



National Council for Science and the Environment

*Improving the scientific basis for environmental decisionmaking*

## Environmental and Natural Research Funding at Universities: Patterns and Responses

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# Outline of talk

- Introduction to NCSE
- Recent federal funding trends of environmental and conservation research.
- Impacts on universities
  - Trends
  - Responses
- National Science Foundation – Science, Engineering and Education for Sustainability (SEES)



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## I. Introduction to NCSE

### **Mission:**

to improve the scientific basis of environmental decisionmaking.



Mission – improving the scientific basis for environmental decision-making

Programs – foster collaboration between diverse institutions and individuals (research, education, environmental, and business organizations as well as governmental bodies)

- Education and Careers
- Science Solutions
- Science Policy
- International Council for Science and Environment



Environmental Internship Clearinghouse





# University Affiliate Program





**Council of Environmental Deans  
and Directors (CEDD)**

**<http://www.ncseonline.org/cedd>**

- **Top Environmental Leaders at Affiliate Universities**
- **Curriculum, including Climate Solutions Curriculum**
- **Careers, including Environmental Alumni Career Study and Campus to Careers Program**
- **Program Administration**
- **Interdisciplinary Hiring, Tenure and Promotion**



## Council of Energy Research and Education Leaders (CEREL)

<http://www.ncseonline.org/cerel>

- Top Academic Energy Leaders
- Research Funding Advocacy
- Curriculum and Careers
- Program Administration
- Communications and Outreach
- In partnership with APLU
- 33% discount for affiliates





# National Conference on Science, Policy and the Environment

**Goal:** develop pathways to solutions on  
conference theme

**Partners** – All communities



- “the Davos of the Environment”
- 2-3 days, 800-1,200 participants
- Multi-sector: research, education, business, civil society, government
- Learn, network, and develop strategies to combine science and policy to yield real-world solutions
- A launch pad for new initiatives and partnerships









# SAVE THE DATE



## Disasters and Environment

*SCIENCE, PREPAREDNESS, AND RESILIENCE*

13th National Conference on Science, Policy and the Environment

### January 15-17, 2013

Ronald Reagan Building & International Trade Center, Washington, D.C.



National Council for Science and the Environment

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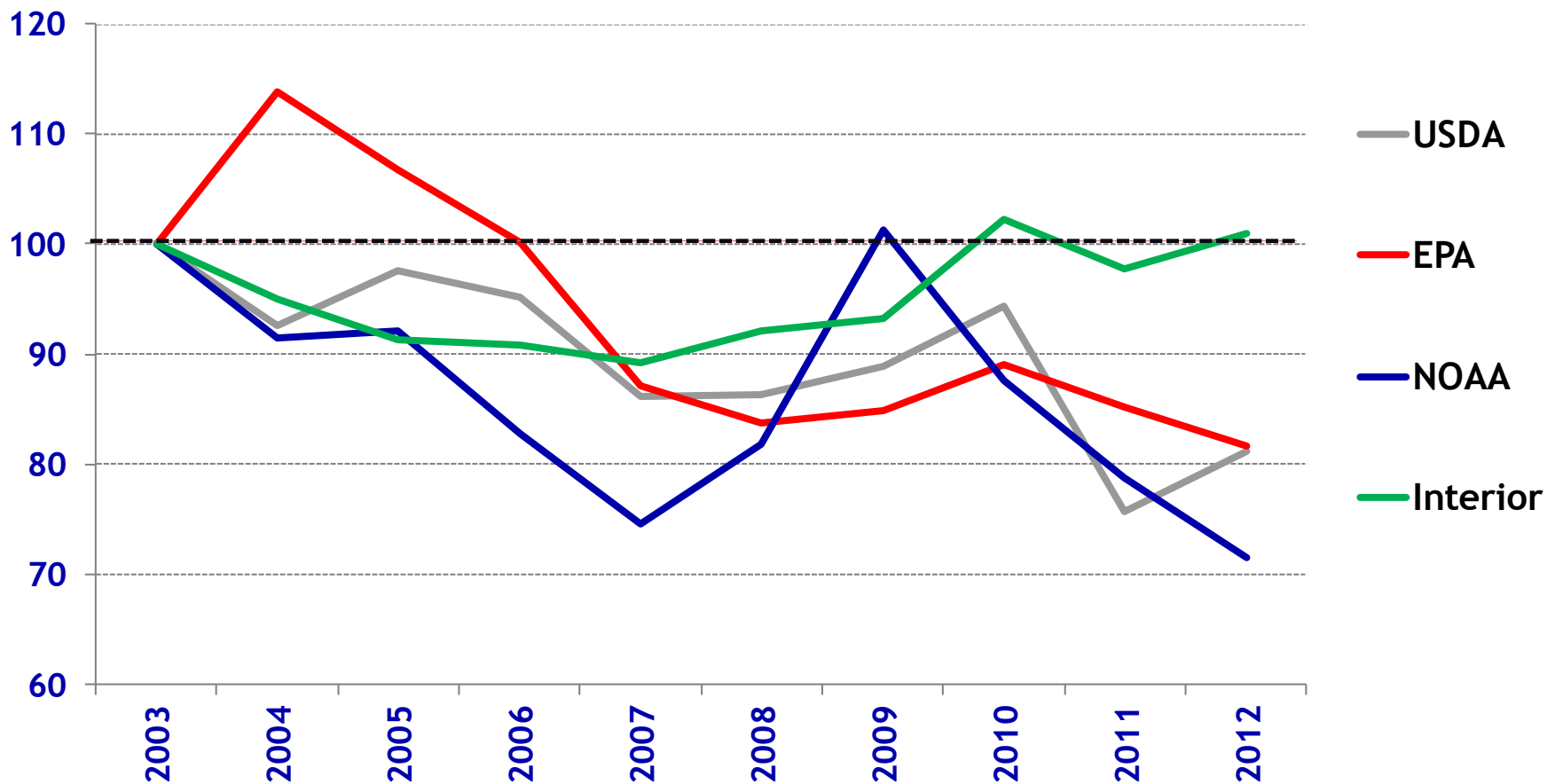
[www.DisastersandEnvironment.org](http://www.DisastersandEnvironment.org)

# Handbook of Federal Funding for Environmental R&D

- NCSE's online Handbook of Federal Funding for Environmental Research & Development (R&D) was created to help faculty and administrators at universities and colleges identify opportunities for funding in the environmental and energy fields. The handbook covers a broad range of federal agencies and offices, describing how each office engages in environmental research and highlighting opportunities for universities to participate in federal extramural research.
- The updated handbook now includes:
  - A comprehensive survey of \$9 billion in federal funding for environmental R&D
  - A report of trends in federal funding for environmental R&D
  - Programmatic descriptions of federal agencies and offices engaging in environmental research, as well as links to sources of federal funding for extramural research
- The password-protected handbook is available exclusively to University Affiliate schools

# Trends in Environmental R&D Agencies

Changes from FY03 to FY12, FY03 = 100



Source: AAAS Research & Development series and agency budget documents.

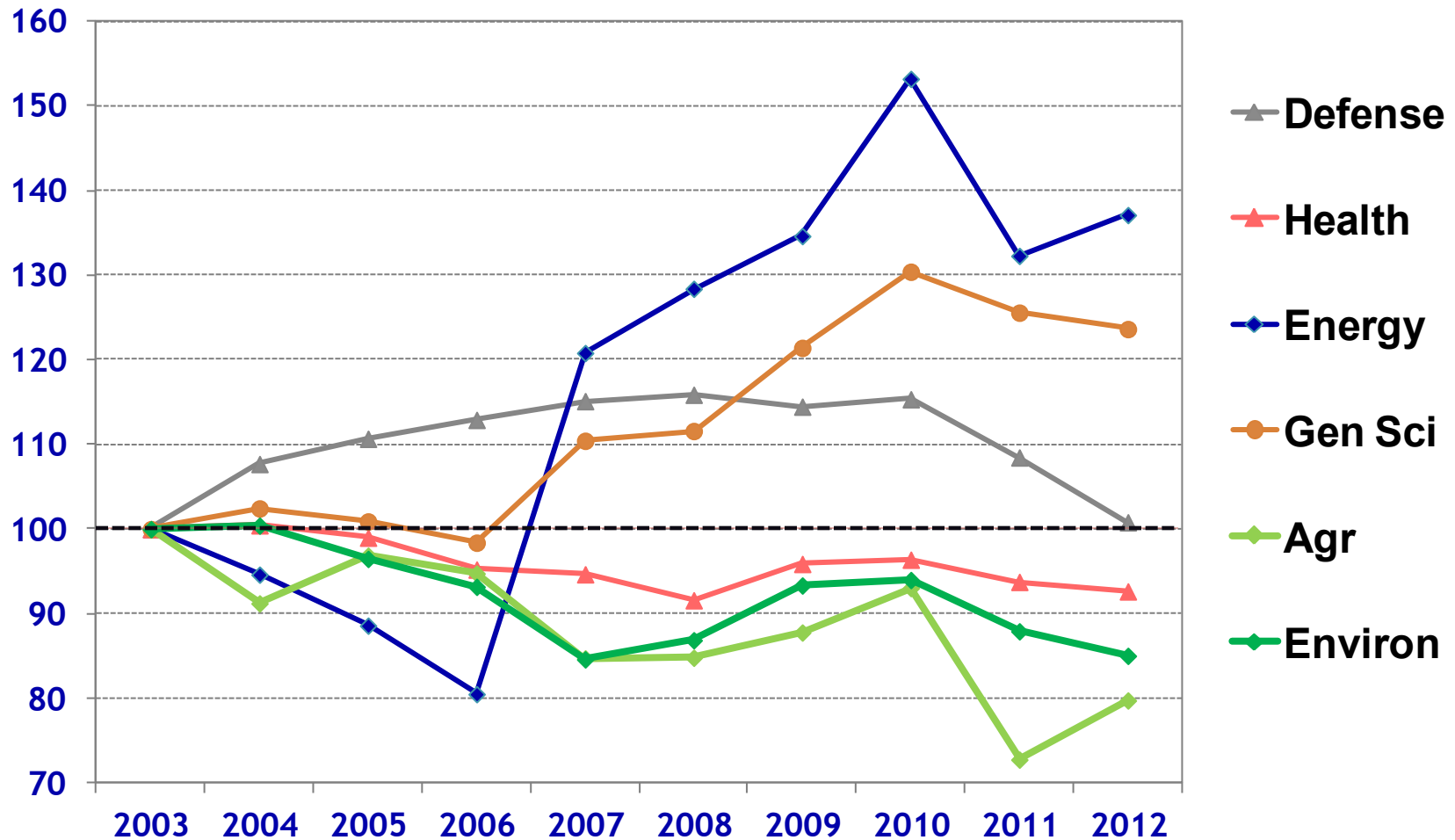
FY 2012 is the latest estimate.

