

**A Report from the Second National
Conference on Science, Policy
and the Environment**

Recommendations for **ACHIEVING
SUSTAINABLE COMMUNITIES**
Science & Solutions

DECEMBER 6-7, 2001

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

NATIONAL COUNCIL FOR SCIENCE AND THE ENVIRONMENT

Improving the scientific basis for environmental decisionmaking

THE NATIONAL COUNCIL FOR SCIENCE AND THE ENVIRONMENT (NCSE) has been working since 1990 to improve the scientific basis for environmental decisionmaking, and has earned an impressive reputation for achievement. The Council helped stimulate the National Science Foundation's new long-term environmental science and engineering initiative, which over five years will seek to attain an additional \$1 billion-per-year for environmental research, assessment, and education grants.

The Council envisions a society where environmental decisions are based on an accurate understanding of the underlying science, its meaning and its limitations. In such a society, citizens and decisionmakers receive accurate, understandable, and integrated science-based information, and they understand the risks, uncertainties and potential consequences of decisions.

The Council promotes a new crosscutting approach to environmental science and engineering that integrates interdisciplinary research, scientific assessment, education and communication of science-based information to decision makers and the public. Supported by 500 academic, scientific, environmental, government and business organizations, the Council works closely with representatives of the many communities that play key roles in creating and using environmental knowledge, affecting science and shaping environmental decisions.

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The Council brings diverse communities together to advance science for more informed environmental decisionmaking. Four Council programs bring together these communities to work and learn in the same room:

- Center for Science Agendas,
- National Commission on Science for Sustainable Forestry (NCSSF),
- Annual National Conference on Science, Policy and the Environment, and
- Annual John H. Chafee Memorial Lecture on Science and the Environment.

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Continuously expanded and updated, this widely-acclaimed online Library includes directories of academic environmental programs, journals, foundations, meetings, job opportunities, news sources, laws and treaties, reports, reference materials and much more. NLE includes: Congressional Research Service Reports, PopPlanet.org, PopEnvironment.org, and USEnvironment.org.

EDUCATION AND OUTREACH

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PUBLICATIONS

Through regular analysis and reporting, the Council documents and encourages efforts to improve the scientific basis for environmental decisionmaking at the National Science Foundation and other federal agencies. An annual online Handbook for Federal Environmental Research and Development and a monthly Science, Environment and Policy Report are available exclusively to members of the NCSE University Affiliate Program. NCSE Updates (e-mail and fax) are available to anyone requesting the service.

The National Council for Science and the Environment is grateful to the following sponsors for making possible the 2nd National Conference on Science, Policy and the Environment:

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CONTENTS

2	INTRODUCTION	24	LIBRARIES: Sharing Sustainability Data and Information— The Role of Libraries and Library Networks
3	SUMMARY OF CONFERENCE	25	POLLUTION PREVENTION: Use of Scientific Tools to Address Issues of Pollution Prevention and Community Sustainability
5	SUMMARY OF RECOMMENDATIONS	26	REMOTE SENSING: Community Energy and Environmental Decisionmaking—Seeing the Big Picture with Remote Sensing and Satellites
RECOMMENDATIONS		27	RURAL COMMUNITIES: Sustainable Community Development—Applications of Research, Education and Extension
7	CURITIBA, Brazil: Plenary Case Study	28	URBAN DESIGN: Scientific Approaches to Healthy Urban Form and Function
8	PORTLAND, Oregon: Plenary Case Study	APPENDICES	
9	WORKING FOR WATER, South Africa: Plenary Case Study	29	Appendix 1: Conference Agenda
11	ARCHITECTURE: LEEDing Green and Planning Design	31	Appendix 2: Breakout Sessions
12	BUSINESS: Ecologically Sustainable and Economically Competitive	35	Appendix 3: Keynote Address by Donald Kennedy
14	CHILDREN’S HEALTH: Children’s Health and the Environment	40	Appendix 4: Presentation Outline of Governor Jaime Lerner and Report on Sustainability in Curitiba, Brazil
15	COMMUNITY DESIGN: New Community Design and Community Based Planning and Design	46	Appendix 5: Plenary Lecture by John Dernbach
17	CULTURE: Integrating Indigenous Peoples’ Values to Promote Sustainable Science and Technology	51	Appendix 6: NCSE Congressional Leadership Award Presentation to Congressman Sherwood Boehlert
17	ENERGY: Energy Sustainability—Current Realities and Future Possibilities	52	Appendix 7: Remarks by Maurice Strong on receiving first NCSE Lifetime Achievement Award
18	FEDERAL GOVERNMENT EMPLOYEES: Science, Technology and Public Policy Seminar	56	Appendix 8: Earth Charter
19	FORESTRY: Issues in Sustainable Forestry	60	Appendix 9: Conference Participants
21	HIGHER EDUCATION: Progress Toward Sustainable Community Development and Partnerships for Sustainability in Higher Education	66	CONFERENCE SPONSORS
22	INDICATORS: Sustainable Community Indicators— Experiences, Lessons Learned, and Evolving Opportunities in the United States	68	INDEX
23	INFORMATION SYSTEMS: Interoperability in Support of Effective Environmental Decisionmaking		

This report contains the recommendations of more than 550 scientists and decisionmakers who participated in the second National Conference on Science, Policy and the Environment on December 6 and 7, 2001. The conference was sponsored by the National Council for Science and the Environment and was held at the Smithsonian National Museum of Natural History and the Renaissance Washington DC Hotel.

INTRODUCTION

CONFEREES INCLUDED INDIVIDUALS from more than 40 states, the District of Columbia, Puerto Rico, and 11 nations. They came from a broad range of disciplines and perspectives in the natural sciences (from agriculture to zoology), social sciences, and engineering, as well as the information technology and policy sectors. Participating were:

- 200 academics, including administrators, faculty, staff and students from a diverse set of universities and colleges;
- 120 government employees, including Democratic and Republican elected officials, scientists, administrators, and managers at the local, state, tribal, federal and international levels;
- 110 representatives of environmental and community organizations working at local, state, tribal, regional, national and international levels;
- 35 individuals representing a range of private businesses; and
- 110 self-identified as “others,” including journalists, school teachers and representatives of scientific organizations.

The first National Conference on Science, Policy and the Environment, in December 2000, introduced the concept of *sustainability science*: a synthetic, interdisciplinary approach to better understanding the complex interactions between society and nature so that the alarming trend towards increasing vulnerability is reversed. This second National Conference explored the application of such science to community sustainability. Conferees listened to world-class speakers and examined three of the world’s best examples of sustainability, paying particular attention to science’s contribution to these successes. Inspired by these examples, participants used their own experiences to look

for general lessons and strategies to apply these lessons during breakout sessions ranging from urban to rural development, architecture, business, children’s health, culture and indigenous peoples’ values, education, energy, forestry, government, sustainability indicators, libraries and information systems, pollution prevention and remote sensing.

These diverse sessions developed recommendations on how to advance and apply sustainability science in the context of the upcoming World Summit on Sustainable Development (WSSD). Each breakout session was charged with generating a brief set of recommendations for improving the generation and application of science to sustainability within the topical area. In total, the recommendations form a broad agenda for sustainability that includes these overarching themes:

- Science and technology are important and necessary tools for achieving sustainability, but community participation is essential for scientific and technical information to be incorporated into the policymaking process.
- Programs for achieving sustainable communities should be undertaken on a cost-effective and timely basis.
- Conserving natural resources, preserving biodiversity and maintaining a clean environment are essential factors for sustaining a healthy human community.
- Educational and research institutions should mobilize their intellectual capital, problem solving capacities and information systems to assist in seeking solutions for achieving sustainability.
- Exchange of information on sustainability models, programmatic activities and successful projects should be established on an international basis.

Keynote speaker **Donald Kennedy**, Editor-in-Chief of *Science* magazine and former President of Stanford University, challenged participants to turn around the familiar axiom “Think Globally, Act Locally” to “*Think Locally, Act Globally.*” He emphasized the need “for a kind of science that can help with both tasks—that is, can inform and guide good work at the meters-to-kilometers scale, and at the same time can help nations develop and implement policies that ensure sustainability.” Kennedy’s text is in Appendix 3.

Summary of CONFERENCE

WIDENER UNIVERSITY LAW SCHOOL professor **John Dernbach** outlined how environmental protection and restoration has joined the four basic elements of development—peace and security, economic development, social development or human rights, and supportive national governance—to redefine progress under the concept of sustainable development. Dernbach described United States progress towards sustainable development since the 1992 Earth Summit and in preparation for WSSD. According to Dernbach, the “good news” is the large number of state and local initiatives being undertaken to achieve sustainable communities; the “bad news” is the many challenges still remaining on a national and global scale. Dernbach’s text is in Appendix 4.

Three plenary case studies showed how it is possible to meet Kennedy’s challenge to both think and act locally and globally. **Governor Jaime Lerner** of the Brazilian state of Parana described his success as Mayor of Curitiba, which has achieved renowned status as one of the world’s most sustainable cities. Under Lerner’s charismatic leadership, using comprehensive planning, participatory democracy and innovation spurred by resource constraints, Curitiba has achieved an admirable record in education, health, well-being, safety, environmental protection and community spirit. Lerner talked about the importance of solidarity with present and future generations. His message of “Eo posible” (it is possible) inspired the conferees. A panel

chaired by **Thomas Lovejoy** of the World Bank, including **Deborah Bleiviss** of the InterAmerican Development Bank, **Karen Peabody O’Brien** of the W. Alton Jones Foundation and former Chattanooga, Tennessee council member **David Crockett** talked about how the example of Curitiba is being applied in cities around the world. An outline of Lerner’s talk and information on Curitiba is in Appendix 5.

Brian van Wilgen described the Working for Water Programme in the Republic of South Africa where, based on the scientific understanding of the detrimental impacts of eucalyptus trees and other exotic vegetation on the local water supply, the government has created a massive program to employ unskilled workers to remove exotic vegetation. He described how the project increases the skills of the workers, prevents wastage of water, and restores ecosystems supporting large numbers of rare native plant species. Van Wilgen’s colleague **Ahmed Khan** joined **Jamie Reaser** of the U. S. National Invasive Species Council, **Ann Bartuska** of The Nature Conservancy, **Peter McCornick** of the United States Agency for International Development and **Gunars Platais** of the World Bank in a discussion chaired by **Twig Johnson** of the National Academy of Sciences that explored the creative approach and potential applications of the Working for Water model.

City of Portland **Commissioner Dan Saltzman** and **Greg Wolf** of the office of Governor James Kitzhaber (OR) described efforts to implement sustainability in Portland

and Oregon. These efforts range from the very local, such as construction of “green homes,” to regionally-comprehensive land use planning. **Congressman Earl Blumenauer** (OR) described the need for national initiatives to complement those in his hometown and state. Panelists **Bonnie Prochaska** of Racine, Wisconsin, **Shari Wilson** from the state of Maryland and **Dan Mazmanian** from the University of Southern California described how their local efforts implemented many of the same approaches being applied in the city of Portland and the state of Oregon.

A panel led by **Sarah Moten** of the U.S. Agency for International Development and including journalist **Dianne Dumanoski** along with **Crockett** and **Mazmanian** identified the common themes of the plenary sessions and debated the role of science in sustainability. Crockett answered the local/global challenge by calling for “lobal thinking” (as in frontal lobes) integrating useful, sound science with rational, forward-thinking decisionmaking at all possible scales.

Noted Harvard biologist **Edward O. Wilson** presented the second **John H. Chafee Memorial Lecture on Science and the Environment**. Speaking under the title of his latest book, *The Future of Life*, released in January 2002, Wilson described the dangers facing humankind due to the loss of biological diversity. Wilson warned the audience that time was running short to prevent this catastrophe, which will greatly impact the quantity (through loss of genetic, species, and community diversity) and quality (through loss of ecosystem function) of life available to future generations.

The National Council for Science and the Environment (NCSE) presented two awards to leaders in the area of science and sustainability. **Representative Sherwood Boehlert** (NY), Chairman of the Science Committee of the U.S. House of Representatives, received the **NCSE Congressional Leadership Award** for his role in advancing the use of science in environmental decisionmaking. In accepting the award, Boehlert remarked, “I am honored to receive this award. A key to a sound and forceful environmental policy is a strong scientific foundation. NCSE understands that. I look forward to continuing to

work with groups like NCSE to ensure that science drives environmental policy—even when science points toward problems like climate change that are difficult to address.”

Maurice Strong, a senior advisor to the Secretary-General of the United Nations, received the first **NCSE Lifetime Achievement Award**. Strong chaired the UN Conference on Environment and Development, also known as the Earth Summit, in Rio de Janeiro in 1992, and shepherded the adoption of **Agenda 21**, the ambitious plan for sustainable development adopted by the nations attending that unprecedented conference. In accepting his award, Strong called for a new paradigm of cooperative global governance. He made the case for all people and nations to give the same kind of priority to civilizational security and sustainability as they make to personal and national security. He called upon the United States to lead in this effort and for the scientific community to provide guidance and leadership. He advocated the adoption of the Earth Charter as a unifying global statement. Strong’s text is presented in Appendix 6, and the Earth Charter is in Appendix 7.

Strong participated in the closing panel along with former **Representative John E. Porter** (IL), **Alan Hecht** of The White House Council on Environmental Quality, **Jonathan Margolis** of the U. S. State Department and **Jacob Scherr** of the Natural Resources Defense Council. The panel reviewed and praised the recommendations developed by the conference. They emphasized the importance of a strong partnership between science, government and private efforts towards sustainability. They invited and challenged the conference participants to remain engaged in the process leading up to WSSD and in science for sustainability efforts in general.

The National Council for Science and the Environment will continue to catalyze the efforts of the scientific community to develop and apply sustainability science and engineering. Please check the conference web site (<http://www.cnie.org/NCSEconference/2001conference/>) periodically for updates leading to the WSSD in August 2002.

Although each breakout session was independent, there is considerable commonality of themes and recommendations. These general and overarching recommendations have been drawn from a synthesis of the individual recommendations.

Summary of RECOMMENDATIONS

Science and technology are important and necessary tools for achieving sustainability, but community participation is essential for scientific and technical information to be incorporated into the policymaking process.

- **Importance of Science and Technology:** Acquisition of scientific knowledge and development of technological tools are important and necessary steps in attaining ecologically sound and sustainable communities.
- **Development of Sustainability Science and Engineering:** Priority should be given for the development of scientific information and technical tools that provide state-of-the-art and innovative approaches to sustainable communities. Emphasis should be given to developing a science-based understanding of sustainability.
- **Involvement of Stakeholders:** A crucial aspect of achieving sustainable communities at the local, regional and national levels is the involvement of all stakeholders from the inception of the policymaking process.
- **Public-Private Cooperation:** Public agencies and private sector corporations, along with civic society organizations, should forge an ongoing and close working partnership to implement short- and long-range programs for attaining sustainability.

Programs for achieving sustainable communities should be undertaken on a cost-effective and timely basis.

- **Cost-Effectiveness:** Long-range programs on sustainability should keep in mind the direct and indirect economic costs of agreed-upon goals and objectives. Individual projects should not be capital intensive or heavily subsidized by public agencies, but should be self-sustaining and funded equitably by all segments of society.
- **Timeliness:** Urban, suburban and rural communities should undertake projects on sustainability on an expedited basis, without engaging in a cumbersome planning process by policy makers, administrators and experts or awaiting major infusions of financial support or significant mobilization of material resources.

Conserving natural resources, preserving biodiversity and maintaining a clean environment are essential factors for sustaining healthy human communities.

- **Conservation and Dispute Resolution:** Where conflict between natural ecosystems and economic development arises, emphasis should be given to conservation of natural resources and to preservation of the flora and fauna of the region. Wherever possible, independent scientists and other technical experts should be requested to help resolve outstanding disputes on development projects at the local or regional level.

- **Impacts on Vulnerable Populations:** Economic and social programs in developing regions of the world should consider the long-term consequences of their activities, especially the adverse environmental impacts on the health and welfare of children and other vulnerable members of human communities.

Educational and research institutions should mobilize their intellectual capital, problem-solving capacities and information systems to assist in seeking solutions for achieving sustainability.

- **Curriculum Building and Research Projects:** As a matter of priority, universities and colleges should revise their current educational curricula, scientific projects and data collection to provide means and guidance for arriving at innovative solutions for sustainability.
- **Outreach to the Community:** In order to understand and incorporate the concerns of the public, universities and colleges should reach out to the larger community in developing their educational and research programs on sustainability.
- **Knowledge Dissemination:** Educational specialists, research scientists and technical experts should develop clearly written and easily accessible information and educational tools on sustainability for dissemination to the general public.

Exchange of information on sustainability models, programmatic activities and successful projects should be established on an international basis.

- **Creation of International Information Centers:** Information clearinghouses, using electronic media and organized on an international basis, should be established to allow for widespread access of material resources and databases on sustainability for all sectors of society.
- **User Friendliness of Information:** Information exchange on sustainability should occur within a multidisciplinary context, where scientific knowledge and technical materials are available to non-specialists and the public in an easily understandable and user-friendly form.
- **Open Accessibility of Information:** An ongoing working relationship between educational and research institutions and policymaking bodies should be established that allows for open and easy access of information on sustainability.
- **Equity of Access:** Data and information should be made available at the lowest possible cost, including access of remotely sensed information at no charge to individuals who are unable to pay.

The National Council for Science and the Environment expresses its most sincere gratitude to all of the participants in the conference and to all of those who will consider these recommendations and work toward their adoption and effective implementation. In particular, the Council wants to thank those 100 or so individuals who prepared background material and papers, who presented formal remarks to the conference, and who chaired, facilitated, and prepared the recommendations for each of the breakout sessions. Their names appear in Appendix 2.

The National Council for Science and the Environment will communicate these recommendations to the World Summit on Sustainable Development, Administration and Congressional policymakers and will work with the various stakeholders represented at the conference to encourage their adoption and effective implementation.

Additional comments and requests for information should be addressed to Dr. David E. Blockstein, Report Editor, National Council for Science and the Environment; 202-530-5810; fax 202-628-4311; David@ncseonline.org

CURITIBA, Brazil

Plenary Case Study

Curitiba, the capital of Parana state in southeastern Brazil, is well recognized as one of the world's most sustainable cities. An innovative participatory planning approach that has emphasized priority to people and public transit, design with nature and technologically appropriate solutions has allowed Curitiba to manage its rapid growth and provide for the needs of its citizenry (see Appendix 5). Curitiba provides many lessons for cities worldwide.

RECOMMENDATIONS

RECOMMENDATIONS

The World Summit on Sustainable Development should adopt policies that **empower cities** to develop the approaches taken in Curitiba, including:

1. Strategies and Tools

- Develop workable and innovative ideas for **public transit** and other alternatives to private automobiles.
- Develop **tools** that link the **planning of a city** with **integrated economic, social, and environmental functions**, including co-location of work, home, school, and entertainment that would better enable transportation needs to be met by walking or biking.
- Develop tools such as an “eco-clock” (which could measure minutes before a midnight catastrophe) to help **citizens understand the impacts** of urban features on environmental quality.
- Foster **public-private partnerships** that promote affordable solutions.
- Promote strategies for **stakeholder consultation** and **public input**.

