Global Water Resources
Geography 14: Winter 2015
10A (T & Th: 10-11:50)

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Office Hours: Monday and Tuesday 1-2
Course Information: canvas.dartmouth.edu

COURSE DESCRIPTION

This course covers the political, social, and legal aspects of water resources management both domestically and internationally. The material and course lectures emphasize that water-related issues occur in a socio-political arena such that effective management and policy formulation requires a technical as well as a social framework. The allocation of water has evolved to meet the greater demands for an array of historical uses, such as agriculture and industry, and for recent environmental uses such as in-stream flow benefits and the protection of endangered aquatic species. Because water use and supply vary regionally across the US, it is fundamental to establish the historical, institutional, and legal history associated with the allocation of this scarce resource. Allocation is complicated by water's dual perception as both a common property resource and as private property subject to laws of the market, and this course covers the emergence of environmental economics and cost-benefit analysis in the pricing of water and the market failures often associated with water allocation. Internationally, strong differences in water use exist between more developed and less developed nations resulting in a broad range in water footprints. Water development has often gone hand-in-hand with plans for economic development, and this course covers the role of large dams in the development process as well as the economic, social, and environmental impacts of large dams. The construction of these large dams has led to considerable water conflict, and in the last part of the class, we cover the broader dimensions of hydro-politics and the associated international mitigation strategies. Lastly, we address future issues of water development especially in the context of potential problems arising from predicted climate change scenarios.

GRADING AND COURSE REQUIREMENTS

Your grade will be derived from a mixture of exams, projects/papers, and class participation/discussion. There will be a midterm during the fifth week of classes and it will account for 30% of your grade. There will be a non-cumulative final during the regularly scheduled final exam period (Saturday, March 14th at 11:30), and it will represent 30% of your final grade. No make-ups will be given for either test. There is one paper for this class. The research paper represents 30% of your grade and will consist of a 14-page paper on a topic of your choice. The topic must be approved by me by February 19th and is due on Tuesday, March 10th. There will be no extensions for the research paper nor any make-ups for the exams. Periodically, we will use part of the lecture as a discussion period. Students will be required to summarize one of the discussion articles and add it to the course blog. More details about the blog will be presented in class. Classroom participation (including article summary) will account for 10% of your grade.

BOOKS:

Rogers, P., 1993. America's Water: Federal Roles and Responsibilities, MIT Press, Cambridge, MA, 285 pp. (listed as "AW" in the readings).
Richter, B., 2014, Chasing Water: A Guide for Moving from Scarcity to Sustainability, Island Press, 171 pp. (listed as "CW" in the readings)
Gleick, P., 2010, Bottled and Sold: The Story Behind Our Obsession with Bottled Water, Island Press, 232 pp. (listed as "BAS" in the readings).

SYLLABUS

Week 1: Hydrology and The Physical Dimensions of Water

I. Water in the Environment
   A. Fundamentals of Hydrology
   B. Water Pathways, Distribution, and Use
   C. The Hydrologic Cycle

Readings:

Amid Texas Drought, High-Stakes Battle Over Water (URL) (1/6)
Texas Drought Forces a Town to Sip From a Truck (URL) (1/6)
The New 'It' Thing in Texas: A Well (URL) (1/6)
Chap 1: The Water Cycle (1/8) CANVAS
Chap. 6: Description of Runoff Processes (1/8) CANVAS
Chap. 7: Ground Water (1/8) CANVAS
AW: Chaps. 1 and 2 (1/8)
CW: Chap. 2 (1/8)
Dallas, R., 1990, The agricultural collapse of the arid Midwest, *Geographical Magazine*, 62:16-20 (1/8) CANVAS

Week 2: Domestic and International Supply/Use of Water

I. Domestic Supply and Use of Water
   A. Consumptive Use
   B. Withdrawals
      l. Domestic
      2. Industrial
      3. Irrigation

II. Water Supply and Use in the Developing World

   A. Historical Dimensions
   B. Water and Socio-Economic Development
   C. Institutional Development
   D. Where Does My Water Come From?
   E. Where Does Other People's Water Come From?

