SCIENCE, ENGINEERING, AND EDUCATION FOR SUSTAINABILITY

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Science, Engineering, and Education for Sustainability (SEES)

- SEES established in FY10
- Cross-NSF investment
- Portfolio of existing and new programs
- Encouraged systems-based approaches
- Support research and education to understand the complex issues of sustainability
- Highlight NSF's unique role

Sustainability

✧"The interactions between **natural and social systems** and how those interactions affect the challenge of **sustainability**:

…meeting the needs of present and future generations while substantially reducing poverty and conserving the planet's life support systems"

✧ www.pnas.org/site/misc/sustainability.shtml

SEES Portfolio

- ✧ **Initially focused on the intersection of climate and environment**
- ✧ **Specific attention to incorporating the human sciences**
- ✧ **Study complex problems at the energy, economy, and environment nexus**
- ✧ **Goal to generate discoveries and build capacity to achieve an environmentally and economically sustainable energy future**

SEES Competitions – FY10 and continuing

- Water, Sustainability, and Climate
- Ocean Acidification
- Dimensions of Biodiversity
- Climate Change Education
- Regional and Decadal Earth System Modeling

Water Sustainability and Climate

- WSC goal:
  - To understand and predict the interactions between the water system and climate change, land use, the built environment, and ecosystem function and services through
  - **Support place-based research and integrative models**
  - BIO, ENG, GEO, SBE

- NSF 10-524

http://www.nsf.gov/pubs/2010/nsf10524/nsf10524.htm

Example Water Sustainability & Climate Award:

Impacts of extreme events on water quality in the Great Lakes

- *What are the possible effects of climate-change-induced extreme events on water quality and ecology in the Great Lakes system.*
- *What management strategies would be effective to address these changes?*

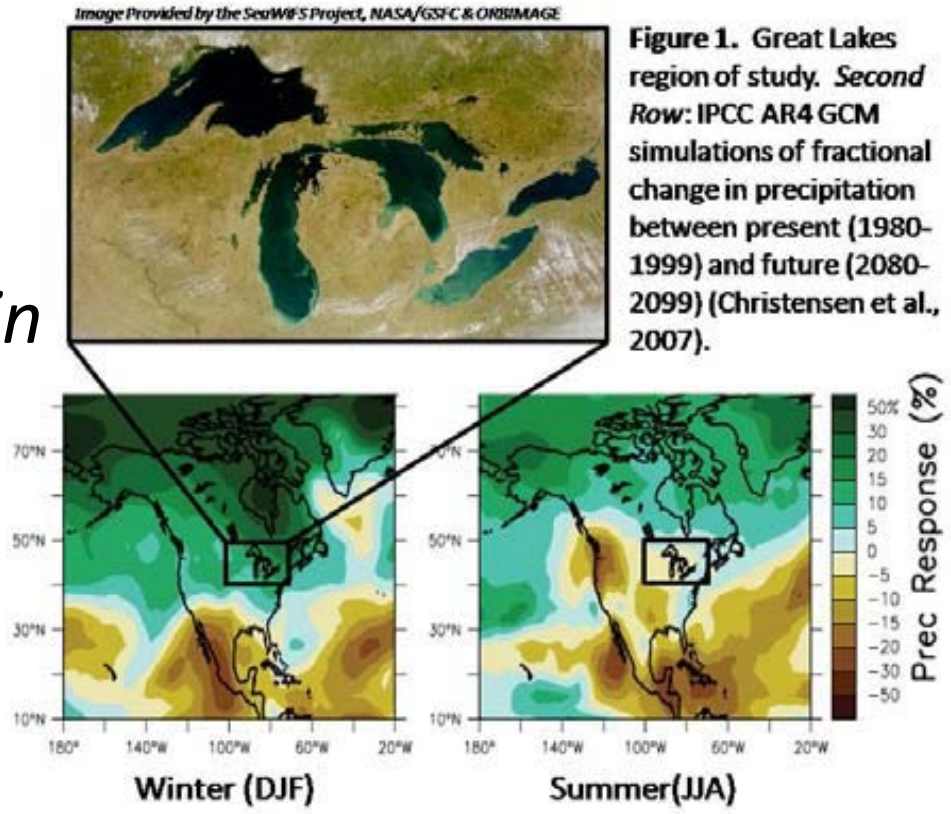

Figure 1. Great Lakes region of study. *Second Row*: IPCC AR4 GCM simulations of fractional change in precipitation between present (1980-1999) and future (2080-2099) (Christensen et al., 2007).