2. Dissemination of Sustainability Information

- Create a credible **website on innovative approaches taken in Curitiba and other cities** and disseminate information on approaches to sustainable planning.

- Use **interactive visuals** to demonstrate what can be done, as part of the stakeholder participation process.
- In poor communities, create **mobile urban design centers** to educate in schools, neighborhood centers, and churches.

3. Education

- Integrate the idea of sustainable urban practices, such as organic school gardens, into **childhood education**.
- Create **multidisciplinary curricula** regarding sustainability for professionals such as planners, architects, and urban developers.
- Create **public “universities”** for urban citizens to learn more about integrating environmental concerns into community development.
- Include physical **examples and demonstrations** in educational programs.

4. Investment

- Look for opportunities to invest “**green**” funds in tangible projects for “green” cities.
- Link projects to generate **greenhouse gas emissions credits** with green city investment.

PORTLAND, Oregon

Plenary Case Study

Sustainability is a major issue in Oregon, with initiatives at local, regional and state levels. Scientists play major roles in these initiatives. Efforts in other regions of the U.S. including Racine, Wisconsin; Chattanooga, Tennessee; Seattle, Washington; and the states of Maryland and Utah offer lessons on how to advance sustainability in urban areas in a developed country.

RECOMMENDATIONS

The World Summit on Sustainable Development should support policies and programs that advance the following actions:

1. Collaborative Governance and Place-based Activities

- Develop a system for **collaborative governance** around place-based activities.
- Include **stakeholders**, local, state, tribal and federal government in partnerships such as watershed councils.
- Support **place-based activities** that integrate efforts among agencies, organizations and academic institutions.

2. Application of Science to policymaking

- Encourage **multidisciplinary** efforts in applying science to affect policymaking.
- Encourage a **dialogue** between scientists and policymakers.
- **Reward** scientists for efforts to assist policymakers by recognition, awards, mention in journals, and funding.
- **Implement sustainability projects** such as
 - Revitalized **downtowns and neighborhoods**.
 - Strong **economies**.
 - Affordable **housing**.
 - Community-based **action**.

3. Sense of Place

- Develop and communicate a **sense of place**.
- Conduct additional **scientific inquiry** into what constitutes and promotes a sense of place.

4. Land-use Laws and Business Practices

- Incorporate ecological information and goals into **land-use laws and business practices**.

5. Decisionmaking

- Incorporate environmental, social and economic equity into all stages of **decisionmaking**.

6. Economic Benefits

- Communicate the **economic benefits** of sustainable activities.

7. Long-term Focus

- Focus on **long-term planning and investment** with return horizons of at least 30-40 years.

8. Federal, State, and Local Collaboration

- Use federal funding, encouragement, and expertise to **support state and local efforts**.

9. Urban Growth Boundaries

- Encourage the use of **urban growth boundaries**.
- **Transportation, land use, and economic situation** are the major crosscutting considerations.

WORKING FOR WATER, South Africa

Plenary Case Study

The Working for Water (WFW) Project was launched in 1995 by the government of South Africa. Currently about 30,000 people are employed by the Poverty Relief Programme through WFW. The Project is aimed at clearing invasive plants. These plants are a major threat to water resources and reduce the amount of water available for other purposes. It is estimated that as much as 10 percent of the country's mean annual water run-off has been lost to alien plants. WFW demonstrates the integration of science, conservation of biological resources, job creation and sustainable rural community development.

RECOMMENDATIONS

These recommendations are directed towards governments unless otherwise stated. For additional recommendations regarding invasive species, see “Recommendations for Improving the Scientific Basis for Environmental Decisionmaking,” a report from the first National Conference on Science, Policy and the Environment, December 7-8, 2000.

COORDINATION AND COOPERATION

Governments should develop **inter-ministerial mechanisms** for coordination and cooperation to address specific issues that affect sustainable development (e.g., ensuring freshwater, managing invasive species). This is intended to avoid duplication and gaps in planning, policies and practice.

SCIENCE

1. Youth Programs

- Governments should create **projects and mentorships** that engage young people in sustainable development programs.
- This will **enhance opportunities** for education, training and expansion of the workforce.

2. Scientific Capacity

- Developed country governments should **invest adequate financial resources** to maintain and enhance their own scientific capacity and support efforts by developing country governments to do similarly.

3. Science to Policy Translation

- Governments should provide **incentives and mechanisms** for scientists to translate scientific information into formats and tools that meet policymakers' needs.
- This will require scientists and policymakers to **identify a common language** (e.g., simple metrics) and hold joint workshops to **facilitate understanding and enhance communication**.

4. Technologies and Incentives

- Governments should help to develop new technologies and economic incentives that enable and support sustainable development.
- Both low-tech and high-tech tools with an emphasis on **pollution prevention** should be evaluated using an **industrial ecology framework**.

WORKING FOR WATER, South Africa

Plenary Case Study (continued)

INVASIVE ALIEN SPECIES (IAS)

1. National Strategy

- Governments should develop a national strategy or plan to manage IAS that incorporates **prevention, control and eradication** of IAS in order to reduce their biological, societal and economic costs.

2. Workforce

- Governments should develop a **trained workforce of local community members** who understand the ecological implications of IAS and who participate in the management of IAS.

3. Development Programs

- Aid agencies should **recognize, assess and manage the risks** posed by the use of non-native species in development projects.
- Particular attention needs to be given to food aid programs, carbon sequestration projects and restoration projects.

FRESH WATER

1. System Integrity

- In order to maintain the integrity and quality of freshwater systems, governments should **restrict use of some freshwater systems** so that they are reserved as a source of drinking water.

2. National Water Policy

- Governments should develop a **single national water policy** that establishes a **just and equitable right** to surface and groundwater resources.

3. Indicators

- Governments should establish clear and concise **indicators** for sustainable water systems and **monitor** these systems based on indicators.

4. Community-based Monitoring

- Governments should promote **community-based freshwater monitoring** that takes **inventory** and establishes **baselines**.
- This will promote awareness and build a sense of water rights, ownership and responsibility.

5. Connections Among Systems

- Governments should develop policy and planning programs that recognize that freshwater systems **impact and are impacted by other systems** (e.g., marine).

ARCHITECTURE

LEEDing Green and Planning Design

Design of buildings and other structures can have substantial impacts on use of materials and energy. A holistic approach to building green, including sustainable planning and landscape design for watershed protection, and cost effective, multi-functional building-integrated design elements, will have immediate and long-term benefits. The World Summit on Sustainable Development (WSSD) can facilitate improvement in design and construction that can be positive factors towards sustainability.

RECOMMENDATIONS

1. Government Programs

- Governments should develop and implement programs for **reducing ozone depletion and the production of greenhouse gases, including thorough regulation of the building industry.**
- Governments should develop criteria to incorporate energy performance standards into the building industry.

2. Cost Structure

- All aspects of **building life cycle cost and liability** should be considered in a cost structure up front.
- The construction and purchase of buildings should be regulated so that complete financial information becomes the basis of **construction loans.**
- This approach would act as an incentive to sustainable design by emphasizing the **lowest total package** cost over the lowest initial cost.

3. LEED Rating System

- The US Green Building Council's **LEED (Leadership in Energy and Environmental Design) Rating System** is a system of practical incentives that are each given points resulting in a scoring system for sustainability.
- This system, or one like it, should be incorporated into **professional licensing exams** for the building industry.
- **Certification requirements** for design and construction professionals should require proficiency in sustainable design.

4. Certification of Building Materials

- The WSSD should encourage the selection of environmentally preferable building materials by establishing **guidelines for developing certification systems for building materials.**
- This system would evaluate products by the degree of impact on the environment throughout the life cycle.

5. Indoor Air Quality

- The WSSD should facilitate the continual development of **indoor air quality monitoring systems** that measure the concentration of contaminants in the indoor environment.

6. Energy

- The WSSD should encourage **renewable and alternative energy sources.**
- The WSSD should facilitate development of **hands-on training** programs for professionals to use innovative, energy-efficient designs.

BUSINESS

Ecologically Sustainable and Economically Competitive

Many opportunities exist to bring credible scientific information to private companies to help them to develop and implement business practices that are ecologically sustainable and economically competitive.

Key areas of further research include the areas of industrial ecology, green accounting, material flows, value of ecological services and natural capital.

CROSSCUTTING THEMES: Four crosscutting themes—the four “I’s”—when combined, will help businesses make significant contributions towards sustainability.

- **Information**—disseminating the latest scientific developments and best practices to other businesses that can benefit.
- **Innovation**—encouraging innovation within companies and across sectors.
- **Incentives**—driving innovation.
- **Investments**—providing the financial backing to drive innovation and promoting business practices that are environmentally sustainable and economically competitive.

RECOMMENDATIONS

1. Leadership

- Develop strong **leadership at all levels** of an organization and across all sectors of society to promote sustainable business practices.
- **Recognize** those companies and individuals at all levels of a corporation who are leading sustainability efforts.

2. Education

- Foster sustainable business practices by improving **environmental literacy** among employees, consumers, suppliers, investors, business schools, policymakers and the media.

3. Incentives

Create incentives to promote sustainable business practices, such as:

- Encouraging **manufacturers to take responsibility** for the life cycle of their products.
- Developing environmental regulations that **promote** rather than stifle **innovation**.
- Encouraging private companies to **conserve and restore ecological systems**.
- Instituting public and private **procurement policies** that create markets for products and services that are based on sustainable business practices (e.g., re-manufacturing).

BUSINESS

Ecologically Sustainable and Economically Competitive (continued)

4. Integration and Coordination

- Improve the integration and coordination of **government agencies** that have responsibility for environmental issues.
- Encourage these agencies to improve the scientific basis for environmental decisionmaking, including the application of **risk-based science**.

5. Case Studies

- Develop case studies of **best practices** for sustainability.
- Develop **mentoring programs** to promote information exchange among businesses.

6. Market and Consumer Behavior

- Undertake **research** to understand market and consumer behavior in order to better promote products and services that are based on sustainable business practices.

7. Research and Assessment

- Provide aggressive support for **research and assessment tools** related to sustainable business practices, such as:
 - industrial ecology,
 - green accounting,
 - materials flows analysis, and the
 - valuation of environmental services (*e.g.*, wetlands) and natural capital.
- Create a **Bureau of Environmental Statistics** to collect and disseminate information about sustainable practices and performances.

8. Information and Technology Transfer

- **Improve access** to information and technology that promotes environmentally sustainable and economically competitive business practices.
- Encourage and support programs at multilateral lending institutions (*e.g.*, World Bank) and other transnational organizations (*e.g.*, United Nations) to ensure that **developing nations have access** to this information and technology.



CHILDREN'S HEALTH

Children's Health and the Environment

Each year, millions of children around the world die and hundreds of thousands more endure chronic suffering from *preventable* health problems that are caused or exacerbated by environmental conditions. Approximately 5 million children annually die from respiratory diseases frequently associated with exposure to indoor and outdoor air pollution, by airborne particulates, sulfur dioxide, and ozone. More than 3 million children annually die from waterborne diseases caused by ingesting contaminated water.

Millions of children in the workplace risk exposure to noxious substances and hazardous conditions that can impair their physical development and mental health. Malnutrition and other conditions caused by poverty lower children's ability to fight off disease or eliminate environmental toxins from their bodies, thus exacerbating the effects of chronic illnesses and increasing the risk of child death due to environmental health factors.

CHILDREN ALSO ARE FACED with newly emerging threats to their health due to toxins in the environment. Infants born with synthetic chemical substances already in their bodies feed on breast milk, which may be contaminated with heavy metals and other toxic substances. Synthetic chemical substances such as pesticides along with solvents and heavy metals such as mercury and lead can impair a child's nervous system. PCBs and dioxins disrupt the body's hormonal balance, while radiation, asbestos and arsenic contribute to the onset of cancer.

RECOMMENDATIONS

1. Focus on Children's Health

- Children are 100% of our future. The WSSD should affirm that environmental health issues must focus **first** on the child, and especially children in the most vulnerable populations.
- The WSSD should affirm that **prevention of exposure** is both the most effective and the most efficient way to protect children's health.
- The WSSD should help to mobilize **financial and technical resources**.

2. The WSSD Should Bring Focus on These Key Areas for Action

- Water (quality and access) and sanitation.
- Lead.
- Indoor and outdoor air pollution.

3. Data Collection and Monitoring

The WSSD should help to:

- Establish a set of globally recognized key **indicators** and **benchmarks** for monitoring the **environmental exposure and resulting health effects** on children.
- Harmonize methodology for **data collection**.

- Create a formal mechanism to facilitate the **exchange of information and data** among all affected countries.
- Develop **policy indicators to measure the effectiveness of government implementation**, including the involvement of NGOs and the private sector, with access to services, and transparency in setting policies.

4. Education and Capacity Building

The WSSD should help to ensure that:

- Programs should **focus on children and caregivers**, with particular attention to the **education of girls**.
- Institutional, policy and technical mechanisms (such as environmental health indicators) and expertise **are provided to people and institutions at all levels**, from the family, community, national, and international organizations so that they can prevent and address environmental threats.
- An **international network** among governments, private sector, and NGOs is developed **for information sharing and capacity building**.

COMMUNITY DESIGN

New Community Design and Community Based Planning and Design

A new approach to community design is needed to combat sprawl and create vibrant neighborhoods with housing, parks, schools, civic services, jobs, and transit. A key to success is design that will break the dependence upon automobiles.

RECOMMENDATIONS

DESIGN

To assure design of sustainable communities, the World Summit on Sustainable Design should encourage the following:

1. Integrated Communities

- **Communities** that integrate mixed land uses and multiple uses of public buildings within the community, providing access to food, clean water, adequate housing, health care, education, jobs, and civic services within walking distance or easily accessible by public transportation.

2. Human Dimensions

- **Incorporation of human dimensions** in growing communities by helping to empower local people to implement their own community vision.
- This will help assure that quality of life, health and environment are top priorities and that communities are built to meet long-term needs.

3. Existing Models

- Focus on **existing real places that meet smart growth criteria as models** for projects and processes, including other cultures and other times in history.
- Use these models in other places with awareness of local contexts and constant assessment and evaluation of success.

4. Institutionalize Goals

- Institutionalization of **sustainable community goals** within the political system.
- Use tools such as sustainability impact statements for projects.
- Use public-private partnerships and other incentives for private sector participation to create a community-based strategic framework, develop strategies and implement diverse, quality community development.

RESEARCH

The World Summit on Sustainable Design should **build processes to generate scientific data** to be used for community design and **improve the quality and quantity of social and scientific data** for the following issues:

1. Political Issues

- **Reallocation of government and foreign aid funding** for sustainable communities.
- **Decrease of private sector control of public systems.**
- Development of “**Sustainability Impact Assessments**” (like Environmental Impact Assessments), which evaluate social and economic dimensions as well as environmental aspects.

COMMUNITY DESIGN

New Community Design and Community Based Planning and Design (continued)

2. Social Issues

- **Consumer** preferences, markets and needs.
- Distinguishing “**quality of life**” from “standard of living,” fostering the experience of sacredness and connectivity to other people, to diversity, and to the natural world.
- Processes that allow communities to create their **own visions and plans** based on their values.
- **Education** systems for sustainability and its components for future planners, local officials, decision makers, women, children, etc.

3. Environmental Issues

- Access to clean, non-degraded **natural spaces** as a human right.
- Preservation of land, **biodiversity**, and restoration of habitat.
- Use of native species and working with **local ecological systems**, incorporating waterways, watershed and region.

4. Economic Issues

- Alternatives to automobiles and incentives to support alternatives.
- Taxes and subsidies to support sustainable communities.
- Market incentives.
- Leverage of private sector influence, particularly for education and social marketing of sustainability concepts.

CULTURE

Integrating Indigenous Peoples' Values to Promote Sustainable Science and Technology

The rights of Indigenous Peoples to self-determination are central to sustainability. An integral part of that right is the ability to use and develop their traditional knowledge to protect and manage their natural resources in a manner consistent with their sense of self, their culture, their traditions, and their spirituality.

RECOMMENDATIONS

World Summit on Sustainable Development should:

1. Policy

- Recognize, acknowledge and give solidarity to outcomes from **indigenous communities**.
- Recognize **alternative ways to offer environmental protection**, including those that come from indigenous people.
- Recognize and acknowledge that **indigenous science** should carry the same weight and importance as western science.

2. Science Process

- Acknowledge the contribution of **indigenous knowledge** to global knowledge.
- Recognize **tribal institutions** and their contributions in science, technology and environmental preservation.
- Recognize the importance of indigenous processes and support a **pluralistic approach to science** methodology.

3. Programs

- Contribute to programs within indigenous and non-indigenous communities that pursue the **establishment of goals, visions and programs** in order to facilitate and improve international science.
- Establish programs that will empower and endorse **indigenous environmental perspectives** and values.

ENERGY

Energy Sustainability: Current Realities and Future Possibilities

Energy production and use is presently one of the major contributors to humanity's unsustainable course. The World Summit on Sustainable Development can help to catalyze a global movement to fuel sources and use patterns that meet economic and societal needs while minimizing environmental impact.

RECOMMENDATIONS

The World Summit on Sustainable Development should adopt a document that calls for the following actions:

1. Fuel Sources

- Increase research and development in **renewable, low-emission and non-carbon** fuel sources, including hydrogen.

2. Price

- Incorporate **externalities** into the price of energy.

3. Technology Transfer

- Maximize efforts to transfer **sustainable energy technologies** from the industrialized world to **developing countries** in a manner that is locally appropriate.

4. Education

- Educate the public on the importance of more energy-efficient **lifestyles** and less harmful, renewable energy sources.

5. Transit

- Encourage "**smart growth**;" minimize reliance on individual automobiles and maximize use of **mass transit**.

6. Collaboration

- Encourage **cross-disciplinary collaboration** to address energy needs.

FEDERAL GOVERNMENT EMPLOYEES

Science, Technology & Public Policy Seminar

These recommendations have been produced by senior managers from more than ten federal government agencies at the conclusion of a two-week class on Science, Technology & Public Policy that was organized by the Office of Personnel Management. The class members participated in the NCSE National Conference and produced the following recommendations on how to implement sustainability in a federal agency.

RECOMMENDATIONS

1. Incentive-based Policies

- Incentive-based policies should be established systematically for the conservation of natural resources.
- Current examples of successful policies are multiple rate structures and emission cap and trade programs with progressively declining caps.

2. Mass Balance Models

- Research should be undertaken to create mass balance models with an economic component.
- Such models could be used by decisionmakers for two major purposes:
 - Forecasting and planning.
 - Assessment of policy options by manipulating variables to see likely impacts on sustainability.

