

Spring 2019
The Water-Energy-Food Nexus
AS.271.402
Professor Ben Zaitchik
1/24/2019

*Disclaimer: Please note that the syllabus may change before or during the class. The most up-to-date syllabus can be found in Blackboard.

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Course Description

The water, energy and food (WEF) nexus is a topic of growing interest in research and policy communities. Critical physical linkages include the enormous appropriation of water resources for food and energy production, the high energy demand of the water sector for transport and treatment, and the uncertain impacts that climate change will have on all three components. Policy linkages include rights and pricing, infrastructure development, and resource competition between sectors. This course will survey WEF concepts and principles, introduce tools of analysis, and engage students in case studies of critical WEF issues within and between nations.

This course aims to empower students to engage in WEF policy design and debate. As WEF policy decisions are often founded on highly technical analysis, we will find it necessary to evaluate arguments based on climate, economic, optimization, and integrated assessment models. However, as WEF debates often encounter matters of hegemony, equity, and natural rights, we will also address policy considerations that lie beyond the realm of quantitative analysis. In class discussion, policy notes, and the term paper students are expected to integrate these approaches to knowledge in order to find creative solutions to current and emerging policy dilemmas.

Structurally, each class session (except the first and last) will consist of two blocks. First, we will have presentations and extended discussion of the previous week's briefing paper assignment. Second, there will be lecture/discussion on the topic stated in the syllabus and a brief introduction to the new briefing paper assignment. Required readings should be completed *before* class.

Requirements

Three briefing papers (2-page paper + oral walk-through): 45%

- Prepare a high level briefing paper for a Principal in a government agency, non-governmental institution, or international organization. The paper should provide adequate background on the issue, key decisions that need attention, and a proposed position on those decisions, with justification.
- Assignments will be divided to ensure that we have an even number of briefing papers for each case study.

Term paper (10-15 pages): 30%

- The term paper will address the WEF nexus as it applies to a geographic or thematic case study. Depending on the topic, the paper will be either a review of existing literature or a new application of WEF nexus principles to an understudied issue.

Presentation on term paper topic: 15%

- A 10 minute presentation, supported with visuals as needed, on your term paper topic. This is envisioned as independent work, but if we have a large class then group presentations or poster presentations are a possibility.

Class participation: 10%

- Each class period will include lecture and extended discussion. Attendance and active participation in discussion is expected of all students.

Tentative Schedule and Reading [reading list is indicative and subject to change; **bold** indicates required reading, all others are supplemental]

Session	Topics	Readings
1. Finding the Nexus [1/28]	Definitions and diagrams, implications, projections, analysis frameworks Briefing paper assignment: the Eastern Nile River basin	Bazilian M et al. (2011) Considering the energy, water and food nexus: Towards an integrated modeling approach Scott CA et al. (2014) The Water-Energy-Food Nexus: Enhancing Adaptive Capacity to Complex Global Challenges IRENA (2015) Renewable Energy in the Water, Energy & Food Nexus: Chapter 1 Randers J (2010) What was the message of the Limits to Growth? World Economic Forum (2009) The Bubble Is Close to Bursting: A Forecast of the Main Economic and Geopolitical Water Issues Likely to Arise in the World during the Next Two Decades World Economic Forum (2011) Water Security: the Water-Food-Energy-Climate nexus. Chapter 1

Recommended briefing paper readings:

Eastern Nile Working Group (2014) The Grand Ethiopian Renaissance Dam: An Opportunity for Collaboration and Shared Benefits in the Eastern Nile Basin

Blackmore D and Whittington D (2008) Opportunities for Cooperative Water Resources Development on the Eastern Nile: Risks and Rewards

2. Water for Food [2/4]

Irrigation, groundwater resources, water quality and water value, food security, transboundary dynamics, fisheries, projections and challenges

Briefing paper assignment: India groundwater

Kemp-Benedict E et al. (2011) Connections between poverty, water and agriculture: evidence from 10 river basins

Peterson JM et al. (2003) Conserving the Ogallala Aquifer: Efficiency, Equity, and Moral Motives

Molden D et al. (2007) Trends in water and agricultural development

de Fraiture C et al. (2007) Looking ahead to 2050: scenarios of alternative investment approaches

Genoways T (2015) Fear in a handful of Dust. The New Republic (<http://www.newrepublic.com/article/121558/what-climate-change-doing-texas-cattle-ranch>)

Hamza W & Mason S (2004) Water Availability and Food Security Challenges in Egypt

