Science, Engineering and Education for Sustainability (SEES)

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Our most pressing contemporary problem

Complex interactions at multiple scales

SEES – Our Rationale

A sustainable world is one in which human needs are met equitably without harm to the environment, and without sacrificing the ability of future generations to meet their needs. Meeting this formidable challenge requires a substantial increase in our understanding of the integrated system of society, the natural world, and the alterations humans bring to Earth.

Meeting Sustainability Challenges…

…requires the simultaneous consideration of social, economic, and environmental systems and the long-term viability of those systems.

SEES: Science, Engineering and Education for Sustainability

Mission: Advance science, engineering, and education to inform the societal actions needed for environmental and economic sustainability and sustainable human well-being

- Established in Fiscal Year 2010
- Portfolio of existing and new programs
- All NSF Directorates and offices involved
- Partnerships (e.g. other agencies, CNRS, Belmont Forum)

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SEES Goals

1. **Interdisciplinary research and education…towards** global sustainability
2. Link projects and **partners** and add **new participants** to sustainability endeavors
3. Develop the **workforce**…to address…sustainability

SEES Themes

- Natural Systems
- Human Systems
- Built Systems
- Energy and materials
- Adaptation and Resilience

SEES Characteristics

Systems Thinking

- Holistic approaches that link human, built and natural systems, and reach across disciplines

Partnerships & Networks

- Connect intellectually and spatially disparate communities, institutions and organizations

Workforce & Education

- Development and education of new researchers and students on critical aspects and issues of sustainability

A Brief History of SEES 2010

Five new initiatives:

- Dimensions of Biodiversity
- Water Sustainability & Climate (WSC)
- Decadal Regional Climate Prediction using Earth System Models (EaSM)
- Ocean Acidification
- Climate Change Education

SEES tracks for two existing programs:

Dynamics of Coupled Natural Systems (CNH)

Research Coordination Networks (RCN)

A Brief History of SEES 2011-13

Added new initiatives and tracks (*some one-time):

- **SEES Fellows**
- **Sustainability Research Networks (SRN)**
- **Sustainable Energy Pathways (SEP)***
- **SEES Focus for Partnerships for International Research & Education (PIRE)***
- **SEES STTR (Small Business Technology Transfer Program)***
- **Arctic SEES**
- **CyberSEES**

SEES Financial Commitments

- FY 2010: $70 million
- FY 2011: $93 million
- FY 2012: $170 million
- FY 2013: $184 million
- FY 2014: $162 million (estimate)
- FY 2015: $139 million (budget request)

Grand total 2010-2013: ~4700 projects reviewed and ~500 awards made (including co-funds)

SEES in FY 14/15

Solicitations (see SEES webpage for latest information)
ArcSEES (Arctic)
CNH (Dynamics of Coupled Natural and Human Systems)
Coastal SEES
CyberSEES
Dimensions of Biodiversity
Earth Systems Modeling (EaSM)
Hazards
Ocean Acidification
SEES Fellows
SusChEM (Sustainable Chemistry, Engineering and Materials)
Sustainability Research Networks (Urban)

Open/ongoing
Considering/planning
Ended

SEES – Future Plans

Evaluation: Program-wide evaluation began April 2014

Other activities: PI Meetings, workshops; presentations & other outreach

Transition: Planning for long-term support for sustainability research in NSF after 2017

Advice to SEES PIs

Take all words in the competition title very seriously:

e.g. Dynamics of Coupled Natural and Human Systems
Sustainability Research Networks

You will probably need to involve researchers from a variety of disciplines

We encourage:

- generalizable theoretical development
- analysis and synthesis

We generally do not encourage:

- descriptive studies
- normative or prescriptive projects
- projects where the primary outcome is a tool

Make sure your proposal includes everything (including all the sections, and supporting documents) the solicitation says we need…

…but no more than that.

Sustainability Research Networks (SRN) 2014 Urban Focus

How can we develop sustainable, resilient urban systems that provide healthy, safe, and affordable environments for the growing number of people living in cities and their surrounding metropolitan areas across the globe?

Deadline April 29th, 2014. No further competitions planned.

SRN Awards 2012

Joseph Ryan (PI) – University of Colorado Boulder

Routes to Sustainability for Natural Gas Development and Water and Air Resources in the Rocky Mountain Region. *(airwatergas.org)*

Award amount: $11.1 million

Klaus Keller (PI) - Pennsylvania State University

What are Sustainable Climate-Risk Management Strategies? (scrimhub.org)

Award amount: $11.9 million

Cyber SEES (NSF 14-531)
Cyber-Innovation for Sustainability Science and Engineering

Goal: To advance sustainability science via interdisciplinary research enabled by innovations in computing & information sciences.

