

**UNIVERSITY OF COLORADO, FALL 2005**  
**NATURAL RESOURCE ECONOMICS, Econ 3535-001**  
Lectures: MWF 12:00 to 12:50 p.m. @ EDUC 220

**Instructor: Vijaya R. Sharma, Ph.D.**

Office Hours: MWF 10:30 a.m.-12:00 noon. @ Econ 4A or by appointment

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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 also assigns a number of readings. An introductory course in economics (Econ 1000) or principles of microeconomics (Econ 2010) is a prerequisite for this course.

**Textbook and Readings**

1. There is no required textbook for this course.
2. All readings that are prescribed in the course outline below are posted on the instructor's web site.
3. Web notes on many topics are also available on the instructor's web site.

**Examinations and Grading**

The course grade will base on performances in three exams (30% each) and on fulfillment of assigned readings (10%). For each assigned reading students are required to submit a brief summary with comments (maximum 2 pages) on or before its due date to get full credit. Only hard copy, no electronic copy, of summary is accepted. If a summary is not submitted on its due date, one-half credit can still be obtained with a late submission on or before the next exam that follows the due date. No further late submission will be accepted. **Caution: non-fulfillment or only partial fulfillment of readings may hurt the overall course grade.** If a student is unable to take an exam (among the three exams offered), he/she can substitute it by writing a paper on an environmental issue or topic that has not been adequately discussed in the class. To utilize this option the student needs to obtain the approval of the instructor.

Exam 1: Sep 26, Monday

Exam 2: Oct 31, Monday

Exam 3: Dec 10, Saturday, 10:30 A.M.

**Course Outline and Tentative Schedule**

1. Course Introduction (Aug 22; Web Notes 1)  
Syllabus and Grading Policy, Types of Resources (Resource Flows, Natural Resources, Environmental Resources), Further Classifications of Natural Resources-renewable and nonrenewable, Reasons of Studying Natural Resource Economics (Dynamic decisions, pervasive market failure, potential irreversible consequences,

multidisciplinary knowledge), Broad Issues (Efficiency, Sustainability, Resource Scarcity and Economic Growth)

2. Review of Basic Economic Concepts and Economics Approach (Aug 24,26; Web Notes 1)

Law of Diminishing Marginal Returns, Demand, Marginal Willingness to Pay, Consumer Surplus; Law of Increasing Opportunity Cost, Supply, Marginal Cost of Production, Producer Surplus; Economics Approach: Rationality and Anthropocentricity, Rule of Economizing Behavior, Weighing of Personal Benefits and Personal Costs, Monetary and Non-Monetary Benefits and Costs, Importance of Marginal Analysis

**Reading #1 due on Aug 26: The Cost of Fur (news piece published in the Economist of March 1, 2001)**

3. Economic View of Natural Resources (Aug 29,31; Web Notes 1)

Economic View of Natural Resources: Instrumentalist and Utilitarian, Economic Value vs. Environmental Value

**Reading #2 due on Aug 29: Economic Assessment of Biodiversity and Protected Species, from Environmental Economics, Theory, Application, and Policy, by Duane Chapman, Addison Wesley Longman, 2000, pp. 273-281**

Basis for Option, Discovery and Existence Values: Asymmetry of Technological Progress, Changing Preferences in favor of natural amenities, Uncertainty, Lack of Information and Possible Irreversible Consequences (Measures of Caution), Safe Minimum Standard of Use (SMS); Human Preference and Natural Availability as Determinants of Value of a Resource, Market Price as an Indicator of Marginal Value, Revealed Preference vs. Stated Preference Approaches of Determining Value

4. Economic Efficiency, Allocation of Resources, and Equity (Sep 2,7,9,12,14; Web Notes 1)

Private vs. Social Costs: Distinction and Examples; Efficiency, Pareto Efficiency, Kaldor Efficiency, Maximization of Social Net Benefits, Interpersonal Comparison of Benefits and Costs, Rule of Static Efficiency; Concept of Scarcity Rent

Dynamic Efficiency: Rate of Time Preference, Discounting and Present value formula, Discount Rate (Rate of Time Preference + Risk Premium), Treatment of Inflation Premium in Discount Rate, Choosing the Discount Rate, Rule of Dynamic Allocation of a Fixed Stock of Resource, Scarcity Rent, Marginal User Cost  
Introduction to Issue of Sustainability, Equity Consideration: Utility Possibility Curve, Efficiency and Equity Tradeoff, Egalitarian View, Social Welfare Function, John Rawls' View

5. Property Rights and Environmental Problems, Market Failure Cases, Role of Government and Limitations (Sep 16,19,21,23; Web Notes 1)

Characteristics of Well-Defined Property Rights, Market Failure Cases and Environmental Problems: Open Access Resources, Externalities, Public Goods, Divergence between Private and Social Discount Rates (why), Imperfect Competition  
Role of Government: Public Policy Interventions and Possibility of Government Failure (Rational voter ignorance, short sightedness, special interest effects, and rent seeking)

