1987, section 2.8)(Baumol and Oates 1988, p. 237-38)(Weitzman 1974)(Dasgupta and Heal 1979, sections 1 to 3)
- 5. The Economics of Non-Renewable Resources
 - i. A basic two-period model
 - ii. The T-period problem in discrete time
 - iii. The social optimum with rising prices
 - iv. The competitive mineral industry
 - v. Continuous-time analysis
 - Read: (Perman et al. 2003, ch 15)(Gaudet 2007)
 - References: (Hartwick and Olewiler 1998, ch 8)(Pearce and Turner 1990, ch 15)
- 6. The Economics of Forest and Water Resources (if time permits)

C. Property Regimes, Transaction Costs, Conflict and Cooperation

- (a) **Review:** Elements of Game theory
 - Read: (Varian 1992, 15.4 (mixed strategy) to 15.6, 15.10, 15.11)
- (b) Coase's Insights
 - Ref (Coase, 1960; Coleman, 1990, chap. 3)
- (c) Privatization with Exogenous Transaction Costs: Reconsidering Efficiency
 - References: (Samuelson 1974, Cohen and Weitzman 1975, de Meza and Gould 1992)

- (d) Endogenous Enforcement, Conflict and Resource Exploitation
 - Read: (Mendelsohn 1994, Hotte 2001, Hotte 2005)
- (e) Common Property Resources: The Basics
 - i. Examples of CPR problems(Libecap and Wiggins 1984)
 - ii. A taxonomy of property regimes based on transaction costs
 - iii. The repeated PD game
 - iv. Alternatives to the PD game structure
 - References: (Ostrom 1990, chap 1, 2 and 3)(Baland and Platteau 1996, chap 4, 5 and 6 (NB Electronic version at library)) (Coleman 1990, chap 9 and 10)(Eggertsson 1990, chap 2 and 3)(Ostrom 2000)(Dayton-Johnson and Bardhan 2002)
- (f) Common Property Resources: Issues in cooperation
 - i. Heterogeneous users
 - ii. Terminal period
 - iii. Reputation
 - iv. The evolution of cooperation (Axelrod and Hamilton 1981, Axelrod and Dion 1988, Milgrom 1984)
 - Read: (Stevenson 1991, Seabright 1993)
 - References: (Ostrom 1990, chap 1, 2 and 3)(Baland and Platteau 1996, chap 4, 5 and 6 (NB Electronic version at library)) (Coleman 1990, chap 9 and 10)(Eggertsson 1990, chap 2 and 3)(Ostrom 2000)(Dayton-Johnson and Bardhan 2002)
- (g) Evolution of Property Regimes
 - Read: (Fitzpatrick 2006)
 - Ref (Sethi and Somanathan 1996)(Eggertsson 1990, chap 8)(Coleman 1990, chap 11 and 12)(Deiniger 2003)
- (h) Sustainable Development
 - i. Resource Depletion, Scarcity, and Sustainability
 - References (Perman et al. 2003, ch 2 and 14)(Hanley et al. 1997, ch 8)
 - ii. Population Growth and Renewable Resources
 - Ref (Brander and Taylor 1998, André and Platteau 1998, Brander 2007)

References

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