

Water Management & Policy: The Water-Energy-Food Nexus
Spring Semester 2016, Seminar: Thursdays, 12:30-3:00PM, ENR2 Building, Room S223

Instructor

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Course summary

This seminar provides participants with a global overview of water management and policy challenges. Emphasis is placed on the water-energy-food nexus. Related topics include options and alternatives for managing demands for water for agriculture and urban growth in order to conserve critical ecosystems.

New insights on the coupled linkages between water, energy, and food have moved “nexus assessment” beyond straightforward resource quantification, e.g., water-for-energy coefficient analysis. In the context of global change (including climate change, rapid urbanization, and global markets for energy, biofuels, and food), research and decision-making on nexus coupling increasingly focuses on:

- spatial patterns of water, food, and energy use (source to consumption),
- mutual influences between energy, agricultural, and water policy and planning,
- internalizing ‘externalities’ (unintended consequences—indeed reinterpretation—of ‘waste, including deferred impacts), and
- policy formulation (with emphasis on global change adaptation involving water, energy, and food that does not undermine long-term mitigation)

The seminar addresses the following list of topics:

- the energy futures to meet agricultural and urban water demand,
- water resources needs for power generation using conventional fuels and renewables,
- the implications and role of water and agriculture in the emerging carbon-neutral economy,
- comparative energy- and water-based perspectives on efficiency and conservation, and
- co-production of research and policy-making on water, energy, and food.

While the primary focus is on applied assessment of the drivers and potential solutions to challenges encountered, the theoretical underpinnings are strongly informed by coupled natural and human systems, resilience theory, ecohydrology, and stakeholder-based policy analysis. As a result, seminar participants will be exposed to physical and social science approaches to water management and policy. Participants interested in exploring specific topics in greater detail, or related issues not covered in the syllabus, are encouraged to meet with the instructor. To the degree possible, students should build synergies between their term paper for this seminar and their ongoing or planned Masters or Doctoral research.

We follow a seminar format in which participants play a central role in leading discussions. Individually or in groups of two, students must lead discussion of two topics of their interest from the syllabus, and if applicable, help to host the guest speaker on the day of their session. Discussion leaders may, in advance of their selected sessions and with the concurrence of the instructor, identify and assign additional material for all participants to read.

Course materials - Reading materials will be posted on the course D2L site.

Grading policy

Grades are based on regular participation in the seminar (both as discussion leader and active participant in discussions led by others) and submission of the abstract and full version of your research paper. Absences for important study, work, and life events should be cleared with the instructor in advance.

Grades are based on regular participation in seminar discussions, Using the rubrics below, regular grades (A, B, C, D, or E) will be awarded upon completion of the seminar.

Seminar participation (total 40%) based on:

20% - Lead discussions of readings

Expectation for A-grade

Clearly relate theory/ main argument to broader context, prepare written questions/commentary (1-page per student per session selected) for discussion & conceptual development.

20% - Join discussions led by others

Insightful comments showing you have read the material.

Research paper (total 60%) based on:

20% - Abstract & prelim. lit review (due 2/11)

Expectation for A-grade

Descriptive title, articulate research question, 10 annotated references (not including seminar readings).

40% - Final paper (due 4/28)

Review literature, identify theoretical/ conceptual gaps in which to situate your research, demonstrate analytical rigor, relate findings/ discussion to theory and concept, explore ways forward/ next steps.

Guest speakers

Robert Varady, Interim Director & Research Professor of Environmental Policy, Udall Center for Studies in Public Policy, University of Arizona

Lily House-Peters, PhD Candidate, School of Geography & Development, University of Arizona

Gary Nabhan, Director, Center for Regional Food Studies, University of Arizona

Carl Bauer, Associate Professor, School of Geography & Development, University of Arizona

Asia Philbin, Marana Water, Marana, Arizona

Gregg Garfin, Associate Professor, School of Natural Resources & Environment, University of Arizona

Requirements

Course participants must write an original research paper that is conceptualized and researched as part of the course. Term papers are expected to be a minimum of 20 pages double-spaced (not counting pages listing references; however, a consistently formatted reference section is required). Primary data collection (including as part of students' ongoing Masters or PhD research) is encouraged but not required.

Additionally, students must lead discussion of two topics of their interest from the syllabus.

There is no pre-requisite for this course.

