

Sustainability

**CAISE and the NSF ISE Program
Sustainability Science and Informal Science
Education Convening**

February 6, 2012

**Science and Technology for Sustainability Program
Policy and Global Affairs Division
National Research Council
The National Academies**

ABOUT THE NATIONAL ACADEMY OF SCIENCES

...the Academy shall, whenever requested upon by any department of the Government, investigate, examine, experiment, and report upon any subject of science.

—1862 Act of Incorporation, signed by Abraham Lincoln

With these words, Congress established the National Academy of Sciences in 1862 as a private, non-profit organization. Devoted to advancing the science of the United States, the Academy was the first and still remains a high honor for American scientists. Members of the National Academy of Sciences—and its sister organizations, the National Academy of Engineering and the Institute of Medicine—are among the nation's most respected and authoritative leaders in the scientific, technological, and health communities, including hundreds of Nobel Prize winners and recipients of National Medal of Science and of Turing.

Today, the responsibility for providing independent advice to the government on matters of science, technology, and medicine is shared by these three organizations, and the National Research Council. Each year, thousands of the world's most knowledgeable scientists, engineers, and other experts volunteer their time to work together on committees that advise the Executive Branch, Congress, and the courts on some of the most important and difficult issues of our time.



One of the first National Academy of Sciences studies was commissioned to improve the performance of compasses on sea ships.

The National Research Council and the Institute of Medicine produce more than 200 reports each year, using scientific evidence to make recommendations about many of the nation's most pressing issues. The audience for these recommendations are the nation's policymakers and the general public. Some examples of reports are displayed on the panels to your left and right.

These reports are increasingly influential, often catalyzing new federal policies or enhancing and improving existing programs. High standards and a reputation for independence and objectivity help to give the reports their unparalleled credibility, leading weight to their conclusions and recommendations.

In addition to writing these reports, we also publish scientific periodicals and popular books. And we host many events that bring together scientists, policymakers, and the public from the United States and abroad. Access to nearly all of these reports and news is provided through our Web site at www.nas2000.org.



These engineers first determined the way that light waves behaved in 1801.

About the National Academies

Purposes

- To advance science and technology
- To advise government and the nation

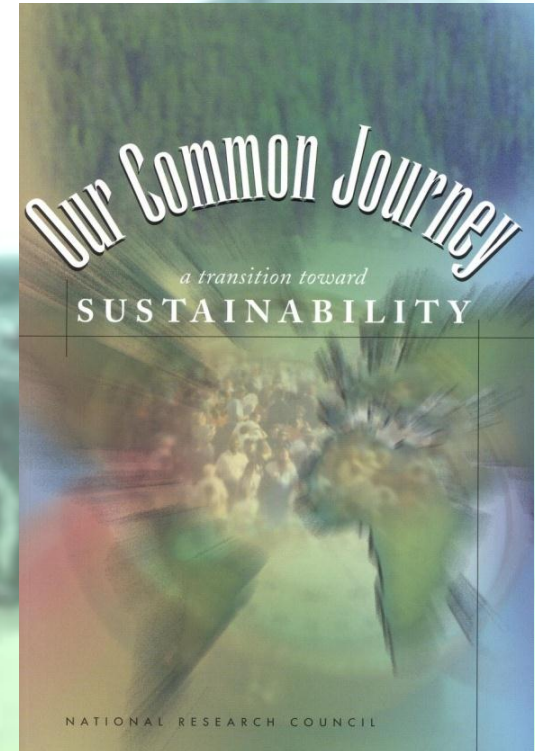
Principles

- Independence
- Balance
- Objectivity



***Our Common Journey: A Transition toward Sustainability* (NRC, 1999) – described the goals of sustainability:**

“The primary goals of a transition to sustainability over the next two generations should be to meet the needs of a much larger but stabilizing human population, to sustain the life support systems of the planet, and to substantially reduce hunger and poverty.”



Sustainability

- A Different Way of Thinking: Three Pillars
- Process and a Goal
- Organizing Principle
- Unique Characteristics: “Transdisciplinary”
- Systems Approach

Science and Technology for Sustainability Program

Policy and Global Affairs Division

- Encourage the use of science and technology to achieve long-term sustainable development.
- Goal: to contribute to sustainable improvements in human well-being by creating and strengthening the strategic connections between scientific research, technological development, and decision-making.
- The program concentrates on activities with the following attributes:
 - Cross-cutting in nature, requiring expertise from multiple disciplines;
 - Important both in the United States and internationally;
 - Effectively addressed via cooperation among multiple sectors, including academia, government, industry, and NGOs.

