

**NCSE's 16th National Conference and Global Forum on Science, Policy and the
Environment: *The Food-Energy-Water Nexus***

Final Technical Report

Submitted by the National Council for Science and the Environment
to the US Department of Energy

Grant Number: DE-SC0014162

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Period of Performance: August 1, 2015 – July 31, 2016.

The National Council for Science and the Environment (NCSE) received \$50,000 from the US Department of Energy to support the organization of the of the 16th National Conference and Global Forum on the theme of The Food-Energy-Water Nexus, held January 19-21, 2016 at the Hyatt Regency Crystal City in Crystal City, VA. Approximately 1,000 participants attended the event from the fields of science, engineering, federal and local government, business, and civil society.

The conference developed and advanced partnerships focusing on strategies and initiatives to address the world's interconnected food, water and energy systems, specifically how to provide these resources to a population of 9 billion people by mid-century without overwhelming the environment. The conference emphasized actionable outcomes—moving forward on policy and practice with a focus on “opportunities for impact” on the most critical issues in the relatively near term.

During the two-and-a-half day event, more than 400 speakers presented in seven keynote addresses, four plenary roundtable discussions, 34 symposia panels, and 30 world café and workshop sessions. Highlighted keynote speakers included:

- Daniel Barber, Executive Chef, Blue Hill Farm
- Dr. Rita Colwell, Distinguished Professor, University of Maryland (*Lifetime Achievement Award*)
- Dr. France Cordova, Director, National Science Foundation
- Paul Lussier, Director of Science Communications with Impact Network, Yale University
- Dr. Anthony Michaels, CEO, Midwestern BioAg
- Dr. Veerabhadran “Ram” Ramanathan, Distinguished Professor, Scripps Institution of Oceanography (*Lifetime Achievement Award*)
- Dr. Carlos Rodriguez-Franco, Associate Deputy Chief for Research and Development, US Forest Service
- Simran Sethi, Author of *Bread, Wine, Chocolate: The Slow Loss of Foods we Love*
- Dr. Juergen Voegelé, Senior Director of Agriculture Global Practice, The World Bank

The Conference addressed a wide range of issues specific to the US Department of Energy programs, engaged Department of Energy scientists and program managers as presenters, and involved a broad range of DOE stakeholders. The US Department of Energy provided guidance on conference program planning, through the participation of Gary Geernaert, Division Director, Climate and Energy Sciences Division, and Bob Vallario, Program Manager, Climate and Environmental Sciences Division, who served on the Conference Leadership Group.

Below is the summary of the conference program and compiled outcomes and recommendations that resulted from the conference's interactive workshops.

The Conference Program Summary Agenda

Tuesday, January 19, 2016

7:30 a.m. – 9:00 a.m.	Discussion: Arizona, the Living Laboratory: How Food, Energy, and Water Converge in the Southwest
9:00 a.m.	Welcome: Peter Saundry, Conference Chair, National Council for Science and the Environment (NCSE) Introduction to New NCSE Leadership: James L. Buizer, Board Chair, and Michelle Wyman, Executive Director
9:40 a.m.	Plenary 1: “Megatrends” and the Food-Energy-Water Nexus Moderator: Kathleen Merrigan, Executive Director of Sustainability, George Washington University Speakers: <ul style="list-style-type: none"> • Robert Engelman, Senior Fellow, Worldwatch Institute • Clive Mutunga, Population, Environment and Development Technical Advisor, U.S. Agency for International Development • Nebojsa Nakicenovic, Deputy Director General, International Institute for Applied Systems Analysis • Rebecca Shaw, Associate Vice President and Senior Lead Scientist, Environmental Defense Fund
10:40 a.m.	Plenary 2: Opportunities for New Science and Innovation Moderator: John Nielsen, Science Correspondent Speakers: <ul style="list-style-type: none"> • Daniel Kammen, Director, Renewable and Appropriate Energy Laboratory, University of California, Berkeley • Edwin Piñero, Senior Vice President for Sustainability, Veolia • Richard Spinrad, Chief Scientist, National Oceanic and Atmospheric Administration • Catherine Woteki, Under Secretary for Research, Education & Economics, U.S. Department of Agriculture
11:45 a.m.	Introduction: Betsy Fink and Jesse Fink, Co-founders, Betsy and Jesse Fink Foundation
11:50 a.m.	Keynote: Daniel Barber, Executive Chef, Blue Hill Farm Interviewed by Kathleen Merrigan, Executive Director of Sustainability,

