ACE 510/ECON 548: Advanced Natural Resource Economics Fall 2018

Instructor: Benjamin Gramig
Class: T/R 1:30-2:50pm, 316S Mumford Hall bgramig@illinois.edu
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Office hours: M 3-4:30pm/W 9-10am www.bengramig.com
or by appointment

Prerequisite: ECON 302 Intermediate Microeconomic Theory (Instructor assumes this as the *bare minimum familiarity* with micro theory; 302 is a calculus-based micro theory course). If you do not have this pre-requisite, speak with the instructor about your preparedness for the class immediately.

Course catalog description: Economic theory is used to examine the allocation of renewable [*and non-renewable resources*] and efficiency issues that arise from natural resource policy and management issues. [*italics* added by instructor]

The course will also *introduce* non-market valuation techniques during the final weeks of the semester, focusing on the methods and techniques that are most commonly published in the economics literature today. Namely, the travel cost model for revealed preference data and the use of choice experiments (attribute-based methods, more generally) for stated preference data.

Lectures will consist of working through theoretical models of natural resource management with an emphasis on optimality conditions, solving for equilibria, and characterizing the dynamics of different equilibria (stable, unstable, etc.). Presentation and discussion of journal articles that are applications of the material in the course text and additional topics, especially at the frontier of research, will also occupy class time.

Goals for the course:

1. Be able to read and understand the natural resource economics and policy literature
2. Synthesize and present articles from the literature that apply the methods and theory of natural resource economics
3. Understand the application of dynamic optimization techniques to natural resources
4. Formulate an economic research question, develop and interpret a theoretical model, and propose a plan to develop a full economic analysis of a natural resource management or policy issue

Course materials

A dynamically updated course schedule with readings links is available to students via the Compass2g course website at compass2g.illinois.edu.

Textbook

There is no required text book for the class. I will lecture from notes compiled from multiple resources, including the following texts:

Champ, Boyle and Brown (eds.). A Primer on Nonmarket Valuation. 2nd edition. Springer, 2017.

Clark, Colin W. Mathematical Bioeconomics: Optimal Management of Renewable Resources, Second edition. Wiley and Sons, 2005. [this is a canonical, mathematically rigorous reference for renewable resource management]

Conrad, Jon M. and Colin W. Clark. Natural Resources Economics: Notes and problems. Cambridge University Press, 1987 (2002 printing).

Hanley, Nick, Jason Shogren and Ben White. Environmental Economics in Theory and Practice, Second edition. Palgrave MacMillan, 2007. [modern, compact treatment of ERE]

Perman, Roger, Yue Ma, Michael Common, David Maddison, James Mcgilvray. Natural Resource and Environmental Economics. 4th Edition, 2012. Pearson, 744 pages.

There are many texts and other resources available on the mathematical methods of dynamic optimization. Two that are particularly accessible are:

Chiang, Alpha C. Elements of Dynamic Optimization. Waveland Press, Inc., 2000.

Shone, Ronald. Economic Dynamics. Second edition. Cambridge University Press, 2002.

There are quite a few other texts that emphasize different methods and applications, depending on the authors' research area. There is an increasing emphasis in the economics literature on applying advanced computational/numerical methods and computing resources to model economic dynamics and solve intertemporal and spatial optimization problems. The text by Miranda and Fackler listed below is a widely used text with code provided to implement the methods covered. The text by Stachurski is more oriented toward macroeconomics and the author also provides code on his website.

Miranda and Fackler, Applied Computational Economics and Fincance, MIT Press, 2002.

Stachurski, Economic Dynamics: Theory and Computation, MIT Press, 2009.

A Note on Software

I have used Wolfram Mathematica in much of my work because of its strong advantage relative to other software when working with symbolic representations of theoretical models and deriving analytical conditions. I will demonstrate the utility and power of using such a package in your research. I may also use code I have adapted from the Shone text to demonstrate how to solve some of the kinds of problems covered in the course and construct graphs of numerical solutions.

Becoming adept at using a software package(s) that suits your needs is very wise investment in your research toolkit. *Matlab* is much more widely used by economists, as far as a commercial software package goes. *R* is a powerful open-source package that can be used for numerical computation and dynamic simulation, in addition to its widespread use in econometrics and statistics. *Python* is another option that is also open-source and carries over to many other applications and software development. *Python* and *R* are both widely used in data science and there are many online resources to learn these programming languages and techniques.

I highly recommend the open source online resources available through the *Quantitative Economics* initiative at https://quantecon.org/ that includes lectures, workshop materials and lots of code for Python (and Julia). The materials on using Anaconda to manage open source software packages and Jupyter notebooks are helpful in and of themselves. Jupyter provides a browser-based platform to work in both *R* and *Python* (and many other programming languages).

Assignments/Course Deliverables

All assignments will be posted on Compass2g course website and all submissions will be via upload to Blackboard/Compass2g on the due date. No paper or emailed submissions will be accepted. This helps me keep all of the class related material in one place for grading purposes.

