

**Department of Agricultural and Resource Economics and Department
of Economics**

University of Maryland

Fall 2010

**AREC 785/ECON 785: Advanced Economics of Natural
Resources**

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Hours: Monday 2:30-3:30, Wednesday 3:30-5:00 or by appointment
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DESCRIPTION:

This course examines the use of exhaustible and renewable natural resources from normative and positive points of view. Current methods of analysis are developed with an emphasis on applications to problems in energy, mineral, fishery, forestry, and water resources. The course will examine both optimal and equilibrium allocation of natural resources.

COURSE REQUIREMENTS:

There will be 2 exams (a midterm and a final, the latter to be given at the official exam time, Friday December 17 8-10 am) that test students' mastery of the technical material covered in the course. There will also be a project/paper. The grades will be weighted as follows:

Midterm Exam	20%
Final Exam	35%
Paper	35%
Presentation	10%

Problem sets will be given out to provide an opportunity for students to familiarize themselves with the concepts and techniques of the course and to help develop the necessary skills to analyze economic aspects of natural resource problems. These problem sets will not be graded but they will be essential preparation for the exams. Complete answers will be made available on ELMS in a timely fashion.

READINGS AND LECTURE NOTES:

Required readings are listed in the course outline. The readings are primarily journal articles, most of which will be posted as pdf files on ELMS; copies will also be available in the AREC Library. It is recommended that you read the assigned articles prior to lecture. The notes for most lectures will be available as pdf files posted on ELMS in advance of each lecture—but be aware that last-minute revisions are always possible.

WRITING ASSIGNMENT:

One goal of the course is to teach students systematically how to conduct research in natural resource economics. A first step in this process is learning how to read the technical economics literature with a critical eye. The writing assignment for this course is intended to teach that skill.

The assignment will focus on a published article containing an analysis of a dynamic natural resource or environmental problem or a static natural resource problem. Students are free to choose any dynamic resource or environmental problem. Static models of natural resources (e.g., surface water) may also be appropriate depending on the topic. Static environmental problems are more appropriate for ECON 781 and cannot be used for this course. Articles assigned as course readings cannot be used for this assignment. The choice of an article is subject to my approval.

The first stage of this assignment will involve each student writing a critique of the article. The critique will consist of the following components:

1. Putting the article in context: Explain (in your own words) the issue(s) the article examines and why those issues are interesting from a policy perspective and/or from the perspective of the existing economics literature. Try to think broadly here—there's no reason to limit your explanation to items mentioned in the article itself (and it's probably a good idea not to do so).
2. Deconstructing the article: Derive in detail all of the results of the paper, demonstrating specifically how the assumptions of the model are used to derive those results.
3. Assessing the robustness of the results: Discuss whether the assumptions made are reasonable or unduly stringent and how sensitive the results are to one or more of those assumptions.
4. Truth in advertising: Discuss the extent to which the mathematical results correspond to the verbal claims made about them. (E.g., is what is shown formally less general than claimed?)
5. Assessing the robustness of the model: Discuss whether there are any other results that can be derived straightforwardly from the model. If so, derive them and discuss whether they make sense or provide additional insights.
6. Putting the article in perspective. Review the existing literature and determine what article contributes to that literature, i.e., our understanding of policy and/or technical analytical issues. Identifying the relevant literature is, of course, an

- important component of this part of the assignment. Useful approaches to identifying that literature include reading the articles cited by the one you've chosen and conducting a cited article search (e.g., via Web of Science) to see what other articles have cited the article you've chosen, articles cited by the article you've chosen, and others that seem important in this literature.
7. Setting an agenda for further research: Propose an alternative to or extension of the analysis contained in the paper that would make a new contribution to the literature. If the paper has fundamental flaws, propose a way of remedying those flaws. If the paper is fundamentally sound, propose a way to extend the analysis. Be sure to be clear about what your proposed alternative/extension would add in terms of the literature and/or policy discussions.
 8. The final portion of the assignment is an in-class presentation that will essentially involve teaching the article you've chosen to the class.

This assignment will be conducted in stages to permit feedback at each step of the process.

September 17. Submit a copy of the paper you've chosen. We will discuss that choice the following week.

October 29. An informal preliminary write-up of items 1-5 of the critique is due. We will discuss your progress the following week. This write-up will count for 5% of your final grade.

