Sustainable Development: The Challenge of Transition

Demographers predict that world population will double to around 12 billion people during the first half of the twenty-first century and then begin to level off. Based on this scenario, *Sustainable Development: The Challenge of Transition* examines what societal changes must occur over the next generation to ensure a successful transition to sustainability. A successful transition must provide for the needs of these people within the constraints of the natural environment.

An array of prominent authors presents a broad discussion of the dimensions of sustainable development: not just economic and environmental, but also spiritual and religious, corporate and social, scientific and political. Unlike other books on the subject, this volume provides insightful policy recommendations about how business, government, and individuals must change their current values, priorities, and behavior to meet these challenges. These types of changes ordinarily take many decades to occur, so it is important to begin making them now, before the problems are overwhelming and more costly.

This volume will appeal to scholars and decision makers interested in global change, environmental policy, population growth, and sustainable development, and also to corporate environmental managers.

Sustainable Development: The Challenge of Transition

Edited by

JURGEN SCHMANDT

University of Texas at Austin and Houston Advanced Research Center, Texas, U.S.A.

and

C. H. WARD

Rice University, Houston, Texas, U.S.A.

with the assistance of

MARILU HASTINGS

Houston Advanced Research Center, Texas, U.S.A.

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Contributors

CARLA V. BERKEDAL
is an Episcopal priest and has worked in parish ministry since 1980. She is currently Founding Director of Earth Ministry and the Associate Rector at Emmanuel Episcopal Church on Mercer Island, Washington. As Founding Director of Earth Ministry, a nonprofit, ecumenical, environmental ministry located in Seattle, Carla works with individuals and congregations to help them discover the Christian roots of living lightly, and with gratitude, on the earth. Ms Berkedal has extensive experience as an author, teacher, speaker, consultant, and team member of various boards, committees, and coalitions inside the Church and beyond, including the Presiding Bishop's Environmental Stewardship Team, Sustainable Seattle, and People for Puget Sound. Her voice is especially sought after as one to interpret and apply Christian spirituality and ethics to the care of creation. She has also been honored as a Bloedel Reserve Fellow and as the Seattle Audubon Society's "Environmentalist of the Year." Ms Berkedal's educational accomplishments include a BA in Religion and Philosophy from Bowdoin College, Certificates in Theology and Greek from the University of Strasbourg, and a Master of Divinity from Yale Divinity School.

JAMES B. BLACKBURN
is an environmental attorney and lecturer at Rice University. His law practice involves litigation on air quality, land contamination, risk assessment, environmental auditing, and zero discharge planning, as well as natural resource issues such as wetlands, flooding, and endangered species. Mr Blackburn has taught Environmental Law and Global Environmental Law in the Environmental Science and Engineering Department, and Environmental Planning and Sustainable Development in the Architecture School at Rice University. He received a BA in History, a JD in Law at the University of Texas at Austin and an MS in Environmental Science from Rice University.

FRANCES CAIRNCROSS
is Management Editor on *The Economist.* She was the magazine's first environment editor. Before that, she held posts as principal economic analyst on the *Guardian* newspaper, and as editor of *The Economist's* Britain section. In 1992, she was editor of the World Bank's "World Development Report." Her book, *Costing the Earth: the challenge for governments, the opportunities for business,* is published by Harvard Business School Press and has been translated into Chinese, Danish, Finnish, French, Italian, Japanese, and Spanish. A further book, *Green Inc.*, was published in Britain by Earthscan in May 1995 and in September by Island Press in the United States. Her new book, *The Death of Distance,* is a study of economic and social effects of the global communications revolution and was published by Harvard Business School Press in fall 1997. Ms Cairncross was educated at Oxford University and at Brown University in Rhode Island.

HERMAN E. DALY
is Senior Research Scholar at the University of Maryland, School of Public Affairs. From 1988 to 1994, he was Senior Economist in the Environment Department of the World Bank. Prior to 1988 he was Alumni Professor of Economics at Louisiana State University, where he taught economics for 20 years. He has served as Ford Foundation Visiting Professor at the University of Ceara (Brazil), as a Research Associate at Yale University, as a Visiting Fellow at the Australian National University, and as a Senior Fulbright Lecturer in Brazil. Dr Daly has served on the boards of directors of numerous environmental organizations, including the International Society for Ecological Economics, the Beijer Ecological Economics Institute of the Swedish Royal Academy of Sciences, the World Watch Institute, and is co-founder and associate editor of the journal, *Ecological Economics.* His interest in economic development, population, resources, and environment has resulted in over a hundred articles in professional journals and anthologies, as well as numerous books. In 1996, Dr Daly received the Honorary Right Livelihood Award (Sweden) and the Heineken Prize for Environmental Science awarded by the Royal Netherlands Academy of Arts and Sciences. He holds a BA from Rice University and a PhD from Vanderbilt University.

