

Introducing Sustainability Concepts Into a Billion Ton Bioeconomy

Biomass Research and Development Initiative's
Technical Advisory Committee
Quarterly Meeting
November 21, 2014

Measures of Federal Bioeconomy Program's Success

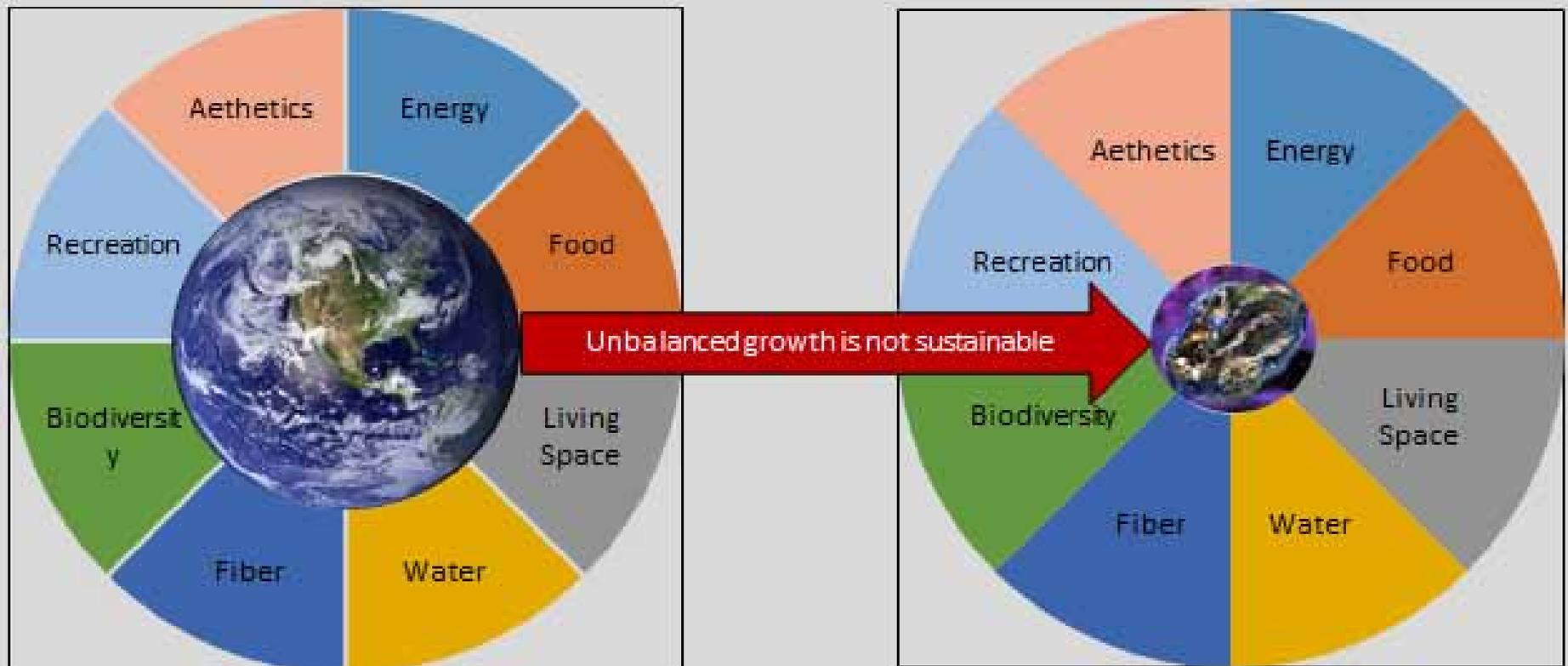
- New technologies developed
- New technologies deployed
- Improved economic competitiveness
- Improved rural development
- Increased food and energy security
- *Introducing sustainability as a measure of success (the new kid on the block)*
 - *Sustainability of integrated systems*
 - *Sustainability of long timelines*
 - *Sustainability at the landscape scale*

Goals and Flow of this Session

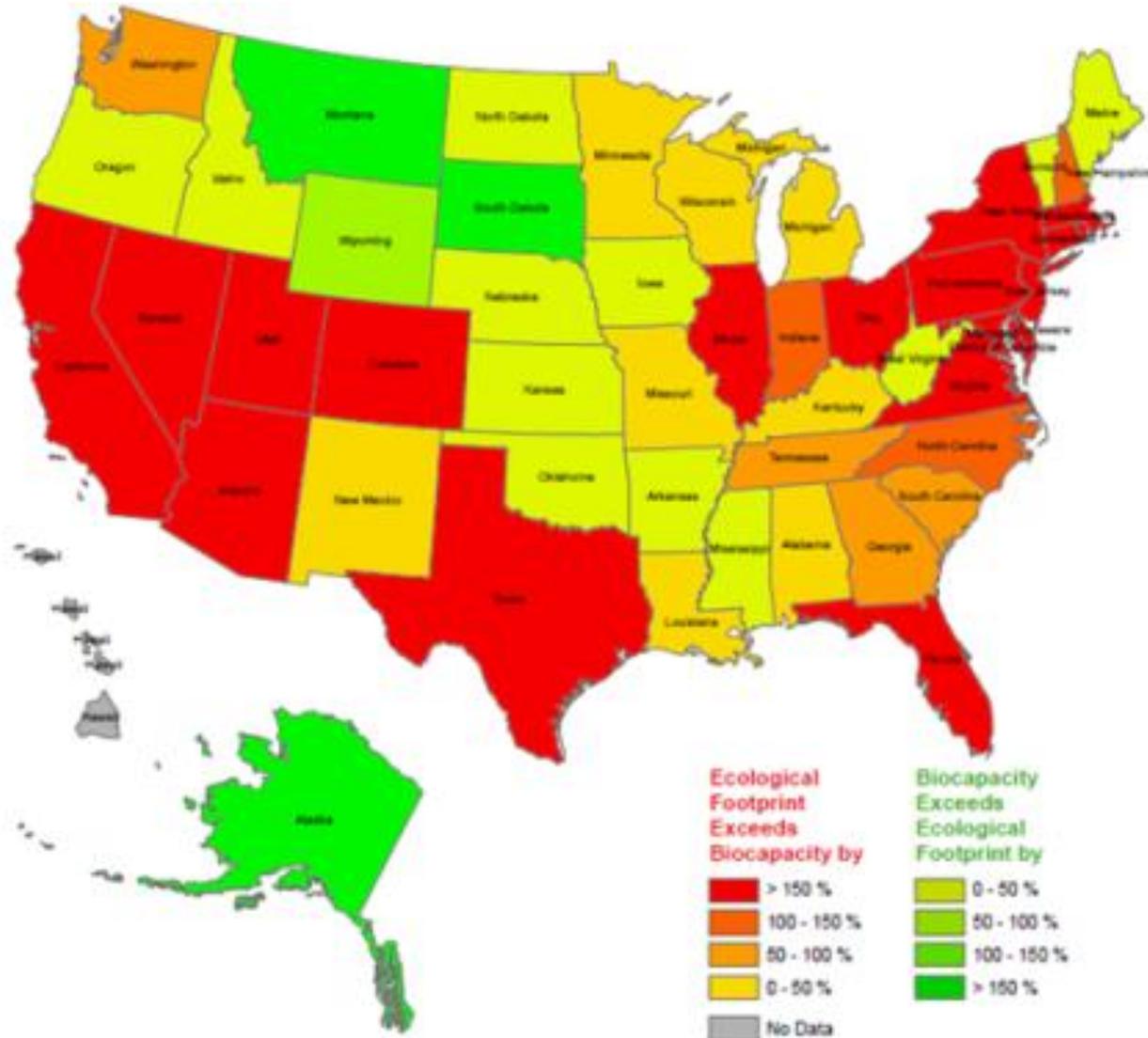
- Briefly highlight some examples of challenges and opportunities for the Bioeconomy
 - *Donna Perla, MPH (EPA)*
- Summarize Federal commitment to integrate sustainability into our decision-making and efforts to provide Frameworks for assessing and managing sustainable outcomes
 - **“Sustainability and the U.S. EPA”**
Marina Moses, DrPh (American Academy of Microbiology)
 - **“Sustainability for the Nation”**
Lynn Scarlett, PhD (The Nature Conservancy)
- Discussion with Technical Advisory Committee on their perspectives, potential role, and action items