Readings:

Gleick, P. *Bottled and Sold* (1/13)
AW: Chap. 3 (1/13)
Hoekstra, A.Y. and Chapagain, A.K., 2006, Water footprints of nations: Water use by people as a function of their consumption pattern, *Water Resources Management*, 21(1): 35-48. (1/13)
Maxwell, S. 2010, The concept of virtual water: understanding our real water use." *Journal American Water Works Association,* 102(12): 88-90 (1/13)
CW: Chap. 4 (1/13)
Brookshire and Whittington, 1993, Water resources in the developing countries, *Water Resources Research,* 29:1883-88 (1/15)
Howe and Dixon, 1993, Inefficiencies in water project design and operation in the Third World: An economic perspective, *Water Resources Research* 29:1889-94 (1/15)
Ostrom, E., 1993, Design principles in long-enduring irrigation institutions, *Water Resources Research*, 29:1907-12 (1/15)
Sorenson, S.B., Morssink, C., and Campos, P.A., 2011, Safe access to safe water in low income countries: Water fetching in current times, *Social Science & Medicine*, 72: 1522-1526 (1/15)
White, G.F., 1989, A global perspective on water resources, *National Forum, Phi Kappa Phi Journal*, Winter/1989: 32-35 (1/15) CANVAS
Kompaore, S., 1989, Women as managers of village water resources, *Natural Resources Forum*, Nov., pp. 319-321 (1/15) CANVAS

Week 3: **Managing a Scarce Resource**

I. Problems Limiting Effective Water Management
   A. Water as a Scarce/non-Scarce Resource
   B. Water as Common Property
   C. Water Pricing

Readings:

Rogers, P., 1986, Water: Not as cheap as you think, *Technology Review*, 89(8): 30-43 (1/20)
Frederick, K.D., 1984, Current water issues, *Journal of Soil and Water Conservation,* 39:86-91 (1/20)
Olsenius, C., 1987, Tomorrow's Water Manager, *Journal of Soil and Water Conservation*, 42: 312-315. (1/20)
The Coming Global Water Crisis (URL) (1/20)
Rogers, P., 1983, The Future of Water, *The Atlantic Monthly*, July 1983, pp. 80-92 (1/20) CANVAS
Rijsberman, Frank R., 2006. Water scarcity – Fact or fiction? *Agricultural Water Management* 80: 5-22 (1/20)
Postel, S.L., 2000, Entering an era of water scarcity: The challenges ahead, *Ecological Applications,* 10(4): 941-948 (1/22)
Los Angeles, City of Water (URL) (1/22)
AW: Chaps. 4 and 5 (1/22)
CW: Chap. 3 (1/22)

Week 4: **Environmental Economics and Benefit-Cost Analysis**

I. Natural Resource Economics
    A. Market Mechanics
    B. Externalities
    C. Defining Costs and Benefits
        l. Economic
        2. Social
        3. Opportunity Costs
    D. Role of Benefit-Cost Analysis in Environmental Analysis

Readings:

AW: Chap. 6 (1/27)
Schulze, P., 1991, Incorporation of environmental damages into cost-benefit analysis, *Bulletin of the Ecological Society of America*, 72: 15-19 (1/27)
Krutilla, J.V. and Fisher, A.C., 1975, Externalities, property rights, and valuation of resources on the public lands, The Economics of Natural Environments, (Chap. 2), pp. 19-38. (1/27) CANVAS
The Economist, 1991, Of bees and lighthouses (1/27) CANVAS
Lee, L.K. and Nelson, 1987, The extent and costs of groundwater contamination by agriculture, *Journal Soil & Water Conservation*, 42: 243-248. (1/29)
Colby, B.G., 1990, Enhancing instream flow benefits in an era of water marketing, *Water Resources Research,* 26: 1113-1120 (1/29)
Risk of Cheap Water (URL) (1/29)
Where Grass Is Greener, a Push to Share Drought's Burden (URL) (1/29)
Gardner, B.D. and Huffaker, R.G., 1988, Cutting the loss from federal irrigation water subsidies, *Choices* (The Magazine of Food, Farm, and Resource Issues): 24-26. (1/29) CANVAS
National Academy of Sciences, 1996, The Future of Irrigation (Chapter 1). *From: A New Era for Irrigation*, pp. 8-19 (1/29) CANVAS