	George Washington University
1:45 p.m.	Symposia A <ol style="list-style-type: none"> 1. Opportunities for Science at the Nexus 2. Feeding 9, 10, 11 Billion Sustainably (Part 1) 3. Opportunities for Innovative Applications in Sustainable Development 4. Cities at the Nexus 5. Metrics for Food-Energy-Water Projects
3:30 p.m.	Symposia B <ol style="list-style-type: none"> 1. Innovations in Managing Water 2. Innovations in Framing Decisions 3. Integrating Nexus Policies at the State Level 4. Innovations in Modeling and Big Data 5. Community Resilience and Sustainability at the Nexus
5:30 p.m.	John H. Chafee Memorial Lecture: Simran Sethi, Author, <i>Bread, Wine, Chocolate: The Slow Loss of Foods We Love</i>

Wednesday, January 20, 2016

7:30 a.m. – 9:00 a.m.	WRI/GE Report Launch & Idea Exchange: Taking Action on Business Risks and Rewards at the Water-Energy Nexus
9:00 a.m.	Keynote: Anthony Michaels, CEO, Midwestern BioAg
9:30 a.m.	Plenary 3: Solutions from the Private Sector Moderator: Terry Yosie, President, World Environment Center <ul style="list-style-type: none"> • Greg Koch, Senior Director, Global Water Stewardship, The Coca-Cola Company • Sanjeev Krishnan, Managing Director, S2G Ventures • Peter Williams, Chief Technology Officer, Big Green Innovations, IBM Corporation • Brandon Owens, Director of Ecomagination Strategy, General Electric
10:50 a.m.	Symposia C <ol style="list-style-type: none"> 1. Connecting Agricultural Science at the Nexus to Inform Policy 2. Managing Public Lands for Ecosystem Services in the Energy-Water Nexus 3. The Water-Energy Nexus: A Federal Perspective 4. Food Waste: Managing a Solvable Problem at the Food-Water-Energy Nexus 5. Lessons from California and the West 6. The Nexus in Cities: Measuring Impact and Exploring Solutions 7. Connecting Education to Practice and the Workforce at the Nexus 8. Considerations and Challenges Associated with a Vibrant Bioeconomy 9. Measuring Natural Capital to Inform Policy and Management 10. Engineering Solutions for Food-Energy-Water Systems: It's More Than Engineering
2:00 p.m. - 3:30 p.m.	World Cafés Round 1 WC1. Models, Metrics, and Data WC2. Integrating Food-Energy-Water Systems across Space and Time

	<p>WC3. Innovative Partnerships for Decision-making at the Nexus</p> <p>WC4. Future Challenges and Solutions at the Water-Agriculture Nexus (Part 1)</p> <p>WC5. Solutions to Energy-Water Conflicts (Part 1)</p> <p>WC6. Innovative Solutions in Cities (Part 1)</p> <p>WC7. Connecting Education to Practice and the Workforce at the Nexus</p> <p>WC8. Advancing Sustainable Development through FEW Integration</p> <p>WC9. Integrating Food, Energy, and Water Systems to Eliminate Waste</p> <p>WC10. Managing Nutrients, Water, and Energy for Producing More Food with Low Pollution</p> <p>WC11. Urban Food Systems</p>
3:45 p.m. - 5:15 p.m.	<p>World Cafés Round 2</p> <p>WC12. Capacity Building through Strategic Partnerships: Leveraging Innovative Tools, Applied Research and Big Data</p> <p>WC13. The Institutional Overlay of Food-Energy-Water Systems: Law, Economics and Decision-making Under Uncertainty</p> <p>WC14. Innovations in Bioenergy and the Bioeconomy</p> <p>WC15. Data Creation, Access and Utilization for Energy Development and Water Conservation</p> <p>WC16. Future Challenges and Solutions at the Agriculture-Water Nexus (Part 2)</p> <p>WC17. Innovative Solutions in Cities (Part 2)</p> <p>WC18. Best Practices in Teaching the Nexus</p> <p>WC19. Integrating Food, Energy and Water: Planning for Sustainable Development</p> <p>WC20. Soil: The Invisible Link Between Food, Water, and Everything Else</p> <p>WC21. Food, Energy and Water in the Corn Belt</p> <p>WC22. Aquaponic and Hydroponic Systems in Controlled Environments</p>
2:00 p.m. - 5:00 p.m.	<p>Workshops</p> <p>W1. Managing Water Resources at the River Basin Scale</p> <p>W2. The Roadmap to Reduce Food Waste: A Focus On Scalable, Transformative Innovation</p>
5:30 p.m.	<p>Lifetime Achievement Awards:</p> <ul style="list-style-type: none"> • Rita Colwell, Distinguished Professor, University of Maryland and Former Director, National Science Foundation • Veerabhadran “Ram” Ramanathan, Distinguished Professor, Scripps Institution of Oceanography
6:10 p.m.	Keynote: France Córdova, Director, National Science Foundation