3. International Labeling Standards

- International standards to label products as being produced in a sustainable manner should be developed.
- Such labels should include materials, content, and manufacturing processes with respect to sustainability.
- Such labels are intended to affect consumer awareness and to encourage buying habits that support sustainability.

4. Government Procurement

- Governments should use their procurement processes to support sustainability.

5. Recognition

- There should be a **World Prize** for implementing **sustainable communities at various scales** (local, municipal, state, regional and national).

6. Government-business Partnerships

- Governments and businesses should establish creative **business-government partnerships** for achieving sustainability goals.
- These partnerships would be near-term incentives for long-term behavioral change on the parts of both parties.
- Some successful U.S. policy mechanisms in this regard include tax incentives, enterprise zones and cooperative research and development agreements.

FORESTRY

Issues in Sustainable Forestry

Forest management has major impacts on community sustainability including the age and size of forested lands, logging practices and opportunities for sustained economic return to local communities.

In recent years a range of certification systems have been developed to evaluate forestry practices for their impacts on biodiversity and sustainability, yet the evaluation criteria and standards vary in design and implementation.

RECOMMENDATIONS

The World Summit on Sustainable Development can encourage forestry to be more sustainable by adopting the following recommendations:

1. Rights of Local Communities and Indigenous People

- Require **legal recognition** of the use and access **rights of local communities and indigenous peoples** in forested areas and forest concession allotments.
- **Acknowledge indigenous knowledge** as a **valid basis** for forest planning and management, and consider **quality-of-life indicators** along with ecosystem health as **essential to sustainability**.

2. Education

- **Educate** consumers, governments, producers and forest communities **about the multiple value of forest lands and sustainable forestry practices**.
- Include relationships of forests and forest management to **local issues** such as **water availability and quality** and **global issues** such as **climate change**.

3. Standardized Definitions

- Recommend to organizations such as the United Nations Food and Agriculture Organization (FAO) ecosystem-based science and technology to develop definitions of **forest sustainability**.
- Standardized terminology is critical to **enable global and temporal comparisons**.

4. Monitoring Tools and Technologies

- Promote the equitable development and standardization of the **technology, tools and indicators** for assessment and monitoring of **forest health**.
- Evaluate the possibility of a global, synoptic, **remote sensing-based forest accounting** as a viable alternative to a bottom-up approach.
- Monitoring processes should be **collaborative, adaptive, and include multiple stakeholders**.

5. Policy and Management

- Encourage clear, feasible **policies** and **management activities** that **address threats** to forest sustainability and health, such as illegal logging, **invasive species** and **lack of long-term management planning**.

6. Public-Private Partnerships

- Develop and empower **public/private partnerships** to foster a **participatory approach** to **education and monitoring**, the development of **sustainable forest products** and maintenance of forest health.
- Develop programs to coordinate and **improve forest planning** and management across **state, private and federal lands**.

FORESTRY

Issues in Sustainable Forestry (continued)

7. International Collaboration and Certification

- Promote **international collaboration** among governments, NGOs, industry, communities and lending institutions to ensure **accountability** in the development and implementation of third party forest **certification** systems.

8. Dissemination, Access and Use

- Promote equitable **dissemination, access and use** of **technology, products and practices** for sustainable forestry to the widest possible audiences at the lowest possible cost.
- The U.S. and other G-8 partners and NGOs should work to **make available at no cost** to users the global, year 2000 ortho-rectified Landsat data it is currently planning to produce, and other appropriate **remote sensing and GIS data**.

- The G-8 partners should work to **support partnerships with countries and NGOs** to conduct interpretation and analysis of satellite data, and to **upgrade their capacity** for ground-truthing and conducting traditional forest inventory for information that cannot be gathered remotely.

9. Economic Context

- Recognize forestry as but **one sector of an integrated economy**, subject to fluctuation and macroeconomic forces.

HIGHER EDUCATION

Progress Toward Sustainable Community Development and Partnerships for Sustainability in Higher Education

Understanding sustainable development requires making **linkages** between information, values and action. **Colleges and universities**, which educate and train our future leaders, professionals and community members, bear a fundamental **responsibility to explore and teach those linkages**. Higher education **must take a lead in defining our vision** for a sustainable world.

RECOMMENDATIONS

The World Summit on Sustainable Development can adopt the following recommendations:

OVERALL

1. Models of Sustainability

- **Universities should be models of sustainability** in all aspects of their functioning, including curriculum, research, operations, outreach, monitoring, and reporting.

CURRICULUM

1. Sustainability Education

- **Sustainability education** should be required in all undergraduate courses of study and degrees.

2. Sustainability and Health

- Universities should seek to understand and educate about the **connections between sustainability and human health**.

3. National Curriculum Committee

- Governmental and non-governmental organizations should form a **national sustainability curriculum committee** by combining existing committees and involving other interested parties.

COMMUNITY AND PUBLIC POLICY

1. Public Policy Needs

- Colleges, universities and environmental educational and policy institutes should link their **courses of study with public policy needs**.

2. Leadership

- Universities need to **serve as leaders** for establishing regional, national and international sustainability **policies and programs**.

3. Community Resources

- Higher education institutions should become more **effective resources for their communities** and help **educate citizens** about the local, regional, national and international dimensions of environmental problems facing environmental decisionmakers.

INDICATORS

Sustainable Community Indicators: Experiences, Lessons Learned, and Evolving Opportunities in the United States

Indicators provide quantitative information about the condition of a system. Good sustainability indicators measure key issues such as long term balance among economic, social and environmental goals, carrying capacity of community capital (natural capital, social capital and built capital) and equity (both intra-generational and intergenerational). Indicators must be understandable and useful to the community decisionmaking process. Communities of stakeholders at all levels from local to global must be involved in developing indicators as part of collaborative decisionmaking processes.

RECOMMENDATIONS

The World Summit on Sustainable Development should support the following recommendations.

1. Indicators to Action

- Communities at all levels should develop **sustainability goals and indicators** that allow self-assessment with respect to sustainable development and that support creation and implementation of strategic management and policy decisions.
- A **new set of indicators should be developed** to support societal decisionmaking for sustainable livelihoods and sustainable community development.
- Indicators must be **practicable** and facilitate work on the ground.
- Mechanisms like the **International Sustainability Indicators Network (ISIN)** are needed to bring together practitioners and experts at all levels (ISIN is a non-profit organization of sustainability indicator practitioners and experts).

2. Integration

- Governmental and nongovernmental organizations at all levels should develop a **nested set of sustainability indicators** that integrates across scales, sectors and disciplines.
- **Methodologies and other tools** are needed to facilitate the integration.
- Existing tools need to be **identified** and **gaps** in the tools need to be addressed.

- **All stakeholders, including businesses**, chambers of commerce and other business associations must be a part of the efforts.

3. Research for Integration, Synthesis and Assessment

- Indicator efforts must be **linked more closely to science**.
- Those who develop and use indicators should also assist in setting the research agenda, participate in research and use the scientific results.
- Research is needed to **understand and remove barriers**, including information gaps, to the effective implementation and use of indicators, especially in the area of equity and social and economic well being of communities.
- **Funding** is needed to carry out this research.
- Researchers need **incentives** to collaborate across disciplines and with local communities.
- **Governmental coordinating mechanisms** such as the Federal Geospatial Data Committee (FGDC) and the Council on Environmental Quality (CEQ) are needed to integrate sustainability into the government.
- There should be a governmental **clearinghouse** for sustainability research and data.

4. Education

- Education is needed to raise consciousness and awareness of sustainability issues among all members of society.
- Education standards must include **ecological literacy**.
- The Council for Excellence in Government should work with government and nongovernmental organizations to develop an **action plan** for sustainability education.

INFORMATION SYSTEMS

Interoperability in Support of Effective Environmental Decisionmaking

Building on the recommendations of the first National Conference on Science, Policy and the Environment, the Information Systems Breakout Session confirmed that **data and information** are the transportation between science and decisionmaking for a sustainable environment.

The US is moving forward aggressively in building a **national environmental information infrastructure**, although many challenges remain. National borders do not limit many of these challenges.

RECOMMENDATIONS

The World Summit on Sustainable Development should advance the following approaches:

1. Global Environmental Information Commons

- Nations need to work together to create a **Global Environmental Information Commons** as a cooperative venture among nations, including all sectors of society (government, non-governmental organizations, industry, academia and the public).
- The Commons would include **data, tools and infrastructure**.

2. Open Information Culture

- Decisionmakers and scientists need to work toward creating an **open information culture** where the needs of the scientists and generators of data are valued.
- The culture needs to embrace the **accessibility** of scientific data to the **many potential user communities** including policymakers, resource managers, researchers, students, teachers and citizens.
- **Stronger interfaces** must be built among **data generators, managers and users**.

3. Common Data Definitions

- Scientists and users need to **work on globally common data definitions** so compatible information can be managed and then used.
- Interoperability is dependent upon resolution of current semantic barriers and incompatibilities.

4. Life Cycle Approach

- Developers of information systems must look at the **life cycle of information systems** and develop a unified strategic framework for long-term data capture, access, archiving and preservation.

5. Long Term Needs

- Interdisciplinary data generation, management and user communities on a variety of scales, from local to international, need to begin an **interactive process** that determines the specific long-term questions that will need to be addressed in the next 10 to 100 years.
- Then they must **identify the data to be collected** in order to assess future environmental issues, conditions and trends.

LIBRARIES

Sharing Sustainability Data and Information: The Role of Libraries and Library Networks

Sustainable communities must have effective, efficient, reliable, economic, and equitable access to critical data and information. Yet, many community members do not have adequate access to primary data and information resources, nor do they have the expertise to understand and use these primary resources effectively in the decisionmaking process. They need similar access to the data and information tools to analyze, evaluate, and manage these resources. Communities also need access to the institutional and human reservoirs of expertise and knowledge to assist them in the use of data and information for the decisionmaking process.

LIBRARIES AND LIBRARY NETWORKS HAVE ESTABLISHED a historic public trust as stewards of information and providers of resources, services, and products to assist communities in the sharing and use of that information. Libraries and library networks provide communities with “sustainable ICE:” **Information, Communication, and Education**. They can be **LINKS** between science and community by providing **Literacy, Information, Networks, Knowledge, and Synthesis**. The World Summit on Sustainable Development should involve libraries, library networks and librarians in building sustainable communities.

RECOMMENDATIONS

The World Summit on Sustainable Development should support the following approaches.

1. Partnerships

- Librarians and information providers are actively engaged in linking information sources and information consumers.
- **Librarians** should be valued as **natural partners** in planning and implementing sustainability initiatives and actions at local, national and international levels.

2. Information Exchange

- Librarians and information providers should actively promote the **exchange of useful scientific data and engage members of local communities in decision-making**.

3. Awareness

- Libraries and librarians should be encouraged and empowered to **foster environments of learning and awareness**.

- They use, promote the use of, and increase the awareness of data and information sources and resources for the communities they serve.
- They also use, promote the use of, and increase the awareness of the appropriate information and data technologies and tools for members of the communities for their evaluation, integration and synthesis in decisionmaking across disciplines and perspectives.

4. Networks

- The WSSD should encourage the use of library networks and programs such as the Libraries Build Sustainable Communities program initiated by the American Library Association and Global Learning Inc. (<http://www.ala.org/sustainablecommunities>).
- The WSSD should use the existing international networking capacities of the International Federation of Library Associations as a conduit for promoting understanding and implementation of sustainable programs.

POLLUTION PREVENTION

Use of Scientific Tools to Address Issues of Pollution Prevention & Community Sustainability

Pollution prevention is generally defined as the reduction or elimination of industrial and domestic waste at the source of generation.

Air, water, and soil pollution affect ecosystems on scales ranging from local to global, and fall under a range of regulatory regimes. Efforts to develop effective pollution prevention technologies are underway at national laboratories, industrial affiliates, and colleges and universities.

RECOMMENDATIONS

The World Summit on Sustainable Development can make a major contribution towards sustainability by supporting the following recommendations.

1. Total Systems Approach

- Sustainability can be achieved at all levels by encouraging the use of **environmental management systems**, including environmental health and safety programs, to utilize **innovative technology**, reduce **life cycle costs** and implement **pollution prevention** through a **total systems approach**.

2. Government Commitment to Pollution Prevention Research and Development

- Governments should support **pollution prevention science and technology development and transfer**.

3. Environmental Performance and Assessment Measures

- **Standardize environmental performance measures** for businesses and communities as tools for assessing progress in pollution prevention.

4. Incentive Programs

- **Promote and extend current incentives for individuals, communities and businesses** to continuously **improve environmental performance** through pollution prevention.

5. Information Accessibility to Communities

- Promote efforts to **make scientific tools** and educational **programs** on pollution prevention resources **more accessible** to local communities.

6. Strengthening Environmental Security through Pollution Prevention

- Promote the development of pollution prevention opportunities in efforts to **reduce on-site production and storage** of chemicals and hazardous materials, thereby reducing potential terrorist targets and achieving environmental security.

REMOTE SENSING

Community Energy and Environmental Decisionmaking: Seeing the Big Picture with Remote Sensing and Satellites

Remote sensing has generated considerable data about the condition of the planet. However, many of these data are not available or not provided in a format that can be readily understood by community groups and other non-technical users. Efforts to provide, interpret and translate data in a useful manner, as well as train new users, should be commensurate with the effort to collect data.

RECOMMENDATIONS

The World Summit on Sustainable Development should promote the following policies.

1. Data Availability

- Providers of remote sensing data should provide **free data to all users**, particularly to those in developing countries.

2. Expert Systems

- WSSD should promote the **international development of remote sensing expert systems** (training people and providing the needed technology) to **interpret global and community data**.
- Groups such as U.S. Agency for International Development (USAID), Peace Corps, universities, and other institutions can deploy these systems.
- Ultimately, the goal should be to **break technical barriers** and **develop capacity**.

3. Data Translation

- **Agencies** such as the U.S. Environmental Protection Agency (EPA), U.S. Geological Survey (USGS), Federal Emergency Management Agency (FEMA), and their international equivalents should **cultivate intermediary organizations that work with users to translate remote sensing data into useful information**.

4. Application to Environmental Problems

- Providers of remote sensing data should conduct and fund **research** to develop methods for using **remote sensing to address environmental problems** (e.g., deforestation, water pollution, air pollution).

5. Community Needs

- National environmental agencies and local NGOs, in partnership with providers of remote sensing data, should **determine specific community needs and match them with appropriate technology**.

6. Clearinghouses

- The **United Nations** should **provide coordination** and **encourage development** of information **clearinghouses** to help people find data easily and offer technical assistance on the use of remotely sensed data.

RURAL COMMUNITIES

Sustainable Community Development: Applications of Research, Education and Extension

Rural communities around the world are changing rapidly due to increased industrialization of agriculture, emigration of people to urban areas, and sprawl of urban and suburban areas. Many of the desirable characteristics of rural communities are being lost and rural environments are being degraded.

There is much potential for retaining and restoring sustainable rural communities and healthy rural environments through a combination of education (via social capital development) and empowering people (by connections with resources).

RECOMMENDATIONS

The World Summit on Sustainable Development should support activities that educate and empower rural communities in the following ways:

1. Local Culture

- Emphasize the **preservation of local cultures and practices** with an **emphasis on maintaining indigenous knowledge** to preserve rural character.
- Fund and staff programs for education of the **rural public** that incorporates indigenous community culture and its interdependence with ecological systems.

2. National Support Network

- Create national support networks for sustainable rural communities utilizing an **up-dated cooperative extension service in partnership** with the field offices of other federal, non-governmental and private organizations.

3. Higher Education and Distance Learning

- Establish and support **university satellite campuses** and **distance learning infrastructure** in rural areas.
- Charge the education enterprise to develop **academic, government and commercial partnerships for local economic development**.
- Provide incentives and support for universities to develop **curriculum** and **programs** that link learning and pre-career skill development with needs of rural communities.

4. Local Civic Engagement

- **Broaden local civic engagement** by building on the talents and resources of local people and organizations.
- Employ **educated rural citizens** in educating their own or other rural communities about sustainable practices and land use options.

5. Increased Sustainable Practices

- Provide incentives through a combination of **education** and **government aid** for **increased sustainable practices** in rural areas such as: implementation of riparian areas, crop rotation and wood lot management.

6. Promoting a Positive Vision

- Scientists and educators should use popular media and the arts to **develop and deliver key messages** of positive visions of sustainability.

URBAN DESIGN

Scientific Approaches to Healthy Urban Form and Function

Most cities are more of a result of history and ad hoc development than any comprehensive science-based planning. Development and application of an interdisciplinary science of sustainable communities could greatly increase the quality of life for urban inhabitants. While this science is being developed, there are many opportunities to incorporate sustainability principles into urban planning and development.

RECOMMENDATIONS

The World Summit on Sustainable Development should support activities that educate and empower urban communities in the following ways:

1. Public Awareness Campaign

- Local government officials and non-governmental leaders should **publicize their successes** in sustainable urban design to the public and to governments outside their jurisdictions.
- Governments at all levels should promote conservation and efficient technologies in the form of **public service announcements, websites, educational curricula, information kiosks and advertising campaigns**.
- The condition of the world for future generations should be emphasized.

2. Interdisciplinary Collaboration

- City planners should encourage developers, architects, engineers, natural scientists, social scientists and educators to **collaborate on urban design projects**.
- Formal and informal education on sustainable urban design should increasingly **integrate interdisciplinary perspectives**.

3. Directing Government Funding and Creating Economic Incentives

- Legislators should use **direct investment, public-private partnerships and tax incentives** to promote sustainable policies.

- Much more financing is needed for **research and development** of environmentally sustainable technologies.

4. Encouraging Sustainability in Governmental Operations

- Governments at all levels should encourage “green” building, sensitive urban design and energy efficiency on government-owned land.
- Planning for public lands and facilities including military bases, national parks, courthouses, federal agency headquarters and all state and local government buildings should **incorporate best practices in sustainable design**.
- Government officials should consult with a **broad range of scientific experts** who focus on ecology and urban design to better understand the social and environmental impacts of infrastructure investments such as highways, energy sources and urban expansion.

5. Eco-City Challenge

- The United States and every other Agenda 21 member country should **develop at least one model eco-city**, whether by improving the design of an existing city or building a new city using sustainable principles such as self-reliance, widespread access to nature, resource efficiency and livable density.
- There is a need to take a **comparative scientific approach** to urban design.

SUSTAINABLE COMMUNITIES: SCIENCE & SOLUTIONS

Second National Conference on Science, Policy and the Environment

APPENDIX 1

DECEMBER 6, 2001

SMITHSONIAN NATIONAL MUSEUM OF NATURAL HISTORY, BAIRD AUDITORIUM

8:00 AM REGISTRATION

9:00 AM WELCOME

- Robert Sullivan, Associate Director for Public Programs, Smithsonian National Museum of Natural History
- Stephen Hubbell, Chair, National Council for Science and the Environment

9:15 AM KEYNOTE ADDRESS

- Introduction by Ambassador Richard Benedick, President, National Council for Science and the Environment

Setting the Stage and Envisioning the Big Picture of Sustainability

- Donald Kennedy, Editor-in-Chief, *Science*, American Association for the Advancement of Science; former President of Stanford University

10:30 AM PLENARY I: WHAT ARE SUSTAINABLE COMMUNITIES?

