

AREC 740 – Advanced Resource and Environmental Economics
Department of Agricultural and Resource Economics
Colorado State University
Fall, 2011

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. The first four and one half weeks of the course will focus on dynamic models of natural resource allocation, and introduce numerical methods for solving dynamic problems that are generally intractable analytically.

Weeks 5-7 will focus on theoretical and empirical aspects of water demand estimation.

Weeks 8-10 will focus on non-market valuation, methods and applications.

The final five weeks will focus on externalities, public goods, and environmental institutions, and how those are examined theoretically, empirically, and experimentally.

Course Objectives

Students will become familiar with the core literature in the field of natural resource and environmental economics, and learn to apply analytical, numeric, statistical and experimental tools to problems of natural resource management and environmental valuation. The portfolio of techniques and literature will contribute to 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 journal articles. Each instructor will provide a relevant reference list.

Coursework and Exams

Given the nature of the course, no exams will be given in the class. Instead, a number of problem sets and paper presentations will be assigned to aid in your understanding of the concepts discussed in class and to further explore related topic material. In addition, students will complete a paper for Dr. Goemans.

Grading

The total grade will be a weighted average of the individual grades by the four instructors.

Bond: Problem sets will be weighted as 50% of the grade, while class presentations and participation will be weighted 50% (25% and 25%, respectively). Students may work in groups for problem sets.

Goemans: Each student will be required to complete a paper. 100% of your grade from this portion of the class will be based on your paper. Students will have the choice of coming up with their own topic or completing a “stock” paper for which I will provide (real) data and an outline. Students wanting to pursue their own topic must submit an outline (and have me approve it) by November 1st. Papers must be submitted by 12/12/2011. Late papers will be docked 10% per day they are late. Additional details on this assignment will be presented on the first day of class and posted online.

Loomis: Each student will be expected to lead the discussion on one paper. Grades are based on: (1) your presentation of the paper you selected (25%); (2) class participation (i.e., how well you were prepared to discuss the other papers-25%). (3) Two problem sets (25% each).

Kroll: Each student will select a recent theoretical or empirical (non-experimental) article from *Journal of Environmental Economics and Management* (JEEM), *Environmental and Resource Economics* (ERE), *Land Economics* (LE) or an environmental/resource economics paper from a different journal, design and program an experiment in order to test the results from the selected paper, and present paper and experimental design in class. Grades are based on: (1) presentation of paper and design (25%); (2) class participation (preparedness for all papers-25%); (3) experimental idea and design (25%); (4) experimental program (25%).

Outline and Reading List

Below is a tentative course outline.

Weeks 1 – 3.5 (8/23-9/13):

Introduction to Dynamic Programming (Bond)

8/23/11: Dynamic Programming and the Hamilton-Jacobi-Bellman Equation (Caputo Ch. 19)

8/25/11: Discrete Time, Discrete Space Finite Horizon Deterministic DP (Miranda and Fackler Ch 7; GAMS code)

8/29/11: Discrete Time, Discrete Space DP Extensions (Infinite, Stochastic, etc...) (Miranda and Fackler Ch 7; Judd Ch. 12; GAMS/MATLAB code)

8/31/11: Discrete Time Continuous Space DP and Function Approximation (Miranda and Fackler Ch 8-9; Judd Ch. 6, Howitt et al.; code)

9/6/11: Value and Function Approximation in Continuous Space DP (Miranda and Fackler Ch 8-9; Judd Ch. 12; Howitt et al.; code)

9/8/11: Existence value and optimal timber-wildlife management in a flammable multistand forest, aka "Flaming Possums" (Spring and Kennedy, 2005)

9/13/11: Adaptive Management and Learning by Doing (Bond, 2011, 2010; Bond and Loomis 2009)

References:

Bond, C.A. 2010. On the Potential Use of Adaptive Control Methods for Improving Adaptive Natural Resource Management. *Optimal Control Applications and Methods* 31:55-66.

Bond, C.A. 2011. Alternative Information Regimes in Renewable Resource Management with Potentially Irreversible Regime Shifts: A State Space Approach. Working Paper: Colorado State University.

Bond, C.A. and J.B. Loomis. 2009. Using Numerical Dynamic Programming to Compare Passive and Active Learning in the Adaptive Management of Nutrients in Shallow Lakes. *Canadian Journal of Agricultural Economics* 57(4): 555-573.

