University of California, San Diego
Department of Economics
ECON 267: Natural Resource Economics
Winter 2014

Time: Tuesday 2:00PM-4:50PM
Location: ECON 200
Instructor: Junjie Zhang, RBC 1303, (858) 822-5733, junjiezhang@ucsd.edu
Office Hours: Wednesdays 2:00-4:00 and by appointment

Course Description: This course addresses theoretical and empirical questions about natural resource scarcity, covering both depletable and renewable resources. This course consists of two parts. First, we provide students a solid foundation in the theory of natural resource economics by introducing a broad set of tools used this field. In particular, we apply dynamic optimization and optimal control methods to the management of natural resources. Second, we highlight some contemporary themes in resource economics. Those topics of policy importance will be selected and analyzed. We use econometric models to test the results predicted by the theory.

This course is mainly designed for PhD students in environmental and resources economics. However, those students in macroeconomics, applied microeconomics, public finance, public policy and development may find the applied tools useful in their research. Students must have completed a year of PhD-level microeconomic theory and econometrics.

Readings: I recommend the following four text books.

Strogatz, Steven H. *Nonlinear Dynamics and Chaos*. Westview Press, 1994.

Clark, C.W., *Mathematical Bioeconomics: Optimal Management of Renewable Resources*, 2nd Edition, Wiley, 1990. (The 3rd edition is available)

Caputo, M.R., *Foundations of Dynamic Economic Analysis: Optimal Control Theory and Applications*, Cambridge University Press, 2005.

Dasgupta, P. and G.M. Heal, *Economic Theory and Exhaustible Resources*, Cambridge University Press, 1980.

Requirement: The course will be run as a combination of lectures by the instructor and discussions by students. Thus, attendance at class meetings is mandatory. The homework assign includes three parts: 1) Three problem sets in the first three weeks, 2) Leading classroom discussion for designated papers. Please sign up here for discussion leader: http://goo.gl/COaYWf. Presentation slides can be used but are not required; and 3) A final project that proposes to apply nonlinear dynamics or optimal control theory to an economic question. The project can be theoretical or empirical. Some preliminary results are expected to demonstrate the project is feasible.

Grading: The course grade will be based 20% on classroom participation, 20% on homework assignment, 20% on discussion leader, and 50% on a research proposal.

Academic Integrity: Student conduct related to this course is governed by the UCSD Policy on Integrity of Scholarship: "Students are expected to complete the course in compliance with the instructor's standards. No student shall engage in any activity that involves attempting to receive a grade by means other than honest effort."

Course Outline
(* designates discussion papers)

Week 1: Introduction and logistics

Strogatz chapter 1

Kolstad, C.D. 2000. "Energy and Depletable Resources: Economics and Policy, 1973-1998," *Journal of Environmental Economics and Management* 39(3): 282-305.

Wilen, James E. 2000. Renewable Resource Economists and Policy: What Differences Have We Made? *Journal of Environmental Economics and Management* 39(3): 306-327.

Week 2: Nonlinear dynamics: one-dimensional system

Strogatz chapters 2-4 & Clark chapter 1

Zellner, Arnold. 2002. "My Experiences with Nonlinear Dynamic Models in Economics." *Studies in Nonlinear Dynamics & Econometrics* 6(2): Article 1.

Week 3: Nonlinear dynamics: n-dimensional system

Strogatz chapters 5-12 & Clark chapter 6

Smith, V. L. 1968. "Economics of Production from Natural Resources." *The American Economic Review* 58: pp. 409-431

Brander, J.A. and M. Scott Taylor. 1998. "The Simple Economics of Easter Island: A Ricardo-Malthus Model of Renewable Resource Use," *American Economic Review* 88:1, 119-139.

Kremer, M. & Morcom, C. 2000. "Elephants." *The American Economic Review* 90: pp. 212-234

Week 4: Optimal control theory

Caputo chapters 1-3, 10, 12 & Clark chapter 4

Week 5: Non-renewable resources: lecture

Hotelling, H. 1931. "The Economics of Exhaustible Resources." *Journal of Political Economy* 39: pp. 137-175.

