



Innovation at the Nexus of Food, Energy and Water

Thomas Torgersen

On behalf of the NSF INFEWS Working Group





INFEWS

This is a dynamic, coupled system:

- **3% of US electricity is used to pump, treat, & transport water**
 - **90% of the energy bill on some farms**
- **40-50% of water withdrawals in the US are for thermoelectric power plant cooling**
- **30-40% of water withdrawals in the US are for irrigating crops**
- **10% of the US energy budget is associated with food production, processing, distribution, etc.**



INFEWS: Innovations at the Nexus of Food, Energy, and Water Systems

Growing populations, changes in land use, and increasing geographic and seasonal variability in precipitation patterns are placing ever-increasing stresses on the critical resources of food, energy and water (FEW).



Amy Landis studies the feasibility of restoring soils degraded by industrial wastes and other pollutants for growing bioenergy crops.
Credit: Jessica Hochreiter/Arizona State University



INFEWS

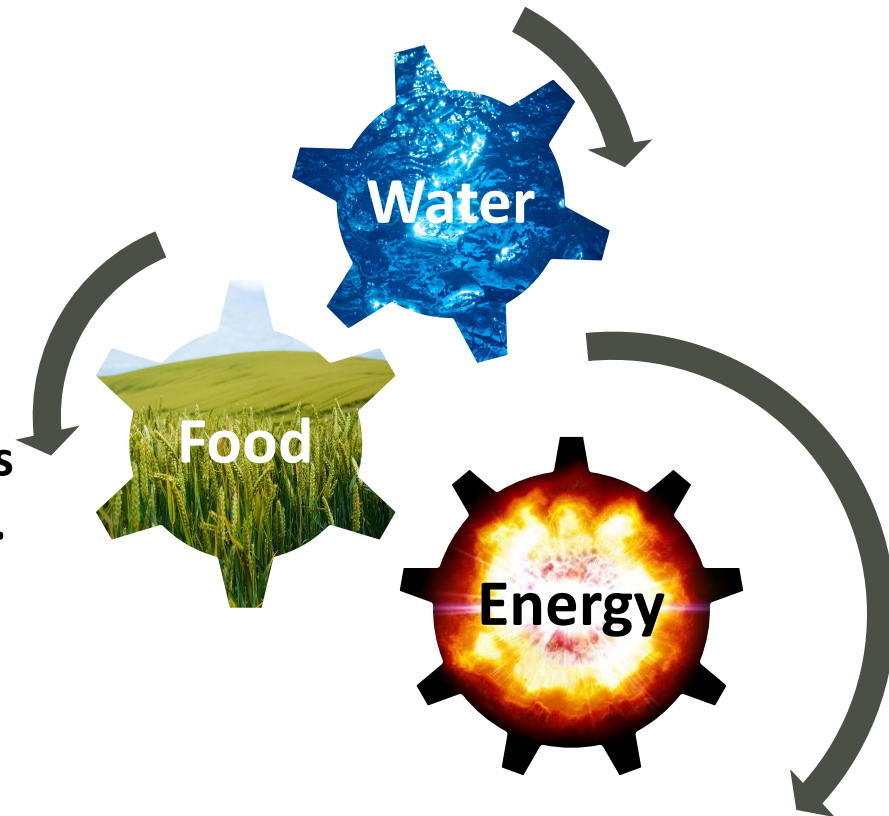
The water security, food security and energy security trilemma creates a multidimensional web that is a structurally complex network with dynamic links ...

Perrone and Hornberger, 2014

... will require significant action, either through institutional and behavioral paths or technological and infrastructural paths.

Perrone and Hornberger, 2014

NSF: Basic Science is necessary to inform policy decisions ... and synergistic with “core”

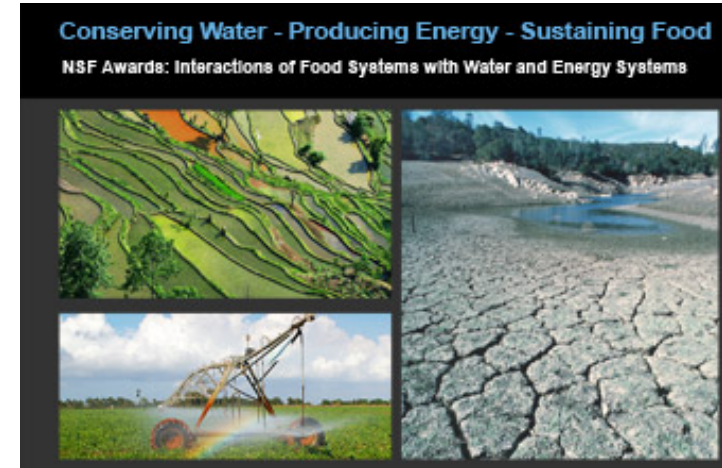




INFEWS

- ◆ DCL issued 2 Feb '15: NSF 15-040 *SEES: Interactions of Food Systems with Water and Energy Systems*
- ◆ June 2015, 17 workshops and 27 supplements funded \$6.3M
- ◆ INFEWS solicitation deadline: 22 March 2016
- ◆ Build communities across traditional disciplines; integrate science; systems

“New grants foster research on food, energy and water: a linked system”





INFEWS Goals FY16

- ◆ Track 1 ~ Significantly advance our understanding of the food-energy-water system through quantitative and computational modeling, including support for relevant cyberinfrastructure;
- ◆ Track 2 ~ Develop real-time, cyber-enabled interfaces that improve understanding of the behavior of FEW systems and increase decision support capability;
- ◆ Track 3~ Enable research that will lead to innovative system and technological solutions to critical FEW problems; and
- ◆ Track 4~ Grow the scientific workforce capable of studying and managing the FEW system, through education and other professional development opportunities.





INFEWS

- ◆ The solicitation, DCL and companion calls establish **CONTEXT**:
 - ◆ an INFEWS context for research across NSF and “disciplines”
 - ◆ a focus for interaction with sister agencies
- ◆ The central solicitation will provide a **FOCUS** for new research
 - ◆ enable creative interdisciplinary research
 - ◆ “fuzzy” track boundaries focus research on major challenges but also represent Pasteur Quadrant opportunity
- ◆ Future... **CONTINUITY** to maintain interdisciplinary thinking, build new breed of scientists and interact with core programs
 - ◆ Strong links to the core sciences as exhibited in the DCLs