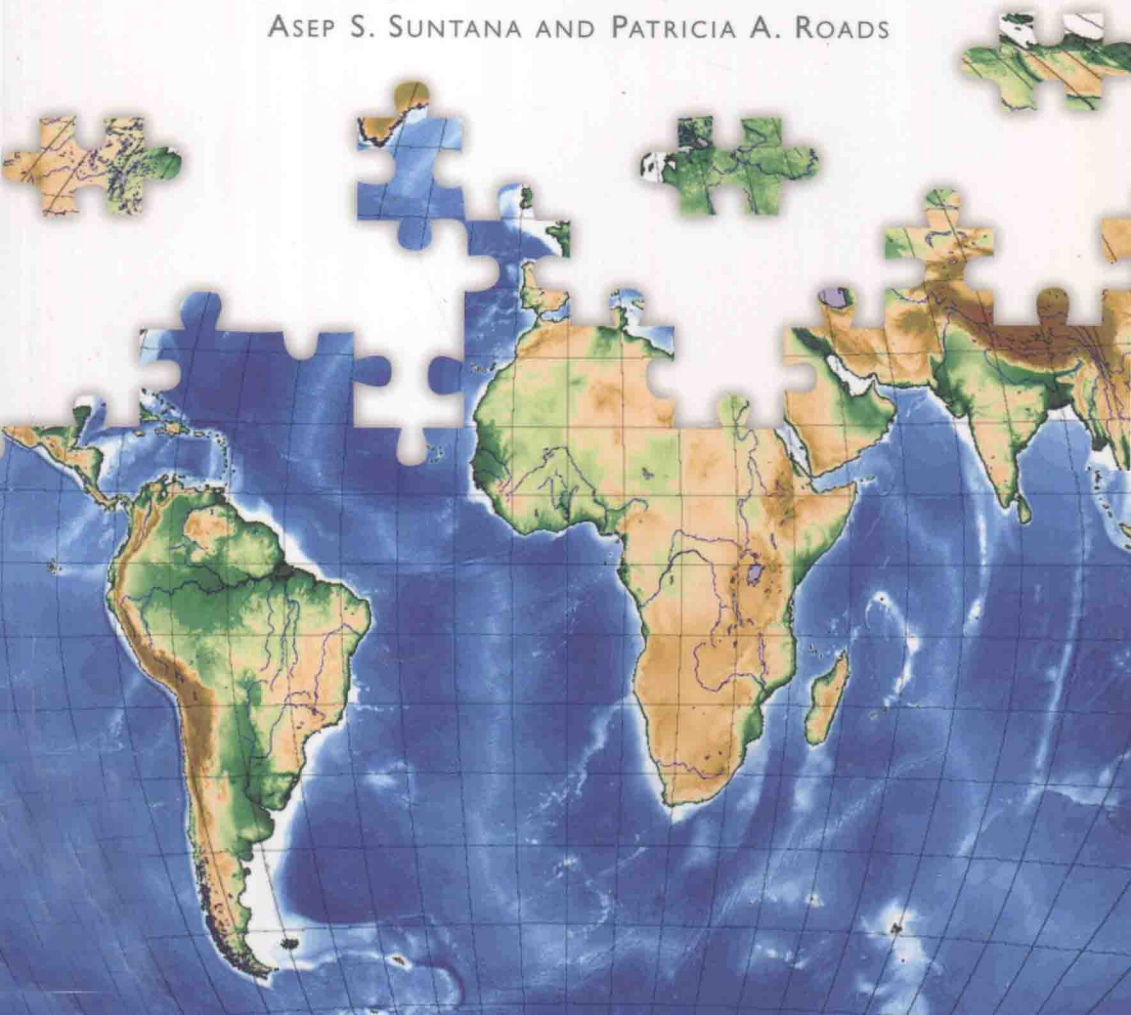
SUSTAINABILITY UNPACKED

FOOD, ENERGY AND WATER FOR RESILIENT ENVIRONMENTS AND SOCIETIES

KRISTIINA A. VOGT, TORAL PATEL-WEYNAND, MAURA SHELTON, DANIEL J. VOGT, JOHN C. GORDON, CALVIN T. MUKUMOTO, ASEP S. SUNTANA AND PATRICIA A. ROADS