MALCOLM GILLIS
is the sixth president of Rice University. His first academic post, as an Assistant Professor of Economics at Duke University, was followed by years at Harvard. He returned to Duke in 1984 as Professor of Economics and Public Policy. From 1986 to July 1991, Dr Gillis served as Dean of the Graduate School and Vice Provost for Academic Affairs. From 1991 until June 1993, he was Dean of the Faculty of Arts and Sciences. In recent years, his research and

teaching activities have been focused upon two broad classes of issues in their national and international dimensions: fiscal reform and environmental policy. He was the co-founder and chair of the Board of Trustees of the Center for World Environment and Sustainable Development and was also co-founder of the Duke Center for Tropical Conservation. He has authored or edited ten books. In addition, he has published more than sixty articles in journals and books. Dr Gillis has spent his professional life bringing economic analysis to bear on important issues of public policy in nearly twenty countries, from U.S. and Canada to Ecuador, Colombia, Ghana and Indonesia. He has been a frequent consultant to the State of Alaska, the U.S. Treasury Department, the Canadian Ministry of Finance, the World Bank, and the Governments of Colombia, Ecuador, Bolivia, and Indonesia. Dr Gillis received his BA and MA degrees from the University of Florida and his PhD from the University of Illinois.

Robert W. Kates

is an independent scholar in Trenton, Maine and University Professor (Emeritus) at Brown University. He is an Executive Editor of *Environment* magazine, Co-chair of *Overcoming Hunger in the 1990s*, Distinguished Scientist at the George Perkins Marsh Institute at Clark University, Faculty Associate of the College of the Atlantic, and Senior Fellow at The H. John Heinz III Center for Science, Economics and the Environment. His current research and professional interests include the prevalence and persistence of hunger; long-term population dynamics; sustainability of the biosphere, climate impact assessment; and theory of the human environment. Dr Kates is a recipient of the 1991 National Medal of Science, the MacArthur Prize Fellowship (1981–5), the honors award of the Association of American Geographers, and an honorary degree from Clark University. He is a member of the National Academy of Sciences, the American Academy of Arts and Sciences, a foreign member of the Academia Europaea, and a fellow of the American Association for the Advancement of Science. In 1993–4, he was the President of the Association of American Geographers. He holds a PhD degree in geography from the University of Chicago.

Bruce W. Piasecki

is a professor at Rensselaer Polytechnic Institute's School of Management and Business Administration and director of their Master of Science degree program in Environmental Management and Policy. Prior to his current position, Dr Piasecki was Associate Director of the Hazardous Waste and Toxic Substances and Management Center at Clarkson University. Internationally, he has been a recipient of various grants, including the German Marshall Fund of the United States for his research throughout

Europe on environmental management developments. In 1981, Dr Piasecki founded the American Hazard Control Group, a business development organization providing legal, planning, policy, and communication advice on environmental management decisions. He remains President of the AHC Group, based in Troy, New York. His clients have included the American Plastics Council, Consolidation Edison, Allergan, Energy Answers Corporation, the New York State Energy Authority, CIBA-GEIGY, the New Jersey Siting Commission, and the Ontario Waste Management Corporation.

Jurgen A. Schmandt
is Professor of public affairs at the University of Texas in Austin. He is also Chief Policy Officer and director, Center for Global Studies, at the Houston Advanced Research Center (HARC). His current areas of work include water management, impacts of global change, and policies for sustainable development. His professional career includes work with the German Academic Exchange Service, Organization of Cooperation and Economic Development, Harvard University, and the US Environmental Protection Agency. In Austin, Dr Schmandt participated in the planning and development of a new school of public affairs. He was particularly active in the development of year-long policy research projects which help graduate students gain experience in working with public or private sector agencies. At HARC, he has developed a research center specializing in assessing the regional impacts of global change. He has worked closely with colleagues in Brazil and Mexico on problems of semi-arid regions. Dr Schmandt received his doctor of philosophy degree from the University of Bonn.