Week 5: **Legal Background of Water Policy**

I. Water Law
    A. History
    B. Key Legislation
    C. Regional Differences
        1. Eastern Riparian Doctrine
        2. Western Prior Appropriation
    D. Surface Water vs. Groundwater Law
    E. Water in the West
    F. Native American Reserved Rights to Water

Readings:

AW: Chaps. 3 and 7 (2/3)
Jensen, D.W., 1977, Some legal aspects of water resources management, *Public Administration Review*, pp. 456-461. (2/3)

Hansen, S. and Marsh, F., 1982, Arizona ground water reform: innovations in state water policy, *Ground Water*, 20:67-72. (2/3)
Brajer et al., 1989, The strengths and weaknesses of water markets as they affect water scarcity and sovereignty interests in the West, *Natural Resources Journal,* 29(2), 489-509. (2/5)
Gardner, B.D., 1987, Removing impediments to water markets, *Journal Soil & Water Conservation*, 42(6): 384-388 (2/5)
Lewotsky, K., 1988, Water in the West, The Missouri River Brief Series. CANVAS (2/5)
Lewotsky, K. 1988, Indian reserved water rights, The Missouri River Brief Series. CANVAS (2/5)
McCool, D., 1993, Indian water settlements: the prerequisites of successful negotiation, *Policy Studies Journal*, 2: 227-42. (2/5)
Brown, I.L. and Ingram, The rising commodity value and view of water, In: Water and Poverty in the Southwest. CANVAS (2/5)

Week 6: Water Basin Management in the U.S.

I. History of Federal Resources Management
II. Key Legislation
III. Local vs. Regional vs. National Water Management
IV. Water Institutions

Readings:

AW: Chap. 8 (2/10)
Wandschneider, 1984, Managing River Systems: Centralization versus Decentralization, *Natural Resources Journal*, 24: 1043-65.
Pisani, D.J., 2003, Federal reclamation and the American West in the Twentieth Century, *Agricultural History*, 77: 391-419 (2/10)
Lord, W. B. 1979. Conflict in federal water resource planning, *Water Resources Bulletin*, 15(5): 1226–1235 (2/10)
White, G. F., 1957, A perspective of river basin development*, Law and Contemporary Problems* 22(2): 157-187 (2/10)
Fort, D., 1991, Federalism and the prevention of groundwater contamination, *Water Resources Research*., 27: 2811-17 (2/12)
Lemarquand, D. (1989). Developing river and lake basins for sustained economic-growth and social progress, *Natural Resources Forum* 13(2): 127-138 (2/12)
Reisner, M., Introductory Chapter & Chapter 3. In, *Cadillac Desert: The American West and Its Disappearing Water* (2/12)
Moore, M.R., 1991, The Bureau of Reclamation's new mandate for irrigation water conservation: purposes and policy alternatives, *Water Resources Research,* 27: 145-155 (2/12)

Week 7: Dams

I. Environmental Impacts of River Regulation
II. How Much Water Does A River Need?
III. Dams as Monuments/Icons of Development

Readings:

Ortolano, L. and Cushing, K., 2002, Grand Coulee Dam 70 Years Later: What Can We Learn? *Water Resources Development*, 18(3): 373-390 (2/17)

Barrow, C., 1988, The impact of hydroelectric development on the Amazonian environment: with particular reference to the Tucurui Project, *Journal of Biogeography,* 15: 67-78 (2/17)