Thursday, January 21, 2016

8:50 a.m.	Opening: Carlos Rodriguez-Franco, Acting Deputy Chief, USDA Forest Service
9:00 a.m.	Keynote: Juergen Voegelé, Senior Director, Agriculture Global Practice, The World Bank
9:45 a.m. -	Symposia D:

11:15 a.m.	<ol style="list-style-type: none"> 1. How Telling Stories About Our Work Can Help Us Do It Better 2. Public Opinion and Nexus Policy 3. Ecosystem Services for Nexus Solutions 4. Confluence of Government, Industry and Academic Research Activities 5. Systems-Based Modeling of FEW Nexus in Megacities 6. Feeding 9, 10, 11 Billion Sustainably (Part 2) 7. Fish, the Forgotten Food Source, in Food-Water-Energy Nexus 8. Integrating Water and Energy Efficiency 9. Sustainability Education at the Food-Energy-Water Nexus: Ongoing Research 10. Transforming Food and Agricultural Policy
11:30 a.m.	Plenary 4: Implementing Innovations Moderator: Richard Harris, Science Correspondent <ul style="list-style-type: none"> • Chizuru Aoki, Lead Environmental Specialist, Global Environment Facility • Rabi Mohtar, TEES Endowed Professor, Texas A&M University • Alexander Müller, Study Leader, The Economics of Ecosystems and Biodiversity Agriculture and Food • Franklin Orr, Under Secretary for Science and Energy, U.S. Department of Energy
12:30 p.m.	Keynote: Paul Lussier, Director, Science Communications With Impact Network at Yale; Founder, President and Executive Producer, Me2U Media, Inc.
Symposia and World Cafés 2:30 p.m. - 4:00 p.m. Workshops 2:30 p.m. - 5:30 p.m.	Combined Sessions: SE1. A Systems Approach to Understanding the Energetics of Global Agriculture SE2. Towards a Food-Energy-Water Nexus Data and Data Science Community SE3. Perspectives on Integrated Nexus Assessment SE4. The Status of Low Cost Energy Technologies to Treat Saline Water for Freshwater Uses WC23. Opportunities and Challenges for Integrated Food-Energy Systems W3. Strengthening American Food System Resilience W4. Sustainability Education at the Food-Water-Energy Nexus W5. How to Get Faculty to Overcome Barriers to Collaboration W6. The Food-Energy-Water Nexus in Asia and Its Global Importance W7. Implementing an Ecologically Sustainable Food Production System to Address the Food-Energy-Water Nexus

Other Conference Features

In addition to the formal Conference sessions described above, the *Food-Energy-Water Nexus* Conference featured an exhibition and poster session, which received considerable attendee participation over the course of the three-day event.

Another popular featured event at the conference was the John H. Chafee Memorial Lecture on Science and the Environment on the evening of January 20. Simran Sethi, author of *Bread, Wine, Chocolate: The Slow Loss of Foods We Love* delivered the lecture, focusing on sustainable choices around food and other energy sources at various levels of personal and public life. Sethi is a journalist and educator focused on food, sustainability, and social change. She is an associate at the University of Melbourne's Sustainable Society Institute in Australia, a contributor for Orion Magazine and a recent visiting scholar at the Cocoa Research Centre in St. Augustine, Trinidad. Sethi was the anchor and writer of the Sundance Channel's environmental programming "The Green" and has been featured on National Public Radio. Sethi was also the host of the Emmy Award-winning PBS documentary "A School in the Woods."