The proposed research under this solicitation must be well-grounded in at least one concrete sustainability problem facing the planet, but applicable more generally. The sustainability challenges associated with computing itself are also covered by the solicitation.

Award Types:

Type 1: Small, proof-of-concept, capacity building, or exploratory research projects (up to $400K, 2 yrs)

Type 2: Regular projects (up to $1.2M, 4 yrs)

Next deadlines:

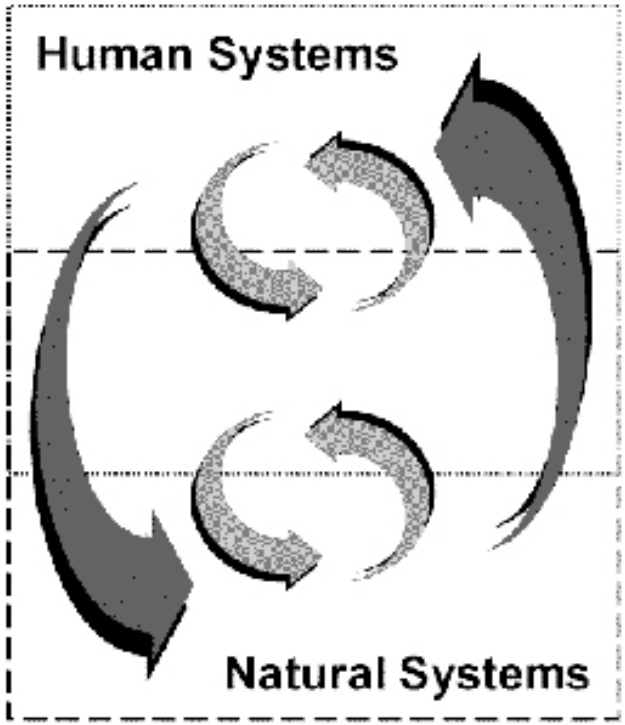
Feb. 3, 2015 (max. 2 per PI/co-PI)

Sustainable Chemistry, Engineering & Materials (SusChEM) (NSF 13-013)

- **DCL**: Opportunities for interdisciplinary research & education in chemical sciences & engineering related to sustainable synthesis, use and reuse of chemicals & materials
- Advance science, engineering & education to inform societal actions aimed at environmental & economic sustainability
- Partnerships and educational experiences to train workforce strongly encouraged
- Existing programs with co-review & co-funding involving:
  - Chemical, Bioengineering, and Transport Systems & Civil, Mechanical and Manufacturing Innovation (Engineering)
  - Chemistry & Materials Research (MPS)
  - Earth Sciences (Geosciences)

The Dynamics of Coupled Natural and Human Systems competition promotes…

…quantitative, **interdisciplinary** analyses of relevant human **and** natural **system processes** and **complex interactions** among human and natural systems at diverse scales.



Special Emphases in CNH

- Focus on coupling of natural and human systems
- Emphasis on complex (non-linear) interactions among systems
- Strongly quantitative research, although qualitative research may also be used
- Global perspective as appropriate to the project
- Highly complementary education plan
- Strong management plan
- Compelling broader impacts

CNH Success Rates

Year	Project Proposals	Highly Competitive / Competitive (fundable)	Funded	Funding Rate (total received) %	Funding Rate (fundable) %
2007	80	26	12	15	46
2008	64	30	9	14	30
2009	94	34	14	15	41
2010	97	25	14	14	56
2011 (f | e | R)	98 | 37 | 4	24 | 13 | 2	14 | 5 | 1	14 | 14 | 25	58 | 38 | 50
2012 (f | e | R)	91 | 35 | 6	31 | 12 | 3	12 | 6 | 0	13 | 17 | 0	39 | 50 | 0
2013 (f | e | R)	93 | 40 | 3	25 | 9 | 1	14 |6 | 1	15 | 15 | 33	56 | 67 | 100

Common Problems in CNH Proposals

H or N system poorly developed

Not looking at full range of relevant coupling

Team lacks an expert in …

Missing relevant literature in …

Project is unlikely to result in theoretical advances

Results would not be generalizable

No clear statement of the research question(s) / hypothesis

Project does not address research question(s)