A Challenge for Natural Resources and the Bioeconomy

Competing Demands for Limited Land Use and Resources



Our Ecological Footprint in U.S. Exceeds Biocapacity

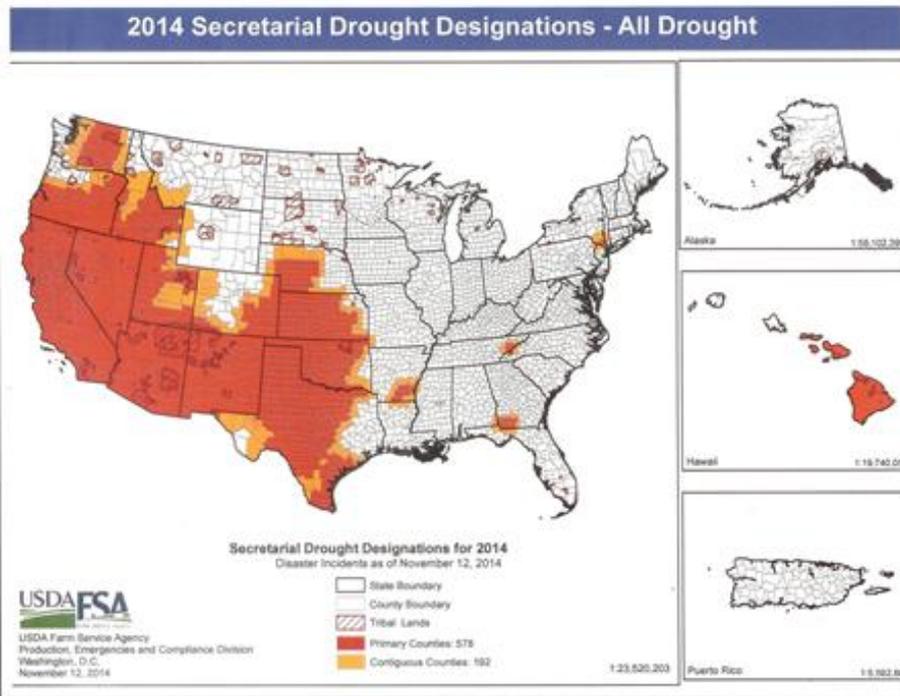


Source: Preliminary assessment, © 2013 Global Footprint Network, www.footprintnetwork.org

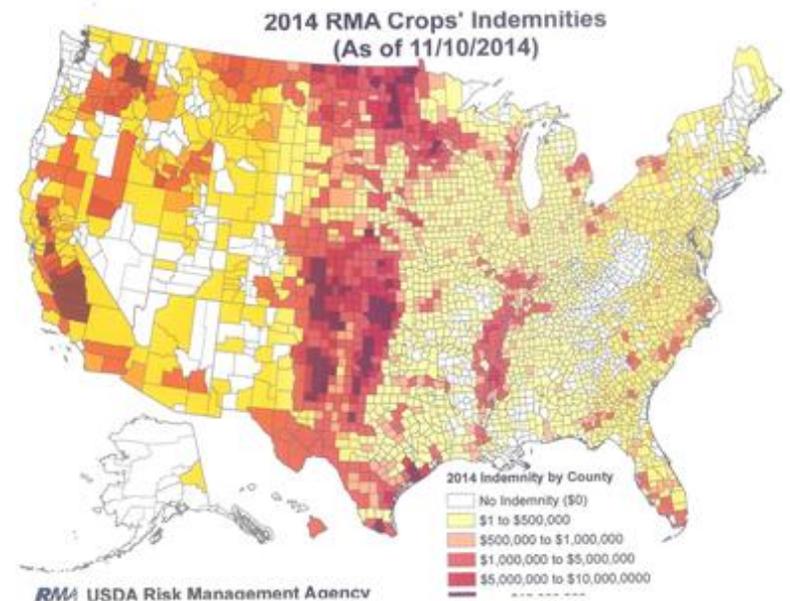
Challenges and Opportunities

- Climate change, human activities and increased population all present challenges to natural resources
 - altered biogeochemical cycles,
 - Depletion of natural resources
- Choices we make about land use, technologies, infrastructures, and product use as we expand the bioeconomy will further alter these cycles – for better or worse?
- There are opportunities in the Bioeconomy for optimizing:
 - Greenhouse gas reductions
 - Sustainable materials management
 - Natural resource conservation

The Bioeconomy Relies on Already Stressed Resources and Systems

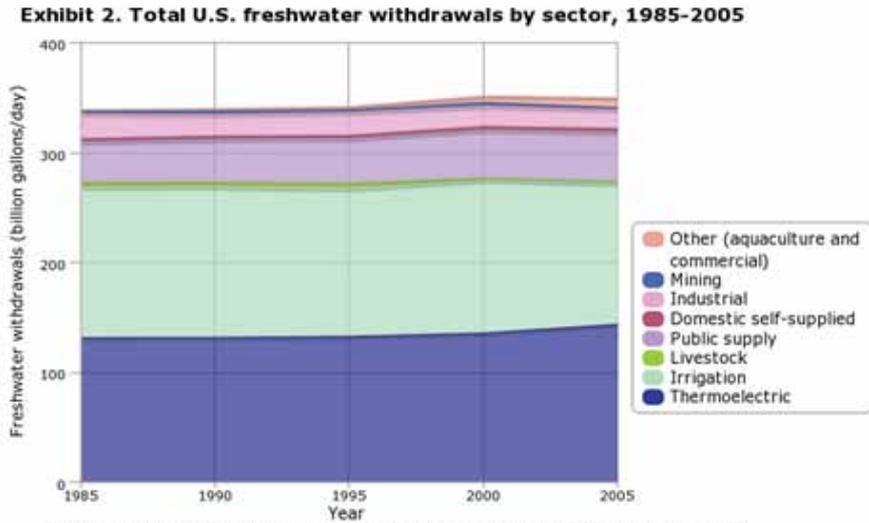


Crop Failures From Floods, Droughts, Pests, Plant Diseases, etc.



