# Coastal Management Revisited

# Coastal Management Revisited:

## *Navigating towards Sustainable Human-Nature Relations*

Edited by

Bernhard Glaeser and Marion Glaser

Cambridge
Scholars
Publishing

Coastal Management Revisited: Navigating towards Sustainable Human-Nature Relations

Edited by Bernhard Glaeser and Marion Glaser

This book first published 2023

Cambridge Scholars Publishing

Lady Stephenson Library, Newcastle upon Tyne, NE6 2PA, UK

British Library Cataloguing in Publication Data
A catalogue record for this book is available from the British Library



ISBN (10): 1-5275-9267-7
ISBN (13): 978-1-5275-9267-4

This book is dedicated to Heide and Rex. They maintained and stabilized our respective family lives while we were out for field research, conferences or official visits.

Bernhard Glaeser and Marion Glaser

# CONTENTS

# LIST OF CO-AUTHORS TO INDIVIDUAL CHAPTERS

Roberta Sá Leitão, Barboza, Universidade Federal do Pará- Campus Bragança, Brazil.
Uta Berger, Inst. of Forest Growth & Forest Computer Sciences, Technical University Dresden, Germany.
Lucinaldo Blandtt, Universidade Federal do Pará- Campus Bragança, Brazil.
Rebecca Borges, Centre for Marine Tropical Research (ZMT) Bremen, Germany.
Patrick Christie, College of the Environment, University of Washington, Seattle, United States.
Karen Diele, Edinburgh Napier University, Scotland, United Kingdom.
Larissa Dsikowitzky, Rheinisch-Westpfälische Technische Hochschule Aachen (RWTH), Germany.
Beatrice Padovani Ferreira, Universidade Federal do Pernambuco, Brazil.
Sebastian Ferse, Centre for Marine Tropical Research (ZMT) Bremen, Germany.
Kira Gee, Human Dimensions of Coastal Areas, Helmholtz Zentrum Geesthacht—Centre for Materials and Coastal Research, Germany.
Leopoldo C. Gerhardinger, Institute of Environmental Science and Technology (ICTA) - Universidad Autónoma de Barcelona
Leandra R. Gonçalves, Oceanographic Institute, São Paulo University (IOUSP).
Philipp Gorris, University of Osnabrück, Germany.
Andreas Kannen, Human Dimensions of Coastal Areas, Helmholtz Zentrum Geesthacht—Centre for Materials and Coastal Research, Germany.
Rosangela Macedo, Universidade Federal do Parà, Campus Belém, Brazil (2004).
Simone Marques, Universidade Federal do Pernambuco, Brazil.
Inga Nordhaus, Nationalpark Wattenmeer, Wilhelmshaven, Germany.
Irendra Radjawali, University of Bonn, Germany.
Achim Schlüter, Centre for Marine Tropical Research (ZMT) Bremen, Germany.
Kathleen Schwerdtner Mañez, Place-Nature Consultancy, Ashausen, Germany.
Horst Sterr, Branch of Coastal Geography, Institute of Geography, Kiel University, Germany.
Alexander Turra, Oceanographic Institute, São Paulo University (IOUSP).
Christian Wild, Faculty 2 Marine Ecology, University of Bremen, Germany.
Luciana Yokoyama Xavier, Oceanographic Institute, São Paulo University (IOUSP).

# ABOUT THE EDITORS

**Bernhard Glaeser** is a Professor of Sociology at the Free University of Berlin, with an emphasis on environment and development. Earlier, he was a Professor and Chair of the Human Ecology section at the University of Gothenburg (Sweden) and Program Director of the Swedish national research programme, "Sustainable Coastal Zone Management" (SUCOZOMA). At the University of Vienna (Austria) he was appointed Visiting Professor. In Berlin, he coordinated "Regional spatial planning for the German coast: the national ICZM strategy". This politically significant project was instrumental in developing a conceptual framework for a German national ICZM strategy. Beyond his national involvements, Glaeser was appointed a LOICZ Scientific Steering Committee member. His research projects are devoted to sustainable rural development and coastal management, particularly in Germany, Sweden, Poland, Tanzania, China, India, and Indonesia. He was President of the German Society for Human Ecology (DGH) 1987–2017, and is now Honorary President. Currently retired as a Senior Researcher and ICZM Project Director at the Berlin Social Science Center (WZB), Dr. Glaeser served on multiple international advisory boards in Germany, United States, United Kingdom, China, and India. He is also the founder and co-editor of the book series "Routledge Studies in Environment, Culture, and Society" (United Kingdom).

**Marion Glaser**, PhD PD (habil) is a Work Group Leader and Senior Social Scientist at the Centre for Tropical Marine Research & at the University of Bremen, Germany. With a background in development cooperation in Colombia, Bangladesh and Belize, a PhD from the University of Bath, United Kingdom and professorial qualifications from the Humboldt University, Berlin and the University of Bremen, she teaches at the University of Bremen and at Universities in Brazil, Indonesia, and Bangladesh. Dr. Glaser has coordinated two decade-long research projects in Brazil and Indonesia, and been Vice Chair of the global Integrated Marine Biodiversity (IMBeR) project and of the German Society for Human Ecology (DGH). Her current research focuses on developing inclusive and impactful social-ecological sustainability research in coastal and marine areas with a focus on methods and on tracing equity-related patterns and feedbacks in social-ecological systems dynamics. Dr Glaser currently leads global ocean sustainability research projects in Brazil and Bangladesh.

Glaeser and Glaser cooperated closely for many years in Germany and in Indonesia after their respective returns from long-term work stays in Sweden and Brazil.

# ACKNOWLEDGEMENTS

We, the editors and principal authors, acknowledge the invaluable expertise and contribution of our co-authors to some chapters. All chapters have been newly revised and updated, their original publications are noted. In addition, we are pleased to present five completely new chapters written for this book: Coastal management revisited: Scope and synopsis; Chapter 13, Beyond natural hazard maps: Ethical and political perspectives; Chapter 15, Social participation in Brazilian coastal governance and management; Chapter 18, Typology: Analysis as decision support. A summarizing attempt; and Outlook on coasts, oceans and climate change.

We gratefully acknowledge the support from and trustful collaboration with fishers and other coastal residents, with colleagues and students in Brazil and Indonesia, Sweden, Poland, Germany, and the United States.

We also greatly appreciate the professional help received in preparing this manuscript from Jewel Das, Malin Delfs, and Dr. Torsten Reinsch. We thank Mariel W., Senior Editor at American Journal Experts (AJE), for English language editing of three chapters, and we are grateful for the financial support provided by ZMT, Bremen.

Bernhard Glaeser and Marion Glaser

# FOREWORD

The concept and practice of Coastal Management has recognized from its origins over 50 years ago that establishing effective strategies for the sustainable management and conservation of coastal resources depends upon having a comprehensive understanding of scientific complexity of those same coastal and ocean ecosystems. It took some additional years before practitioners fully acknowledged that having an equally comprehensive understanding of the complex socioeconomic systems and cultural landscapes is also a vitally important component of successful Coastal Management.

Bernhard Glaeser's and Marion Glaser's excellent and informative accounting of the intersection of the Human–Nature relationship and the insights learned from twenty years of field research and observations throughout the world brings this crucial aspect of Coastal Management into clear focus. Global demographic trends of populations migrating to the coast, congregating in urban settlements and intensifying the economic development pressure on those coastal resources prompted the creation of Coastal Management. Those trends continue today; but at a scale and level of complexity that makes today's challenge of achieving sustainable coastal communities more challenging than ever before.

