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Earth System Governance

The Challenge for Social Science

Frank Biermann

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The Global Governance Project is a joint research programme of eight European research institutions. It seeks to advance understanding of the new actors, institutions and mechanisms of global governance, especially in the field of sustainable development.

Co-ordinator	Vrije Universiteit Amsterdam, Institute for Environmental Studies (IVM)
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Abstract

This paper introduces the concept of earth system governance as a new social phenomenon, as a political programme, and as a subject of research. It then sketches the key problem structures that complicate earth system governance, and derives principles for earth system governance both as a political project and as research practice, namely credibility, stability, adaptiveness and inclusiveness. The main part of the paper introduces five research and governance challenges that lie at the core of earth system governance: architecture, agency beyond the state, the adaptive state, accountability, and allocation.

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Foreword

This working paper was written as part of the Global Governance Project, a joint research programme of eight European research institutions that seeks to advance understanding of the new actors, institutions and mechanisms of global governance. While we address the phenomenon of global governance in general, most research projects focus on global environmental change and governance for sustainable development. The Project is co-ordinated by the Institute for Environmental Studies (IVM) of the Vrije Universiteit Amsterdam and includes associate faculty members and research fellows from eight European institutions: Science Po Bordeaux, Bremen University, Freie Universität Berlin (Environmental Policy Research Centre), London School of Economics and Political Science, Oldenburg University, Potsdam Institute for Climate Impact Research, Vrije Universiteit Amsterdam, and Wageningen University.

Analytically, we define global governance by three criteria, which also shape the research groups within the Project. First, we see global governance as characterised by the increasing participation of actors other than states, ranging from private actors such as multinational corporations and (networks of) scientists and environmentalists to public non-state actors such as intergovernmental organisations ('multiactor governance'). These new actors of global governance are the focus of our research group MANUS–Managers of Global Change.

Second, we see global governance as marked by new mechanisms of organisation such as public-private and private-private partnerships, alongside the traditional system of legal treaties negotiated by states. This is the focus of our research group MECGLO–New Mechanisms of Global Governance.

Third, we see global governance as characterised by different layers and clusters of rule-making and rule-implementation, both vertically between supranational, international, national and subnational layers of authority ('multilevel governance') and horizontally between different parallel rule-making systems. This stands at the centre of our research group MOSAIC–'Multiple Options, Solutions and Approaches: Institutional Interplay and Conflict'.

Comments on this working paper, as well as on the other activities of the Global Governance Project, are highly welcome. We believe that understanding global governance is only feasible through joint effort of colleagues from various backgrounds and from all regions of the world. We look forward to your response.

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Introduction

Since prehistoric times, humans have altered their local environment. About a century ago, they have begun to alter their planet. More and more parameters of the earth system are changing due to human influences. The atmospheric concentration of carbon dioxide has increased by one third since pre-industrial times, and global mean temperatures are rising. Stratospheric ozone depletion through emission of chlorofluorocarbons since the 1920s has increased ultraviolet radiation. Six billion humans now use one tenth of the renewable freshwater available in lakes, rivers or glaciers worldwide. Material cycles have changed: the amount of biologically available nitrogen from human activities has increased nine-fold in the last hundred years, and eighty per cent more nitrogen now reaches the oceans than in 1860. The flow of phosphorus to the seas is today three times higher than historical background rates. Marine resources are depleted, and man-made persistent chemicals have spread throughout the ecosystems up to unsettled polar regions. Humankind today uses about forty per cent of the terrestrial biomass production. Most other living species of the planet are affected. Over the past centuries, humans have increased the species extinction rate thousand times. Between ten and thirty per cent of mammal, bird and amphibian species are threatened with extinction. In earth history, there have been five mass extinctions of species, the most recent 65 million years ago. The current sixth mass extinction is the first caused by one species alone.

Research indicates that the entire earth system now operates 'well outside the normal state exhibited over the past 500,000 years'. Scientists believe that 'human activity is generating change that extends well beyond natural variability—in some cases, alarmingly so—and at rates that continue to accelerate.' It now appears likely that 'human activities could inadvertently trigger severe consequences for Earth's environment and habitat, potentially switching the Earth System to alternative modes of operation that may prove irreversible and inhospitable to humans and other life'.[1]

These scientific findings about the earth system and its current transformation become more confident every day. And there is no dearth of political responses from decision-makers at all levels. In 1988, the United Nations General Assembly declared the changing climate a 'common concern of humankind' and called upon all countries to limit emissions. The 1992 United Nations Conference on Environment and Development was at that time the largest diplomatic gathering in human history, later surpassed only by the 2002 Johannesburg World Summit on Sustainable Development. More than nine hundred international agreements on environmental protection are now in force.

[1] These quotes are from the mission statement of the Earth System Science Partnership, a recent joint initiative of the four principal global change research programmes: the integrated programme of biodiversity science DIVERSITAS, the International Geosphere-Biosphere Programme, the World Climate Research Programme, and the International Human Dimensions Programme on Global Environmental Change. See http://www.essp.org/about_essp.html. The text is based on the 2001 Amsterdam Declaration on Global Change (http://www.sciconf.igbp.kva.se/fr.html). For a comprehensive scientific treatment, see Steffen et al. 2004.

Yet there remains a serious mismatch between the research and recommendations of earth system analysts and the actions of political decision-makers, who are still caught in a nation-state system inherited from the 20th century. Policy-makers in the 20th century gained much experience in managing confined ecosystems, such as river basins, forests or lakes. In the 21st century, they are faced with one of the largest governance challenges humankind has ever had to deal with: 'managing' the entire system earth, including most of its subsystems, and building stable institutions that guarantee a safe transition process and a co-evolution of natural and social systems.

I call this the challenge of 'earth system governance'. In this paper, I will introduce the concept of earth system governance as a new social phenomenon, as a political programme, and as a subject of research. I then sketch the key problem structures that complicate earth system governance, and derive principles for earth system governance both as a political project and as research practice. In the main part of the paper I introduce five research and governance challenges that lie at the core of earth system governance.

The Concept

What is earth system governance? The concept stands at the interface of two broader strands of academic inquiry, earth system analysis and (global) governance theory.

The notion of 'earth system analysis' has emerged from the complexities of global environmental change that require the involvement of most academic disciplines at multiple spatial and temporal scales. Especially in the natural sciences that build on quantification and computer-based modelling, efforts have long been underway to combine and integrate models of different strands of research to gain understanding not of isolated elements of global change, but of the totality of processes in nature and human civilisation. Integrated earth system analysis as a scientific enterprise is the consequence of these efforts, attempting the resuscitation of the medieval academic ideal of a *universitas* of the *facultates*. John Schellnhuber, a key proponent of the concept,[2] ascribes earth system analysis the status of a science in statu nascendi, because, as he writes, it has '1. a genuine subject, namely the total Earth in the sense of a fragile and "gullible" dynamic system, 2. a genuine methodology, namely transdisciplinary systems analysis based on, i.a., planetary monitoring, global modelling and simulation, 3. a genuine purpose, namely the satisfactory (or at least tolerable) coevolution of the ecosphere and the anthroposphere (vulgo: Sustainable Development) in the times of Global Change and beyond'.[3]

[2] In particular, see Schellnhuber 1998, 1999.

[3] Schellnhuber and Wenzel 1998, vii. Schellnhuber proposed five paradigms of sustainable development: (1) standardisation, the identification of long-term corridors for the co-evolution of nature and humankind; (2) optimisation, the maximisation of the nature-humankind welfare function through selection of an appropriate co-evolution segment; (3) pessimisation, the acceptance of a certain distance to optimal zones in order to leave room for mismanagement; (4) equitisation, the preservation of options for future generations; and eventually (5) stabilisation. Cf. Schellnhuber 1999, C23; Schellnhuber 1998, 176-81.

Earth system analysis relates to 'sustainability science', a closely connected concept to integrate different disciplines and communities in the larger quest for a transition to sustainability.[4] As Robert Kates, William Clark and colleagues argue, the challenge of sustainable development is so complex that it requires a 'sustainability science' as a new integrative field of study.[5] A sustainability science shall improve collaboration of natural and social scientists as well as deliver research designs that better integrate all scales from local to global. It would also imply modifications of the traditional model of knowledge generation and a new way in which sustainability science, as a science, is conducted.[6]

Institutionally, earth system analysis has found expression in the Earth System Science Partnership, an initiative of four global change programmes: the biodiversity sciences programme DIVERSITAS, the International Geosphere-Biosphere Programme, the World Climate Research Programme, and the International Human Dimensions Programme on Global Environmental Change.[7] The Partnership builds on a holistic concept of the earth as a complex and sensitive system regulated by physical, chemical and biological processes and influenced by humans. It focuses on anthropogenic change, including through integrated approaches and advanced modelling technologies. To this end the Partnership supports joint projects of the various global change research programmes, such as the Global Carbon Project, the Global Environmental Change and Food Systems Project, the Global Water System Project or the Global Change and Human Health Project.

The study of earth system governance is part of this larger context of earth system analysis and sustainability science. However, earth system governance also maintains a distinctive role owing to the particular theoretical, epistemological and methodological approaches of the social sciences and the humanities, which are essentially qualitative, case-based, context-dependent, and reflexive. Sustainability science thus rests on two theoretical and methodological pillars: One is driven by an integrated computer-based approach that brings together models and modules of natural sciences as well as of some social sciences that are able to contribute models and quantified data, such as economics and some strands of geography. The other pillar is the development of an earth system governance theory that unites those social sciences that analyse organised human responses to earth system transformation, in particular the institutions and agents that cause global environmental change and the institutions, at all levels, that are created to steer human development in a way that promises a 'safe' co-evolution with natural processes. Both pillars are crowned by a common, collaborative roof that organises issue-specific co-operation between the pillars, for example on the global carbon cycle.

4 Key texts are available at http://sustsci.harvard.edu/. See also Clark, Crutzen and Schellnhuber 2005, Schellnhuber et al. 2004, as well as the reports of the Friibergh Workshop on Sustainability Science, held 11-14 October 2000 in Friibergh Manor, Örsundsbro, Sweden. The workshop concluded that sustainability requires a new field of sustainability science that would need to differ by structure, method and content from traditional science. Sustainability science would also require new forms of institutional organisation to support interdisciplinary research and to integrate such research in coherent systems of research planning, assessment and decision-support.

