Science, Engineering, and Education for Sustainability

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Update - April, 2011

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 defined

- The National Academy of Sciences definition:

  "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 –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 Competitions

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

Dear Colleague Letter

- Highlights NSF's unique role
  - Support research and education to understand the complex issues of sustainability

- Describes SEES portfolio
- Lists opportunities
  - Enhanced competitions
  - Planning workshops
  - Postdoctoral research
  - International collaboration
- Directs to SEES web site for updates

- Issued January 2011 (NSF 11-022)

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

Research Coordination Networks (RCN)

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

- facilitate open communication and exchange of information and resources
- integrate research and/or education activities of scientists working independently on topics of common interest
- nurture a sense of community among junior scientists
- minimize isolation and maximize cooperation so as to eliminate unnecessary duplication of efforts

RCN- SEES Track

To advance sustainability science, engineering, and education as an integrative (systems) approach to the challenges of adapting to environmental, social and cultural changes associated with growth and development of human populations, and attaining a sustainable energy future.

Motivated by the need to solve problems and to predict and mitigate future risks.

$750,000 for 5 year duration
Expect to making 6-7 awards each round of competition

Solicitation NSF 11-531
Next deadline: May 24, 2011

www.nsf.gov/SEES

National Science Foundation
Environmental Research & Education (ERE)

SEARCH
NSF Web Site

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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

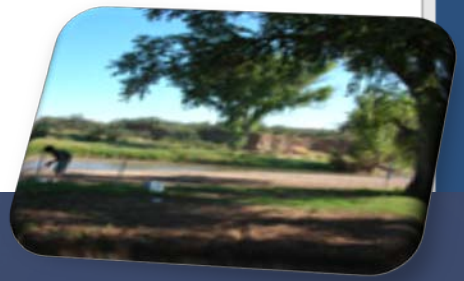
SEES awards

SEES News Releases

- **News Release:** NSF Awards Grants to Study Effects of Ocean Acidification (NSF 10-186) (October 13, 2010)
- **News Release:** NSF Awards Grants for Study of Water Sustainability and Climate (NSF 10-182) (October 6, 2010)
- **News Release:** NSF Awards Grants to Study Dimensions of Earth's Biodiversity (NSF 10-179) (October 5, 2010)
- **News Release:** Climate Change Education Partnership awards (NSF 10-165) (September 10, 2010)
- **News Release:** Improving Predictions of Climate Change and Its Impacts (NSF 10-044) (March 22, 2010)
- **JOINT NSF, DOE, and USDA PRESS CONFERENCE:** New interagency program to improve predictions of climate change and its impacts (March 22, 2010)

SEES Related News Releases

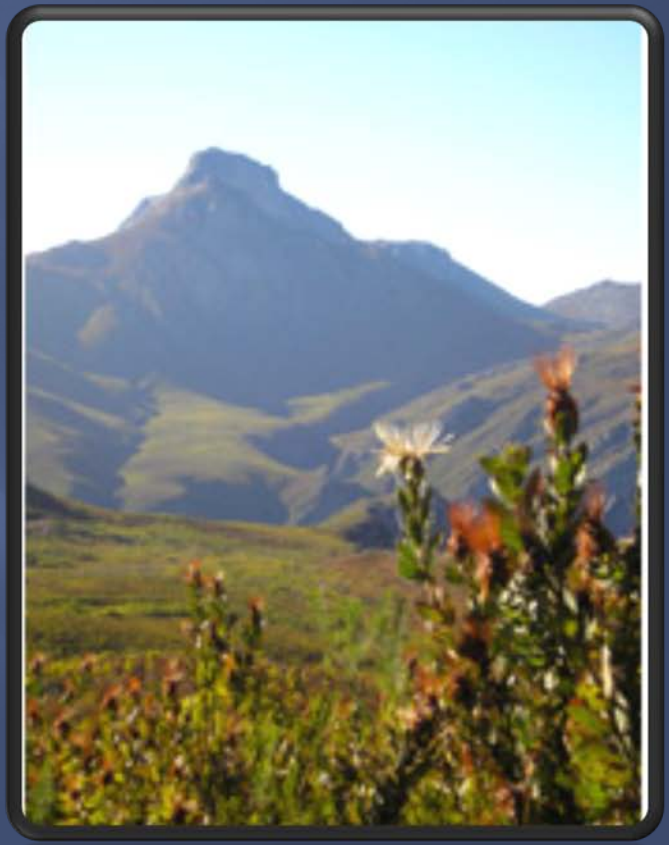
- **News Release:** NSF Awards Grants on Interactions Among the Environment, Economy and Society (NSF 10-194) (October 19, 2010)
- **News Release:** NSF Awards Grants for Research on Coupled Natural and Human Systems (NSF 10-198) (October 21, 2010)



Return to SEES Homepage

SEES 'Summit'

- High level, high visibility gathering of national and international experts, distinguished speakers, and recent awardees on SEES projects
- Highlight NSF's role and partnerships with other agencies
- Crosses many sectors, institutions, disciplines, regions, etc.
- Fall 2011 event in planning stage



SEES Themes – FY 2012

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

SEES –Major Aims

- Interdisciplinary research and education
- Build connections between existing projects and create new nodes
- Develop interdisciplinary personnel

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

SEES Portfolio Examples

- Research at the energy- environment- society nexus
- Novel energy production, harvesting, storage, transmission, and distribution technologies
- Adoption, socioeconomic, and policy issues related to adaptation and mitigation strategies
- Understanding and optimizing life- cycle energy costs and carbon footprints of natural, social and built systems
- Study of societal factors such as vulnerability, resilience and sensitivity to regional environmental change

Questions?