© 2012 AAAS



# R&D Changes by Function Since 2003

change from FY 2003 to FY 2012, FY 2003 = 100



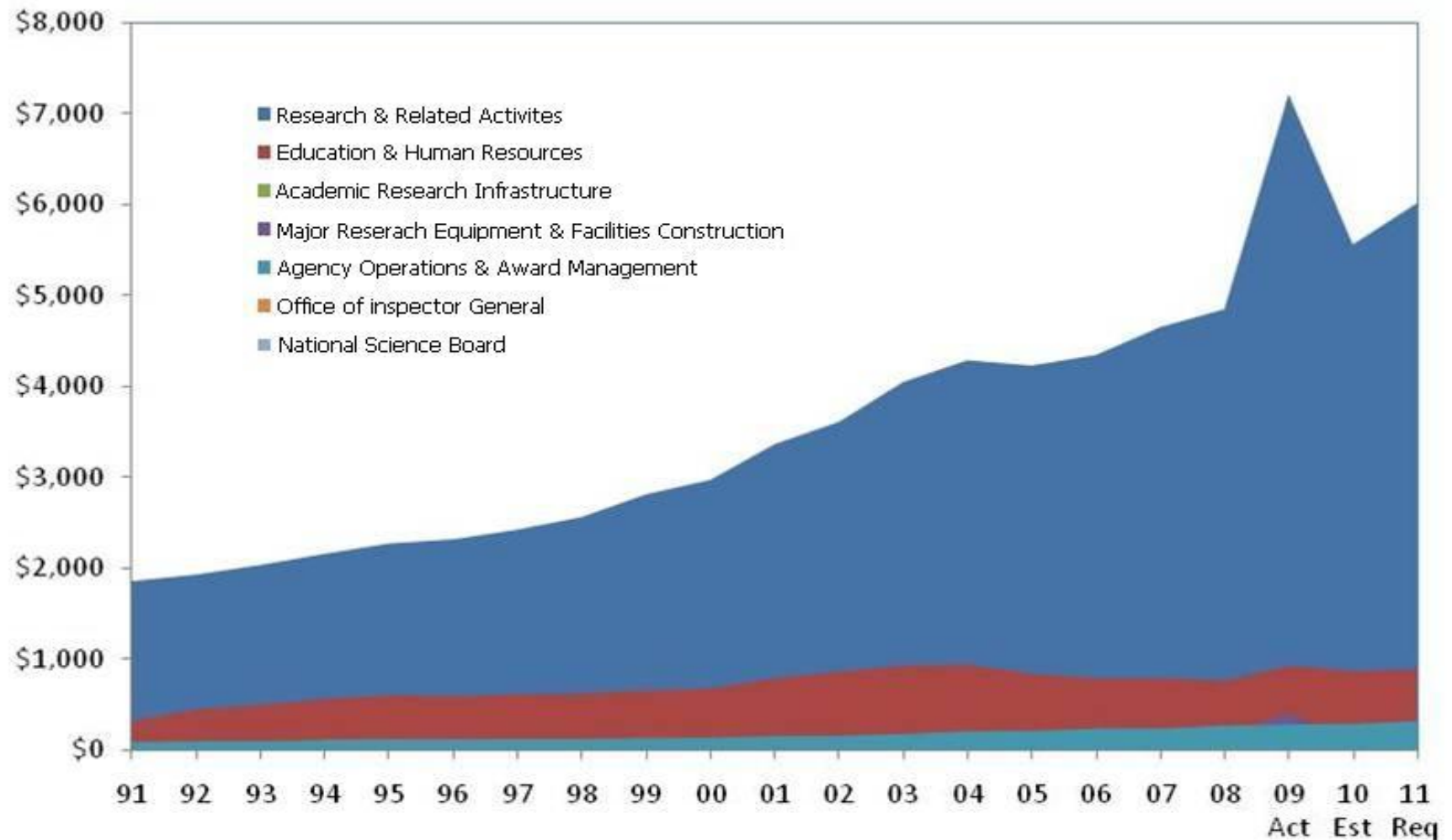
Source: OMB R&D data, agency budget justifications, and agency budget documents. FY 2012 is the latest estimate. Environment includes natural resources R&D.

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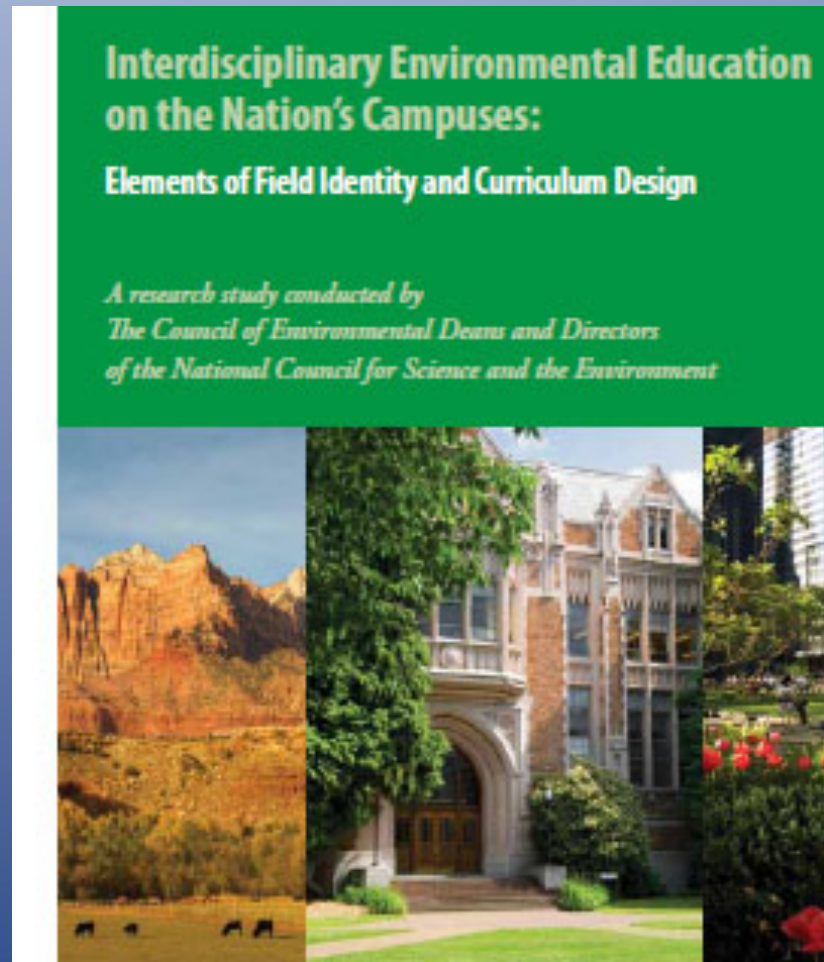
# NSF By the Numbers

**NSF Twenty Year Budget History by Account**  
in Millions of Current Dollars



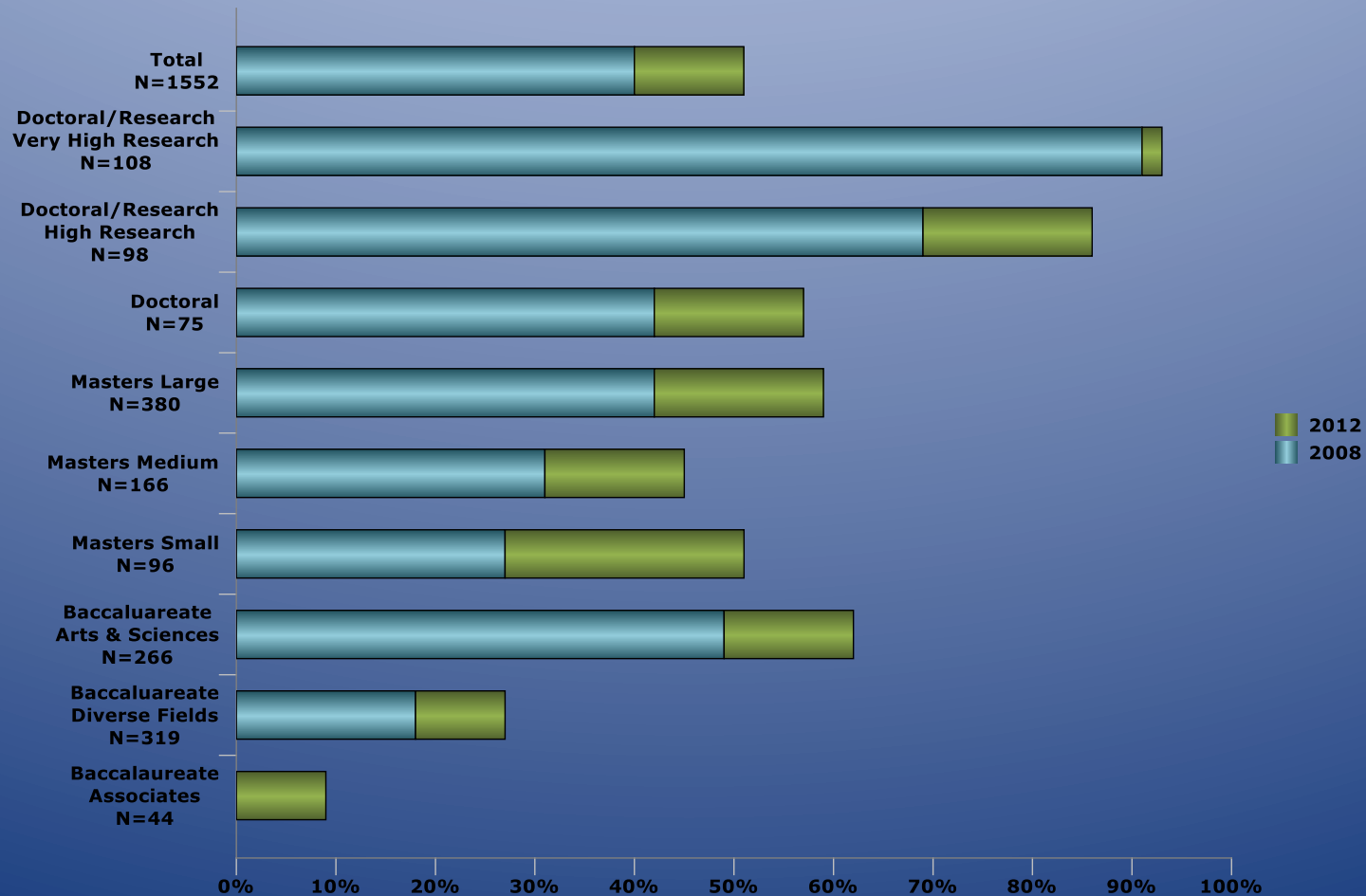
# 2012 Census of Environmental & Sustainability Academic Programs