5 Kates et al. 2001.

6 On social learning and sustainability science, see for example Social Learning Group 2001; Siebenhüner 2004.

7 See the Partnership's website at www.essp.org.

The future structure of this integrative 'roof' of earth system analysis is difficult to foresee. Many natural scientists believe in the development of computer-based modelling tools that will provide a true integration of *all* sciences. The Earth System Science Partnership asserts that 'the core' of its activities will be the 'in-depth analysis and advanced modelling of the Earth System as a whole, incorporating data and information from the diverse fields represented by the four global change programmes'.[8] Political governance is therefore part of most theoretical conceptualisations of an integrated earth system analysis. The physicist John Schellnhuber, for example, has formalised the notion of a 'global subject' *S*, which he conceptualises as part of the human civilisation *H* together with the anthroposphere *A* (the totality of human life, actions and products that affect other components of the earth system).[9] Translated into social science language, this 'global subject' *S* could be seen as the political system at the global level including its national and subnational subparts, all of which share the collective ability to bring the 'human impact' in line with the needs of the ecosphere.[10]

In practice, however, it remains unclear to what extent institutional and governance research can contribute to, and integrate with, the more model-driven research programmes, apart from problem-oriented, issue-specific collaboration. Quantifiable hypotheses and computer-based modelling are problematic for most students of institutions and governance—and are likely to remain so.[11] Social science research groups that attempt to use computer-modelling and quantification as a tool for integrating governance research into larger models have still to provide convincing results. Qualitative modelling projects to analyse international governance processes and institutions are in their infancy.[12] Major problems in modelling international governance remain, to name a few, complexity of relevant variables at multiple levels, human reflexivity, and difficulties in conceptualising key social concepts such as 'power', 'interest' or 'legitimacy'.

Quite typical is the conceptualisation of social science in the 23 questions that the Global Analysis, Integration and Modelling task force of the International Geosphere-Biosphere Programme has put forward as overarching questions for the earth system analysis community.[13] Some of these questions relate to the social sciences. However, these social science questions are not viewed as part of the 'analytical ques-

8 See the Partnership's mission statement at www.essp.org. A first practical step is the increased collaboration of the Global Analysis, Integration and Modelling task force of the International Geosphere-Biosphere Programme with the Working Group on Coupled Modelling of the World Climate Research Programme, both natural-science oriented. Two additional initiatives are underway 'to integrate human dimensions into earth system analysis and modelling'—again, this language, taken from the Earth System Science Partnership mission statement, is explicit in its link of earth system analysis with modelling and the need to 'integrate' human dimensions into a seemingly independent, pre-existent earth system analysis. One new initiative is the Global Carbon Project, which aims to develop integrated carbon cycle models that couple biophysical processes with dynamics of energy systems, land-use change, and institutional and political change. See www.ess-p.org/ess-p/jointproj_carbon.htm. The other initiative is the Oslo Group, a network of the International Geosphere-Biosphere Programme and the International Human Dimensions Programme on Global Environmental Change to explore theoretical and methodological aspects of natural-social science integration.

9 In Schellnhuber's model, the earth system *E* is the totality of the ecosphere *N* (a function of atmosphere, biosphere et cetera) and the human civilisation *H*.

10 Schellnhuber 1999, C20-C22. See also Schellnhuber and Biermann 2000.

11 On the state of the art in this field, see for instance Young et al. 2005.

12 See for pioneering examples Eisenack 2003 and Eisenack, Kropp and Welsch 2005.

13 See Schellnhuber and Sahagian 2002.

tions' (which are exclusively related to natural science), but as part of the 'strategic questions' (for example question no. 23, 'What is the structure of an effective and efficient system of global environment and development institutions?'), or 'normative questions' (for example, question no. 18, 'What kind of nature do modern societies want?'). The value of institutional research as an *analytical* programme of inquiry is relegated to its policy-oriented, advisory dimensions.

Arguably, this is a logical outcome of an earth system analysis programme that is motivated by computer-modelling and quantification. As a consequence, I believe that instead of subjecting governance and institutional analysis to computer-modelling, quantification and epistemological uniformism and to methods that are unfeasible to implement and impossible to trust in the social sciences, scholars of the governance of human-nature interactions will need to continue to develop independent research programmes that are interdisciplinary across the different social sciences—for example, linking international relations and international law—and that follow the internal logic, methods and meta-theories of social science. One such concept can be the notion of earth system governance. Earth system governance is part of the larger project of earth system analysis. Yet it must also remain independent and autonomous in its distinct methodological and theoretical development.

This leads to the delineation of 'governance', the second element of the concept of earth system governance. Although 'governance' is not uniformly defined in the social sciences,[14] it usually denotes new forms of regulation that differ from traditional hierarchical state activity and implies some form of self-regulation by societal actors, private-public co-operation in the solving of societal problems, and new forms of multi-level policy. (Other usages less relevant here are normative in the sense of 'good governance' and management-oriented in the sense of 'corporate governance').[15] Earth system governance is thus not confined to states and governments as sole actors. Instead, it is marked by participation of myriad public and private non-state actors at all levels of decision-making, ranging from networks of experts, environmentalists and multinational corporations to new agencies set up by governments, such as intergovernmental bureaucracies.

Earth system governance is related to the recent discourse on 'global governance'.[16] 'Global governance' is often used as a description of modern world politics, sometimes limited to traditional forms of international relations,[17] sometimes broader to encompass myriad social and political interactions.[18] The term is also used prescrip-

14 See for an overview van Kersbergen and van Waarden 2004.

15 De Alcántara 1998, van Kersbergen and van Waarden 2004. See also Underhill's inaugural lecture at the Universiteit van Amsterdam (2001) for a conceptualisation of a state-market governance 'condominium'.

16 The following is elaborated in Biermann 2006-b. See also Commission on Global Governance 1995, Finkelstein 1995, Gordenker and Weiss 1996, van Kersbergen and van Waarden 2004, Rosenau 1995, Simonis 1999, 2001, Smouts 1998, Young 1994, 1999, 1997.

17 For instance, Young (1999, 11) sees global governance as 'combined efforts of international and transnational regimes'. Finkelstein (1995, 369) defines it as 'doing internationally what governments do at home'.

18 For example, Rosenau (2002, 4) writes that 'the sum of the world's formal and informal rules systems at all levels of community amount to what can properly be called global governance'. Earlier, Rosenau (1995, 13) had defined global governance broadly as 'systems of rules at all levels of human activ-

tively as a political programme to cope with problems of modernity, for example in calls for 'global governance' as a counterweight to globalisation and for new institutions, new and more effective international organisations or new international financial mechanisms.[19] At times, global governance is also seen in the negative: Neoconservatives view it as the attempt to limit the freedom of action of powerful states, notably the United States. Some authors from the South have also cautioned that in 'an international community ridden with inequalities and injustice, institutionalising "global governance" without paying careful attention to the question of who wields power, and without adequate safeguards, is tantamount to sanctioning governance of the many weak by the powerful few'.[20] Notwithstanding these different definitions, much of the advance in theoretical, conceptual and empirical knowledge on global governance will be fruitful also for the development of a theory of earth system governance, as a special challenge of global governance.

Earth system governance thus differs from government, certainly from world government. It also differs from management, a term more closely related to notions of hierarchical steering, planning and controlling of social relations. 'Earth system management' is a term at times used in policy articles predominantly by natural scientists.[21] In a social science perspective with its large foundation of management studies and management literature, however, 'earth system management' as an analytical or normative concept would be both infeasible and—in its connotation of hierarchical planning—undesirable. Last but not least, earth system governance is not synonymous with the discourse on geo-engineering, such as proposals for 'fertilising' the ocean plankton to increase carbon dioxide uptake. The value of such proposals needs to be assessed on their merit—they are not inherently linked to the concept of earth system governance.

ity—from the family to the international organization—in which the pursuit of goals through the exercise of control has transnational repercussions'. The Commission on Global Governance (1995, 2-3) described governance similarly vague as 'the sum of the many ways individuals and institutions, public and private, manage their common affairs. It is a continuing process through which conflicting or diverse interests may be accommodated and co-operative action taken'. Such all-encompassing definitions bring the problem that they leave little room for anything that is not global governance.

19 The Commission on Global Governance (1995), for example, proposed far-reaching reforms to solve the problems of globalisation. This use of the term is popular in continental Europe. In Germany, a parliamentary commission on globalisation defined global governance as the 'problem-adequate reorganization of the international institutional environment' (Deutscher Bundestag 2002, 415, 450). Likewise, French analyst Marie-Claude Smouts (1998, 88) views the debate on global governance not as an 'analytical reflection on the present international system [but as a] standard-setting reflection for building a better world'. However, a normative understanding of global governance is also present in the thinking of some US academics, e.g. Gordenker and Weiss 1996.

20 South Centre 1996, 32.

21 Earth system management is the term used in the 2001 Amsterdam Declaration on Global Change that 'urgently' called for 'an ethical framework for global stewardship and strategies for Earth System management' (http://www.sciconf.igbp.kva.se/fr.html). The declaration was signed by the major global change research programmes and was hence also supported by the International Human Dimensions Programme. However, the term is to my knowledge not used, and also not usable, for social science research programmes. To-date one finds it mostly in relation to natural science programmes, for example when it comes to providing data on earth system parameters that are influenced by human action. For instance, earth system management is one of the three research foci of the natural-science oriented Centre for Marine and Climate Research in Hamburg, Germany, there defined as provision of models and methods as instruments for information, planning and legislation on global, regional and local scales. Tellingly, the first time the term has been used—to my knowledge—was at the 7th International Remote Sensing Systems Conference in Melbourne in 1994 by a representative of the UN Environment Programme, Noel J. Brown, in his presentation *Agenda 21: Blueprint for Global Sustainability, New Opportunities for Earth System Management* (personal communication Heiner Benking, August 2005).

Instead, earth system governance can be defined as *the sum of the formal and informal rule systems and actor-networks at all levels of human society (from local to global) that are set up to influence the co-evolution of human and natural systems in a way that secures the sustainable development of human society*—that is, a development that meets the needs of present generations without compromising the ability of future generations to meet their own needs. This notion of earth system governance is phenomenological inasmuch as it describes an emerging social phenomenon expressed in hundreds of international regimes, international bureaucracies, national agencies, local and transnational activists groups and expert networks. At the same time, earth system governance can be understood as a political project that engages more and more actors who seek to strengthen the current architecture of institutions and networks at local and global levels. And in both meanings, earth system governance is a demanding and vital subject of research for the social sciences.

As such, earth system governance bridges traditional levels of analysis in governance and policy studies. On the one hand, it goes beyond traditional environmental policy analysis as it emerged in the 1970s with its focus on managing environmental problems of industrialised countries.[22] The anthropogenic transformation of the earth system encompasses more puzzles and problems than have been traditionally examined within environmental policy studies, now ranging from changes in geophysical systems to the global loss of biological diversity. Key questions—such as how Bangladesh could adapt to raising sea levels, how deterioration of African soils could be halted or how land-use changes in Brazil could be analysed—have barely been covered by environmental policy research. Yet they are inevitably part of the study of earth system governance.

On the other hand, earth system governance covers more than problems of the 'global commons', but also local problems from local air pollution to the preservation of local waters, waste treatment or desertification and soil degradation. Earth system governance thus exceeds the academic disciplines of international relations and international law. Their contributions remain crucial: hundreds of international regimes now regulate the environmental behaviour of governments, and understanding these regime processes is ever more important. The international relations and law communities have produced a vast literature in this field. Yet these are still largely related to theory development within their own disciplines, less to research on domestic politics and to the larger global environmental change research community. Earth system governance, however, requires the integration of all these strands of research and must bridge scales from global to local. This need of integrated multilevel analysis is widely agreed upon in principle. It needs further efforts in practice.