November 12. An informal preliminary write-up of items 6-7 is due. We will discuss that work the following week. This write-up will count for 5% of your final grade.

December 17. Final draft due. The final draft should be written as a formal research report; use William Thomson's *A Guide for the Young Economist* (MIT Press, 2001) as a style guide. The final version will count for 25% of your final grade.

Important Notice: It is permissible to use your paper for this class to satisfy the requirements for another class provided you obtain the prior approval of both professors. In this class the grading standard for such papers will be higher as I expect you to write a better paper if you are using it to satisfy the requirements for more than one class.

COURSE OUTLINE with required and recommended readings:**I. INTRODUCTION**

McInerney, J. 1981. Natural resource economics: the basic analytical principles, chapter 3 in *Economics and Resources Policy*, (J.A. Butlin, ed.), London, Longman.

II. FUNDAMENTAL PRINCIPLES OF INTERTEMPORAL RESOURCE ALLOCATION**A. Review of Capital Theory**

Dasgupta, P.S. and G.M. Heal. 1979. *Economic theory and exhaustible resources*, Cambridge, Cambridge University Press, Chapter 4.

B. Review of Optimal Control

Leonard, D. and N.V. Long. 1992. *Optimal control theory and static optimization in economics*, Cambridge, Cambridge University Press, chapter 4.

Carpenter, S.R., D. Ludwig, and W.A. Brock. 1999. Management of eutrophication for lakes subject to potentially irreversible change. *Ecological Applications* 9, 751-771.

C. Exhaustible Resources—Basic Theory

Dasgupta, P.S. and G.M. Heal. 1979. *Economic theory and exhaustible resources*, Cambridge, Cambridge University Press, Chapter 6.

Livernois, J. and P. Martin. 2001. Price, scarcity rent, and a modified r -percent rule for non-renewable resources. *Canadian Journal of Economics* 34, 827-845.

Eswaran, M., T.R. Lewis, and T. Heaps. 1983. On the non-existence of market equilibria in exhaustible resources with decreasing costs, *Journal of Political Economy* 91, 154-167.

Lozada, G.A. 1996. Existence of equilibria in exhaustible resource industries: Nonconvexities and discrete vs. continuous time. *Journal of Economic Dynamics and Control* 20, 433-444.

Chakravorty, U. and D.L. Krulce. 1994. Heterogeneous demand and order of resource extraction, *Econometrica* 62, 1445-1452.

Gaudet, G., M. Moreaux, and S.W. Salant. 2001. Intertemporal depletion of resource sites by spatially-distributed users, *American Economic Review* 91, 1149-1159.

Livernois, J. 2008. On the empirical significance of the Hotelling Rule. *Review of Environmental Economics and Policy* 3, 22-41.

D. Natural Resources and the Economics of National Income Accounting

Asheim, G.B. 2003. Green national accounting for welfare and sustainability: a taxonomy of assumptions and results. *Scottish Journal of Political Economy* 50, 113-130.

Asheim, G.B., W. Buchholz, and C. Withagen. 2003. The Hartwick rule: myths and facts. *Environmental and Resource Economics* 25, 129-150.

Weitzman, M.L. 1999. Pricing the limits to growth from minerals depletion, *Quarterly Journal of Economics* 114, 691-706.

Weitzman, M.L. and K.-G. Lofgren. 1997. On the welfare significance of green accounting as taught by parable, *Journal of Environmental Economics and Management* 32, 139-153.

E. Optimal Control Over Space—Ricardo/von Thunen Models

Xabadia, A., Goetz, R.U. and D. Zilberman. 2006. Control of accumulating stock pollution by heterogeneous producers. *Journal of Economic Dynamics and Control* 30, 1105-1130.

Lankoski, J., E. Lichtenberg, and M. Ollikainen. 2008. Effluent trading with spatial heterogeneity, *American Journal of Agricultural Economics* 90, 1044-1058.

F. Deterministic and Stochastic Dynamic Programming

Sundaram, R.K. 1996. *A first course in optimization theory*. Cambridge, Cambridge University Press, chapters 11-12.

Levhari, D., R. Michener, and L.J. Mirman. 1981. Dynamic programming models of fishing: competition. *American Economic Review* 71, 649-661.

Lichtenberg, E. 2007. Tenants, landlords, and soil conservation. *American Journal of Agricultural Economics* 89, 294-307.