Case Study: Curitiba, Brazil

- Governor Jaime Lerner, State of Parana and former Mayor of Curitiba, Brazil

Panel Discussion

- *Chair*, Thomas Lovejoy, The World Bank
- Deborah Bleiviss, Inter-American Development Bank
- David Crockett, former City Council Member, Chattanooga, TN
- Karen Peabody O'Brien, W. Alton Jones Foundation

Audience Questions and Comments

12:00 PM LUNCH

1:30 PM PLENARY LECTURE

From Rio to Johannesburg: Implementing Sustainable Development on the Global and Local Scales

- John Dernbach, Associate Professor of Law, Widener University Law School

2:15 PM PLENARY II: SCIENCE AND TECHNOLOGY DEVELOPING SOLUTIONS TO SUPPORT SUSTAINABLE COMMUNITIES

Case Study: Working for Water, South Africa

- Brian van Wilgen, Manager, Catchment Management Services, Council for Scientific and Industrial Research, Stellenbosch, South Africa

Panel Discussion

- *Chair*, Twig Johnson, National Academy of Sciences
- Ann Bartuska, The Nature Conservancy
- Ahmed Khan, Working for Water Programme, South Africa
- Peter McCornick, U.S. Agency for International Development
- Gunars Platais, The World Bank
- Jamie K. Reaser, National Invasive Species Council

Audience Questions and Comments

4:15 PM PLENARY III: What Are the Necessary Science and Policy Links for Achieving Sustainable Communities?

Case Study: Portland, Oregon

- Representative Earl Blumenauer (OR)
- Commissioner Dan Saltzman, City of Portland
- Greg Wolf, Office of the Governor of Oregon

Panel Discussion

- *Chair*, A. Karim Ahmed, National Council for Science and the Environment
- Dan Mazmanian, University of Southern California
- Bonnie Prochaska, Sustainable Racine
- Shari Wilson, Office of Smart Growth, State of Maryland

Audience Questions and Comments

5:45 PM ROUND TABLE DISCUSSION

Sustainable Communities: Science, Solutions and Environmental Decisionmaking

- *Chair*, Sarah Moten, United States Agency for International Development
- David Crockett, former City Council Member, Chattanooga, TN
- Dianne Dumanoski, Journalist, Newton, MA
- Dan Mazmanian, University of Southern California

6:30 PM NCSE CONGRESSIONAL LEADERSHIP AWARD

- Representative Sherwood Boehlert (NY), Chair, Science Committee, U.S. House of Representatives

6:50 PM BUFFET RECEPTION IN MUSEUM ROTUNDA

8:00 PM JOHN H. CHAFEE MEMORIAL LECTURE ON SCIENCE AND THE ENVIRONMENT

Welcome

- Ambassador Richard Benedick, President, National Council for Science and the Environment

Remarks

- Georgia Chafee Nassikas

Introduction

- Stephen Hubbell, Chair, National Council for Science and the Environment

“THE FUTURE OF LIFE”

- Edward O. Wilson, Pellegrino University Research Professor, Harvard University

DECEMBER 7, 2001

RENAISSANCE WASHINGTON DC HOTEL

9:00 AM–12:00 PM BREAKOUT SESSIONS AND WORKSHOPS (APPENDIX 2)

9:00 AM–4:00 PM CONFERENCE EXHIBITION—SUSTAINABILITY SCIENCE: Products and Projects

12:00 PM BUFFET LUNCH SERVED IN EXHIBIT HALL

2:30 PM NCSE LIFETIME ACHIEVEMENT AWARD

- Presentation by Ambassador Richard Benedick, President, National Council for Science and the Environment to:
Honorable Maurice Strong, Senior Advisor to the United Nations Secretary-General

3:00 PM CLOSING PLENARY: From Washington DC to Johannesburg

SCIENCE, STAKEHOLDER NEEDS AND SOLUTIONS

- Alan Hecht, Council on Environmental Quality
- Jonathan Margolis, U.S. Department of State
- Representative John Edward Porter, (IL), retired
- Jacob Scherr, Director, International Programs, Natural Resources Defense Council
- Honorable Maurice Strong

BREAKOUT SESSIONS

APPENDIX 2

CURITIBA, Brazil

Plenary Case Study

SESSION CHAIR

Deborah Bleiviss, Program Manager for the Sustainable Markets for Sustainable Energy (SMSE) Program at the Inter-American Development Bank (IDB)

PRESENTERS

- *Governor Jaime Lerner*, State of Parana and former Mayor of Curitiba, Brazil
- *David Crockett*, former City Council Member, Chattanooga, TN
- *Karen Peabody O'Brien*, W. Alton Jones Foundation

PORTLAND, Oregon

Plenary Case Study

SESSION CHAIR

Juge Gregg, Perkins Coie, Portland, Oregon

PRESENTERS

- *Comissioner Dan Saltzman*, City of Portland
- *Greg Wolf*, Office of the Governor of Oregon
- *Bonnie Prochaska*, interim Executive Director, Sustainable Racine
- *Shari Wilson*, Office of Smart Growth, State of Maryland

WORKING FOR WATER, South Africa

Plenary Case Study

SESSION CHAIR

Jamie K. Reaser, Assistant Director for International Policy, Science, and Cooperation, National Invasive Species Council, U.S. Department of the Interior

PRESENTERS

- *Brian van Wilgen*, Manager, Catchment Management Services, Council for Scientific and Industrial Research, Stellenbosch, South Africa
- *Ahmed Khan*, Working for Water Programme, South Africa
- *Ann Bartuska*, Executive Director, Invasive Species Initiative, The Nature Conservancy

ARCHITECTURE

LEEDing Green Planning and Design

SESSION ORGANIZER

Katrin Scholz-Barth, Director of Sustainable Design, HOK Planning Group, Washington, D.C.

PRESENTERS

- *Duncan Lyons*, HOK Architects, Washington, D.C.
- *Lisa McCabe*, HOK Architects, Washington, D.C.
- *Qasim Mansoor*, HOK Architects, Washington, D.C.

BUSINESS

Ecologically Sustainable and Economically Competitive

SESSION ORGANIZERS

Robert Johnson, Executive Vice President,
Wildlife Habitat Council
Kimberly Lamphier, Outreach Program Manager,
Wildlife Habitat Council

PRESENTERS

- *Joanna Underwood*, President, Inform, Inc.
- *Richard Bartlett*, Vice Chairman, Mary Kay Holding Corp.

CHILDREN'S HEALTH

Children's Health and the Environment

SESSION ORGANIZERS

Michelle Leighton, Director of International Programs,
Natural Heritage Institute
A. Karim Ahmed, President, Global Children's Health &
Environment Fund

PRESENTERS

- *E. Ramona Trovato*, Director, Office of Children's Health Protection, US Environmental Protection Agency
- *Tee Guidotti*, Chair, Environmental and Occupational Health, School of Public Health, George Washington University
- *Vanessa Tobin*, Chief of Water, Environment and Sanitation, UNICEF
- *Terri Damstra*, World Health Organization/International Programme for Chemical Safety
- *Bamgboye Afolabi*, Roll Back Malaria Program, WHO, Lagos, Nigeria (resource individual)

COMMUNITY DESIGN

New Community Design and Community Based Planning and Design

SESSION ORGANIZER

Joel Hirschhorn, Director, Natural Resources Policy Studies,
National Governors Association, Center for
Best Practices

PRESENTER

- *Richard Heapes*, Principal, Street-Works

CULTURE

Integrating Indigenous Peoples' Values to Promote Sustainable Science and Technology Decisions

SESSION ORGANIZER

Mervyn Tano, President, International Institute for
Indigenous Resource Management

PRESENTERS

- *Mike Barns*, University Fellow, International Institute for Indigenous Resource Management
- *Jeanne Rubin*, General Counsel, International Institute for Indigenous Resource Management

ENERGY

Energy Sustainability: Current Realities and Future Possibilities

SESSION ORGANIZERS

Alan Miller, Team Leader, Climate Change and Ozone Depletion, Global Environmental Facility
Neil Numark, Numark & Associates

PRESENTERS

- *Steven Fetter*, Professor, University of Maryland School of Public Affairs
- *Gunter Schramm*, International Finance Corporation
- *David Wade*, Argonne National Laboratory
- *Stephen Dunn*, WorldWatch Institute
- *Christine Egan*, Collaborative Labeling and Appliances Standards Program (CLASP)

FEDERAL GOVERNMENT EMPLOYEES

Science, Technology and Public Policy Seminar

SESSION ORGANIZER

David Ost, Office of Personnel Management

PRESENTERS

- *William Cooper*, Michigan State University
- *Ted Harris*, Denver, CO

FORESTRY

Issues in Sustainable Forestry

SESSION ORGANIZER

Chris Bernabo, National Commission on Science for Sustainable Forestry, National Council for Science and the Environment

PRESENTERS

- *Maureen Gilbert*, ABN AMRO Bank
- *Tony Janetos*, World Resources Institute

HIGHER EDUCATION

Progress Toward Sustainable Community Development and Partnerships for Sustainability in Higher Education

SESSION ORGANIZERS

Richard M. Clugston, Executive Director, Association of University Leaders for a Sustainable Future (ULSF)
Wynn Calder, Associate Director, Association of University Leaders for a Sustainable Future (ULSF)

PRESENTERS

- *Bruce Coull*, Dean of the School of the Environment, University of South Carolina
- *Alan Elzerman*, Chair, Department of Environmental Engineering and Science, Clemson University
- *Harold Glasser*, Assistant Professor of Environmental Studies, Western Michigan University
- *Collette Hopkins*, Associate Director of Partnerships, Clark Atlanta University
- *Julian Keniry*, Manager, National Wildlife Federation, Campus Ecology Program

INDICATORS

Sustainable Community Indicators: Experiences, Lessons Learned and Evolving Opportunities in the United States

SESSION ORGANIZER

Ruth McWilliams, National Sustainable Development Coordinator, USDA Forest Service

PRESENTERS

- *Maureen Hart*, President, Sustainable Measures
- *Gerald Gray*, Vice President of Policy, American Forests

INFORMATION SYSTEMS

Information Systems Interoperability in Support of Effective Environmental Decisionmaking

SESSION ORGANIZERS

Bonnie Carroll, Information International Associates Inc.
Jack Hill, Houston Advanced Research Center

PRESENTERS

- *Gladys Cotter*, Associate Chief Biologist, USGS
- *Karen Siderelis*, Geographic Information Officer, USGS
- *Robin O'Malley*, Fellow and Project Manager, H. John Heinz III Center for Science, Economics and the Environment
- *Robert Turner*, Executive Director, Southern Appalachian Man and the Biosphere Program

LIBRARIES

Sharing Sustainability Data and Information: The Role of Libraries and Library Networks

SESSION ORGANIZER

Frederick Stoss, Associate Librarian, Science and Engineering Library, University of Buffalo, State University of New York

PRESENTERS

- *Jeffrey Brown*, Principle Investigator, Libraries Build Sustainable Communities/ALA, NJ Sustainable Schools Network; Executive Director, Global Learning, Inc.
- *Terry Link*, Founding Chair, Task Force on the Environment/ALA; Director, Office of Campus Sustainability, Environmental Studies and Urban Planning Librarian, Michigan State University
- *Patricia Bonner*, Manager, Public Involvement Policy, Environmental Protection Agency (EPA); Project Manager EPA National Dialogues

POLLUTION PREVENTION

Use of Scientific Tools to Address Issues of Pollution Prevention and Community

SESSION ORGANIZER

Christopher Campbell, Manager, WERC Pollution Prevention Center, New Mexico State University

PRESENTERS

- *Michael Hightower*, Distinguished Member of the Technical Staff in the Energy and Critical Infrastructure Center at Sandia National Laboratories
- *Tim Mohin*, Corporate Environmental and EHS Design Manager, Intel Corporation
- *Henry Topper*, Chair, Community Assistance Technical Team, EPA Office of Pollution Prevention and Toxics

REMOTE SENSING

Community Energy and Environmental Decision-making: Seeing the Big Picture with Remote Sensing and Satellites

SESSION ORGANIZERS

Jill Engel-Cox, Battelle Memorial Institute
Ray Hoff, Joint Center for Earth Systems Technology, University of Maryland, Baltimore County

PRESENTERS

- *Mike McGuire*, Center for Urban Environmental Research and Education
- *Timothy Gubbels*, NASA
- *Louise Meyer*, Solar Household Energy, Inc.
- *Darwin Curtis*, Solar Household Energy, Inc.

RURAL COMMUNITIES

Sustainable Community Development: Applications of Research, Education and Extension

SESSION ORGANIZER

Greg Crosby, National Program for Sustainable Development, USDA CSREES

PRESENTERS

- *Bo Beaulieu*, Director, Southern Rural Development Center, Mississippi State University
- *Jill Auburn*, National Program Leader, Sustainable Agriculture, USDA CSREES
- *Amber Levofsky*, Policy Analyst, EPA
- *Josh Mandelbaum*, US Department of Transportation, NRDP Truman Fellow
- *Peggy Harwood*, Regional Planner, Green Infrastructure, USDA Forest Service

URBAN DESIGN

Scientific Approaches to Healthy Urban Form and Function

SESSION ORGANIZERS

Richard Register, President, Ecocity Builders, Inc.
Elizabeth Margold, Director of Development and Latin American Programs, International Center for Sustainable Development

SUSTAINABILITY: PROBLEMS, SCIENCE AND SOLUTIONS

Keynote Address to the second National Conference on Science, Policy and the Environment

By Donald Kennedy, Editor-in-Chief, *Science*,
Former President, Stanford University
December 6, 2001
Smithsonian National Museum of Natural History

APPENDIX 3

THE ENVIRONMENTAL MOVEMENT has been characterized, since its very beginnings, by attention-getting slogans. One of them attempts to focus on two scales at once, by advising that we “act locally, think globally.” I shall have more to say about this particular bumper sticker later on, because it focuses us on scale—a matter that profoundly affects how we treat the environmental problem writ large.

But the concept of *sustainability* has become a slogan too. It is now such a watchword in the litany of environmental policymaking that it has assumed an enlarged entity, one that captures—or attempts to capture—an essential part of what environmentalism and conservation are all about. That may be too much freight. The trouble is that the term isn’t very precise, so I will take an historical approach to explore three different levels of meaning and argue for the most inclusive one. Next I shall try to identify some of the challenges that face us in using science to help establish sustainability on two scales: large, that is global; and local, that is, at the level of communities. Finally, returning to the bumper sticker to reverse its message, I will argue that we are readier than people think to act globally, and less ready to figure out the right local arrangements.

We all understand what sustainability is in a general way. Aldo Leopold famously advised us to “save all the parts.” More formally, it means adopting policies to ensure that the *n*th generation has access to the same resources, and is therefore as well off, as the current generation.

But that begs the question: what, exactly do we mean when we talk of human welfare and the kinds of resources

we need to provide it? It also neglects some important issues of equity. Finally, it says nothing about whether we should use as our starting point the convenient present—‘time zero’—or instead include some consideration of past rates of change. I will consider these three in turn.

First, what counts as human welfare? Much of the conservation dialog is about nature and the satisfactions human beings obtain from nature. Some of these satisfactions are consumptive: we mine, or graze cattle, or catch fish. Others are non-consumptive, but nevertheless involve *uses* of nature: camping in a national park, or bird-watching along a beach. Still others, though, don’t involve use at all. We may appreciate the existence of a national park even if we never take the opportunity to visit it.

Since the very beginnings of the environmental movement, people have worried about what is happening to these various versions of human welfare in a world with finite resources and a rapidly growing population. They have not agreed, however, on which ones within the range of human satisfactions should concern us most. In *Man and Nature*, perhaps the first truly environmental book, George Perkins Marsh produced a meticulous, even exhausting nineteenth-century critique of what humans have done to their environment. For many contemporary conservationists, Marsh is a peculiar and even disturbing book to read today: there is little in it of the love of nature that animates many modern readers who, like my Stanford freshmen, come to it late. The book begins with an account of the glories of early Rome—a moral, Republican landscape later desecrated by the Empire, in an exploitation

that Marsh clearly links to political repression. There follow nearly 500 hundred pages and hundreds of long footnotes, describing what has happened to the Earth's water, its woods, and its soils. Nowhere in it will you find a sense of one-ness with Nature, nor a shred of spirituality. Marsh is a practical Vermonter: Nature is important because it provides human services. We are, he says, irreversibly damaging our capacity to continue enjoying those services. He makes a plea for sustainability without ever using the word, but it is plain that his concern is for use values, especially the consumptive kind.

Many modern environmentalists attach a very different set of values to Nature. They find in it some things that lie far beyond practical utility. Their account would emphasize the capacity of wild lands to lift the human spirit, or perhaps to provide people with a sense of oneness with the rest of the living world. The late Wallace Stegner, much admired by contemporary conservationists, made a claim equivalent to Marsh's but with a very different tone: "We have been too efficient at destruction; we have left our souls too little space to breathe in. Every green natural space we save saves a fragment of our sanity and gives us a little more hope that we have a future." His account of the fall matches Marsh's, but his sense of what has been lost relates to quite another kind of welfare, a kind better captured within the domain of non-use values. In a lecture at Stanford recently, former Secretary of the Interior Bruce Babbitt went farther – employing the Noachian covenant ("not two of some, but two of every one.") as a plea for biodiversity that certainly reflected an obligation well beyond 'use.'

Rachel Carson, surely the launcher of the modern environmental movement, starts *Silent Spring* not with an appeal to wild Nature but with a description of a pastoral landscape; and she ends the book with a critique of our attempts to over-manage Nature through the use of insecticides and other poisons. There are occasional passages that reach for the kind of spirituality that Stegner invokes, but her argument is fundamentally practical. In making the case for nature, Carson is really asking us to pick the low-hanging fruit: she is urging us to be conservationists for the most practical of reasons. My colleague Gretchen Daily, in a useful book called *Nature's Services*, emphasizes that conservation efforts can get practical help from monetizing some ecosystem services so that they can be included in cost-benefit calculations about development.

This has turned into a debate within the environmental movement, a soil on which debate flourishes readily. Some environmentalists believe that to monetize nature's values

degrades the entire effort; they want none of it. Others argue that it is a practical and moral way to achieve objectives we can all agree on. It is an argument that wastes time: what we should be concerned about is the full range of human satisfactions. If we arrange sustainability for the use values but neglect the non-use ones, I don't think we will have met the test.

The second issue involves an equity problem. We need to agree on what we really mean by sustainability, beyond the easy definition is that it consists of that set of practices that leave the nth generation no worse off than the present generation. I just argued that this means equally well off in terms of access to *all* of the resources needed to sustain life and the full range of human satisfactions.

