NATIONAL SCIENCE FOUNDATION
4201 WILSON BOULEVARD
ARLINGTON, VIRGINIA 22230

NSF 15-040

Dear Colleague Letter: SEES: Interactions of Food Systems with Water and Energy Systems

February 2, 2015

Dear Colleagues:

NSF established the Science, Engineering, and Education for Sustainability (SEES) investment area in 2010 to lay the research foundation for decision capabilities and technologies aimed at mitigating and adapting to environmental changes that threaten sustainability. SEES investments advance a systems-based approach to understanding, predicting, and reacting to stress upon and changes in the linked natural, social, and built environments. In this context, the importance of understanding the interconnected and interdependent systems involving food, energy, and water (FEW) has emerged. Through this Dear Colleague Letter (DCL), the NSF aims to accelerate fundamental understanding and stimulate basic research on systems that extend beyond the interests of the SEES Water Sustainability and Climate (WSC) program to include couplings to energy and food systems where the NSF already has established presence.

Water and energy are critical for agriculture and food production. In addition, many factors - including changing land-use practices; increased urbanization; population growth and distribution; changing demand and consumer preferences; water contamination; and climate variability - create stresses on water, energy, and agriculture resources and systems in multiple and sometimes unexpected ways. These multifaceted interactions among food, energy, and water systems function according to fundamental scientific principles that govern the coupling of various physical, chemical, biological and social processes. There is a critical need to enhance understanding of the couplings within these complex systems and how they determine the systems-level response of the FEW system. a need for basic research to enable foundational technologies critical to the safety, security, productivity, and resilience of the FEW system and to pursue sustained cyberinfrastructure (data, software, and computational resources) that will support these activities and advances. The NSF supports basic research in nearly all key scientific and engineering disciplines which can further the understanding of these physical, chemical, biological, and social interactions, as well as the integration of heterogeneous data and uncertainties. In addition, the NSF supports the building of knowledge and educational advances to foster a broad and diverse next generation workforce.

The NSF defines the FEW system very broadly, incorporating physical processes (such as new technologies for more efficient resource utilization), natural processes (such as biogeochemical and hydrologic cycles), biological processes (such as agroecosystem structure and productivity), social/behavioral processes (such as decision making and governance), and cyber elements. Understanding these complex, dynamic coupled systems will require new or enhanced partnerships across many disciplinary research communities.

The NSF requests innovative proposals in the form of (1) supplements, to build upon existing NSF-

funded research activities; or (2) conferences of typically 30-80 attendees that stimulate debate, discussion, visioning and collaboration across research communities, and enable a higher appreciation, visualization and understanding of food systems and their couplings to energy and water systems. Such conferences are typically identified as "workshops" and will hereafter be referred to as simply "workshops". All NSF Directorates/Office listed below are interested in receiving inquiries. These proposals should address the coupled nature of the food, energy, and water system and the interdisciplinary dimensions of physical, natural, biological, cyber, and social/behavioral processes of relevance.

Workshop proposals should facilitate and enable interdisciplinary partnerships among natural science, physical science, social science, computing and engineering researchers and develop innovative, interdisciplinary research approaches to understanding the FEW system. Workshop projects should culminate in deliverable white papers that define scientific, engineering and data challenges in understanding the FEW system. In addition to academic researchers, workshop participants may include scientists, engineers, educators, and practitioners from industry, local, state, and federal agencies (e.g. EPA, DOE, USDA, USGS, NOAA). For any potential NSF follow-on effort in the FEW system, NSF anticipates some Federal agency partner participation.

Workshop proposals may be submitted to any appropriate program, with prior approval of the program's manager, and may be additionally discussed by other relevant programs. Prior to submitting a proposal the PI must contact one of the individuals listed below to ensure that the proposal fits the goals of this DCL. PIs will then be directed to appropriate Program Directors for submission through the normal submission process outlined in the NSF Grants Proposal Guide. Workshop proposal budgets must be less than a total of $100,000. The title of workshop proposals submitted under this DCL should begin with "FEW."

Supplements to existing NSF active grants may be proposed with prior permission of the appropriate managing Program Officer. These requests must enhance existing projects by incorporating or exploring the concepts described in this DCL. For example, a project focusing on energy and water might propose to add a component related to food production. In addition, proposed supplements may provide an opportunity to broaden the project's interdisciplinary dimensions to incorporate physical, natural, biological, cyber, and social/behavioral processes of relevance. All supplement requests must include costs associated with use of facilities or other infrastructure. Supplements whose focus is to foster and strengthen interaction among scientists, engineers, and educators, to advance research or education in the FEW system, across disciplinary, organization, geographic, and international boundaries, will also be considered.

Workshop proposals and supplement requests must be submitted by March 30, 2015, for consideration. Workshop proposals should focus their activities and deliverables in the September to December 2015 timeframe. For supplements that foster new collaborations and partnerships to address interdisciplinary topics, it is strongly encouraged to have initial activities during 2015. Proposals or requests where PIs have not contacted the relevant program officers, as described in this DCL, will be returned without consideration.

MPS will also consider EAGERs following specific discussion with the MPS point of contact below. Investigators are encouraged to review the six "bottleneck" areas of research identified in the July of 2014 report of the Mathematical and Physical Sciences Advisory Committee - Subcommittee on Food Systems "*Food, Energy and Water: Transformative Research Opportunities in the Mathematical and Physical Sciences.*" This report can be found at: http://www.nsf.gov/mps/advisory/mpsac_other_reports/nsf_food_security_report_review_final_rev2.pdf

Points of contact for participating Directorates:

ENG: JoAnn Lighty, FEW Working Group co-Chair
Division Director
Division of Chemical, Bioengineering, Environmental, & Transport Systems

GEO: Thomas Torgersen, FEW Working Group co-Chair
Program Officer, Division of Earth Sciences

BIO: Alan Tessier
Deputy Division Director (Acting), Division of Environmental Biology

SBE: Leah Nichols
Program Officer, Division of Behavioral and Cognitive Sciences

OIIA: Audrey Levine
Program Officer, Experimental Program to Stimulate Competitive Research

MPS: Colby Foss
Program Officer, Division of Chemistry

CISE: David Corman
Program Officer, Division of Computer and Network Systems

EHR: Amy Chan Hilton
Program Officer, Division of Undergraduate Education