UNIVERSITY OF COLORADO AT BOULDER
DEPARTMENT OF ECONOMICS, SPRING 2008
NATURAL RESOURCE ECONOMICS, Econ 4535-001
Lectures: TR 11:00 a.m. to 12:15 p.m. @ Duan G2B47

Instructor: Vijaya R. Sharma, Ph.D.
Office Hours: TR 12:30 p.m. to 2:00 p.m. @ Econ 216A
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Course Introduction
This course presents theories of efficient utilization of natural resources and discusses issues related to current practices of use of resources. It also discusses issues of sustainability, conservation, and preservation. The course extensively uses graphical analyses and some mathematical models. It assigns a number of theoretical assignments and reading assignments and provides an option to the students to write a paper on a relevant natural resource issue.

Course Prerequisites
Econ 3070 Intermediate Microeconomics and Econ 1070/1080 Mathematical Economics

Textbook (optional)
Environmental and Natural Resource Economics, by Frank A. Ward, Pearson Prentice Hall

Web Notes
Notes on most course materials are available on the instructor's web site. They may differ from actual lectures in some details, especially the mathematical and graphical representations, and may even be incomplete or nonexistent for some topics.

Theoretical Assignments and Reading Assignments
The prescribed five theoretical assignments (TAs) and eight reading assignments (RAs) are listed in the course outline. Each TA requires students to submit mathematical and/or graphical derivation and interpretation of rules of optimal extraction of resource on its due date, and each RA requires students to submit a summary (max 2 pages) of reading on its due date. All assigned readings have been posted on the instructor's web site. A student can obtain partial credit for a missed theoretical or reading assignment by submitting it on or before the exam that immediately follows after the due date. NO LATER SUBMISSION AND NO ELECTRONIC OR EMAIL SUBMISSION IS ACCEPTED.

Paper Writing
A willing student chooses a paper topic on a relevant natural resource issue and gets approval from the instructor on or before February 28, conducts the necessary research and study, submits both hard and electronic copies of the paper on or before April 29.

Examinations

Exam dates are firm. NO MAKEUP EXAM SHALL BE GIVEN.

Midterm 1: Feb 14, Thursday
Midterm 2: Mar 20, Thursday
Final: May 5, Monday at 1:30 P.M.

Grading Policy

The course grade will base on performances in two midterm tests, one paper presentation, theoretical assignments, readings, and the final exam:

Midterm 1	20%
Midterm 2	20%
Final Exam	20%
Paper Write-up	20%
Theoretical assignments	10%
Readings	10%

If you miss a midterm for any reason or prefer not to write a paper, the remaining exams and/or the paper shall be weighted 26.66% each. If you do not miss any midterm and also write and submit a paper, the worst score among the two midterms and the paper shall be dropped and the remaining exams and/or paper shall be weighed 26.66% each if that improves your grade.

Course Outline and Tentative Schedule

1. INTRODUCTION, INTER-TEMPORAL DECISIONS AND RELATED CONCEPTS – Jan 15, 17, 22
   Syllabus, requirements and grading policy; Resource Taxonomy – Resource Flows, Natural Resources (Renewable and Non-renewable), Environmental Resources, Reasons of Studying Natural Resource Economics – involves inter-temporal decisions, pervasive market failure, potential irreversible consequences, and multidisciplinary knowledge; Broad Issues – Efficient utilization, Sustainability, Resource Scarcity and Economic Growth; Intertemporal Graphical Model: Rate of time preference, concept of discounting, optimal allocation rule, marginal user cost and scarcity rent
   RA #1 due on Jan 22: The Cost of Fur (news piece published in the Economist of March 1, 2001)
2. BENEFIT – COST ANALYSIS, VALUES OF RESOURCES, AND NONMARKET VALUATION TECHNIQUES – Jan 24, 29, 31, Feb 5, 7
   TA #1 due Jan 24: Draw the inter-temporal graphical model with proper labels, explain the curves, and interpret the equilibrium condition of optimal inter-temporal allocation
   Brief introduction of benefit – cost analysis: net present value, benefit-cost ratio, internal rate of return, and the pay back period (simple v. discounted); evaluation of mutually exclusive projects (NPV, incremental B/C, incremental IRR)
   RA #2 due on Jan 31: Conservation Revisited, by John Krutilla, from American Economic Review
   Use v. Non-use values, types of use values, types and bases of nonuse values – option, discovery and existence value and the issues of uncertainty, lack of

information, and possible irreversible consequences, also the issues of asymmetry of technological progress, inability to reproduce unique resources, and evolving preferences; Economic value v. Environmental value and the issue of non-human value; Techniques of nonmarket valuation – hedonic price method, travel cost method, and contingent valuation method

RA #3 due on Feb 7: Using Contingent Valuation to Estimate a Neighborhood's Willingness to Preserve Undeveloped Urban Land, by Breffle, Morey, and Lodder

3. TRENDS OF RESOURCE SCARCITY – Feb 12

   RA #4 due Feb 12: Trend of Natural Resource Commodity Prices, by Margaret Slade, from Journal of Environmental Economics and Management

   Trends of Economic Scarcity – Price, marginal extraction cost, and rent, Factors Mitigating Scarcity, Recent findings in the literature

MIDTERM 1: FEB 14, THURSDAY

4. NONRENEWABLE RESOURCES AND ENERGY – Feb 19, 21, 26, 28, Mar 4

   Reserve Taxonomy – Current Reserves, Potential Reserves, and Total Resource Endowment; Resource Pyramid and Warehouse Concept of Reserves; Two Markets – Asset Market and Flow Market; Two-Period Hotelling Model – Mathematical Derivation, Equilibrium Conditions, Interpretations, and link with the inter-temporal graphical model

   TA #2 due Feb 26: Set up the mathematical form of Hotelling model, derive the first order conditions, and interpret them.