Nevertheless, as *Coastal Management Revisited: Navigating Towards Sustainable Human–Nature Relations* clearly and insightfully recounts through numerous success stories in a variety of circumstances, the ever evolving, increasingly sophisticated and more technologically advanced practice of Coastal Management has much to offer to those communities which hope to strive towards a more sustainable existence in a rapidly changing world.

The same coastal demographic, environmental and socioeconomic trends that spawned the field of coastal management in the first place, continue today and are now significantly intensified by the cross-cutting impacts of climate change, particularly in the developing countries featured by Glaeser and Glaser. The timely appearance of this book in many ways, traces the maturation of the field of coastal management whilst it draws out key lessons learned in various settings in countries around the world. The book's detailed analysis of this evolution as experienced by two highly esteemed researchers whose pioneering research on the nexus between ecological and social systems in coastal communities, sets it apart from being just another coastal management treatise.

*Coastal Management Revisited* is a significant contribution and resource for academic researchers and coastal managers alike; but also for anyone who shares our concern about the future of coastal communities and resources and who is searching for strategies and practices that could make that future much more sustainable and healthy.

*Richard Delaney*
President of the Center for Coastal Studies, Provincetown, Massachusetts and long-time Coastal Management Director in the United States.
*Dr. Biliana Cicin-Sain*
President of the Global Ocean Forum and Director of the Gerard J. Mangone Center for Marine Policy, University of Delaware († 2020).

# COASTAL MANAGEMENT REVISITED: SCOPE AND SYNOPSIS

BERNHARD GLAESER

*As for human beings making a comeback…their arms have become flippers…Those parts of people's brains which used to control their hands…don't exist anymore…And all the people are so innocent and relaxed now, all because evolution took their hands away…*
*What humanity was about to lose…was what the trackless sea could never lose, so long as it was made of water: the ability to heal itself. As far as humanity was concerned, all wounds were about to become very permanent…*
*Thanks to certain modifications in the design of human beings, I see no reason why the earthling part of the (universe's) clockwork can't go ticking forever…*
Kurt Vonnegut, Galápagos (1985, p. 113/144/181)

## 1. Weather and climate change

Who has not noticed an increase in the amount of uncomfortably hot weather in Europe and elsewhere over the past decade? At the same time, we have been hearing about a prolonged, extremely cold winter in New England and other parts of the United States, as well as the cold rainy weather that lasted well into June. Could this be a result of global climate change?

Jennifer Francis, a scientist at the Woods Hole Research Center, explored this question in the magazine Scientific American. She presented graphs showing a trend in the Northeast United States but much more importantly, showing the steadily increasing frequency of all unusual weather in North America and the world since the 1970s: extremely cold winters in Northeast and central Asia, unusually hot dry weather in Northwest and Western Europe, and severe storms, tornadoes, and hurricanes that have been causing floods and wildfires while also affecting agriculture and health. Francis presented evidence for an interesting hypothesis that explains how such unusual weather could be caused by an effect of the amplified warming of the Arctic on the route of the jet stream over the mid-latitudes: Arctic warming is causing unusual weather in the mid-latitudes, and climate change is making severe weather worse (Francis, 2018, 2019).

## 2. Are we taken by surprise?

"Thirty years ago, we could have saved the planet," is the first sentence of a documentary produced by the New York Times in 2018 (Rich, 2018). Nathaniel Rich, through 18 months of research and more than 100 interviews, traced the efforts of scientists and politicians to sound the alarm and stave off catastrophe. To understand how close some activists were to solving the climate problem during the decade from 1979 to 1989 comes as an agonizing revelation. Between 1979 and 1982, the science of climate change was established, consensus was formed, and the highest levels of government became involved. Between 1983 and 1989, awareness was translated into policy, culminating in an international summit meeting in November 1989, the Noordwijk Ministerial Conference (Netherlands). A carbon agreement was nearly made; it would restrain emissions and stop climate change from progressing. Scientists and world leaders were united in the conviction that action had to be taken, and the United States would need to lead. It didn't (Rich, 2018, Editor's Note p. 3; Prologue p. 9).

Instead, more carbon has been released into the atmosphere since the 1989 Noordwijk conference than in the entire history of human civilization before that year. In 1990, the figure was 20 billion metric tons of carbon dioxide; by 2017, it had increased to 32.5 billion. "It was James Hansen's testimony before Congress in 1988 that…made oil and gas executives begin to consider the issue's potential to hurt their profits." Soon after, "Exxon's manager of science and strategy development prepared an internal strategy paper urging the company to 'emphasize the uncertainty in scientific conclusions'." When President Clinton proposed an energy tax in 1993 hoping to meet the goals of the 1992 Rio treaty, the American Petroleum Institute invested $1.8 million in a climate change disinformation campaign (Rich, 2018, Epilogue p. 64).

As early as 1972, the Club of Rome, in a widely acknowledged study, warned about the limits to global growth. The authors identified five basic factors that limit growth on this planet: population increase, agricultural production, non-renewable resource depletion, industrial output, and pollution (Meadows et al., 1972). Still, in 1972 and 1 year later, in 1973, my friend and older colleague, the physicist and philosopher Klaus M. Meyer-Abich (1936–2018), identified global warming as the ultimate and ecological limit to growth. In his response to the Club of Rome's alerts, Meyer-Abich warned that a 1° (one degree) Celsius increase as a global average might be detrimental to life on Earth in its present form, the biosphere at large and to human livelihoods and well-being (Meyer-Abich, 1972, 1973a,b, 1974). Fifty years later, we have exceeded that limit to 1.5 to 2.0° C. The one degree limit benchmark is lost forever.

Meanwhile, the world has warmed more than 1°C since the industrial revolution. The Paris climate agreement of 2016 hoped to restrict global warming to 2°C, "a prescription for long-term disaster" (James Hansen), which is presently the best-case scenario. Three degrees of heating may produce a short-term disaster, with the loss of most coastal cities and forest growth in the Arctic (Rich, 2018, Prologue p. 8).

Today, in 2022, a global transformation has already changed the planet. "Since 1981, Arctic sea ice has decreased by an average of 1.3 percent per year. … By 2030, the number of people affected by floods is expected to triple…By 2050, the Arctic Ocean is expected to be largely ice-free in the summer. By the turn of the next century, global sea levels will have risen by one to four feet, potentially turning hundreds of millions of people into refugees" (Rich, 2018, Endpaper p. 70; IPCC 2022).

Coasts and oceans are affected by climate change, and climate change is a cross-cutting issue. So is coastal management. The situation we face today is about human–nature relations, and a variety of approaches are needed to cut across university disciplines in order to identify how we, as humans, depend on nature and how we are shaping nature in the geological and ecological epoch consequently called the Anthropocene. From the human perspective, why do coasts and coastal management play a significant role in this human–nature interface? Coastal populations are canaries in the coal mine of climate change. They are closer to it because coasts and oceans are immediately affected by storms, floods, rising seas, or erosion. Seashore protection follows climate change as an adaptation strategy.