Stephen H. Schneider
is a professor in the Department of Biological Sciences, a Senior Fellow at the Institute for International Studies and Professor by Courtesy in the Department of Civil Engineering at Stanford University. He was honored in 1992 with a MacArthur Fellowship for his ability to integrate results of global climate research through public lectures, seminars, classroom teaching, environmental assessment committees, media appearances, Congressional testimony, and research collaboration with colleagues. He also received, in 1991, the American Association for the Advancement of Science/Westinghouse Award for Public Understanding of Science and Technology for furthering public understanding of environmental science and its implications for public policy. Dr Schneider's current global change research interests include climatic change; global warming; food/climate and other environmental/science public policy issues; ecological and economic implications of climatic change; climatic modeling of paleoclimates and of human impacts on climate, e.g., carbon dioxide "greenhouse effect" or

environmental consequences of nuclear war. He is also interested in advancing public understanding of science and in improving formal environmental education in primary and secondary schools. Dr Schneider received his PhD in Mechanical Engineering and Plasma Physics from Columbia University in 1971.

Jeffrey R. Vincent
is a Fellow of the Institute at Harvard Institute for International Development (HIID). He is also a lecturer on economics in the Department of Economics and an adjunct lecturer in public policy at the Kennedy School of Government. He joined HIID in 1990 after teaching for three years at Michigan State University. He is a resource economist with special interests in tropical forest policy, national income accounts and the environment, and environmental management in newly industrializing and transition economies (in particular, pollution policy). He was resident in Malaysia during 1992–93 as leader of that country's first comprehensive research project on environment and development, and he has worked extensively elsewhere in Asia as a researcher, policy adviser, and workshop lecturer. From 1994 to 1998, he was director of HIID's Newly Independent States Environmental Economics and Policy Project, which advised the governments of Russia and the Central Asian Republics on natural resource and environmental policy.

C. H. "Herb" Ward
is the Foyt Family Chair of Engineering in the George R. Brown School of Engineering at Rice University. He is also Professor of Environmental Science and Engineering and Ecology and Evolutionary Biology. Following 22 years as Chair of the Department of Environmental Science and Engineering at Rice University, Dr Ward is now Director of the Energy and Environmental Systems Institute (EESI), a university-wide program designed to mobilize industry, government, and academia to focus on problems related to energy production and environmental protection. He is also Director of the Department of Defense Advanced Applied Technology Demonstration Facility. For the past 14 years, he has directed the activities of the National Center for Ground Water Research. He is also Co-Director of the EPA-sponsored Hazardous Substances Research Center/South & Southwest. Dr Ward is currently Vice President of the U.S. National Committee of the International Water Resources Association and is the co-founder and Editor-in-Chief of the international journal, *Environmental Toxicology and Chemistry.* Dr Ward earned his PhD from Cornell University. He also earned the Master of Public Health in environmental health from The University of Texas School of Public Health.

Foreword

Each human generation chooses not only its place on the planet, but also the state of the planet it will leave in its place. If trends persist, the legacy of the current occupants will be mixed. Some but not all of our descendants will enjoy increased material well-being and opportunities for fulfilling lives, and the world as a whole will be a warmer, more crowded, more consuming, less biologically diverse, and more stressed place. These latter trends can not be supported indefinitely. They will limit the choices of future generations, and they will affect the developed as well as the developing countries. Within the early decades of the next century, there must be a transition to a new path of human development. Shifting course will require that people meet their wants and needs in ways that move away from degrading the planet's life support systems towards sustaining and restoring those systems, and that move away from widening disparities in human welfare towards improved living standards worldwide that reduce or eliminate hunger and poverty. We need to begin to pursue this path today, if we are to leave a more sustainable world for future generations.

How can we make better choices about environment and development to achieve the goals of sustainable development? Consider, for example, the requirements for meeting the goal declared at the World Food Summit of 1996 of reducing the number of undernourished people to half their present level of approximately 800 million no later than 2015. This goal can be achieved only with significant expansion of and efficiency in agricultural production and food distribution in developing countries. Thus, we need to utilize the advances of the modern biological revolution as well as gain a better understanding of the interactions among the natural and social factors affecting agricultural production and food

distribution. These include soil fertility loss, climate change, air and water quality changes, increasing pesticide resistance, and the range of policies (e.g., for land-use, transportation, energy, market regulation) that influence land management, economies, incentives, and behaviors.