Course Grade

The final course grade will be based on the total points earned from each category below:

1) Journal article presentation 10%
2) Exams (2) 40%
3) Class participation 10%
4) Research project: Proposal, Paper, Presentation 40%

Details for each assignment type will be provided on Compass2g and discussed in class before the due dates.

Exams

There will be 2 exams. The first exam will be given in class and the second will be given during the scheduled final exam time. The focus of the first exam will be on applying dynamic optimization to natural resource problems with an emphasis on setting up continuous time dynamic optimization problems, and deriving and interpreting optimality conditions. The second exam is not comprehensive and will cover material on non-market valuation and other topics covered *after* Exam 1.

Journal Article Presentation

Each student will be responsible for a 20 minute presentation of one of the assigned articles over the course of the semester. The emphasis should be on: (i) the main point of the paper and how author(s) made their point; (ii) contribution of this paper to knowledge/literature; and (iii) limitations of the paper.

The student that presents the reading will also be responsible for leading a discussion of the article in class that day following their presentation. Slide presentations may be used, but this is often not the best medium. Please explore alternative means of lecturing and consider preparing a handout for the class. Grading is based on how clearly the critical issues in the paper are presented, not on how fancy your presentation is. Simply reading slides or a handout will be penalized. A score sheet for your presentations will be distributed.

Electronic versions of any materials presented or handed-out, including any discussion outline/plan prepared for use by the presenter/discussion leader should be submitted to the instructor using the Journal Article Presentation assignment link inside the Compass website.

Class participation

Active engagement during lectures (asking questions, responding to instructor questions, etc.) and classroom discussion of assigned readings is *expected throughout the course*.

Each student must submit 2-3 *substantive* questions that demonstrate a thorough reading of and reflection upon *each* reading at least 1 hour prior to class time (12:30PM) on the day each reading will be discussed in class. Student questions for each class reading must submitted using the appropriate assignment link inside Compass2g for each class when an article will be discussed.

Each day that questions must be submitted, you will be given a score of 0, 1 or 2:
0=failed to submit;
1 = submitted but questions were late or showed little depth;
2 = questions demonstrate that you have given the reading thought.

NOTE: You do not need to submit discussion questions on the day when you are the article presenter/discussion leader.

Research paper requirement

The research paper is 40% of the course grade in ACE 510 and consists of three (3) deliverables:

1.	A research proposal/abstract	October 16
2.	(i) A detailed outline of your paper structure and content	
	(ii) A proposed theoretical model for your research paper	November 8
3.	Complete research paper	
	15 pages, 1" margins, 12pt Times New Roman font, double-spaced	December 11

The intent of the written paper is that students will develop the introduction, literature review, theoretical model with analytical results, and a plan to conduct numerical analysis, simulation or an econometric analysis. As with any research paper you write for a course in graduate school, this research paper could serve as a starting point for your PhD prospectus, a dissertation essay/chapter, or a journal article. Each student will select a topic for their paper based on their own research interests. The paper must be a dynamic analysis that hopefully will include either the use of optimal control theory or dynamic programming techniques.

Each paper will include an introduction stating the motivation for the paper and why a professional economist should be interested in the research. A brief literature review on the chosen topic is a required component of the paper. The literature review cannot be exhaustive given time and page constraints, but is intended to identify the knowledge gap that will be filled by the paper. One pragmatic approach to the literature review could be to focus on previous research that has either been static or otherwise limited in terms of the dynamic problem of

interest. A theoretical model must be constructed and a set of analytical results that interpret the conditions required for optimality should be derived to fulfill the requirements for the paper.

A full-blown empirical analysis or simulation is not expected. You are required to include a (proposed) plan to conduct numerical analysis or a simulation-based study, to support or apply the analytical results from your theoretical model. This should aid intuition (at a minimum) and provide a possible path forward for the paper to be developed further in the direction of becoming a conference paper or research prospectus.

Though not required, any software package can be used to derive analytical results, perform numerical simulations or plot graphs to communicate the findings. Theoretical models and analytical results/interpretation of the theoretical model can be done without the aid of any software package. The professor has limited knowledge of particular software packages and will likely have limited ability to help show you how to use a software package as part of your course research project. He will, however, help students with this task to the extent possible.

Grade Policy

Final grades will be assigned according to the following +/- scale:

Grade	GPA Value	Percentage
A+	4.0	97.0-100
A	4.0	93.0-96.9
A-	3.67	90.0-92.9
B+	3.33	87.0-89.9
B	3.0	83.0-86.9
B-	2.67	80.0-82.9
C+	2.36	77.0-79.9
C	2.0	73.0–76.9
C-	1.67 [lowest grade to receive credit earned grade for CR-NC grade option]	70.0–72.9
D+	1.33	67.0–69.9
D	1.0	63.0–66.9
D-	0.67	60.0–62.9
F	0.0	< 60.0

Tentative Course Schedule/Topics Covered

NOTE: The most current schedule with readings links on Compass2g supersedes this.