Final note

All information contained in this syllabus (except the grading policy) may be subject to change with reasonable advance notice, and considering student input

SCHEDULE of TOPICS (subject to revision as agreed/ announced)

Date	Topic	Reading / Notes
Week 1. 1/14/16	Global grand challenges: mutual human-environment interactions	<p>Reid, W.V., D. Chen, L. Goldfarb, H. Hackmann, Y.T. Lee, K. Mokhele, E. Ostrom, K. Raivio, J. Rockström, H.J. Schellnhuber, A. Whyte. 2010. Earth system science for global sustainability: grand challenges. <i>Science</i> 330: 916-917.</p> <p>Young, O.R., L. A. King, H. Schroeder. 2008. "Summary for policy makers" (pp. xiii-xix) in <i>Institutions and Environmental Change: Principal Findings, Applications, and Research Frontiers</i>. MIT Press, Cambridge, MA.</p>
Week 2. 1/21/16	Water management and policy framing concepts ("paradigms"): overview past and present	<p><u>Water supply, sanitation, and hygiene (WASH)</u> Salaam-Blyther, T. 2012. Global access to clean drinking water and sanitation: US and international programs. Congressional Research Service R42717, Washington DC. [Read pp. i-10, 20-23] Sachs, J.D. 2012. From Millennium Development Goals to Sustainable Development Goals. <i>Lancet</i> 379: 2206-2211.</p> <p><u>River-basin infrastructure and development</u> Wittfogel, K. 1957. <i>Oriental Despotism</i>. Pergamon, New York [selections] White, G.F. 1963. Contributions of Geographical Analysis to River Basin Development. <i>The Geographical Journal</i> 129(4): 412-432. doi:10.2307/1794656.</p> <p><u>Integrated water resources management (IWRM)</u> Tortajada, C. 2014. IWRM revisited: from concept to implementation. <i>International Journal of Water Resources Development</i> 30(3): 361-363. Pahl-Wostl, C., J. Sendzimir. 2005. The relationship between IWRM and adaptive water management. NeWater Working Paper 3.</p> <p><u>Adaptive water management and governance</u> Huitema, D., E. Mostert, W. Egas, S. Moellenkamp, C. Pahl-Wostl, R. Yalcin. 2009. Adaptive water governance: assessing the institutional prescriptions of adaptive (co-) management from a governance perspective and defining a research agenda. <i>Ecology & Society</i> 14(1): 26</p>
Week 3. 1/28/16	<p>Water security: passing fad or durable concept?</p> <p><i>Note: Instructor will be on travel; 12:30-2:00 will be in-class student discussion of last week's (1/21) readings, followed by guest lecture starting at 2:00</i></p>	<p>[2:00-3:00] Guest speaker: Robert Varady, Udall Center Varady, R.G., K. Meehan, J. Rodda, E. McGovern, M. Iles-Shih. 2008. Strengthening global water initiatives. <i>Environment: Science and Policy for Sustainable Development</i> 50(2): 18-31.</p> <p>Scott, C.A., F.J. Meza, R.G. Varady, H. Tiessen, J. McEvoy, G.M. Garfin, M. Wilder, L.M. Farfán, N. Pineda Pablos, E. Montaña. 2013. Water security and adaptive management in the arid Americas. <i>Annals of the Association of American Geographers</i> 103(2): 280-289, doi: 10.1080/00045608.2013.754660.</p> <p>Garfin, G.M., P. Romero-Lankao, R.G. Varady. 2013. Editorial: Rethinking integrated assessments and management projects in the Americas. <i>Environmental Science and Policy</i> 26 (Feb.): 1-5. http://dx.doi.org/10.1016/j.envsci.2011.12.010.</p>