Judd, K.L. 1998. Numerical Methods in Economics. Cambridge, MA: MIT Press.

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

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. Working Paper, U.C. Davis.

Spring, D.A. and J.O.S. Kennedy. 2005. Existence value and optimal timber-wildlife management in a flammable multistand forest. *Ecological Economics* 55:365-379.

Weeks 3.5 – 4.5 (9/15-9/20):

Student Presentations: Dynamic Models in the Environmental and Resource Literature

Each student will prepare a presentation of a(n) (approved) paper appearing in the literature that uses the dynamic methods discussed in the first 3.5 weeks of class (or similar methods).

The objectives of this exercise are to:

- a) Expose students to cutting-edge natural resource economics research appearing in the recent literature
- b) Illustrate how to use structural modeling to tell economic stories
- c) Highlight the techniques, choices, and tradeoffs associated with dynamic modeling

Each presentation should be no longer than 20 minutes, and include the following elements:

- Identification of the research question(s) and/or the contributions to the literature
- A complete discussion of the model(s) used to answer the research question, including:
 - Techniques used
 - Assumptions made
 - Advantages and disadvantages/limitations of the approach
- Major results of the research

Students should select a paper in the literature (and have paper approved by Dr. Bond) on a topic of their choice to present no later than 9/8/11. Time slots on 9/15 and 9/20 will be allocated according to student choice on a first come-first served basis. All students are required to read each paper, and prepare (in writing) at least one seminar-style question to ask each presenter.

Weeks 4.5 – 7 (9/22-10/6):

Topics in Water (Goemans)

Note: A more detailed outline including additional references and suggested exercises is available on RamCT

A. A Review of Utility Theory and Demand Estimation¹ (Thursday, 9/22)

Required Readings:

Chapter 2, Determinants of Urban Water Use in Urban Water Demand Management and Planning (Bauman, Boland, and Hanemann, 1998)

B. Complex Rate Structures (Tuesday, 9/27)

Required Readings:

Scheduling, NBER Working Paper (Liebman and Zeckhauser, 2004)

C. Approaches to Estimating Demand under Complex Rate Structures, Average and Marginal Price

Part 1: Average and Marginal Price (Thursday, 9/29):

Required Readings:

The Demand for Electricity: A Survey, Bell Journal of Economics (Taylor, 1975)

A Proposed Modification of Taylor's Demand Analysis: Comment, Bell Journal of Economics (Nordin 1975)

Part 2: Discrete Continuous Choice Models (Tuesday, 10/4 and Thursday, 10/6):

Required Readings:

A Discrete/Continuous Choice Approach to Residential Water Demand under Block Pricing, Land Economics (Hewitt and Hanemann, 1995)

Note: Wednesday, September 28, Seminar: Jeffrey Bennett (Australian National University), "Recent Advances in Australian Environmental Valuation using Stated Preference Methods"

Weeks 8 – 10 (10/11-10/27):

Topics in Nonmarket Valuation (Loomis)

A. Overview of Non Market Valuation Techniques (October-11)

B. Revealed Preference

Travel Cost Methods (October 11th)

1. (October 11th) Welfare Estimation Using Aggregate and Individual Observation Models.

Daniel Hellerstein. Am. J of Ag Economics 77: 620-630. (1995).

Hand out Count Data TCM data homework (due October 18th).

2. (October 13th) Two RUM's Unclashed: Nested-Logit Models of Site Choice.

¹ Be sure to complete the required readings prior to class. We will move quickly.

Ed Morey, CU Boulder. On his website at:

(<http://www.colorado.edu/Economics/morey/papers/uncloak8.pdf>);

Also in Kling and Herriges book on Valuing Recreation and the Environment

3. (October 13th) Comparison of Welfare Estimates from Four Models for Linking Seasonal Recreational Trips to Multinomial Logit Models of Site Choice. *Journal of Environmental Economics and Management* 38: 143-157. 1999.

Hedonic Property Method

(October 18th) Count Data TCM homework due.

1. Spatial Dependence in Hedonic Property Models: Do Different Corrections Result in Economically Significant Differences in Estimated Implicit Prices. *Journal of Agricultural and Resource Economics* 33(2): 212-231. J. Mueller and J. Loomis. 2008.

2. Estimating the Demand for Protecting Freshwater Lakes from Eutrophication. *American Journal of Agricultural Economics* 81: 1118-1122. Kevin Boyle, Joan Poor and Laura Taylor.

