

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/277889868>

Handbook of Sustainable Development

Book · January 2014

CITATIONS

94

READS

22,792

4 authors, including:



[Giles Atkinson](#)

The London School of Economics and Political Science

97 PUBLICATIONS 7,473 CITATIONS

[SEE PROFILE](#)



[Eric Neumayer](#)

The London School of Economics and Political Science

270 PUBLICATIONS 21,917 CITATIONS

[SEE PROFILE](#)



[Matthew Agarwala](#)

The London School of Economics and Political Science

34 PUBLICATIONS 697 CITATIONS

[SEE PROFILE](#)

HANDBOOK OF SUSTAINABLE DEVELOPMENT



Handbook of Sustainable Development

Second Edition

Edited by

Giles Atkinson

Professor of Environmental Policy, Department of Geography and Environment and Associate, Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science, UK

Simon Dietz

Co-Director, Grantham Research Institute on Climate Change and the Environment, Director, ESRC Centre for Climate Change Economics and Policy, and Associate Professor, Department of Geography and Environment, London School of Economics and Political Science, UK

Eric Neumayer

Professor of Environment and Development, Department of Geography and Environment and Associate, Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science, UK

Matthew Agarwala

Senior Research Associate at Centre for Social and Economic Research on the Global Environment (CSERGE), University of East Anglia and Doctoral Researcher at Department of Geography and Environment, London School of Economics and Political Science, UK

Edward Elgar

Cheltenham, UK • Northampton, MA, USA

© Giles Atkinson, Simon Dietz, Eric Neumayer and Matthew Agarwala 2014

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means, electronic, mechanical or photocopying, recording, or otherwise without the prior permission of the publisher.

Published by
Edward Elgar Publishing Limited
The Lypiatts
15 Lansdown Road
Cheltenham
Glos GL50 2JA
UK

Edward Elgar Publishing, Inc.
William Pratt House
9 Dewey Court
Northampton
Massachusetts 01060
USA

A catalogue record for this book
is available from the British Library

Library of Congress Control Number: 2014932522

This book is available electronically in the ElgarOnline.com
Economics Subject Collection, E-ISBN 978 1 78254 470 8



ISBN 978 1 78254 469 2

Typeset by Servis Filmsetting Ltd, Stockport, Cheshire
Printed and bound in Great Britain by T.J. International Ltd, Padstow

Contents

<i>List of editors</i>	ix
<i>List of contributors</i>	xi
<i>Preface</i>	xxvii
<i>Acknowledgements</i>	xxix

1 Introduction	1
<i>Giles Atkinson, Simon Dietz, Eric Neumayer and Matthew Agarwala</i>	

PART I FUNDAMENTALS OF SUSTAINABLE DEVELOPMENT

2 Comprehensive wealth accounting and sustainable development	25
<i>Kirk Hamilton and Esther Naikal</i>	
3 Sustainable development in ecological economics	41
<i>Jeroen C.J.M. van den Bergh</i>	
4 Strong sustainability and critical natural capital	55
<i>Paul Ekins</i>	
5 Ecosystems as assets	72
<i>Edward B. Barbier</i>	
6 Ecological and social resilience	91
<i>W. Neil Adger and Jennifer Hobdod</i>	

PART II EQUITY ACROSS GENERATIONS

7 Ethics and sustainable development: the virtues of an adaptive approach to environmental choice	105
<i>Bryan G. Norton and Allen Thompson</i>	
8 Equitable intergenerational preferences and sustainability	125
<i>Geir B. Asheim</i>	
9 Evaluating impacts in the distant future: cost–benefit analyses, discounting and the alternatives	140
<i>Cameron Hepburn and Greer Gosnell</i>	
10 Weak sustainability, conservation and precaution	160
<i>Alan Randall</i>	

PART III EQUITY WITHIN GENERATIONS

- | | | |
|----|---|-----|
| 11 | Distribution, sustainability and environmental policy
<i>Geoffrey Heal and Bengt Kriström</i> | 175 |
| 12 | Environmental justice and sustainability
<i>Julian Agyeman</i> | 188 |
| 13 | Vulnerability, poverty and sustaining well-being
<i>W. Neil Adger and Alexandra Winkels</i> | 206 |
| 14 | Human wellbeing and sustainability: interdependent and intertwined
<i>J. Allister McGregor</i> | 217 |

PART IV GROWTH, CONSUMPTION AND NATURAL CAPITAL

- | | | |
|----|---|-----|
| 15 | Green growth
<i>Alex Bowen</i> | 237 |
| 16 | Economic growth and the environment
<i>Matthew A. Cole and Andrea Lucchesi</i> | 252 |
| 17 | The resource curse and sustainable development
<i>Richard M. Auty</i> | 267 |
| 18 | Sustainable consumption
<i>Tim Jackson</i> | 279 |
| 19 | Population and sustainability
<i>Geoffrey McNicoll</i> | 291 |
| 20 | Technological lock-in and the role of innovation
<i>Timothy J. Foxon</i> | 304 |

PART V PROGRESS IN MEASURING SUSTAINABLE DEVELOPMENT

- | | | |
|----|--|-----|
| 21 | Environmental accounting
<i>Glenn-Marie Lange</i> | 319 |
| 22 | Genuine saving as an indicator of sustainability
<i>Kirk Hamilton and Esther Naikal</i> | 336 |
| 23 | Measuring sustainable economic welfare
<i>Philip Lawn</i> | 348 |
| 24 | Ecological Footprint accounts
<i>Mathis Wackernagel, Gemma Cranston, Juan Carlos Morales and Alessandro Galli</i> | 371 |

PART VI THE INTERNATIONAL SETTING

- | | | |
|----|--|-----|
| 25 | International trade and sustainable development
<i>Louis Dupuy and Matthew Agarwala</i> | 399 |
| 26 | International environmental cooperation
<i>Carlo Carraro</i> | 418 |
| 27 | The international politics of sustainable development
<i>John Vogler</i> | 432 |
| 28 | Financing for sustainable development
<i>Samuel Fankhauser and David Pearce</i> | 446 |

PART VII DIMENSIONS OF SUSTAINABILITY

- | | | |
|----|---|-----|
| 29 | Climate change adaptation: a risk-management approach
<i>Gary W. Yohe</i> | 463 |
| 30 | Linking climate change mitigation research to sustainable development
<i>Ottmar Edenhofer, Susanne Kadner, Christoph von Stechow,
Gregor Schwerhoff and Gunnar Luderer</i> | 476 |
| 31 | Sustainable development of water resources
<i>Matthew Agarwala and Tony Allan</i> | 500 |
| 32 | Sustainable agriculture
<i>Clement A. Tisdell</i> | 517 |
| 33 | Sustainable energy policy
<i>Richard Green, Yacob Mulugetta and ZhongXiang Zhang</i> | 532 |
| 34 | Sustainable cities and local sustainability
<i>Yvonne Rydin</i> | 551 |
| 35 | Corporate social responsibility, sustainability and the governance of
business
<i>Andy Gouldson, Rory Sullivan and Stavros Afionis</i> | 564 |

1/2 Index 577



Editors

Giles Atkinson is Professor of Environmental Policy in the Department of Geography and Environment at the London School of Economics and Political Science (LSE). He is also currently Co-Lead of the work programme on Resource Security in LSE's Grantham Research Institute on Climate Change and Environment. Giles has published extensively on sustainable development and natural capital accounting including the monographs *Measuring Sustainable Development* (with Kirk Hamilton, David Pearce and others) and *Wealth, Welfare and Sustainability* (with Kirk Hamilton). He is a member of the UK Natural Capital Committee (NCC) established in 2012 to advise HM Government in the UK where and how natural assets are being used unsustainably. Giles is also a member of the Policy and Technical Experts Committee for the World Bank's WAVES Partnership (Wealth Accounting and the Valuation of Ecosystems Services) and the Advisory Board for TEEB (The Economics of Ecosystems and Biodiversity Review).