Date	Topic	Reading	Deliverable/Note
8/28	Introductions and course overview	Syllabus	
8/30	Property Rights		
9/4	Article 1: Coase, The Problem of Social Cost		
9/6	Dimensionality; continuous dynamic systems		
9/11	Isoclines; phase portraits		
9/13	Optimal control theory		
9/18	Cont'd.; Discrete dynamic systems		
9/20	Cont'd.		
9/25	Bioeconomics of the fishery		
9/27	Article 2: Policy instruments		
10/2	Forestry		
10/4	Article 3: Carbon and/or environmental amenities w/ rotation/harvest decision		
10/9	Water quantity		
10/11	Article 4: Irrigation		
10/16	Water quality		Paper: Topic proposal/abstract due today
10/18	Article 5: Stock pollution control		
10/23	Non-renewable resources		
10/25	Article 6: Backstop technology and/or renewable energy transition		
10/30	Exam 1		
11/1	Non-market valuation: Stated Preferences		
11/6	Article 7		
11/8	Non-market valuation: Revealed Preferences		Paper: Detailed outline and proposed theoretical model due
11/13	Article 8		
11/15	[extra class for schedule adjustments throughout the semester]		
11/20-22	THANKSGIVING BREAK		
11/27	Article9 : Natural Capital		
11/29	Article 10: Sustainability		
12/4	Begin student paper presentations		
12/6	Continue student paper presentations		
12/11	Finish student paper presentations		Paper: due today
TBD	Exam 2 during scheduled final exam period		

Additional Help & Resources
I encourage students to come see me during office hours (or by appointment) if you have questions about the class material or would like to discuss research or other topics relevant to the course subject matter. I want you all to learn the course material and be successful in this class and beyond, and I will work with you to help you succeed. If you don't understand something or find yourself falling behind in the class, I cannot help you if you do not take the initiative to come meet with me.

Academic Integrity
The University of Illinois at Urbana-Champaign Student Code should also be considered as a part of this syllabus. Students should pay particular attention to Article 1, Part 4: Academic Integrity. Read the Code at the following URL: http://studentcode.illinois.edu/

Academic dishonesty may result in a failing grade. Every student is expected to review and abide by the Academic Integrity Policy: http://studentcode.illinois.edu/. Ignorance is not an excuse for any academic dishonesty. It is your responsibility to read this policy to avoid any misunderstanding. Do not hesitate to ask the instructor(s) if you are ever in doubt about what constitutes plagiarism, cheating, or any other breach of academic integrity.

Students with Disabilities
To obtain disability-related academic adjustments and/or auxiliary aids, students with disabilities must contact the course instructor and the as soon as possible. To insure that disability-related concerns are properly addressed from the beginning, students with disabilities who require assistance to participate in this class should contact Disability Resources and Educational Services (DRES) and see the instructor as soon as possible. If you need accommodations for any sort of disability, please speak to me after class, or make an appointment to see me, or see me during my office hours. DRES provides students with academic accommodations, access, and support services. To contact DRES you may visit 1207 S. Oak St., Champaign, call 333-4603 (V/TDD), or e-mail a message to disability@uiuc.edu. http://www.disability.illinois.edu/ .

Emergency Response Recommendations ***Run > Hide > Fight***
If an emergency situation arises, leaving the area quickly is the best option if it is safe to do so [*run*]. When you can't or don't want to run, take shelter indoors [*hide*]. In an extreme safety situation, you may need to fight to increase your chances of survival [*fight*].

Emergency response recommendations can be found at the following website: http://police.illinois.edu/emergency-preparedness/. I encourage you to review this website and the campus building floor plans website within the first 10 days of class. http://police.illinois.edu/emergency-preparedness/building-emergency-action-plans/ .

Family Educational Rights and Privacy Act (FERPA)
Any student who has suppressed their directory information pursuant to Family Educational Rights and Privacy Act (FERPA) should self-identify to the instructor to ensure protection of the

privacy of their attendance in this course. See http://registrar.illinois.edu/ferpa for more information on FERPA.

Expectations, attendance and etiquette

Students are expected to attend every class, and *come to class prepared to learn* having read assigned readings and done other necessary preparation. Students can expect the instructor to come to class prepared to teach and facilitate student learning.

In this course, each voice in the classroom has something of value to contribute. Please take care to respect the different experiences, beliefs and values expressed by students and staff involved in this course. ACE 510 embraces the UI's commitment to diversity, and welcomes individuals of all ages, backgrounds, citizenships, disability, sex, education, ethnicities, family statuses, genders, gender identities, geographical locations, languages, military experience, political views, races, religions, sexual orientations, socioeconomic statuses, and work experiences. Please ***report any incidents of hate or bias*** in this course to your instructor so they can be addressed promptly, or report them Assessment and Response Team (BART) via email mailto: tolerance@illinois.edu or using the form http://go.illinois.edu/intolerance.