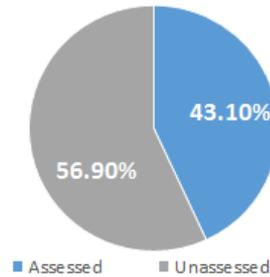
Enormous Stressors on Water

Power Generation and Agriculture Use 2/3 of U.S. Water

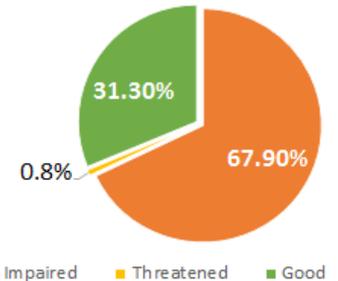


More than Two-Thirds of Assessed Lakes, Reservoirs, and Ponds Are Impaired

Percent of U.S. Lakes, Reservoirs, and Ponds Assessed



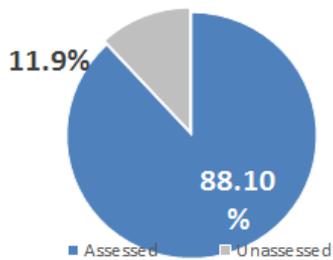
Water Quality Attainment Status of Assessed Waters



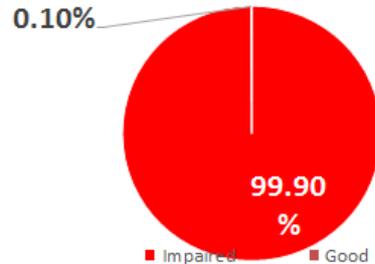
Source: U.S. EPA, Watershed Assessment, Tracking & Environmental Results. National Summary. Water Quality Attainment in Assessed Lakes, Reservoirs, and Ponds. http://aspub.epa.gov/waters10/attains_nation_cycontrol

All Assessed Great Lakes Open Waters Impaired (the largest source of fresh water on earth)

% Great Lakes Open Waters Assessed



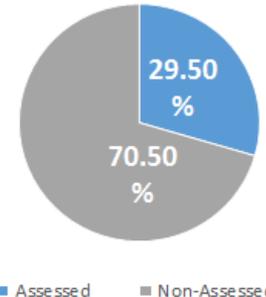
Water Quality Attainment Status of Assessed Waters



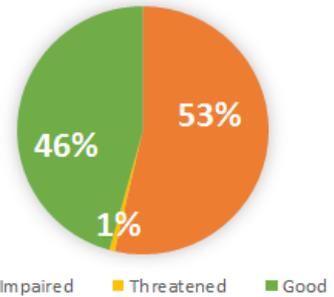
Source: U.S. EPA, Watershed Assessment, Tracking & Environmental Results. National Summary. Water Quality Attainment in Assessed Great Lakes Open Water. http://aspub.epa.gov/waters10/attains_nation_cycontrol

More than Half of Assessed U.S. Rivers Are Impaired

Percent of U.S. Rivers and Streams Assessed



Water Quality Attainment Status of Assessed Rivers and Streams

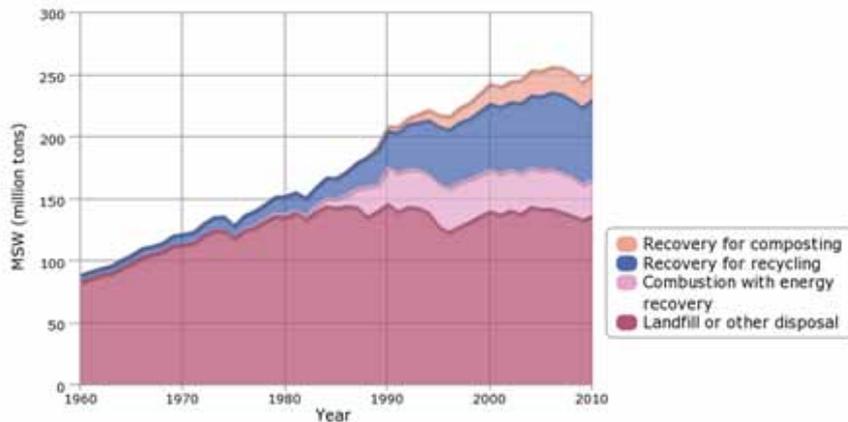


Source: U.S. EPA, Watershed Assessment, Tracking & Environmental Results. National Summary. Water Quality Attainment in Assessed Rivers and Streams. http://aspub.epa.gov/waters10/attains_nation_cycontrol

New Opportunities: Non-Land Based Biomass & Pathways that Help Mitigate Environmental, Economic, and Social Concerns

Non-Land-Based Feedstock Are Available for An Expanded Bioeconomy

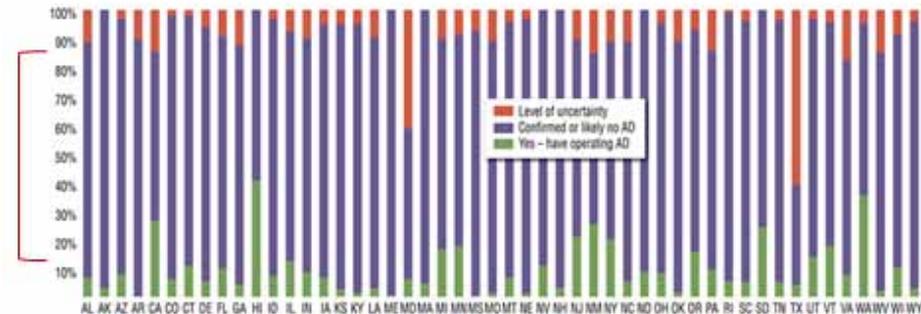
Exhibit 1. Municipal solid waste generated and managed in the U.S., 1960-2010



Source: Franklin Associates. A Division of ERG. 2011. Historical working papers for: U.S. EPA. 2011. Municipal solid waste in the United States: Facts and figures.
<http://www.epa.gov/epawaste/nonhaz/municipal/msw99.htm>.

Majority of Biosolids from WWTPs Are Not Tapped To Date

Figure 1. Percentages of WWTPs that send solids to AD, by state (green)¹



¹The total number of WWTPs in each state is from the U.S. EPA 2008 Clean Watersheds Needs Survey (CWNS). Green represents the confirmed number of facilities sending solids to AD divided by the CWNS total. Purple represents the large percentage of WWTPs in each state that are assumed or were confirmed as not having AD or sending solids to AD. Red indicates a relative measure of uncertainty about the data: the longer the red bar, the less certainty there is that all the WWTPs with AD in that state were identified.