III. FISHERIES

A. Population Dynamics

Turchin, P. 2003. *Complex Population Dynamics: A Theoretical/Empirical Synthesis*. Princeton: Princeton University Press, Chapters 1-3.

B. Fisheries: Issues, Background, and Basic Theory of Open Access

Hilborn R., et al. 2003. State of the world's fisheries. *Annual Review of the Environment and Resources* 28, 359-399.

Beddington, J.R., D.J. Agnew, and C.W. Clark. 2007. Current problems in the management of marine fisheries, *Science* 316, 1713-1716 (plus supporting online material).

Smith, V.L. 1968. Economics of production from natural resources. *American Economic Review* 58, 409-431.

Smith, V.L.. 1969. On models of commercial fishing. *Journal of Political Economy* 77, 181-198.

C. Open Access and Trade

Brander, J.A. and M.S. Taylor. 1997. International trade and open-access renewable resources: the small open economy case, *Canadian Journal of Economics* 30, 526-552.

Copeland, B. and M.S. Taylor. 2009. Trade, tragedy, and the commons, *American Economic Review* 99, 725-49.

D. Fishery Regulation

Wilén, J.E. 2000. Renewable resource economists and policy: what difference have we made?, *Journal of Environmental Economics and Management* 39, 306-327.

Homans, F.R. and J.E. Wilén. 1997. A model of regulated open access resource use. *Journal of Environmental Economics and Management* 32, 1-21.

Homans, F.R. and J.E. Wilén. 2005. Markets and rent dissipation in regulated open access fisheries. *Journal of Environmental Economics and Management* 49, 381-404.

Heaps, T. 2003. The effects on welfare of the imposition of individual transferable quotas on a heterogeneous fishing fleet, *Journal of Environmental Economics and Management* 46, 557-576.

Boyce, J.R. 2004. Instrument choice in a fishery. *Journal of Environmental Economics and Management* 47, 181-206.

Abbott, J.K. and J.E. Wilén. 2009. Rent dissipation and efficient rationalization in for-hire recreational fishing. *Journal of Environmental Economics and Management* 58, 300-314.

E. The Bycatch Problem

Singh, R. and Q. Weninger. 2009. Bioeconomics of scope and the discard problem in multiple-species fisheries. *Journal of Environmental Economics and Management* 58, 72-92.

Boyce, J.R. 1996. An economic analysis of the fisheries bycatch problem. *Journal of Environmental Economics and Management* 31, 314-336.

F. Patch Ecology Models: Marine Reserves and No Take Zones

Sanchirico, J.N. and J.E. Wilen. 2001. A bioeconomic model of marine reserve creation. *Journal of Environmental Economics and Management* 42, 257-276.

Sanchirico, J.N. 2005. Additivity properties of metapopulation models: implications for the assessment of marine reserves. *Journal of Environmental Economics and Management* 49, 1-25.

Sanchirico, J.N. and J.E. Wilen. 2005. Optimal spatial management of renewable resources: matching policy scope to ecosystem scale. *Journal of Environmental Economics and Management* 50, 23-46.

Sanchirico, J.N., U. Malvadkar, A. Hastings, and J.E. Wilen. 2006. When are no-take zones an economically optimal management strategy? *Ecological Applications* 16, 1643-1659.

IV. COMMON POOL RESOURCES

Negri, D. 1989. The common property aquifer as a differential game. *Water Resources Research* 25, 9-15.

Rubio, S.J. and B. Casino. 2001. Competitive versus efficient extraction of a common property resource: the groundwater case. *Journal of Economic Dynamics and Control* 25, 1117-1137.

Heintzelman, M.D., S.W. Salant and S. Schott. 2009. Putting free-riding to work: a partnership solution to the common property problem. *Journal of Environmental Economics and Management* 57, 309-320.

Ruseski, G. 1998. International fish wars: the strategic roles for fleet licensing and effort subsidies. *Journal of Environmental Economics and Management* 36, 70-88.

Mesterton-Gibbons, M. 1993. Game-theoretic resource modeling. *Natural Resources Modeling* 7, 93-147.

V. FORESTRY RESOURCES

Amacher, G.S., M. Ollikainen, E.A Koskela. 2009. *Economics of Forest Resources*.
Cambridge: MIT Press, chapters .1-3, 6, 8.

Hartwick, J.M., N.V. Long and H. Tian. 2001. Deforestation and development in a small
open economy, *Journal of Environmental Economics and Management* 41, 235-251.