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TORAL PATEL-WEYNAND is an Affiliate Associate Faculty at the University of Washington and an Associate of the Forest Systems and Bioenergy, UW. Before taking up her current position as a Senior Policy Adviser at the US Forest Service in Reston, Virginia, she was a biologist in the US Geological Survey, BRD/Biological Informatics group. She supervised and managed the International Biological Informatics Group and engaged in cooperation through multilateral and bilateral activities and professional meetings. She also coordinated the International Program to address gaps in conservation networks and assist in developing bilateral and regional initiatives that help link biological networks and databases to geospatial information systems to improve the predictive capability of models which aid in policy formulation and decision making. She served as co-lead on the Pacific Biodiversity Information Facility and the Ocean Biogeographic Information Network and works closely with Japan, Australia and New Zealand and Pacific Island Countries both bilaterally and in multilateral fora on biological data sharing. She also served as the US delegation lead to the United Nations Environment Programme (UNEP) on Strengthening the Scientific Base of UNEP. Prior to this, she served as technical adviser to the Department of State and as USGS liaison on Cooperation with the Rio Conventions, including the UN Convention on Biological Diversity, Convention to Combat Desertification, the Ramsar Convention on wetlands and the UN Framework Convention on Climate Change, as well as other international initiatives and organizations such as UNEP, the International Union of Forest Research Organizations/Global Forest Information Service (IUFRO/GFIS) and the Arctic Council, among others. From 2001 to 2004 she was the Senior Science Policy analyst for the US Department of State, Bureau of Oceans, Environment and Science, Office of Global Change, Washington, DC. She has a BA in Economics from Bombay University in India, a BA from Temple University in Pennsylvania, an MS (Environmental Policy and Planning) from George Washington University in Washington, DC and a PhD (Ecosystem Ecology) from Yale University. She has co-authored or edited several books including *Forests and Society: Sustainability and Life Cycles of Forests in Human Landscapes* (CABI) and *Ecosystems: Balancing Science with Management* (Springer-Verlag).

MAURA SHELTON is a Research Associate with the Forest Systems and Bioenergy Program in the School of Forest Resources, College of the Environment, at the University of Washington. She is presently a National Science Foundation IGERT Bioenergy Fellow developing geospatial techniques to determine appropriate sites from sustainable biomass removal while considering include cultural attributes. She is developing the decision tools for determining how biomass can be removed from forests without impairing their resiliency to disturbances and to maintain their provision of ecosystem services. She is also coordinating the capacity of indigenous communities in the Philippines and in Indonesia, as well as American Indian tribes, to manage their own energy systems and to determine how much forest material can be sustainably collected. She has previous experience working on capacity-building in the Philippines and in

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DANIEL J. VOGT is Associate Professor in Soils and Ecosystem Ecology of the School of Forest Resources, College of the Environment and came to the University of Washington in July 2000 from Yale University. He is also the co-coordinator of the Forest Systems and Bioenergy program at the School of Forest Resources, University of Washington. At the School of Forestry and Environmental Studies at Yale, was a teaching faculty member in Ecosystem Ecology and Forest Soils and also the Director of the Greeley Analytical Laboratory. Professor Vogt received degrees from New Mexico State University (Biology BS, 1968; Agronomy MS, 1976) and from the University of Washington (Forest Resources PhD in 1987). He is an internationally-recognized scholar with over 50 author credits, including co-authorship of books on *Ecosystems: Balancing Science with Management* (Springer, with a Chinese translation), *Forest Certification: Roots, Issues, Challenges and Benefits* (CRC Press) and *Forests and Society: Sustainability and Life Cycles of Forests in Human Landscapes* (CABI Publishing). His research interests include studies on many different ecosystems from around the world including boreal, temperate and tropical biomes. He is also currently a senior consultant of Interforest LLC, a sustainable forestry consulting firm and a partner in a start-up bioenergy company, Renewol, which employs a mobile generator that uses low quality wood and cellulosic waste to produce methanol.

JOHN C. GORDON was Chairman of Interforest LLC, a sustainable forestry consulting firm and a founder of the Candlewood Timber Group Inc., a sustainable forestry company with forestland and operations in Argentina. He is also Pinchot Professor Emeritus of Forestry and Environmental Studies at the Yale School of Forestry and Environmental Studies, where he was Dean from 1983 to 1992 and again in 1997–98. Before that he was Head and Professor, Department of Forest Science at Oregon State University; Professor of Forestry at Iowa State University; and Principal Plant Physiologist in the Pioneering Project in Wood Formation, USDA Forest Service, Rhinelander, Wisconsin. He has a BS (Forest Management) and a PhD (Plant Physiology and Silviculture) from Iowa State University and has been a Fulbright Scholar in Finland (University of Helsinki) and India (GKVK State Agricultural University, Bangalore). His primary expertize is in the biological basis of forest productivity, the management of research and forest policy and management. He has consulting experience with public and private organizations including forest product firms, the Intertribal Timber Council, the World Bank and the United Nations Development

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Preface

Sustainability and adaptability are interdependent, essential traits of human history recorded on the Earth, which itself is dynamic. Sustainability, as a stand-alone trait or circumstance, may suggest a static condition, which, of course, is absolutely impossible in terms of the physical–chemical–biological processes that operate on and in the Earth.