Source:

Maile Lono-Batura, Yinan Qi and Ned Beecher
BioCycle December 2012, Vol. 53, No. 12, p. 46

How can sustainability be integrated into development of the Billion Ton Bioeconomy?

Are there pathways in developing the Bioeconomy that can optimize economic, social, and environmental outcomes?

What tools are needed for us to assess and implement choices that lead to sustainable systems?

Sustainability

Biomass R&D Technical Advisory Committee
November 21, 2014

THE NATIONAL ACADEMIES

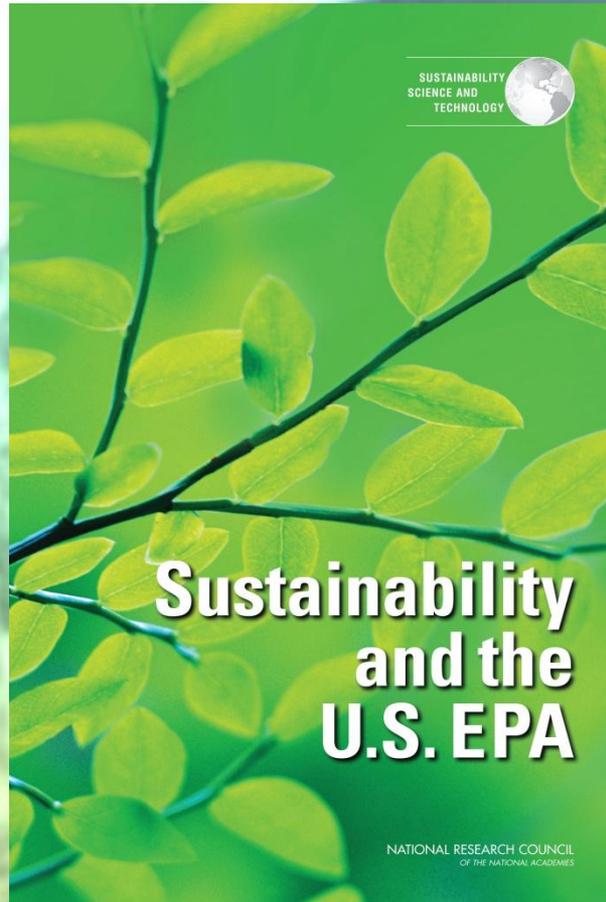


AMERICAN
SOCIETY FOR
MICROBIOLOGY

AMERICAN
ACADEMY OF
MICROBIOLOGY
RECOGNIZING SCIENTIFIC EXCELLENCE

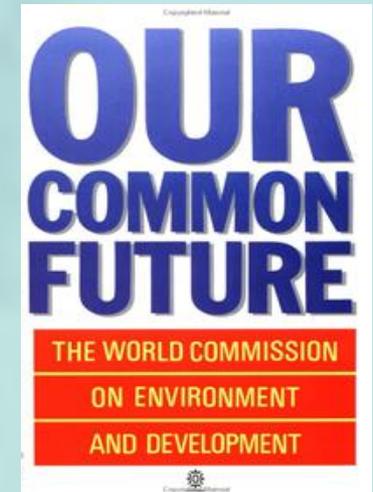
The logo features a white line-art illustration of a classical building with a pediment and columns, positioned to the right of the text.

Framework Study



World Commission on Environment and Development (1987)

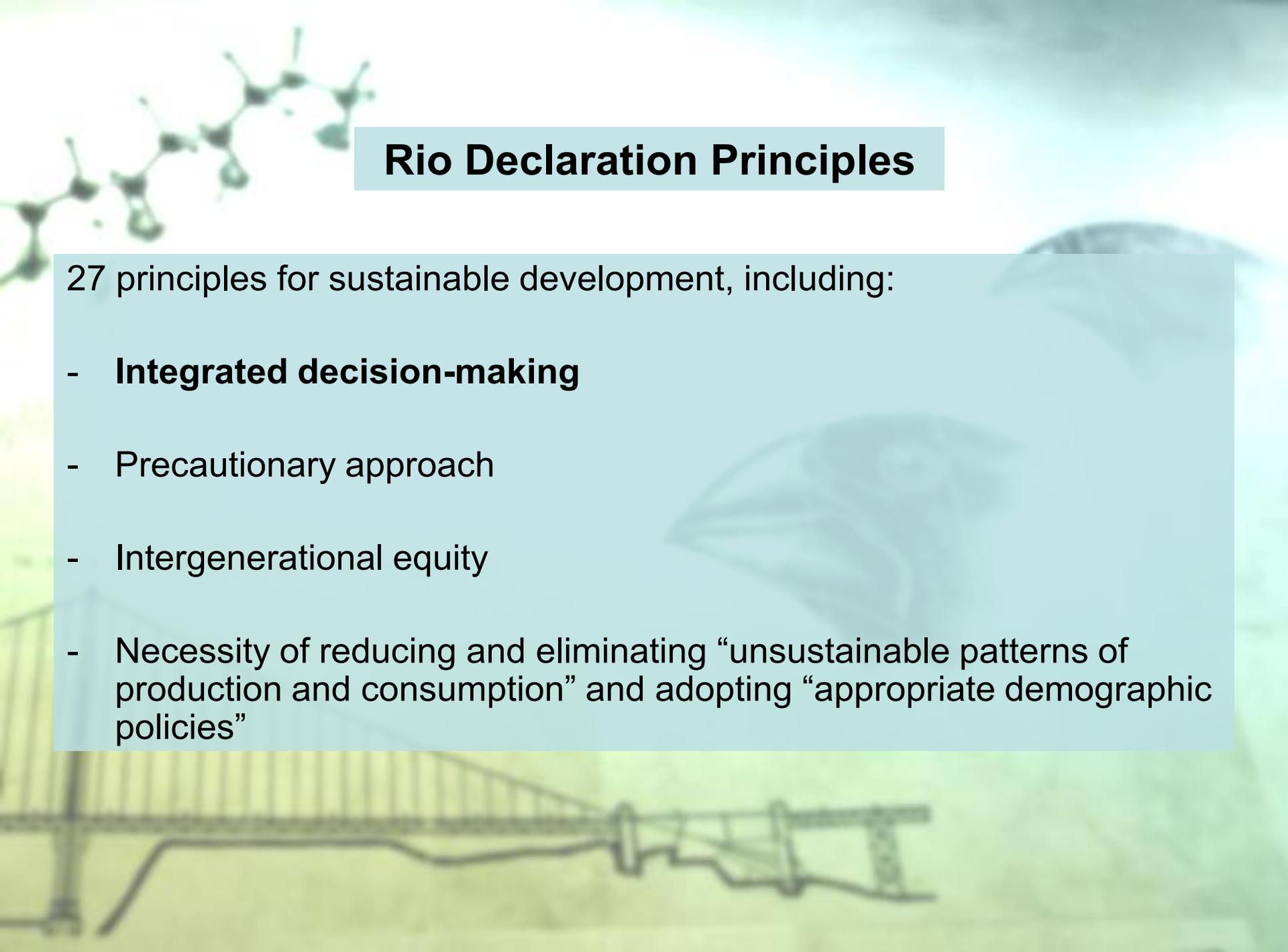
- Created by 1983 U.N. General Assembly resolution
- Definition of sustainable development: **“development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”**
- Described “a threatened future”
- Called on U.N. General Assembly to
- “transform this report” into a global plan
- of action for sustainable development