Science and Technology for Sustainability Program

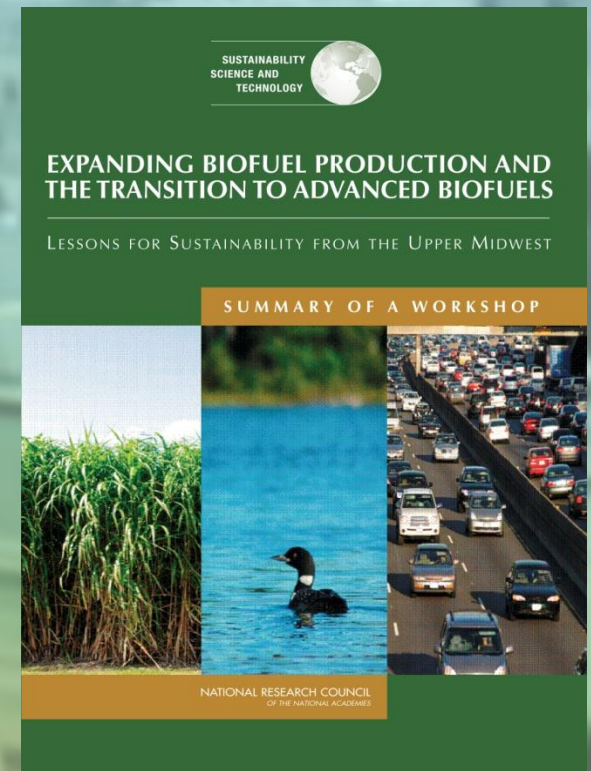
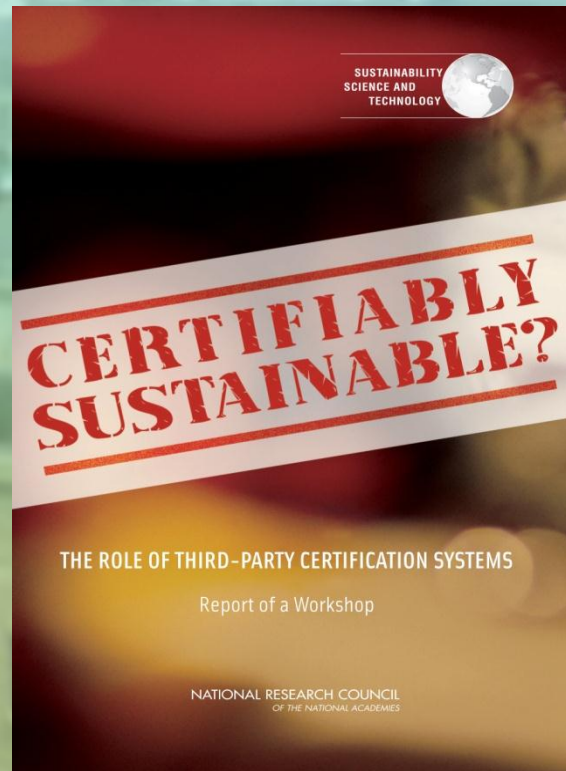
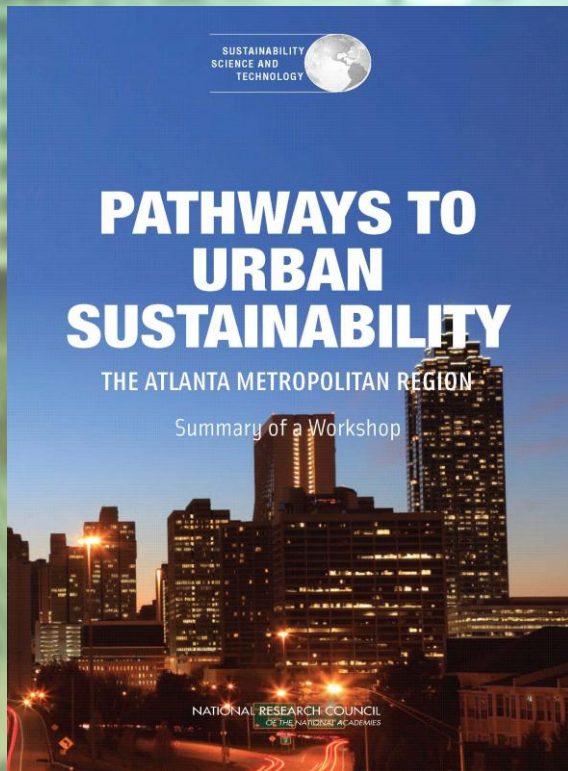
Programmatic Elements