   Best Reserve First Principle, Time Path of efficient prices and scarcity rent under Zero MEC, Constant MEC, Increasing MEC, Impacts of changes in discount rate, Price of substitute, Stock, MEC, and Demand, Extraction under Monopoly, Negative externality, Effect of Price Ceiling

   RA #5 due Mar 4: The Economics of Resources or the Resources of Economics, by Robert Solow, from American Economic Review

   Trend of oil prices, reasons, and inferences; diversification, conservation, and development of alternative energy efforts

5. WATER RESOURCES – Mar 6, 11, 13, 18

   Ground Water Allocation: Safe Yield Use Principle of maintaining water table in aquifers, optimal rate of depletion of aquifers; Surface Water Allocation: Equi-marginal principle of allocating surface water – mathematical derivation and graphical model, scarcity rent of water, marginal user cost, and marginal cost pricing of water

   TA #3 due Mar 13: Set up the mathematical two-user water allocation problem, derive the first order conditions, and interpret them.

   Colorado River Compact, Management of Water Resources in Colorado, Water Rights Market, Pricing of Drinking Water and Conservation: Average v. marginal cost pricing, Practice of tap fees, Price vs. watering restrictions

MIDTERM 2: MAR 20, THURSDAY

6. TIMBER HARVESTING MODEL AND FORESTRY ISSUES – Apr 1, 3, 8
   Growth characteristics of timber, stumpage value, the MAI rule of harvesting
   Net present value from timber harvesting, Single Crop Optimal Harvesting Period – mathematical derivation, graphical representation, and interpretation
   Optimum Rotation Model, Site Expectational Value, Addition of non-timber values
   TA #4 due Apr 3: Set up the mathematical single crop timber harvesting model, derive the first order condition, and interpret it. Also, discuss the change in the rule when infinite rotation is allowed.
   Forestry issues: roadless and wilderness v. roaded, protection against wildfire and invasive species, timber management v. multiple use management, below-cost timber sales, allowing participation of environmental activist organizations in bidding for clear-cutting of forests
   RA #6 due April 8: Free Market Forestry, by Mark Muro, from the Denver Rocky Mountain News, Sunday, June 1, 1997, pp. 1B
7. FISHERY SUSTAINABLE YIELD MODEL AND PROBLEMS OF OPEN ACCESS – Apr 10, 15, 17, 22
   Fishery growth characteristics, Minimum threshold stock, Maximum sustainable stock, Physical relationship between stock and yield, Concept of Maximum Sustainable Yield (MSY); Economic model (graphical presentation) – assumptions, fishing effort, relationship between fishing effort and sustainable yield, Revenue and Cost graph, Optimum sustainable stock and yield, interpretations
   TA #5 due Apr 17: Clearly draw the fishery graphical model, label the axes, show the optimum sustainable harvesting point, and interpret the optimal point.
   Regulatory system of controlling open access fishing, tax on fishing, Coase theorem: privatization, tradable fishing quotas, and community ownership
   RA #7 due April 22: Economic Incentives and Poaching of the One-Horned Indian Rhinoceros in Nepal, from the Poverty Reduction and Environmental Management No. 1, Jan 2005
8. POPULATION, ENVIRONMENT, AND ISSUE OF SUSTAINABILITY – April 24, 29, May 1
   Neo-Malthusian Perspective on Population, Economic model of family size, Modern theory of demographic transition, Mutual relationship between economic growth and population growth, Impact of population growth on environment – downward spiral hypothesis, induced innovation hypothesis, Ecological perspectives and Ecological Economics
   RA #8 due Apr 29: Sustainability - An Economist's Perspective, by Robert Solow, from Economics of the Environment, Selected Readings, 3rd edition, edited by R. Dorfman and N. Dorfman, W.W. Norton & company, 1993, pp. 179-187
   John Rawl's sustainability principle of nondeclining welfare, Solow-Hartwick sustainability rule of nondeclining capital, Issue of Substitutability of Natural Capital with Manmade Capital, Weak Measure of Sustainable Development, Strong Measure of Sustainable Development, Empirical Findings on Sustainable Development in Selected Countries, Safe Minimum Standard of Use (SMS), Daly's Steady-State Principles

FINAL EXAM: MAY 5 MONDAY AT 1:30 P.M.

Accommodations for Students with Documented Disability
If you qualify for accommodations because of a disability, please submit a letter to me from Disability Services in a timely manner so that your needs may be addressed. Disability Services determines accommodations based on documented disabilities. Contact 303-492-8671, Willard 322, or www.Colorado.EDU/disabilityservices.

Absences due to Religious Observances
Campus policy regarding religious observances requires that faculty make every effort to reasonably and fairly deal with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. If you have any such conflict, please inform the instructor at least two weeks in advance to make a reasonable arrangement or adjustment according to the University policy, which can be seen at http://www.colorado.edu/policies/fac_relig.html.

Classroom Behavior Policy
Students and faculty each have responsibility for maintaining an appropriate learning environment. Students who fail to adhere to behavioral standards may be subject to discipline. Faculty have the professional responsibility to treat students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which students express opinions. See policies at http://www.colorado.edu/policies/classbehavior.html and at http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code.

Honor Code
All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-725-2273). Students who are found to be in violation of the academic integrity policy will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). Additional information on the Honor Code can be found at http://www.colorado.edu/policies/honor.html and at http://www.colorado.edu/academic/honorcode.