Week 4. 2/4/16	The water-energy-food nexus: resources, institutions, security	<p>Scott, C.A., M. Kurian, J.L. Wescoat, Jr. 2015. The Water-energy-food nexus: Adaptive capacity to complex global challenges. In M. Kurian and R. Ardakanian (eds.). <i>Governing the Nexus: Water, Soil and Waste Resources Considering Global Change</i>, Springer, Berlin, pp. 15-38.</p> <p>Allan, T., M. Keulertz, E. Woertz. 2015. The water-food-energy nexus: An introduction to nexus concepts and some conceptual and operational problems. <i>International Journal of Water Resources Development</i> 31(3): 301-311.</p> <p>Mayor, B, E. López-Gunn, F.I. Villarroya, E. Montero. 2015. Application of a water–energy–food nexus framework for the Duero river basin in Spain. <i>Water International</i> 40: 791-808 doi:10.1080/02508060.2015.1071512</p> <p><i>Recommended:</i></p> <p>Carter, N. T., 2010. <u>Energy's Water Demand: Trends, Vulnerabilities, and Management</u>. Congressional Research Service, Washington, DC</p>
Week 5. 2/11/16	The conventional water-energy nexus: coupled resources, decoupled policy	<p><u>Term paper abstract & preliminary literature review due via email.</u></p> <p>Holland, RA et al. 2015. Global impacts of energy demand on the freshwater resources of nations. <i>PNAS</i> Nov. 16, 2015, E6707-6716. www.pnas.org/cgi/doi/10.1073/pnas.1507701112</p> <p>Hoff, H. 2011. Understanding the Nexus, Background Paper for the Bonn 2011 Conference: The Water, Energy and Food Security Nexus. Stockholm Environment Institute, Stockholm.</p> <p>Scott, C.A., M.J. Pasqualetti. 2010. Energy and water resources scarcity: Critical infrastructure for growth and economic development in Arizona and Sonora. <i>Natural Resources Journal</i> 50(3): 645-682.</p>
Week 6. 2/18/16	<p>Water for energy: carbon and nuclear legacies</p> <p><i>Note: Wed. 2/17, 9:30-12:30, students invited to Doubletree Hotel – “Water, energy, food” panel session and science-policy dialogue as part of “Open Knowledge: Bridging Perspectives to Address Water Challenges.”</i></p>	<p>Hightower, M., S.A. Pierce. 2008. The energy challenge. <i>Nature</i> 452(20): 285-286.</p> <p>Floerke, M., E. Teichert, I. Baerlund. 2011. Future changes of freshwater needs in European power plants. <i>Management of Environmental Quality</i> 22 (1): 89-104.</p> <p>Government Accountability Office (GAO). 2009. Energy-water nexus. improvements to federal water use data would increase understanding of trends in power plant water use. GAO-10-23. GAO, Washington, DC. 73 pp.</p> <p>Sovacool, B. K., and K. E. Sovacool. 2009. Identifying future electricity–water tradeoffs in the United States. <i>Energy Policy</i> 37: 2763–2773.</p>
Week 7. 2/25/16	The nexus: reconsidering environmental security and adaptive capacity	<p><u>Guest speaker: Lily House-Peters, School of Geography & Development</u></p> <p>de Grenade, R., C.A. Scott, L. House-Peters, B. Thapa, M. Mills-Novoa, A. Gerlak, K. Verbist. Manuscript in review. The nexus: Reconsidering environmental security and adaptive capacity. For submission to <i>Current Opinion in Environmental Sustainability</i>.</p> <p>Allouche, J., C. Middleton, D. Gyawali. 2015. Technical veil, hidden politics: Interrogating the power linkages behind the nexus. <i>Water Alternatives</i> 8(1): 610-626.</p>

Week 8. 3/3/16	Comparative perspectives and Efficiency and conservation	Hussey, K., J. Pittock. 2012. The Energy–Water Nexus: Managing the Links between Energy and Water for a Sustainable Future. <i>Ecology and Society</i> 17(1): 31. http://dx.doi.org/10.5751/ES-04641-170131 . Richter, B. 2010. "Efficiency: the first priority" (pp. 94-121) in <i>Beyond Smoke and Mirrors: Climate Change and Energy in the 21st Century</i> . Cambridge University Press, Cambridge. Jenkins, Matt. 2007. The efficiency paradox. <i>High Country News</i> Vol. 2 No. 39 February 5, 2007.
Week 9. 3/10/16	Food systems: security and beyond	Guest speaker: Gary Nabhan, Director, Center for Regional Food Studies, University of Arizona Nabhan, G.P., 2013. <i>Growing food in a hotter, drier land: lessons from desert farmers on adapting to climate uncertainty</i> . Chelsea Green Publishing [selected readings]
3/17/16	No seminar	Spring Break
Week 10. 3/24/16	Hydropower and the large dams debate	Guest speaker: Carl Bauer, School of Geography & Development World Commission on Dams (WCD). 2000. <i>Dams and Development: A New Framework for Decision-Making – Overview</i> . WCD. Dubash, N.K., M. Dupar, S. Kothari, T. Lissu. 2001. <i>A Watershed in Global Governance? An Independent Assessment of the World Commission on Dams - Executive Summary</i> . Washington, DC: World Resources Institute, Lokayan, and Lawyers' Environmental Action Team. Moore, D., J. Dore, D. Gyawali. 2010. The World Commission on Dams + 10: Revisiting the large dam controversy. <i>Water Alternatives</i> 3(2): 3-13. Bauer, C.J. 2009. Dams and markets: rivers and electric power in Chile. <i>Natural Resources Journal</i> 49: 583-651. Ahlers, R., J. Budds, D. Joshi, V. Merme, M. Zwarteveen. 2015. Framing hydropower as green energy: assessing drivers, risks and tensions in the Eastern Himalayas. <i>Earth System Dynamics</i> 6:195-204. doi: 10.5194/esd-6-195-2015.
Week 11. 3/31/16	The groundwater irrigation – electrical power nexus	Scott, C.A. 2011. The water-energy-climate nexus: resources and policy outlook for aquifers in Mexico. <i>Water Resources Research</i> 47, W00L04, doi: 10.1029/2011WR010805. Shah, T. 2009. Wells and welfare", "Diminishing returns?", "Can the anarchy be tamed?" (pp. 91-150, 187-207) in <i>Taming the Anarchy: Groundwater Governance in South Asia</i> . RFF Press, Washington DC. Kumar, M.D. 2005. Impact of electricity prices and volumetric water allocation on energy and groundwater demand management: analysis from Western India. <i>Energy Policy</i> 33(1): 39-51. Scott, C.A., T. Shah. 2004. Groundwater overdraft reduction through agricultural energy policy: insights from India and Mexico. <i>International Journal of Water Resources Development</i> 20(2): 149-164.
Week 12. 4/7/16	The urban water-energy-agriculture nexus	Guest speaker: Asia Philbin, Marana Water Brown, R.R., L. Sharp, R.M. Ashley. 2006. Implementation impediments to institutionalising the practice of sustainable urban water management. <i>Water Science & Technology</i> 54(6–7): 415–422.