## 3. Why coasts and oceans?

Coasts emerge where land, water, and air meet. Coastal areas are often renowned for their particular cultural histories, resource abundance and economic wealth, their biological productivity and biodiversity, and their scenic beauty. Unfortunately, coasts are also highly vulnerable from an ecological point of view. Multiple uses tied to a plethora of interests can generate conflict. Preserving the richness of coastal areas as well as their function as an economic base requires a comprehensive management scheme. This is where integrated coastal management (ICM)[1] becomes crucial: it is designed to mediate disputed claims fairly and justly and, at the same time, to enable and guarantee regional sustainable development. Sustainability is a 'regulative concept' (Immanuel Kant) that sets standards generally based upon notions such as resource replenishment, conservation, socioeconomic well-being, and social justice. In line with the thrust of human ecology, ICM attempts to bring a process full circle—from laying some of the theoretical foundations to implementing concrete sustainability measures in coastal management.

What is a 'coastal zone'? Definitions vary. Land-oriented quantitative definitions often assume a 60–100-km strip of land when population dynamics or economic development are at stake. On the other hand, it is claimed that the seaward side, extending to 12 nautical miles or up to the boundary of the exclusive economic zone (EEZ), is also part of the coastal zone because the coast integrates land *and* sea. The American National Research Council defines a coastal zone as extending seaward 200 miles from the coastline to the limit of the United States' EEZ and extending landward from the coastline to the limit of tidal influence (National Research Council, 1995, p. 5). According to Sorensen (1997, pp. 4–9), the coastal zone includes offshore waters, the coastline, and the adjacent shores. These parts can be understood and combined in changing variations so that a plethora of definitions can be produced. In addition, one may include river catchment areas that influence or contribute to coastal character, sedimentation, or fertility. Such was the stance of the IGBP-IHDP (United Nations International Geosphere-Biosphere Programme and International Human Dimensions Programme) global project, 'Land-Ocean Interactions in the Coastal Zone' (LOICZ).

In the face of a multitude of disputable definitions, one useful approach might be a functional definition, according to problems or tasks. There are various coastal uses and use functions, such as fishing, shipping, harbour development, recreation, conservation, coastal protection, or as a bulwark of defense. Apart from these functions, there are also economic production aspects (agricultural, aquacultural, or industrial, for instance), the problems of ecological regulation, and socio-cultural and aesthetic considerations (traditions, landscape/seascape), all of which are generally inextricable from the overall coastal zone problematique. Different uses and functions thus affect how a coastal zone is defined, and such definitions will also vary over time.

[1] The term 'integrated coastal zone management' or 'ICZM' has been subsequently simplified to 'integrated coastal management' or 'ICM'. I have opted to use the simplified expression throughout this text.

The coast, as the interface of land, water, and air, represents a challenge for spatial planning and marine and coastal zone developments and use. Offshore wind energy generation, establishing marine protected areas, or the socioeconomic polyculture of fisheries and fish farming represent combinations of uses and signify profound change. The likely results include an intensification of land-sea interactions as well as the emergence of new conflicts over coastal use, for instance, wind farming versus fisheries versus shipping. Spatial planning and the administrative integration of land and sea have become crucial components of national ICM strategies. Antagonistic interests and rival stakes must be resolved to achieve balanced, satisfactory, and fair uses of coastal resources.

## 4. The new paradigm matures[2]

This book departs from an analysis of conceptual framings, i.e. mental constructs of human–nature relations, and interlinks changing approaches to social–ecological systems analysis and integrated and sustainable coastal management (CM), originally called Coastal Zone Management (CZM). Whereas it should have been theoretically self-evident and politically imperative not to separate social and ecological issues, it took a long time before research and politics recognized the need for integration. Regarding coastal areas globally, the first legislation to establish this link was the American Coastal Zone Management Act (CZMA) of 1972, which declared a national policy to preserve, protect, develop, or restore coastal resources for present and future generations[3].

The challenges for science, policy, and civil society were vast, in that a complex issue framed a new paradigm. 'Integration' then not only implied the need to link social and ecological systems. It was acknowledged that three coastal elements—terrestrial, shelf water, and air—needed to be integrated. The same was true for three realms of scientific knowledge—the natural sciences, the social sciences, and the humanities—as they together captured basic aspects of coastal life. Consequently, science and policy began to cooperate closely. Science addressed societal problems to inform policy; policy and politics were needed to solve emerging problems. Issues changed over time, and problems diverged widely—in the spatial sense—between regions and climate zones (Glaeser et al., 2018).

We, two social science researchers authoring and editing this book, have been fascinated by those variegated and complex scientific challenges and options, ranging from epistemology to basic and applied science, to policy and policy advice, and from definitions to problem solving. We were also captivated when we discovered in hindsight how scientific and political outlooks changed over time, determining and redefining societal needs that in turn produced and resulted in changing research priorities. This book presents an account some 25 years of research on coasts, oceans and small islands, linking social and ecological systems, in close collaboration with natural scientists, managers, policy makers, and the local populations involved. We faced challenges to society, arising in temperate and tropical environments, and challenges to the environment generated by human activity (Glaeser, 2019b).

Integrated and sustainable coastal management is multi-faceted, greatly issue dependent and has, during its history, followed different trends and paths. The initial goals were to identify coastal stakeholders, resolve their conflicts, and achieve sustainable coastal development socially, environmentally and economically. Later, 'governance' gained importance as a focal theme, and national and international ICM strategies were devised. In the wake of the increasing incidence and strength of natural calamities, the coastal hazards theme came to dominate much of coastal management in many world regions, in particular on tropical coasts and islands, soon to be overwhelmed by climate change issues. This shift in attention has occurred as a product of an apparent increase in catastrophic coastal incidents sparked by two early 'marker stone' events, the tsunami in December 2004, which destroyed hundreds of thousands of lives and homes in several Southeast Asian countries, and hurricane Katrina in August 2005, which devastated much of the low-lying areas of New Orleans. More recently, a consolidation has been observed in parts of international research—an attempt to filter, to differentiate and to link the accumulated knowledge relating to coasts and oceans as an integrated whole. Coastal and ocean typologies, combining social and ecological factors, have become topical. As part of this more general trend in the LOICZ and IMBER research networks, we—the authors— have been involved in the development of an analytical instrument to serve as a governance tool in coastal and ocean planning and policy. We have witnessed the maturation of a field: integrated and sustainable ocean and coastal management (Glaeser, 2019a).

## 5. Book structure

Part I, 'Human–nature relation: Conceptual framings', presents theoretical insights and mental constructs to illuminate the relations between human societies and physical nature. Emphasis is placed on the social dimension and on global change. It is argued that carefully considered mind mapping is a major prerequisite for improving ecosystem governance and management and ensuring sustainable development at multiple levels, from the local—including sustainable livelihoods and socio-environmental justice—to the global level, where planetary challenges and boundaries are gaining prominence.

---

[2] See also: "Outlook on coasts, oceans and climate change," closing chapter of this book.

[3] See https://www.energy.gov/nepa/downloads/coastalzone-maragement-act-and-regulations-noaa, accessed 9/20/2019 and the NOAA website, accessed May 1, 2022.

Part II, 'Methods to approach human–nature dynamics', introduces a selection of approaches to better comprehend the dynamics of human–nature relations. These include integrating interdisciplinary knowledge, the development of indicators to measure sustainability, participatory management, and multi-agent modelling; they also include visual tools to analyse the social–ecological dynamics surrounding marine resource management and the linking of knowledge systems, which has classically been termed transdisciplinary but has later come to be known as collaborative knowledge generation.