**Exam 1 on the above materials: September 26, Monday** (the last late submission date for Readings #1 and 2)

6. Economics of Nonrenewable Resources (Sep 28,30, Oct 3,5,7; Web Notes 2)  
Resource Taxonomy (Current Reserves, Potential Reserves, Resource Endowment), Price and Size of Reserves, Indicators of Physical Scarcity (static reserve index and exponential reserve index), Limitations of such Indicators; Theory of Efficient Extraction: Hotelling Rule, Mathematical and Graphical Explanations, Asset Market and Flow Market Equilibrium Conditions; Best Reserve First, 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, Effects of Price Ceiling; Empirical findings on Hotelling value
  7. Discussion on Economic Indicators of Scarcity (Oct 10,12,17; Web Notes 2)  
Indicators of Economic Scarcity: price, marginal extraction cost, scarcity rent, factors mitigating scarcity, evidences on historical trends of natural resource commodity prices  
**Reading #3 due on October 10: Trends of Prices of Natural Resource Commodities, by Margaret Slade, 1982**
  8. Discussion on Energy Reserves and Prices (Oct 19,21; Web Notes 2)  
Warehouse concept of reserves, resource pyramid, closed model vs. open model, theoretical production and price trends, and implications of recent energy price trends  
**Reading #4 due on October 19: Energy Resources - Cornucopia or Empty Barrel?, by Peter McCabe, the American Association of Petroleum Geologists, 1998**
  9. Discussion on Recycling (Oct 21, Web Notes 2)  
**Reading #5 due on October 21: Recycling Programs, by Katherine McClain, from the Handbook of Environmental Economics, edited by D. Bromely, Blackwell Publishers Limited, Cambridge, 1996, pp. 222-239**  
Implications of recycling to stock, exhaustion, and price of virgin resource, Economics of recycling (demand, quality, and cost)
  10. Efficient Utilization of Water Resources (Oct 24,26,28; Web Notes 3)  
Types and Growth Characteristics of Renewable Resources (Water, Forestry, Fisheries); Safe Yield Use Principle of Ground Water, Use of ground water as an exhaustible resource, Equimarginal Principle of Allocation of Surface Water, Problems of water rights transfer, Pricing of Water (flat monthly fee, uniform price per gallon, rising block rate pricing)  
**Reading #5 due on October 24: Is Water Different?, by R. Miller, D. Benjamin, and D. North, from The Economics of Public Issues, by the same authors, 10<sup>th</sup> edition, 1996, pp. 37-41**
- Exam 2 on post-Exam 1 material: October 31, Monday** (the last late submission date for Readings #3, 4, 5, 6)
11. Efficient Utilization of Forest Resources (Nov 2,4,7,9; Web Notes 3)  
MAI rule of harvesting, Optimal Timber Harvesting Rules: Single Harvesting, Optimum Rotation, Efficient Harvesting when there are non-timber benefits of forests  
**Reading #7 due on November 9: Free Market Forestry, by Mark Muro, from the Denver Rocky Mountain News, Sunday, June 1, 1997, pp. 1B**
  12. Efficient Utilization of Fishery Resources (Nov 11,14,16; Web Notes 3)  
Sustainable Fishery Harvesting Rules: Static Model, Dynamic Model

**Reading #8 due on November 16 (submit one summary):**

- a. **Conservation through Commerce, by Ike Sugg, from the Denver Rocky Mountain News, Sunday, July 20, 1997, pp. 1B**
- b. **Bye, Bye, Bison, by R. Miller, D. Benjamin, and D. North, from the Economics of Public Issues, by the same authors, 10<sup>th</sup> edition, 1996, pp. 164-170**

13. Population Problem (Nov 18,21,23; Web Notes on Population Problem)  
Pessimist vs. Optimist Views, The Population Problem, World and U.S. population growth, Impact of population growth on economic development and environment and vice-versa, Some general population control policies

14. Sustainability, Conservation, and Preservation (Nov 28,30, Dec 2,5,7; Web Notes 4: web notes on this section are scanty)  
John Rawl's sustainability principle as nondeclining welfare, Solow-Hartwick sustainability rule of nondeclining capital

**Reading #9 due on Nov 28: Sustainability - An Economist's Perspective, by Robert Solow, from Economics of the Environment, Selected Readings, 3<sup>rd</sup> edition, edited by R. Dorfman and N. Dorfman, W.W. Norton & company, 1993, pp. 179-187**

Issue of Substitutability of Natural Capital with Manmade Capital, Sustainability as nondeclining flow of physical services of natural resources

**Reading #10 due on Dec 2: Measuring Sustainable Development, by David Pearce and Giles Atkinson, from the Handbook of Environmental Economics, edited by D. Bromely, Blackwell Publishers Limited, Cambridge, 1996, pp. 166-181**

Weak Measure of Sustainable Development, Strong Measure of Sustainable Development, Empirical Findings on Sustainable Development in Selected Countries

**Exam 3 on post-Exam 2 materials: December 10, Saturday, 10:30 a.m.**

**Accommodations for Students with Documented Disability**

If you qualify for accommodations because of a disability, please submit to the instructor a letter 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, and [www.Colorado.EDU/disabilityservices](http://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. In this class 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](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 such behavioral standards may be subject to discipline. Faculty has the professional responsibility to treat all students with understanding, dignity and respect, to guide classroom discussion and to set reasonable limits on the manner in which they and their students express opinions. Professional

courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, culture, religion, politics, sexual orientation, gender variance, and nationalities. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. See policies at <http://www.colorado.edu/policies/classbehavior.html> and at [http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student\\_code](http://www.colorado.edu/studentaffairs/judicialaffairs/code.html#student_code).

### **Discrimination and Harassment Policy**

The University of Colorado at Boulder policy on Discrimination and Harassment (<http://www.colorado.edu/policies/discrimination.html>), the University of Colorado policy on Sexual Harassment and the University of Colorado policy on Amorous Relationships applies to all students, staff and faculty. Any student, staff or faculty member who believes s/he has been the subject of discrimination or harassment based upon race, color, national origin, sex, age, disability, religion, sexual orientation, or veteran status should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Judicial Affairs at 303-492-5550. Information about the ODH and the campus resources available to assist individuals regarding discrimination or harassment can be obtained at <http://www.colorado.edu/odh>.

### **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, and 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](mailto: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>.