But do we mean something beyond the average welfare of the nth generation (greatest good for the greatest number), or do we want to insist that no member of the nth generation should be worse off than the poorest member of the current one? Surely a society that sustained itself by ensuring that AVERAGE welfare held constant while its poorest members lost ground would not be one in which most of us would like to live. Instead, an intra-generational test for equity ought to be part of our evaluation of intergenerational sustainability.

A third aspect of the sustainability problem has to do with where one starts to measure welfare, and what else has been going on. Nations and societies do not stand still; most of them grow—in population, in average income, and in technological sophistication. In that sense, sustainability sits on a moving target. Should the recent trajectory of growth be incorporated into a consideration of sustainability? If generation 1 has moved ahead of generation 0 by 10% in some indicator of average welfare, should generation 2 expect another 10%, or should it be satisfied with staying level? The straightforward take on sustainability would adopt the second, but our welfare detectors are sensitive to history as well as to disparity.

That obliges us to consider some of what has been learned about the history of income and environmental resources as nations develop, beginning with the effect of income improvement on equity. Simon Kuznets received the Nobel Prize in Economics for a 1955 paper in which he demonstrated that as average income improves during development, income disparity first increases and then falls. More recently, U-shaped "Kuznets curves" have been discovered for several variables related to environmental quality: as nations become richer, air and water quality first get worse and then get better.

Explanations for the economic Kuznets effect rest on the need for initial capital investments to support later infrastructural improvements that spread benefits more broadly. The wealthier members of society enjoy early income improvement from the investments only they can make; later, the poor get a delayed boost from trickle-down effects.

A similar trajectory, it has been argued, applies to the environment: the first improvements are often dirty, as with the soot left in the British midlands during the Victorian industrial revolution. Later, technological improvements, more widely distributed wealth and changing social priorities make remediation possible.

It thus seems clear that both kinds of Kuznets curves apply to those Western nations that went through their development in the Victorian era. But do we really have to go through all that again? Many economists now doubt the relevance of the Kuznets effects to today's newly developing countries. Several of the newest successful Asian economies appear not to have suffered the initial dip in income disparity, and it is by no means clear that environmental improvement is destined always to come late.

What does that history have to say about sustainability? If we ask the question in a poor country where economic development is in its early stages, we are likely to get an answer quite different from the one we would get in Washington. I think the expectation there will be for an economy and an environment that marks to experience, not to steady-state: in short, developing countries will want nothing to do with a concept of sustainability that offers no continuing mandate for development.

Answers to all of these questions: how we define welfare, how sustainability incorporates equity, and how it incorporates history—are likely to be important as we deal with sustainability, whether on a global or on a local basis. Improved equity and the capacity for continuing economic development will be essential parts of the picture for the poor countries. Here, solving the sustainability problem is going to require more than political will, which is hard enough to get. It will need science and technology—capacities concentrated in the rich nations, but most needed in the poor ones. The world's scientific community is becoming increasingly aware of this maldistribution, and is starting to do something about it. For example, *Science* and *Nature*, the world's two leading scientific journals, have now joined with the Third World Academy of Science to sponsor a website—SciDevNet—that will make science

news and information more readily available to scientists and policymakers in the developing world.

We know that the environmental problems the world faces occupy the entire scale from very local to global. On the one hand, climate change and similar challenges require not only international scientific cooperation but complex, multi-party negotiation toward solutions by treaty. On the other hand, in the villages of the Third World water resources must be divided by local agreements among users, and forest conservation, if any, will rest on some form of local decisionmaking.

That takes me back to the bumper-sticker I mentioned at the beginning—the version of the Good Environmentalist as one who Thinks Globally, Acts Locally. Is there a kind of science that can help with both tasks—that is, can inform and guide good work at the meters-to-kilometers scale, and at the same time can help nations develop and implement policies that ensure sustainability?

That is a difficult task. An international group of 23 environmental scientists, economists, and others published in *Science* a thoughtful review of the problem earlier this year. The collaboration said much about the effort to bring science to the problem of sustainability. There is a nascent alliance of the world's scientific academies, international programs, and informal networks, like that represented by these authors; it represents a real hope that serious attention from the scientific community can be integrated with the various political agendas of economic development. It's the right time, since the Rio plus 10 conference—the World Summit on Sustainable Development—will be held in South Africa next year.

At the global level, the present and prospective roles for science are clear and evident in some cases, subtle and diffuse in others. The prospect of global warming and its relationship to the emission of carbon dioxide and other greenhouse gases has by now fueled a large effort at computer modeling, carried out in several superb national centers and coordinated by the Intergovernmental Panel on Climate Change. That work is vital to the resolution of what surely is the most prominent and threatening of the large-scale problems. But there is another task, less dramatic and—so far at least—attracting less attention and fewer resources. That is the job of monitoring and surveillance, not only of climate data but other measures of environmental welfare—measures that may be required to inform more local action. For example, satellite measures of forest cover, especially in places that are hard to reach and explore to establish “ground truth” are important



—and the technology needs improvement. Rapid assessments of biological diversity and the management of the resulting databases are much needed. So is focusing scientists on problems of tropical biology and ecology—an important commitment of the Smithsonian Institution where this meeting is being held.

The aspects of sustainability I have just been discussing in the global context—especially the matter of what kinds of welfare we want to sustain, and with what considerations of equity—will be just as important on a more local scale. And they are likely to vary even among communities here in the United States, where the most important land-use and resource decisions are made through planning and zoning. Environmental policymaking, like politics, is mostly local. Compare Gardiner, Montana and Woodstock, Vermont. Both are rural towns, of about the same size; both have some industry and some tourist business. Woodstock, the birthplace of George Perkins Marsh, is a settled, stable town; Gardiner is a growing community at the border of Yellowstone National Park. Both communities have active environmental groups, but if you asked each of them about sustainability my guess is that they would come up with quite different definitions because their histories, resources, and economic dependencies are so different.

Interesting, innovative movements are now underway to make sustainability efforts work at this more local level. It is a challenging task, because the problems at restricted scales have to be resolved against deep political differences—and politics is, as Tip O’Neill liked to remind us, local. The Yellowstone neighbors who ranch and have to contend with wolves who have difficulty recognizing the Park boundary, and the loggers in the Northwest who find that their livelihoods are under threat from the Endangered Species Act and the Spotted Owl, are angry people. They are mad at “environmentalists” who, in their view, have only a distant and esthetic—if not effete—interest in a land with which the ranchers and loggers not only have an economic interest but also a deep and often sympathetic familiarity.

Indeed, the bumper-sticker mantra of the environmental movement—“Think globally, act locally”—may not be the best possible instruction. It implies that we’re really all set to move ahead in our own communities—what we need to do is wake up and act. In fact the task is a whole lot harder than that: the sphere of possible actions is clouded by long histories of political difference, ownership patterns, and traditions. In my part of the country, the West—where much of the land is federal, water is scarce, and natural

areas precious—organizations have sprung up that bring special economic and political skills to communities in which there is a need to resolve these differences. It is heavy lifting. The Sonoran Institute, for example, has been able to help Arizona communities facing uncontrolled peri-urban sprawl and industrial development work out a consensus vision for their own future and then take the political steps to realize it. In some cases—as with communities like Gardiner that are public lands gateways—the Institute faces the task of educating federal agencies as well as community leaders about the value of compromise.

The degree of difficulty is well illustrated by the history of the Endangered Species Act as it has been applied to local situations. It was plainly intended by the Congress as a kind of sustainability initiative: to conserve for our children and grandchildren the value of our living natural endowment. In the legislative dialog, however, it became plain that the Members were really talking about Bald Eagles and Wolves—the Charismatic Megafauna—just as they had a century earlier when they established National Parks because they contained “natural wonders” like Old Faithful. Environmentalists found the Endangered Species Act useful in blocking some unwise large federal projects, like Tellico Dam, and in preventing some local economic developments that some people wanted a lot. In doing so they appealed not members of the Charismatic Megafauna but to creatures like the Snail Darter and the Furbish Lousewort, creating a pantheon of Boring Microfauna and flora that became a political lightning rod for objections to the Act. Fortunately there was room for some good local thinking, followed by government cooperation; the result was a series of Habitat Conservation Plans in which conflicting interests could find resolution.

Most of you know how difficult this has been. It is a difficulty created in large part because land planning in the United States is a mess, having ignored ecology and landscape in permitting growth to follow need with minimal control. It shows how unclear and bumpy the path toward local resolution may be. It might make more sense to turn the bumper sticker around, so that it reads “Think Locally, Act Globally.”

Returning to the larger scale: surely you will argue that global resolutions are even harder than local or regional ones. For the big-ticket issues like climate change, where national interests and histories collide, that may be true. But there are a number of important environmental domains in which we already know what to do, so that the admonition to act globally is realistic. THE primary enemy of sustainability in the developing world is poverty: poverty

that places so much focus on the here and now that there is no room for thoughts about the welfare of the next generation. The next generation is already fetching wood and water instead of going to school.

First-world science can really help, if we can do the right kind and get it to the right places. Technologies for improving the ability of developing-world smallholders to produce food and manage water are available now. We need to make the resource investments to export them. We will do well to get over some of our rich-country scruples about the use, for example, of genetic modification technology. If you don't give people the means to grow more food on the flats, they deforest the hills.

I think we are readier than we know to Act Globally. In a splendid editorial in last week's *Science*, Jonathan Lash laid it on the line in pointing out that we have to deal with the tinder of terrorism—poverty—as well as the flint.* If we really mobilized our scientific potential, he says, “We could create the knowledge base that would allow people everywhere to manage ecosystems more productively and more sustainably, preserving the forests and fisheries for present and future generations.” It is a reachable goal, and it is time to get started. So it wouldn't be such a bad idea to Think Locally, Act Globally. I might even put it on my bumper as soon as I get my ZEV electric hybrid.

*Lash, Jonathan. “Dealing with the Tinder as Well as the Flint,” *Science* Nov. 30, 2001:1789



BIOGRAPHY

Donald Kennedy

Editor-in-Chief, Science, American Association for the Advancement of Science; former President of Stanford University

DONALD KENNEDY received A.B. and Ph.D. degrees in biology from Harvard. His research interests were originally in animal behavior and neurobiology: in particular, the mechanisms by which animals generate and control patterned motor output. His research group explored the relationship between central “commands” and sensory feedback in the control of locomotion, escape, and other behaviors in invertebrates.

His present research program, conducted partially through the Institute of International Studies at Stanford University, consists of interdisciplinary studies on the development of policies regarding such trans-boundary environmental problems as: major land use changes; economically-driven alterations in agricultural practice; global climate change; and the development of regulatory policies. Although these interests remain, they have been overtaken by a deeper concern with ecology and environmental policy.

In 1977, Dr. Kennedy took a 2-1/2 year leave to serve as Commissioner of the U.S. Food and Drug Administration. This followed an increasing academic interest in regulatory policy regarding health and the environment, which included the chairmanship of a National Academy of Sciences study on alternatives to pesticide use and membership on the World Food and Nutrition Study.

Following his return to Stanford in 1979, Dr. Kennedy served for a year as Provost and for twelve years as President. During that time he continued to work on health and environmental policy issues, as a member of the Board of Directors of the Health Effects Institute, Clean Sites, Inc. and the California Nature Conservancy. Dr. Kennedy is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, and the American Philosophical Society.

PLENARY I: What Are Sustainable Communities?

Case Study: Curitiba, Brazil

Jaime Lerner

Governor State of Parana and former Mayor of
Curitiba, Brazil

December 6, 2001

APPENDIX 4

PRESENTATION OUTLINE

- Among the several definitions of sustainability, this is the one I like most: Sustainability is solidarity with the present and the future generations.
- The creation of a renovation cycle, which future generations may enjoy, means responsibility. It means solidarity. It means sustainability.
- The ideal would be a global practice of solidarity, with clear rules and the firm commitment of nations. Though a growing number of authorities in the world are engaged in that effort, we know it is a long, rocky road. That is why the practice of solidarity must spread in countries, regions and cities.
- The city is the meeting point of solidarity and sustainability.
- Let's start with a more generous view of cities. If you envisage doom you will certainly get it. Cities are the solution, not the problem. Cities may better solve the problems of housing, health and the environment.
- The good coexistence in a city implies the integration of urban functions and income. That is how a city becomes more democratic and, consequently, more supportive. This will be a factor in the quality of life of future generations, who will find a city with greater possibilities.
- Cities should save the most and waste the minimum. This is sustainability. Not wasting today means saving for tomorrow.
- A trend is not destiny. Cities are better able to prevent undesirable trends. They can design scenarios most people find desirable and contribute to put them into practice. This means solidarity with future generations. This is sustainability.
- The beneficial transformation of a city depends on five requirements: a) Political will, b) Supportive view, c) Strategic view, d) Shared responsibility, e) Collective dream.
- The secret of Curitiba was a commitment to simplicity, not wanting to have all the answers, starting the process, and seeking the synergy of efforts.
- Science is a key ally of sustainability. In cities, it must always be the parameter guiding the choice of the appropriate technology.

CURITIBA, Brazil

A Positive Reference For Social Development

Curitiba, the capital of Parana state in southeastern Brazil, faced explosive growth from the 1950s onward. Its metropolitan population mushroomed from a town of 300,000 in 1950 to a metropolis of 1.6 million in 1990, making it Brazil's fastest growing city.

Various trends indicated a tendency for uncontrolled growth and the well-known social and environmental negative consequences of rapid urbanization. The city's geophysical configuration suggested a physical growth pattern following that of Sao Paulo, the biggest mega-city in the region, located 250 miles north of Curitiba.

The rapid economic surge from a centre for processing agricultural products to a regional industrial and commercial nucleus, attracted massive waves of migrants from the countryside, also as a result of the mechanization of plantations. The poverty and income profile in Curitiba is similar to other cities in southeastern Brazil.

However, even though all trends pointed in the direction of chaotic urbanization, Curitiba showed that trend is not necessarily destiny. The city has been recognized by the international media, experts and development institutions as a successful example of urban environmental management and social development. Relevant international publications, such as *Time*, *Le Monde*, *Newsweek*, *Asahi Shinbun* and others credit political leadership as a key element for change. In this regard, the name of former Mayor Jaime Lerner is inextricably associated to the experience of Curitiba and to the political will that drove this process in a transparent and socially conscious manner.

The following text will briefly elaborate on the various social aspects that characterized this experience, with emphasis on principles, procedures and lessons.

1. PRINCIPLES

PRIORITY TO PEOPLE AND TO PUBLIC TRANSPORT

Mayor Lerner's first administration (1971-1974) consciously decided to take control of its urban growth process by using two basic instruments: land use legislation in combination with the right to determine public transport routes. Total priority was given to public transport throughout the entire city and to pedestrians in the Central Area.

The city presented the tendency to grow in expanding concentric circles from the city centre. In the 1970s, city authorities began to implement the urban design structure that counteracted urban sprawl and emphasized linear growth along five pre-determined structural axes. Land use legislation was enacted to guide this growth, allowing for higher housing densities in streets served by public transport. Curitiba's planned road network and public transport system are probably the most influential elements accounting for the present shape of the city. The plan was transparently shared with the population, which contributed to avoid land speculation. It is also important to remark that this design helped provide mobility to all segments of society, from higher income households to lower-income settlements located in the periphery. A "social fare" was also encouraged, i.e., people who live closer to the city centre pay the same flat fare as the lower-income users who board the buses in the periphery.

Over the years, urban growth has been encouraged along the "structural" axes, also known as structural sectors. Each axis was designed as a "trinary road system": the central road has two restricted lanes in the middle for express buses flanked by two local roads. There are high capacity one-way streets into and out of the central city one block on either side of this central road. In the areas adjacent to each axis, land use legislation has encouraged high-density occupation, together with services and commerce.

The city augmented these spatial changes with a bus-based public transportation system designed for convenience and speed. The five express bus lanes along the structural axes are complemented by interdistrict and feeder buses that expanded as the city has grown. There are large bus terminals at the end of the five express bus ways where people can transfer to interdistrict, feeder or inter-city buses. Medium-sized terminals are located every two kilometres along the express routes and a single fare allows passengers to transfer from the express routes to interdistrict and local buses. In high demand routes, tubular, subway-style boarding stations speed boarding times through pre-payment and level boarding. This system replicates some of the advantages of a subway system at the surface, costing approximately 200 times less than a conventional subway. A few design features such as segregated bus lanes, articulated and bi-articulated buses, boarding at the same level (boarding tubes) multiply the capacity of the express bus ways.

Curitiba has over 500,000 private cars (more per capita than any Brazilian city except Brasilia). Remarkably, 75% of all commuters (more than 1.4 million passengers per day) take the bus. This has resulted in fuel consumption rates that are 25% lower than comparable Brazilian cities and has contributed to the city having one of the lowest rates of ambient air pollution in the country.

A very important aspect is that the average Curitiba low-income resident spends only about 10 percent of income on transport, which is relatively low for Brazil.

DESIGNING WITH NATURE

Flooding was one of the most serious problems that Curitiba faced. The city centre used to have frequent floods that were worsened by the construction of houses and other structures along stream and river basins. In addition, during the 1950s and 1960s, many streams were covered and converted into artificial underground canals that made drainage more difficult. Necessary drainage works had to be dug underground at a very high cost. At the same time, new developments on the periphery of the city were being constructed without proper attention to drainage.

Beginning in the early 1970s, some strips of land for drainage were set aside and certain low-lying areas were put off-limits for building purposes. The remaining natural drainage system was then protected by stringent legislation. River basins were classified as special areas requiring protection and management, often through park development. Stream protection strips were developed as linear parks and supported by comprehensive tree planting. Other areas subject to flooding were transformed into parks and enhanced with sports and leisure facilities. The parks are also well integrated in the transportation system via free green-colored public buses and bicycle paths, so that all social segments can enjoy all parks.

There were several advantages to this “design with nature” strategy. The preventive measures allowed the city to forego substantial new investments in flood control and have made serious and costly flooding a thing of the past. In 1970, Curitiba averaged only 0.5 m² of serviced green space per capita. This figure has now increased one hundredfold to 50 m² per person and all during a period of rapid population growth. The manner by which this was accomplished is a lesson in environmental management—solving several problems with win-win solutions accessible to all social groups in the City.

APPROPRIATE RATHER THAN HIGH-TECH SOLUTIONS

Curitiba could have chosen a number of technologically sophisticated solutions to its woes. Two examples illustrate this point. The conventional wisdom was that cities with over a million people needed a subway system to deal with congestion. The other prevailing dogma was that cities that generated over one million tons of solid waste annually required expensive mechanical garbage separation plants.

Instead, Curitiba chose different paths for its transportation and garbage problems, paths that were based on the principles of simplicity and resource conservation. The choice of transportation technology was simple economics: an underground metro system would have cost \$90-100 million per kilometre while the express bus way system came in at \$200,000 per kilometre. Bus operation and maintenance were also familiar technologies that could be operated by the private sector.