		<p>Eden, S., C.A. Scott, M.L. Lamberton, S.B. Megdal. 2011. Energy-water interdependencies and the Central Arizona Project. In D. Kenney and R. Wilkinson (eds.) <i>The Water-Energy Nexus in the American West</i>, Edward Elgar, Cheltenham, UK, pp. 109-122.</p> <p>Ward, S., D. Butler, S. Barr, F.A. Memon. 2009. A framework for supporting rainwater harvesting in the UK. <i>Water Science & Technology</i> 60(10): 2629-2636.</p>
Week 13. 4/14/16	Energy and water for global change adaptation and mitigation	<p><u>Guest speaker: Gregg Garfin, School of Natural Resources & Environment, and Institute of the Environment</u></p> <p>Overpeck, J. et al. 2013. "Summary for Decision Makers". In <i>Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment</i>, edited by G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy, 1–20. A report by the Southwest Climate Alliance. Island Press, Washington, DC.</p> <p>Garfin, G., M.A. Crimmins, and K.L. Jacobs. 2007. "Drought, climate variability, and implications for water supply and management" (pp. 61-78) in B.G. Colby and K.L. Jacobs (eds.), <i>Arizona Water Policy. Resources for the Future Press, Washington DC.</i></p>
Week 14. 4/21/16	Renewable energy: the water-land nexus, food-biofuels tradeoffs?	<p>De Perthuis, C. 2011. "Building a low-carbon energy future" (pp. 57-87) in <i>Economic Choices in a Warming World</i>. Cambridge University Press, Cambridge.</p> <p>Richter, B. 2010. "Renewables" and "Biofuels" (pp.150-183) in <i>Beyond Smoke and Mirrors: Climate Change and Energy in the 21st Century</i>. Cambridge University Press, Cambridge.</p> <p>National Research Council. 2007. <i>Water Implications of Biofuels Production in the United States</i>. National Academies Press, Washington, DC.</p> <p>Varghese, S. 2007. <i>Biofuels and global water challenges</i>. Institute for Agriculture and Trade Policy, Minneapolis.</p>
Week 15. 4/28/16	Synthesis and seminar wrap-up: revisit principal water management & policy concepts (from start of seminar) in light of nexus thinking	<p><i>Final term papers due by email</i></p> <p><u>Water supply, sanitation, and hygiene (WASH)</u> Biggs E. M. et al. 2015. Sustainable development and the water–energy–food nexus A perspective on livelihoods. <i>Environmental Science and Policy</i> 54:389-397.</p> <p><u>River-basin infrastructure and development</u> Lawford, R. et al. 2013. Basin perspectives on the water-energy-food security nexus. <i>Current Opinion in Environ. Sustainability</i> 5: 607-616.</p> <p><u>Integrated water resources management (IWRM)</u> Benson, D., A.K. Gain, J. Rouillard. 2015. Water governance in a comparative perspective: From IWRM to a 'nexus' approach? <i>Water Alternatives</i> 8(1): 756-773.</p> <p><u>Adaptive water management and governance</u> Muller M. 2015. The 'nexus' as a step back towards a more coherent water resource management paradigm. <i>Water Alternatives</i> 2015, 8(1): 675-694.</p> <p><u>Water security</u> Rasul G. 2014. Food, water, and energy security in South Asia: A nexus perspective from the Hindu Kush Himalayan region. <i>Environmental Science and Policy</i> 39: 35-48.</p>

