COLORADOSCHOOLOFMINES

Subject: EBGN Number: 610

Course Title: Advanced Natural Resource Economics

Section: A

Semester/year: Spring/2014

Instructor or Coordinator: Harrison Fell

Contact information (Office/Phone/Email): EH 313/303-273-3757/hfell@mines.edu

Office hours: MW 1:30 – 3:00

Class meeting days/times: MW 11:00 – 12:15

Class meeting location: EH 211

Web Page/Blackboard link (if applicable): Blackboard site available to enrolled students

Instructional activity: **37** hours lecture **3** semester hours

Course designation: ___ Common Core ___ Distributed Science or Engineering

___ Major requirement ___ Elective _x_ Other (required course for PhD's, elective for other graduate students)

Course description from Bulletin:

Optimal resource use in a dynamic context using mathematical programming, optimal control theory and game theory. Constrained optimization techniques are used to evaluate the impact of capital constraints, exploration activity and environmental regulations. Offered when student demand is sufficient. Prerequisites: Principles of Microeconomics, MATH111, MATH5301, EBGN509, EBGN510, EBGN511; or permission of instructor.

Textbook and/or other requirement materials:

Required text: Conrad, J.M. and C.W. Clark. 1987. *Natural Resource Economics: Notes and Problems*. Cambridge University Press, Cambridge. ISBN: 0-521-33769-0

Other required supplemental information:

Dasgupta, P.S. and G.M. Heal. 1979. *Economic Theory and Exhaustible Resources*. Cambridge University Press, Cambridge. ISBN: 0-521-29761-3

Hartwick, J.M. and N.D. Olewiler. 1998. *The Economics of Natural Resource Use* (2nd Edition). Addison Wesley, Reading, MA. ISBN: 978-0321014283

Student learning outcomes: At the conclusion of the class students will…

1. be familiar with economic literature regarding natural resource economics and the methodologies used in these papers

2. have a greater understanding of intertemporal analysis and dynamic optimization techniques for both non-renewable and renewable resources in a variety of settings
3. have a sufficiently strong foundation in the fundamentals of natural resource economic analysis and understanding of the existing literature that they may go forward with original research in the field.

Brief list of topics covered:

1. Dynamic Optimization Methods Review
2. Classic Non-renewable Resource Models
3. Renewable Resource Models
4. Empirical Examples on Resource-Related Topics
5. Sustainability and Scarcity Measures
6. Natural Resources and Environmental Regulation

Policy on academic integrity/misconduct: The Colorado School of Mines affirms the principle that all individuals associated with the Mines academic community have a responsibility for establishing, maintaining an fostering an understanding and appreciation for academic integrity. In broad terms, this implies protecting the environment of mutual trust within which scholarly exchange occurs, supporting the ability of the faculty to fairly and effectively evaluate every student's academic achievements, and giving credence to the university's educational mission, its scholarly objectives and the substance of the degrees it awards. The protection of academic integrity requires there to be clear and consistent standards, as well as confrontation and sanctions when individuals violate those standards. The Colorado School of Mines desires an environment free of any and all forms of academic misconduct and expects students to act with integrity at all times.

Academic misconduct is the intentional act of fraud, in which an individual seeks to claim credit for the work and efforts of another without authorization, or uses unauthorized materials or fabricated information in any academic exercise. Student Academic Misconduct arises when a student violates the principle of academic integrity. Such behavior erodes mutual trust, distorts the fair evaluation of academic achievements, violates the ethical code of behavior upon which education and scholarship rest, and undermines the credibility of the university. Because of the serious institutional and individual ramifications, student misconduct arising from violations of academic integrity is not tolerated at Mines. If a student is found to have engaged in such misconduct sanctions such as change of a grade, loss of institutional privileges, or academic suspension or dismissal may be imposed.

The complete policy is online.

Grading Procedures: *(Note: all courses must have a published, transparent grading policy that students can use to gauge their performance and progress in the class through the course of the semester.)*

Coursework Return Policy:

The grading of this class will be based on three deliverables – a midterm, referee report, and an in-class presentation. The weighting of these deliverables for the final grad will be determined as follows:

Midterm –	35%
Literature Review Paper –	35%
Presentation –	15%
In-class Paper Review –	10%
Participation –	5%

The midterm will be an in-class exam scheduled tentatively for 8th week of class. The exam is closed book *and* closed notes. This will test your ability to solve the basic problems we cover in class.