Simon Dietz is one of the founders and is a current Co-Director of the Grantham Research Institute on Climate Change and the Environment at the London School of Economics and Political Science (LSE), where he is also Director of the ESRC Centre for Climate Change Economics and Policy, and Associate Professor in the Department of Geography and Environment. His research interests range from climate change to biodiversity and from decision theory to the theory of economic growth. In 2006–2007 he was an analyst at the UK Treasury on the Stern Review on the Economics of Climate Change, and played a leading role in the Review's modelling of the 'cost of inaction'. He sits on the editorial board of the *Journal of Environmental Economics and Management*.

Eric Neumayer is Professor of Environment and Development at the London School of Economics and Political Science (LSE). He is currently the Head of the Department of Geography and Environment. He has broad research interests, with main interests in environmental economics, international political economy and research methods. He has published widely in a range of journals across different social science disciplines and is the author of three books, including *Greening Trade and Investment: Environmental Protection without Protectionism* (Earthscan, 2001) and *Weak versus Strong Sustainability: Exploring the Limits of Two Opposing Paradigms* (4th edition, Edward Elgar, 2013). He is an editorial board member of *Ecological Economics*, *Global Environmental Change* and *Review of International Organizations*.

Matthew Agarwala is Senior Research Associate at the Centre for Social and Economic Research on the Global Environment (CSERGE), at the University of East Anglia (UEA) and a PhD candidate in Environmental Economics at the Department of Geography and Environment and the Grantham Research Institute on Climate Change and the Environment at the London School of Economics (LSE). His research interests include the economics of water and virtual water, natural capital and comprehensive wealth accounting, and sustainable development. Matthew has taught at McMaster

x *Handbook of sustainable development*

University, King's College London, and the LSE. He holds combined honours degrees in Economics and Political Science (*summa cum laude*) and a Masters in Economic Policy from McMaster University in Canada, where he had the distinct privilege of studying under Professor Atif Kubursi.

Contributors

W. Neil Adger is a Professor in Geography at the University of Exeter. He researches dimensions of sustainable development, including the challenges of global environmental change, institutional- and ecological-economic dimensions, and the science of resilience. He is a member of the Resilience Alliance, a global network of natural and social scientists dedicated to investigating ecological and social resilience as a basis for sustainability. His books are *Governing Sustainability* (CUP, 2009) and *Adapting to Climate Change: Thresholds, Values, Governance* (CUP, 2009).

Stavros Afionis is a postdoctoral research fellow in the Sustainability Research Institute (SRI) at the University of Leeds. His research interests focus on the role of the European Union in international climate change politics and governance, and on its efforts to encourage the sustainable production and consumption of biofuels in the Common Market. His work has appeared in journals such as *Nature Climate Change* and *Environmental Politics*.

Julian Agyeman is a Professor in the Department of Urban and Environmental Policy and Planning at Tufts University, Boston/Medford, USA. He is an environmental social scientist whose expertise and current research interests are in the complex and embedded relations between humans and the environment, whether mediated by institutions or social movement organizations, and the effects of this on public policy and planning processes and outcomes, particularly in relation to notions of justice and equity. He is co-founder and editor of the international journal *Local Environment: The International Journal of Justice and Sustainability*. With over 150 publications, his books include *Just Sustainabilities: Development in an Unequal World* (MIT Press, 2003); *Sustainable Communities and the Challenge of Environmental Justice* (NYU Press, 2005), *Cultivating Food Justice: Race, Class and Sustainability* (MIT Press, 2011) and *Introducing Just Sustainabilities: Policy, Planning and Practice* (Zed Books, 2013). He was founder in 1988 of Britain's Black Environment Network (BEN) and is currently a member of: the Advisory Board of the Center for Diversity and the Environment (2009); the Board of Directors of The Massachusetts Audubon Society (2009–) and is on the editorial board of several journals.

Tony Allan is globally recognized as a pioneer in the development of key concepts in the understanding and communication of water issues and how they are linked to agriculture, food, climate change, economics and politics. He was awarded the prestigious Stockholm Water Prize in 2008, the Florence Monito Water Prize in 2013 and the Monaco Water Prize in 2013. He is a Corresponding Member of the Academy of Sciences of Spain. Tony Allan's research focuses on the social and political contexts which influence and usually determine water use and water policy. The research aims to explain why environmental and economic priorities fail to figure on the agenda of those using and allocating water. The major current research focus takes into account the underlying fundamentals of water in the hydrological cycle and the impact of engineering interventions. Policy

issues are a prime concern and especially the difficulties that scientists and professionals encounter in gaining a place for their 'knowledge' in water policy discourses. In the Middle East and North Africa, a major regional focus of research, it has been shown that the water crisis has been ameliorated through the availability of virtual water embedded in the international food trade. Tony is Emeritus Professor in the Department of Geography at King's College London.

Geir B. Asheim has been Professor of Economics at the University of Oslo since 1994. He received his PhD in Economics at the University of California, Santa Barbara in 1979 and has had longer visits to several US universities, including Cornell, Harvard, Northwestern and Stanford. His main research fields are: (1) game theory, in which he has published the book *The Consistent Preferences Approach to Deductive Reasoning in Games* (2006) in addition to a number of journal articles (one awarded the Royal Economic Society Prize); and (2) intergenerational equity, in which he has published numerous articles during the last 25 years. Geir B. Asheim is currently working on axiomatic analysis of intergenerational equity, motivated by the need to resolve the intergenerational conflict that climate change leads to.

Richard M. Auty is Professor Emeritus of Economic Geography at Lancaster University. He has advised many agencies on economic development issues, including the World Bank, EBRD, UNCTAD, IUCN, DFID, the US State Department, Chatham House and KIET. His research interests include resource-driven development, industrial policy and the political economy of development. His books include: *Energy Wealth and Governance in the Caucasus and Central Asia* (Routledge, 2006); *Resource Abundance and Economic Development* (Oxford University Press, 2004); *Sustainable Development in Mineral Economies* (Oxford University Press, 1998, with R.F. Mikesell); *Patterns of Development: Resource Endowment, Development Policy and Economic Growth* (Edward Arnold, 1995); *Economic Development and Industrial Policy: Korea, Brazil, Mexico, India and China* (Mansell, 1994); and *Resource-Based Industrialization: Sowing The Oil In Eight Developing Countries* (Clarendon Press, 1990).

