ENVR 252 Analysis of Water Resource Systems
Spring 2005

Instructor:
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Class Location and Time: Tue/Thu, 11-12:15pm in McGavran-Greenberg (McG) 2302

Office Hours*:* After class or by appointment

Prerequisites: Calculus and some computational skills (e.g. Excel). Knowledge of a mathematical programming language (e.g., Mathematica, Matlab) would be helpful, but not required. Those that have taken ENVR 291/PLAN 234 will find that background to be useful, but it is not required.

Text: *Water Resource Economics: Scarcity, Policies, and Projects*, Ronald C. Griffin (pre-publication copy, MIT Press), there will also be a number of handouts on various topics

Course Motivation: Water scarcity has become a reality in a growing number of regions throughout the world, as increasing demands associated with population growth and economic development have strained finite water resources. Growing environmental concerns over the maintenance of instream flows and the impacts of large-scale water resource development projects (e.g., dams) have served to further limit, and in some cases even reduce, the volume of available supplies. In addition, research suggests that global climate change may increase hydrologic variability (e.g. more frequent droughts) making the maintenance of water supply reliability even more challenging. This combination of factors has made meeting regional water demands more difficult, and a growing number of regions are seeking water resource strategies that will allow them to meet future water supply goals within budgetary and regulatory constraints. The traditional path of simply developing additional supplies, or expanding existing facilities, is no longer practical in many places. Therefore, planning solutions that involve integrating new development with conservation activities and reallocation (e.g., tradable rights) have become increasingly attractive. The development of such solutions requires the use of tools from both engineering and economics, as well as an understanding of the related legal and political institutions.

Course Objectives: This course is intended to develop a student's ability to quantitatively and qualitatively evaluate approaches to water resource management in terms of their technical feasibility, economic merits, and public policy implications. This will include assessing plans for the development of new infrastructure, as well as the expansion of existing supplies. Economic concepts (e.g., supply, demand, economic efficiency) are discussed, followed by an introduction to methods for computing and maximizing the net benefits of water use. Engineering concepts related to water supply and conveyance, such as hydrologic frequency analysis and pipe/open channel flow, are presented and applied. Both engineering and economic principles are incorporated into optimization exercises (Linear programming, Multi-objective optimization, Lagrangian techniques) that are used as a means of policy analysis. Special effort is made to include consideration of legal, regulatory, and political factors at all levels of this course (i.e. lectures, readings, assignments), with the expectation that students will gain sufficient awareness of these issues to incorporate them into regional water resource analyses.

Course Format:
The multi-faceted nature of the analytical techniques developed in this course do not lend themselves well to examinations, therefore grades will be determined on the basis of student performance on several (4-5) "mini-projects". These will be lengthy and require a substantial amount of forethought regarding problem formulation, solution methods, and assumptions, so please do not wait until the last minute to begin work on them. In addition, there will be group projects in which students will have an opportunity to diagnose and evaluate water resource challenges in a selected region of the basis of technical, economic, and policy-related criteria. Students will then produce a series of recommendations for improved regional water management and defend them in both written and oral presentations. Grades will be based on performance in the mini-projects (50%), final project (40%), and participation in class discussions and activities (10%).

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Date	Lecture #	Title	Remarks
1/13	1	Introduction	Chap. 1
1/18	2	Economic Concepts: Supply & Demand	Chap. 2
1/20	3	Economic Concepts: Supply & Demand	
1/25	4	Benefits, Costs & Net Benefits	
1/27	5	Static Economic Efficiency	
2/1	6	Discount Rates/Dynamic Efficiency	Chap. 3
2/3	7	Dynamic Efficiency	
2/8	8	Maximizing Net Benefits	
2/10	9	Institutions and Policymaking	Chap. 4 & 5
2/15	10	Water Transfers/Markets	Chap. 7
2/17	11	Water Transfers/Markets	Chap. 6
2/23	12	Regional Economic Models of Water Use	
2/25	13	Regional Economic Models of Water Use	Chap 11
3/1	14	Infrastructure/Cost-Benefit Analyses	
3/3	15	Infrastructure/Cost-Benefit Analyses	
3/8	16	Reservoir/Water Supply Planning	
3/10	17	Preliminary Project Presentations	
3/15		**Spring Break**	
3/17		**Spring Break**	
3/22	18	Reservoir/Water Supply Planning	
3/24	19	Linear Programming	Handouts
3/29	20	Linear Programming	
3/31	21	Optimization of Water Supply Systems	
4/5	22	Optimization of Water Supply Systems	
4/7	23	Hydropower, Recreation, Instream Flows	Handouts
4/12	24	Hydropower, Recreation, Instream Flows	
4/14	25	Multi-objective Linear Programming	Handouts
4/19	26	Multi-objective Linear Programming	
4/21	27	Optimization of Regional Water Resource Sys	
4/26	28	Optimization of Regional Water Resource Sys	
4/28	29	Final Project Presentations	