Finally, we need to attend to the *normative goal* that underlies the project of earth system governance. This goal cannot be purely environmental protection on a planetary scale—this would make earth system governance devoid of its societal context. Environmental targets within earth system governance—such as control of greenhouse gases—can be reached in global and local governance practice through different means with different costs for actors in different countries and regions. Earth system governance is therefore about environmental protection as well as social welfare; it is

22 Explicitly so for example in the textbook of Jänicke et al. 1999, 14.

about effectiveness as well as global and local equity. The normative aspiration of earth system governance must hence be sustainable development—within its triangle of ecological, economic and social sustainability.[23]

Problem Structure

I will now discuss the specific problem structure of earth system governance, since any governance system must be tailored to the structure of its underlying problems. This causes particular difficulties for earth system governance. The anthropogenic transformation of the earth system is diverse in its causes, consequences and possible responses, which renders it impossible to design one solution that fits all. Earth system governance must cope with at least five problem characteristics:

Analytic and Normative Uncertainty

First, the anthropogenic earth system transformation is marked by persistent uncertainty regarding the causes of global environmental change, its impacts, the interlinkage of various causes and response options, and the effects of possible response options. Most transformations, such as global climate change, are non-linear and might accelerate, or slow down, at any time. Surprises in system behaviour can be expected, but are by definition unforeseeable. The history of the belated and partially accidental scientific discovery of stratospheric ozone depletion and its man-made causes has been particularly well documented in the literature, with its intriguing story of computer systems that excluded high ozone depletion as measurement errors, of scientists who first did not report their findings, and of politicians who first refused to act. Uncertainty has found its institutional response in repeated rounds of global environmental assessments that have brought together the world's leading scientists in complex institutional settings, with the Intergovernmental Panel on Climate Change as a prime example. Yet these scientific assessment and research institutions cannot fully resolve the persistent uncertainty that will remain to complicate earth system governance.

Uncertainty is not only analytical, but also normative. Most problems of earth system transformation are unprecedented. The adequate policies, polities and, in particular, modes of allocation are unknown, initially always contested, and need to be developed and agreed upon by societies over time. Uncertainty hence poses particular governance challenges. It requires governance to be stable over decades and centuries to withstand sudden changes of earth system parameters (or changes in our knowledge about these parameters), but also to be flexible enough to adapt to changes within the larger stable framework. Governance must be oriented towards the long term, but must also provide solutions for the near future. Normative uncertainty requires the development of new norms and conceptual frameworks for global collective action in uncharted territory. The global allocation of 'emissions rights' in climate governance,

[23] For a recent overview of definitions and conceptualisations of sustainable development, see Kates, Parris and Leiserowitz 2005. On the emerging legal-political principles that form the basis of sustainable development, see the *New Delhi Declaration of Principles of International Law Relating to Sustainable Development* of the International Law Association (2002).

which oscillates between the extremes of equal per capita allocation and allocation according to existing use, is a prime example. Analytical and normative uncertainty is part of any collective decision-making. In earth system governance, it is most extreme.

Temporal Interdependence

Second, the anthropogenic transformation of the earth system creates intergenerational dependencies that pose further exceptional governance challenges. Causation and effect of earth system transformations are usually separated by decades, often by generations. The same holds for the decoupling over decades of the costs of mitigation and the benefits of avoided harm. Sea-level rise, for example, is expected within a timerange of hundred years. Such planning horizons exceed the tenure and even the lifetime of present decision-makers and stakeholders. Among other things, this poses the challenge of international credibility and trust that future governments will reciprocate and comply, and the problem of democratic legitimacy of policies in the intergenerational context. What rights and responsibilities do present generations, and their representatives in parliament, owe their unborn successors? Intergenerational equity and responsibility is not confined to earth system governance, but is also, for example, part of many social security systems. Yet in earth system governance, intergenerational interdependence is at the core.

Functional Interdependence

Third, earth system governance must respond to the functional interdependence of earth system transformation and of potential response options. Functional interdependence relates to the interdependence of natural subsystems—which links, for instance, climate change to biodiversity or land degradation—as well as to the interdependence of social systems and policy areas. Response strategies in one problem segment or one policy domain are likely to have repercussions for many other areas. Functional interdependence also relates, in many problem segments, to the mutual substitutability of response options, which poses particular problems of international allocation. In climate governance, for example, for every global policy target there are an unlimited number of possible combinations of local responses across nations and time frames with equal degrees of effectiveness. Functional interdependence requires policy co-ordination and integration to the extent possible. It lies at the heart of the discourse on environmental policy integration at the national level as well as of recent attempts to cluster the plethora of international regimes into core groups, such as a 'chemicals cluster' or 'biodiversity cluster'.[24] Functional interdependence is also a key concern in the debate on bringing together the various intergovernmental environmental bureaucracies—notably the major treaty secretariats—into one integrated 'world environment organisation'.[25]

[24] See in more detail Von Moltke 2005.
[25] See on this debate the contributions in Biermann and Bauer 2005a and Rechkemmer 2005.

Global Spatial Interdependence

Fourth, the anthropogenic transformation of the earth system creates new forms and degrees of (global) spatial interdependence. This relates to both natural (direct) and social (indirect) interdependencies. Natural interdependencies are functions of the earth system that transform local environmental pollution into changes of the global system that affect other localities. Prominent examples are climate change, stratospheric ozone depletion, the global distribution of persistent organic pollutants, and the global spread of species with potential harm for local ecosystems. Social interdependencies are functions of the (global) social system that transform local environmental degradation into transregional or global social, economic and political crises. This includes negative influences on the world economy, for example because of large-scale flooding, drought or disease. It also includes negative influences on the material security of human populations, for example, when regional climatic change causes decreases in food production and thus increases in global food demand and food prices. Eventually, these social interdependencies will also affect global and regional security. Economic crises or mass migration due to transformation of the earth system will not be confined to some states. They will affect all. Spatial ecological interdependence binds all nations. This creates a new dependence of states, even the most powerful ones, on the community of all other nations. This is a defining characteristic as well as a key challenge of earth system governance that requires an effective institutional framework for global co-operation.

Extreme Impacts

Fifth, earth system governance has to cope with, and gains its particular relevance from, the extraordinary degree of harm that is possible, and that current governance systems might not be fully prepared for. Sea-level rise, food shortage, drought, storms, land degradation, reproductive disorder and many other consequences of earth system transformation—if unchecked—are conceivable. Some might be catastrophic, such as changes in monsoon patterns or in the thermohaline circulation, large-scale breakdown of ecosystems, or rising sea levels in low-lying countries. In particular developing countries will be ill prepared to adapt to these changes that might in some cases require large-scale migration or transnational food assistance. Earth system governance is challenged in many ways. Extreme impacts could exceed the regulatory capacity of individual states, both in affected regions and in less affected potential donor regions. Global assistance, including globally co-ordinated planning and preparing, is needed. Large-scale assistance programmes will challenge emerging norms of global solidarity to an unprecedented extent. Global solidarity led states and private citizens to transfer substantial funds to victims of disasters in the past, from the flood assistance to the Dutch in 1953 to the Tsunami aid programmes in early 2005. Yet the extent of potential impacts of earth system transformation will put these emerging norms of global solidarity to the test, in particular when mass migration—for example from low-lying islands—is the only practical and financially viable option.

Governance Principles

These problem characteristics of the global transformation of earth system parameters through human action—high analytic and normative uncertainty, high temporal, functional and spatial interdependence, and potentially extreme impacts—are unprecedented in the governance of human affairs. From these characteristics of earth system transformation, I derive four core principles of earth system governance.

Credibility

First, effective earth system governance requires governments to commit resources both domestically and through transnational transfer mechanisms for mitigation and increasingly adaptation policies. Given the uncertainty and temporal and spatial interdependence of anthropogenic earth system transformation, governments will need to commit these resources based on the assumption that other governments will reciprocate when it is their turn—including the still unknown future governments of other nations. Earth system governance must thus produce the necessary credibility for governments and others to believe in this reciprocity of interaction partners over time and space.

Stability

This requires that earth system governance is stable enough over decades to withstand political changes in participating countries or changes in the world political system. Governments that commit resources within a global normative framework in the present must rely on the perseverance of this framework over time independent from transitions in other countries and other policy domains. Yet effective transnational institutions and governance systems with a time-horizon of centuries are rare—the Catholic Church with its 2000-year stable leadership succession and decision-making mechanisms is probably the only transnational empirical example. It will be a key task for analysts to chart ways for such stable systems of earth system governance in the 21st century.

Adaptiveness

Within this stable framework, future actors must have the ability, based on previously agreed procedures and principles, to change governance elements to respond to new situations, without harming both credibility and stability of the entire system. The tension between stability and credibility and trust, on the one hand, and the requirements of being able to respond quickly to new scientific findings and new interest constellations is one of the key challenges for earth system governance. Governing has always implied a degree of social learning and of adaptation to changed circumstances—at least for those political systems that survived the course of time for some generations. Earth system transformation brings with it new challenges regarding the degree and speed of potential change. The conditions for effective and equitable 'adaptive governance' are increasingly discussed at the local and regional levels, for example concerning water system governance. The conditions for effective global adaptive govern-

ance of large-scale earth system transformations during the 21st century within a stable global institutional order are less understood.

Inclusiveness

The interdependence of earth system governance, as well as the complexity and uncertainty of the entire system that may change the overall interest constellation within a few years, require the governance system to be as inclusive as possible regarding the number of stakeholders involved. This requirement of 'participatory governance' includes weaker states that might lack influence in world politics but are important both for mitigation and adaptation efforts. In particular developing countries are significantly more relevant, and hence more powerful, in key issue areas of earth system governance, from climate change to biodiversity governance. Participatory governance is also the challenge of including non-state stakeholders in decision-making at local and global levels. The complexity and uncertainty of earth system governance cannot be resolved through action by governments and public agents alone. However, this inclusion of private actors and 'civil society' requires methods and mechanisms that are perceived by all stakeholders as legitimate, effective and fair.

Research and Governance Challenges

Earth system governance is an emerging empirical phenomenon as well as a political project of the 21st century. In both dimensions, it is also a demanding challenge for social science, which must generate theoretical insights and practical tools to develop effective means of earth system governance. This section elaborates on five key clusters of questions that could guide a renewed research effort in earth system governance theory. It is the problem of different overall *architectures* of earth system governance, of *agency* beyond the state, of the *adaptiveness* of governance mechanisms and of their *accountability* and legitimacy, and of the mode of *allocation* in earth system governance.