Edward B. Barbier is the John S. Bugas Professor of Economics, Department of Economics and Finance, University of Wyoming. His main expertise is natural resource and development economics as well as the interface between economics and ecology. He has served as a consultant and policy analyst for a variety of national, international and non-governmental agencies, including many UN organizations and the World Bank. Professor Barbier is on the editorial boards of several leading economics and natural science journals, and he appears in the 4th edition of *Who's Who in Economics*. He has authored over 200 peer-reviewed journal articles and book chapters, written or edited 21 books, and published in popular journals. His books include *Blueprint for a Green Economy* (with David Pearce and Anil Markandya, 1989), *Natural Resources and Economic Development* (2005), *A Global Green New Deal* (2010), *Scarcity and Frontiers: How Economies Have Developed Through Natural Resource Exploitation* (2011), *Capitalizing on Nature: Ecosystems as Natural Assets* (2011) and *A New Blueprint for a Green Economy* (with Anil Markandya, 2012).

Alex Bowen joined the new Grantham Research Institute on Climate Change and the Environment at the London School of Economics in Autumn 2008 as a Principal

Research Fellow. His research interests include the design of public policies to reduce greenhouse gas emissions, 'green' growth and the macroeconomic and labour market aspects of climate-change policies. He has been a consultant to the EBRD, OECD, World Bank, ADBI, UK DFID and UK DECC. Alex has a BA in Economics from Cambridge University and a PhD in Economics from the Massachusetts Institute of Technology, where he studied on a Kennedy Scholarship. Trained initially as a labour and development economist, he first worked at Brunel University and then the Centre for Labour Economics at the LSE. Alex has long been involved in aspects of economic policy, having worked as an economist in the Bank of England for sixteen years, most recently as Senior Policy Adviser. He had responsibility successively for the Bank's *Inflation Report* and *Financial Stability Review*. He first became involved in climate change issues when seconded as Senior Economist to the team that produced the *Stern Review of the Economics of Climate Change* in 2006.

Carlo Carraro is President of the Università Ca' Foscari Venezia, where he is also Professor of Environmental Economics and Econometrics. He holds a PhD from Princeton University. In 2008, he was elected Vice-Chair of Working Group III and Member of the Bureau of the Nobel Laureate Intergovernmental Panel on Climate Change (IPCC). He has been working as IPCC Lead Author since 1995. Professor Carraro is Chairman of the Scientific Advisory Board of the Fondazione Eni Enrico Mattei, Director of the Climate Impacts and Policy Division of the Euro Mediterranean Centre for Climate Change (CMCC), and Director of the International Centre for Climate Governance (ICCG). He is a member of the Green Growth Knowledge Platform (GGKP) Advisory Committee and of the International Advisory Board of the Harvard Environmental Economics Program (HEEP). He is also a member of the Scientific Committee of the International Human Dimensions Programme (IHDP) and of the Ifo Institute for Economic Research, Munich. He is a research fellow of the CEPR (Center for Economic Policy Research), London, CESifo (Center of Economic Studies), Munich, and Associate Research Fellow, CEPS (Center of Economic Policy Studies), Brussels.

Matthew A. Cole is a Professor of Environmental Economics in the Department of Economics, University of Birmingham. His research interests are in the broad area of 'globalization and the environment' and more specifically, the impact of trade, economic growth and investment flows on the environment and the role played by differences in environmental regulations. He is the author of over 50 journal articles, books and book chapters and is currently a co-editor of the leading environmental economics journal, the *Journal of Environmental Economics and Management*.

Gemma Cranston is a Programme Manager at the University of Cambridge Programme for Sustainability. Gemma works within the Natural Capital Leaders Platform which brings together influential companies with a global reach to work on addressing the impacts of ecosystem and natural capital loss and degradation on business, their customers and wider society. Previously, she was the Lead Scientist for the Global Footprint Network, leading projects out of the Geneva office as well as supporting the organization's Research and Standards Department by contributing to research on the Ecological Footprint methodology, projects and applications. Gemma completed her PhD in the Department of Mechanical Engineering at the University of Bath, UK in 2010. She also

earned a Masters of Aerospace Engineering at the same institution. Her research areas include ecological and carbon footprints, assessing the determinants behind the footprint and studying the differences between high-income and low-income countries.

Louis Dupuy obtained an MSc in International Banking and Finance at the University of Birmingham, UK, and a Magistère in International Economics and Finance from the Université Montesquieu Bordeaux IV, France. He is currently assistant lecturer in the LAREFI (Laboratoire d'analyse et de recherche en économie et finance internationales) at the Université Montesquieu Bordeaux IV, France. He is currently completing his doctoral thesis on 'sustainability and international trade'. His main areas of interest are international trade theory and sustainable development, notably exploring potential bridges between neoclassical trade models and sustainability approaches. He is co-chair of the research contract 'High-Speed rail in the South-West of France: which territorial mutation?', about regional trade, governance and sustainable mobility.

Ottomar Edenhofer is Professor of the Economics of Climate Change at the Technische Universität Berlin and co-chair of Working Group III of the Intergovernmental Panel on Climate Change (IPCC), which won the Nobel Peace Prize in 2007. He is Deputy Director and Chief Economist at the Potsdam Institute for Climate Impact Research and is currently leading Research Domain III – Sustainable Solutions, which focuses on research in the field of the Economics of Atmospheric Stabilization. He is Director of the newly founded Mercator Research Institute on Global Commons and Climate Change (MCC). He is a member of the Science–Industry Cooperation, the Workgroup Climate, Energy and Environment within the German National Academy of Sciences Leopoldina, and advises the World Bank as a member of the advisory committee of the Green Growth Knowledge Platform.

Paul Ekins has a PhD in Economics from the University of London and is Professor of Resources and Environmental Policy at University College London (UCL), where he is also Director of the UCL Institute for Sustainable Resources. He is also a co-Director of the UK Energy Research Centre, in charge of its Energy Systems theme. He was a Member of the Royal Commission on Environmental Pollution from 2002 to 2008. He also has extensive experience consulting for business, government and international organizations, and has been a contributor to His Royal Highness the Prince of Wales' course for senior executives on business and the environment, and the Cambridge Programme for Sustainability Leadership, at the University of Cambridge. In 2012–13 Paul Ekins chaired the UCL Green Economy Policy Commission. In 1994 he received a Global 500 Award 'for outstanding environmental achievement' from the United Nations Environment Programme. Paul Ekins' academic work focuses on the conditions and policies for achieving an environmentally sustainable economy, concerning which he has written numerous books, papers and articles.

Samuel Fankhauser is co-Director at the Grantham Research Institute on Climate Change and Deputy Director of the ESRC Centre for Climate Change Economics at the London School of Economics. He is also a Director of the economics consultancy Vivid Economics. Sam is a member of the Committee on Climate Change, an independent public body that advises the UK government on carbon targets, and the CCC's Adaptation Sub-Committee. Previously, he worked at the European Bank for

Reconstruction and Development (EBRD), the World Bank and the Global Environment Facility. Sam's research interests include climate change policy, carbon markets and the economics of adaptation to climate change. He has studied economics at the University of Berne, the London School of Economics and University College London.

Timothy J. Foxon is Reader in Sustainability and Innovation at the Sustainability Research Institute, School of Earth and Environment, University of Leeds, UK, and a member of the ESRC Centre for Climate Change Economics and Policy. He was previously a Research Councils UK Academic Fellow at the University of Leeds, and a research associate and lecturer at the University of Cambridge and Imperial College London. His research explores the technological and social factors relating to the innovation of new energy technologies, and the co-evolution of technologies and institutions for a transition to a sustainable low carbon economy. He has published over 40 academic journal papers and book chapters, a co-edited book, and has been lead or co-author on a number of reports for UK and international policy makers.