For the literature review, students will choose a topic and write a review paper on the issue that outlines the problem, discusses the academic literature regarding the issue, and outlines some areas of the issue that have yet to be resolved. Because this is an economics class in an economics department, the majority of literature that this review draws upon should be from the *economic* literature. A suggested (but not exclusive) list of journals and their abbreviations that students should draw upon includes:

American Economic Review (AER), *Quarterly Journal of Economics* (QJE), *Journal of Political Economy* (JPE), *Economics Journal* (EJ), *Review of Economics and Statistics* (ReStat), *Journal of Public Economics* (JPubE), *American Economic Journal: Economic Policy* (AEJ:EP), *Journal of Environmental Economics and Management* (JEEM), *American Journal of Agricultural Economics* (AJAE), *Resource and Energy Economics* (REE), *Environment and Resource Economics* (ERE), *Review of Environmental Economics and Policy* (REEP), *Energy Journal* (EnergyJ).

These review papers will be due no later than the scheduled final exam date and time for this class. We will discuss the specifics of the paper in more detail at a later date, but in general I expect these them to be 8-15 pages long with at least 10 citations and that you select your topic by the 9th week of class.

The in-class presentations will be formal presentations of one of the papers discussed in the review paper. These presentations are expected to be of a similar format to what one would present at an academic conference. Again, more details on the specific expectations of these presentations will be given at a later date, but in general these presentations will be approximately 20-25 minute long. Finally, this class will primarily be on reviewing key paper in resource economics. During some classes, I will have a student give a brief presentation on a paper that we will not have time to fully review in class. Chosen students will be alerted of their presentation assignment at least one class prior to the class in which they are expected to present. The presentations are expected to be approximately 10-15 minute long and should be done using Power Point or Beamer slides, with a **maximum of 10 slides**. The presentation should discuss:

- What is the basic research question(s) of this paper?
- What are the key findings of the paper?
- How did this paper contribute to the literature?
- If relevant, how have others built upon this paper?

Absence Policy (e.g., Sports/Activities Policy): Attendance and participation are mandatory. Please notify the instructor of any planned absences.

Homework:

- Homework assignments will be given, but are optional to complete. These are simply practice problems for the exam.
- Exams: If you will be absent during a scheduled exam, you should schedule a make-up time before you leave.

Detailed Course Schedule:

Below is a tentative outline for the class with an expected reading list. I stress that this is a tentative list. Topics, readings, and listed order are all subject to change based on class progress and professor preferences. Please consult the blackboard page for this class frequently for updates on topics covered and required readings.

Dynamic Optimization Methods Review

Topics:

- Continuous time dynamics
- Discrete time dynamics

Readings:

- Kamien, M.I. and N.L. Schwartz. 1991. *Dynamic Optimization: The Calculus of Variations and Optimal Control in Economics and Management*.(Part II: Chapters 1- 13)

Classic Non-renewable Resource Topics

Topics:

- Competitive extraction, Monopoly extraction, Socially optimal extraction
- Extraction with capacity constraint
- Extraction with a backstop
- Extraction with exploration
- Extraction with taxes
- Durable non-renewables
- Grade/cost differentiated reserves

Readings:

- C & C Chapter 3
- Levhari, D. and N. Liviatan. 1977. "Notes on Hotelling's Economics of Exhaustible Resources." *Canadian Journal of Economics* (2).
- Krautkraemer, J.A. 1998. "Nonrenewable Resource Scarcity." *Journal of Economic Literature* (36).
- Dasgupta, P., G. Heal and J. Stiglitz. 1980. "The Taxation of Exhaustible Resources." NBER Working Paper No. 436 (http://www.nber.org/papers/w0436.pdf)
- Levhari, D. and R. Pindyck. 1981. "The Pricing of Durable Exhaustible Resources." *QJE*, 96.
- Hartwick, J.M. 1993. "The Generalized *r%* Rule for Semi-durable Exhaustible Resources."*Resource and Energy Economics*, 15.
- Holland, S. 2003. "Extraction Capacity and the Optimal Order of Extraction" *Journal of Environmental Economics and Management,* 45(3): 569-588
- Gaudet, G., Moreaux, M. and S.W. Salant (2001): "Intertemporal Depletion of Resource Sites by Spatially Distributed Users." *American Economic Review*,91(4).
- Chakravorty, U. and D.L. Krulce. 1994. "Heterogenous Demand and Order of Resource Extraction." *Econometrica*, 62(6).