Recommended briefing paper readings:

Shah T et al. (2012) Political economy of the energy-groundwater nexus in India: exploring issues and assessing policy options

Birkenholtz T (2009) Groundwater governmentality: hegemony and technologies of resistance in Rajasthan's (India) groundwater governance

3. Water for Energy [2/11]

Hydropower, thermoelectric cooling, renewables, conventional and unconventional fossil fuel extraction

Briefing paper assignment: powering Africa OR the Bakken formation

IRENA (2015) Renewable Energy in the Water, Energy & Food Nexus: Chapter 2

Scott CA et al. (2011) Policy and institutional dimensions of the water-energy nexus

World Economic Forum (2011) Water Security: the Water-Food-Energy-Climate nexus. Chapter 2

Stein C et al. (2014) Advancing the Water-energy-food Nexus: Social Networks and Institutional Interplay in the Blue Nile

Recommended briefing paper readings:

Deichmann U (2013) The economics of renewable energy expansion in rural Sub-Saharan Africa

Vidic et al. (2013) Impact of shale gas development on regional water quality

4. Energy for Water [2/18]

Water transport and treatment, desalination

Briefing paper assignment: California

Rothauson S & Conway D (2011) Greenhouse-gas emissions from energy use in the water sector

Copeland C (2014) Energy-Water Nexus: The Water Sector's Energy Use

Elimelech & Phillip (2011) The Future of Seawater Desalination: Energy, Technology, and the Environment

Craig RK (2009) Water Supply, Desalination, Climate Change, and Energy Policy

Sellers JM (2011) Desalination Policy in a Multilevel Regulatory State

Recommended briefing paper readings:

Hanak E et al. (2011) Managing California's water: from conflict to reconciliation [excerpts]

Cooley H et al. (2011) Sustaining California Agriculture in an Uncertain Future [excerpts]

5. Food as Energy [2/25]

Biofuels

Briefing paper assignment: US ethanol

de Fraiture C et al. (2008) Biofuels and implications for agricultural water use: blue impacts of green energy

Harvey M & Pilgrim S (2011) The new competition for land: Food, energy, and climate change

Searchinger T et al. (2008) Use of US croplands for biofuels increases greenhouse gases through emissions from land-use change

Recommended briefing paper readings:

Tilman et al. (2009) Beneficial Biofuels—The Food, Energy, and Environment Trilemma

Searchinger T (2009) Government Policies & Drivers of World Biofuels, Sustainability Criteria, Certification Proposals & Their Limitations

6. Food as Water [3/4]

Virtual water flows, footprinting

Allan JA (2003) Virtual Water - the Water, Food, and Trade Nexus. Useful Concept or Misleading Metaphor?

Briefing paper assignment:
Chinese food security

Boelens R & Vos J (2012) The danger of naturalizing water policy concepts: Water productivity and efficiency discourses from field irrigation to virtual water trade

Hoekstra AY and MM Mekonnen (2012)
The water footprint of humanity

Verma S et al. (2009) Going against the flow: A critical analysis of inter-state virtual water trade in the context of India's National River Linking Program

Aldaya MM et al. (2008) Strategic importance of green water in international crop trade

Recommended briefing paper readings:

Lu Y et al. (2015) Addressing China's grand challenge of achieving food security while ensuring environmental sustainability

Anderson K & A Strutt (2014) Food security policy options for China: Lessons from other countries

Shifflett SC et al. (2015) China's Water-Energy-Food Roadmap

7. Energy for Food [3/11]

Agricultural inputs, pumping and transfers, shipping, food utilization

Briefing paper assignment:
UNFCCC Agriculture Mitigation

Pelletier et al. (2011) Energy Intensity of Agriculture and Food Systems

IEA (2006) Energy for cooking in developing countries

Vermeulen S et al. (2012) Climate Change and Food Systems

FAO (2011) "Energy Smart" Food for People and Climate

Recommended Briefing Paper Readings:

Smith P et al. (2014) Agriculture, Forestry and Other Land Use (AFOLU). In: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the IPCC

Kibo Consulting (2014) Options for Agriculture in the 2015 International Climate Change Agreement

Boos D et al. (2014) How are INDCs and NAMAs linked?