For problems of trash generation and collection, Curitiba instituted two innovative programs. The “Garbage that is not Garbage” initiative involves curbside collection and disposal of recyclable materials that have been sorted by households. The “Garbage Purchase” program, designed specifically for low-income areas, seeks to clean up sites that are difficult for the conventional waste management system to serve by exchanging garbage bags collected by residents for bus tokens, parcels of surplus food, and children’s school notebooks. Another initiative, “All Clean,” temporarily hires retired and unemployed people to clean up specific areas of the city where litter has accumulated.

The results of these challenges to conventional wisdom have been beneficial. In addition to the benefits of the bus system that have already been cited, the city has a self-financing public transportation system instead of being saddled by debt to pay for the construction and operating subsidies that a subway system entails. The savings have been invested in other priority areas. For solid waste management, over 70 percent of households participate in the recycling programs. Nearly 1200 trees are “saved” each day by the volume of recycled paper alone. Sixty neighborhoods with 31,000 families have benefited from the garbage purchase program by receiving nearly a million bus tokens, 1200 tons of surplus food, and school notebooks in exchange for collecting over 11,000 tons of garbage. These innovations have reduced the costs and increased the effectiveness of the city’s solid waste management system while conserving resources, beautifying the city, and providing employment—another win-win (and low-tech) solution that benefits all social groups in the City.

INNOVATION AND PARTICIPATION

The city managers of Curitiba have learned that good systems and incentives are better than good plans. The city’s master plan helped forge a vision and strategic principles to guide future developments. However, the vision was transformed into reality by reliance on the right systems and incentives, not on slavish implementation of a static plan.

An example of a system that yields desirable results is the provision of public information about land. City Hall can deliver information to any citizen in five minutes about the building potential of any plot in the city. Updating the system is a requirement—anyone wishing to obtain or

renew a business permit must provide City Hall with information used to project traffic generation figures, infrastructure needs, parking requirements, and other impacts. The transparent information system helps to avoid land speculation and has been essential for budgetary purposes as property tax is the main source of revenue.

Incentives have also been important in reinforcing positive behavior. Within the city’s historic district, owners have the right to transfer the building potential of their plots to another area of the city. This means that historical buildings are preserved and owners are compensated. Businesses throughout the city can “buy” up to two extra floors beyond the legal limit in specified areas. Payment can be in the form of cash or land, which the city then uses as resources for low-income housing.

2. PROCEDURES

TIME IS MONEY

The longer it takes to implement solutions, the more expensive they become. Cities are not static and nor are solutions. For example, a low-cost sanitation technology that is suitable for a density of 40 families per hectare will not be suitable for a density of 100 families per hectare. A more costly approach may be required. Curitiba has developed alternative approaches to deal with the pollution of the Iguazu river tributaries. For certain areas, however, demographic density still demands conventional approaches, which represent a heavy burden on the municipalities’ budget. In another example, with the definition of a comprehensive urban growth design, Curitiba demonstrated the importance of making the right decisions at the right time.

The same applies to public transport technologies, to waste management techniques, to drainage and urban services in general.

PREVENTION X REMEDIATION

With relation to environment and urban infrastructure, for instance, it is well known that the cost of prevention can relate to the cost of remediation by a factor of 1 to 100. In other words, it makes sense to spend one dollar today in order not to have to spend one hundred dollars tomorrow.

The planning of the “structural sectors” is an example, which directly saves in transport costs and indirectly in the distribution of infrastructure improvements, such as water, sewage, electricity and communication.



INSISTENCE PAYS

People are sensitive to any city administration that shows signs of constant care. Maintenance is of paramount importance in providing to the population an indication of how much the city administration is concerned. A simple example: Curitiba decided to regularly implement flowers on what had been the main avenue of the city center and became the first pedestrian street in Brazil. At the time, people did not have the habit of seeing flowers on the streets, which were often picked up or vandalized. With time, insistence and a regular scheme for the exchange of flowerpots, the population began to respect, and even defend, the flowers. A city's culture is permeable to administrative care.

INSTITUTIONAL STREAMLINING

How should the decisionmaking flow in a City Hall that has thousands of employees and hundreds of bosses? In Curitiba, three different functions were always developed separately, but with constant inter-facing: planning, execution and administration. A weekly meeting (Monday mornings) between the mayor and the key actors in each one of these areas defined the targets for the week. The execution of these targets was closely monitored during the following weeks. The streamlining of institutional actors is as important as the integrated participation of personal actors—whether conflictive or consensual.

INCREMENTAL LEARNING

The perfect plan will never be implemented. Rather than pursuing perfection, Curitiba concretely did what was possible to do at specific moments in time—and incrementally developed such ideas in practice when they were already operational. The land use legislation, the industrial city, bicycle paths, the parks policy, bus design, public transport terminals design are examples of this approach. It should always be clear that an idea has three components: the idea, the viability, and the operation. This sequence forms a circle, which then feeds back the idea again for further improvements.

LEAVING THE DRAWING BOARD

One advantage of working for local administrations is that the issues are concrete and the problems are just outside your door. This clarity is not easily attainable in broader levels of administration, such as states or countries. There is always a bureaucratic way of dealing with any issue and this is certainly the best way not to solve it. Planning officials, architects and other professionals in Curitiba were always encouraged to look at the problems, talk to the people, discuss the main issues, and only then reach for the pen. This behaviour was promoted by Mayor Lerner, who pioneered a new style of municipal administration in Brazil. A genuine concern in looking at the problems and talking to the people, at any level of decision, provides an insight, which is seldom self-evident at the drawing table.

3. LESSONS FOR AN URBANIZING WORLD

Some of the lessons that emerge from the Curitiba experience for other cities include:

- **Top priority should be given to public transport rather than to private cars, and to pedestrians rather than to motorized vehicles.** Bicycle paths and pedestrian areas should be an integrated part of the road network and public transportation system. In Curitiba, less attention to meeting the needs of private motorized traffic has generated less use of cars.
- **A sustainable city is one that uses the minimum and conserves the maximum.** This pragmatic application of demand management and recycling is exemplified in Curitiba by solid waste recovery, re-use of old buses as mobile schools, preservation and use of historic dwellings, and employment policies where poor people are employed in the waste separation plant and as teachers of environmental education courses.
- **There can be an integrated and environmentally sensitive action plan for each set of problems.** Solutions within any city are not specific and isolated but interconnected. The action plan should involve partnerships between responsible actors such as private sector entrepreneurs, nongovernmental organizations, municipal agencies, utilities, neighbourhood associations, community groups, and individuals.

- **Creativity can substitute for financial resources.** Ideally, cities should turn what are traditional sources of problems into resources. For example, public transport, urban solid waste, and unemployment are traditionally listed as problems but they have the potential to become generators of new resources and solutions. Creative and labor-intensive ideas can, to some extent, substitute for capital-intensive technologies. Also, cities do not need to wait for bailouts or structural reforms to begin working on some of their problems.
- **Social, environmental and economic solutions can be integrated into holistic approaches.** Mayor Lerner's leadership and creativity proved that there could be a sustainable solution for each set of problems usually found in fast-growing cities worldwide. A combination of public-private partnerships, transparency and participation was promoted in the development of equations of co-responsibility. The experience of Curitiba demonstrates that solutions, not only problems, can be seen in an integrated way.

Beyond the city level, the Curitiba case suggests that state and national governments would do well to acknowledge the strategic importance of cities as potential instruments for positive development and change.

These lessons are being learned by other cities inside and outside of Brazil. In Brazil and other Latin American cities, pedestrian walkways, bus lanes, waste management programmes that were pioneered in Curitiba have become popular urban fixtures and procedures. Cities in regions as different as Africa, Asia, North America and Europe have expressed interest in the approaches put to practice in Curitiba.

One size does not fit all—not all cities enjoy Curitiba's political will and continuity. However, one of Curitiba's many creative, resource-conserving solutions may fit many cities that make up an increasingly urban world.



BIOGRAPHY

Jaime Lerner

Governor of the State of Parana, Brazil; Former Mayor of Curitiba, Brazil

JAIME LERNER is an inspiring planner. He was mayor of Curitiba three times (1971-75, 1979-83 and 1989-92) and turned that city into a paradigm of city planning, and not only for developing countries. He created an infrastructure in Curitiba that kept the city from bursting out of its seams despite its rapid growth. His bus tickets, which also were lottery tickets, are internationally renowned.

As Mayor of Curitiba, Lerner consolidated the City's basic urban transformations and implemented an Integrated Mass Transport System. In addition to leading-edge urban planning initiatives, he pioneered an encompassing program that resulted in social and environmental advances.

He was elected Governor of Paraná State in 1994 and re-elected in 1998 and will be in office until 2002. Lerner has promoted the greatest economic and social transformation in all of Parana's history. Parana has consolidated its position as the country's new industrial hub thanks to a series of policies geared toward attracting productive investments.

As a UN urban planning consultant, he has been involved with planning designs, mass transportation programs and urban projects in several cities of Brazil, Latin America and Asia. Lerner has been awarded numerous national and international prizes including the United Nations Environmental Award, granted by the United Nations Environmental Program (UNEP), New York, (1990); the Child and Peace Award from UNICEF, (1996); the Thomas Jefferson Medal from the University of Virginia (1997) and the Prince Claus Fund Award, the Netherlands (2000).



FROM RIO TO JOHANNESBURG

Implementing Sustainable Development At the Global and Local Scale

John C. Dernbach
Professor of Law, Widener University
December 6, 2001

APPENDIX 5

THANK YOU, DR. AHMED, for the kind introduction, and for the invitation to speak here today. It is particularly delightful to be speaking at the Smithsonian Institution, one of my favorite places in Washington, D.C.

Imagine a world in which the ordinary effect of human activity is to protect and restore the environment. Imagine, too, a world in which large scale poverty has been eliminated. This is the world that sustainable development seeks to achieve.

This future is not pie in the sky. The world's population will increase by about 50 percent between now and the middle of the century, and the world's economy will grow by a factor of three to five in that period. If we do not make a transition toward that world soon, the future will be much more difficult and dangerous for humans and the environment.

Sustainable development is not liberal or conservative, Republican or Democratic. And it is not the same old way of talking about the environment.

My presentation today will cover four basic points. First, I'll explain what sustainable development means, based on the agreements reached at the United Nations Conference on Environment and Development (UNCED) or Earth Summit in Rio de Janeiro in 1992. Then I'll discuss the bad news about what has happened since Rio, particularly in the United States. I'm afraid there is a lot of that. I'll also discuss the good news, and there is some good news. Finally, I'll share some thoughts about what the World

Summit on Sustainable Development in Johannesburg in August/September 2002 can contribute to achieving sustainable development, particularly in the United States.

The U.S. focus is based in large part on this country's position in the world today. The U.S. has the strongest economy and military in the world, and our nation has enormous potential to exercise international leadership on sustainable development.

I am now editing a book, to be published by the Environmental Law Institute in 2002, that assesses U.S. progress on sustainable development in the first ten years following the Earth Summit and makes recommendations for future U.S. actions. Several dozen experts from around the country are contributing to this book, including Anne Ehrlich (Stanford University), Jim Salzman (American University Law School), Tom Graedel, Amit Kapur (both of Yale University), Mark Levine and Lynn Price (both from the Lawrence Berkeley National Energy Laboratory).

Chapters from this book will also be published as articles in the Environmental Law Reporter, beginning in January.

The book is a more ambitious version of an article I published in the Environmental Law Reporter in 1997, which assessed U.S. efforts for the first five years after the Earth Summit. That article grew out of a seminar, and was based largely on student research. Remarkably, the article was then, and still is, the most comprehensive assessment of U.S. activities since Rio. For the ten-year anniversary, I believe, U.S. actions require a more thorough review.

RIO AND SUSTAINABLE DEVELOPMENT

The most commonly cited definition of sustainable development is taken from a report entitled *Our Common Future*, which was published in 1987 by the World Commission on Environment and Development (or Brundtland Commission, after its chair, Gro Harlem Brundtland of Norway). According to that definition, sustainable development is “development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

The meaning of sustainable development was articulated more fully at the 1992 Earth Summit, which followed from this report. There, the world’s nations endorsed a set of 27 sustainable development principles known as the Rio Declaration. They also endorsed Agenda 21, a detailed and lengthy blueprint for achieving sustainable development. Analysis of these and other international agreements leads to a straightforward understanding of sustainable development.

Because “sustainable” modifies “development,” it is first important to understand what development means. This may be harder than it seems because Americans tend to think of development as the term that describes the replacement of fields and woodlots with parking lots and malls. As much as we may use the term in that way, development has a different meaning at the international level.

Internationally, development is a set of concepts that grew out of World War II and the Great Depression that preceded it. The international community wanted to make sure that such events did not occur again. So it put in place a set of treaties and other agreements that had three substantive goals. The first goal, peace and security, is supported by the United Nations Charter. The second goal, economic development, is supported by the agreements that created the World Bank, the International Monetary Fund, and (more recently) the World Trade Organization. The third goal, social development or human rights, grew out of the Holocaust and the Nuremberg trials, and later took the form of several international human rights treaties.

And none of these goals can be achieved without supportive national governance. In a world of sovereign nations, international agreements or ideas cannot be implemented in any other way.

Taken together, then, development has four basic elements—peace and security, economic development, social development or human rights, and supportive national governance. These elements, in turn, are all directed at a common endpoint—human freedom, opportunity, and quality life.

This is not an arcane point of interest only to specialists. This model of development represents our understanding, and the public’s understanding, of what progress means. We haven’t had a third world war, the global economy is growing, people are living longer and are better educated. All of these things represent progress.

The 1987 Brundtland Commission report, however, found two related problems with this model of development. First, more and more people live in poverty. Second, there is widespread and growing environmental degradation all around the world. And these problems are mutually reinforcing. Poverty causes and is caused by environmental degradation. Poor people, for example, breathe the most polluted air, drink the most polluted water, and have the least access to other essential natural resources.

In addition, the Brundtland Commission found, environmental degradation undermines or weakens the four elements of development. Environmental degradation can cause or contribute to wars and civil strife, thus hindering peace and security. Economic development cannot occur when forests are destroyed, the seas are fished out, and land is contaminated. People who are made unhealthy by their environment are less likely to go to school, keep a job, or participate in governmental decisions. And so environmental degradation also interferes with the ability of national governments to achieve these goals.

The point here is that the environment is important not only for its own sake. It is also important because of its close connections to these other goals.

Sustainable development adds a fifth element, environmental protection and restoration, to the four standard elements of development. In so doing, sustainable development also redefines progress. Instead of making progress at the expense of the environment, environmental protection and restoration is part of what progress means. Like development, sustainable development is directed toward human quality of life, freedom, and opportunity.



Put differently, sustainable development is not simply about the environment. As the official name of the 1992 Earth Summit suggests, it is a framework for integrating environment and development. It is also a framework for integrating the environment into national governance, international law, and international relations.

As the Rio Declaration indicates, sustainable development is based on a set of principles. These include the following:

- **Precautionary principle.** Governments should act, even in the face of incomplete scientific information, to address important problems.
- **Intergenerational equity.** Our actions should not shortchange future generations. Intergenerational equity is one of the most powerful ways that sustainable development is understood.
- **Polluter pays principle.** Businesses and others should pay for the environmental costs of their actions rather than imposing those costs on others in the form of pollution or other environmental harms.
- **Developed country leadership.** Developed countries are expected to take the lead in addressing global environmental problems because they have contributed the most to creating these problems and have superior resources to address them.
- **Sustainable consumption and population levels.** This principle, as you might guess, raises some of the hardest and most important problems addressed by sustainable development. A key challenge is to decouple prosperity from the intensive use of materials and energy.

These principles, however, all depend on another—integrated decisionmaking. This is, of course, not the most exciting name for a principle, especially an important one. Let me try to unpack some key parts of what it means.

Integrated decisionmaking can be understood in procedural terms. The idea here is that a decisionmaker should consider the environment before making a decision. An example is the obligation to prepare an environmental impact statement before proceeding with a major action.

Integrated decisionmaking can also be understood in substantive terms. Instead of merely considering the environment, the decisionmaker would actually protect or restore the environment as part of the decision.

These two meanings go to the core of why some people have difficulty understanding what sustainable

development is about. Those who say that sustainable development is a journey tend to focus on the procedural aspect of integrated decisionmaking. Those who say that sustainable development is a destination tend to focus on the substantive aspect.

In truth, and paradoxically, sustainable development is both a journey and a destination. It is a journey because we cannot get there overnight, and we will have to work toward sustainability in a series of steps over time. But it is a destination because it describes, at least in outline form, the essential characteristics of a human society that acts in harmony with nature. And we are not likely to get there unless we set and achieve specific environmental goals. So we need to both consider and protect the environment as part of the decisionmaking process.

BAD NEWS

The bad news is easy to summarize: a lot of things have gotten worse since Rio. At the global level, there is a continuing decline in ocean and regional fisheries, a widespread loss of biodiversity, a growing concentration of greenhouse gases, and increasing poverty. War, instability, and terrorism are also part of the landscape.

There is also a fair bit of bad news for the United States. The points that I'm sharing with you today about the U.S. are some preliminary conclusions from the book I'm editing. I have not received or edited all of the chapters, and some of what follows may change. But it is reasonably clear that population, as well as consumption of materials and energy, have increased. Suburban sprawl continues unabated. Relatively little further progress has been made in controlling air pollution, water pollution, or hazardous waste over the past decade. The United States has no national strategy for achieving sustainable development, and no generally accepted indicators to mark progress along the way.

The nation's response to terrorist acts of September 11, 2001 is not inconsistent with sustainable development. As I have already explained, peace and security are an essential component of sustainable development. Hence, sustainable development requires prevention and control of terrorism. On the other hand, the threat of terrorism challenges our ability to think clearly about the environment, and it is plainly affecting national priorities. In that sense, the terrorist acts have made it harder to focus on the environmental aspects of sustainable development.

GOOD NEWS

Having said that, there is some good news to report for the United States. Much of it is at the state and local level. At this level, the connections between environment, economy, and social development are easier to see and understand. None of these efforts go as far as we might like. Very few can be described as widespread. Still, some things are happening.

At the community level, many sustainability initiatives have been undertaken, and are yielding some positive results. One of the oldest of these—it predates Rio—is in Chattanooga, Tennessee.

In addition, policy-specific initiatives have been undertaken in some states. These include laws and policies to foster smart growth, recycling, energy efficiency, renewable energy, and redevelopment of brown fields. Some states, including New Jersey, Oregon, and Minnesota, are working toward sustainable development more holistically.

At the national level, we have seen increased use of habitat conservation plans to protect endangered species, newly adopted (but apparently soon-to-be modified) regulations for sustainable forestry in the national forests, and some integration of environment into U.S. trade and export credit policies.

We also have the recommendations of the President's Council on Sustainable Development, or PCSD. The PCSD operated during the Clinton Administration between 1993 and 1999. It demonstrated that common ground can be achieved between economic and environmental interests, and provided many common sense recommendations. The Clinton Administration showed little interest in implementing these recommendations, however, and there appears to be little interest now.