United Nations Conference on Environment and Development--1992

At Rio de Janeiro “Earth Summit,” nations of the world endorsed sustainable development

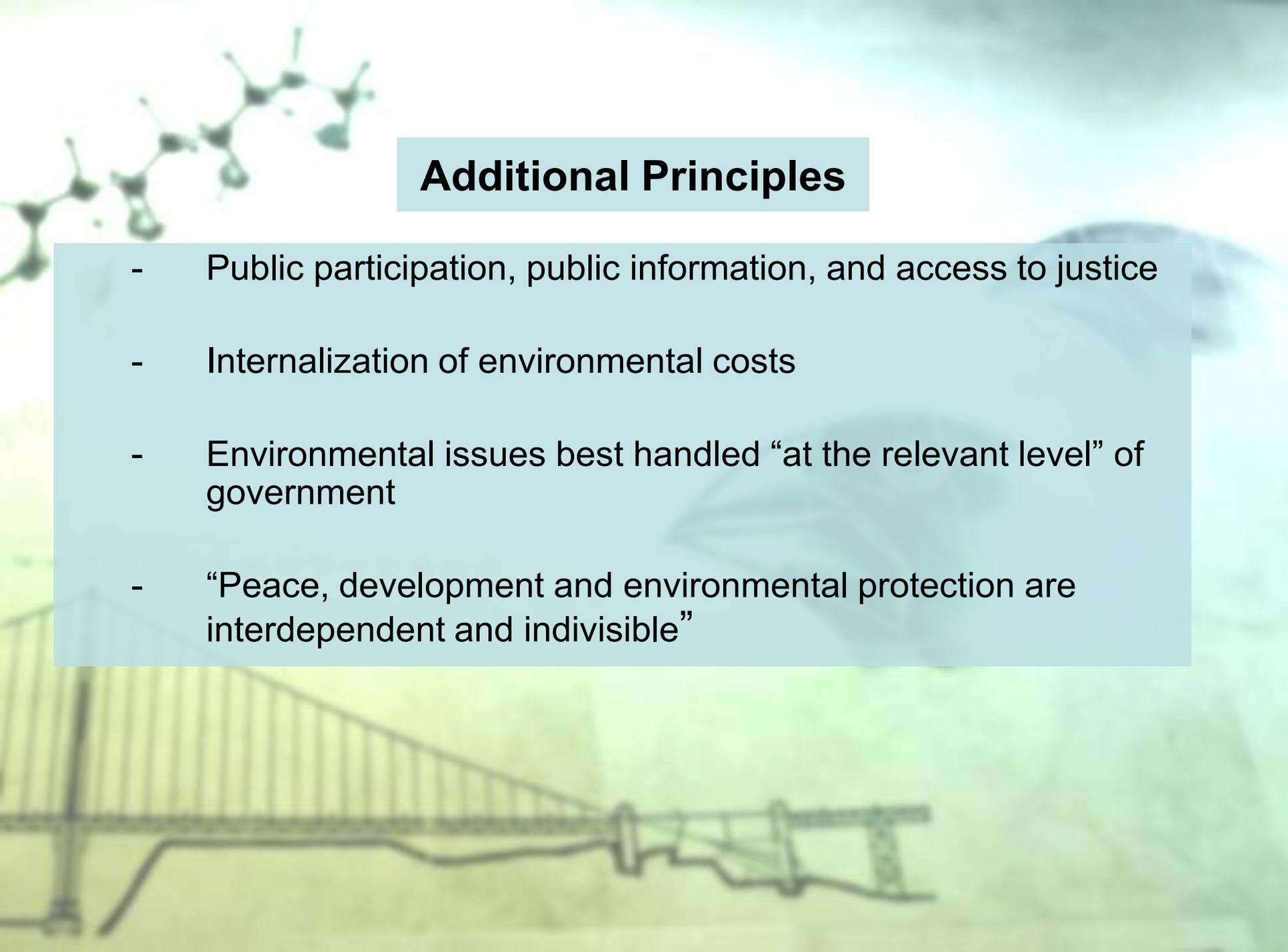
- Agenda 21—comprehensive action plan
- Rio Declaration—statement of principles
- Forest Action Plan
- United States participated actively and agreed



Rio Declaration Principles

27 principles for sustainable development, including:

- **Integrated decision-making**
- Precautionary approach
- Intergenerational equity
- Necessity of reducing and eliminating “unsustainable patterns of production and consumption” and adopting “appropriate demographic policies”