Alessandro Galli is a Senior Scientist and the Mediterranean Program Director at Global Footprint Network. As Senior Scientist, he works in the Research and Standards Department of Global Footprint Network, contributing to research on the Ecological Footprint methodology and technical publications. His research focuses on analysing the historical changes in human dependence on natural resources and ecological services through the use of sustainability indicators and environmental accounting methods. Previously, he worked as technical adviser with the Emirates Wildlife Society (EWS-WWF) on the Al Basama Al Beeiya (Ecological Footprint) Initiative in the United Arab Emirates. Alessandro holds a PhD in Chemical Sciences from Siena University. He is the lead author of the 'Mediterranean ecological footprint trends' report and co-author of several publications, including 13 articles in peer-reviewed journals, the article 'Global biodiversity: indicators of recent declines' published in the leading journal *Science*, and the WWF's 2008 and 2012 Living Planet Reports. Alessandro is also a member of the editorial board of the journal *Resources: Natural Resources and Management*, and was a MARSICO Visiting Scholar at the University of Denver, Colorado, USA, in April 2011.

Greer Gosnell is currently pursuing a PhD in Environmental Economics at the London School of Economics (LSE). Her research combines experimental and behavioural economics to reveal cost-effective climate change mitigation techniques at the microeconomic level. In 2012, she completed an MSc in Environmental Economics and Climate Change at LSE.

Andy Gouldson is Professor of Sustainability Research and Director of the ESRC Centre for Climate Change Economics and Policy at the University of Leeds. An interdisciplinary social scientist, his main area of expertise relates to the ability of different forms of policy and regulation, and of broader forms of governance, to improve the relationship between business, economic development and the environment. In recent years, his work has focused on the economics, financing and governance of low carbon cities, and he currently has related projects underway in China, India, Indonesia, Malaysia and Peru. He is also Editor of *Environmental Policy and Governance* and a member of the expert advisory panel on social sciences for the UK Department of Energy and Climate Change and the UK Department for Environment, Food and Rural Affairs.

Richard Green is the Alan and Sabine Howard Professor of Sustainable Energy Business at Imperial College Business School. An economist, he has been researching the economics of the electricity industry for more than twenty years. In particular, he has worked on market power in electricity wholesale markets, on transmission pricing and on the impact of renewable energy on the industry. He has worked at the Universities of Cambridge, Hull and Birmingham, and held visiting positions at the Office of Electricity Regulation, the World Bank, the University of California Energy Institute and the Massachusetts Institute of Technology.

Kirk Hamilton is a Visiting Professor at the Grantham Research Institute on Climate Change and the Environment, London School of Economics, and co-author of *The Changing Wealth of Nations* (World Bank, 2011) and *World Development Report 2010: Development and Climate Change*. He is principal author of *Where is the Wealth of Nations?* (World Bank, 2006) and leads research on the links between poverty and environment, ‘greening’ the national accounts, and the economics of climate change. Previously a senior research fellow at the UK Centre for Social and Economic Research on the Global Environment (CSERGE), Dr Hamilton has researched and published extensively on growth theory and the economics of sustainable development. He also served as Assistant Director of National Accounts for the government of Canada, where his responsibilities included developing an environmental national accounting programme for the government of Canada. His degrees include a PhD in Economics and MSc in Resource and Environmental Economics from University College London, as well as a BSc (Eng.) from Queen’s University at Kingston.

Geoffrey Heal is Donald C. Waite III Professor of Social Enterprise at Columbia Business School, and is noted for contributions to economic theory and resource and environmental economics. He holds bachelors (first class), masters and doctoral degrees from Cambridge University, where he studied at Churchill College and taught at Christ’s College. He holds an Honorary Doctorate from the Université de Paris Dauphine. Author of eighteen books and about two hundred articles, Professor Heal is a Fellow of the Econometric Society, Past President of the Association of Environmental and Resource Economists, recipient of its prize for publications of enduring quality, and was a member of President Sarkozy’s *Commission on the Measurement of Economic Performance and Social Progress*.

Cameron Hepburn is an economist with expertise in energy, resources and the environment. He is Professor of Environmental Economics at the University of Oxford, based at the Smith School and the Institute for New Economic Thinking at the Oxford Martin School, and is also Professorial Research Fellow at the Grantham Research Institute at the London School of Economics and a Fellow at New College, Oxford. He has degrees in law and engineering, a doctorate in economics, and over 30 peer-reviewed publications in economics, public policy, law, engineering, philosophy and biology. He has particular expertise in environmental and climate-change economics, with research interests in the theory and implementation of emissions trading, the economics and ethics of cost–benefit analysis, green growth, behavioural economics, and discounting and intertemporal optimization. His work has been referred to in publications such as *The Economist* and the *Financial Times*, and he has been interviewed on television and radio in various

countries. He has provided advice on energy and environmental policy to governments and international institutions around the world. Hepburn also has an entrepreneurial career, co-founding two successful businesses and investing in several other start-ups.

Jennifer Hodbod is a Walton Sustainability Solutions Initiative Postdoctoral Research Fellow at Arizona State University. Her research focuses on land-use change, and the interactions and trade-offs within social-ecological systems that result from such change. Within this area, her key interest is interactions within food systems, investigating the trade-offs between production, consumption, livelihoods and food security. Jennifer completed her PhD at the University of East Anglia (UK) in 2013, within the Tyndall Centre for Climate Change Research. Her PhD research examined the impacts of biofuel expansion on social-ecological systems in Ethiopia, investigating the impacts at different scales on food security, livelihoods, the environment and energy security using interdisciplinary methods. The application of a resilience lens is a key facet of Jennifer's work and allows the dynamics of social-ecological systems to be fully investigated, identifying potential trade-offs and regime shifts. Jennifer's work also highlights the need to examine all scales to highlight the winners and losers across the system, as only examining one scale conceals the dynamic nature of interactions between actors.

Tim Jackson is Professor of Sustainable Development at the University of Surrey. From 2006 to 2011 he was Director of the ESRC Research Group on Lifestyles, Values and Environment (RESOLVE). Funded by the UK Economic and Social Research Council, the aim of RESOLVE was to develop a robust understanding of the links between lifestyle, societal values and the environment, and to provide evidence-based advice to policy makers seeking to influence people's lifestyles and practices. Professor Jackson now directs the Defra/ESRC-funded Sustainable Lifestyles Research Group. From 2004 to 2011 he was Economics Commissioner on the UK Sustainable Development Commission, where his work culminated in the publication of the controversial book *Prosperity without Growth: Economics for a Finite Planet* (Earthscan, 2009). In addition to his academic work, Tim is an award-winning dramatist with numerous radio writing credits for the BBC.

Susanne Kadner is Deputy Head at the Intergovernmental Panel on Climate Change (IPCC) Working Group III (WGIII) Technical Support Unit. She manages the contribution of WGIII to the IPCC's 5th Assessment Report on the 'Mitigation of Climate Change'. Before joining the IPCC, Susanne worked as a research analyst for the co-Chair of the German Advisory Council on Global Change (WBGU) and chief government adviser on climate and related issues during the German G8/EU twin presidency in 2007, Professor Hans Joachim Schellnhuber. She has already edited and contributed to several books and high-level reports on the physical causes of climate change, its impacts, and the options for adaptation and mitigation. Susanne gained her PhD from the School of Environmental Sciences at the University of East Anglia, UK.