McCool, D., 2005, The river commons, *Texas Law Review*, 38:1903-1927 (2/17)

Brismar, A., 2002, River systems as providers of goods and services: a basis for comparing desired and undesired effects of large dam projects, *Environmental Management*, 29(5): 598–609 (2/19)

Ansar, A., Flyvbjerg, B., Budzier, A., & Lunn, D., 2014, Should we build more large dams? The actual costs of hydropower megaproject development. *Energy Policy*, 69: 43-56 (2/19)

Poff, N. L., Allan, J. D., Palmer, M. A., Hart, D. D., Richter, B. D., Arthington, A. H., ... & Stanford, J. A., 2003, River flows and water wars: emerging science for environmental decision making. *Frontiers in Ecology and the Environment*, *1*(6), 298-306.

Brazil Weighs Costs and Benefits of Alliance With China (URL) (2/19)

Week 8: HydroPower, Hydropolitics, and Global Water Issues

I. Water Conflicts
II. Riparian Nations and Hydropolitics
III. Water "Wars" vs. Water Negotiations
IV. Water and Energy Development in the Developing World

Readings:

Freeman, K., 2001, Water Wars? Inequalities in the Tigris-Euphrates River Basin. *Geopolitics* 6(2): 127-140 (2/24)

Hellier, C., 1990, Draining the rivers dry, *Geographical Magazine*, (July), 62(7): 32-35 (2/24)

Anderson, E.W., 1991, White Oil, *Geographical Magazine*, (February), 63(2): 10-14 (2/24)

Postel, Sandra L. and Wolf, A.T., 2001, Dehydrating Conflict, *Foreign Policy* 126 (2/24)

Harris, L. M., 2002, Water and conflict geographies of the Southeastern Anatolia Project, *Society & Natural Resources*, 15(8): 743-759. (2/26)

Sneddon, C., & Fox, C. (2011). The Cold War, the US Bureau of Reclamation, and the technopolitics of river basin development, 1950–1970. *Political Geography*, *30*(8), 450-460 (2/26)

Week 9: 21st Century Water Policy

I. Climate Change and Water Availability
II. Developing New Strategies for Effective Water Management

Readings:

CW: Chaps. 5 and 6 (3/3)

Gleick, P., 2000, A Look at twenty-first century water resources development, *Water International*, 25(1): 127 – 138 (3/3)

Kundzewicz, Z. W., L. J. Mata, et al., 2008, The implications of projected climate change for freshwater resources and their management. *Hydrological Sciences Journal-Journal Des Sciences Hydrologiques* 53(1): 3-10 (3/3)
Milly, P. C. D., K. A. Dunne, et al., 2005, Global pattern of trends in streamflow and water availability in a changing climate. *Nature* 438(7066): 347-350 (3/5)
Oki, T. and Kanae S., 2006, Global hydrological cycles and world water resources, *Science* 313(5790): 1068-1072 (3/5)
Kanae, S., 2009, Global warming and the water crisis, *Journal of Health Science*, 55:860-864 CANVAS (3/5)
Vorosmarty, C.J. and Sahagian, D., 2000, Anthropogenic disturbance of the terrestrial water cycle, *BioScience,* 50(9): 753-765 (3/9)

SUGGESTED (BUT NOT REQUIRED) READINGS:

Week 2:

Dankelman, I., 1988, The Invisible Water Managers, In: Women and the Environment in the Third World, pp. 29-41. UN Inter-Regional Seminar on Rural Water Supply, 1980, Water Supply and Health, pp. 34-57.
Fass, S.M., 1993, Water and Poverty: Implications for Water Planning, *Water Resources Research*, 29:1975-81.
Ray, I., 2007, Women, water and development. *Annual Review of Environment and Resources*, 32:421-449.
Whittington, D., Okorafor, A., Okore, A., and McPhail, A., 1990, Strategy for cost recovery in the rural water sector: A case study of Nsukka District Anambra State, Nigeria, *Water Resources Research*, 26: 1899 - 1913.
Turton, Anthony et al. 2001. Feminization as a critical component of the changing hydrosocial contract. *Water Science and Technology*, 43(4): 155-163
Seager, J., 2008, Expert group meeting: Gender-disaggregated data on water and sanitation. http://www.womenforwater.org/docs/UNW-DPC_KnowledgeReportNo.1.pdf
Shah, A., 2002, Women, water, irrigation: respecting women's priorities, *Economic and Political Weekly,* 37, 4413-4420.