Parts III and IV, 'Navigating scales—Temperate and tropical cases', explore real-world project-level approaches to establishing sustainable coastal management. We present our case studies in a historical sequence. The case studies observe developments in Sweden (1995–1998), Germany (1999–2007), Brazil (1996–2005 and 2018), and Indonesia (2005–2016). We cover regional to national and global scales and represent temperate and tropical climate zones as well as 'old' industrialized countries vis-à-vis societies that have been engaged in classical economic development more recently. The coastal issues in these contexts range from fisheries and eutrophication (Sweden) to off-shore wind farming and economic transformation (North Sea West Germany and Baltic East Germany), to mangrove-related livelihoods and co-management strategies (Brazil), and to tropical multi-species fisheries in combination with coral reef destruction (Indonesia).

Part V, 'Ethics and governance', offers wider insights from the presented national cases. Transgressing the boundaries of natural hazards, the first contribution discusses ethical and political perspectives of coastal management strategies, including achievements and shortcomings. This is followed by a discussion of national coastal and marine strategies that focus on a strong and novel off-shore spatial planning component. The future of coastal areas is to include more prominent interactions between society and coastal ecosystems. This focus is exemplified by the national German research program Coastal Futures. Participatory practices and the respective central actors and programmes in Brazilian coastal management are presented at national level and in three regional case studies, and outcomes of participation in coastal management analysed up to the time (2019) when a political regime shift began to generate less favourable conditions for decentralized, inclusive and pro-poor approaches.

Part VI, 'Linking research to governance', proposes pathways towards a social–ecological typology. With this, we offer a building block on the road towards a 'Good Anthropocene', in which vastly increased human potentials to affect social–ecological futures are channelled in more sustainable directions. A multi-level analysis of social–ecological systems leads to a research-driven global sustainability matrix that is the basis for a coastal and marine typology. The typology itself serves as a tool to analyse coastal and marine social–ecological systems and thus links science to policy and management.

The 'Outlook on coasts, oceans and climate change' distils the major arguments and outcomes of the book and draws conclusions for the research and policy agendas that—in our view—need to shape our future. It is no surprise that climate issues play a prominent role.

## References

Francis, J. (2018). Clarity and Clouds: Progress in understanding arctic influences on mid-latitude weather: 74-80. In: 2018 Arctic Report Card, NOAA Arctic Program. URL: http://whrc.org/a-force-for-arctic-science-dr-jennifer-francis-joins-whrc/

Francis, J. (2019). Rough weather ahead. Scientific American, June 2019, vol. 320/6: 48-53.

Glaeser, B. (2019a). Sustainable coastal management for social-ecological systems: A typology approach in Indonesia. In: Krishnamurthy, R.R., Jonathan, M.P., Srinivasalu, S. & Glaeser, B. (Eds), Coastal Management: Global Challenges and Innovations. Elsevier, London et al: 61-76.

Glaeser, B. (2019b). Human-nature relations in flux: Two decades of research in coastal and ocean management. In: Wolanski, E., Day, J.W., Elliott, M. & Ramachandran, R., (Eds). Coasts and Estuaries – The Future. Elsevier, Amsterdam, Oxford and Cambridge, MA: 641-657.

Glaeser, B., Ferse, S. & Gorris, P. (2018). Fisheries in Indonesia between livelihoods and environmental degradation: coping strategies in the Spermonde Archipelago, Sulawesi. In: Guillotreau P, Bundy A, Perry RI (Eds) Global change in marine systems. Integrating natural, social and governing responses. Routledge: Studies in Environment, Culture, and Society. London and New York: 67-82.

IPCC (International Panel on Climate Change) (2022). Climate Change 2022. Impacts, adaptation and vulnerability. Summary for policymakers. In: IPCC, WGII Sixth Assessment Report. IPCC.

Meadows, D.H., Meadows, D.N., Randers, J. & Behrens III. W.W. (1972). The limits to growth. A report for the Club of Rome's project on the predicament of mankind. Potomac Associates – Universe Books, Washington, DC.

Meyer-Abich, K.M. (1972). Die ökologische Grenze des Wirtschaftswachstums (The ecological limit to economic growth). In: Umschau, Vol. 72/20: 645-649. Reprint 1973 (abridged) as: Die ökologische Grenze des bisherigen Wirtschaftswachstums. In: Forschung 74. Berichte aus Wissenschaft und Technik. Fischer, Frankfurt: 13-18.

Meyer-Abich, K.M. (1973a). Die ökologische Grenze des herkömmlichen Wirtschaftswachstums (The ecological limit to traditional economic growth). In: von Nussbaum, H. (Ed. 1973), Die Zukunft des Wachstums — Kritische Antworten zum „Bericht des Club of Rome". Bertelsmann Universitätsverlag, Düsseldorf: 163-186. Reprint 1973 (abridged) as: Ökologische Grenzen des Wirtschaftswachstums. In: Nachrichtenblatt der Societas Annensis (Augsburg), Vol. 21 (Fall): 4-22.

Meyer-Abich, K.M. (1973b), Die Begrenzung des herkömmlichen Wirtschaftswachstums durch die klimatischen Wirkungen des Einsatzes von Energie (The limitation of traditional economic growth through climate effects by energyinput). In: Wirtschaftspolitische Blätter (Vienna), Vol. 20/5: 306-310.

Meyer-Abich, K.M. in cooperation with W. Caspar & H. Flohn (1974). Wärmebelastung der Atmosphäre und Klimabeeinträchtigungen (Heat load of the atmosphere and climate effects). In: Bundesministerium des Innern (Hg. 1974). Bericht der Projektgruppe „Umwelt und Energie“ beim Bundesminister des Innern. Umweltbrief 9. Heute: Umwelt und Energie, 25-30. Bonn. (Heat load of the atmosphere and climate effects). In: Federal Minister of the Interior (Ed. 1974). Report by Project Group “Environment and Energy” at the Federal Ministry of the Interior. Environmental Letter No. 9. Today: Environment and Energy, 25-30. Bonn.)

National Research Council (NRC) (1995). Science, policy, and the coast. Improving decisionmaking. National Academy Press, Washington, D.C.

Rich, N. (2018). Losing earth. New York Times Magazine. August 5, 2018.

Sorensen, .J (1997). National and international efforts at Integrated Coastal Management: Definitions, achievements, lessons. Coastal Management, 25: 3-41.

Vonnegut, K. (1985). Galápagos. A novel. Delacorte Press/Seymore Lawrence: New York.

# Part I

# Human-nature relation: Conceptual framings

## *The global and the social*

Part I looks into theories and mental constructs to describe and analyse human–nature relations. Chapter 1 presents the social and cultural aspects of global environmental change. The scientific community is called upon to contribute to sustaining environmental conditions for the sake of global livelihoods. The social dimension, social influences on ecosystems and, conversely, of ecosystems on society is the theme in Chapter 2. The chapter examines the reasons that have inhibited social–ecological management and offers a conceptual framework that includes quality criteria for the social dimension of human–nature relations. Chapter 3 presents mental models of human–nature relations, examples of ecocentric, anthropocentric, and interdisciplinary mind maps. Mind maps of complex systems are capable of operationalizing the social dimension of ecosystem management to support resilience-oriented management. System stakeholders participating in transformative and adaptive transdisciplinary work are central in these endeavours.