Solow, Robert M. 1974. "The Economics of Resources or the Resources of Economics." *The American Economic Review* 64(2): pp. 1-14.

Pindyck, R. S. 1978. "The Optimal Exploration and Production of Nonrenewable Resources." *Journal of Political Economy* 86: pp. 841-861.

Devarajan, S. and Fisher, A. C. 1981. "Hotelling's "Economics of Exhaustible Resources": Fifty Years Later." *Journal of Economic Literature* 19: pp. 65-73.

Gaudet, G. 2007. "Natural resource economics under the rule of Hotelling." *Canadian Journal of Economics* 40: 1033-1059

Livernois, J. 2009 "On the Empirical Significance of the Hotelling Rule." *Review of Environmental Economics and Policy* 3(1):22-41

Week 6: Non-renewable resources: discussion

* Halvosen, R. and T.R. Smith. 1984. "On Measuring Natural Resource Scarcity," *Journal of Political Economy* 92: 954-964.

* Lin, C.-Y. C. and Wagner, G. 2007. Steady-state growth in a Hotelling model of resource extraction. *Journal of Environmental Economics and Management* 54: 68-83

* Anderson, S. R. Kellogg and S. Salant. 2014. "Hotelling Under Pressure". Working Paper.

* Mason, Charles F. and Klaas van't Veld. 2013 "Hotelling Meets Darcy: A New Model of Oil Extraction," 20th Annual Conference of the European Association of Environmental and Resource Economists.

Week 7: Renewable resources: lecture

Clark, C.W., 1973. "The Economics of Overexploitation," *Science* 181: 630-634.

Brown, Gardner M., 2000. "Renewable Natural Resource Management and Use without Markets." *Journal of Economic Literature* 38(4):875-914.

Gordon, H. S. 1954. "The Economic Theory of a Common-Property Resource: The Fishery," *Journal of Political Economy* 62, 124-142.

Smith, V.L. 1969. "On Models of Commercial Fishing," *Journal of Political Economy* 77, 181-198.

Karpoff, J. M. 1987. "Suboptimal Controls in Common Resource Management: The Case of the Fishery." *Journal of Political Economy* 95: pp. 179-194

Week 8: Renewable resources: discussion

* Wilen, J.E. (1976), Common Property Resources and the Dynamics of Overexploitation: The Case of the North Pacific Fur Seal, University of British Columbia, Resources Paper No. 3, September 1976.

* Costello, C., Gaines, S. D., and Lynham, J. 2008. "Can Catch Shares Prevent Fisheries Collapse?." *Science* 321: 1678-1681 (with supplemental materials)

* Smith, M. D., Sanchirico, J. N., and Wilen, J. E. 2009. The economics of spatial-dynamic processes: applications to renewable resources. *Journal of Environmental Economics and Management*, 57(1), 104-121.

* Taylor, M. S. 2011. "Buffalo Hunt: International Trade and the Virtual Extinction of the North American Bison." *American Economic Review* 101: 3162-95

Week 9: Additional Topics

Session 1: Stock pollutants

Harford, Jon D., 1998. "The Ultimate Externality," *American Economic Review* 88(1): 260-265

Falk, I. and R. Mendelsohn, 1993. "The Economics of Controlling Stock Pollutants: An Efficient Strategy for Greenhouse Gases," *Journal of Environmental Economics and Management* 25: 76-88.

Sinn, H.-W. 2008. "Public policies against global warming: a supply side approach." *International Tax and Public Finance* 15: 360-394

Session 2: Sustainable Development

Heal, Geoffrey, 2005. "Intertemporal Welfare Economics and the Environment." In K.-G Maler and J.R. Vincent, eds., *Handbook of Environmental Economics*. Elsevier Science, Vol 3, Chapter 21: 1106-1143.

Chichilnisky, Graciela, 1996. "An axiomatic approach to sustainable development," *Social Choice and Welfare* 12(2): 231-257.

Week 10: Research project proposal presentations