

AREC 792 – Seminar in Natural Resource and Environmental Economics
Department of Agricultural and Resource Economics
Colorado State University
Fall, 2007

Course Syllabus

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Course Description

This class is designed as a Ph.D.-level class in natural resource and environmental economics that expands on the material covered in AREC 540 and AREC 541. Three-quarters of the class will focus on primarily dynamic models of natural resource allocation at the firm and industry levels, drawing on articles of interest in the literature. Topics include renewable and non-renewable resources, wildlife/ecosystem management, sustainability and green accounting, spatial dimensions of resource use, and multiple use resources. In this context, we will further explore optimal control theory, as well as introduce numerical methods for solving dynamic problems which are generally intractable analytically.

The final quarter of the class will cover advanced topics in environmental economics. Tentatively (subject to student interests), half of the classes will be devoted to *externality theory* and half to *non-market valuation methods*. Each topic area will be introduced and synthesized by the instructor followed by class discussion of selected journal articles based on presentations by the students.

Course Objectives

Students will become familiar with recent literature in the field of natural resource and environmental economics, and learn to apply analytical, numeric, and statistical tools to problems of natural resource management and environmental valuation. The portfolio of techniques and literature will provide the necessary background for future research and teaching in the natural resource and environmental economics field.

Recommended Texts, Readings, and Software

As an advanced graduate level class, there is no one textbook that covers the all of the class material; instead, we will draw from a number of books and plenty of journal articles. The Caputo book is highly recommended as a reference for optimal control theory (and is relatively inexpensive). Other control references include Kamien and Schwartz and Leonard and van Long books. We will draw heavily from Miranda and Fackler (available from the library as an e-book) and Judd when discussing dynamic numerics. Dasgupta and Heal and Clark present good comprehensive coverage of non-

renewable and renewable theory, respectively, while the Hartwick and Olewiler book is a good reference at the undergraduate level. We will use the (free and downloadable) student version of GAMS for much of the numeric analysis.

Caputo, Michael, *Foundations of Dynamic Economic Analysis: Optimal Control Theory and Applications*. Forthcoming: Cambridge University Press, 2004.

Kamien, Morton, and N.L. Schwartz, *Dynamic Optimization: the Calculus of Variations and Optimal Control in Economics and Management*, Elsevier Science Publishing Co., 1991.

Leonard, Daniel and N.G. Van Long, *Optimal Control Theory and Static Optimization in Economics*, Cambridge University Press, 1992.

Miranda, M.J. and P.L. Fackler, *Applied Computational Economics and Finance*, MIT Press, 2002.

Judd, K.L., *Numerical Methods in Economics*, MIT Press, 1998.

Dasgupta, P.S. and G.M. Heal, *Economic Theory and Exhaustible Resources*, Cambridge University Press, 1979.

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.

Coursework and Exams

Given the nature of the course, no exams will be given in the class. Instead, a number of problem sets will be assigned to aid in your understanding of the concepts discussed in class and to further explore related topic material, and you will be asked to briefly present and lead a discussion of several journal article(s) or other written works.

Grading

Problem sets will be weighted as 50% of the grade, while class presentations and participation will be weighted 50%.

Outline and Reading List

Below is a tentative time schedule and a list of the readings that we hope to cover, time permitting, in class. A supplemental reading list of additional resources and topics will be distributed via RamCT at a later date.

ADVANCED TOPICS IN RESOURCE ECONOMICS

Weeks 1- 1½ (Bond)

Review of optimal control, stability of systems of differential equations, comparative statics and dynamics

References:

Caputo Ch. 13, 17, and lecture notes, Simon and Blume Ch. 23 and 25

Weeks 1½-4 (Bond)

Principles of Dynamic Programming and Numerical Analysis

References:

Caputo Ch. 19, Miranda and Fackler Ch. 6-9, Judd Ch. 6 and 12

Howitt, R., S. Msangi, A. Reynaud, and K. Knapp. "Using Polynomial Approximations to Solve Stochastic Dynamic Programming Problems: or a "Betty Crocker" Approach to SDP.