But knowledge by itself is not enough. We must diffuse this knowledge and the ability to use it around the world to advance the prospects of all people for sustainable development. We need to connect what is known to be wise long-term behavior to the everyday decisions we all make and the actions we take. This requires a life-long, intergenerational process of learning and adapting amidst times of turbulence and surprise. Frequent monitoring will be needed to help seize opportunities, respond to threats, and take corrective steps. Science provides much of the knowledge that we need for action. Thus, it is essential that the scientific and technical communities exert leadership in the production and dissemination of the knowledge required to influence choices about the environment and development and to set us on a course toward sustainability.

In late 1994, with the generous support of Mr George P. Mitchell, Chairman and Chief Executive Officer, Mitchell Energy and Development Corporation, the National Academy of Sciences embarked on a Global Commons Project, the goals of which center on sustainable development. The project is being conducted in cooperation with the Houston Advanced Research Center (HARC) and includes a number of activities of both institutions. HARC seeks to engage the private sector in advancing the application of sustainability concepts in business practices and industrial production. This volume, which is built upon the foundation of a conference hosted by Rice University in March 1997 on 'Sustainable Development: Managing the Transition,' represents a contribution of HARC and Rice University to the overall effort.

The Academy complex – the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine – with its broad ability to reach into the scientific, medical, and engineering communities both nationally and internationally, is conducting individual studies of sustainability concerned with fisheries, land use, Middle East water supply, and megacities, as well as a comprehensive assessment of the knowledge requirements for a successful transition to sustainability in the early years of the next century. All of these findings will be presented at a Year 2000 Conference on the worldwide transition to sustainability being sponsored by the InterAcademy Panel on Interna-

tional Issues, an umbrella organization for the world's science academies. Through such activities, the Academy seeks to illuminate the critical issues in development, promote science-based responses, and encourage greater involvement of the scientific and technical communities worldwide in working with governments, the private sector, and international organizations and institutions to shape a sustainable future.

The sustainable fisheries project aims to evaluate whether current marine-capture fisheries are sustainable, determine to what degree marine ecosystems are affected by fishing, and assess whether an ecosystem approach to fishery management can help achieve sustainability. The study of the relationship between population and land use is being conducted in partnership with the Chinese Academy of Sciences and the Indian National Science Academy, using case studies of the Pearl River Delta and the Jitai Basin in China; Kerala and the Haryana Punjab in India; and the Florida Everglades and Chicago in the United States. The range in population and land use policies, social and economic status, and histories of development at these six sites provides a diversity that is important for designing creative practical strategies that address the problems of population pressure on land use. An international committee of experts is carrying out a study of sustainable water supplies for the Middle East, focusing on methods developed in the Middle East and elsewhere for avoiding over-exploitation of water resources, and exploring relationships between water supply enhancement and preservation of environmental quality. The study is considering the scientific and technological aspects of such issues as treating municipal wastewater for irrigation and other purposes, desalination, water harvesting, restoration of degraded water bodies, ground water contamination cleanup, and opportunities offered by improved conservation technologies to enhance water quality and prevent resource degradation. The study evaluating sustainable economic development in the rapidly growing megacities of the world focuses on four major issues for megacities: urban employment opportunities; technologies for affordable housing; sustainable water and sanitation services; and affordable, less-polluting transportation. Initial findings and recommendations were presented at the United Nations Conference on Human Settlements (Habitat II) in Istanbul in June 1996.

Last but not least, an overall vision for exploring a sustainable future is being scoped by our Board on Sustainable Development in a far reaching study to develop a research agenda for a transition to sustainability in the

twenty-first century. In the Board's view, a successful sustainability transition would require that the world provide the energy, materials, and knowledge to feed, house, nurture, educate, and employ many more people than are alive today – while preserving the basic life support systems of the planet and reducing hunger and poverty. Such a profound and unprecedented transition has no charted course. Science can help provide direction by identifying the energy, materials, and knowledge requirements for the transition; the crucial indicators of unsustainability; the levers of change to move us towards sustainability; and the measurements needed to report on our progress.