# CHAPTER 1

# THE CHANGING HUMAN–NATURE RELATIONSHIP IN THE CONTEXT OF GLOBAL ENVIRONMENTAL CHANGE

BERNHARD GLAESER[1]

## Abstract

The objective of this introductory essay is to convey a broad view of social and cultural aspects of global environmental change (GEC). It represents a Western, social science perspective, and reflects on discourses influenced by the third millennium. Upon remarks concerning the relationship between natural and social change (Section 1), Section 2 raises the question, "to what extent is nature peripheral to humans?" Section 3 focuses on interpretations of how a millennial shift is experienced: "Do the social and interdisciplinary sciences take notice of the human–nature relationship (HNR) in the context of GEC?" An important new topic is the social dimension of sustainability, including social exclusion and development (Section 4). The final Section 5 draws conclusions as to historical, theoretical, ethico-behavioural, and political aspects of the HNR within the context of GEC: Finding solutions to sustain the environmental conditions for the sake of global livelihood, including social justice.

*All things change yet never die…*
*Nothing retains its shape of what it was,*
*And nature, always making old things new,*
*Proves nothing dies within the universe,*
*But takes another being in new forms…*
*And fortune changes many looks of places.*
*…For Earth itself*
*Is like an animal that breathes and sighs*
*Fires and flames and as she shakes her sides,*
*New doors are opened for her sighing breath*
*While others close again…Then as the Earth grows weary*
*Of feeding fuel to fire – for Earth is old –*
*Nature herself will starve, hungry, depleted,*
*Neglecting fires that eat her nourishment…*
*So times and countries change or weaker, stronger,*
*To rise or fall within the changing years…*
*To let you know how all things are mutations –*
*Heaven or Earth and all that grows within it,*
*And we among the changes in creation.*
Ovidius Naso (1960, lines 165–456 in the Latin original)

In his Metamorphoses or Transformations, completed in the year 8 a.d., the great Roman poet P. Ovidius Naso tells the story of changes in nature, mythology, and human history. In particular, the philosophy lecture in Book 15 gives an amazing account of natural and social change that include such themes as global change, the Gaia hypothesis, environmental destruction, and human and political development. Ovid's depiction demonstrates the broad scope of natural and social change; it is the starting point for this attempt to discuss a variety of perspectives concerning the changing relationship between humans and nature in the context of global environmental change (GEC).

The overall objective of this introductory essay is to convey a broad view of social and cultural aspects of GEC. It represents a Western, social science perspective, and reflects on today's discourses as influenced or characterized by the turn from the second to the third millennium. It is concluded that the international scientific community can and should play a vital role in finding solutions to sustain the environmental conditions for the sake of global livelihoods, including social justice.

---

[1]This chapter was originally published as Glaeser, B., 2002. The changing human-nature relationships in the context of global environmental change. In: Munn, T. (Ed.), Encyclopaedia for Global Environmental Change. Volume 5: Social and Economic Dimensions of Global Environmental Change. John Wiley, Chichester/UK, pp. 11–24. ISBN: 0471-97796-9. The text was shortened, updated and related to 2020 issues by M. Glaser and B. Glaeser.

## 1. Natural versus social change

Relationships between humankind and nature are first of all physical and material: they determine the very substance of and conditions for human survival. But, at the same time, humans interpret and construct relationships between themselves and nature. It is this complex interplay that constitutes and complicates consideration of the social and cultural aspects of global environmental change (GEC). Shifting perceptions relate to physical, economic, social, and cultural changes over time. The changing relationship between humans and nature is an open issue; the cultural and social sciences attempt to interpret it in terms of the following questions: What did the human–nature relationship (HNR) look like before and after the start of GEC? What is the specific difference? When did GEC occur and with what consequences for the HNR? We do not really know the answers to these questions for several reasons.

- Natural as well as social systems are determined by 'perpetual change'. When change ceases, the system stops functioning and perishes.
- There is disagreement as to the novelty of global change, because there is some dispute over the meaning of the term 'globalization'. One view is that globalization indicates Western modernity; that it was initiated by Columbus discovering and exploiting the New World, followed, in turn, by the rise of capitalism and the age of technology. This view is based upon the idea that the Renaissance combined wisdom and the power of Mediterranean antiquity with northern European modernity, which really means globalization on a temporal, historical scale. The 'perfected' regime of this power combination is called the Anthropocene.
- Opinions differ as to the values attached to nature and the nature–human relation. These values depend on the degree of an individual's exposure to nature, the needs he or she attaches to nature, the capacity for self-reflection contained in these various concepts and the willingness to abstract from nature. Individuals, ethnic groups, and cultural systems construct their own concepts of nature on which they rely and to which they relate. Stakeholders shape the respective human–nature relationships.

These reasons suggest the following point of departure and focus. Since natural and social systems are characterized by perpetual, uninterrupted change, we shall focus on what appears to be its present mode, after the turn of the 21st century, and its corresponding interpretations, concepts and constructs. Humans and nature: which is central, which is peripheral? The age-old question is again raised. It has ethical and political consequences; these are labelled respectively as the anthropocentric and, conversely, the bio-ecocentric approach. What is the dominant concept of nature? Nature may mean cosmos, the origin of life, an object for philosophical contemplation or artistic production—not to speak of its practical form as a natural resource serving as a vital factor of economic production. Are there different cultural outlooks, such as a typically oriental or typically occidental perspective? *Ex oriente lux*, enlightenment from the Orient, was the belief or romantic fashion of different ages, including New Age culture.

What is the importance attached to the relationship-to-nature topic and who are the winners and the losers of GEC? In Europe, during the 1990s, environmental issues lost a lot of appeal to issues of job security and the labour market; whereas in the rural developing world, environmental degradation and loss of soil fertility are often synonymous in that they determine income, livelihood, and survival chances—those of rural women more than anybody else (Kiely and Marfleet, 1998; Klingebiel and Randeria, 1998).

Finally, how does the sustainability concept serve in this context and at this point? What is its social dimension and its political outlook? Holistic, interdisciplinary or transdisciplinary approaches have won recognition. Consequences are felt by the research community who have become stakeholders in this field. The mode of knowledge production is changing, and this implies yet other relationships: that between the natural and the social sciences as well as that between the sciences and the participatory involvement of other (non-scientific) stakeholders affected by GEC. In the political arena, global environmental politics is becoming a strategic issue, environmental and climate security (Liebenguth, 2020) follows military and food security. Structural policy is needed to give global change a proper shape (Schellnhuber and Pilardeaux, 1999; Pérez de las Heras, 2020; Abrahams, 2019).

## 2. Nature: Is it peripheral to humans?

As we use ever bigger telescopes to observe the universe, such amplification technology also enables us to literally view the past. We are not too far from witnessing the 'birth' of the universe: Empirical evidence will tell us which hypotheses and theories are to be falsified. Light travels at a velocity of approximately 300,000 km/s, which means, for instance, that it takes sunlight a full 8 min to reach the earth. These simple and well-known physical facts have theoretically interesting implications as scales increase. Imagine that we can see and photograph a galaxy at a *distance* of one billion light years away! Since the light as we have observed has been travelling for so long a *time*, namely one billion years, we are, from a human standpoint, literally looking into the remote past without even knowing whether what we observe still exists 'at present'.