Architectures above the State

The first major research and policy concern of earth system governance is its overall 'architecture'. Most research in this field in the last thirty years has focussed on single institutions. We now have a better understanding of the creation, maintenance and effectiveness of international environmental regimes, as well as better methodological tools to study these questions.[26] It has been shown, for example, that different international norms and verification procedures, compliance management systems, modes of regime allocation as well as external factors, such as the structure of the prob-

[26] Earlier studies include Kennan 1970, Johnson 1972, Caldwell 1984, and Young 1980. For recent overviews and discussions, see Mitchell 2002 and Young 2001. See also Bernauer 1995, Brown Weiss and Jacobson 1998, Haas, Keohane and Levy 1993, Helm and Sprinz 2000, Keohane and Levy 1996, Mitchell 1994, Mitchell and Bernauer 1998, Underdal 2002, Young 1994a, 1997, 1999, 2001, Young, Levy and Osherenko 1999.

lem, all influence regime effectiveness. Most of these studies have focussed on the effectiveness of single institutions, often within larger comparative projects.[27] More recently, the increasing number and scope of international environmental institutions has led to new research on their interaction, for example in studies on regime interlinkages, regime 'clusters' or regime 'complexes'.[28] Institutional interplay has also been one of the three analytical themes of the Institutional Dimensions of Global Environmental Change project of IHDP.[29]

These approaches to understanding the effectiveness and the interaction of different institutions had to be methodologically reductionist to be successful. Distinct institutions, sometimes distinct institutional elements of larger institutions, have been analysed regarding their effectiveness and their relationship to other institutions or institutional elements. The macro-level—that is, the system of institutions that address aspects of earth system governance—have remained largely outside the focus of the major research programmes. Given the advances in regime theory and institutional analysis, it appears that further progress now requires a complementary research programme that analyses this macro-level and the overarching research puzzles. I call this the *'architecture'* of earth system governance. This term is increasingly used in policy circles—the term 'global governance architecture', for example, is now mentioned on 189 websites largely related to policy institutions and advocacy groups (April 2005).[30] The architecture of earth system governance then refers to the entire interlocking web of widely shared principles, institutions and practices that shape decisions by stakeholders at all levels.

The principles of earth system governance derived above suggest four interrelated criteria for its overall architecture:

First, the principles of stability and inclusiveness require that earth system governance goes not only beyond, but partially also *above the state*. It must include limitations to the autonomy of individual state behaviour and some elements of a post-sovereign governance architecture that expresses the interests of the international community. This is not shorthand for world government. Instead, it describes already existing state behaviour in other non-environmental policy fields, observable for example in the increasing subjugation of foreign economic policy to juridical decisions by the World Trade Organisation. Such elements of subjugation of states to 'governance above the state' are observable in all functions of governance, where governments accept limitations to their sovereign decision-making to protect their extended national interest and their 'global sovereignty'. Regarding the legislative function of earth system governance, for example, governments have accepted in the Montreal ozone protocol binding majority decisions on the adjustment of the timetable for the phase-out of regulated substances.[31] The tacit-acceptance procedure of the International Maritime Organisation also comes close to majority-based decision-making. Likewise, the harmonisation of trade policy under the World Trade Organisation has limited the room for independ-

27 E.g., Haas, Keohane and Levy 1993, Keohane and Levy 1996, Miles et al. 2002, Victor, Raustiala and Skolnikoff 1998, Young 1997, Young, Levy and Osherenko 1999.

28 For example, Asselt, Gupta and Biermann 2005, Chambers 2001, Oberthür and Gehring 2006, Rosendal 2001a, 2001b, Stokke 2000, Velasquez 2000.

29 See Institutional Dimensions of Global Environmental Change Project 1999 and Young 2002.

30 Note that the term 'policy architecture' is more widely used.

31 Montreal Protocol on Substances that Deplete the Ozone Layer 1987, article 2.9.

ent policy-making of governments, also on environmental issues. Regarding adjudication, the world has experienced a shift from voluntary adjudication such as through the International Court of Justice or ad hoc tribunals to compulsory adjudication, notably through the International Tribunal on the Law of the Sea, the International Criminal Court and the WTO dispute settlement system. Even the provision of funds for post-sovereign functions is changing. Governments have accepted unprecedented stricter legal language on providing the required funding for the protection of the ozone layer, the climate and biological diversity. These changes from horizontal interstate relations to post-sovereign earth system governance are mirrored in recent attempts at a reconceptualisation of international law, for example in the concept of 'common concern of humankind'.[32]

Related to this, the earth system governance architecture must be based on *universally accepted constitutional principles and basic norms*, many of which are still contested. The political behaviour of states is guided not merely by calculations of material interest and power, but by international norms that prescribe and prohibit types of behaviour and create an international society that 'socialises' states—including new governments that have not participated in the original creation of norms.[33] For such norms to be effective, they must be relatively simple, cross-culturally appealing, and sufficiently clear and unambiguous. For example, the success of the world trade regime in liberalising trade and phasing out most custom duties within half a century is partially attributed to the simplicity and general acceptability of its basic principles, notably reciprocity and the most-favoured-nation clause. Another example is the development of human rights norms in the course of the 20th century.[34] Similar basic norms for earth system governance are emerging, such as the principle of common but differentiated responsibilities. Others are still disputed, such as the notion of interstate liability in the area of global environmental change. Developing such universally accepted constitutional principles is hence a key research challenge for scholars of both international relations and international law.

The credibility and stability of earth system governance requires its basic norms to be enforceable, that is, actors must be able to assess both the normatively required and the actually implemented contribution of other actors to the solution of the problem once significant costs are involved. This relates both to the clarity of commitments and the availability of monitoring and reporting mechanisms. Mechanisms with strong sanctions are in place, for example, in the areas of trade and nuclear non-proliferation. In the field of earth system governance, enforceable commitments probably require less strict compliance mechanisms because non-compliance often results not from wilful (non)-action by governments (as generally the case in 'hidden custom duties' or nuclear proliferation), but rather from economic or other constraints within a country.[35] The typical case is Russian non-compliance with the Montreal Protocol in the 1990s, which

32 See Biermann 2002a. Sand 2004 offers a good overview of the recent legal debate.

33 This is largely linked to the theoretical strand of sociological institutionalism. See, among many others and with further references, March and Olsen 1989, 1996, 1998, Finnemore 1996a, Barnett and Finnemore 1999, Biermann and Bauer 2005b, Finnemore and Sikkink 1998, Schmidt 2002.

34 Risse, Ropp and Sikking 1999.

35 In the academic debate, 'soft' compliance management has in particular been advanced by Chayes and Chayes 1995. For a critique, see for example the economic reasoning of Barrett 2003.

was resolved not through sanctions but through co-operative non-compliance management that included positive side-payments and the transfer of technology.[36]

Third, an effective earth system governance architecture needs to employ mechanisms that guarantee effective *vertical interaction* of governance systems across levels and scales. The increasing global institutionalisation of world politics is not conceivable without continuing policy-making at national and subnational levels. Global standards are implemented and put into practice at the local level, and global norm-setting requires local decision-making to set the frames for global decisions. This results in the coexistence of policy-making at the subnational, national, regional and global levels in more and more issue areas, with the potential of both conflicts and synergies between different levels of regulatory activity. The international regulation of trade in genetically modified organisms is as a prime example for such multilevel governance, where the 'global is local'.[37] Multilevel governance has been intensively researched;[38] the more elements of governance above the state emerge, the more relevant multilevel governance as a research problem will become.

Fourth, the principles of earth system governance suggest that its architecture must be *universal* to be effective, because the governance principles of long-term credibility, stability, adaptiveness and inclusiveness cannot be brought into line with persistent fragmentation of norms, rules and decision-making procedures. Stable, credible and adaptive governance mechanisms require maximum inclusion and participation. Otherwise, excluded actors could later reject agreements, destabilise them, threaten the credibility of commitments over time, or resist co-operation if changing circumstances makes the participation of excluded stakeholders suddenly more relevant.

This need to create universal agreements has been disputed in recent years. In climate governance, for example, some researchers have argued against a universal regime architecture and for fragmentation through regional agreements of like-minded countries.[39] It has been argued that sectoral or selective agreements promise quicker solutions since negotiations are easier given the smaller number of actors and interests at the table. The advantage of fewer parties has been emphasised also by some strands of negotiation theory, which posit stronger commitments and faster progress the fewer (like-minded) parties participate in a given negotiation. Some cite the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer,[40] which was negotiated in the mid-1980s within a small group of industrialised countries with only few developing countries involved. A fragmented governance architecture may also allow for the testing

36 See Victor 1996.

37 See A. Gupta 2004, also A. Gupta 2001.

38 Two themes within the IHDP Institutional Dimensions of Global Environmental Change project have dealt with questions of policy level, that is, with the 'problem of fit' (are existing institutional arrangements well-matched to the properties of the biophysical systems to which they relate?) and the 'problem of scale' (to what extent can findings about the roles institutions play be generalised across levels on spatial, temporal and jurisdictional scales?). On the problem of fit, see Ebbin 2002, Pritchard et al. 1998, Young 2002; on the problem of scale, see among others Alcock 2002, Gibson, Ostrom and Ahn 2000, A. Gupta 2001 and 2004, Ostrom et al. 1999, Sand 2004, Young 1994b.

39 Bodansky 2002a, for instance, suggested an 'institutional hedging strategy' in which the United States would support 'a more diversified, robust portfolio of international climate change policies in the long term'. He also suggests agreements of the United States with Colombia, Costa Rica and Mexico. See also Stewart and Wiener 2003.

40 E.g., Simpson 2002, 72.

of innovative policy instruments in some nations or at some levels of decision-making, with subsequent diffusion to other regions or levels.[41]

Yet on the other hand, a fragmented governance architecture produces solutions only for the few participating countries and fits the interests only of those countries. A quick success in negotiating sectoral agreements might run counter to long-term success, when important structural regime elements have not sufficiently been resolved. Lack of a universal governance architecture may jeopardise the success of policies adopted by individual groups of countries. The possibly strong economic implications of stringent policies adopted by only few states may also have severe ramifications for other policy arenas such as the world trade regime.[42] Finally, smaller agreements with few 'like-minded countries' decrease the opportunity for side-payments across negotiation clusters within a policy domain and across different policies, which minimises overall policy acceptance and effectiveness.[43] Developing countries, in particular, often resist fragmented governance approaches. Universalism allows the South to count on its numbers in diplomatic conferences and gain bargaining power from a uniform negotiation position, and it minimises the risk for developing countries to be coerced into bilateral agreements with powerful nations that might offer suboptimal negotiation outcomes.

The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer illustrates many of these problems. The protocol was first negotiated largely among the industrialised countries, with participation of only a dozen developing countries. Yet, this initial regime—especially its allocation mechanism—was not accepted by the majority of the developing countries, which successfully demanded amendments to the initial regime structure.[44] In the ozone regime, the Southern contribution to the problem was small, yet threatened to grow, which forced industrialised countries to accept Southern amendments. In climate or biodiversity governance, the Southern role is much larger from the outset. Here, a fragmented governance architecture with regional agreements of a few like-minded countries is even less likely to bring the long-term trust and governance stability that is needed. An 'institutional hedging strategy'[45] with different policies and regimes scattered around the globe will cause havoc to the larger goal of building a truly universal earth system governance architecture. Earth system governance requires institutional mechanisms that are trustworthy, stable and adaptive, provide for cross-issue bargains, and include all nations. This can be offered only by universal agreements that set out the constitutional rules of earth system governance in the 21st century, and detailed agreements on subquestions that are negotiated within the larger stable architecture that provides the 'grand bargain'.