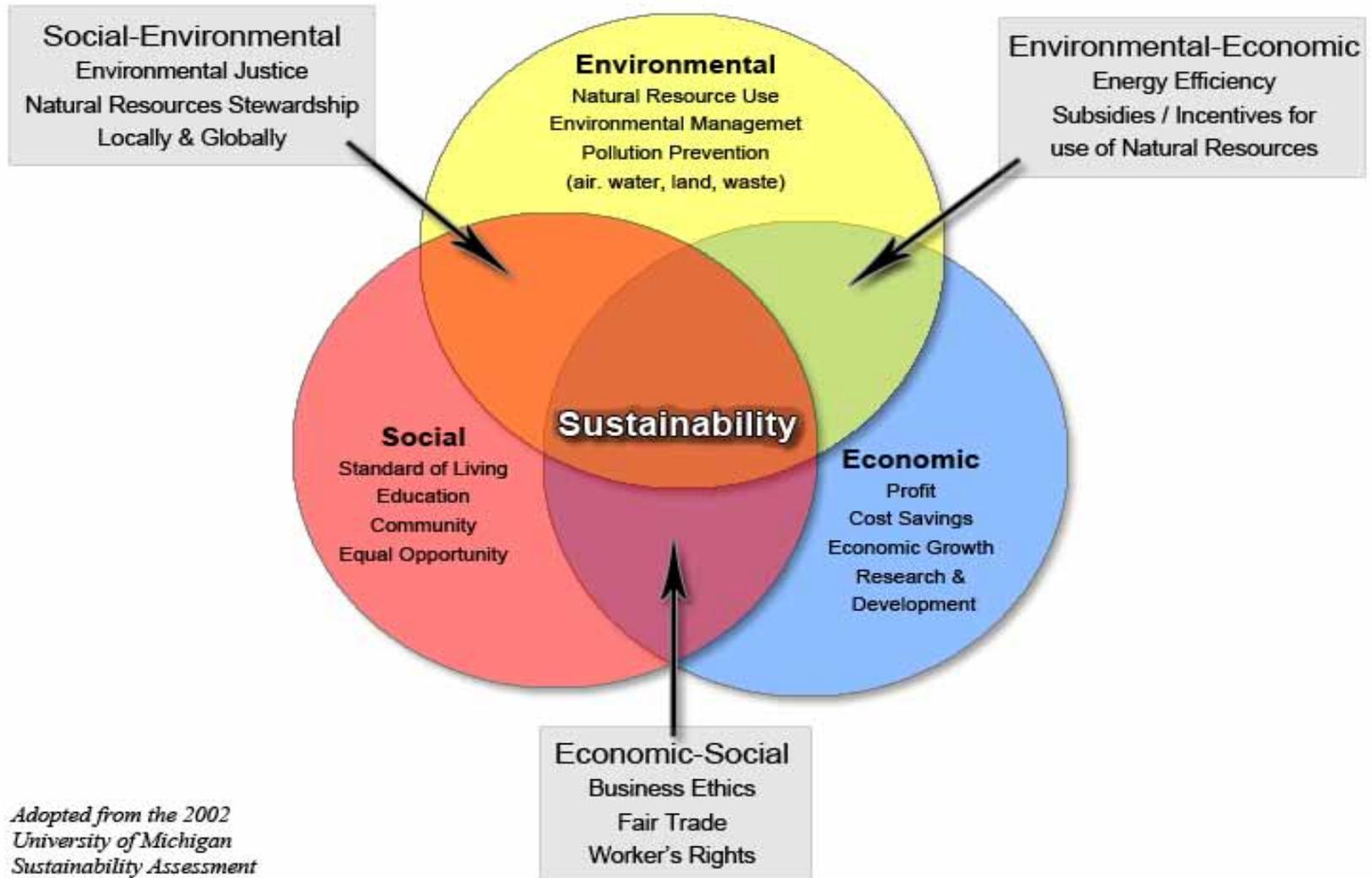
Additional Principles

- Public participation, public information, and access to justice
- Internalization of environmental costs
- Environmental issues best handled “at the relevant level” of government
- “Peace, development and environmental protection are interdependent and indivisible”

Sustainability

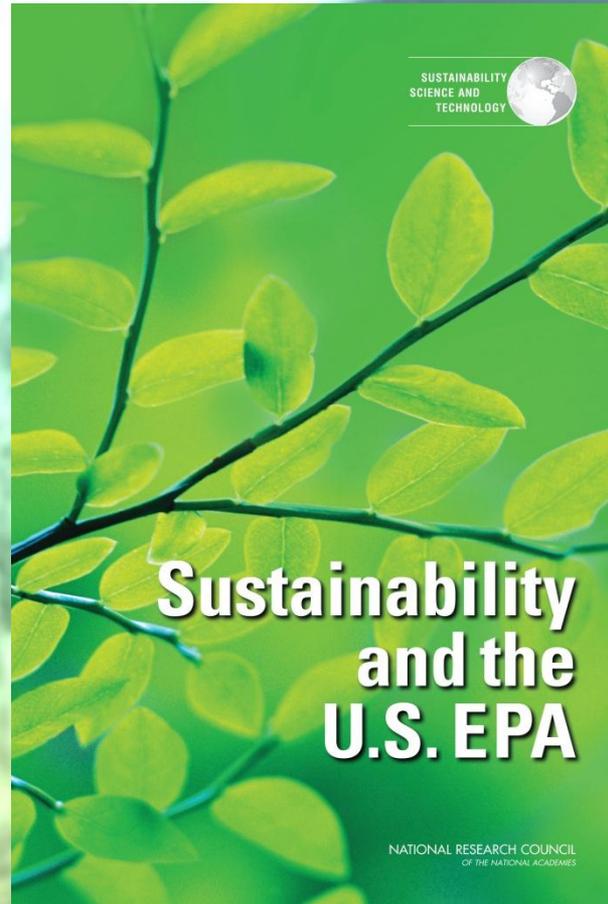
- A different way of thinking
- Paradigm shift
- “Organizing Principle”
- Unique characteristics: grass-roots, “transdisciplinary”
- How does it work?

The Three Spheres of Sustainability



*Adopted from the 2002
University of Michigan
Sustainability Assessment*

Framework Studies







Sustainability and the U.S. Environmental Protection Agency

- A committee under the STS Program conducted 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 builds 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
- Defines 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 answers 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)

Approach to Task, 1 of 2

- Sustainability is a Process and a Goal
- Staged and programmatic implementation – will lead to accelerated programs and to a growing body of Agency successes and experiences with sustainability
- Sustainability Framework Level 1: Components that define the Agency-wide process
- Sustainability Framework Level 2: Elements of Sustainability Assessment and Management (SAM) component

Approach to Task, 2 of 2

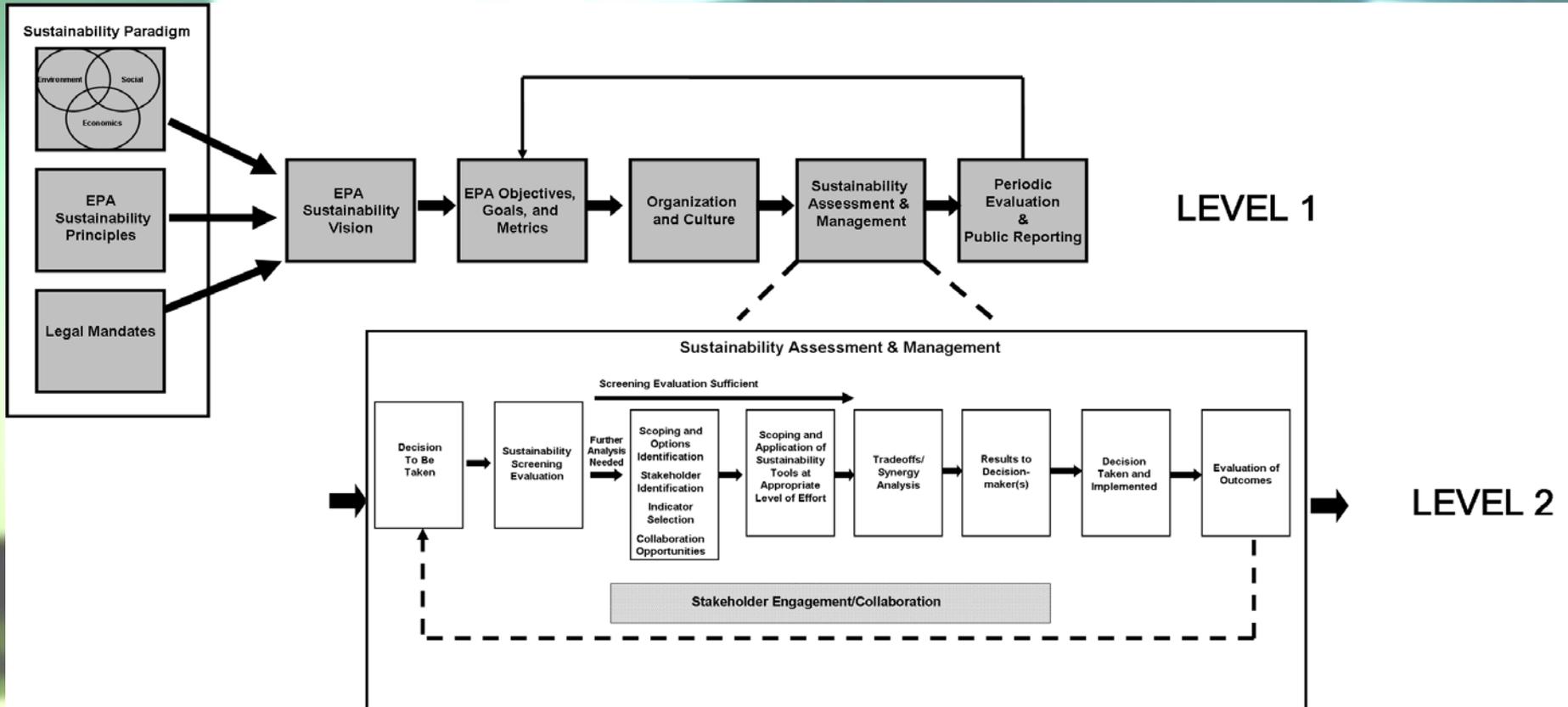
- The committee examined the benefits, where EPA has statutory authority and discretion in regulatory and non-regulatory programs, of building sustainability considerations into its administration of these statutes. Because EPA did not request that the committee address laws pertaining to EPA or to organizational and institutional aspects of the agency's operations, the committee did not examine these topics.