Bengt Kriström is Professor of Resource Economics and Research Director, CERE, SLU-Umeå and Umeå University, Sweden. His main research interest is applied welfare economics, in which pricing of non-market goods, green accounting and welfare analysis in equilibrium models is of primary interest. Bengt is an elected member of two Swedish academies of science, a member of the Council of Economic Advisors 1998–2001, Chair

of the Expert Group on Environmental Studies (2007–2012) and member, Commission on Sustainable Development, the Prime Minister's Office, during its term of reference. He has served as expert on seven Governmental Commissions on environmental policy and has been consultant to the OECD in several projects. He has organized the Ulvön international Conference on Environmental Economics since 1993.

Glenn-Marie Lange leads the environmental policy and economics work of the World Bank's Department of Agriculture and Environmental Services, which is responsible for the World Bank's work on wealth accounting and adjusted net savings, including the recent report, *The Changing Wealth of Nations*. She leads the Global Partnership for Wealth Accounting and Valuation of Ecosystem Services (WAVES), which is working in more than ten countries to mainstream natural capital in national economic accounts and development planning. Dr Lange joined the World Bank in 2009, coming from the Earth Institute at Columbia University (2004–2008), where her work focused broadly on ecosystems services valuation, environmental accounting and development. Prior to that, 1985 to 2004, she worked at New York University's Institute for Economic Analysis. Working extensively in Africa, Dr Lange pioneered the use of environmental valuation and accounting to integrate environmental concerns into macroeconomic and sectoral policy analysis since 1995. Dr Lange received a PhD in Economics from New York University in 1990.

Philip Lawn is an Associate Professor at the Flinders Business School, Flinders University, Adelaide. Over the past decade Philip has written and edited a number of books and articles on the principles, indicators and policy aspects of sustainable development. Some of his books include: *Sustainable Development Indicators in Ecological Economics* (Edward Elgar, 2006), *Frontier Issues in Ecological Economics* (Edward Elgar, 2007), *Sustainable Welfare in the Asia-Pacific* (co-edited with Matthew Clarke, Edward Elgar, 2008), and *Environment and Employment: A Reconciliation* (Routledge, 2009). Philip is currently working on a climate change book and an edited volume on how nations can best make the transition to a sustainable, just and efficient economy.

Andrea Lucchesi has a PhD degree in Economics at the University of São Paulo, Brazil. Her research interests are in Environmental Economics, Technology, Policy, Labor Economics and Quantitative Methods. Her recent work deals with the interaction between environmental innovation, regulation and skilled labour demand at a firm-level approach.

Gunnar Luderer leads a research group on Global Energy Systems at the Potsdam Institute for Climate Impact Research (PIK). His research focuses on the model-based analysis of climate change mitigation and transformation pathways. In particular, he explores the technological, economic and political requirements of low stabilization. He studied Physics, Economics and Atmospheric Sciences at the University of Heidelberg and Oregon State University, and obtained his PhD at the Max Planck Institute for Chemistry in Mainz. He played a key role in several international climate mitigation research projects, such as RECIPE, Stanford EMF 27, RoSE and ADVANCE. He served as a contributing author to IPCC Reports and is a lead author of the UNEP Gap Report 2013.

J. Allister McGregor is a Fellow in the Vulnerability and Poverty Reduction Team at the Institute of Development Studies, Sussex, UK. Throughout his career he has used his background in economics and anthropology to study how the formulation and implementation of development policies impact on poor people. This has involved work on a range of key development issues including governance and civil society, credit and debt, and poverty in natural resource dependent communities. He has extensive experience of primary fieldwork, using a range of different research methods in South and South-East Asia, and additional development experience in Africa, Eastern Europe and Latin America. He has written extensively on the concept and methodologies for understanding human wellbeing and was a lead author in and co-editor of *Wellbeing in Developing Countries* (Cambridge University Press, 2007).

Geoffrey McNicoll, senior associate of the Population Council, New York, is co-editor of *Population and Development Review*. His main research interests are the comparative analysis of demographic regimes, economic and political demography, and population policy. Current research is on government roles in demographic change in strong and weak states. McNicoll has a BSc from the University of Melbourne, Australia, and a PhD in demography from the University of California, Berkeley. He was a research associate at the East-West Population Institute, Honolulu, and subsequently held various posts in the Population Council's Center for Policy Studies. From 1988 to 2000 he was professorial fellow, and later professor, in the Research School of Social Sciences, Australian National University, Canberra. He has also worked in the Central Bureau of Statistics, Jakarta, and at the National Planning Association, Washington, DC.

Juan Carlos Morales is Director of Research and Standards at Global Footprint Network (GFN), an international sustainability think-tank focusing on bringing about a sustainable human economy in which all can live well within the means of one planet. Morales leads the planning and general operations for the research and standards team at GFN. Before joining GFN, he spent three years in the California State University system as a senior research administrator. He was programme director at the United States National Science Foundation, overseeing the Systematic Biology and Biodiversity Inventories programme for the Division of Environmental Biology, as well as an associate research scientist and adjunct faculty at Columbia University's Center for Environmental Research and Conservation in New York City. His educational achievements include a PhD in Wildlife and Fisheries Sciences from Texas A&M University, an MS in Biology from Angelo State University, and a BS in Biology from Universidad Nacional Autónoma de México. He has published more than fifty publications in peer-reviewed journals, served as a mentor for several undergraduate and graduate students, and lectured at the Department of Ecology, Evolution, and Environmental Biology at Columbia University.

Yacob Mulugetta is a Reader in the Centre for Environmental Strategy at the University of Surrey, UK. He has a background in earth sciences and energy systems. He is the founding member of the African Climate Policy Centre (ACPC) at the UN Economic Commission for Africa (UNECA) based in Addis Ababa, Ethiopia where he worked on the opportunities and constraints of pursuing low carbon development for economic transformation. Yacob has 20 years of research, teaching and policy advice experience specializing in the links between infrastructure provision (energy mainly) and human

welfare, rooted in sustainability principles of equity and environmental stewardship. His research is focused on two interconnected areas: energy and development; and energy and climate change. His energy and development work takes the perspective of how energy systems have evolved, and how they are likely to evolve in the future in line with medium and long-term development plans. This connects with the need for alternative technology pathways, institutional development, financial and policy analysis to serve the delivery of energy services, mainly in developing countries. His energy and climate-related work research looks at dimensions of behaviour change, lifestyle choice, governance and technical interventions for avoiding future emissions. Yacob currently serves as a Coordinating Lead Author of the Energy Systems chapter of the IPCC's 5th Assessment Report (Working Group III on Mitigation), and is a member of the core writing team for the IPCC synthesis report.

Esther Naikal is a research analyst in the environmental policy and economics team of the World Bank's Agriculture and Environmental Services Department. For the past three years she has been responsible for the database update and management of the wealth accounting work, which includes indicators published in the World Development Indicators such as Adjusted Net Saving, Adjusted Net National Income, and Resource Rents. She previously worked on the World Bank's climate change knowledge and learning initiative, leading the module on the economics of climate change. She received an MA in Economics from the University of Maryland in 2008 and a BA from the University of Richmond in 2006.