- All 1638 4-year HE institutions in U.S. – 2010 Carnegie Classification (76 multiple campus FP)
- Interdisciplinary/broad programs
- Discipline & professional fields with specializations
- Minors/certificates
- Center & Institutes

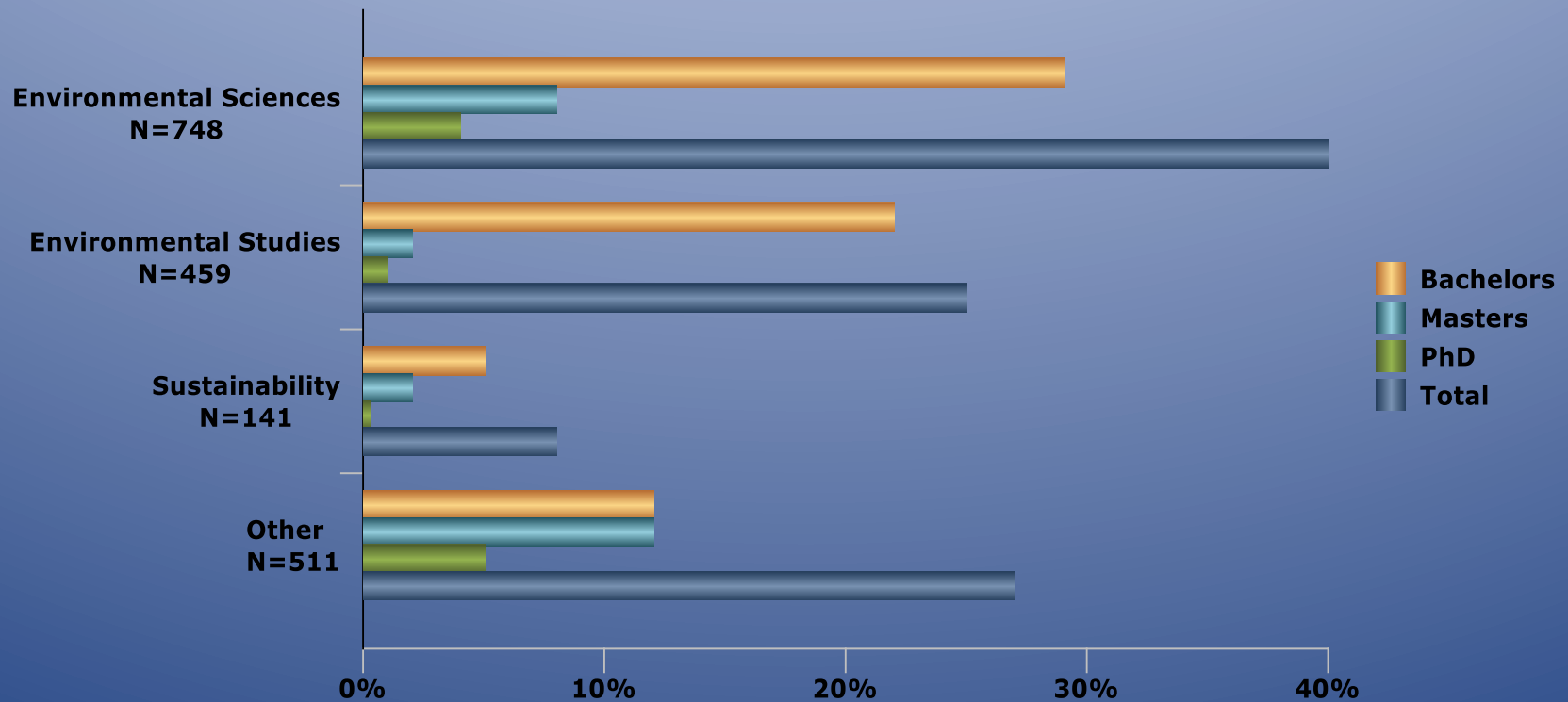


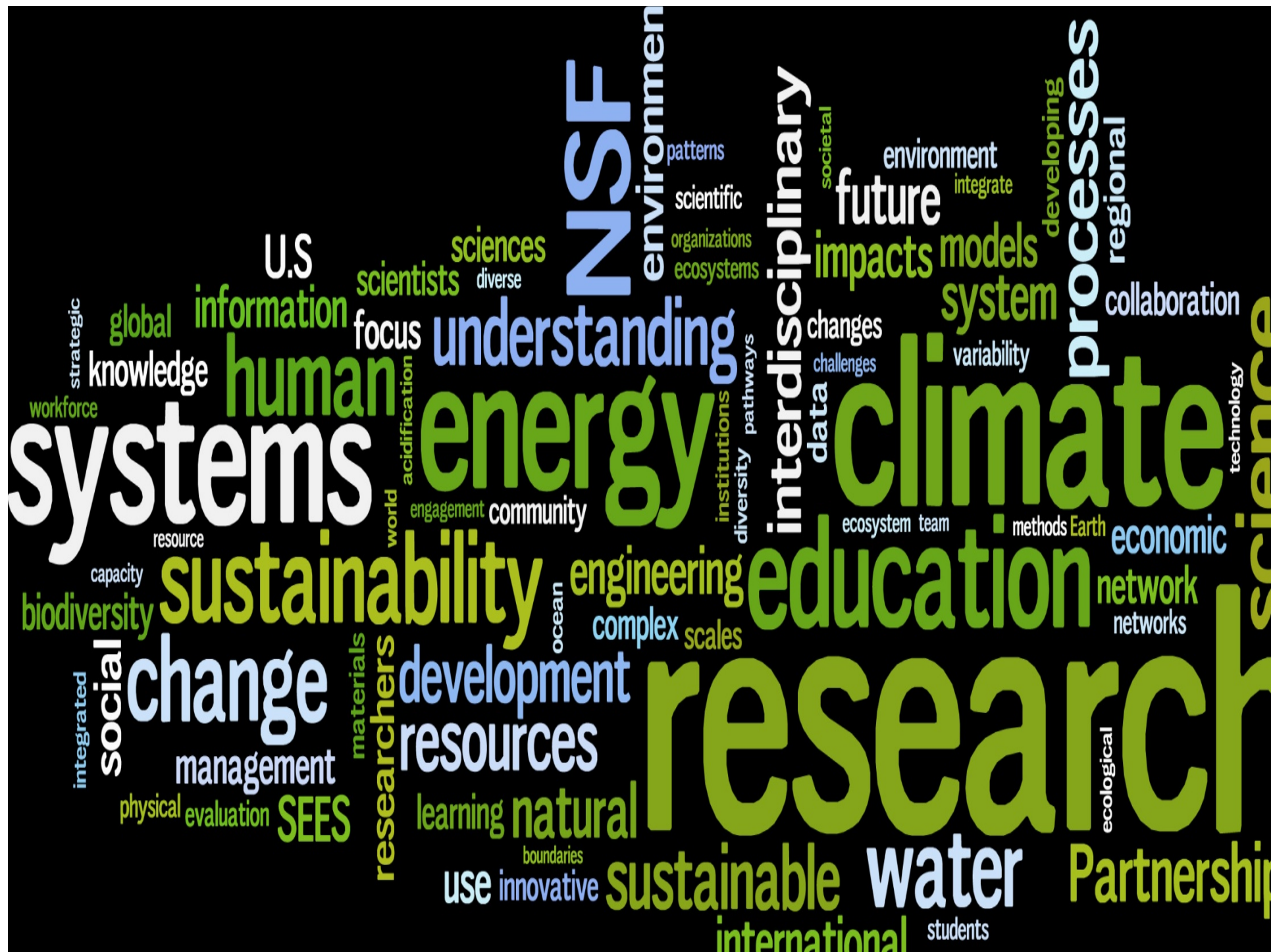


# Trends: Rapid Growth in HE Institutions Hosting Programs



# IE Degree Types





# Administration R&D Priorities

- Promoting **sustainable** economic growth and job creation
- Defeating the most dangerous diseases and achieving better **health** outcomes
- Moving toward a **clean energy** future
- Understanding, adapting to, and mitigating the impacts of **global climate change**
- Managing competing demands on **natural resources**, based on **sustainability and biodiversity**
- Developing the technologies to protect our troops, citizens, and national interests (**security**)