- Roundtable on Science and Technology for Sustainability
- Network for Emerging Leaders in Sustainability
- Sustainability at the Academies Newsletter
- Sponsor-Requested Workshops and Studies

Approach

- Applied Cases
- Framework Studies

Examples of the Applied Cases





Pathways to Urban Sustainability

The Atlanta Metropolitan Area

October 2010

Outcomes

- Endorsed a “systems approach” as having an important role in addressing sustainability. For example, infrastructure – transportation, electrical and energy systems, water and waste handling, and natural systems – require such an approach as major environmental and societal components are interconnected and interrelated
- Education is a critical part of metropolitan Atlanta’s transition to sustainability. Informed citizenry has the potential to influence the political climate and elect leaders and public officials that are receptive to creating sustainability goals and implementing programs which achieve those goals



Pathways to Urban Sustainability

A Focus on the Houston Metropolitan Area

January 2012

Focus Issues

- Located in a vulnerable coastal zone, and extreme events such as 2008's Hurricane Ike demonstrated outsized impacts natural disasters can have on urban areas. Land use decisions have resulted in a high degree of automobile dependency, traffic congestion, and polluted sites in close proximity to residential areas
- Air quality has been problem for decades—ozone and particulate matter are persistent threat to human health in the area



A Sustainability Challenge: Food Security for All

Workshop 1: Measuring Food Insecurity and Assessing the Sustainability of Global Food Systems (February 16-17, 2011)

- Workshop participants examined commonly used indicators for food security and malnutrition; poverty; and natural resources and agricultural productivity as well as the data sources used.
- A key objective was to explore approaches for making these indicators more useful to policy makers to assess and monitor progress in achieving food and nutritional security.
- The workshop reviewed various measures of agricultural productivity, critical tools for assuring that increased production does not endanger the long term viability of critical natural resources.
- A workshop summary now posted on the NAP website.

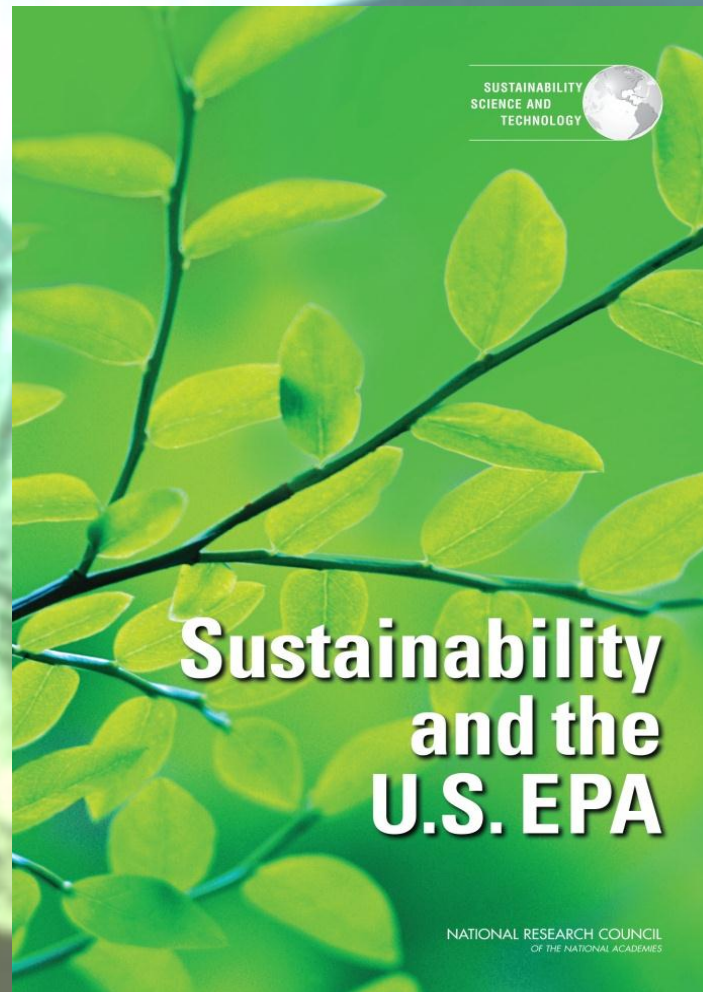


A Sustainability Challenge: Food Security for All

Workshop 2: Exploring Sustainable Solutions for Increasing Global Food Supplies (May 2-4, 2011)

- The second workshop explored approaches to sustainably increasing food availability in a world where the population will grow to more than 9 billion by 2050 requiring 70 percent more food.
- Workshop participants examined some of the major barriers to expanding food production including water availability; limited productive land, and risks associated with climate change.
- They also discussed the policy, technology and governance interventions that could reduce these barriers and promote sustainable food availability as a basic pillar of sustainable food security.
- A workshop summary now posted on the NAP website.