Weeks 5 – 8 (Students)

Topics in Natural Resource Economics

References (Students will present 2 papers each):

Nordhaus, W.D., "The Allocation of Energy Resources", in *Brookings Papers on Economic Activity*, 3, 1974.

Farzin, Y.H. "Optimal Pricing of Environmental and Natural Resource use with Stock Externalities", *Journal of Public Economics* 62, 1996.

Ulph, A.M. and G.M. Folie, "Exhaustible Resources and Cartels: An Intertemporal Nash-Cournot Model," *Canadian Journal of Economics* 13(4), 1980, 645-658.

Megri, D.H., "The Common Property Aquifer as a Differential Game," *Water Resources Research*, 25(1), 1989, 9-15.

Zivin, J., B.M. Hueth, and D. Zilberman, "Managing a Multiple-Use Resource: The Case of Feral Pig Management in California Rangeland", *Journal of Environmental Economics and Management*, 39, 2000, 189-204.

Horan, R.D. and J.S. Shortle, "Optimal Management of Multiple Renewable Resource Stocks: An Application to Minke Whales," *Environmental and Resource Economics* 13(4), 1999, 435-458.

Brock, W.A. and A. Xepapadeas, "Valuing Biodiversity from an Economic Perspective: A Unified Economic, Ecological, and Genetic Approach," *American Economic Review* 93(5), 2003, 1597-1614.

Sanchirico, J. and J.E. Wilen, "A Bioeconomic Model of Marine Reserve Creation", *Journal of Environmental Economics and Management*, 42(3), 2001, 257-276.

Smith, M.D. and J.E. Wilen, "Economic Impacts of Marine Reserves: The Importance of Spatial Behavior", *Journal of Environmental Economics and Management*, 46(2), 2003, 183-206.

Hartwick, J.M., "Intergenerational Equity and the Investing of Rents from Exhaustible Resources". *American Economic Review*, 66, 1977, 972-974.

Bond, C.A. and Y.H. Farzin, "Alternative Sustainability Paradigms and Intertemporal Welfare in a Simple Agroecosystem Model: A Numerical Analysis", Working Paper.

Chichilnisky, G. "What is Sustainable Development?" *Land Economics* 73(4), 1997, 467-491.

Week 9 (Bond)

Wildlife/Ecosystem Management: The Flaming Possum Paper!

References:

Spring, D.A. and J.O.S. Kennedy, "Existence Value and Optimal Timber-Wildlife Management in a Flammable Multistand Forest," *Ecological Economics* 55, 2005, 365-379.

Week 10

Maximum Entropy Econometrics

References:

Golan, A., G. Judge, and D. Miller, *Maximum Entropy Economics: Robust Estimation with Limited Data*, New York: John Wiley and Sons, 1996.

Bond, C.A. and Y.H. Farzin, "Estimating Agricultural Pollution Abatement Costs at the Plot Level Using Experimental Data: A Maximum Entropy Approach", *Journal of Agricultural and Resource Economics* 32(2), 2007, 273-290.

ADVANCED TOPICS IN ENVIRONMENTAL ECONOMICS

Week 11/12 (Kipperberg)

Theory of Externalities

References:

Baumol, W.J. and W.E. Oates. 1988. *The Theory of Environmental Policies*. Cambridge University Press. Second Edition.

Instructor provided handouts.

Week 12/13 (Students)

Presentation and discussion of selected journal articles on externalities (tentative topics: prices versus quantities; uncertainty; non-convexities).

References:

TBA

Week 13/14 (Kipperberg)

Non-Market Valuation Methods

References:

Freeman, A.M. 2003. *The Measurement of Environmental and Resource Values: Theory and Methods* Second Edition, Resources for the Future Press.

Instructor provided handouts

Week 14/15 (Students and Kipperberg)

Presentation and discussion of selected journal articles on non-market valuation (tentative topics: dual-constraint models; panel mixed logit; combining revealed and stated preference methods).

References:

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