The Board's approach is unique. It focuses on the time period of the next two generations when the most important transitions, especially the leveling off of population, will be taking place, and a time when action can make a real difference for outcomes. It chooses a science base rather than politics for determining the needs and requirements for changing the course of human development. It identifies a set of normative goals for meeting human needs, based on international agreements rather than moral decisions. It discusses social and environmental challenges together rather than as separate elements of the development conundrum. It describes a science and technology agenda that draws upon all branches of science – the natural, social and medical sciences, plus engineering. And, it identifies new technologies and institutional needs, as well as tools and incentives, to facilitate social learning and adaptive management. This report was published in late 1999.

Like the Board's report, the present volume explores ways of thinking about the future. It describes how humanity has responded to the challenges of global change with prospects for sustainable development. The contributors represent broad disciplinary expertise and have diverse views of what the future holds. Their efforts reinforce an important lesson. Only with a greatly increased sharing of ideas and solutions – among all sciences, all sectors, all institutions, and all people – will we be able to strengthen our ability to leave behind a sustainable world full of robust possibilities for the many generations to come.

Bruce Alberts
President
National Academy of Sciences

Preface

One of the most important topics for the twenty-first Century is *sustainable development* – development that meets the needs of the present without foreclosing the needs and options of future generations. Sustainable development is a comprehensive concept involving many disciplines, giving it both a philosophical base and a pragmatic approach. It appeals to a wide range of interests from nations to corporations to stakeholders because it combines economic development and environmental protection into a single system.

As the global community enters into the next phase of the evolution of sustainable development, making the transition from theory to action will be the next great challenge. World population is expected to double within the next 50 years, placing enormous demands on resources for food, shelter, and energy. Innovative solutions, incorporating the concepts of sustainable development, must be developed and implemented to mitigate these impending economic and environmental uncertainties and to guide society through the resulting period of transition. Examining this shift from theory to action and developing a plan of action was the framework of the De Lange♦Woodlands Conference, which was held March 3–5, 1997 in the Alice Pratt Brown Hall at Rice University in Houston, Texas.

The conference was organized by the Energy and Environmental Systems Institute at Rice University and the Center for Global Studies at the Houston Advanced Research Center in The Woodlands, in partnership with the National Academy of Sciences and the James A. Baker III Institute for Public Policy at Rice University. A distinguished group of world leaders were invited to participate in six conference sessions over a three day period: (1) Sustainable Development: Defining the Twenty-first

Century Challenges; (2) Achieving Ethical and Equitable Leadership; (3) Scientific Issues and Uncertainty in Decision Making; (4) Market Tools: Trade, Pricing, and Signals; (5) Stakeholders, Empowerment, and Dispute Resolution; and (6) Charting the Roadmap: Institutions, Leadership, and Policies. The conference, attended by over 500 people, provided an international forum for vigorous debate of sustainable development issues and timely analysis of the state-of-progress of sustainable development thought and action. Conference papers were published in a proceedings (*Sustainable Development: Managing the Transition*, De Lange♦ Woodlands Conference, Rice University, Houston TX, 639 pp, 1997).

The De Lange endowment at Rice University was established by Mr and Mrs C.M. Hudspeth in 1991, in memory of her parents, Albert and Demaris De Lange, for the purpose of organizing conferences at Rice featuring top ranked experts and major world figures to address topics of great concern to society. Past De Lange conferences have focused on Julian Huxley, 1887–1975 (1987), Human Impact on the Environment (1991), and Biotechnology: Science, Engineering, and Ethical Challenges for the 21st Century (1994). The Woodlands Conference Series was founded by oilman and developer George P. Mitchell in 1974. Five Woodlands conferences have been held, all dealing with various aspects of global change and sustainable development. At each conference, the George and Cynthia Mitchell Prize for Sustainable Development was awarded. The 1997 prize winners were Marcelo de Andrade from Brazil and nine young scholars from around the world.

This volume is not a proceedings, but it is a product of the De Lange♦ Woodlands Conference. A distinguished speaker from each of the conference sessions was commissioned to write a chapter highlighting important features of each session but stressing his or her own insights, experience, and conclusions. We hope the product of their labors and our efforts to bring this volume together will contribute to a continuing international dialog on sustainable development.

C.H. Ward
Jürgen Schmandt