Bryan G. Norton is Distinguished Professor of Philosophy, Science and Technology in the School of Public Policy, Georgia Institute of Technology, a school he helped to form in the 1990s. His current research concentrates on sustainability theory and on problems of scale in the formulation of environmental problems. He is the author of *Why Preserve Natural Variety?* (Princeton University Press, 1987), *Toward Unity Among Environmentalists* (Oxford University Press, 1991), *Searching for Sustainability* (Cambridge University Press, 2003), and *Sustainability: A Philosophy of Adaptive Ecosystem Management* (University of Chicago Press, 2005). Norton has contributed to journals in several fields and has served on the Environmental Economics Advisory Committee of the US EPA Science Advisory Board, and for two terms as a member of the Governing Board of the Society for Conservation Biology. He was a Gilbert White Fellow at Resources for the Future, 1985–86 and he was a member of the Board of Directors of Defenders of Wildlife from 1994 to 2005 and is currently on their Scientific Advisory Board. He is currently preparing a book on adaptive management as a response to rapid global change.

David Pearce, OBE was an Emeritus Professor at the Department of Economics at University College London (UCL). As a pioneer in environmental economics, David published over fifty books and more than three hundred academic articles, including the well-known *Blueprint for a Green Economy*. David was one of the first environmental economists to directly influence government policy in the UK, and served as an adviser to UK Secretaries of State between 1989 and 1992. In 1989 he was named in the Global 500 Roll of Honour for services to the World Environment by the United Nations Environment Programme, and in 2004 he became the first recipient of the Lifetime

Achievement Award of the European Association of Environmental and Resource Economists. He played an instrumental role in convincing economists and policy-makers that sustainable development is an important and achievable goal, that it is both possible and necessary to value the natural environment and our impact upon it, and that sound environmental policy could and should make use of market incentives. Perhaps one of his most significant contributions was the establishment in 1990 of an MSc in environmental and resource economics at UCL – the first of its kind, and a model that has been adopted by universities around the world. Many of the contributors to this volume participated in this programme, either as students, as faculty, or both. David passed away suddenly in 2005.

Alan Randall is Professor and Head of Agricultural and Resource Economics at the University of Sydney, having served previously at The Ohio State University for 25 years (12 as department chair). He specializes in environmental economics and policy, with particular interests in environmental risk; biodiversity, habitat and environmental sustainability; environmental regulation, monitoring and enforcement; and the benefits and costs of environmental projects and programmes. His writings include *Risk and Precaution* (2011), *Making the Environment Count: Selected Essays* (1999), *Resource Economics: An Economic Approach to Natural Resource and Environmental Policy* (3rd edn, 2010, with John C. Bergstrom), and numerous journal articles. He is active in professional associations, editorial boards, and a variety of efforts to inform the policy process. Alan has received several awards for excellence in research. He is a Fellow of three scholarly societies (American Agricultural Economics Association, Australian Agricultural and Resource Economics Society, and Association of Environmental and Resource Economists), and holds honorary doctorates from the University of Sydney and the Norwegian University of Environment and Life Sciences.

Yvonne Rydin is Professor of Planning, Environment and Public Policy in the Bartlett School of Planning, University College London. She is a specialist in governance for urban sustainability, with a particular emphasis on planning and urban development. Her research has covered a variety of topics including urban energy initiatives, health in cities, sustainable construction, urban green spaces and air quality. Within planning processes, she has looked at strategies for natural resource management, sustainability indicators and the role of social capital in relation to public participation. Currently she is extending her theoretical interests in planning discourses to consider the relevance of actor-network theory to the analysis of sustainable urban development. Her most recently published book is *Governing for Sustainable Urban Development* (Earthscan, 2010).

Gregor Schwerhoff is a postdoctoral researcher at the Potsdam Institute for Climate Impact Research (PIK). Having completed a master's degree in Mathematics at the Université Paris-Sud he obtained a PhD in Economics at the Bonn Graduate School of Economics and the Max Planck Institute for Research on Collective Goods in Bonn, Germany. During his PhD he worked on the link between resource production and economic growth as well as the effect of globalization on inflation. He now works on a project entitled 'Climate policy and the growth pattern of nations', financed by the German Federal Ministry of Education and Research. Accordingly, his research is

focused on the differential effect climate policy might have on the dynamics of economic growth in different world regions.

Rory Sullivan, Senior Research Fellow at the University of Leeds, is an internationally recognized expert on the financial and investment implications of climate change. His experience includes seven years in one of the largest asset management companies in the UK where he focused on the investment implications of climate change and energy issues; extensive periods working as an adviser on environmental finance, regulation and policy issues for international bodies such as EBRD, OECD, World Economic Forum, UNEP and UNDP; and the provision of strategy and policy advice on these and related issues to industry and investor networks, national governments and private sector companies. He has written seven books and many papers, reports and articles on investment, climate change, human rights and development issues. His publications include *Valuing Corporate Responsibility: How Do Investors Really Use Corporate Responsibility Information?* (Greenleaf, 2011), *Corporate Responses to Climate Change* (Greenleaf, ed., 2008) and *Rethinking Voluntary Approaches in Environmental Policy* (Edward Elgar, 2005).

Allen Thompson is an Associate Professor of Philosophy in the School of History, Philosophy, and Religion at Oregon State University. His primary areas of interest are environmental philosophy, philosophical ethics, social and political philosophy, and practical reason. Recent work has focused on forward-looking conceptions of human natural goodness and re-visioning our moral responsibility for managing ecosystems under conditions of global climate change. He co-edited *Ethical Adaptation to Climate Change: Human Virtues of the Future* (MIT, 2012) with Jeremy Bendik-Keymer, and with Stephen Gardiner he is presently co-editing *The Oxford Handbook of Environmental Ethics* (Oxford University Press, forthcoming). Other representative work includes 'Radical hope for living well in a warmer world' (*Journal of Agricultural & Environmental Ethics*) and 'Valuing novel ecosystems' with Andrew Light and Eric Higgs, in *Novel Ecosystems: Intervening in the New Ecological World Order* (Wiley-Blackwell, 2013).

Clement A. Tisdell is Professor Emeritus in the School of Economics at The University of Queensland and a Professorial Research Associate of its Risk and Sustainable Management Group. He is also a Fellow of the Academy of Social Sciences in Australia. He has had a long-term research interest in the subject of sustainable development. His first publications on this subject appeared in the 1980s and he continues this interest. For example, this subject is given prominence in his book *Economics of Environmental Conservation*, 2nd edn, 2005 and in *Resource and Environmental Economics: Modern Issues and Applications* (2009). Presently, he is preparing manuscripts in which sustainable development is covered as a prominent issue.

Jeroen C.J.M. van den Bergh is ICREA Research Professor at the Institute of Environmental Science and Technology, Universitat Autònoma de Barcelona. He is also Professor of Environmental and Resource Economics in the Faculty of Economics and Business Administration and the Institute for Environmental Studies, VU University Amsterdam. Previously, he occupied professorships in Environmental Economics (1997–2007) and 'Nature, water and space' (2002–2007) at VU University, and was a member of the Energy Council of the Netherlands (2003–2007). He has a masters degree in

Econometrics from Tilburg University (1988) and a PhD from VU University (1991). His research is on the intersection of economics, environmental science and innovation studies. He is editor-in-chief of the Elsevier journal *Environmental Innovation and Societal Transitions* and editor of the Edward Elgar book series *Advances in Ecological Economics*. He was awarded the 2002 Royal/Shell Prize and the 2011 IEC Environmental Prize (Premi Sant Jordi de Medi Ambient).

