

**Economics of Natural Resources**

ECO 6143 (Winter 2010)

University of Ottawa

55 Laurier E, 10TH FLOOR

Ottawa, Ontario, Canada K1N 6N5

**Professor:**

Louis Hotte

1-613-562-5800 ext. 1692

louis.hotte@uottawa.ca

<http://aix1.uottawa.ca/~lhott3/>**COURSE OUTLINE**

Throughout this course, we shall build an analytical framework that helps us understand and analyze the principal causes of natural resource misuse. The course is primarily theoretical and intends to be relevant for both the developed and the developing world.

We shall first pin down the basic user incentives believed to be responsible for an inferior use of the resource. We then look at factors that may impede actions to redress the situation at either the community level, or policy interventions at the state level. This institutional approach builds on the interplay between rule adoption, economic behavior and transaction costs. For this reason, game theory provides us with powerful analytical tools. Political-economic issues of cooperation, conflict and redistribution are recurrent themes.

We begin with static models of resource use and basic institutional arrangements. This provides a simple analytical framework that helps apprehend the fundamental role played by institutions, and some policy implications.

Dynamic stock-flow models of natural-resource use are then introduced. To this end, dynamic optimization methods and basic concepts in finance are used. We consider explicitly the cases of fisheries and non-renewable resources, such as minerals and oil deposits. Extensions to other types of resources, such as water, forest, game, land or pastures, are introduced along the way. Policy measures are discussed.

In the final part and depending on time, we extend to specific topics such as trade, conflict, sustainable growth, etc.

**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 social science. Much emphasis is thus put on interpreting the results and discussing their implications for society and economic policy. The evaluation will reflect this.

The ability to interpret and discuss results can only be properly achieved through long-term 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 individual and hand-written copy is to be submitted the following week in person at 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 Mondays 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.

## THEMES<sup>1</sup>

### A. 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 scarcity rents
  - i. Land quality
  - ii. A non-renewable resource with two periods
    - References: (Hartwick and Olewiler 1998, ch 3)
3. Basic 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. Transaction costs
  - Ref (Coase, 1960; Coleman, 1990, chap. 3)
5. General equilibrium and property regime
  - i. Political economy of property arrangements
  - ii. Privatization with Transaction Costs: Reconsidering efficiency and its persistence
    - Read: (Cohen and Weitzman 1975)
    - References: (Samuelson 1974, de Meza and Gould 1992)
6. Rights of exclusion and anti-commons
  - Ref (Buchanan and Yoon 2000, Heller 1998, Alchian and Demetz 1973)

### B. The dynamics of resource use

1. The economics of the fishery
  - i. Steady-State Analysis

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<sup>1</sup>Themes, readings, references, and their timing are subject to change.

- Read: (Perman, Ma, McGilvray and Common 2003, ch 17)
- 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. **Review:** Elements of capital theory
  - Ref (Hanley, Shogren and White 1997, ch 7)(Clark 1976, chapter 3)(Nicholson 1992, chapter 24)
- iv. Fishery dynamics and present-value maximizing in discrete time
  - Ref: (Hartwick and Olewiler 1998, ch 11)
- v. Introduction to optimal control and the maximum principle
  - Read: (Dorfman 1969)
  - References: (Chiang and Wainwright 2005, chapter 20)(Perman et al. 2003, ch 14 and website)(Chiang 1992)
- vi. Fishery dynamics and present-value maximizing in continuous time
  - Read: (Perman et al. 2003, ch 17)
- vii. 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)
- 2. Resources, population growth and Malthusian growth: An overview
  - Read:
  - References:
- 3. 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)
- 4. The Economics of Forest and Water Resources (*if time permits*)

### C. Common Property Resources, Conflict and Cooperation

- (a) **Review:** Elements of Game theory
  - Read: (Varian 1992, 15.4 (mixed strategy) to 15.6, 15.10, 15.11)
- (b) 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)
- (c) 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)
- (d) Conflict and land degradation
  - Read: (Hotte 2001)
  - References: (Mendelsohn 1994)
- (e) Trade, property rights, and resource use
  - Read: (Hotte, Long and Tian 2000)
  - References: (Pethig 1976, Chichilnisky 1994)
- (f) Evolution of Property Regimes
  - Read: (Fitzpatrick 2006)
  - Ref (Sethi and Somanathan 1996)(Eggertsson 1990, chap 8)(Coleman 1990, chap 11 and 12)(Deiniger 2003)
- (g) 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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