Framework Studies



Sustainability and the U.S. Environmental Protection Agency

- A committee under the STS Program will conduct a study at the request of the U.S. Environmental Protection Agency (EPA)'s Office of Research and Development to help define efforts to incorporate sustainability concepts into Agency programs.
- This study will build on existing sustainability efforts in EPA by strengthening the analytic and scientific basis for sustainability as it applies to human health and environmental protection within the Agency's decision-making process.

Sustainability and the U.S. Environmental Protection Agency

- Develop a framework for EPA to solve complex environmental challenges through a more integrated, systems approach
- Similar to the 1983 NRC report Risk Assessment in the Federal Government
- Will define for EPA a recommended framework that will then be scaled up under the broader NRC study, Sustainability Linkages in the Federal Government (“Linkages”) to develop a decision framework to help all federal agencies examine the consequences, tradeoffs, synergies, and operational benefits of sustainability-oriented programs

Sustainability and the U.S. Environmental Protection Agency

The consensus report answered the following questions:

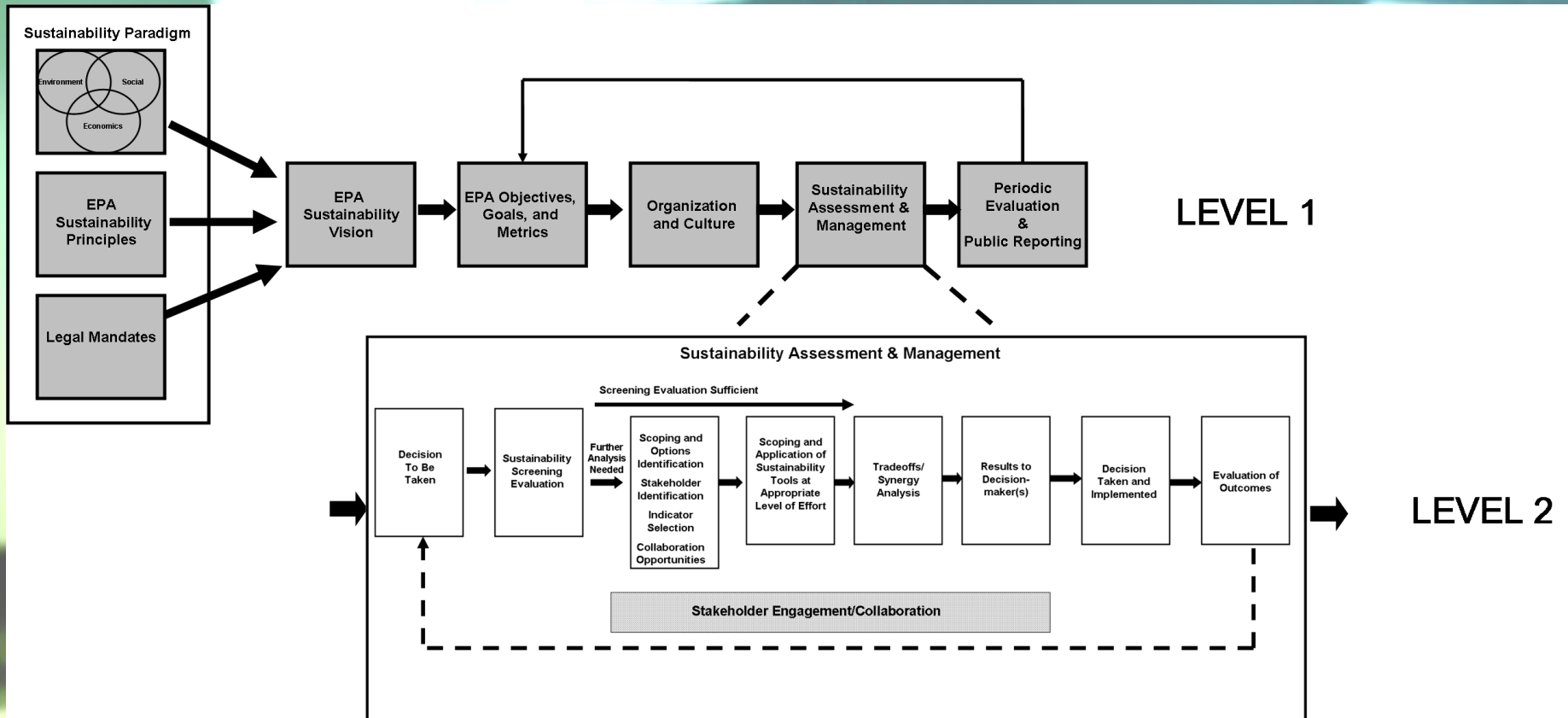
- What should be the operational framework for sustainability for EPA?
- What scientific and analytical tools are needed to support the framework?
- How can the EPA decision making process rooted in the risk assessment/risk management (RA/RM) paradigm be integrated into this new sustainability framework?
- What expertise is needed to support the framework?