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Where discoveries begin

Background slides

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

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

CNH
Recent awards

- the integration of human choice into models of biogeochemical cycling in urban ecosystems
- coupling hydrologic, economic and social network models to improve understanding of surface water-groundwater interactions
- 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
- dynamic coupling of the water cycle and patterns of urban growth

Research Coordination Networks

RCN SEES track

4. **Targeted Science, Engineering and Education for Sustainability track.** The Science, Engineering and Education for Sustainability (RCN-SEES) track represents an NSF-wide activity seeking to foster interdisciplinary research and education that advances sustainability science and engineering as an integrative approach to the challenges of adapting to environmental, social and cultural changes associated with growth and development of human populations, and attaining a sustainable energy future. Many questions in sustainability science and engineering are motivated by the need to solve problems and to predict and mitigate future risks. For example, how vulnerable are regional socio-economic systems to unpredictable natural events, altered hydrological regimes, and loss of biodiversity? What are the engineering options and costs for reconfiguring natural ecosystem services disrupted by expansion of urban centers? How do we develop effective modeling and simulations for improved knowledge of energy processes that can lead to design of affordable technologies, which consider social, environmental and economic implications, and can provide universal accessibility to sustainable energy sources? What is the role of education and public communications in social-systems dynamics and the resilience of socio-economic systems, and how can learning sciences' research and educational practice foster knowledge, attitudes, and behaviors that affect sustainability? Addressing these types of questions and others requires a multifaceted, systems-level consideration of our natural and built environments, human populations, behavior, social systems and energy use and advances in technological development and implementation.

The RCN-SEES track recognizes the growing need and urgency for research collaborations that productively cross the boundaries of the natural sciences, engineering, mathematics and the computational sciences, and the social, behavioral and economic sciences to develop new understanding, theory, models and technology to sustain and improve the quality of life for humankind within a healthy Earth system. The challenge of sustainability is of global concern and the RCN-SEES track is also envisioned as a means to strengthen connections and collaborations of US scientists with the broader international science and engineering community. An RCN-SEES proposal should have a theme relevant to sustainability science, engineering, and education as the focus of its activities, and is expected to involve a highly interdisciplinary set of participants and be long term (4 to 5 years duration, maximum proposed budget of $750,000).

For more information about the NSF investments in Science, Engineering and Education for Sustainability, consult the SEES website http://www.nsf.gov/geo/sees/)

www.nsf.gov/pubs/2011/nsf11531/nsf11531.pdf

Partnerships for International Research and Education (PIRE) – FY12

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NSF 11-025

Dear Colleague Letter: Partnerships for International Research and Education (PIRE) with Science, Engineering, and Education for Sustainability (SEES) Focus

This letter is to call your attention to an upcoming opportunity that is anticipated to span the FY2011-FY2012 fiscal years. The Partnerships for International Research and Education (PIRE) Program, a National Science Foundation program since 2005, will focus its next competition exclusively on the NSF-wide investment area of Science, Engineering, and Education for Sustainability (SEES). Through SEES, NSF seeks to enable the discoveries needed to inform actions that lead to environmental, energy and societal sustainability while creating the necessary workforce to address these challenges.

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.

By focusing the PIRE program on the SEES area, the National Science Foundation is investing strategically in research for which many of the intellectual foci are global in scope, require a comparative understanding of international variability, and are best tackled with the sharpest intellects from around the world engaged in leading-edge discovery and innovation. A SEES focus for PIRE will result in a more globally engaged U.S. workforce in the area of sustainability science, engineering and education. It will also enable U.S. institutions to more effectively partner with centers of excellence abroad in these areas of national and global need.

The PIRE program will ask that proposals address sustainability research by making interdisciplinary linkages across natural, social and/or built environments. More information about NSF's SEES investment area can be found on the SEES webpage at: http://www.nsf.gov/sees/. Of particular interest is the recent SEES Dear Colleague letter NSF 11-022 (US NSF - Dear Colleague Letter for the Science, Engineering and Education for Sustainability (SEES) NSF-Wide Investment Area).

Information on the first three PIRE competitions is available at: http://www.nsf.gov/funding/pgm_summ.jsp?pims_id=12819. (Please note that previous competitions did not have a disciplinary focus.)