In addition, we have much better information about many environmental problems now than we did in 1992. For example, the U.S. Global Change Research Program recently produced two major reports that describe in detail the impact of climate change on various parts of the country and on various economic sectors. What we are not doing, sadly, is acting on that information.

WHAT CAN JOHANNESBURG CONTRIBUTE?

Johannesburg will be a different type of conference than Rio. At Rio, nations endorsed sustainable development for the first time, and began to chart the course. Johannesburg should continue what started in Rio.

The most basic thing Johannesburg can do is revitalize and strengthen national and international efforts to achieve sustainable development, and to reinvigorate the Rio process. I remember in Rio the sense that something really important was happening, and media accounts of the conference suggested the same thing. But here in the U.S. in the years immediately following Rio, it was almost as if the Earth Summit hadn't happened.

I often tell people of the Rio-plus-five assessment that my seminar helped produce in 1997, and how no one else produced an assessment of U.S. actions. "That's great," some people say, meaning great for me. "That's terrible," other people say, meaning that no one else bothered. They're both right, of course. We need Johannesburg to rekindle and strengthen the enthusiasm that seemed evident in 1992.

In addition, Johannesburg should be also used to assess and learn from the efforts of the past ten years. It should also be used to set and monitor concrete and achievable environmental and other goals for at least the next five to ten years.

Johannesburg should also prompt the U.S. to take sustainable development more seriously. Within this country, several basic things need to happen soon. The federal government should establish and begin implementing a national strategy for sustainable development, setting goals and priorities, and harnessing all sectors of society to achieve those goals. Climate change and biodiversity should be key priorities in this strategy.

The U.S. should also work to develop integrated data for integrated decision making. The National Research Council's 1999 report, *Our Common Journey*, contains a thoughtful call for a "place-based science" that would integrate scientific information at the local or regional level. Such information would help decisionmakers in various parts of the country to better understand the consequences of actions before they are taken. Integrated scientific and other data should also be readily available, reliable, and easy to use. And sustainable development indicators should be employed to measure our progress.

As important as actions are, we also need a better understanding of the carrying capacity of the United States. We need to better integrate ecology into agricultural research, and increase our knowledge of marine ecosystems. We need to improve our ability to measure or monitor ecosystem health and biodiversity, sustainable forestry, and sustainable consumption of materials.



Finally, I need to add a word about law. The environmental debate in the U.S. over at least the past decade has been almost entirely about more regulation vs. less regulation. That debate is misleading and wrongheaded. It is misleading because there are many tools, other than regulation, that can be used to achieve sustainable development, including tax law, property law, and required disclosure of information. It is wrongheaded because it obscures the effect of governmental subsidies for fossil fuels, highway development, sprawl, and other manifestations of unsustainable development.

A better approach would, among other things, reduce subsidies for unsustainable development and integrate sustainability into a variety of laws as they are enacted or modified. Electric utility restructuring, for instance, can be a powerful stimulus for renewable energy if it is done correctly.

It is pretty easy for cynics to say that this is all still pie in the sky. But consider the alternative, which is continuing and worsening poverty and environmental degradation

around the world. Consider the effects of that on ourselves and others. Consider the effect of that on our national security, on our ability to continue economic development, and our ability to provide for the common welfare.

Sustainable development represents the only existing international consensus on how to address these problems. There is no other game on the planet.

And sustainable development is about more than avoiding bad things. It is also about achieving good things. Imagine, as I said at the outset, a world in which the ordinary effect of human activity is to protect and restore the environment. Imagine, too, a world in which large scale poverty has been eliminated.

On her 100th birthday, Marjory Stoneman Douglas, who spent most of her life fighting to protect the Florida Everglades, was asked whether she was hopeful about its future. "I am neither an optimist nor a pessimist," she replied. "I say it's got to be done." The same is true of sustainable development.

BIOGRAPHY

John Dernbach

Associate Professor of Law, Widener University Law School

JOHN C. DERNBACH is Associate Professor of Law at Widener's Harrisburg campus. Professor Dernbach received a B.S. from University of Wisconsin, Eau Claire in 1975, and a J.D. from the University of Michigan in 1978.

He has held positions as Assistant Counsel, Pennsylvania Department of Environmental Resources, Harrisburg, PA, 1981-87; Special Assistant, Pennsylvania Department of Environmental Resources, 1987-92 and Director of Advanced Science and Research Team, Pennsylvania Department of Environmental Resources, 1992-93.

Professor Dernbach joined Widener as a Visiting Associate Professor of Law in 1993. He served in that role from 1993-94 and has served as Associate Professor since 1994. Professor Dernbach has been active in a number of professional and civic organizations, including the Susquehanna Conference, the American Bar Association's Central and East European Law Initiative and the President's Council on Sustainable Development.

He is also a member of the executive committee for the Pennsylvania Resources Council and Pennsylvania Consortium for Interdisciplinary Environmental Policy.

Professor Dernbach teaches and writes in the areas of Administrative Law, Environmental Law, International Law, International Environmental Law, Property, Sustainability and the Law, and Climate Change.



NCSE CONGRESSIONAL LEADERSHIP AWARD

Presented to Congressman Sherwood Boehlert, Chairman of Science Committee,
U.S. House of Representatives

DECEMBER 6, 2001

APPENDIX 6

The National Council for Science and the Environment (NCSE) awarded its second annual Congressional Leadership Award to Congressman Sherwood Boehlert (R-NY), Chairman of the Science Committee of the U.S. House of Representatives.

NCSE Executive Director Peter Saundry stated, “Chairman Boehlert is a stalwart leader in promoting and using a scientific approach to environmental decisions. He has a well-earned reputation as one of Congress’ scientific leaders as well as one of its leading environmentalists. Since becoming Chair of the Science Committee, he has restored the committee to its role of educating Congress about the science underlying environmental issues. Chairman Boehlert has been a champion for research and education funding.”

Sherwood Boehlert is in his 10th term in Congress, representing central New York state. He is a former Oneida County Executive. Boehlert has served on the Science Committee since 1983, and was elected Chairman in January 2001. The Committee has jurisdiction over all federal nonmilitary scientific and technology research and development programs, on which the federal government spends more than \$30 billion a year. The Committee has jurisdiction over NASA, the National Science Foundation, and research and development initiatives within the Environmental Protection Agency, the Department of Energy, and the Department of Commerce. Environment and education have been among his top priorities for the Committee.



Left to right: Stephen Hubbell, Chair, NCSE; Sherwood Boehlert, Chair, House Science Committee; Richard Benedick, President, NCSE

In accepting the award, Congressman Boehlert remarked, “I am honored to receive this award. A key to a sound and forceful environmental policy is a strong scientific foundation. NCSE understands that. I look forward to continuing to work with groups like NCSE to ensure that science drives environmental policy—even when science points toward problems like climate change that are difficult to address.”

The first NCSE Congressional leadership award was presented in December 2000 to Representative Jim Saxton (R-NJ) for his leadership in advancing the concept of a National Institute for the Environment (NIE).

Remarks on Receiving the FIRST NCSE LIFETIME ACHIEVEMENT AWARD

Maurice F. Strong

Senior Advisor to the United Nations Secretary-General

December 7th, 2001

APPENDIX 7

FIRST LET ME EXTEND MY PROFOUND GRATITUDE

for honoring me today with your first Lifetime Achievement Award. Coming as it does from an organization, which is contributing so much to the cause, which is central to my own life interests, it is something that is especially meaningful and precious to me. I am genuinely humbled at the awesome thought that the National Council for Science and Environment with a membership consisting of such a galaxy of scientists, experts and policy makers would consider me worthy of such an honor. If there is anything particularly distinctive in what I have done it is the result of the guidance, advice and support I have enjoyed from a remarkable cast of co-workers, some of whom I am pleased to see here today. None have made more important and valued contributions than your President The Honorable Richard Benedick, whose friendship and guidance I have appreciated so much over many years.

It is in this spirit that I am so proud and pleased to accept this Award as a tribute to all of those who have illuminated the pathway from Stockholm through Rio and next year's Summit Conference in Johannesburg, made possible the notable progress we have made along the way and defined the formidable nature of the challenges we continue to face if the human community is to achieve the secure, sustainable and equitable future to which we aspire. It is a future, which I am convinced, is achievable, but only if in the first period of this new millennium we make the

fundamental "change of course" called for by business leaders at the Earth Summit at Rio de Janeiro in 1992. We have still not made that change of course and will not do so unless we take the decisions and actions that will break the inertia which continues to propel us along a course that is not sustainable. As an optimist I continue to believe that such a change of course is possible. But as a realist I am deeply concerned that despite all the knowledge we have gained and the progress we have made since Stockholm first put the issue on the international agenda we have still not demonstrated the degree of will or sense of priority that such a change of course requires.

This is why I attach such importance to your mission of "improving the scientific basis for environmental decisionmaking." For I am convinced that the decisions that we take, or fail to take, in the first three decades of this new millennium will set the direction and determine the prospects for the human future. These decisions must be guided by the best knowledge and advice that science can provide, and this must be accompanied by a more sustained exercise of wisdom, moral and ethical responsibility than we have yet manifested.

The transition to a sustainable pathway in which our economic life is brought into a positive synthesis with our environmental and social needs is, I submit, as essential to the future of the human community as it was before the tragic terrorist attacks of September 11th, 2001, on

New York and Washington. The preoccupation with the ominous consequences of these horrendous attacks is understandable and, indeed, necessary. But we must not allow this to sideline or undermine our efforts to achieve economic, environmental and social sustainability and security. The events of September 11th have dramatically brought home to us that the phenomena we now refer to as globalization, which has opened up so many new and exciting opportunities, has also united us in facing a new generation of risks and vulnerabilities. Risks to our personal security and the security of our homes, offices and communities as well as to the security of the earth's life-support systems on which the survival and well being of the entire human family depends. These risks and vulnerabilities are inextricably linked through the complex systemic processes of globalization by which human activities are shaping the human future. They cannot be understood or dealt with in isolation. Nor can they be managed alone by any nation, however powerful. Indeed they require a degree of cooperation beyond anything we seem yet prepared to accept.

This insight is not entirely new. The Greek historian Polybius, in the 1st Century B.C. wrote "Now in earlier times the world's history had consisted, so to speak, of a series of immolated episodes, the origins and results of each being as widely separated as their localities. But from now onwards history becomes an organic whole: the affairs of Italy and Africa are connected with those of Asia and Greece, and all events bear a relationship and contribute to a single end". Of course in our times the scale and speed of these interactions has accelerated exponentially.

The multilateral system of institutions, treaties and international arrangements that has developed since World War II, largely on the enlightened and responsible initiative of the United States, provides many of the elements required to facilitate and support such cooperation. Yet most are in need of fundamental reform and realignment of their structures and mandates if they are to be up to the task of providing effective and systemic support for the cooperative processes by which our future must be managed.

The need for a stronger, more effective multi-lateralism has never been greater; yet there is clearly not the political will to make the necessary changes in multilateral institutions and provide them with the mandates and support they require to enable the nations of the world to manage cooperatively those critical issues which none can manage

alone. Contrary to what some contend, this does not involve abdication of national sovereignty, but rather the voluntary exercise of sovereignty in cooperation with others in those cases where it is not possible or desirable to act alone. This is why there was widespread concern and apprehension at the retreat of the United States prior to September 11th, from leadership in respect of a number of international agreements and negotiations, notably the Kyoto Protocol to the Climate Change Convention.

If there is anything positive that could result from events as tragic as the terrorist attacks of September 11th, 2001, it is to be hoped that the realization that the international cooperation which is so necessary to the US led war on terrorism is equally essential in dealing with so many of the other risks and vulnerabilities which the United States shares with the other nations of the world. A major test of this will be the degree to which the United States in undertaking the measures that President George W. Bush has promised to reduce its own impacts on climate change will meet its responsibilities as the largest source of greenhouse gas emissions. The world looks hopefully to the United States for a re-assertion of its leadership and it is surely in the American tradition as well as its interest to exercise that leadership.

The United States is the dominant power in a world of unprecedented wealth and opportunity. Yet, the fact that the benefits accrue disproportionately to a relatively small proportion of the world's population, widening the gap between the rich and the poor both within and amongst nations, is clearly breeding a series of deepening imbalances, frustration, resentments and tension which threaten the security and stability of our societies. It is surely self evident that a world in which such stark dichotomies and imbalances prevail can be neither secure nor sustainable.

We in the more mature industrialized countries will have to become accustomed to the fact that we are a minority—a privileged minority to be sure—but one on which the majority is gaining both in numbers and in economic power. More than three quarters of the world's population lives in developing countries, which are also producing most economic growth and will soon account for more than half the world's GNP. Although their contribution to major environmental risks such as those of climate change has thus far been much less than ours, it is growing rapidly. Indeed our own environmental security will ultimately depend on the ability of developing countries to manage



their own economic growth on a sustainable basis. In doing so they will be far more influenced by our example than by our exhortations, and will require our support in technology, in funding, and in fair trade and intellectual property policies. These should not be looked on as aid or charity on our part but as essential investments in our own future.

At Stockholm we lost our innocence. We recognized that much of what we had been doing in pursuit of our economic goals had, however inadvertently, been producing environmental damage and social dichotomies which were undermining the quality of life and our prospects for the future. Since then we have learned a great deal more about the nature and the causes of this and have made notable progress in developing the technologies, the tools and the capacities to manage them successfully. Indeed there have been many success stories which demonstrate that it is possible to bring our economic life in to a positive balance with our environmental and social systems by making the transition to a sustainable development pathway. On a global basis we have the knowledge, the resources, and the capacities to build in this new millennium a civilization and mode of life in which pollution and poverty are eradicated and the benefits which knowledge and technology afford made available universally to ensure all inhabitants of the earth access to the better life and a secure, sustainable future which is clearly within our reach.

It is really a question of priorities and our motivations determine how we set our priorities. The better world to which all aspire is achievable, but thus far we have not demonstrated the will to make the changes that will take us there. Jawaharlal Nehru commented on this paradox in an article on "The Strange Behavior of Money" in which he said that "the extraordinary spectacle of abundance and poverty existing side by side" and that "if capitalism is not advanced enough... some other system must be evolved more in keeping with science". And a recent article in "The Economist" - hardly a radical publication - stated that "if the Marxist prediction of a proletariat plunged into abject misery under capitalism has so far been unfulfilled, the widening gap between have and have-nots is causing some to think that Marx might yet be proved right on this point after all".

At the deepest level people and societies are motivated by the fundamental moral, ethical and spiritual values in which their beliefs are rooted. One of my greatest disappointments in the result of the Earth Summit was our inability to obtain agreement on an Earth Charter to define a set of basic moral and ethical principles for the conduct of people and nations towards each other and the Earth as the basis for achieving a sustainable way of life on our planet. Governments were simply not ready for it. So following Rio, I joined with Mikhail Gorbachev, as well as many other organizations and hundreds and thousands of people around the world to undertake this important piece of unfinished business from Rio. A global campaign is now underway to engage millions of people in the process of using the Earth Charter as a basis for examining and guiding their own basic motivations and priorities and challenging their communities, their governments their organizations to do the same. This promises to be a compelling and authoritative voice of the world's people at Johannesburg, which hopefully will inspire the leaders there to accept it as a moral guide to the decisions they take there.

I am persuaded that the 21st century will be decisive for the human species. For we are now in a very real sense trustees of our own future. I was so pleased that Professor E.O. Wilson, who I have so greatly admired and from whom I have learned so much over the years, chose as the title of the John H. Chafee Memorial Lecture he delivered last night "The Future of Life" and articulated so masterfully the ways in which the increases in human population and human activities are altering and threatening the conditions on which our future depends. The direction of the human future will be largely set in the first decades of this century. For all the evidences of environmental degradation, social tension and inter-communal conflict we have seen to date have occurred at levels of population and human activity that are a great deal less than they will be in the period ahead. The risks we face in common from the mounting dangers to the environment, resource base and life support systems on which all life on earth depends are far greater as we move into the 21st century than the risks we face or have faced in our conflicts with each other.

A new paradigm of cooperative global governance is the only feasible basis on which we can manage these risks and realize the immense potential for progress and fulfillment for the entire human family, which is within our reach. In our attempts to do this we are locked in a struggle between the world's ecosystems and its egosystems. It is the egosystems—the nations, the institutions, and indeed the individuals, which will have to change, and which are so resistant to change.

All people and nations have in the past been willing to accord highest priority to the measures required for their own security. We must give the same kind of priority to civilizational security and sustainability. This will take a major shift in the current political mind-set. Necessity will compel such a shift eventually; the question is can we really afford the costs and the risks of waiting. More than ever we need the guidance and the leadership, which your Council and its members provide.

BIOGRAPHY

Honorable Maurice Strong



Senior Advisor to the United Nations Secretary-General

MAURICE STRONG, a senior advisor to the Secretary-General of the United Nations and former senior advisor to the President of the World Bank, is one of the world's most influential political and environmental activists.

Strong served on the board of directors for the United Nations Foundation, a UN affiliated organization established by Ted Turner's historic \$1 billion donation. He is also a director of the World Economic Forum Foundation, Chairman of the Earth Council, former Chairman of the Stockholm Environment Institute, and former Chairman of the World Resources Institute.

In his native Canada, Strong has a career spanning over five decades at some of Canada's most prestigious companies, running several companies in the energy and resources sector, including the Power Corporation of Canada, Ontario Hydro, and Petro-Canada. He is currently the chairman of Technology Development, Inc., which funds research in the groundbreaking field of applying nanotechnology towards creating energy sources that are both affordable and ecofriendly.

He first worked with the United Nations as a junior officer in 1947, when he was eighteen, and returned in 1970 to lead the Conference on the Human Environment in Geneva, after which he became executive director of the UN's environmental program. Strong also coordinated the UN's emergency relief efforts in Africa in the mid 1980s and was in charge of the historic 1992 Earth Summit in Rio. He recently took part in the reorganization of the UN's University for Peace.

Strong is a member of the Queen's Privy Council for Canada, the Swedish Royal Order of the Polar Star, and the Royal Societies of both Canada and Great Britain. He has received 41 honorary doctorates from universities in North America and Europe.

He has been featured in every major news media outlet in the United States, Canada and Europe. Strong regularly travels across the globe, from Japan to Africa, London to Costa Rica, and all corners of the planet to further the causes of peace and the environment.

THE EARTH CHARTER

Preamble

We stand at a critical moment in Earth's history, a time when humanity must choose its future. As the world becomes increasingly interdependent and fragile, the future at once holds great peril and great promise. To move forward we must recognize that in the midst of a magnificent diversity of cultures and life forms we are one human family and one Earth community with a common destiny. We must join together to bring forth a sustainable global society founded on respect for nature, universal human rights, economic justice, and a culture of peace. Towards this end, it is imperative that we, the peoples of Earth, declare our responsibility to one another, to the greater community of life, and to future generations. (www.earthcharter.org)

APPENDIX 8

EARTH, OUR HOME

Humanity is part of a vast evolving universe. Earth, our home, is alive with a unique community of life. The forces of nature make existence a demanding and uncertain adventure, but Earth has provided the conditions essential to life's evolution. The resilience of the community of life and the well being of humanity depend upon preserving a healthy biosphere with all its ecological systems, a rich variety of plants and animals, fertile soils, pure waters, and clean air. The global environment with its finite resources is a common concern of all peoples. The protection of Earth's vitality, diversity, and beauty is a sacred trust.