Sustainability Framework

The committee developed the Sustainability Framework and the Sustainability Assessment and Management approach to provide guidance to EPA on incorporating sustainability into decision making.

The Sustainability Assessment and Management process is intended to be equally applicable to all types of issues, including human health and ecological risks.

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?

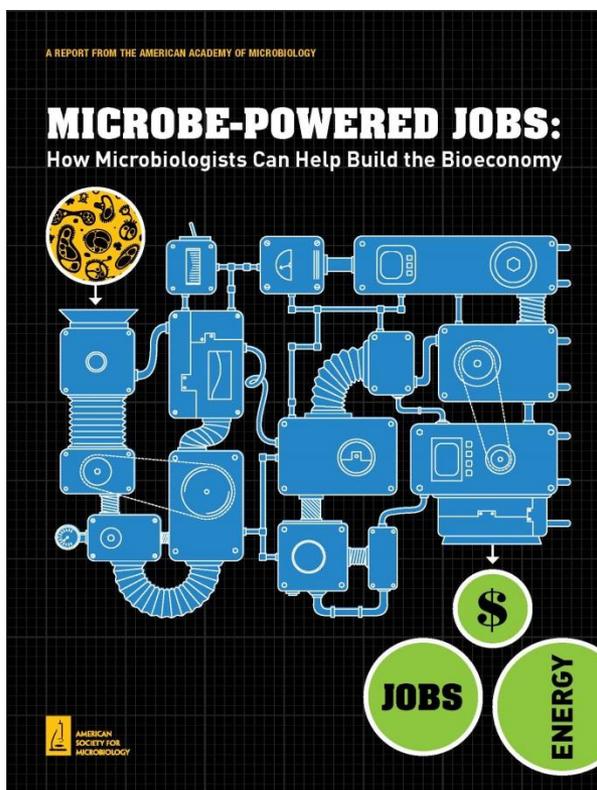
The committee recommends that EPA hire multidisciplinary professionals who are proficient in many disciplines, who have experience in the development and implementation in the sustainability assessment tools described, and who have a working knowledge in all three pillars and their application to environmental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

Applying Sustainability



What could microbe-powered industries do?

The Biomass R&D Technical Advisory Committee, established in 2000 to advise the Dept. of Energy and the US Dept of Agriculture on how best to use biomass to improve US energy security, established goals for 3 sectors: biopower, biobased transportation fuels, and biobased products. Microbial approaches are relevant in all three areas.

<http://academy.asm.org/images/stories/documents/MicrobePoweredJobs.pdf>

Thanks!

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Sustainability for the Nation: Resource Connections & Governance Linkages

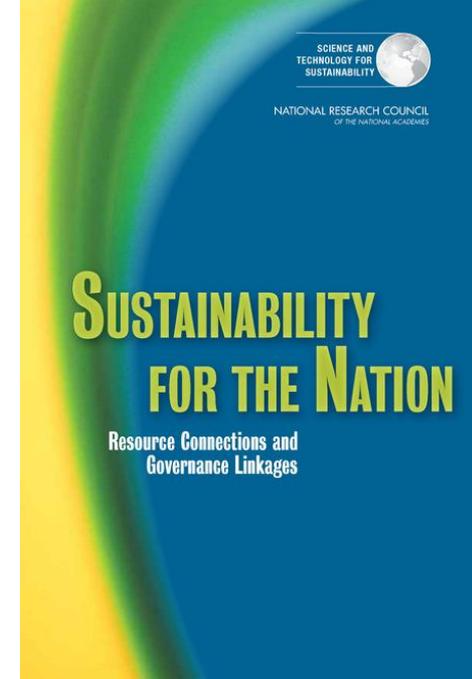
Lynn Scarlett

Managing Director for Public Policy

The Nature Conservancy

Science and Technology for Sustainability
Program

The National Academies



Sustainability Definitions Vary, but Most Involve...

- Holistic framework that includes social, environmental & economic goals
- Both near- and long-term horizons