Methodology is not clear / important details are missing

Hard to see how the individual subprojects fit together

Project is tool development, not research

Project is driven by agenda, not scientific enquiry

Proposal is poorly written / is confusing / has errors / is hard to navigate

Proposal is not compliant

Urban Vulnerability to Climate Change: A System Dynamics Analysis

PI: Sharon Harlan, Arizona State University

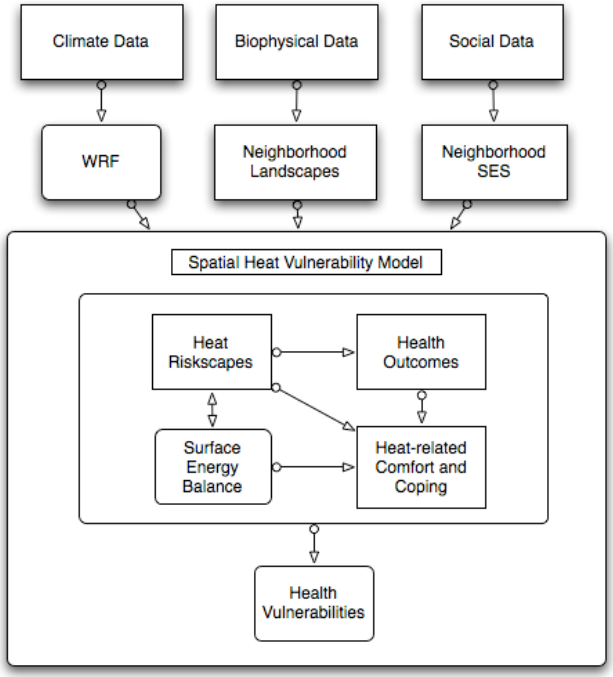
NSF Award 0816168, $1.4 million

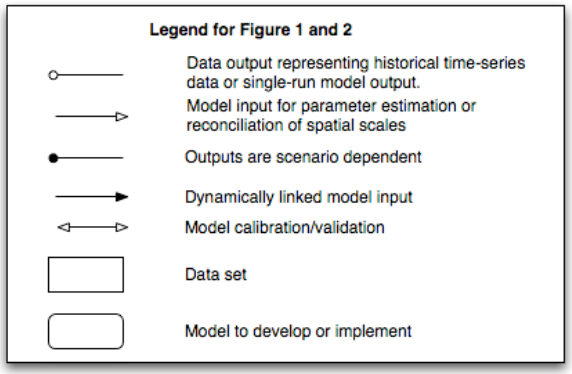
Examining vulnerability of different urban neighborhoods and socio-economic groups to heat-related health hazards.

Developing future scenarios under climate change.

Devising local adaptation strategies, landscape changes.

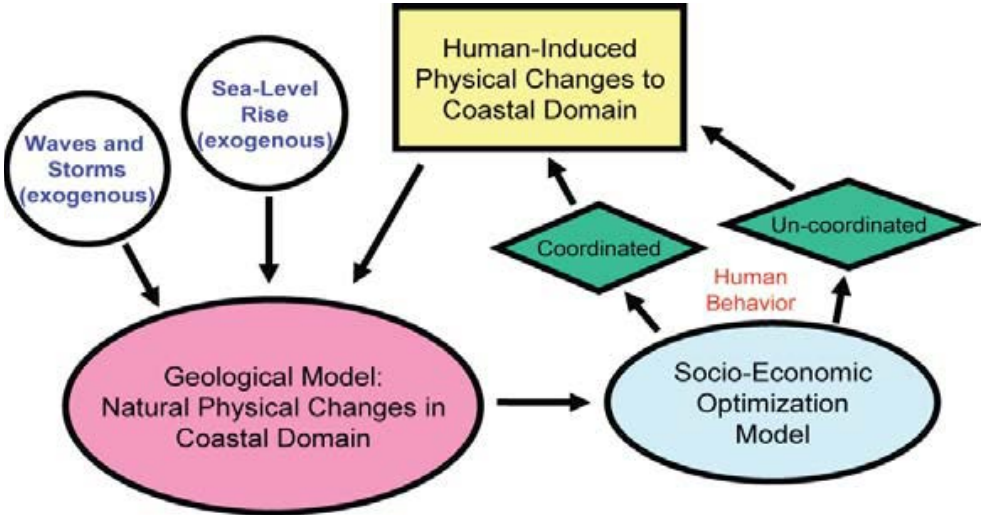
Strong involvement of local communities in project.