THE GLOBAL SITUATION

The dominant patterns of production and consumption are causing environmental devastation, the depletion of resources, and a massive extinction of species. Communities are being undermined. The benefits of development are not shared equitably and the gap between rich and poor is widening. Injustice, poverty, ignorance, and violent conflict are widespread and the cause of great suffering. An unprecedented rise in human population has overburdened ecological and social systems. The foundations of global security are threatened. These trends are perilous—but not inevitable.

THE CHALLENGES AHEAD

The choice is ours: form a global partnership to care for Earth and one another or risk the destruction of ourselves and the diversity of life. Fundamental changes are needed in our values, institutions, and ways of living. We must

realize that when basic needs have been met, human development is primarily about being more, not having more. We have the knowledge and technology to provide for all and to reduce our impacts on the environment. The emergence of a global civil society is creating new opportunities to build a democratic and humane world. Our environmental, economic, political, social, and spiritual challenges are interconnected, and together we can forge inclusive solutions.

UNIVERSAL RESPONSIBILITY

To realize these aspirations, we must decide to live with a sense of universal responsibility, identifying ourselves with the whole Earth community as well as our local communities. We are at once citizens of different nations and of one world in which the local and global are linked. Everyone shares responsibility for the present and future well being of the human family and the larger living world. The spirit of human solidarity and kinship with all life is strengthened when we live with reverence for the mystery of being, gratitude for the gift of life, and humility regarding the human place in nature.

We urgently need a shared vision of basic values to provide an ethical foundation for the emerging world community. Therefore, together in hope we affirm the following interdependent principles for a sustainable way of life as a common standard by which the conduct of all individuals, organizations, businesses, governments, and transnational institutions is to be guided and assessed.

PRINCIPLES

I. RESPECT AND CARE FOR THE COMMUNITY OF LIFE

1. **Respect Earth and life in all its diversity.**

- a. Recognize that all beings are interdependent and every form of life has value regardless of its worth to human beings.
- b. Affirm faith in the inherent dignity of all human beings and in the intellectual, artistic, ethical, and spiritual potential of humanity.

2. **Care for the community of life with understanding, compassion, and love.**

- a. Accept that with the right to own, manage, and use natural resources comes the duty to prevent environmental harm and to protect the rights of people.
- b. Affirm that with increased freedom, knowledge, and power comes increased responsibility to promote the common good.

3. **Build democratic societies that are just, participatory, sustainable, and peaceful.**

- a. Ensure that communities at all levels guarantee human rights and fundamental freedoms and provide everyone an opportunity to realize his or her full potential.
- b. Promote social and economic justice, enabling all to achieve a secure and meaningful livelihood that is ecologically responsible.

4. **Secure Earth's bounty and beauty for present and future generations.**

- a. Recognize that the freedom of action of each generation is qualified by the needs of future generations.
- b. Transmit to future generations values, traditions, and institutions that support the long-term flourishing of Earth's human and ecological communities.

In order to fulfill these four broad commitments, it is necessary to:

II. ECOLOGICAL INTEGRITY

5. **Protect and restore the integrity of Earth's ecological systems, with special concern for biological diversity and the natural processes that sustain life.**

- a. Adopt at all levels sustainable development plans and regulations that make environmental conservation and rehabilitation integral to all development initiatives.
- b. Establish and safeguard viable nature and biosphere reserves, including wild lands and marine areas, to protect Earth's life support systems, maintain biodiversity, and preserve our natural heritage.

- c. Promote the recovery of endangered species and ecosystems.
- d. Control and eradicate non-native or genetically modified organisms harmful to native species and the environment, and prevent introduction of such harmful organisms.
- e. Manage the use of renewable resources such as water, soil, forest products, and marine life in ways that do not exceed rates of regeneration and that protect the health of ecosystems.
- f. Manage the extraction and use of non-renewable resources such as minerals and fossil fuels in ways that minimize depletion and cause no serious environmental damage.

6. **Prevent harm as the best method of environmental protection and, when knowledge is limited, apply a precautionary approach.**

- a. Take action to avoid the possibility of serious or irreversible environmental harm even when scientific knowledge is incomplete or inconclusive.
- b. Place the burden of proof on those who argue that a proposed activity will not cause significant harm, and make the responsible parties liable for environmental harm.
- c. Ensure that decisionmaking addresses the cumulative, long-term, indirect, long distance, and global consequences of human activities.
- d. Prevent pollution of any part of the environment and allow no build-up of radioactive, toxic, or other hazardous substances.
- e. Avoid military activities damaging to the environment.

7. **Adopt patterns of production, consumption, and reproduction that safeguard Earth's regenerative capacities, human rights, and community well being.**

- a. Reduce, reuse, and recycle the materials used in production and consumption systems, and ensure that residual waste can be assimilated by ecological systems.
- b. Act with restraint and efficiency when using energy, and rely increasingly on renewable energy sources such as solar and wind.
- c. Promote the development, adoption, and equitable transfer of environmentally sound technologies.
- d. Internalize the full environmental and social costs of goods and services in the selling price, and enable consumers to identify products that meet the highest social and environmental standards.
- e. Ensure universal access to health care that fosters reproductive health and responsible reproduction.
- f. Adopt lifestyles that emphasize the quality of life and material sufficiency in a finite world.

8. Advance the study of ecological sustainability and promote the open exchange and wide application of the knowledge acquired.

- a. Support international scientific and technical cooperation on sustainability, with special attention to the needs of developing nations.
- b. Recognize and preserve the traditional knowledge and spiritual wisdom in all cultures that contribute to environmental protection and human well-being.
- c. Ensure that information of vital importance to human health and environmental protection, including genetic information, remains available in the public domain.

III. SOCIAL AND ECONOMIC JUSTICE

9. Eradicate poverty as an ethical, social, and environmental imperative.

- a. Guarantee the right to potable water, clean air, food security, uncontaminated soil, shelter, and safe sanitation, allocating the national and international resources required.
- b. Empower every human being with the education and resources to secure a sustainable livelihood, and provide social security and safety nets for those who are unable to support themselves.
- c. Recognize the ignored, protect the vulnerable, and serve those who suffer, and enable them to develop their capacities and to pursue their aspirations.

10. Ensure that economic activities and institutions at all levels promote human development in an equitable and sustainable manner.

- a. Promote the equitable distribution of wealth within nations and among nations.
- b. Enhance the intellectual, financial, technical, and social resources of developing nations, and relieve them of onerous international debt.
- c. Ensure that all trade supports sustainable resource use, environmental protection, and progressive labor standards.
- d. Require multinational corporations and international financial organizations to act transparently in the public good, and hold them accountable for the consequences of their activities.

11. Affirm gender equality and equity as prerequisites to sustainable development and ensure universal access to education, health care, and economic opportunity.

- a. Secure the human rights of women and girls and end all violence against them.

- b. Promote the active participation of women in all aspects of economic, political, civil, social, and cultural life as full and equal partners, decision makers, leaders, and beneficiaries.

- c. Strengthen families and ensure the safety and loving nurture of all family members.

12. Uphold the right of all, without discrimination, to a natural and social environment supportive of human dignity, bodily health, and spiritual well being, with special attention to the rights of indigenous peoples and minorities.

- a. Eliminate discrimination in all its forms, such as that based on race, color, sex, sexual orientation, religion, language, and national, ethnic or social origin.
- b. Affirm the right of indigenous peoples to their spirituality, knowledge, lands and resources and to their related practice of sustainable livelihoods.
- c. Honor and support the young people of our communities, enabling them to fulfill their essential role in creating sustainable societies.
- d. Protect and restore outstanding places of cultural and spiritual significance.

IV. DEMOCRACY, NONVIOLENCE, AND PEACE

13. Strengthen democratic institutions at all levels, and provide transparency and accountability in governance, inclusive participation in decision making, and access to justice.

- a. Uphold the right of everyone to receive clear and timely information on environmental matters and all development plans and activities, which are likely to affect them, or in which they have an interest.
- b. Support local, regional and global civil society, and promote the meaningful participation of all interested individuals and organizations in decision making.
- c. Protect the rights to freedom of opinion, expression, peaceful assembly, association, and dissent.
- d. Institute effective and efficient access to administrative and independent judicial procedures, including remedies and redress for environmental harm and the threat of such harm.
- e. Eliminate corruption in all public and private institutions.
- f. Strengthen local communities, enabling them to care for their environments, and assign environmental responsibilities to the levels of government where they can be carried out most effectively.

14. Integrate into formal education and life-long learning the knowledge, values, and skills needed for a sustainable way of life.

- a. Provide all, especially children and youth, with educational opportunities that empower them to contribute actively to sustainable development.
- b. Promote the contribution of the arts and humanities as well as the sciences in sustainability education.
- c. Enhance the role of the mass media in raising awareness of ecological and social challenges.
- d. Recognize the importance of moral and spiritual education for sustainable living.

15. Treat all living beings with respect and consideration.

- a. Prevent cruelty to animals kept in human societies and protect them from suffering.
- b. Protect wild animals from methods of hunting, trapping, and fishing that cause extreme, prolonged, or avoidable suffering.
- c. Avoid or eliminate to the full extent possible the taking or destruction of non-targeted species.

16. Promote a culture of tolerance, nonviolence, and peace.

- a. Encourage and support mutual understanding, solidarity, and cooperation among all peoples and within and among nations.
- b. Implement comprehensive strategies to prevent violent conflict and use collaborative problem solving to manage and resolve environmental conflicts and other disputes.
- c. Demilitarize national security systems to the level of a non-provocative defense posture, and convert military resources to peaceful purposes, including ecological restoration.
- d. Eliminate nuclear, biological, and toxic weapons and other weapons of mass destruction.
- e. Ensure that the use of orbital and outer space supports environmental protection and peace.
- f. Recognize that peace is the wholeness created by right relationships with oneself, other persons, other cultures, other life, Earth, and the larger whole of which all are a part.



THE WAY FORWARD

AS NEVER BEFORE IN HISTORY, common destiny beckons us to seek a new beginning. Such renewal is the promise of these Earth Charter principles. To fulfill this promise, we must commit ourselves to adopt and promote the values and objectives of the Charter.

This requires a change of mind and heart. It requires a new sense of global interdependence and universal responsibility. We must imaginatively develop and apply the vision of a sustainable way of life locally, nationally, regionally, and globally. Our cultural diversity is a precious heritage and different cultures will find their own distinctive ways to realize the vision. We must deepen and expand the global dialogue that generated the Earth Charter, for we have much to learn from the ongoing collaborative search for truth and wisdom.

Life often involves tensions between important values. This can mean difficult choices. However, we must find ways to harmonize diversity with unity, the exercise of freedom with the common good, short-term objectives with long-term goals. Every individual, family, organization, and community has a vital role to play. The arts, sciences, religions, educational institutions, media, businesses, nongovernmental organizations, and governments are all called to offer creative leadership. The partnership of government, civil society, and business is essential for effective governance.

In order to build a sustainable global community, the nations of the world must renew their commitment to the United Nations, fulfill their obligations under existing international agreements, and support the implementation of Earth Charter principles with an international legally binding instrument on environment and development.

Let ours be a time remembered for the awakening of a new reverence for life, the firm resolve to achieve sustainability, the quickening of the struggle for justice and peace, and the joyful celebration of life.

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APPENDIX 9

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The Center, directed by Professor David Frumkin, produces serious intellectual work that is interdisciplinary, international, non-ideological, and of practical applicability. Nobel Laureate Amartya Sen holds the Center's visiting professorship.

The Center is a forum for representatives and experts from a broad range of disciplines to take an informed, rigorous, and thoughtful look at the multiple forces that will shape our global community and determine what specific impact they may have on our lives. Center conferences address issues such as "The Future of Values" and "Challenges to the Existing Political Structure of the World."

<http://www.bu.edu/pardee/>

The RAND Frederick S. Pardee Center for Longer Range Global Policy and the Future Human Condition

The RAND Frederick S. Pardee Center for Longer Range Global Policy works to improve our ability to think about the longer-term future—from 35 to as far as 200 years ahead—and to develop new methods of analyzing potential long-range, global effects of today's policy options in order to design sound policies that are sensitive to those effects.

The Center, under the leadership of Dr. James A. Dewar, concentrates on five broad areas:

- Developing new methodologies—or refining existing ones—to improve thinking about the long-range effects of policy options.
- Developing improved measures of human progress on an international scale.
- Identifying policy issues with important implications for the long-term future, i.e., 35 years and beyond.
- Using longer-range policy analysis and measures of global progress to improve near-term decisions that have long-term impact.
- Collaborating with like-minded institutions and colleagues, including the United Nations Development Program, academic research centers, futures societies, and individuals around the globe.

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Conference Report INDEX

Capacity Building:

Working for Water: Page 9, Science: Recommendation 1, 2
Invasive Alien Species: Page 10, Recommendation 2
Architecture: Page 11, Recommendation 3
Business: Page 12, Recommendation 1
Children's Health: Page 14, Recommendation 4
Remote Sensing: Page 26, Recommendations 2, 3
Rural Communities: Page 27, Recommendation 4

Certification Systems:

Federal Government Employees: Page 18, Recommendation 3
Architecture: Page 11, Recommendation 4
Forestry: Page 20, Recommendation 7

Intragovernmental Coordination:

Working for Water: Page 9, Science: Recommendation 2
Portland: Page 8, Recommendations 1, 8
Business: Page 13, Recommendation 4
Forestry: Page 19, Recommendation 6
Indicators: Page 22, Recommendation 3
Remote Sensing: Page 26, Recommendation 3
Rural Communities: Page 27, Recommendation 2
Urban Design: Page 28, Recommendation 4

Public/Private Partnerships:

Curitiba: Page 7, Recommendation 1
Portland: Page 8, Recommendation 1
Community Design: Page 15, Design: Recommendation 4
Forestry: Page 19, Recommendation 6
Indicators: Page 22, Recommendations 2, 4
Rural Communities: Page 27, Recommendation 2
Urban Design: Page 28, Recommendation 2

International Collaboration:

Working for Water: Page 9, Science: Recommendation 2
Children's Health: Page 14, Recommendation 4

Energy: Page 17, Recommendation 3
Forestry: Page 20, Recommendation 7
Information Systems: Page 23, Recommendation 1
Remote Sensing: Page 26, Recommendation 2

Formal Education:

Curitiba: Page 7, Recommendation 3
Higher Education: Page 21, Recommendation 2
Indicators: Page 22, Recommendation 4
Rural Communities: Page 27, Recommendation 3
Urban Design: Page 28, Recommendation 2

Public Education:

Curitiba: Page 7, Recommendation 2
Community Design: Page 15, Recommendation 3
Energy: Page 17, Recommendation 4
Forestry: Page 19, Recommendation 2
Higher Education: Page 21, Recommendation 3
Rural Communities: Page 27, Recommendation 1
Urban Design: Page 28, Recommendation 1

Funding Mechanisms:

Curitiba: Page 7, Recommendation 4
Federal Government Employees: Page 18, Recommendation 4
Community Design: Page 15, Research: Recommendation 1
Portland: Page 8, Recommendation 8
Rural Communities: Page 27, Recommendation 5
Urban Design: Page 28, Recommendation 3

Economic Incentives:

Working for Water: Page 9, Science: Recommendation 4
Federal Government Employees: Page 18, Recommendation 1
Architecture: Page 11, Recommendation 2
Business: Page 12, Recommendation 3
Community Design: Page 16, Research: Recommendation 4

Energy: Page 17, Recommendation 2
Pollution Prevention: Page 25, Recommendation 4

Information Management and Access:

Business: Page 13, Recommendations 5, 8
Children's Health: Page 14, Recommendation 3
Forestry: Page 20, Recommendation 8
Indicators: Page 22, Recommendation 3
Information Systems: Page 23, Recommendations 2–4
Libraries: Page 24, Recommendations 2, 3
Pollution Prevention: Page 25, Recommendation 5
Remote Sensing: Page 26, Recommendations 1, 6

Institutional Changes:

Working for Water: Page 10, Invasive Alien Species: Recommendation 3
Fresh water: Recommendation 1
Business: Page 13, Recommendation 7
Community Design: Page 15, Design: Recommendation 4
Research: Recommendation 1
Energy: Page 17, Recommendation 5
Higher Education: Page 21, Recommendation 1
Urban Design: Page 28, Recommendation 4

Monitoring:

Working for Water: Page 10, Fresh water: Recommendation 4
Architecture: Page 11, Recommendation 5
Forestry: Page 19, Recommendation 4

Policy Development:

Portland: Page 8, Recommendations 5, 7, 9
Working for Water: Page 10, Fresh water: Recommendation 5
Architecture: Page 11, Recommendations 1, 2
Culture: Page 17, Recommendation 1
Forestry: Page 19, Recommendation 5
Pollution Prevention: Page 25, Recommendations 2, 3

Remote Sensing: Page 26, Recommendation 5
Rural Communities: Page 27, Recommendation 1

Research Agenda:

Curitiba: Page 7, Recommendation 1
Working for Water: Page 9, Science: Recommendation 4
Federal Government Employees: Page 18, Recommendation 2
Business: Page 13, Recommendations 6, 7
Children's Health: Page 14, Recommendation 3
Community Design: Page 16, Research: Recommendations 2, 3
Culture: Page 17, Recommendation 3
Energy: Page 17, Recommendation 1
Forestry: Page 19, Recommendation 3
Indicators: Page 22, Recommendations 1, 3
Information Systems: Page 23, Recommendation 5
Remote Sensing: Page 26, Recommendation 4

Science-Policy Translation:

Portland: Page 8, Recommendation 2
Working for Water: Page 9, Science: Recommendation 3
Children's Health: Page 14, Recommendations 1, 2
Libraries: Page 24, Recommendation 1
Pollution Prevention: Page 25, Recommendation 1
Rural Communities: Page 27, Recommendation 6
Urban Design: Page 28, Recommendation 4

Stakeholders:

Curitiba: Page 7, Recommendation 1
Portland: Page 8, Recommendation 1
Community Design: Page 15, Design: Recommendation 2
Culture: Page 17, Recommendation 2
Forestry: Page 19, Recommendation 1
Indicators: Page 22, Recommendation 2

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The National Council for Science and the Environment is a 501(c)(3) nonprofit organization which carries out educational activities, science development, and limited advocacy work. The work of the National Council for Science and the Environment is funded by foundations, Affiliate Universities, members of the NCSE Associates Program, and individuals.

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ISBN 0-97104-392-2