# CLIMATE ENERGY



## THE CLIMATE SOLUTIONS CONSENSUS



National Council for Science and the Environment



# Obama administration agenda on climate and energy

- “Washington may not be ready to get serious about energy independence, but I am...”
- Inaction is not an option that is acceptable to me...— not on energy, not on the economy, and not at this critical moment.”
- “we will transform the way we use energy”
  - largest ever increase in funding for basic research







# Hot Research Areas

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- Climate Change and Energy
  - water issues,
  - livelihood issues,
  - ecological restoration
  - extreme events
  - disaster preparedness
  - security
  - health effects of energy choice
  - vulnerable populations
  - adaptation
  - alternative energy and conservation
  - sustainability

# The future of energy

- Transition to the age of renewables
  - Scientific advances in non-energy fields have great potential to transform the future supply and use of energy
    - Nano/**bio**/microbio/info/cogno science and technology
    - Behavioral and social sciences
    - Interplay between energy and other natural resources



## 2012 SRN Awards

**Joseph Ryan (PI) – University of Colorado Boulder**

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

Requested amount: \$11.1 million

**Klaus Keller (PI) - Pennsylvania State University**

***What are Sustainable Climate-Risk Management  
Strategies?***

Requested amount: \$11.9 million



# Water

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- Water Quality Decisionmaking
- Demand/Use
- Health/Pollution
- Research Funding lagging



# Forecasting

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- Bio- and Eco- Informatics
- Regional Forecasting
- Sensors and Sensor Networks
- Remote and Ground-Based



# Indicators

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- Sustainable Communities
- Economic, Social Environment
- Health and Environmental Impact Assessment
- Cumulative Impacts of Multiple Stressors

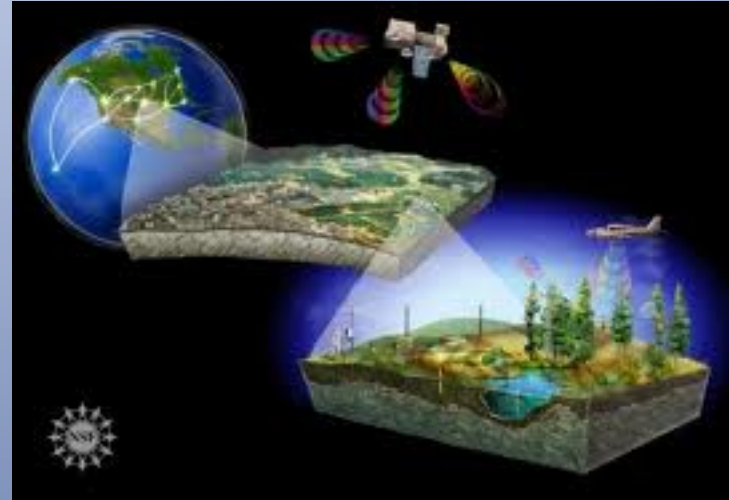




# Research Trends

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- Emphasis on collaborative research and big science aided by sensing and computation technology
- National Ecological Observatory Network
- Decline of single investigator research
- Integration of research and education
- Citizen and participatory science



ISE PI MEETING,  
MARCH 15, 2012



# Common Themes

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- Cross Disciplinary
- Problem-Oriented
- Impacts and Effects
- Integration of Social Sciences
- Translation of science into policy
- Long Term
- Private-Public
- Substantial Investment
- Sustainability
- Social science
- Communication
- Diversity – broader impacts



# Impacts on Universities

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- Land grant and comprehensive universities throughout the West are looking to DoI, USDA, EPA, NASA and NOAA for supporting the next generation of research, but budgets are declining rapidly..
- USGS seems to have successfully passed through their evolution from more of a basic science to more of an applied science and technical assistance agency. Thus they are competing less with universities.
- Over 9000 cooperative agreements have been created through the Cooperative Ecosystem Services Unit (CESUs), but now federal contracting officers are increasingly reluctant to use cooperative agreements to work with universities.



# Impacts on Universities

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- As the research mission at many institutions has increased, and as the pressure on university faculty to obtain sponsored projects (and the indirect costs that come with them), there are many more faculty competing for research awards. This is especially true at NSF.
- Many older faculty have good pipelines of support established through years or decades of cooperative research.
- Younger faculty are really in a bind. Sure there are some programs focusing on young investigators, but they are a drop in the bucket. The federal resource management agencies will continue to provide an important avenue for research funding to develop our younger faculty.



# Impacts on Universities

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- The federal resource management agencies will continue to provide an important avenue for research funding to develop our younger faculty.
- Concern about continued budget cuts and financial impacts on universities.
- Many researchers trying to compete for NSF funding, but NSF focus is on fundamental research.
- NSF Science, Engineering and Education for Sustainability Initiative provides opportunities, but success rates are only 20%.



# Responses by Universities

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- -- faculty are looking to other places for research support.
- -- more funding support and engagement from Industry.
- ---increasing cross-university collaboration





# Responses by Universities

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- Ohio State three \$50K seed grant teams that 1). Have to seek grants totaling over \$3 million and 2). Must involve at least two different colleges.
- OSU website to help faculty learn about others with a similar interest. Key words for each person; key words will be cross-linked so you can use key words to find people who have used that same key word.
- More "upstream" activities such as engaging agencies in their process of designing grants and increasing communication with agency program managers. More help (budget help, proposal writing) to researchers who are writing grants.

# **NSF OVERVIEW for AC-ERE**

**Dr. Margaret Cavanaugh  
(AD GEO Acting)**

**September 12, 2012**

**Advisory Committee for  
Environmental Research and  
Education (AC-ERE)**

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# NSF by the Numbers (FY 2011 data)

- **\$6.9B** appropriations (excludes special or donated funds)
- **1,875** Colleges, universities, and other institutions receiving NSF funding
- **51,600** proposals evaluated through a competitive merit review process
- **11,200** competitive awards funded
- **262,000** proposal reviews conducted
- **276,000** estimated number of people NSF supports directly (researchers, postdoctoral fellows, trainees, teachers, and students)
- **44,000** students supported by NSF Graduate Research Fellowships since 1952

# NSF FY2013 Budget

Total: \$7.373 B

Increase: \$340 M

4.8% over FY12

enacted

## FY 2013 BUDGET REQUEST

### NSF Budget by Appropriation (dollars in millions)

	FY 2011 Actual	FY 2012 Estimate	FY 2013 Request	Change Over FY 2012 Estimate	
				Amount	Percent
Research and Related Activities	\$ 5,608.38	\$ 5,689.00	\$ 5,983.28	\$ 294.28	5.2%
Education and Human Resources	861.04	829.00	875.61	46.61	5.6%
Major Research Equipment and Facilities Construction	125.37	197.06	196.17	-0.89	-0.4%
Agency Operations and Award Management	299.29	299.40	299.40	-	-
National Science Board	4.47	4.44	4.44	-	-
Office of Inspector General*	14.00	14.20	14.20	-	-
<b>TOTAL</b>	<b>\$ 6,912.55</b>	<b>\$7,033.10</b>	<b>\$ 7,373.10</b>	<b>\$ 340.00</b>	<b>4.8%</b>

Note: Totals may not add due to rounding.

\*Includes FY 2011 obligations from funds appropriated through the American Recovery and Reinvestment Act of 2009.

# NSF FY12 & FY13 Agency Priority Goals

- **Access to Digital Products of NSF-funded Research**

**NSF will have established policies for public access to high-value data and software in at least two data-intensive scientific domains**

- **Undergraduate Programs**

**80% of institutions funded through NSF undergraduate programs document the extent of use of proven instructional practices**

- **Innovation Corps**

**80% of teams participating in the Innovation Corps program will have tested the commercial viability of their product or service**



# Balancing Priorities



## OSTP/OMB Priorities

- Innovation
- Manufacturing
- Green Energy
- STEM Education
- Cyber-security
- Economy
- Jobs

## NSF Priorities

- Fundamental research
- Interdisciplinary opportunities
- OneNSF goals
- Quality of STEM education
- Frontier infrastructure
- Early career students, faculty
- Building a diverse workforce





# SCIENCE, ENGINEERING, and EDUCATION for SUSTAINABILITY (SEES) Update

National Science Foundation

AC-GEO, Fall 2012



# Science, Engineering, and Education for Sustainability (SEES)

- **Mission:**  
*To advance science, engineering, and education to inform the societal actions needed for environmental and economic sustainability and sustainable human well-being*
- Established in FY2010
- Cross-NSF investment
- Portfolio of existing and new programs
- System-based approaches





# SEES Goals

- **Build the knowledge base:**  
Support interdisciplinary research and education that facilitates the move towards global sustainability
- **Grow the workforce of the future:**  
Develop a workforce trained in interdisciplinary scholarship needed to understand and address the complex issues of sustainability
- **Forge critical partnerships:**  
Build linkages among existing projects and partners and add new participants in the sustainability research enterprise