The Copernican revolution revealed the fact that the Earth was not the centre of the universe, or even the centre of the solar system. Our earth is simply a minute and by no means unique particle somewhere at the periphery of our galaxy, the 'Milky Way', and also of the presently known universe. This revelation could not be publicized freely at the time, because it hurt the interests of an important 16th century 'global player' and stakeholder, namely, the Catholic Church. Throughout most of Europe, the Church held a monopoly on the interpretation of not only all metaphysical matters, but also the view of the world and all worldly matters. The Church of Rome represented God the Almighty on Earth, so it claimed, as an institutionalized human trustee; it intended to expand the domain of its monopolistic trust around the globe, along with the worldly powers that used fire and sword to subdue the rest of humanity. So this interpretative and

explanatory competence meant power, in a subtle way perhaps. The promulgation of the new heliocentric theory by the Polish astronomer Nicolaus Copernicus (1473–1543) and the rise of science as a whole thus challenged the authority of the Church and its cultural imperialism.

Today, half a millennium later, we witness a second Copernican Revolution (Schellnhuber, 1999) which calls our attention back to planet Earth. The 'Earth system' as a whole is to be analysed. Understanding it is the basis on which to develop concepts of and for global environmental management. Earth system analysis (Schellnhuber and Wenzel, 1998) is the holistic and transdisciplinary attempt to model and simulate the ecosphere, i.e. the geosphere–biospheric complex, including its climatic history as far back as half a million years ago. This is an endeavour that takes the Gaia hypothesis seriously—the paradigm that interprets the Earth system as a cybernetic whole endowed with a self-regulating capacity (Lovelock, 1979). The basis of this theory is hardcore empirical data that demonstrate that self-regulating biospheric mechanisms have kept the Earth's crust stable and its environment habitable. Biospheric evolution eventually produced humankind.

After four and a half billion years of natural and eventually cultural evolution, we have learned two things. First, we are capable of continuously undermining the conditions for our own survival. Global environmental change in the destructive mode can be seen, for instance, in human activities such as oil spills and toxic waste proliferation, perforation of the stratospheric ozone layer (thus exposing us to more UV-B radiation), or nuclear warfare. Second, we have developed—perhaps to a lesser extent—the ethical and managerial tools to protect and safeguard the global environment against forces of destruction like those just mentioned (Parry and Livermore, 1999; Pearce, 1999).

Again, interpretative and explanatory competence has a significant role. Unlike 500 years ago, when enlightenment and the rationality of science freed humankind from religious obedience to strive towards self-determination, it may now be the interpretative dialectics of mythology that reveal the destructive mode of science and technology: Humankind has become simultaneously Shiva and Vishnu, the Hindu gods who represent the concepts for Destruction and Preservation, respectively.

## 3. The millennial shift: Gnosticism and the environment

At the beginning of the third millennium (*anno domini* in our Christianity-centred temporal accounting) environmental management has to cope with global environmental changes. Fears of global destruction and extinction witnessed the earlier transition from the first to the second millennium. According to the doctrines of Gnosticism, salvation could be attained only through the pursuit of spiritual truth and the transcendence of matter. Jesus Christ was considered by Gnostics to be non-corporeal. In keeping with this doctrine was the belief that the beginning of the second millennium would bring about the spiritual age. Gnosticism incorporated an apocalyptic and chiliastic vision of nature's decline and God's ultimate reign over Earth, 1000 years after the birth of Christ. Chiliasm is the doctrine stating that Christ will reign on Earth for 1000 years; ancient gnostic knowledge and belief originated in Mesopotamia, Syria, and Egypt, around the Mediterranean, and was revived by Scotus Eriugena in the 9th century (Voegelin, 1952, 1959).

In the following, I draw a parallel between the lack of interest in the natural world on the part of traditional social science and the lack of interest in the physical world by Gnostics. My thesis is that some 'concept-oriented' or 'social-constructivist' social scientists are, or behave as if they were, Gnostics. As proof of this, I briefly review some journals in the field that devote special issues to the recent millennial shift.

Is GEC and/or the changing HNR of interest to social science? A few international academic journals focused their last issues in 1999 (or the first issues in 2000) on millennial aspects: the transition from the second to the third millennium, its meaning and relevance for the development of social or interdisciplinary science. I review four journals and their topical issue: two interdisciplinary and two specialized in sociology. *The Ecologist* (1/2000) and *Universitas* (December 1999), a German-language academic journal, are both interdisciplinary and concentrate on gnostic themes.

*The Ecologist* (1/2000) dealt with the 'cosmic covenant'—"re-embedding religion in society, nature and the cosmos". Emphasized is "the role that religion can and must play in saving what remains of the natural world", as Edward Goldsmith puts it in his editorial. Knowledge and values that attributed the utmost priority to the preservation of creation were once propagated by the various religious groupings or cultures. The rediscovery and revival of ecological themes and cosmic theologies appears to be an environmental priority. The theological underpinnings of most religions relate the individual to society, the natural world, and the cosmos. Mainstream science committed the 'ultimate blasphemy' in that "*Homo scientificus* has deified himself"; mainstream religion has lost its way and needs to return to its roots. Noah's flood symbolizes the forces of chaos. Historical storms and floods in Orissa (India) or Vietnam may remind us of this archetype human failure to observe the cosmic covenant, that is, to fulfil our contract to live in harmony with the laws of nature and the cosmic order (Goldsmith, 2000a, pp. 6–8). Religious inspiration and perennial beliefs are to be found among the primal creeds or religions because these derive from the cosmic covenant—the universal revelation given to humans (Griffith, 2000). Tribal stories maintain such wisdom and its ecological message (Wilson, 2000). So did classical mythology and the ecological worldviews of ancient societies such as those of Greek, Chinese, Egyptian, Indian, or Persian antiquity, by using the notion of the 'path' that must be taken to maintain the cosmic order on which human welfare depends (Goldsmith, 2000b; Chaitanya, 2000). Related cosmic and ecological insights are quoted for the Islamic and the Judeo-Christian traditions, to some extent influenced by the ancient civilizations (Nasr, 2000; Murray, 2000; Barker, 2000; Rossi, 2000; Roth, 2000; Echlin, 2000). The cosmos was embedded in the Church until western scientific thought replaced the term 'creation' with 'environment', thus separating human from non-human nature. The message of the special issue of *The Ecologist* is that such desecration of the cosmos ought to be reversed in the third millennium.

*Universitas* (December 1999) entitled its special millennium issue "Endzeiten, neue Zeiten?" (Final age, new age?), and focused on topics of transition (Geissler, 1999) between the two millennia. Western industrial societies have eliminated many rites of passage and transition; the symbolism of fireworks, for instance, whose original intention was to vanquish 'evil spirits', has been lost. Instead, the transition from the second to the third millennium has been marked by spectacular events not necessarily of universal importance or interest such as who (in somebody's town) gives birth to the first millennium baby (Hilgers, 1999). In a similar way, the great issue of the apocalypse has changed. Originally, St. John, pictured the apocalypse in *The Book of Revelations* as the vision of salvation coming about after a transitory collapse. This 'transitory collapse' is itself frequently referred to as the apocalypse. The visionary apocalypse represented the advent of the millennial God's reign on Earth, the 'New Jerusalem', as it was called. In the 20th century, Hitler and Stalin were associated with the advent of the apocalypse. The transitional period during which both leaders were in power was an extremely violent and bloody episode, characterized by massive internment in concentration camps and *gulags*, and massive human slaughter, in particular genocide. All of this was designed to 'purify human blood' or to convince people to adopt the 'right doctrine', for the purpose of achieving some perfect millennial Third Reich or ideal post-historic age of communism.