John Vogler is Professorial Research Fellow in International Relations in the School of Politics, International Relations and Philosophy at Keele University, UK. He is currently a member of the ESRC Centre for Climate Change Economics and Policy and was, for 20 years, convenor of the British International Studies Association Environment Working Group. His books include: *The Global Commons* (John Wiley, 2000) and with Charlotte Bretherton, *The EU as a Global Actor* (Routledge, 2006). He also edited, with Mark Imber, *The Environment and International Relations* (Routledge, 1996) and with Alan Russell *The International Politics of Biotechnology* (Manchester University Press, 2000). He has written various articles on international relations theory, EU external environmental policy and the relationship between climate and energy security. He is currently engaged on a long-term project which seeks to investigate the ways in which climate change is handled by the international political system.

Christoph von Stechow is a doctoral researcher at the Potsdam Institute for Climate Impact Research (PIK) and a guest scientist at the newly founded Mercator Research Institute on Global Commons and Climate Change (MCC). He studied history and economics, holds a degree in economics from Humboldt University Berlin and an MA in European Studies from King's College London. As a scientist in the Technical Support Unit for the Working Group III of the Intergovernmental Panel on Climate Change (IPCC) he helps to coordinate the assessment process for the upcoming Fifth Assessment Report. His research interests include the climate science–policy interface, the co-effects of alternative mitigation pathways on additional policy objectives, sustainable development and the analysis of policy instruments for promoting innovation in low-carbon energy such as carbon capture and storage (CCS) and bioenergy.

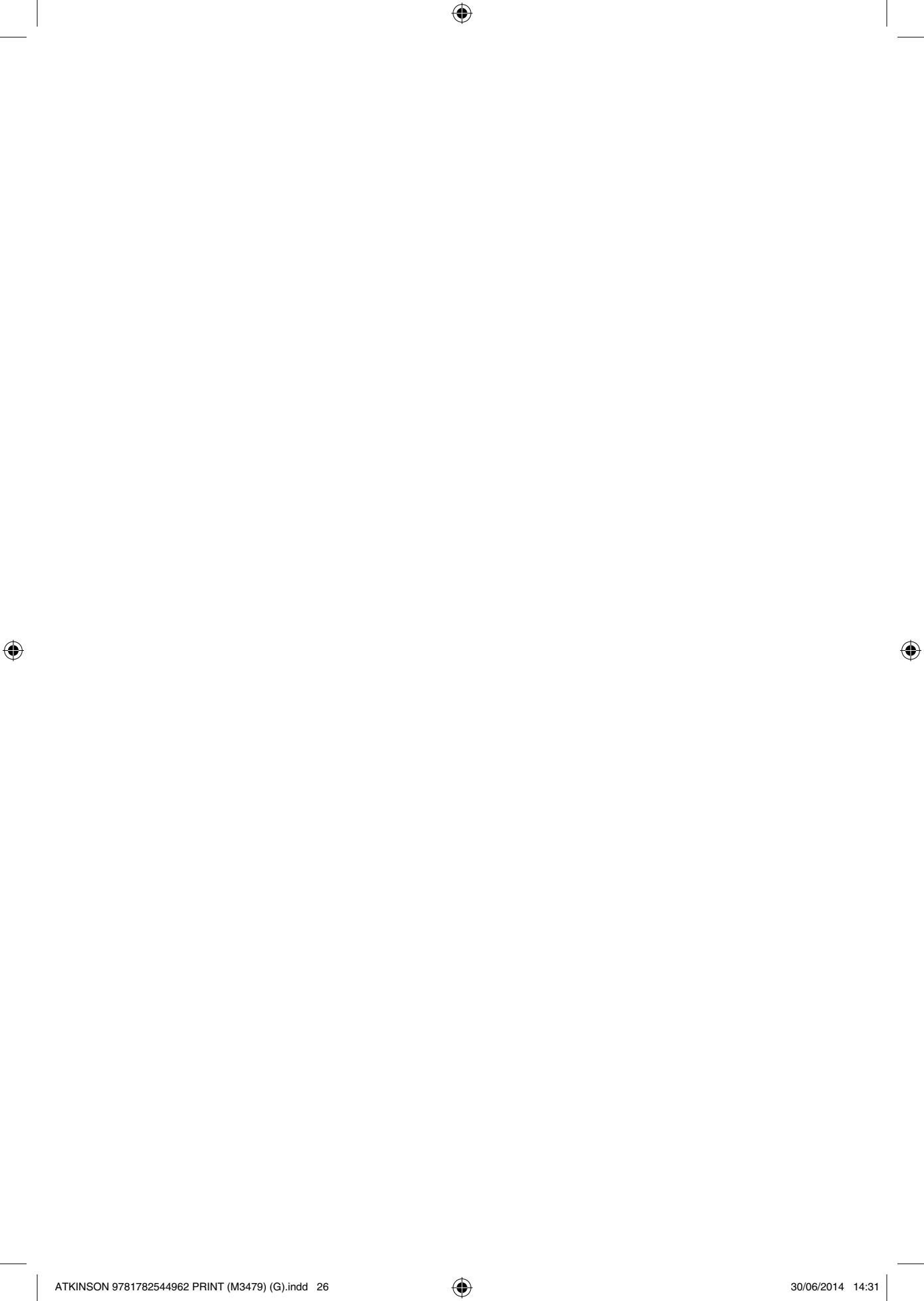
Mathis Wackernagel is the President of Global Footprint Network, an international sustainability think-tank, bringing ecological limits to the centre of decision-making so all can live within the means of one planet. After earning a degree in mechanical engineering from the Swiss Federal Institute of Technology, he completed his PhD in community and regional planning at The University of British Columbia in Vancouver, Canada in 1994. There, as his doctoral dissertation, he created the Ecological Footprint concept with Professor William Rees. Since 2011, he is also the Frank H.T. Rhodes Class of 1956 Visiting Professor at Cornell University. Mathis' awards include the 2013 Prix Natura Swisscanto, the 2012 Blue Planet Prize, the 2012 Binding Prize for Environmental Conservation, the 2012 Kenneth E. Boulding Memorial Award of the International Society for Ecological Economics, the 2011 Zayed International Prize for the Environment, an honorary doctorate from the University of Berne in 2007, a 2007 Skoll Award for Social Entrepreneurship, a 2006 WWF Award for Conservation Merit and the 2005 Herman Daly Award of the US Society for Ecological Economics.

Alexandra Winkels is Teaching Officer and Academic Director for International Development and Global Change at the University of Cambridge Institute of Continuing Education (ICE), and is affiliated with the Centre of Development Studies (POLIS) at the University of Cambridge. Alexandra's research interests revolve around the interactions between population, development and environmental change in developing countries and her current research focuses on migrant vulnerability and the role of social capital in managing livelihood risks. Alexandra has a BSc in Environmental Sciences (University of Salford) and studied for an MPhil in Environment and Development (Geography, University of Cambridge and Clare Hall) before completing her PhD at the University of East Anglia in 2004. Alexandra held a British Academy Postdoctoral Fellowship between 2006 and 2013 and has worked as a consultant for a number of international organizations including Vietnam's United National Population Fund (UNFPA) and the German Technical Cooperation Agency (GTZ) in Fiji and as an academic expert for DFID, IDS, CDKN and SOAS.