Week 3:

Page, B. 2005, Paying for water and the geography of commodities. *Transactions of the Institute of British Geographers*, 30: 293-306.
Gandy, M. 1997, The making of a regulatory crisis: restructuring New York City's water supply, *Transactions; Institute of British Geographers,* 22: 338-358.
Alatout, S. 2007. State-ing natural resources through law: the codification and articulation of water scarcity and citizenship in Israel. *Arab World Geographers*, 10(1): 16-37.
Alatout, S. 2008. 'States' of Scarcity: Water, Space, and Identity Politics in Israel, 1948-1959. *Environment and Planning D: Society and Space*, 26 (6): 959-982.

Week 4:

Glynn, S., 1996, Ethical issues in environmental decision making and the limitations of Cost/Benefit Analysis (CBA), *Ethics and the Environment*, 1:27-39.

Week 5:

Tarlock, AD, 2010, Tribal Justice and Property Rights: The Evolution of Winters v. United States, *Natural Resources Journal*, 50 (2): 471-499.

Shapiro, K., 1987, An argument for the marketability of Indian reserved water rights: tapping the untapped reservoir, *Idaho Law Review*, 23:277-91.

Bauer, C, 2004, Results of Chilean water markets: Empirical research since 1990, *Water Resources Research*, Vol.40, W09S06, doi:10.1029/2003WR002838.

Connall, D. D. Jr., 1982. A History of the Arizona Groundwater Management Act, *Arizona State Law Journal* 14(2) Spring 1982, pp. 313-344.

Colby, B., Crandall, K., and Bushm D., 1993, Water Right Transactions: Market Values and Price Dispersion, *Water Resources Research*, 29:1565-1572.

Hundley, N., 1988, The Great American Desert transformed: aridity, exploitation, and imperialism in the making of the modern American West, In M.T. El-Ashry and D.C. Gibbons (eds.), Water and arid lands of the Western U.S., Cambridge University Press, pp. 21 - 83 (CANVAS)

National Resources Council, 1992, Water Transfers in the West: Efficiency, Equity, and the Environment, Chap. 1 ("Summary"), Chap. 2 ("Third Party Impacts and Opportunities"), and Chap.3 ("Conclusions and Recommendations"), National Academy Press, Washington, D.C.

Week 6:

Fessler, J. W. 1973, The basic theoretical question: How to relate area and function, *Current Issues In Public Administration*, St. Martin's Press, pp. 126-135.

Huffman, J.L., 2009, Comprehensive river basin management: the limits of collaborative, stakeholder-based, water governance, *Natural Resources Journal*, 49 (1): 117-149

Week 7:

Fleischer, T., 1993, Jaws on the Danube: water management, regime change and the movement against the Middle Danube Hydroelectric dam, *International Journal of Urban and Regional Research,* 17:431-443.

Petts, G.E., 1990, Regulation of larger rivers: problems and possibilities for environmentally-sound river development in South America, *Interciencia*, 15: 388-395.

Week 8:

Bauer, C, 2005, In the image of the market: The Chilean model of water resources management, *International Journal of Water*, 3(2): 146-165.

Week 9:

Pahl-Wostl, C., D. Tabara, et al., 2008, The importance of social learning and culture for sustainable water management, *Ecological Economics* 64(3): 484-495.

Sabo, J. L., T. Sinha, et al., 2010, Reclaiming freshwater sustainability in the Cadillac Desert." Proceedings of the National Academy of Sciences of the United States of America 107(50): 21263-21270.