The cyberspace apocalypse, somewhat less deadly, has led us into the third millennium. Virtual reality represents the 'New Jerusalem'. The cybernaut, as the 'new human', exists independently of bodily needs and achieves immortality as part of the permanent memory of a computer network. St. John's 'millennial Third Reich' becomes the age of knowledge beyond the ages of agriculture and industrialization (Vondung, 1999). The fear of collapse was stirred up by the 'Y2K problem', the possibility of a global computer network breakdown. This was originally a technology problem that was heavily and massively 'mythologized' perhaps because billions of dollars were at stake (Csef, 1999). Among the many predictions concerning the year 2000, the 1972 Club of Rome report on the limits to growth was misunderstood as a model to predict the real breakdown of the global economy due to resource depletion, environmental degradation, and population explosion (Schmid, 1999). To summarize, Gnosticism played a vital role in the Universitas millennium issue. Global environmental change and changing human–nature relationships are included but do not feature centrally.

Globalization is featured outside the main section of that special issue in an interview (Reif, 1999) conducted with Harold James, a Princeton University historian, who speaks of globalization beginning in the 19th century and suggests that while the process may be deplorable for some, it is nevertheless irreversible. James cites earlier historical events and occurrences as evidence for globalization, such as the first transatlantic cable in 1866, the New York stock exchange crashes of 1906 and 1907 and their immediate repercussions on the European stock markets, or unifying global trends in fashion, including the Japanese adoption of Western dress and fashion, and similar trends in the fine arts since the age of the Renaissance. As one reaction, globalization has also provoked some outcry such as the one referring to it as the 'globalization trap' (Martin and Schumann, 1996) or critics in the developing world who state that 'globalization equals imperialism'.

Earlier, protective tariffs were designed to bar international competition. Welfare and social legislation were designed to strengthen the nation state. Visionary 'third ways', such as an attempted balance between the market and planned economy, are viewed by some as roads leading directly into Third World underdevelopment. GEC and the HNR do not appear to be connected with globalization in the sense it is used here.

The traditionalist sociologist's world view, similarly, seemed to be less environment-related and nature-minded. We shall now turn to two sociology journals and consider their millennium special issues.

*The British Journal of Sociology* (1/2000) and *Current Sociology* (4/1999) take up the millennial problematique, the latter focusing on 'the future of sociology and the social sciences', the former on 'sociology facing the next millennium'. This could be an indicator of the importance attached to the issue of global change and the nature–human relationship by eminent mainstream sociologists. The latter journal invited its contributors to consider "what the Millennium might indicate about the history of 'human societies' and especially how 'sociology' is facing up to the challenges and opportunities posed", and to provide 'analyses of such transformations' (Urry, 2000a, p. 1).

Manuel Castells opens the volume by proposing a grounded theory of the 'network society' as the social structure of the 'information age'. The networks are empowered by the new communication technologies and reshape the relations of production, consumption, power, experience, and culture. 'Ecologism' is an example of an alternative network in opposition to dominant networks (Castells, 2000). Since the 1960s, 'globalization' has transformed the context of sociology, according to Immanuel Wallerstein. He proposes a unified or re-unified historical social science as a truly global exercise (Wallerstein, 2000). Göran Therborn documents the shift from a universal to a global sociology in the second century after sociology became a discipline. He forecasts a comparative and competitive focus among the neighbouring disciplines—sociology, political science, and economics—rather than along the social-versus-natural-sciences divide (Therborn, 2000). Cross-cultural, empirical comparison of societies in transformation, without worrying too much about theoretical concerns, is advocated (Esping-Andersen, 2000). The conflict between the 'patchwork quilt of nation-states' and the 'cosmopolitan order of human rights' may open the door to the 'second age of modernity' (Beck, 2000). Contributions on urban sociology (Sassen, 2000), cultural diversity and the internet (Featherstone, 2000), and 'mobile sociology' (Urry, 2000b) conclude the volume.

Dissenting from the 'social sociology' orientation, a 'natural tilt' can be detected in subsequent contributions. Science and technology studies and the social explanation of natural scientific facts work towards a 'physical sociology' and its epistemology (Latour, 2000). The focus on socio-environmental theory and the case of genetic modification of food reveal that the "social sciences' relationship to nature and environment matters" (Adam, 2000, p. 125). 'Timescape' is conceived as the temporal equivalent of landscape. The timescape analysis of socio-environmental matters brings

"contextualized temporal complexity to the heart of social theory". Thus the time aspect is central to understanding sustainability and its emphasis on nature's regenerative capacity. Intergenerational equity and cultural equity are at stake—the ownership of reproduction has been transferred to transnational companies. A "time sensitive scholarly enterprise is … the task that confronts social theory at the beginning of the new millennium" (Adam, 2000, 137–140).

*Current Sociology* (*Volume 4*, Number 4, October 1999) reported the results of the symposium on "The Future of the Social Sciences in the 21st Century" which was the concluding session of the XIVth World Congress of Sociology in Montreal in August 1998. The whole issue dwells on the pros and cons and various aspects of interdisciplinarity, of opening up to and collaborating with neighbouring disciplines. Disciplinary boundaries should be negotiated, not simply closed down. To think in 'space-time' and touch geography and history is recommended (Massey, 1999; similarly Allardt, 1999). An active interdisciplinarity is needed, in particular with economics, and also a transdisciplinary or intercultural approach (although the latter terms are not used explicitly, the idea they encompass is implied) to link up with different regions or countries in the age of globalization (Boyer, 1999). Finally, all fragmented perspectives, including those of singular, exclusive disciplinarity, ought to be abandoned in favour of a theoretical unitary reconstruction of the social sciences, if we wish to avoid both the 'barbarism of economist reductionism' and the 'conservative nihilism of postmodernism' (Boron, 1999).

Are the millennial issues representative of social science and interdisciplinary thinking? Do they address the pressing environmental themes substantively and sufficiently? To take up the scope of interdisciplinarity is certainly laudable *per se* and represents *avantgarde* scientific development. The scientific base, though, appears a little narrow as the natural sciences have been left out, by and large. The HNR in the context of GEC was obviously not considered to be of major concern in the wake of a millennial shift. A few environmentally based and theoretically challenging contributions were competently put forward in the British Journal of Sociology. They do not, however, constitute anything close to a social science mainstream movement. To construct a concept of nature and the HNR is hardly even attempted. What are the conclusions as to the relevance of the HNR and GEC for the social science mainstream? Has there been visible change?

Let us briefly review some specific aspects of the environmental sociology discourse as it began in the 1970s (we set aside the Chicago School of sociology in the 1920s) along with the global environmental movement. We argued earlier (Glaeser, 1996) that environmental sociology became established as a sociological sub-discipline in the United States within the short time span from 1978 to 1980. The theoretically ambitious goal at that time was to acknowledge physical and biological factors as independent variables to influence the dependent variables of social structure and social behaviour. This was intended to become a new paradigm within the sociological knowledge canon to turn the sociological mainstream towards an HNR concept.