Ref: Michalak, U. of Michigan

Decadal and Regional Climate Prediction using Earth System Models (EaSM)

- Interdisciplinary grand challenge
- Development of next-generation Earth System Models
  - To include coupled and interactive representations of ecosystems, agricultural working lands and forests, urban environments, biogeochemistry, atmospheric chemistry, ocean and atmospheric currents, the water cycle, land ice, and human activities.
  - Type 1 – capacity building
  - Type 2 – large collaborative projects
- Cross all NSF directorates and offices
- NSF 10-554

http://www.nsf.gov/pubs/2010/nsf10554/nsf10554.htm

FY 2011
Oct 1st 2010 to Sept 30th 2011

- Dear Colleague Letter
  - Issued January 2011 (NSF 11-022)
- Describes SEES portfolio
- Highlights enhanced competitions
- **Encourages planning workshops**
- Directs to SEES web site for updates
  - www.nsf.gov/sees

www.nsf.gov/sees

National Science Foundation
Environmental Research & Education (ERE)

SEARCH
NSF Web Site

ERE Home | ERE Funding | ERE Awards | ERE Discoveries | ERE News | About ERE

Environmental Research and Education

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Proposals and Awards

- Proposal and Award Policies and Procedures Guide
  - Introduction
  - Proposal Preparation and

Science, Engineering and Education for Sustainability (SEES) NSF-Wide Investment

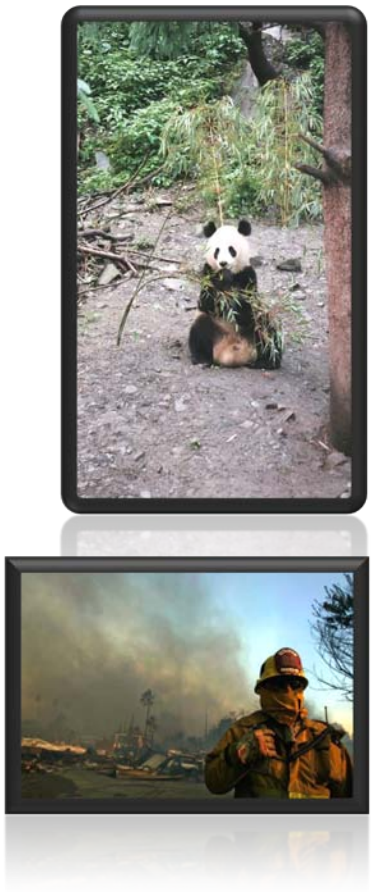
NSF established the Science, Engineering, and Education for Sustainability (SEES) investment area in FY 2010 in order to address challenges in climate and energy research and education using a systems-based approach to understanding, predicting, and reacting to change in the linked natural, social, and built environment. Initial efforts were focused on coordination of a suite of research and education programs at the intersection of climate and environment, including specific attention to incorporating human dimensions.

SEES is expected to be a 5-year effort, extending through FY15. Continuing efforts will focus on supporting research that facilitates global community sustainability, specifically through building connections between current projects, creating new nodes of activity, and developing personnel needed to solve sustainability issues. Future efforts will be expanded to include sustainable energy research in science and engineering, and its socioeconomic and environmental implications.

- Dear Colleague Letter for the Science, Engineering and Education for Sustainability (SEES) NSF-Wide Investment Area **(NSF 11-022)**
- Frequently Asked Questions for SEES **(NSF 11-039)**
- SEES News & Updates
- SEES News Releases
- SEES FY 2012 Activities
- SEES FY 2011 Activities
- SEES FY 2010 Activities
- SEES Portfolio & Highlights
- SEES: Who to Contact

Dynamics of Coupled Natural and Human Systems (CNH)

- **Long-standing program involving three NSF Directorates: SBE, BIO, and GEO**
- **Dynamics and Coupled and Natural and Human systems**
- **Quantitative, interdisciplinary analyses**
- **Address complex interactions among human and natural systems at diverse scales**



- **Enhanced funds for SEES-related projects**
- **Next deadline: November 15, 2011**

Example CNH Awards:

- Dynamic coupling of the water cycle and patterns of urban growth
- Integration of human choice into models of biogeochemical cycling in urban ecosystems
- Dynamic interactions among people, livestock, and savanna ecosystems under climate change
- Direct and indirect coupling of fisheries through economic, regulatory, environmental and ecological linkages
- Interactions between changing climate and technological innovations in agricultural decision-making: implications for land-use and sustainability

Research Coordination Networks (RCN)

Support groups of investigators to communicate and coordinate efforts across **disciplinary, organizational, institutional and geographical boundaries**

- integrate research and/or education activities of scientists working independently on topics of common interest

- **RCN-SEES track:**
  To advance sustainability science, engineering, and education as an integrative (systems) approach

- **Solicitation NSF 11-531; May 24th deadline**

Research Coordination Networks

Support groups of investigators to communicate and coordinate efforts across disciplinary, organizational, institutional and geographical boundaries.