NCSE's 2016 Conference was host to substantial media presence. Media coverage included newspapers, radio, magazine publications and scientific journals. *Bloomberg News*, *The National Journal*, *The Guardian*, *Greenwire*, *Science Magazine*, *National Geographic*, *The Hill* and *GreenBiz* were all represented in attendance at the Conference.

As an additional, new feature of the annual event, the *Food-Energy-Water Nexus* Conference worked to begin the creation of an emerging nexus "Community of Practice," which is currently advancing research and technology, putting ideas into action and moving forward on policy and practice. The Conference's 23 interactive world café sessions, which consisted of lightning presentations followed by group discussions, were successful opportunities for Conference participants to network and solidify this emerging Community of Practice.

Conference Impact and Dissemination

A special issue of the Journal of Environmental Studies and Solutions (JESS), focused on the Food-Energy-Water Nexus and featuring 27 peer-reviewed papers from NCSE 2016 Conference speakers, was published in March 2016. JESS is published by Springer for the Association of Environmental Studies and Sciences.

NCSE also prepared an informational resource on the food-energy-water nexus that included the names of expert presenters from the symposia, world cafés and workshops at the Conference; their contact information; and a brief summary of their research or projects. This "annotated rolodex" will support the Community of Practice working on nexus issues.

Key NASA Involvement

Many NASA personnel and NASA partners were involved in the 2016 Conference as advisors, session organizers and speakers. NCSE was honored to have the leadership of Gary Geernaert, Division Director, Climate and Energy Sciences Division, and Bob Vallario, Program Manager, Climate and Environmental Sciences Division, on the 2016

Conference Core Planning Group. Dr. Geerneart and Mr. Vallario offered expert insight and were instrumental in helping to shape the Conference program.

NASA also provided key leadership for the conference symposia session, “Lessons from California and the West.” This session addressed how recent droughts have caused focused attention on water management and the challenges of maintaining urban water uses, ecosystems, and agricultural uses, particularly throughout the western US. The session examined some of the approaches that have been used in western states and in other arid nations concerning irrigated agriculture.

James Famiglietti, Senior Water Scientist, National Aeronautics and Space Administration Jet Propulsion Laboratory, was a speaker for this symposium session.

NASA participants also co-organized the conference symposium session, “Towards a Food-Energy-Water-Nexus Data and Data Science Community.” This session addressed the importance of data and data science in addressing the food-energy-water (FEW) nexus and understanding problems, connections, and impacts, as well as for monitoring Earth resources for timely detection and management of risks (e.g., hot-spots of resource choke-points). Challenges include fragmented data with diverse collection protocols, representations, monitoring frameworks, and analysis tools with little coordination among producers and consumers. This symposium reviewed a draft report from a recent NSF workshop on data science for the FEW nexus and continued discussions towards building a FEW nexus data community via a panel discussion, explore experiences of other data communities (e.g., climate, astronomy) and assessed new opportunities to increase use and sharing of available data and to help automate data life-cycle.

Bradley Doorn, Program Manager, Earth Science Division, National Aeronautics and Space Administration spoke on this symposium

The Conference World Café session, “Capacity Building through Strategic Partnerships: Leveraging Innovative Tools, Applied Research and Big Data,” involved several NASA participants. This session focused on how the urgent challenges at the food-energy-water nexus disproportionately impact low- and middle-income countries (LMICs) and explored effective strategies to address these challenges using cross-sectoral partnerships and capacity building in LMICs. The session highlighted: (1) interagency and intergovernmental initiatives led by NASA and USAID; (2) presentations on optimal practices, opportunities, and challenges by representatives from the private sector and interdisciplinary collaborators at research institutions; and (3) networking and facilitated discussions to identify further areas of collaboration and priorities for upcoming efforts.

Christine Lee, Scientific Applications Engineer, National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory and Associate Program Manager, National Aeronautics and Space Administration Applied Sciences Water Resources, was a co-moderator for this World Café session. Session speakers also included Stephanie Granger, Technical Staff, NASA Jet Propulsion Laboratory Land Surface Hydrology Group; Forrest Melton, Senior Research Scientist, Ames Research Center, National

Aeronautics and Space Administration; and Nancy D. Searby, Capacity Building Program Manager, Applied Sciences Program, National Aeronautics and Space Administration Headquarters Earth Sciences Division.