# Program Areas

*Climate Change Education - Jill Karsten (GEO)*

*PIRE – John Tsapogas (OISE)*

*Water Sustainability & Climate – Tom Torgersen  
(GEO)*

*Earth System Modeling – Dave McGinnis (SBE)*

*Ocean Acidification – Candace Majors (GEO)*

*RCN-SEES – Bruce Hamilton (ENG)*

*Dimensions of Biodiversity – Richard Inouye (BIO)*

*CNH – Sarah Ruth (GEO)*

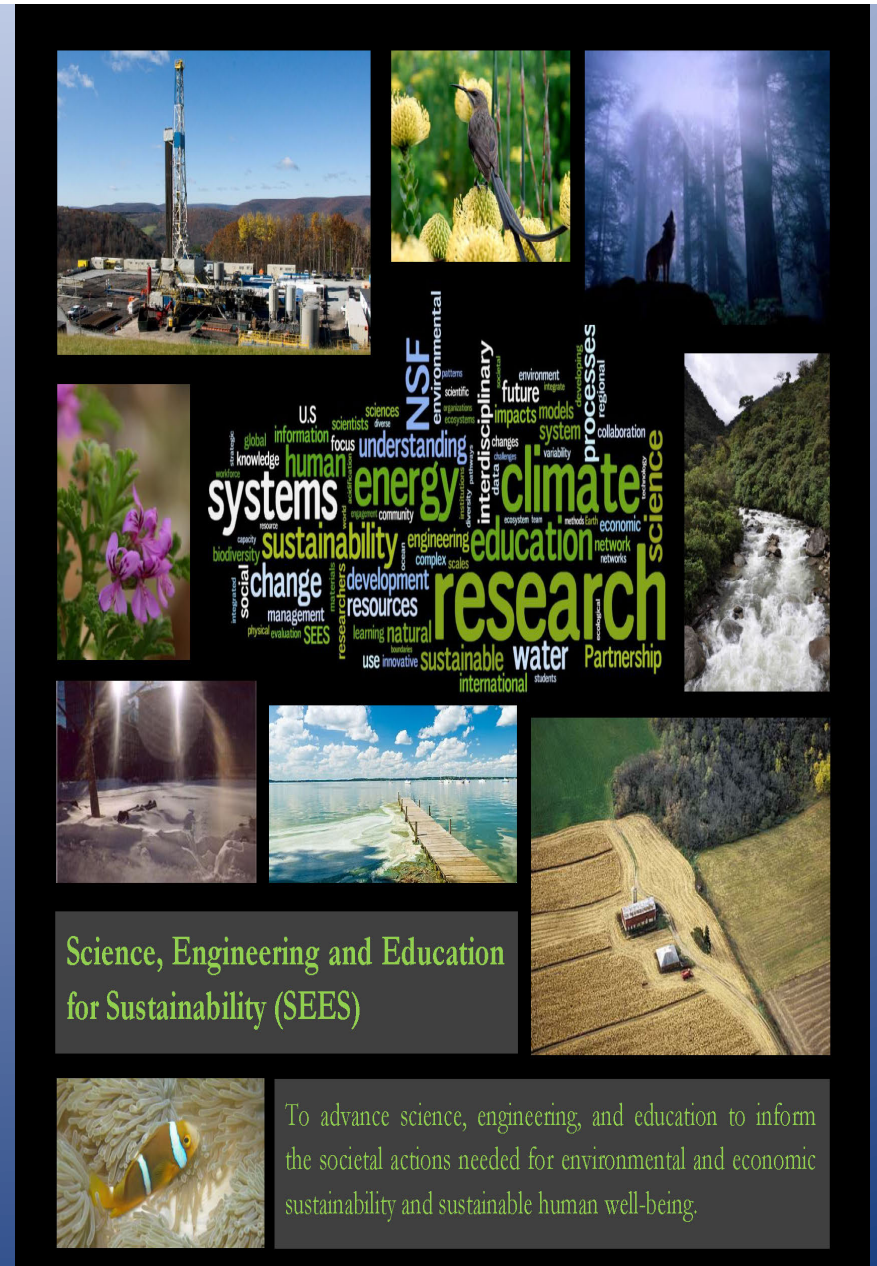
*SEES Fellows – Charles Pibel (MPS)*

*Sustainable Energy Pathways - George Maracas (ENG)*

*Sustainable Research Networks - Sarah Ruth (GEO)*

# SEES in FY2013

- Budget request: \$202.5M
- New programs in:
  - Coastal systems (Coastal SEES)
  - Arctic systems (ArcticSEES)
  - Hazards & Disasters (HazardSEES)
  - Sustainable Chemistry, Engineering and Materials (SusChem)
  - Improvements in IT energy efficiency (CyberSEES)
- Interdisciplinary, research partnerships, professional development







# SEES programmatic Highlights (2012)

- ◎ SEES competitions: 11
- ◎ Total # full proposals: ~ 1200
- ◎ Total # awards: 140 to 150 (1 to 5 yrs)
- ◎ Programs with partners: 4
  - DoB: NASA, NSF-China, FAPESP(Brazil)
  - EaSM: DOE, USDA
  - PIRE: EPSRC & ESRC (UK), Inter-American Institute, JST (Japan), MES (Russia), USAID, US EPA
  - WSC: USDA
- ◎ Total funding: ~ 280M (over five years)
- ◎ New programs: 5
  - Arctic SEES, SuSChEM, Coastal SEES, Hazards & Cyber SEES



# ArcSEES (NSF 12-553)

Proposals are due on September 14, 2012.

Research projects will focus on one or more thematic areas related to Arctic sustainability:

- the natural and living environment
- the built environment
- natural resource development
- governance

Seven directorates, five US agencies, and one international consortium will be jointly reviewing and funding meritorious proposals in FY13.



Photo credits: Steve Hillebrand, USFWS; STG Incorporated/NREL; Peter West, NSF; Lars Poort, Institute of Learning Processes, University of Greenland; Thinkstock





# Engineering & Materials (SUSChEM)

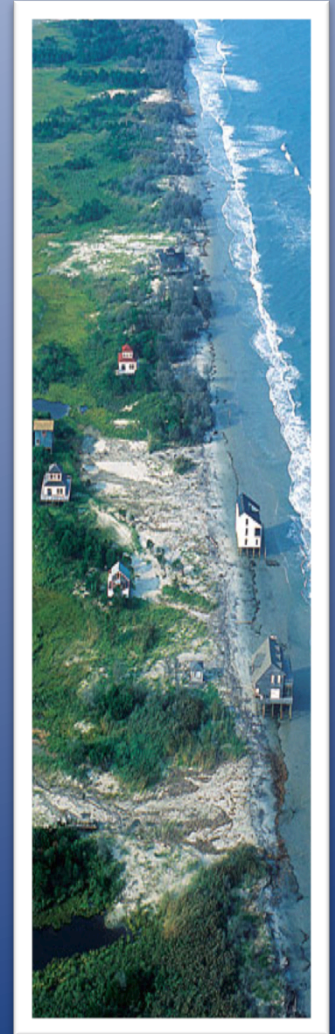
- DCL: Opportunities for interdisciplinary research & education in chemical sciences & engineering related to sustainable synthesis, use and reuse of chemicals & materials (NSF 12-097)
- Advance science, engineering & education to inform societal actions aimed at environmental & economic sustainability
- 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)





# COASTAL SEES (NSF 12-594)

- Multi-directorate (BIO, ENG, GEO, SBE) program that seeks to:
  - Enable place-based system-level understanding of coastal systems on variety of spatial & temporal scales
  - Yield outcomes with predictive value in coastal systems
  - Identify pathways by which outcome could be used to enhance coastal sustainability
- Proposals due January 17, 2013
- Two tracks
  - Incubator proposals (Track 1) --200 to 600K over 2 yrs (strongly encouraged in 1<sup>st</sup> round to build capacity)
  - Research Proposals (Track 2) -- up to \$3M over 5 yrs



# Climate Change Education Partnership

- Connects (1) climate scientists, (2) experts in theories on how people learn science, and (3) formal and informal education experts, with the goals of increasing public understanding of global climate change and preparing the next generation of scientists and educators.
- EHR (DUE & DRL), GEO, BIO, OPP

FY 2009	FY 2010	FY 2011	FY 2012
10 CCE awards in response to Dear Colleague Letter	15 CCEP-I awards (110 proposals): 2 years, up to \$1M	12 supplements: Up to \$250,000 each	6 CCEP-II awards (30 proposals): 5 years, \$5-6M



FY 2013:  
 \* Establish a CCEP Alliance Office  
 \* Initiate Program-Wide Evaluation



# CCEP-II Awards

- **Pacific Islands Climate Change Education Partnership (#1239733) - \$5.9 M**
  - S. Nelson-Barber (PREL), C. Fletcher (Univ. of Hawaii, Manoa), D. Hess (College of the Marshall Islands, Majuro), A. Sussman (WestEd)
  - Using culturally relevant, place-based curriculum to educate K-14 students of the US-Affiliated Pacific Islands about climate science and the unique impacts facing island residents, including sea level rise, ocean acidification, and coastal erosion.
- **Polar Learning and Responding: PoLAR Climate Change (#1239783) - \$5.7 M**
  - S. Pfirman (Barnard), J. Lee (Columbia Univ.), P. Schlosser (Columbia Univ.), E. Sparrow (Univ. of Alaska, Fairbanks), R. Steiner (AMNH)
  - Using novel interactive gaming techniques in formal and informal settings to engage students in climate science and the impacts climate change will have on the polar regions.
- **National Network for Ocean and Climate Change (#1239775) - \$5.5 M**
  - W. Spitzer (New England Aquarium), S. Bales (FrameWorks Institute), P. Boyle (AZA), J. Yoder (WHOI)
  - Using “interpreters” in aquariums to lead regional workshops to effectively convey climate science and impacts to students in an informal setting.





# CCEP-II Awards

- **Making Global Climate Science Local: Implementing an Effective Model to Educate Key Influentials and Community Leaders (#1239797) - \$4.9 M**
  - M. Boudrias (Univ. of San Diego), Mica Estrada-Hollenbeck (California State Univ., San Marcos), Alexander Gershunov (Scripps Inst. of Oceanography), Jeanne Silva-Send (Univ. of San Diego)
  - Developing training modules targeted toward “key influentials” to better understand how to communicate climate science and climate change impacts to community leaders and policymakers.
- **MADE-CLEAR: Maryland-Delaware Climate Change Education, Assessment, and Research (#1239758) - \$5.6 M**
  - D. Boesch (Univ. of Maryland Center for Environmental Science), N. Brickhouse (Univ. of Delaware), Nancy Shapiro (Univ. System of Maryland), Nancy Targett (Univ. of Delaware)
  - Developing curricula for Maryland and Delaware public schools that communicate climate science and climate change impacts, and align with K-16 state standards for education.
- **Climate and Urban Systems Partnership (CUSP) (#1239782) - \$5.9 M**
  - S. Snyder (The Franklin Institute), K. Crowley (Univ. of Pittsburgh), R. Horton (Columbia Univ. Center for Climate Systems Research)
  - Creating a partnership of several cities on the East Coast that use informal education venues and public outreach initiatives to broadly disseminate climate science to a variety of audiences.