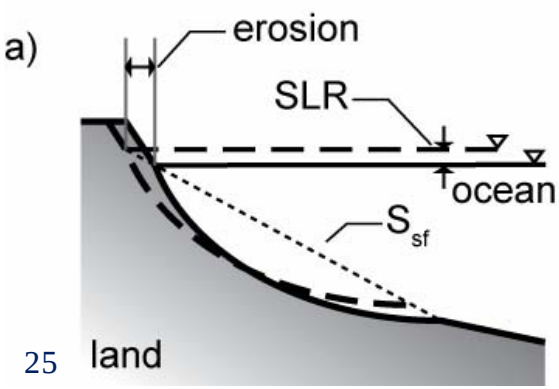


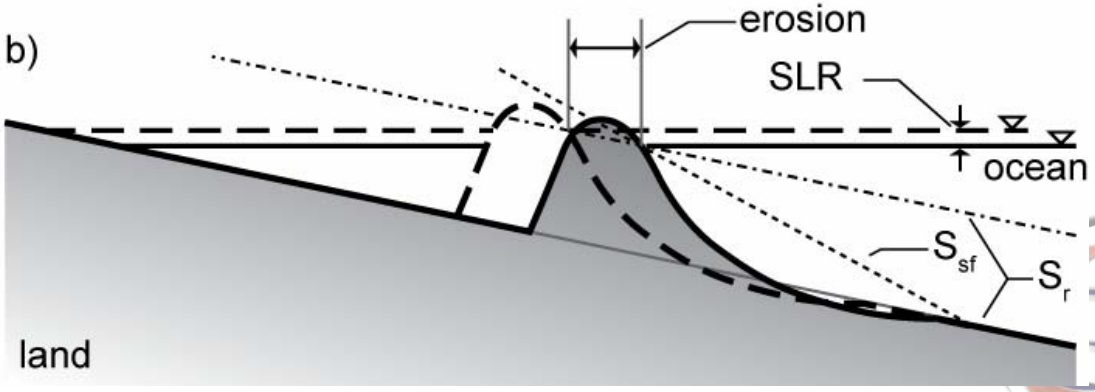


CNH: Drowning of Developed Coastal Barriers: Investigating the Threshold Rates of Sea-Level Rise of the Geologic-Human System

PI: Andrew Ashton, Woods Hole
NSF Award 0815875, $1.4 million







CNH: Cooking Up Clean Air: Scaled-Up Air Quality and Health Impacts of Clean Cookstoves in Ghana

PI: Christine Wiedinmyer, University Corporation for Atmospheric Research

NSF Award 1211668, $1.475 million

Nearly half the world's population cooks over open flames on a daily basis. This releases greenhouse gas and exposes people to toxic emissions that contribute to respiratory disease. In Ghana and other countries in the "meningitis belt," emissions from cooking have been linked to meningitis. We hypothesize that widespread use of efficient, or "clean", cookstoves - which produce less smoke than open fires even while burning the same available materials - will reduce people's exposure to toxic emissions, improve health outcomes, ad improve regional air quality. To test this hypothesis, the project team will introduce cookstoves into households in northern Ghana. In addition to determining whether they do, in fact, improve air quality and health outcomes, we will explore the social and economic factors that encourage or discourage cook stove use, and consider the impacts of climate change.

www.nsf.gov/sees

Shows the latest (known) status of each SEES program

NOTE: Several of the programs have ended

Contains links to the program pages and solicitations for each program

The program pages list contacts

The solicitations describe each competition and due dates

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  - Proposal Preparation and Submission
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Crosscutting/NSF-wide

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

SEES Mission Statement

To advance science, engineering, and education to inform the societal actions needed for environmental and economic sustainability and sustainable human well-being.

CONTACTS

For general inquiries about SEES related activities: nsf-sees-info@nsf.gov.

For program or discipline-specific questions, please see the full list of contacts at: http://www.nsf.gov/geo/sees/sees_contacts.jsp

To subscribe to the SEES listserv, send the text "subscribe SEES" to listserv@listserv.nsf.gov.

SYNOPSIS

Science, Engineering, and Education for Sustainability (SEES) is a portfolio of activities that highlights NSF's unique role in helping society address the challenge(s) of achieving sustainability.

SEES Portfolio of Programs:
See below for program descriptions, news and updates.

Program	Most Recent Solicitation	Status / Most Recent Deadline
Arctic SEES	Belmont Forum call for proposals: Arctic Observing and Research for Sustainability	July 31, 2014
Climate Change Education Partnerships	12-523	The CCEP program has been discontinued as a SEES program and