Definition

- The committee did not devote significant time to defining sustainability. It noted that the description of environmental goals in the 1969 National Environmental Policy Act (NEPA) was fully consistent with sustainability. Support for these goals has been repetitively reaffirmed including Executive Order 13514, where sustainability is defined as:

Sustainability: to create and maintain conditions, under which humans and nature can exist in productive harmony, that permit fulfilling the social, economic, and other requirements of present and future generations (NEPA, 1969; Executive Order 13514, 2009)

Sustainability Framework



What scientific and analytical tools are needed to support the framework?

The committee recommends EPA develop a “sustainability toolbox” that includes a suite of tools for use in the Sustainability Assessment and Management approach.

Collectively, the suite of tools should have the ability to analyze present and future consequences of alternative decision options on the full range of social, environmental, and economic indicators.

Application of these tools, ranging from simple to complex, should have the capability for showing distributional impacts of alternative options with particular reference to vulnerable or disadvantaged groups and ecosystems. **(Recommendation 4.1)**

Examples of Tools

- Risk Assessment
- Life-Cycle Analysis
- Benefit-Cost Analysis
- Ecosystem Services Valuation
- Integrated Assessment Models
- Sustainability Impact Assessment
- Environmental Justice Tools
- Present and Future Scenario Tools

What expertise is needed to support the framework?

The committee recommends that EPA hire multidisciplinary professionals who are proficient in many disciplines, who have experience in the development and implementation in the sustainability assessment tools described, and who have a working knowledge in all three pillars and their application to environmental issues.

The Agency should hire leaders and scientists including from outside sectors to aid the agency in shifting to a more cross-cutting mind set.

Although EPA has existing staff in all the main areas of sustainability-related fields, the agency should further facilitate collaboration among existing professional expertise to encourage dialogue and understanding of the various fields and work already being done within EPA.

(Recommendation 6.10)

Sustainability Linkages in the Federal Government

Rationale

- Understanding the linkages between domains (energy, water, land, health, ecosystem services, non-renewable resources, etc.) is essential for the development of policies and programs supporting long term sustainability.
- These linkages form potential constraints to many key components of sustainability and are generally not considered in sustainability discussions or analyses. The policy implications of such linkages need to be explored and communicated to government agencies.

Significant Interagency/Multi-stakeholder Participation

- Federal Agencies—NSF, EPA, DOE, USGS, NASA, USDA and NOAA
- Packard Foundation, Mitchell Foundation, Private Entities

The Sustainability Silos of the U.S. Government

Environmental
quality (EPA)

Energy (DoE)

Food (DoA)

Land (DoI)

Health (DHHS)

Water
(NOAA)

Minerals
(USGS)



The Sustainability Silos of the Experts

Environmental quality
(ecologists)

Energy (power
engrs., matl. sci.)

Food (crop
researchers)

Land use
(geographers)

Health
(medical
researchers)

Minerals
(geologists)

Water
(hydrolo-
gists)



LANDSCAPES



Urban



Coastal



Mineral Rich



Agriculture/Forest

Science, Innovation, and Partnerships for Sustainability Solutions

May 16-18, 2012, Pew Conference Center, Washington, DC

- A three day public symposium at the request of the National Science Foundation

Objectives

- Examine the National Science Foundation's and other Federal agencies' investments in research related to sustainability, including the most significant outcomes of these investments
- Identify opportunities and key priorities to link knowledge with decision making and to help promote practices that would lead communities toward sustainability
- Foster partnerships and linkages between disciplines, sectors, agencies and nations in science, innovation and application related to sustainability

Additional Information

- **Marina Moses, mmoses@nas.edu, 202-334-2143**
- **Website**
www.nas.edu/sustainability
- **Monthly newsletter**
To subscribe, send email to: sustainability@nas.edu