# **PARTNERSHIPS FOR INTERNATIONAL RESEARCH & EDUCATION (PIRE)**



# Partnerships for International Research and Education

## Examples of 2012 PIRE Awards

Mapping evolutionary process in the face of climate change: an integrated approach to education and conservation prioritization in Central Africa –UCLA-Cameroon, Gabon, United Kingdom, and Germany

Context Sensitive Implementation of Synergistic Water-Energy Systems-Univ. of S. Florida-Belize, Dominican Republic, Panama. United Kingdom

Developing Low-Carbon Cities in the USA China & India through Inter-Disciplinary Integration across Engineering Environmental Sciences Social Sciences & Public Health-U of Minnesota-India and China

Understanding marine biodiversity along geographic and anthropogenic stress gradients-San Diego State-Indonesia

Nuclear energy systems and materials under extreme conditions-Purdue-Russia, Japan, Germany, Ireland

Local to Global Scale Monitoring for a Sustainable Earth Dam and Levee System-Colorado School of Mines-Netherlands and France



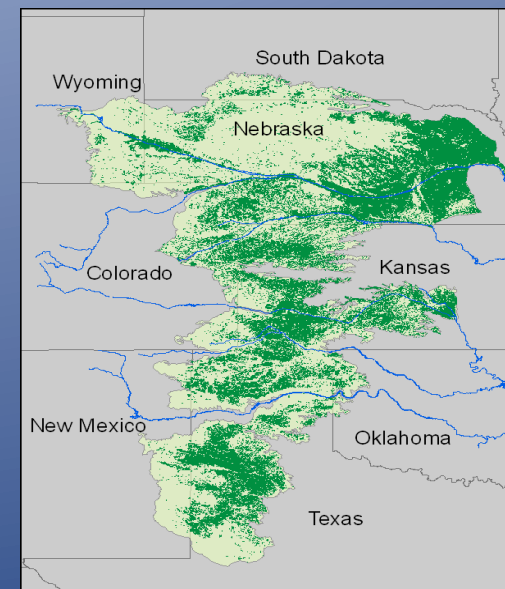
# **WATER SUSTAINABILITY AND CLIMATE (WSC)**



# Water Sustainability and Climate

## NSF 10-524/NSF11-551

The GOAL of the Water Sustainability and Climate (WSC) solicitation is to understand and predict the interactions between the water system and climate change, land use (including agriculture), the built environment, and ecosystem function and services through place-based research and integrative models



Interdisciplinary research on Water Sustainability in the High Plains Aquifer Region to understand the interactions between the water system and climate change, land use (including agriculture), the built environment, and ecosystem function and services through place-based research and integrative models





## WHAT IS WSC?

...transformative systems science that builds upon research in four Directorate/Agency disciplines (BIO/AG, ENG, GEO, SBE).

...to portray the disciplinary processes and the coupling of those processes as a system

...at specific sites singly or in combination ... with or without ongoing observations

...that allow for spatial and temporal extrapolation to other regions, as well as integration across the different processes"

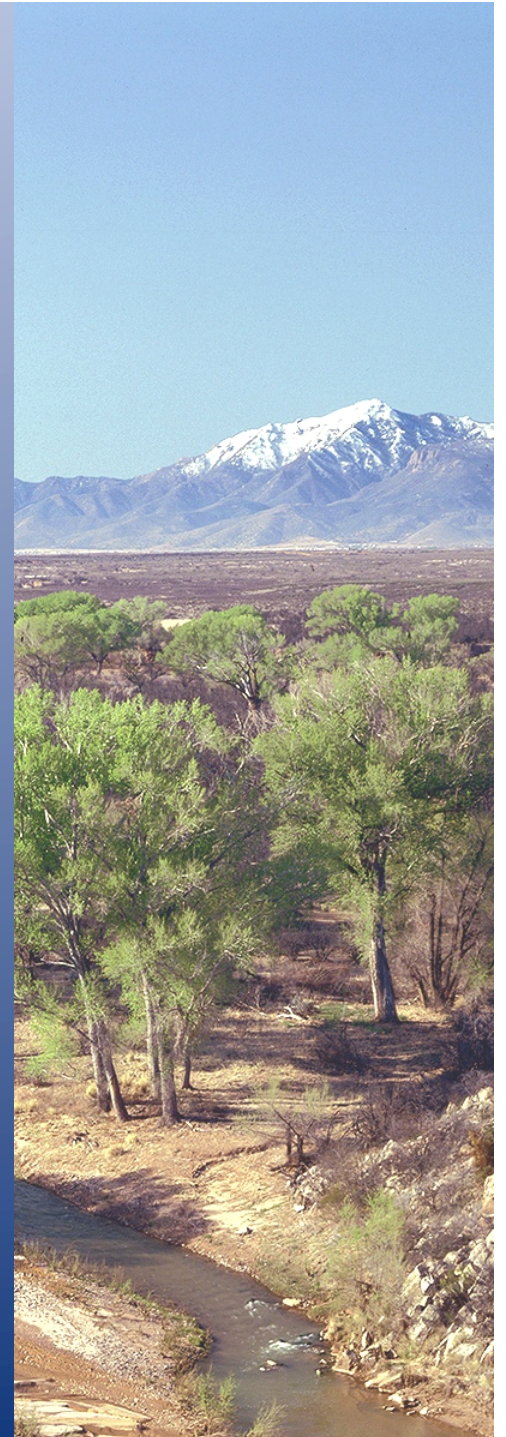
"Proposals that do not broadly integrate across the biological sciences, geosciences, engineering, and social sciences may be returned without review."

## WSC 2010: \$26M

- Cat 1: 65 submissions, 10 projects funded
- Cat 2: 67 submissions, 4 projects funded
- Cat 3: 40 submissions, 3 projects funded

## WSC 2012: \$26M

- Cat 1: 61 submissions, 4 projects funded
- Cat 2: 60 submissions, 4 projects funded
- Cat 3: 42 submissions, 7 projects funded
- *one more time and possibilities for more....*





# Water Sustainability and Climate

▲ Cat 2 funded 2010

● Cat 3 funded 2010

■ Cat 1 funded 2010

□ Cat 1 funded 2012



▲ Cat 2 funded 2012

○ Cat 3 funded 2012

□ Cambodia ● Asia, montaine

▲ SE Asia, Sri Lanka

○ Nationwide



# **Decadal & Regional Climate Prediction Using Earth System Modeling (EaSM)**



# EaSM

- Solicitation revised 2012
  - Proposals were due May 11, 2012
- Program long-term goals
  - Reliable global and regional predictions of decadal climate variability and change
  - Quantify impacts of climate variability and change on natural and human systems
  - Maximize model utility for vulnerability/resilience and risk assessments
  - Translate climate predictions (& uncertainties) into scientific basis for policy and decisions
- 2010 Awards
  - 12 Type I (large) awards (\$21.1M)
  - 15 Type II (exploratory) awards (\$9.0M)
- 2012 competition only for Type I proposals
  - 85 unique projects
  - 204 total proposals
  - 7-12 awards expected; budgets ~ \$3-5M for 3-5 yrs



# Ocean Acidification (2013)



# Research Coordination Networks – SEES Track (RCN-SRN)





## New RCN-SEES Grants (2<sup>nd</sup> Round)

- RCN-SEES grants support research coordination, not research
- The award size is up to \$750K with a duration of 4-5 years
- For this 2<sup>nd</sup> round of the RCN-SEES competition, seven (7) new grants are being made



## New RCN-SEES Grants (continued)

- “Coordinating Phosphorus Research to Create a Sustainable Food System”  
Jim Elser at ASU (managed by CHE/MPS)
- “Multidisciplinary Approaches to Carbon Capture, Utilization and Storage”  
Alissa Park at Columbia U. (managed by CBET/ENG)
- “Building a Research Network for Promoting Arctic Urban Sustainability in Russia”  
Robert Orttung at GWU (managed by OPP)



## New RCN-SEES Grants (continued)

- “Advancing our Social and Environmental Understanding of Complex Mountain Landscapes and Their Vulnerability to Environmental Change”  
James Gosz at U. of Idaho (managed by DEB/BIO)
- “Integrated Network for Social Sustainability: Concepts, Language, and Assessment”  
Nicole Peterson at UNCC (managed by BCS/SBE)
- “Engineering Research Collaboratory for Sustainable Infrastructure in a Changing Climate”  
Jennifer Jacobs at UNH (managed by CBET/ENG)



# ***Dimensions of Biodiversity***





# ***Dimensions of Biodiversity***

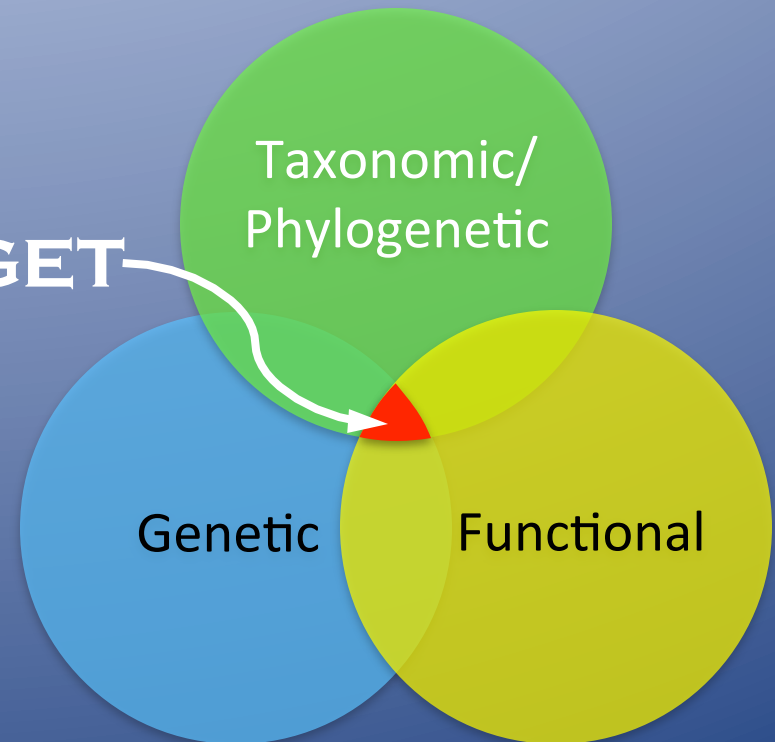


*A 10-year campaign to characterize the dimensions of biodiversity on Earth*

Initial focus on areas where three dimensions overlap

- Integrative approaches
- Innovative concepts
- Rapid advances

**TARGET**



***“This has pushed the community beyond business as usual.”***

***“[Dimensions] will accomplish in 10-15 years what would***



# ***Dimensions of Biodiversity***



## **FY2010**

- 290 letters of intent; 195 proposals reviewed in 2 panels
- 13 research awards, one joint U.S.-China IRCN
- \$26.3 M Total: BIO \$18.9 M; other NSF \$6.8 M; NSFC \$600 K