Handout Hedonic Property dataset homework, due October 25th.

C. Stated Preference

(October 20th)

Contingent Valuation: Single & Double Bound;

Hypothetical Bias: What is the evidence? Often, but not Always (ROC)

1. What's to Know About Hypothetical Bias in Stated Preference Valuation Studies? *Journal of Economic Surveys* 25(2): 363-370. 2011. J. Loomis.

2. A Comparison of Approaches to Mitigate Hypothetical Bias. *Agricultural and Resource Economics Review* 38(2): 166-180. 2009. P. Champ, R. Moore & R. Bishop.

D. Choice Experiments (CE)/Conjoint (Oct 25th)

Collect Hedonic Property Analysis Homework.

Introduction: Similarities & Differences between CVM & CE
Choice Set Design

Heterogenous Preferences Regarding Global Climate Change. The Review of Economics and Statistics 82(4): 616-624; (2000) D. Layton and G. Brown.
Homework data on CE with guidance from Dr. Bond. Due Nov 1st to Dr. Kroll.

Valuation of Cancer & Microbial Disease Reductions in Municipal Drinking Water: An analysis of risk context using multiple valuation methods. *Journal of*

Environmental Economics and Management 61(2): 213-226. W. Adamowicz, D. Dupont, A. Krupnick and J. Zhang.

E. Combining Revealed Preference & Stated Preference Data

(October 27th)

Combining Revealed and Stated Preference Data to Estimate the Nonmarket Value of Ecological Services. *Journal of Economic Surveys*. 22(5): 872-908. Whitehead, et al. 2008.

Weeks 11 – 15 (11/1-12/8):

Topics in Environmental Economics (Kroll)

Weeks 11-12 (11/1-11/8)

Review of Externalities and Introduction to Experimental Economics and zTree

References:

Ehmke, Mariah D. and Jason F. Shogren (2009), “Experimental Methods for Environment and Development Economics,” *Environment and Development Economics* 14(4), 419-456.

One or two articles on externalities (TBA).

Plott, Charles (1983), “Externalities and Corrective Policies in Experimental Markets,” *Economic Journal* 93:106-127.

Fischbacher, Urs (2007), “z-Tree: Zurich Toolbox for Ready-Made Economic Experiments,” *Experimental Economics* 10(2): 171-178.

Optional: Shogren, Jason F. and Laura O. Taylor (2008), “On Behavioral-Environmental Economics,” *Review of Environmental Economics and Policy* 2(1): 26-44.

Weeks 12-13 (11/10-11/15)

Public Goods

References:

One theoretical paper on public goods (TBA).

Nyborg, Karine and Mari Rege (2003), “Does Public Policy Crowd Out Private Contributions to Public Goods,” *Public Choice* 115: 397-418.

Kotchen, Matthew and M. R. Moore (2007), “Private Provision of Environmental Public Goods: Household Participation in Green-Electricity Programs,” *Journal of Environmental Economics and Management* 53(1): 1-16.

Fehr, Ernst and Simon Gächter (2000), "Cooperation and Punishment in Public Goods Experiments," *American Economic Review* 90(4), 980-994.

Fischbacher, Urs, Simon Gächter and Ernst Fehr (2001), "Are People Conditionally Cooperative? Evidence from a Public Goods Experiment," *Economics Letters* 71: 397-404.

Kroll, Stephan, Todd L. Cherry and Jason F. Shogren (2007), "Voting, Punishment and Public Goods," *Economic Inquiry* 45(3): 557-570.

**Weeks 13-14 (11/15-12/1) [Fall Recess: 11/22 and 11/24]
Policies and Institutions**

References:

One theoretical paper on environmental/resource policies (TBA).
Something on tradable permit markets and water quality trading.

Weitzman, Martin L. (1974), "Prices vs. Quantities," *Review of Economic Studies* 41(4): 477-491.

Joskow, Paul L., Richard Schmalensee, and Elizabeth M. Bailey (1998), "The Market for Sulfur Dioxide Emissions," *American Economic Review* 88(4): 669-685.

Shobe, William, Karen Palmer, Erica Myers, Charles Holt, Jacob Goeree and Dallas Burtraw (2009), "An Experimental Analysis of Auctioning Emissions Allowances under a Loose Cap," RFF-Discussion Paper 09-25.

**Week 15 (12/6 and 12/8):
Student Presentations**