41 See, e.g., Vogel 1995, Jänicke and Jörgens 2000.

42 Biermann and Brohm 2005.

43 E.g., Tangen and Hasselknippe 2003.

44 Among other things, developing countries gained the right for financial compensation of their incremental costs. They were also guaranteed that no decision would be valid that would be rejected by the majority of all participating developing countries. The same guarantee was given to the industrialised countries. This double-weighted majority procedure—that requires support for any decision of the simple majority of industrialised and developing countries—was later also included in the decision-making rules for the international fund that finances the phase-out of ozone-depleting substances in the South, and in the Global Environment Facility, which finances programmes for biodiversity, climate, international waters, land degradation and persistent organic pollutants.

45 Bodansky 2002a.

In sum, to be effective, the overall architecture of earth system governance must be post-sovereign, that is, include elements above the state; must be based on universally accepted basic norms among states with some degree of enforceability; must employ mechanisms that guarantee effective vertical interaction of governance systems across levels and scales; and be universal in the sense of maximum inclusion and participation.

Agency beyond the State

Within this larger architecture, earth system governance includes agents that cause, mitigate or adapt to global environmental change, and institutions that govern agents' relations. Most research on global environmental governance has focused on the institutional dimensions of global environmental change, especially on international environmental regimes. Agency has been part of this analysis, especially at the subnational level. At the global level, agency has been studied largely in relation to the creation, maintenance, effectiveness, or interplay of intergovernmental institutions.[46] Yet it is actors that drive these institutions, increasingly non-state actors. We have an elaborate literature on the foreign policy of states, including of their environmental foreign policy, and on institutions created and regulated by states. We still lack comparable knowledge on the behaviour of non-state actors and on the institutions that they create. Many vital institutions of earth system governance are today inclusive of, or even driven by, non-state actors.

Analysing these private actors in earth system governance is hence a key research challenge. This has long been acknowledged.[47] As Ken Conca noted back in 1995, 'the emergence of a global network of environmental organisations has transformed the environmental debate. Individual governments can no longer easily ignore environmental problems, and governments are collectively being pushed, prodded and cajoled towards internationally coordinated action'.[48] Activist groups, business associations and research institutes now provide research and advice, monitor the commitments of states, inform the public about the actions of diplomats at international meetings and give these diplomats direct feedback.[49] Carefully orchestrated campaigns of environmentalists have changed foreign policy of powerful states or initiated new global rules, such as the global campaign on banning anti-personnel landmines.[50] International networks of scientists and experts have emerged, in a mix of self-organisation and state-sponsorship, to provide complex technical information that is indispensable for

46 See for example Mitchell 2002, Young 2001. See also Bernauer 1995, Brown Weiss and Jacobson 1998, Haas, Keohane and Levy 1993, Keohane and Levy 1996, Mitchell and Bernauer 1998, Young 1994a, 1997, 1999, Young, Levy and Osherenko 1999.

47 Cutler, Haufler and Porter 1999, Higgott, Underhill and Bieler 1999, Hall and Biersteker 2002, Pattberg 2004 and 2005b. See also Karkkainen 2004 as well as the contributions in Hisschemöller et al. 2001.

48 Conca 1995, 454.

49 Betsill and Corell 2001, Conca 1995, Princen, Finger and Manno 1995, Raustiala 1997, Wapner 1996.

50 See for example Arts 1998 and 2002, Charnovitz 1997, Edwards and Zadek 2003, van der Grijp forthcoming, van der Grijp and Brander 2004, J. Gupta 2003, van der Heijden 2002, Princen and Finger 1994, Raustiala 1997, Reinalda and Verbeek 2001.

policy-making on issues marked by analytic and normative uncertainty.[51] Business has taken a more prominent role in international decision-making,[52] for example in the Global Compact that major corporations have concluded with the United Nations.[53] There are limits to the influence of private actors, for example in international security policy.[54] Yet this hardly denies that in particular in earth system governance, we can observe elements of a 'world civic society'.[55]

This emergence of private actors and private institutional mechanisms in earth system governance can be broadly explained by its problem characteristics. Analytical and normative uncertainty requires insights and value statements that states no longer can gain through traditional forms of policy-making based on formal representation by their domestic constituencies. Functional or spatial interdependencies create policy deadlocks that make space for private rule-setting, as was the case in global policies on fisheries or forests. Earth system governance therefore requires the private actor at the global and local levels. At the same time, however, this gives private actors new degrees of autonomy from intergovernmental or single-state decision-making.

Moreover, the activities of private actors in earth system governance are no longer confined to lobbying or advising governments in the creation and implementation of international rules. Increasingly, non-state actors participate in rule-setting with states or set their own rules. This is where the key challenge lies: private actors have joined governments to put international norms into practice, for example as quasi-implementing agencies for development assistance programmes administered by the World Bank or bilateral agencies. Private actors now participate in global institutions and at times negotiate their own standards, such as in the Forest Stewardship Council or the Marine Stewardship Council, two standard-setting bodies created by major corporations and environmental advocacy groups without any direct involvement of governments.[56] Public-private co-operation has received even more impetus with the 2002 Johannesburg World Summit on Sustainable Development and its focus on partnerships of governments, non-governmental organisations and the private sector—the so-called Partnerships for Sustainable Development. These partnerships were formally supported in the implementation plan agreed in Johannesburg, with over 220 partnerships with 235 million US dollars committed before the summit.[57]

51 Biermann 2001a and 2002b, Farrell and Jäger, forthcoming, Haas 1992 and 1993, Hisschemöller et al. 2001, Jäger 1998, Jasanoff 1996, Jasanoff and Long Martello 2004, Mitchell et al., forthcoming.

52 See for example Clapp 1998, Cutler, Haufler and Porter 1995, Falkner 2003, Fuchs 2003, van der Grijp, forthcoming, van der Grijp and Brander 2004, Haufler 2000, Korten 1995, Lee, Humphreys and Pugh 1997, Levy and Kolk 2002, Levy and Newell 2000, Levy and Newell 2002, Ottaway 2001, Rowlands 2001, Sell 1999, van der Woerd, Levy and Begg 2005.

53 Cutler, Haufler and Porter 1999, Higgott, Underhill and Bieler 1999, Hall and Biersteker 2002.

54 Clark, Friedman and Hochstetler (1998, 35) note, for example, 'On issues that centrally address state sovereignty, more NGO [non-governmental organisations] visibility only means a more forceful negative response. ... State sovereignty sets the limits of global civil society.'

55 Wapner 1996.

56 See, for example, the detailed guidelines developed by the Forest Stewardship Council (Pattberg 2004 and 2005a).

57 Illustrative for the breadth in scope of these hundreds of partnerships are just a few of their titles, such as: the African Union Initiative On Promotion and Development of Agenda 21 in Africa; the Network of Regional Governments for Sustainable Development; the Partnership for Water Education and Research PoWER); the Partnership for Learning from Best Practices, Good Policies and Enabling Legislation in Support of Sustainable Urbanisation; the partnership National Capacities for Up-scaling Local Agenda 21 Demonstrations; the Millennium Cities Partnership; the Strengthening Human Rights Measures and Poli-

The effectiveness of such initiatives, however, is yet insufficiently understood. Most literature still builds on single-disciplinary case-study research with case selection often influenced by practical considerations or flawed through case-selection on the dependent variable, in particular where only 'success stories' are chosen.[58] I thus believe that the major effort of the 1990s on analysing intergovernmental environmental regimes needs to be complemented by a similar research programme on 'global participatory governance' that explores the public-private and private institutions in earth system governance.

This research programme could address, first, the key conditions that explain the *emergence* of public-private and private-private governance mechanisms at global and regional levels. Second, this could focus on the political *effectiveness* of private governance. Many explanatory variables are conceivable, some of which might be similar to variables identified in the literature on intergovernmental regimes. For example, effectiveness of private institutions could be influenced by their organisational structure, including the existence of monitoring and evaluation mechanisms, the amount and sources of funding, the nature of their co-ordination, decision-making and management mechanisms, or the existence of compliance mechanisms. Success of private institutions could also depend on the types of their goals, that is, whether they are quantified, measurable and time-bound. Moreover, the political problem structure is likely to influence the effectiveness of private institutions by determining the feasibility of their policies, measures and activities in light of potential resistance. This is likely to be influenced by the overall problem structure, including the visibility of the problem, the perceived urgency of the problem and the availability of solutions. Finally, private institutions are likely to be more effective the more their policies and measures are appropriately tailored to the needs and capacities of targeted actors and to the national administrative and regulatory structures of the country in which the agreement shall be implemented. All these factors are likely to influence their effectiveness, similar to past findings of the literature on intergovernmental regimes. However, this field still awaits large-scale research programmes that systematically analyse the emergence and effectiveness of private institutions in earth system governance.

A second key non-state actor with increasing relevance in earth system governance are *international bureaucracies*, ranging from the specialised agencies of the United Nations to the hundreds of international bureaucracies set-up for issue-specific management functions as secretariats to international environmental treaties.[59]

These public non-state actors shape earth system governance in many ways. Within the cognitive sphere of earth system governance, for example, international bureaucracies are crucial through their influence on the knowledge and belief systems of actors: through the funding and administration of research, the synthesis of scientific findings, the development of policy proposals, problem frames and policy assessments, and eventually through the distribution of this knowledge and problem framing to stakeholders, from national governments to individual citizens. The international re-

cies for Sustainable Development (SHRIMPS); or the Sustainable Agriculture and Rural Development (SARD) Initiative: People Shaping Their Sustainable Futures.

58 See as one example Reinicke and Deng 2000.

59 This has been elaborated in Biermann and Bauer 2005b.

sponse to global warming is an illustrative example: In the late 1980s, uncertainty about global warming prevented governments from taking any action. Knowledge was non-existent or disputed among experts and lay-people alike. In this situation, it was the bureaucrats of the World Meteorological Organisation and the UN Environment Programme that initiated and organised the Intergovernmental Panel on Climate Change to develop consensus documents on the state of knowledge and on possible political response strategies. This panel did not generate new knowledge. Yet it helped to establish, through its system of peer review and, later, of geographic balancing in this peer review, the necessary credibility and legitimacy for the existing knowledge—a task that was beyond the scope of individual states that would inevitably be seen as partisan in their assessment.