- Lewis, T.R. 1982. “Sufficient Conditions for Extracting Least Cost Resource First.” *Econometrica*, 50.

Renewable Resources

Topics:

- Forestry Economics
- Fishery Economics

Readings:

- C&C Chapter 2
- H&O Chapters 4, 5, 10, 11

Empirical Examples

Topics:

- Empirical Hotelling models
- Resource Boom/Busts and Resource Curse

Reading List:

- Kronenberg, T. 2008. “Should We Worry about the Failure of the Hotelling Rule?” *Journal of Economic Surveys*, 22(4).
- Slade, M.E. 1982. “Trends in Natural-Resource Commodity Prices: An Analysis of the Time Domain.” *Journal of Environmental Economics Management*, 9.
- Halvorsen, R. and T.R. Smith. 1991. “A Test of The Theory of Exhaustible Resources.” *Quarterly Journal of Economics*.
- Ellis, G.M. and R. Halvorsen. 2002. “Estimation of Market Power in a Non-renewable Resource Industry.” *Journal of Political Economy*, 110(4).
- Lin, C.-Y. and G. Wagner. 2007. “Steady-state Growth in a Hotelling Model of Resource Extraction.” *Journal of Environmental Economics Management*, 54.
- Frankel, J.A. 2010. “The Natural Resource Curse: A Survey.” NBER Working Paper #15836
- James, Alexander and Aadland, David. 2010. "The curse of natural resources: an empirical investigation of U.S. counties," *Resource and Energy Economics*33(2): 440 – 453.
- Jacobsen, G and D. Parker. 2013. “The Economic Aftermath of Resource Booms: Evidence from Boomtowns in the American West”. Working Paper.

Sustainability and Scarcity

Topics:

- Macro growth models with natural resources

- Measures of scarcity
- Peak oil

Readings:

- C&C Chapter 3
- Solow, R. M. 1986. “On the intergenerational allocation of natural resources.” *The Scandinavian Journal of Economics,* 88(1):141–149.
- Hartwick, J.M. 1977. “Intergenerational Equity and the Investing of rents from Exhaustible Resources.” *American Economic Review*, 67(5):972-974.
- Hartwick, John M., 1978. "Investing returns from depleting renewable resource stocks and intergenerational equity," *Economics Letters* 1(1): 85-88.
- Brown, G.M. and B.C. Field. 1978. “Implications of Alternative Measures of Natural Resource Scarcity.” *Journal of Political Economy*
- Smith, J.L. 2011. “On the Portents of Peak Oil (And Other Indicators of Resource Scarcity).” SMU-Cox School of Business working paper.
- Holland, S. 2008. “Modeling Peak Oil” *Energy Journal* 29(2): 61-80.

Natural Resources and Environmental Regulation

Topics

- Stock pollutants and Natural Resources
- Permit trading in dynamic setting
- Dynamic Climate Model issues
- Green Paradox

Readings:

- Farzin, Y. H., 1996. "Optimal pricing of environmental and natural resource use with stock externalities," *Journal of Public Economics*, 62(1-2): 31-57.
- Rubin, J. 1996. “A Model of Intertemporal Emission Trading, Banking, and Borrowing.” *Journal of Environmental Economics Management*, 31.
- Leiby, P. and J. Rubin. 2001. “Intertemporal Permit Trading for Control of Greenhouse Gas Emissions.” *Environment and Resource Economics*, 19.
- Newell, R.G. and W.A. Pizer. 2003. “Regulating Stock Externalities Under Uncertainty.” *Journal of Environmental Economics Management*, 45(2).
- Hoel, M. and L. Karp. 2002. “Taxes versus quotas for a stock pollutant” *Resource and Energy Economics,* 24:367-384
- Hoel, M. and L. Karp, 2001. ‘Taxes and Quotas for a Stock Pollutant with Multiplicative Uncertainty’, *Journal of Pubic Economics*, 82, 91–114.
- Heal, G. 2009. “Climate Economics: A Meta-Review and Some Suggestions for Future Research.” *Review of Environmental Economics and Policy*, 3(1).
- van der Ploeg, F. and C. Withagen. 2012. “Is there really a green paradox?” *Journal of Environmental Economics Management* 64(3): 342-363