The new disciplinary paradigm was defined through transforming the 'human exemptionalism paradigm' (earlier called the 'exceptionalist paradigm') into the 'new ecological paradigm' (Dunlap and Catton, 1979, p. 250). Traditionally, the dominant world view had been to accept humans as the one unique and superior creature on Earth, capable of quick adaptation to environmental change for cultural rather than genetic reasons. The new ecological paradigm also deviated from a specific sociological tradition established by the early French sociologist Emile Durkheim (1858–1917), who postulated that social facts can only be explained by other social facts. In a most authoritative assessment, Buttel concluded in 1987 that environmental sociology had found recognition as a specialty within sociology. It did not succeed, however, in redirecting mainstream sociology (Buttel, 1987, pp. 483–484). In our view, Buttel's evaluation was still valid in the 1990s (Glaeser, 1996, p. 34) and still is in the 2020s; it provides the historical background and a broader base for the millennial focus discussed above.

There was one innovation, however, that gradually altered the social science outlook. During the preparation phase of the UNCED Rio summit in 1992, GEC came up as a new political and scientific paradigm: In 1987, the theme had not yet been included in Buttel's (1987) state-of-the-art review and agenda for environmental sociology. Once again sociology was slow in the uptake. An early exception to this was a contribution by Buttel and Taylor (1992) who advocated in favour of the society–nature relation as a social construct; they argued as well that the GEC topic was a social construct simultaneously serving as a scientific concept and as a way of mobilizing the community of scholars. In short, environmental science and environmental movements are complementary. To date, we might interpret that proposal as an early attempt to integrate environmental stakeholders in a transdisciplinary scientific approach. The HNR theme within the GEC context is still not social science mainstream, but it has gained momentum as will be demonstrated below. This is especially the case for the sustainability discourse in the context of the social situation in the early 22nd century. The remaining parts of this contribution will examine, somewhat more closely, the social dimension of sustainability and present some consequences with respect to historical, theoretical, behavioural and political aspects of the HNR within the GEC context.

## 4. Sustainability: The social dimension

What matters about GEC and sustainable development is the 'human dimension'. The difficulties become obvious when operationalizing this idea is taken fully into account (Rotmans, 1998; Rockwell, 1998; Glaser and Glaeser 2012, chapter 2 this volume). The concept of global change (GC) is broader than that of GEC. GC refers to "the totality of changes on the planet Earth, including all human intentions and alterations" (Rotmans, 1998, p. 423). It involves both the biophysical and the human system, whereas GEC refers to the human-induced biophysical changes only. To disentangle the natural from the anthropogenic changes within the GEC framework represents a major exercise fraught with difficulty.

The sustainability concept, according to Merle Jacob, is ambiguous; its "utility diminishes when one tries to operationalize the concept" (Jacob, 1996, p. 27). The ambiguity, oscillating between an anthropocentric orientation that focuses on the needs of future generations, and an ecocentric view that concentrates on living within the carrying capacity of supporting ecosystems, owes much to the normative character of the sustainability concept, as Rotmans argues, and depends on the cultural perspective of the actors using it. Hence different cultural perspectives would have to be elaborated and translated into different preferences so as to arrive at an operational definition of sustainable development that is linked to the notion of global change (Rotmans, 1998, pp. 423–424 and 447–449). The categorization of cultural perspectives and biased preferences could be linked to Dunlap's and Catton's (1979) paradigmatic shift and dichotomy between the human exemptionalist (exceptionalist) and the new ecological paradigm.

'Sustainability' emerged as a new development paradigm from the concept of 'ecodevelopment', its predecessor. The term was popularized by the Brundtland Report, 'Our Common Future', from 1987. The goal was to reconcile environment and development, yet there was a strong bias in favour of environmental sustainability, which, of course, was necessary to counterbalance the strong emphasis on economic growth.

What is social sustainability? When we discuss social, or perhaps more appropriately societal, sustainability we can build on a relative consensus by saying that we are searching for the criteria to explain why and how societies are sustained. It would then be possible to make some reasonable predictions about the future. We reckon with 6000–8000 years of human civilization composed of, say, 200–300 generations of people. In evolutionary terms, this is minute even though we tend to think of it as a relatively long period in historical, political and sociological terms.

What are the factors that maintain or help maintain a social entity for a longer period of time, such as a social group or society at large? Putting the question like this, hints at a quick and simple answer. On closer investigation, however, we see that it might involve the totality of social science theory including those parts that are yet to be written. With all of these constraints in mind, Serbser (2000) in a contribution to *GAIA*—a Swiss-German, multidisciplinary journal covering ecological perspectives in science, the humanities, and economics—suggested the following procedure. Let us identify those or some of those necessary conditions without which social (societal) survival would not be feasible. We talk about formal requirements in a pragmatic sense: they should be independent of each other, yet in combination constitute the societal context in a total bio-cultural sense. Six preconditions (three cultural and three ecological) for a sustainable human society are suggested. The cultural order contains social action, constitution of social groupings, and their transformation in the sense of social change. These conditions for societal sustainability are contained in and derived from established contributions to sociological theory. The ecological order includes social space, social metabolism, and dominance.

Social action is intentional and linked to symbolic systems such as our language which is sufficiently imprecise to enable us to deal with complex issues. Social groups or social units qua subsystems are constituted by the notion of self-identity and, complementarily, by a sharp outline defining other, competing social units. These groups undergo a constant process of reorganization, that is, transformation or social change. Social groups need a spatial environment as a constituting frame. Social space defines the situation of social action; it determines symbols and language. Social metabolism refers to the activities and interactions of social groups: they produce, they consume, and they reproduce themselves, under a regulatory framework of legal and ethical principles. Dominance, finally, refers to social control, the power structure, and governance (including the system of checks and balances).

All six features—social action, social groupings, social change, social space, social metabolism, dominance—according to Serbser (2000), work in combination and, as an interacting set, they determine the survivability and sustainability of a society. But (as Serbser notes with regret) these features and their interaction have hardly been taken into account in the social sustainability discourse.

As these ideas are still somewhat vague, the yardstick to measure the degree to which they are analytically concrete and applicable could be as follows: First, they could serve as a tool to facilitate the determination, perhaps on a quantitative scale, of whether or not any given social (or societal) situation is sustainable. Second, in a more dynamic sense, they could produce recommendations for the implementation of measures as an incremental approach to societal sustainability.

The examples of integrated and sustainable coastal management or the deep sea commons, to take extreme and topical examples for regulated social processes, show that inequalities or simply competing interests need to be negotiated in a process of mutual control and bargaining. Even if some disagreement remains, consensus must be reached on the degree of disagreement accepted. If this does not happen, social exclusion will occur, either voluntarily or as a result of external force. The state or process of social exclusion is certainly not sustainable one because there will always be group members, be it individuals or states, that will aim to reverse a dissatisfactory situation. It may thus be concluded that consensus building by negotiation indicates a state or process of social sustainability. Its absence is termed 'negative social sustainability'.

Global inequality is a topic that was discussed extensively in the 1970s—on an international scale, as early as 1972, during the United Nations Conference on the Human Environment (UNCHE I) in Stockholm (Glaeser, 1997, pp. 103–105). The theme took on a new dimension during the GEC debate. More explicitly than ever before are North–South relations and inequalities linked to environmental problems that have been intimately connected with livelihood concerns. After the 'lost decade' of the 1980s, following the two oil crises of 1973 and 1979, characterized by huge public debts and structural adjustments in the South, GEC is not defined within a social or cultural vacuum (Redclift and Sage, 1998).