International bureaucracies also influence earth system governance through the creation, support and shaping of norm-building processes. In the early 1980s, for instance, it was the UN Environment Programme that pushed stratospheric ozone depletion on the international agenda, while governments—including the United States that originally had supported international regulation—lacked interest.[60] International bureaucracies are also important in the implementation and revision of treaties. This is in particular the role of the staff of treaty secretariats, which organise meetings, set agendas and report to the conferences of the parties. International bureaucracies are crucial in shaping procedures, providing arenas for issue-specific negotiations and framing inter- and transnational processes of bargaining and arguing.[61]

Finally, international bureaucracies shape earth system governance through assistance to countries to implement international agreements, which reshapes national interests. It is often international bureaucracies that help raise administrative capacity in many countries especially in the developing world. In the ozone regime, it were three international bureaucracies[62] that organised an international campaign to install in each capital in the developing world small administrative offices linked to the national environment ministry with staff trained and financed by these international bureaucracies to draft and implement national programmes on the phase-out of ozone-depleting substances. Even though states paid for these programmes, it was the staff of the international bureaucracies that developed and shaped the programmes, setting the stage for the emission-control programmes in more than one hundred countries. Without the substantive input of these bureaucracies, the positive outcome of the ozone regime would hardly be conceivable.

This role of international bureaucracies in earth system governance is at the core of the current policy debate on the need for a larger integrated organisation, such as a 'global environmental organisation', a 'world environment organisation' or a 'UN environment organisation'.[63] Such an organisation could be created by upgrading the UN Environment Programme to a full-fledged international organisation that would have its own budget and legal personality, increased financial and staff resources and

60 Benedick 1998.

61 See for example the insightful case study on the desertification convention by Bauer (forthcoming).

62 Those were the World Bank, the UN Development Programme and the UN Environment Programme, later joined by the UN Organisation for Industrial Development. See Biermann 1997 on details.

63 The debate is summarised in Bauer and Biermann 2005, Charnovitz 2005 and Lodewalk and Whalley 2002.

enhanced legal powers.[64] This new world environment organisation would function together with the other international institutions and organisations in earth system governance, whose member states might shift some competencies to the new agency. A world environment organisation could pave the way for the elevation of environmental policies on the agenda of governments, international organisations and private organisations, could assist in developing the capacities for environmental policy in African, Asian and Latin American countries, and improve the institutional environment for the negotiation of new conventions and action programmes as well as for the implementation and co-ordination of existing ones.

Yet apart from these policy debates, the role of intergovernmental bureaucracies in earth system governance has been a peripheral research subject so far.[65] Most political scientists remain concerned with states and institutions. International lawyers have offered extensive surveys of the set-up, mandate and diplomatic history of international bureaucracies, yet no convincing comparative assessment of the influence of these bureaucracies or significant explanations for possible variations in this influence. This requires a series of interdisciplinary, well-designed comparative case studies of international bureaucracies, which are not yet available.

Adaptive State

The five problem characteristics of earth system governance developed above place new burdens also on the core functions of the state, which needs to evolve, I argue, into an 'adaptive state'.[66] The adaptive state will be challenged in three ways: by decreased autonomy through increased dependence on other states, increased requirements for legitimacy, and increased stress through the need to adapt to sudden alterations of the natural environment.

First, the spatial interdependence—regarding both natural and social interdependence—of global environmental problems has made states directly *dependent* on the activities of other states. The guarantee of security and the protection of citizens are now possible only in a governance system that transcends state boundaries. The causes and consequences of international interdependence have been discussed dating back to Hirschman's *National Power and the Structure of Foreign Trade* from 1945, Keohane and Nye's *Complex Interdependence* from 1977, or in a more general sense even to Kant.[67] Global environmental change adds new dimensions to this old debate. Unlike economic interdependence that was debated in the 1960s and 1970s, ecological interdependence is indissoluble and inescapable even for the most powerful nations. Ecological interdependence binds all nations, which creates a new dependence of all nations on the community of all others.[68] This is a defining characteristic as well as a key challenge of earth system governance, which must provide an effective institutional framework for global co-operation and collaboration.

64 See my more extensive argument in Biermann 2005.
65 See our review in Biermann and Bauer 2005b.
66 Parts of this section have been elaborated in more detail in Biermann and Dingwerth 2004.
67 Hirschman 1945, Keohane and Nye 1977, Kant 1795.
68 This has been elaborated in Biermann 1998.

Second, spatial and temporal interdependence as well analytical and normative uncertainty create new problems for the *legitimacy of state action*. Drastic mitigation programmes today will mainly benefit—through reduced harm—future generations, which will suffer less from floods, droughts or breakdowns of ecosystems. In addition, most present beneficiaries will live beyond a state's borders. This is complicated by the persistent uncertainty inherent in earth system governance, where it is not always fully clear whether problems exist and to what degree. Normative uncertainty requires current generations inevitably to work towards a model of earth system governance and, implicitly, towards a future state of the earth system whose desirability for future generations remains unknown. Known are merely the costs for current generations, which need to be legitimised if drastic actions are taken. All this places new burdens on the legitimacy of state action.

Third, adaptation to earth system transformations poses additional burdens on *state capacities*. The more environmental change puts stress on societies—for instance through drought, regional climate changes or sea-level rise, but also through new mitigation requirements—the more will state capacities be in danger of becoming overstretched, with local and regional crises as a possible consequence. Given the uneven geographic distribution of adverse consequences of global environmental change, some states will face more demands for adaptation than will others. For some societies adaptation will come at significant costs. Since developing countries will suffer most from a lack of capacities to address the social, economic and environmental problems within their boundaries, the capacities of these states are likely to be stretched most by global environmental change. The added stress that earth system transformation places on states limits their options to fulfil other functions such as guaranteeing political participation and creating minimal social conditions. Where additional capacities to solve the impacts of global environmental change—such as droughts or regular flooding—are needed, decision-making may become more hierarchically structured to save time and resources, thus limiting participation. Likewise, the guarantee of minimal social conditions will become the more difficult the more numerous and complex the demands on the capacities of countries become. Earth system change requires states to prepare for and adapt to its consequences and thus increases the demand for the administrative, organisational, technological and financial capacity of the 'adaptive state'—a demand that some states will find easier to meet than others.

Taken together, while much past research has focused on the role of the state in the advancement of public goals and public goods—economic development, individual freedom, democracy—a key question of earth system governance will be the analysis of the 'adaptive state': a state able to adapt internally and externally to large-scale transformations of its natural environment.

Accountability

All elements of earth system governance that I have described create problems of accountability and legitimacy. Credible, stable and inclusive governance must be perceived as legitimate by all stakeholders, and its actions and representatives must be accountable to their constituencies. In the 20th century, legitimacy and accountability was a problem of national governments. In the 21st century and its new needs of earth

system governance, accountability and legitimacy appear in a different context. Eventually, this comes down to the quest for *democratic* earth system governance.

There are two broad types of research needs:

First, a theoretical one. In purely intergovernmental norm-setting processes, legitimacy derives indirectly through the accountability of governments to their voters. Likewise, international bureaucracies can derive legitimacy through their principals, the governments, which are accountable to their voters. However, such long lines of accountability have been questioned in recent years.[69] Many authors see a solution in the participation of private actors in global governance. David Held, for example, recognises '"new" voices of an emergent "transnational civil society" ... in the early stages of development ... [that] point in the direction of establishing new modes of holding transnational power systems to account, that is, they help open up the possibility of a cosmopolitan democracy'.[70]

Problematic is, however, the accountability and legitimacy of these private actors themselves. In the domestic context, private organisations could derive legitimacy through their members or donors—even though members and donors often have no formal means to decide the policies of the organisation. They could also gain legitimacy from the environmental good they seek to protect. In the Philippines, for example, non-governmental groups have successfully claimed in court to derive legitimacy and *locus standi* by representing the interests of future generations. In the international context, however, with its high disparities in wealth and power, accountability and legitimacy of private actors is more complicated. Most philanthropic organisations are headquartered in industrialised countries (merely 15 per cent of non-governmental organisations accredited with the UN Economic and Social Council are from the South[71]). Most funds donated to their cause stem from the North, both public and private, and it is likely that this influences the agenda of these groups to be more accountable to Northern audiences.[72] Disparities in representation exist also within countries. Few citizens have the means to donate time and money to philanthropic organisations. Given the financial requirements of participation, more rights and responsibilities for non-state actors in earth system governance could also easily privilege representatives of industry and business at the cost of other groups.

This leads me to the second, practical challenge: Because of these disparities, researchers need to design, and practitioners to develop, institutions that guarantee participation of civil society in earth system governance through mechanisms that vouchsafe a balance of opinions and perspectives. For example, networks of transnational private actors can seek to balance views and interests through self-regulation,[73] including financial support for representatives from developing countries. This is done for

69 On the democratic deficit of inter- and transnational politics and on attempts to conceptualise democratic governance on the transnational level see, for instance, Archibugi and Held 1995, Archibugi et al. 1998, Commission on Global Governance 1995, Dingwerth 2005, Dryzek 1999, Habermas 1998, Held 1995, 1997, Scharpf 1996, Scholte 2002, South Centre 1996, Wolf 1999.

70 Held 1999, 108.

71 Commission on Global Governance 1995, 153.

72 South Centre 1996.

73 See for example International Centre for Not-for-Profit Law (ICNL), Integrity, Good Governance and Transparency. Rules for Self-Regulation, at http://www.icnl.org/tools/selfreq.htm (accessed 31 May 2005).

instance through North-South quotas in meetings and alliances of non-state activists within the UN Commission on Sustainable Development. Also the Intergovernmental Panel on Climate Change, as a form of institutionalised participation of non-state actors in earth system governance, could serve as a model for the effective participation of both developing countries and non-state actors from the South.[74] When the panel was set up in 1988, only few experts from developing countries were involved. This led to a notable lack of credibility, legitimacy and saliency of its reports in the South. A number of reforms since 1989 resulted in the institutionalised inclusion of experts from the South. For example, current rules of procedure now require each working group of scientists to be chaired by one developed and one developing country scientist. Each chapter of the reports must have at least one lead author from a developing country. The governance structure of this network of scientists now has a quota system that rather resembles public political bodies such as the meetings of parties to the Montreal Protocol, the executive committee of the ozone fund or the Global Environment Facility, all of which are governed by North-South parity procedures.

Another option to increase legitimacy and accountability of earth system governance by strengthening private participation in a balanced way could be a 'quasi-corporatist' institutionalisation.[75] The Commission on Global Governance proposed in 1995 an international Forum of Civil Society within the United Nations, which would comprise of 300-600 'organs of global civil society'[76] to be self-selected from civil society. Such models are conceivable also as specialised chambers of specialised UN agencies, including the UN Environment Programme or even a future world environment organisation. Some far-reaching proposals even envisage a global parliamentarian assembly, which would bring together parliamentarians from all over the world.[77] The double identity of the parliamentarians—as members of their national parliament and of the 'world parliament'—could guarantee some feedback across scales of negotiations and decision-making. Again, such 'parliaments' could be included also in specialised institutions of earth system governance.