Gary W. Yohe is the Huffington Foundation Professor of Economics and Environmental Studies at Wesleyan University where he has been on the faculty for more than 35 years. He was educated at the University of Pennsylvania, and received his PhD in Economics from Yale University (1975). His work focuses on the mitigation and adaptation/impacts sides of the climate issue. Involved with the Intergovernmental Panel on Climate Change (IPCC) since the mid-1990s, he served as a Lead Author in the Third Assessment Report and as a convening lead author for Working Group II in the Fourth and Fifth Assessment Reports. As such, he is a co-recipient of the 2007 Nobel Peace Prize. Dr Yohe is a member of the New York City Panel on Climate Change and the standing Board on Environmental Change and Society (BECS) of the US National Academy of Sciences. He has testified before the Senate Foreign Relations Committee, the Senate Energy Committee, and the Senate Banking Committee. He served on the Adaptation Panel of the National Academy of Sciences' initiative on America's Climate Choices, National Research Council Panel on Addressing the Challenges of Climate Change through the Behavioral and Social Sciences, The Sustainability Leadership Council of the Green Education Foundation and the National Research Council Committee on Stabilization Targets for Atmospheric Greenhouse Gas Concentrations. He is, currently, Vice-Chair of the National Climate Assessment Development and Advisory Committee that will deliver the Third US National Climate Assessment to the Obama administration for release in March 2014; in addition, he is co-editor (with Michael Oppenheimer), of *Climatic Change*.

ZhongXiang Zhang is a Distinguished University Professor and Chairman at the School of Economics, Fudan University, China. He also is a distinguished professor at the Chinese Academy of Sciences; an adjunct senior fellow at East-West Center, Honolulu; and an adjunct professor at the Chinese Academy of Social Sciences and University of Hawaii at Manoa. He is co-editor of both *Environmental Economics and Policy Studies* and *International Journal of Ecological Economics & Statistics*, and is serving on the editorial boards of ten other international journals including *Climate Policy*, *Energy Policy* and *International Environmental Agreements: Politics, Law and Economics*. He has authored about two hundred journal articles, book chapters and other publications, and has authored and edited 20 books and special issues of international journals. He is

among the most cited authors by the *IPCC Climate Change 2001 and 2007*, and by *Trade and Climate Change: WTO-UNEP Report*. Based on the number of author-weighted journal pages, he is among the Top 1000 Economists in the worldwide ranking. He was involved in a variety of activities with chief climate negotiators from a dozen key countries; served as an expert to many national and international organizations; organized high-profile international conferences in Asia, Europe and the US; and frequently keynotes major international conferences worldwide.



Preface

This book has, at its heart, a concern with taking stock, over twenty-five years on from the influential Brundtland Report (WCED, 1987), of the concept of sustainable development and its implications for the conduct of public policy and human behaviour. There is little doubt about the prominence of the term ‘sustainable development’ in contemporary debates about natural capital specifically and human development more generally. Indeed, if anything the term itself has suffered from overuse alternatively as a panacea for all modern ills or as a catch-all theme to which all policy challenges (no matter of what complexion) are somehow inextricably linked.

In reflecting within these pages on what sustainable development really is, how it can be achieved and how it can be measured, it is the aim of this volume to provide an unequivocal demonstration that the term remains extremely useful. What we can conclude from the contributions that follow is that, while sustainable development does indeed imply a broad research and policy agenda (both in terms of its scale and its scope), it is also an agenda that is far more coherent than might appear to be the case on first impressions. Much of this coherence stems from a shared concern about the development path that developed and developing countries (as well as the world as a whole) are on. For us, as others, this is the essential difference between saying that some action is ‘undesirable’ and saying that it is ‘unsustainable’. That is, undesirable actions may warrant the attentions of policy makers but are not necessarily the domain of concern about sustainable development.

That said, the evolving literature, coming as it does from a variety of disciplinary perspectives, contains a wide range of topics and policy challenges to study and respond to. We have not shied away from this diversity – of subject matter and approach – here. Indeed, in mapping out the structure of the first edition of this volume some years ago, we were immediately faced with the challenge of choosing what should be included. As with our first volume, while we have continually sought to be comprehensive, we are unable to be encyclopaedic. But putting together a second volume has allowed us to revisit this challenge and, importantly, to try to fill any crucial gaps that we were forced to leave first time around. Moreover, debates change and evolve. While the terms ‘green growth’ and ‘ecosystems as assets’ were with us in the run-up to the first edition of this volume, the prominence with which these notions now have come to the fore makes it necessary and highly desirable to include these topics as new chapters.

Our first volume appeared shortly after the death of one of our contributors, David Pearce. David’s passing continues to be a huge loss to the profession and he remains sorely missed. We have taken the liberty of retaining David’s chapter in this revised volume. We are particularly grateful to Sam Fankhauser for agreeing to take on the task of updating this contribution. Given that Sam was one of David’s favourite and most promising young researchers in the years that followed the publication of *Blueprint 1*, we feel that his co-authoring this important chapter is entirely appropriate.

We are also delighted, of course, that so many of our original contributors have been

able to update their chapters. These high quality contributions continue to form the bedrock of this new volume. We are equally pleased to have been able to bring on board so many new contributions from research leaders in a wide variety of fields. We are conscious that, in doing so, we have made this new volume a significantly more substantial read. In our view, the benefits of this have greatly outweighed the costs. We hope, of course, that readers of this new volume will agree. It is only appropriate that we finish this preface with a great many thanks to our contributors without whom this second edition would not have been possible.

GA

SD

EN

MA

Acknowledgements

We would to thank, first and foremost, the authors who have contributed to this volume both through their cooperation and willingness to observe deadlines and make revisions, and their delivery of high quality and accessible chapters.

Giles Atkinson would like to thank his fellow Members and the Secretariat of the UK Natural Capital Committee for many fruitful discussions about sustainability and natural capital, much of which has helped shape thinking about the appropriate focus for this second volume.

Simon Dietz would like to acknowledge the financial support of the Grantham Foundation for the Protection of the Environment and the ESRC Centre for Climate Change Economics and Policy.

Matthew Agarwala would like to acknowledge the generous support of the LSE Geography and Environment Department. He thanks his students and colleagues at the LSE, UEA and KCL for their insightful discussions, and is grateful to SU for unfailing patience and support.

Finally, we would also like to express our appreciation to all at Edward Elgar Publishing, and particularly Edward Elgar for the continued faith shown in this endeavour as well as this book's publishing editors, Alexandra O'Connell and Tori Nicols, and copy editor Yvonne Smith.

We thank the following for permission to reprint or use material:

University of Chicago Press for the use of Figure 7.1 in Chapter 7. This originally appeared in Norton, B. (2005) *Sustainability: A Philosophy of Adaptive Ecosystem Management*, University of Chicago Press, Chicago.

Material in Chapters 2 and 22 by Kirk Hamilton and Esther Naikal, and Chapter 21 by Glenn-Marie Lange appears by kind permission of The World Bank.

Figure 30.6 appears with kind permission from Springer Science and Business Media. It was adapted from Figure S-7 (in supplementary material) from Cherp, A., Jewell, J., Vinichenko, V., Bauer, N. and Cian, E. (2013), 'Global energy security under different climate policies, GDP growth rates and fossil resource availabilities', *Climatic Change*, pp. 1–12.