- integrate research and/or education activities of scientists working independently on topics of common interest

- facilitate open **communication and exchange** of information and resources

- nurture a **sense of community** among early career scientists

- minimize isolation and maximize cooperation so as to **eliminate unnecessary duplication** of efforts.

Five RCN elements to bridge disciplines and foster collaboration

Face to face

Fostering personal contacts

Finding common ground and language

Defining shared interests
Focused questions
Establishing boundaries (geographic, conceptual)

Building bridges

Travel grants for extended inter-lab exchanges
Integrating activities at meetings

Creating focused task groups

Build a network of collaborations

Establishing trust

Synthesis activities that accomplish more than any one person could have achieved.

Colorado River Delta Research Coordination Network

Colorado River Delta
Delta Del Rio Colorado
Research Coordination Network

This network of natural scientists, social scientists and legal scholars seeks to facilitate interdisciplinary, inter-institutional, and international research on the Colorado River Delta of the U.S. and Mexico. **We focus on how natural and human-caused variation in water supply affects the biotas and landscapes of the Colorado River Delta in the United States and Mexico**. Participants are from academic institutions, government agencies and NGOs in both countries.

SEES – Major Aims

- Support **interdisciplinary research and education** to inform global community sustainability

- Build **connections** between existing projects and create new nodes

- Develop interdisciplinary **personnel** needed to understand the complex issues of sustainability

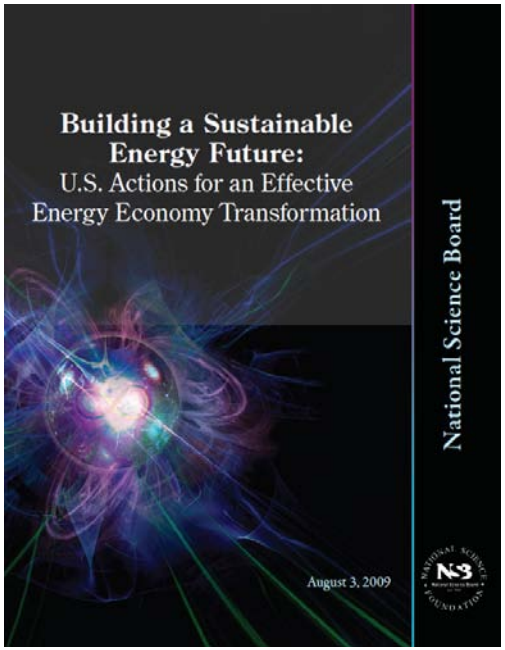
SEES Themes – FY 2012

Oct 1st 2011 to Sept 30th 2012

- Fellowships for Sustainable Solutions
- Sustainable Energy Pathways
- Sustainability Research Networks
- Partnerships for International Research and Education (PIRE)
- Continue climate-related competitions

Sustainable Energy Pathways (SEP)

- Support sustainable energy research and its socioeconomic, environmental implications.
- Research at the **energy-environment-society** nexus
- **Systems approaches** to research, education and workforce development, public awareness and outreach
- **Partnerships** with other agencies, states, universities, industry, international organizations.



Sustainability Research Networks (SRN)

- SRNs will connect **interdisciplinary teams** of investigators focused on performing cutting-edge research and education relating to the challenges of sustainability
- Each SRN will focus on an ambitious SEES **theme**
- Links scientists, engineers, and educators, at **existing** institutions, centers, networks, and develop **new nodes** of research
- Address the **social and cultural dimensions** of sustainability

Partnerships for International Research and Education (PIRE)

Supports innovative, international research and education collaborations

- **The goals of PIRE are to:**
  - **build strong research and education partnerships with foreign collaborators that enable research excellence,**
  - **provide strong well-mentored international research experiences for U.S. students,**
  - **and foster the internationalization of U.S. institutions in science and engineering**
- **Will be focused on SEES for FY12**
- **The PIRE program will ask that proposals address sustainability research by making interdisciplinary linkages across natural, social and/or built environments.**
- **Dear Colleague Letter NSF 11-025**

Questions?

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Where discoveries begin