Finally, the current representation of labour unions and employers associations in the International Labour Organisation (ILO) could serve as a model for achieving a balance in participation of private actors from North and South in order to make earth system governance more representative and legitimate. In the ILO, each state is represented with four votes, two of which are assigned to governments and one each to business associations and labour unions. The ILO procedure, if adopted for environmental institutions, would attend to the basic problem of private participation in global environmental governance—namely that environmental groups can often not adequately compete with the financial power of business associations, and that non-state organisations of developing countries lack standing vis-à-vis the financially well-endowed organisations of industrialised countries. An ILO-type structure would grant business interests and environmental interests formally equal rights, and it would guarantee that the Southern non-governmental associations would have an influence in accordance

74 Agrawala 1998a, b, Siebenhüner 2002a, b, 2003, Biermann 2002b and forthcoming.
75 See for example Spiro 1994.
76 Commission on Global Governance 1995, 258.
77 Again, this idea has found the support of the Commission on Global Governance in 1995, as an 'assembly of the people'. Commission on Global Governance 1995, 257.

with the population represented by them. The ILO formula is far from perfect, in particular given the higher degree of complexity in environmental policy compared to ILO's more clear-cut 'business versus labour'-type of conflicts. And yet, the ILO experience provides a conceptual model along the lines of which an equitable participation of civil society in earth system governance could be developed.

Allocation

Politics is about the distribution of resources and values, and earth system governance is no different. Long-term credible, stable and inclusive earth system governance requires the agreement of all stakeholders that the allocation of costs and benefits is fair. With the increasing relevance of earth system governance in the 21st century, allocation mechanisms and criteria will become central questions to be addressed by social scientists as well as by decision-makers. At stake are not only the costs of mitigation. Given the potential disastrous consequences of earth system transformations, questions of fairness in adaptation will arise. Compensation and support through the global community of the most affected and most vulnerable regions, such as small island states, will not only be a moral responsibility. It will also be politically and economically prudent. Climate change, for example, has even raised questions of litigation and legal liability. In sum, allocation modes are needed that all relevant stakeholders in North and South perceive as fair and support over the course of the 21st century in line with the governance principles of long-term credibility and stability.[78] Without denying the continued relevance of domestic allocation challenges—including the problem of environmental equity within nations—I focus here on international allocation questions, which are in this form unprecedented and contested. I differentiate three modes of allocation in earth system governance: public allocation through international agreement, allocation through public markets, and allocation through global market mechanisms (where I focus on trade and investment restrictions on environmental grounds).

First, costs can be globally allocated through *intergovernmental agreement* and implemented through *public funds under the authority of the community of states*. The 1990 London amendment of the Montreal ozone protocol, for example, saw the creation of a multilateral fund to reimburse the full agreed incremental costs of developing countries in implementing the treaty and in phasing out ozone-depleting substances.[79] The fund is supported by industrialised countries according to negotiated scales of contribution, and it is still regularly replenished. The same governance mechanism applies for compensating developing countries for the costs they incur in protecting the climate, biodiversity, the oceans, as well as in addressing land-degradation and the emission of persistent organic pollutants. Here, a Global Environment Facility, much inspired by the multilateral ozone fund, has been set up under joint management of the World Bank, the UN Environment Programme and the UN Development Programme. Additional support funds for developing countries exist for many smaller regimes, for

78 See similarly Adger, Brown and Hulme (2005), who write in their editorial to *Global Environmental Change* that a 'more explicit concern with equity and justice will be important in furthering the study of global environmental change'.

79 See in more detail Biermann 1997.

example the World Heritage Convention. Not all real costs of environmental policy are borne by these funds, and both environmentalists and Southern representatives regularly complain that the financial support through Northern governments remains short of what is needed. On the other hand, these public funds are based on international legal agreement and function under the umbrella of the United Nations and its normative framework. They guarantee developing countries a degree of control over the conditions of funding and the choice of policy.[80]

Second, costs of mitigation and adaptation can be allocated through *market-based mechanisms that are under public control* and based on international agreement. So far there are few examples of public markets that allocate environmental mitigation costs. Apart from an early form of joint implementation of commitments among industrialised countries in the ozone regime, there exists currently only one intergovernmental system that trades mitigation obligations—the flexible mechanisms under the Kyoto protocol to the climate convention.[81] However, public international markets for mitigation costs need not be limited to climate governance. John Whalley and Ben Zissimos, for example, have proposed setting up an international agency that would create global markets in which all kinds of environmental goods could be traded. This agency would provide the organisational, legal and financial arrangements needed for deals between states and other actors that have an interest in the environmental behaviour of others, and those who would receive financial offers in exchange for adopting certain policies. Rainforests, for example, could be perceived as global goods with the concurrent obligation of the global community to pay for their preservation and to compensate tropical countries for restrictions in the use of their natural resources, with both obligations being tradable in international markets. A new international agency would function like a stock exchange that would trade offers from developing countries not to use sections of their natural resources with offers of industrialised countries to compensate them. This would equal emissions trading without emissions.[82]

The distributive effect of such markets will depend on the initial allocation of mitigation obligations. In the 1997 Kyoto protocol, obligations between nations were differentiated based on political criteria with a mix of economic costs and negotiation power and skills. This ad hoc procedure was inevitable to find sufficient support in the international community for creating the regime in the first place. Yet this willingness-to-pay approach is unlikely to continue. Generally agreed a priori criteria for the definition of a country's emissions reduction obligation will be required.

Some industrialised countries, notably the United States, seek to link future commitments to a set of principles that would protect existing economic activities, such as the principle of equal allocation of emissions rights to each unit of gross national

[80] This also holds for new international transfer mechanisms that are currently emerging or discussed. The emissions trading system of the Kyoto climate protocol includes a form of international transaction tax whose revenues fall under the control of the conference of the parties. Many of the discussed 'automatic financial mechanisms'—international charges on currency transactions ('Tobin tax'), on air traffic, or on maritime transportation—will also be prime examples of publicly controlled international compensation mechanisms within earth system governance.

[81] The protocol provides for three mechanisms: joint implementation between industrialised countries, emissions trading between industrialised countries, and some modified version of joint implementation in form of the clean development mechanism. Because developing countries are currently exempt from emissions trading, the thrust of market mechanisms has not yet affected North-South relations.

[82] See Walley and Zissimos 2001.

product, the principle of protection of 'acquired' past emission rights, or the principle of equal energy efficiency. These principles correlate and would result in smaller obligations for richer industrialised countries. The sum of these principles could be seen as the principle of equal cost of environmental policy, since each nation would reduce emissions in proportion to its overall economic activity. A sizable reallocation of economic resources between countries is unlikely under these principles, which are socially conservative.

Actors from the South strive instead for the acceptance of some or all of the following principles: the principle of equal entitlement of all human beings to equal emissions (allocation of emission rights to countries based on their current population); the principle of historic responsibility (allocation of current emission rights in negative correlation to the amount of past emissions); the principle of basic or survival emissions (relief of countries from reduction obligations below a certain flat rate basic emission); and the principle of economic acceptability within the context of poverty reduction (relief from reduction commitments if the level of development is below certain levels).[83] While these principles are derived from different claims to overarching principles of justice and fairness, they correlate and would exempt developing countries from obligations largely in proportion to their economic development and wealth.

Which approach is more likely to further the earth system governance principles of credibility, long-term stability, short-term adaptiveness and inclusiveness? The answer depends on the conceptualisation of the global warming problem, especially whether it is framed as a global resource to be allocated or as an environmental problem to be solved. The Southern conception comes down to the view that the earth' greenhouse gas absorption capacity is a global resource to be allotted to humankind based on need (that is, in favour of the poorest) or based on equal per-capita entitlements (essentially a human-rights claim): this was the approach taken by the South also regarding the allotment of deep seabed mining resources, Antarctica, the geostationary orbit (here linked to quasi-territorial claims), or even 'the moon and other celestial bodies' (as a 1970s treaty read). Underusing one's quota of resources would then justify a transnational wealth transfer from those who overuse their share. The US conceptualisation, on the other hand, views the global warming problem as a burden to be fairly shared by all nations in a way that allows all partners, rich and poor, to suffer to comparable degrees and as little as possible. Transnational wealth transfer is in such a view unjustified,[84] and existing entitlements to wealth are protected and conserved. This is not the place to discuss the pros and cons of each approach—I believe that much speaks in favour of the principle of equal per-capita emissions in earth system governance as a long-term goal.[85] From the perspective of earth system governance, it is important to note that, like funds, international markets for mitigation obligations are controlled by states and are based on intergovernmental agreement. These agreements will, eventually, determine the distributive effects of the trading scheme.

[83] See in more detail on Southern perspectives J. Gupta 1997, Najam, Huq and Sokona 2003, Simpson 2002.

[84] See for such a perspective that explicitly argues that 'developing countries should be fully compensated for their emission abatement efforts, but should not receive any further transfers', Böhringer and Helm 2004.

[85] This has been elaborated in Biermann 2006-a.

A third mode of allocation in earth system governance works through *environmentally motivated restrictions on international trade* that force producers and investors in some countries to change their process and production methods according to the standards of their trading partners. In other words, environmentally motivated trade restrictions either reduce the market share of exporting countries or force them to adjust their product designs and production processes. Such consequences are powerful allocating mechanisms within the larger system of earth system governance. They force especially smaller nations—who are generally standard-takers—to adapt to standards developed and enforced in larger consumer nations. In particular, they force the South to follow the North.

Trade restrictions can be either binding through incorporation into the law of the importing country or voluntary, for example through labelling programmes that allow consumers in importing countries to decide whether they would like to buy the imported product.[86] Binding restrictions in trade must be in accordance with the agreements under the World Trade Organisation (WTO), notably the General Agreement on Tariffs and Trade (GATT). This conflict between 'trade and environment' has led to much contestation in recent years, with interstate trade disputes on issues as diverse as tuna, shrimps, automobiles, furs or meat of cattle treated with growth hormones.[87] In these and many other cases, some states want to ban the import on environmental grounds, while exporting states invoke their right of non-discrimination in trade granted under the GATT and other WTO agreements. Contested is, in particular, the legitimacy and legality of unilateral action and national decision-making as opposed to multilateral decision-making, with the key conflict running between the governments of the large developed (import) markets in the North, with their strong environmentalist movements, and the developing world.