8. Climate [3/25]

Climate projections, impacts of climate change, adaptation, W-E-F role in mitigation

Briefing paper assignment: UNFCCC Adaptation

Note: Term paper prospectus is due 4/1

IPCC (2014) Climate Change 2014: Impacts, Adaptation, and Vulnerability, Summary for Policymakers. Working Group II Contribution to the Fifth Assessment Report of the IPCC

Schaeffer et al. (2012) Energy sector vulnerability to climate change: A review

Porter JR et al. (2014) Food security and food production systems (Chapter 7). In: Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the IPCC

Moss RH et al. (2010) The next generation of scenarios for climate change research and assessment

Mideksa & Kallbekken (2010) The impact of climate change on the electricity market: A review

Fifth Assessment Report of the IPCC: Working Group I Summary for Policymakers

9. Instability and Conflict [4/1]	<p>Concepts of security, land grabs, the globalized food and energy markets, political instability</p> <p>Briefing paper assignment: Syria OR global food prices</p>	<p>Rulli MC et al. (2013) Global land and water grabbing</p> <p>Bakker K (2012) Water Security: Research Challenges and Opportunities</p> <p>World Bank (2010) Rising interest in global farmland: can it yield sustainable and equitable benefits? [excerpts]</p> <p>Natalini et al. (2015) Quantitative Assessment of Political Fragility Indices and Food Prices as Indicators of Food Riots in Countries</p> <p><i>Recommended Briefing Paper Readings:</i></p> <p>de Chatel et al. (2014) The Role of Drought and Climate Change in the Syrian Uprising: Untangling the Triggers of the Revolution</p> <p>Lagi M et al. (2011) The Food Crises: A quantitative model of food prices including speculators and ethanol conversion</p> <p>Kelley C et al. (2015) Climate change in the Fertile Crescent and implications of the recent Syrian drought</p>
10. Cities [4/8]	<p>Water supply and treatment, urban/rural competition, urban agriculture, sustainability</p> <p>Briefing paper assignment: Bangalore</p>	<p>Beck MB & Walker RV (2013) On water security, sustainability, and the water-food-energy-climate nexus</p> <p>Ramaswamy A et al. (2017) An urban systems framework to assess the trans-boundary food-energy-water nexus: implementation in Delhi, India</p> <p>World Economic Forum (2011) Water Security: the Water-Food-Energy-Climate nexus. Chapter 5</p> <p>Villaruel Walker R et al. (2014) The energy-water-food nexus: Strategic</p>

analysis of technologies for transforming urban metabolism

Venkatesh G et al. (2014) Understanding the water-energy-carbon nexus in urban water utilities: Comparison of four city case studies and the relevant influencing factors

Barthel S & Isendahl C (2013) Urban gardens, agriculture, and water management: Sources of resilience for long-term food security in cities

Grewal & Grewal (2011) Can cities become self-reliant in food?

Santo R et al. (2016) Vacant Lots to Vibrant Plots

Recommended Briefing Paper Readings:

Maria Saleth R & Sastry GS (2004) Water supply and sanitation sector of Karnataka, India: status, performance and change

Raj K (2013) Sustainable Urban Habitats and Urban Water Supply: Accounting for Unaccounted for Water in Bangalore City, India

Ranganathan M (2009) Piped Water Supply to Greater Bangalore: Putting the Cart before the Horse?

11. Economics and Business [4/15]

Pricing water and energy, subsidies, privatization, externalities, investment, public-private partnership

IMF (2008) Fuel and Food Price Subsidies: Issues and Reform Options

WSJ (2012) Are we better off privatizing water?

Whittington D (2006) Pricing Water and Sanitation Services

		2030 Water Resources Group (2009) Charting Our Water Future: Economic frameworks to inform decision-making
		U.S. EPA (2005) Case Studies of Sustainable Water and Wastewater Pricing
		NREL (2010) Decoupling Policies: Options to Encourage Energy Efficiency Policies for Utilities
		Brennan TJ (2010) Decoupling in electric utilities
		World Economic Forum (2011) Water Security: the Water-Food-Energy-Climate nexus. Chapter 8
		Ruben-Salama C (2008) Thirsty for Change: Considering Water Privatization in Developing Nations
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12. Governance [4/22]	Treaties, regulation, incentives, clean development Assignment: discuss papers	Bakker K & Morinville C (2013) The governance dimensions of water security: a review Lele K et al. (2013) Good governance for food, water and energy security Leese M & Meisch S (2015) Securitising Sustainability? Questioning the ‘Water, Energy and Food-Security Nexus’ Allouche J et al. (2014) Nexus Nirvana or Nexus Nullity? A dynamic approach to security and sustainability in the water-energy-food nexus
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13. Presentations [4/29]	Overview of your term paper topic. Length will depend on total course enrollment	
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