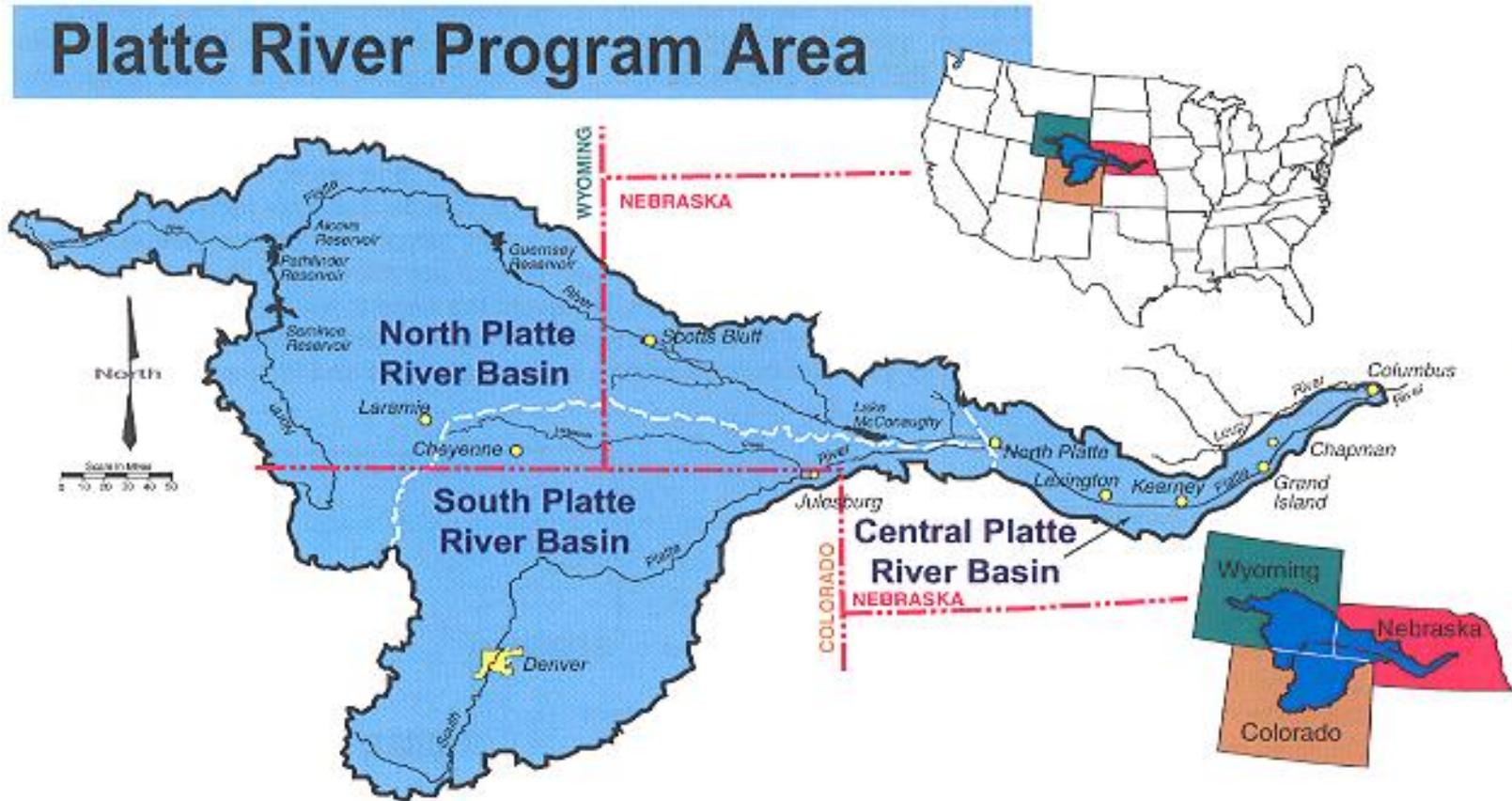
Four sustainability challenges

- How identify & manage connections across issues and sectors
- How operate at decision scales relevant to identifying & managing these connections
- How manage in context of complexity, change, and uncertainty
- How link decisions across agencies and governments

1st Challenge: Issue Connections

- Energy, food, water, and air
- Community safety, public health, energy, infrastructure

2nd Challenge: Relevant Decision Scales



3rd Challenge: Complexity, Change & Uncertainty



4th Challenge: Linking decisions

- Move beyond sectoral approaches within government to more integrated approaches to sustainability challenges

Biodiversity
(EPA)

Water
(NOAA)

Health
(HHS)



Energy (DOE)

Food (USDA)

Minerals
(USGS)

Paths Forward

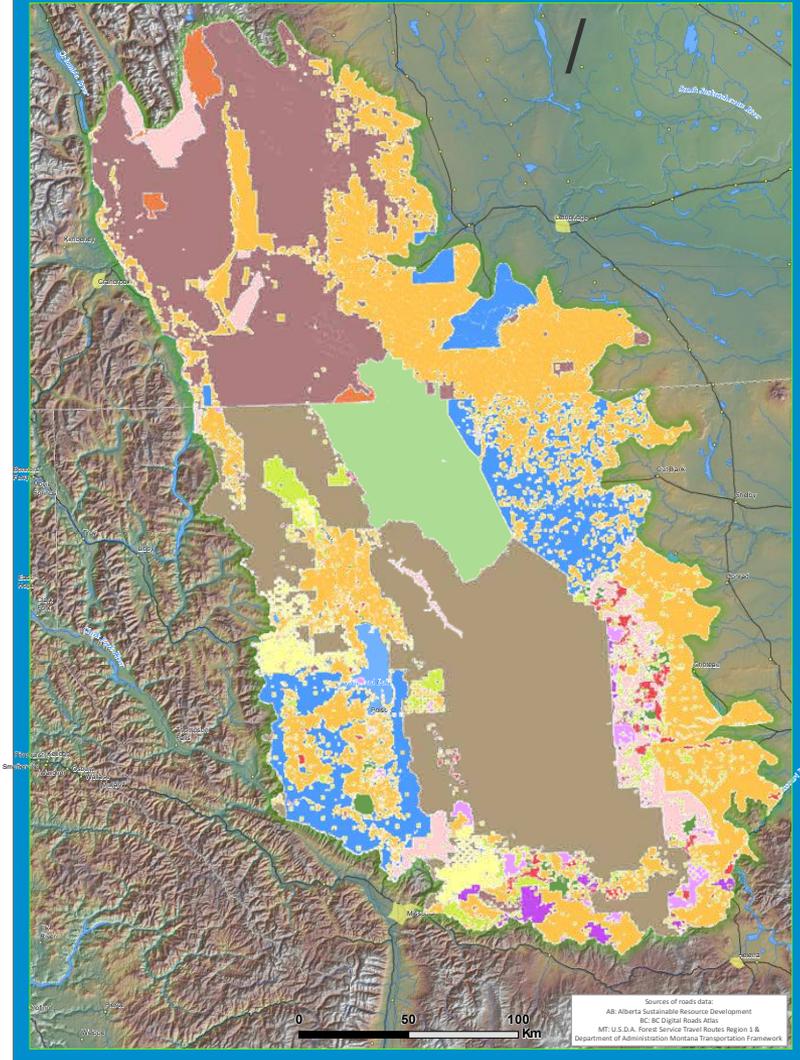
- Change, uncertainty, and complexity underscore relevance of collaborative adaptive management decision framework
- There are models of network governance that transcend organizational and resource boundaries.

Decision Framework



Network Governance

Jurisdictional Complexity



Crown of the Continent

- First Nations/Tribal land
- National Parks
- US Bureau of Land Management
- US Fish & Wildlife
- US Forest Service
- Federal
- Provincially Protected Areas
- State Trusts
- Montana Fish, Wildlife, & Parks
- Provincial/State
- Private Conservation Land
- Plum Creek Timber
- Private Land

Action Items for the BRDI TAC

- How can sustainability be integrated into “techno-economic analysis” given that most environmental & social benefits are not monetized.
- How can new bio-products and bio-energy compete in a marketplace where sustainability requirements are unequally applied?
- What specific advice does the BRDI Board seek from the BRDI TAC in relation to biomass system sustainability?
- Where do the TAC leaders see opportunities for sub-committees to work on this issue next year?