Furthermore, sustainability is similar to hitting a moving target, in no small measure due to the ever-increasing population. The question must be raised: how many humans can the Earth sustain under the unavoidable constraints of climates and soils? These unavoidable constraints control the globe's productive capacity and set the boundaries for how much the human capital can be developed. It is not too early to do more than think about this pressing problem. It is time to formulate some proposals for serious consideration to achieve sustainability in practice. We hope this volume contributes towards the formulation of new proposals to sustainably produce and consume resources that also maintain societal adaptability in the face of dynamic environments and climates.

This volume addresses the survival necessities of life, in particular as they relate to humans – food, water and energy, with emphasis on their dependence on forests. It may be suggested that another necessity for survival is luck, as noted by Hsu (1986). Luck will not be discussed in our book but unpacking sustainable principles should help societies to make the necessary trade-offs to improve decision making.

When resources are considered, it is important to distinguish the two end-members – renewable, represented by biofuels and non-renewable, represented by fossil fuels. Products of both should be considered as creative wealth, as opposed to distributive wealth, represented by the monetary institutions, among others. Resource providers are producers, hopefully with responsible consideration of the ecosystems and they share that responsibility with those who are totally consumers of resources.

This book explores and decodes the interlinking and complex elements of sustainability so that resource use and human development strategies can maintain resilient environments and societies at a country level. Historical examples are used to provide insights into the characteristics of sustainability principles. These are followed by examining how 34 selected countries (advanced-, emerging- and growing-economy) have approached the sustainable

acquisition of energy, food, forest materials and water for their citizens, while being part of the global economy. We shall present and compare several indices developed by international organizations (such as population levels, percentage of people living in rural areas and dependence on fossil fuels), that are being used to rank countries as to their sustainability or vulnerability to environmental and societal changes, for these 34 countries. These climatic, environmental and resource use indices will be explored for their utility in explaining how a country's resource footprints contribute to its ranking in the environmental and climatic index groupings.

Country-level index data, supplemented by data on energy, food, forests and water uses are examined to demonstrate how the elements of sustainability vary among the countries. The country-level data include:

- climatic conditions;
- forest and agriculture productivity as well as their contribution to the GDP;
- the bio-resource productive capacities of the lands;
- fossil- and non-fossil energy consumption;
- carbon dioxide (CO_2) emissions during economic development;
- the importance of bio-resources in the economy;
- food consumption;
- renewable water availabilities and sources;
- soil quality and productive capacities;
- climate risk events.

These analyses are also used to demonstrate what makes a country resilient in its consumption of the four essential resources (food, forests, water and energy) and how appropriate it is to use higher human developed countries (such as Scandinavian countries) as models of sustainability. These data demonstrate that growing-economy countries should not necessarily follow the models developed in industrialized countries for the acquisition of the four essential resources. This is mainly due to the facts that we do not have new frontiers from which to acquire additional resources; our energy supplies are diminishing; and society has to adapt to changing climates. Therefore, for emerging-economies, their resource management and acquisition options should be geared towards efficient resource uses and the adoption of appropriate new technologies that may help them avoid the errors made previously by other countries. We also make a case that the sustainable use and management of forests will be important for those countries wanting to have resilient societies and environments.

By recognizing the links and feedbacks that exist within human landscapes, we hope to suggest how human behaviour can be modified and to emphasize the trade-offs that may have to be made in resource uses. It is important that we move beyond decisions that make us feel good or provide us significant short-term economic return, but have absolutely minimal ability to maintain long-term social and environmental resiliency. We need to move beyond special-interest group decisions, driven by their personal values or even greed, to make informed

decisions that allow for the human development potential to increase, without damaging the environment or human health. We hope this book will contribute to this goal.

We have developed here a comprehensive analysis that allows us to identify (1) the factors that can be managed and (2) when society needs to adapt if it wants to reach a higher human development potential. In addition, we also realize that the decoding of sustainability has to be grounded in scientific knowledge and to include the volumes of information that society has accumulated throughout its history. By simultaneously combining both a historical and a current perspective to explore resource and human development choices made by countries, it will be easier to begin to unpack the elements of what it means to be sustainable. This, we hope, is the value of a book like ours.

The authors really want to express our appreciation to Dr. John W. Shelton for his invaluable discussions, making us aware of pertinent literature, and for his editorial help that allowed us to maintain a balanced and credible discussion of fossil and renewable energy supplies for the countries included in our book. Dr. John W. Shelton is a Professor Emeritus of Geology from Oklahoma State University, and Founder and Editor of American Association of Petroleum Geologists Online Journal.

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List of Figures and Tables

Figures

Tables

Contents