AREC/ECON 540 – Economics of Natural Resources
Department of Agricultural and Resource Economics
Colorado State University
MW 2:00-3:15PM, Clark 364C
Fall, 2011

Course Syllabus

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Course Description

This class is designed as an advanced Masters-level class in natural resource economics that provides an introduction to the theory and tools commonly used for private and public sector natural resource management. Relatively advanced graphical and mathematical modeling techniques, such as optimal control and dynamic programming, will be introduced and utilized extensively throughout the class to analyze problems relating to non-renewable and renewable resources such as minerals, forests, and fisheries. Key concepts include intertemporal analysis under alternative property right, biological, and technology regimes.

Course Objectives

Students will become familiar with the major static and dynamic canonical models that have been developed in the field of natural resource economics during the late twentieth century, and will be able to interpret, extend, and adapt these models to a variety of heterogeneous resources and situations. In addition, students will learn the basics of applied optimal control theory and be able to use this tool to analyze a variety of dynamic economic problems.

Prerequisites

MATH 141 (Calculus in Mgmt. Sciences) and AREC/ECON 306 (Intermediate Microeconomics). AREC/ECON 506 (Microeconomic Analysis I) strongly encouraged. I expect all students to be comfortable and familiar with differential calculus and undergraduate-level intermediate microeconomic theory.

Recommended Texts and Readings

I will take material from a number of books and journal articles, but don't require that you purchase any (in other words, the notes should be sufficient). Of course, this does not release you from the responsibility of looking something up if you need more information. That said, you may want to augment your bookshelf with some, or all, of the following titles:

Caputo, Michael R., *Foundations of Dynamic Economic Analysis: Optimal Control Theory and Application*s. Cambridge University Press, 2005.
Clark, Colin W., *Mathematical Bioeconomics: The Optimal Management of Renewable Resources,* John Wiley and Sons, 1990.

Hartwick, John M. and Nancy D. Olewiler, *The Economics of Natural Resource Use*, Addison-Wesley Educational Publishers, 1998. (I think this is out of print currently).
Neher, Philip A., *Natural Resource Economics: Conservation and Exploitation*, Cambridge University Press, 1990.
Simon, Carl P. and Lawrence Blume, *Mathematics for Economists*, W.W. Norton & Co, 1994.

In addition, I will post additional readings on RamCT (http://ramct.colostate.edu).

Grading

Grades will be calculated based on the scores from problem sets (30%), one midterm examination (35%), and one final examination (35%). Problem sets will be assigned weekly, and are known to be difficult, but serve as preparation for exams. You may work together on the problem sets, and submit one set of answers for up to four students per assignment. Problem set keys will be posted, and should be used for additional learning. Exams will be take-home. Discussion of the exam between students during the exam week will be considered academic dishonesty. **Failure to adhere to this rule will result in failure of the class, plus additional penalties where appropriate**.

Final grades will be based on the distribution of grades across the class, subject to adequate performance of the (hypothetical) mean student. Historically speaking, the mean average numerical grade has been in the 65-75 range which is interpreted as a B+, with identical letter grades within one standard deviation of the mean. For context, the mean final grade last year was 74.5 (B+) with a standard deviation of 6.83. The low was 54.7 (C) and the high was 85.0 (A+).

My Philosophy

I believe that the fundamental objective of resident instruction in economics should be to provide students with the background and practice necessary to *apply* the relevant economic theory/ methods presented in class to contemporary, real-world problems. This requires a fairly deep understanding of the *process* of economic analysis, rather than simple mastery of the technical details of solving a particular problem. Of course, the latter is a necessary condition for satisfaction of the objective, but it is hardly sufficient. If this objective is met, students finish the class with an ability to synthesize material from an array of sources and tell the stories of 1) why agents behave the way they do; and 2) how to change incentive structures, and thus behavior, if such behavior is sub-optimal.

In order to encourage understanding at a deep level, I believe that students should be intellectually challenged in the college classroom. Empirical evidence has shown that low expectations, and often subsequent high grades, does little to promote deep understanding, and can, in fact, be harmful. As such, I strive to compose and assign frequent problem sets that allow for independent learning away from the classroom, and exams are designed such that memorization alone will not guarantee high grades. I work to communicate my enthusiasm for the fact that the subject matter (most often economic theory) is a means for intelligent, structured analysis on a wide array of allocation problems, and that the field of economics, far from being boring or unintelligible, is actually exciting and at times, even fun.

Schedule (subject to revision)

Week 1: Introduction – Property rights, welfare economics, and discounting – H&O Ch. 1
Readings (on RamCT): Tierney, "Betting on the Planet"
Herfindahl, "What is Conservation?"
Hayek, "Use of Knowledge in Society"
Dasgupta, "Decentralization and Rights"

Non-Control Models

Week 2: Land – H&O Ch. 3
Readings: Hardin, "Tragedy of the Commons"
Hardie, et al., "Responsiveness of Rural and Urban Land Uses to Land Rent Determinants in the U.S. South"

Week 3: Mines – H&O Ch. 8
Readings: Hotelling, "The Economics of Exhaustible Resources"

Week 4: Forests – H&O Ch. 10
Readings: Samuelson, "Economics of Forestry in an Evolving Society"

Week 5-6: Intro to Differential Equations and Fisheries – H&O Ch. 4, Caputo Ch. 13
Readings: Gordon, "The Economic Theory of a Common-Property Resource: The Fishery"

Optimal Control Theory

Week 7-8½ : Systems of Differential Equations and Phase Portraits – Caputo Ch. 13, and Caputo Notes Ch. 22
Smith, "Economics of Production from Natural Resources"

MIDTERM EXAM: Take Home, Distributed Monday, Oct. 3, Due in my mailbox (Clark B322), 4PM, Monday, Oct. 10

Week 8½-10: Optimal Control and the Maximum Principle– Caputo Ch. 1-4
Readings: Dorfman, "An Economic Interpretation of Optimal Control Theory"
Davidson and Harris, "Non-Convexities in Continuous-Time Investment Theory" (NOTE: This is a *tough* paper … try to get what you can out of it!)

Optimal Control Models

Week 11-12: Non-Renewable Resources
Readings: Pindyck, "The Optimal Exploration and Production of Nonrenewable Resources"

Week 13-15: Renewable Resources
Readings: Clark, Clarke, and Munro, "The Optimal Exploitation of Renewable Resource Stocks: Problems of Irreversible Investment"
Homans and Wilen, "A Model of Regulated Open Access Resource Use"

FINAL EXAM: Take Home, Distributed Wednesday, Dec. 7, Due in my mailbox (Clark B322), 4PM, Wednesday, Dec. 14