## **FY2011**

- 117 proposals reviewed in 1 panel
- 11 research awards and one joint U.S.-China IRCN
- \$28.6 M Total: BIO \$17.5 M; other NSF \$10.5 M; NSFC \$600 K

## **FY2012**

- 122 proposals reviewed in 1 panel
- 14 research awards – two US-China, one US-Brazil
- \$31.5 M Total: BIO \$21M; other NSF \$5.4 M; NSFC \$2.4 M; Brazil \$2 M; NASA \$731 K

# ***Dimensions of Biodiversity***



## ***Streams of activity***

## ***2020 Goals***

Research	An integrated understanding of the key but unknown dimensions of biodiversity on earth
Cyberinfrastructure	Informatics and infrastructure that support accessible, interoperable information capability for dimensions of biodiversity
Collections	Digitization of collections and enhanced physical infrastructure to link to cyberinfrastructure and leverage the enormous investments of the past
Workforce	A diverse, interdisciplinary, globally-engaged, scientific workforce capable of transforming and communicating our understanding of biodiversity on Earth
Synthesis	Scientific analyses and syntheses that generate and disseminate useful information for scientists, educators and decision makers

## ***Approach:***

Planning &  
Partnering



Base lining &  
synchronizing



Assessing  
progress



Aligning investments  
with emerging  
priorities



# ***Dimensions of Biodiversity***

“...an inexact first pass” with  
focus on key but little known  
dimensions





# **Dynamics of Coupled and Natural Human Systems (CNH) 2012**





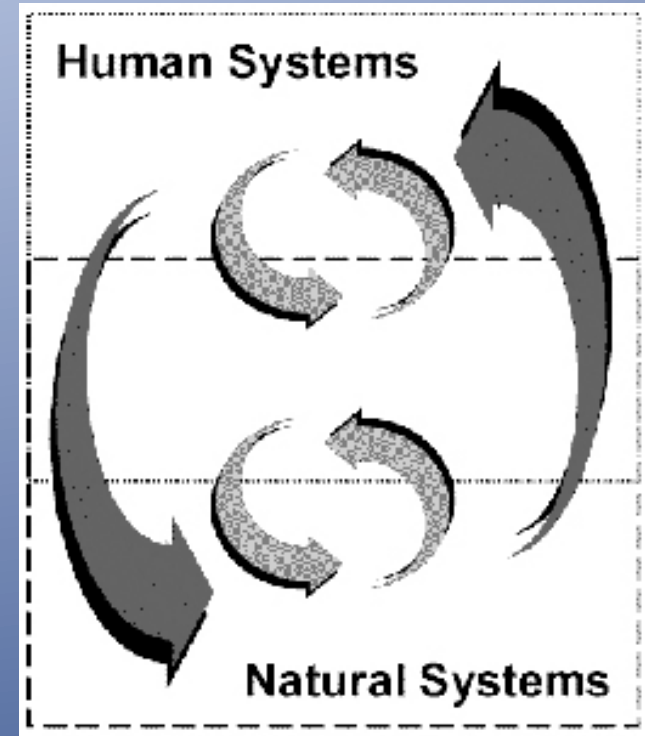
# CNH Solicitation

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

Large (up to \$1.5 million over 4- 5 years)  
Mature projects, typically large teams

Exploratory (up to \$250,000 over 1-2 years)  
New teams, smaller projects  
NOT planning grants

Research Coordination Networks (\$500k over 5 years)  
Build communities and capacity around a common theme







# 2012 CNH Awards

- 13 large and 6 exploratory awards (of 91 and 35 proposals resp.)
- 14 with strong international components (Asia, Africa, Central & South America, Pacific Islands)
- Topics and themes:
  - ecosystems (services and restoration)
  - health (disease vectors and climate)
  - ancient societies, landscapes and practices
  - agriculture and fisheries
  - resilience, vulnerability



# 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	98 (large) 37 (exp.) 4 (RCN)	24 (large) 13 (exp.) 2 (RCN)	14 (large) 5 (exp.) 1 (RCN)	14% (large) 14% (exp.) 25% (RCN)	58% (large) 38% (exp.) 50% (RCN)
2012	91 (large) 35 (exp.) 6 (RCN)	31 (large) 12 (exp.) 3 (RCN)	13 (large)* 6 (exp.) 0 (RCN) * Now 12	14% (large) 17% (exp.) 0% (RCN)	42% (large) 50% (exp.) 0% (RCN)



**SEES Fellows  
Interdisciplinary Graduate Students  
solicitation currently open**

# Sustainable Energy Pathways 2012

To develop efficient pathways towards sustainable energy, from starting points to ending points, via a systems approach in the priority areas of

MPS, ENG CISE, GEO, SBE  
BIO, EPSCoR, MPS/OMA

\$37M for 20 awards

## Fundamental Considerations

• *Scientific knowledge & technological innovation*

• *Environmental, societal and economic imperatives,*

\* *Education and workforce development,*

## Topic Areas

- Sustainable Energy Harvesting, Conversion, and Storage

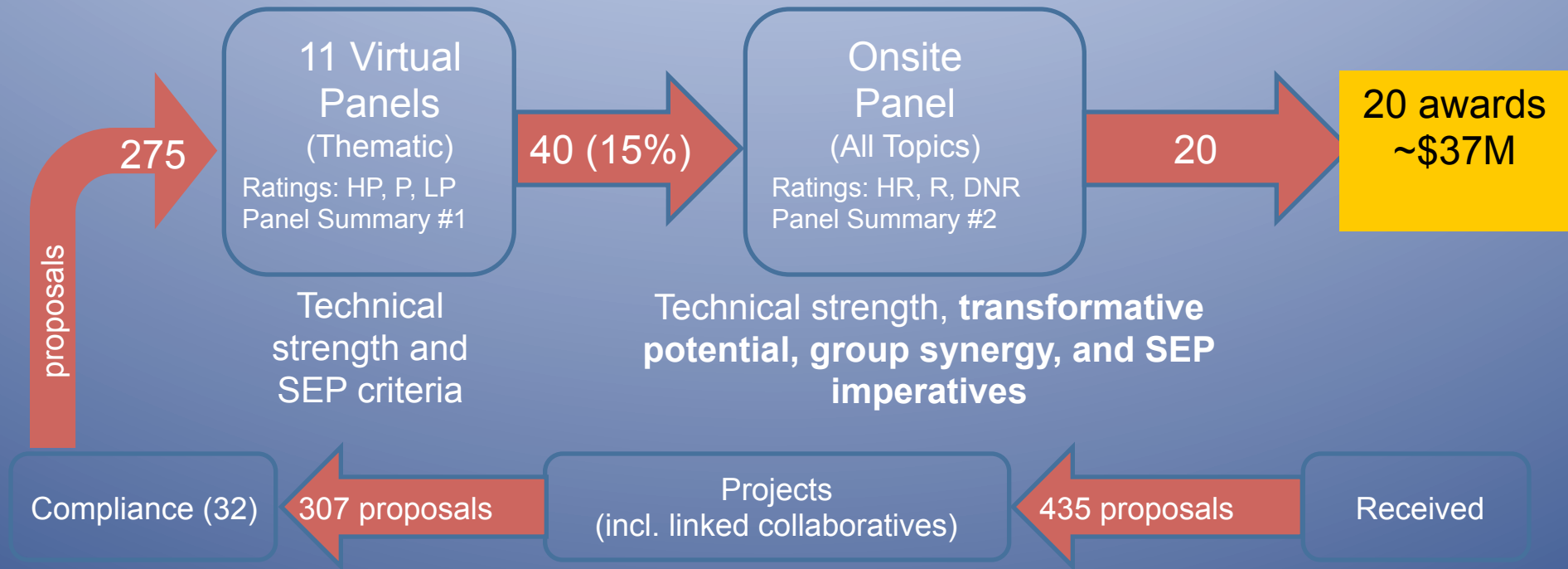
- Energy harvesting and conversion
- Energy storage solutions
- Critical elements and materials
- Nature inspired processes
- Reducing carbon intensity

### Energy Transmission, Distribution, Efficiency, and Use

- Transmission and distribution
- Energy efficiency and management

Role of SBE – present in all awards

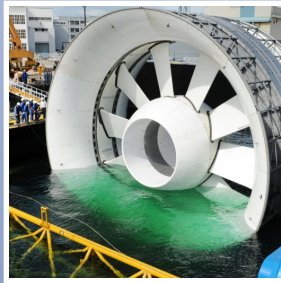
# SEP 2012 Proposal Review Process



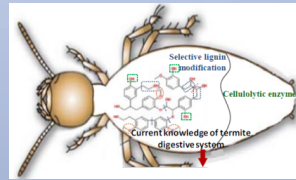
MPS	12,500,000	SBE	4,000,000
ENG	10,000,000	EPSCoR	489,957
CISE	5,000,000	MPS/OMA	300,000
GEO	4,000,000	BIO	500,000

Allocated funds      \$36,789,957

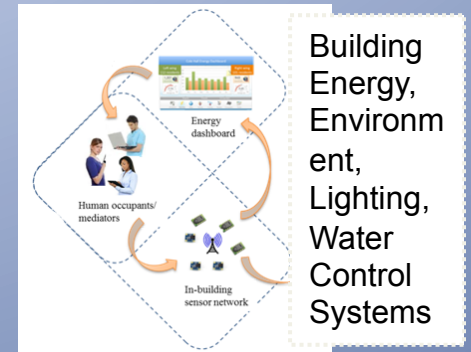




Tidal turbines in Puget Sound (B. Polagye)



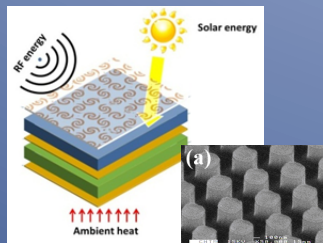
Lignocellulosic biomass fuels using termite enzymes. (S. Chen)



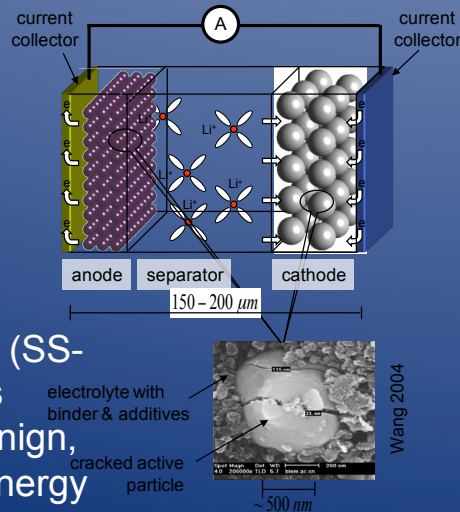
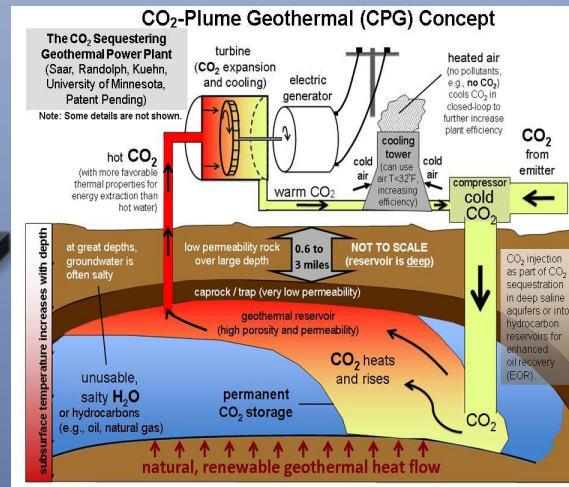
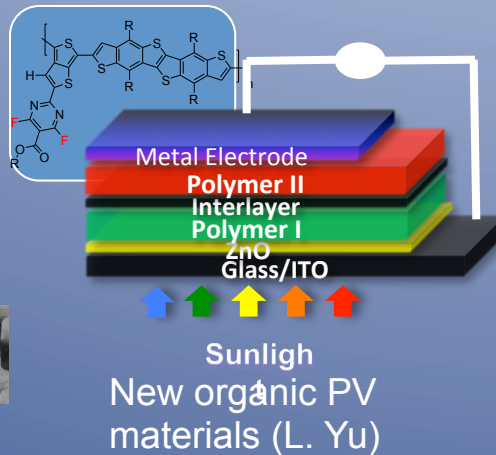
Human-mediated energy systems in multi-occupancy buildings (B. Becerik-Gerber)

CO<sub>2</sub>-Plume Geothermal (O.Saar)

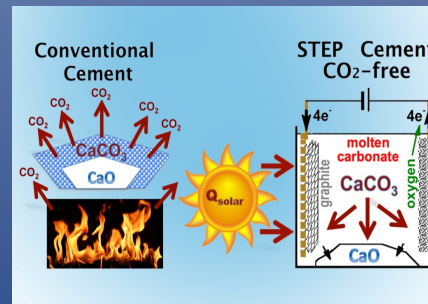
## SEP 2012 Awardees (selected)



Solar, heat, RF & microwave energy harvesting (O. Lavrova)

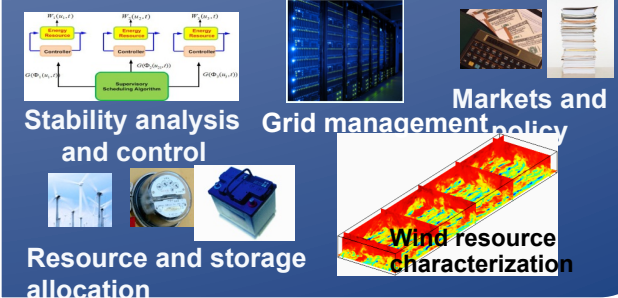


Solid state Li pyrite (SS-LP) battery. FeS<sub>2</sub> is environmentally benign, inexpensive, and energy dense. (S-H Lee)



Calcium oxide production without CO<sub>2</sub> emission (S. Licht)

## Integrated analysis framework



High renewables penetration electric power systems (D. Gayme)



# Sustainability Research Networks (SRN)



# SRN Solicitation

Frontier  
sustainability  
theme

Integration of  
science,  
engineering and  
education

Multi-  
institutional team  
(academic,  
private,  
government,  
NGOs)

Inter-disciplinary  
approach

- 3 - 4 awards
- 4 - 5 years
- up to \$12 million each
- Awarded as cooperative agreements, with additional NSF oversight.



## 2012 SRN Awards

**Joseph Ryan (PI) – University of Colorado Boulder**

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

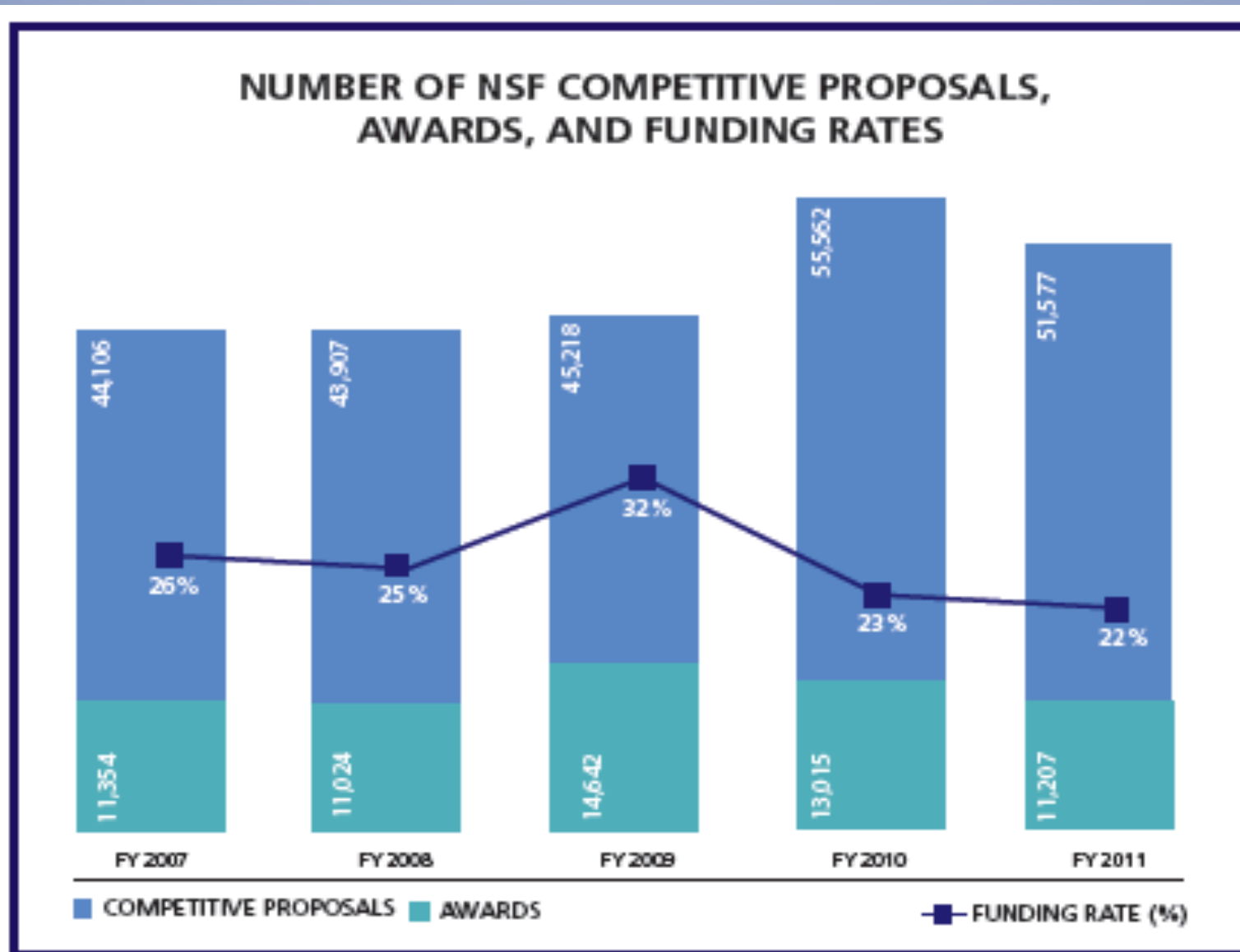
Requested amount: \$11.1 million

**Klaus Keller (PI) - Pennsylvania State University**

***What are Sustainable Climate-Risk Management  
Strategies?***

Requested amount: \$11.9 million

# NSF By the Numbers (FY11 data)





# Questions & Answers



National Council for Science and the Environment  
*Improving the scientific basis for environmental decisionmaking*

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Senior Scientist

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Thank you!