In the world trade regime, such conflicts are resolved in adversary litigation, in addition to intergovernmental negotiation. The landmark decision in this conflict, which has the potential to redefine the global allocation modus in earth system governance, was the *United States—Import Prohibition of Certain Shrimps and Shrimp Products* adjudication of the WTO Appellate Body of 1998.[88] In this case, India, Malaysia, Pakistan and Thailand complained that the United States had banned import of shrimps caught by their fishers through methods not corresponding to US environmental standards. The United States argued that too many sea turtles were killed due to these fishing practices (as accidental catches since the nets hindered sea turtles from escaping). The US trade restrictions did not discriminate between characteristics manifest in the product—that is, differences between Asian and North American shrimps—but only between fishing practices. In other words, the United States had banned the import of only such shrimps that had been produced with methods not consistent with US environmental standards. In addition, the United States targeted environmental assets *beyond its territory*, hence unilaterally assuming a stewardship for global environmental goods. The case has thus wider implications. In its decision, the WTO Appellate Body justified trade restrictions concerning foreign processes and production

86 De Boer and Kuik 2004.
87 For an overview see Charnovitz 1996.
88 WTO Appellate Body 1998. On this case, see for example, Cone 1999, Howse 1998, Mavroidis 2000. The decision also overturned an earlier decision by a panel, see WTO Shrimp Panel 1998.

methods and also approved trade restrictions that seek to protect exhaustible natural resources outside the jurisdiction of the importing state.[89] In the end, however, the United States lost the case for procedural flaws in its legislation.[90] Despite this, many developing country experts view the judgement with concern and consider their countries' success a 'hollow victory' and a 'bitter pill to swallow'.[91] Prima facie, the case relates only to shrimps. Yet would the ruling find wider application, it could well justify trade restrictions regarding the global climate and other core issues of earth system governance.

All three allocation modes in earth system governance can co-exist. The international allocation of mitigation costs in climate governance, for example, is currently influenced by the Global Environment Facility that funds projects in the South and by the clean development mechanism, which pays for mitigation projects in the South by allowing Northern actors to subtract these costs from their own mitigation obligation. In the future, it is likely that developing countries will also participate in emissions trading, which will influence their costs of mitigation. Finally, given the Shrimp/Turtle decision, it is not unthinkable that in the future, developing countries will also be required, through trade restrictions, to adhere to certain energy-efficient production standards without receiving reimbursement through the Global Environment Facility.

All three allocation modes in earth system governance represent different principles of allocation. The ozone fund and the Global Environment Facility build on state-based, universal decision-making. They come closest to domestic modes of allocation: on the revenue side, the contribution to the funds is largely based on the relative per-capita wealth of countries; this could be seen as coming close to taxation. Regarding the expenses, the funds are governed by decisions of state representatives, in a way that grants both the developing and the developed countries a de facto veto right. The disbursement of the funds is largely based on need—the funds reimburse the incremental costs of countries that take action to mitigate global environmental change.

Public markets for mitigation obligations—to put it differently, for emission entitlements— also build on state-based, universal decision-making inasmuch as governments decide on the allocation of mitigation obligations. Overall, the market structure will guarantee an efficient allocation of mitigation costs and may induce technological innovation. The eventual distributive effect of this system depends on the initial allocation of mitigation obligations and can hence differ from the basic principle of international funds. Regarding climate governance, the initial allocation of emission entitlements might result in a more profitable solution for developing countries—to use the extreme options—if per-capita allocation is agreed (some of them would gain more than their incremental costs of environmental action), and to a less profitable solution if allocation based on existing emissions is agreed (some might not receive the reimbursement of all incremental costs).

89 The body did not fully endorse the extraterritorial application of the exception clause of GATT, but recognised that in the case in question, there was sufficient connection between the United States and the Asian sea turtles, because the species of migrating turtles in question lived in both Asian and US waters, and in the high seas. See WTO Appellate Body 1998, para. 133.

90 See in more detail Biermann 2001b.

91 Tetarwal and Mehta 2000.

Allocation through environmental restrictions of the global trade in goods would place additional costs on poorer exporting countries. The WTO Appellate Body has shifted the balance in the trade and environment nexus and given greater reign to unilateral policy. Exporting countries may now be forced to produce their goods according to the environmental production standards of the various importing countries, even if different production methods leave no trace in the product and if the environmental harm does not affect the importing country. Production standards can now be set unilaterally by importing countries without the right or possibility of exporting countries to participate in the elaboration of these standards. Smaller trading nations—especially in the developing world—will have to adopt the environmental preferences and standards of larger economies in order to safeguard their export markets.[92] In the end, this inflicts additional costs on developing countries.

This would be the principle of consumer authority: rich consumer markets are empowered through trade restrictions to globalise their own preferences and production standards and to define and shape the production standards in poorer countries. There would be no reimbursement of incremental costs for environmental policies in developing countries, and no right of co-decision by representatives of developing countries. From the perspective of poorer, smaller nations, private allocation through environmental restrictions of global trade is hence less preferable. This does not imply that trade restrictions concerning processes and production methods and with extraterritorial application have no place at all under WTO law. As with the other modes of allocation discussed in this section, trade restrictions could also be placed under intergovernmental agreement that guarantees and protects the rights and interests of smaller, 'standard-taking' countries. The best political instrument to further these objectives are universal environmental agreements that muster broad acceptance even when they require trade restrictions based on foreign process and production methods.[93] Many such agreements that restrict trade on environmental grounds exist;[94] all are seen as conforming to WTO requirements because of their wide acceptance.

Taken together, modes of allocation are key variables for the stability, credibility and inclusiveness of earth system governance. Eventually, earth system governance must be perceived as fair and equitable to be effective. Yet despite this key relevance of

92 For instance, in a project on the consequences of environmental policies of industrialised countries for developing countries, Tussie concludes that 'environmental upgrading left to the market forces will reflect a Northern-biased agenda' (Tussie 1999, 544; also Tussie 2000). The OECD (1997, 33) states: 'Countries with large markets upon which exporters are dependent … will be more successful in influencing the PPMs [processes and production methods] used by other countries, than will smaller nations whose market is proportionally less relevant. Thus, some argue that the United States and the European Union have been in a better position to influence environmental policy changes in other countries. For the most part, countries with small internal markets will not be able to impose trade restrictions successfully on large countries to which they export their products'.

93 This argument has been elaborated in Biermann 2001b.

94 For example, the 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora bans trade in protected species with non-parties unless they comply with treaty provisions. The 1989 Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal bans the import or export of wastes from states that are not party to the treaty. The 1987 Montreal Protocol on Substances that Deplete the Ozone Layer restricts trade with non-parties by requiring governments to ban the import of goods that have been produced in non-parties with ozone-depleting substances even if those goods no longer contain such substances. Similar examples are the 1998 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade and the 2000 Cartagena Protocol on Biosafety to the 1992 Convention on Biological Diversity.

allocation, research in this field has been scarce in the past, in particular regarding empirical research programmes that could lend substance to the more policy-oriented, philosophical treatises on equity in international relations. The causes and consequences of different allocation mechanisms in earth system governance are still not sufficiently understood. Few research efforts have yet been directed at understanding the causal pathways that lead to specific allocation mechanisms. Little systematic analysis has also been devoted to studying allocation as independent variable and to analysing allocation mechanisms in relation to variant effectiveness of the core institutions of earth system governance. In sum, given the growing relevance of earth system governance in the course of the 21st century in terms of both mitigation and adaptation costs, allocation is certain to become a major concern for researchers and practitioners alike.

Conclusion

This paper has sketched the emerging field of earth system governance as an empirical phenomenon of world politics and as a political programme. I have laid out the key problem characteristics and governance principles, as well as five major research and governance challenges: architecture, agency, adaptiveness, accountability, and allocation.

More than anything else, earth system governance remains an exciting field for social science. As such, however, it also requires a particular research practice. A research programme on earth system governance needs to adopt, first of all, a *holistic analytical perspective* that synthesises a mosaic of local, national, regional and global political processes. While the traditional study of environmental policy has long been devoted to cross-national comparisons,[95] this is even more important for the study of earth system governance. This applies especially to the relations between the academic fields of development studies and African, Asian and Latin American area studies, on the one hand, and traditional environmental policy research that has focused on the rich countries in the North, on the other.[96]

This also requires a global approach to *the organisation of research*. The study of earth system governance encompasses all the world's regions, but must also be internationally organised to make use of local knowledge, values and insights. As Kates and colleagues argued in their blueprint of a sustainability science, 'a comprehensive approach to [scientific] capacity building will have to nurture … global institutions in tandem with locally focused, trusted, and stable institutions that can integrate work situated in particular places and grounded in particular cultural traditions with the global knowledge system.'[97] Such diversity within the research community together with stronger networking is a prerequisite for studying earth system governance. The globalisation of problems can be countered only by the globalisation of research.

Furthermore, earth system governance requires its own *methodology*. It will need to be an interdisciplinary effort that links all relevant social sciences, but draws on

95 See for example Jänicke and Weidner 1997, Jänicke and Jörgens 1998, 2000.
96 See for example Mol 2003.
97 Kates et al. 2001, 642.

findings from natural science as well. In particular when it comes to adaptation, earth system governance is called upon to analyse and design governance systems that respond to emergencies which are merely predicted for the future, but are likely to exceed in scope and quality most of what is known today. Adaptive governance systems that take account of changes in monsoon patterns, large-scale breakdowns of ecosystems or modifications in the thermohaline circulation will need to deal with scales that are unprecedented. While traditional social science builds on the development and testing of theories and hypotheses through historical experience, earth system governance, which is inherently future-oriented, has to rely on new forms of evidence and new forms of validity and reliability of empirical knowledge.

Likewise, research on earth system governance has to cope with *normative uncertainty*. We do not know what governance systems and governance outcomes future generations want. This calls for particular forms of participatory research and assessment that integrate lay-experts in academic research programmes.[98] Stakeholder dialogues or citizens juries are key elements in the larger effort of understanding and strengthening earth system governance. Again, this is common ground among proponents of sustainability science: 'Scientists and practitioners will need to work together with the public at large to produce trustworthy knowledge and judgement that is scientifically sound and rooted in social understanding. … We need to be able to involve scientists, practitioners, and citizens in setting priorities, creating new knowledge, evaluating its possible consequences, and testing it in action'.[99]

Added to this all comes the general problem that all science is *context-bound* in the person of the scientist. When it comes to earth system governance, this contextual embeddedness of the researcher relates to both time and (cultural) space. Regarding time, we need to develop and 'test' today, with the knowledge of today, governance systems that will help to achieve a safe human-nature co-evolution over the course of the century. Regarding space, the cultural-normative embeddedness of social scientists requires new forms of diversity-management in global science in the form that is supported today in many global environmental assessment institutions.[100] Given the dominance of Northern science in both natural and social science programmes, however, this will eventually call for more than quotas for developing country experts in large-scale scientific projects and assessments. It will also require increased efforts in strengthening Southern research capacities on earth system governance.[101]

All this makes earth system governance one of the most challenging, but thus also one of the most exciting research objects in the social sciences. As a political programme, it is no less daunting. Politics appears often determined more by economic stagnation, short-term interests and re-emerging nationalism than by global governance and collective stewardship of the earth. The bolder visions of the earlier philosophers, such as Seneca's idea of a *res publica* whose boundaries would be 'the sun alone'[102] or Kant's proposal of a global federation of states for 'the eternal peace'[103],

98 See Hisschemöller et al. 2001, van de Kerkhof 2004, van de Kerkhof and Wieczorek 2005.
99 'Sustainability Science'—Statement of the Friibergh Workshop on Sustainability Science 2000.
100 See the contributions in Jasanoff and Long Martello 2004 and Mitchell et al., forthcoming.
101 This is elaborated in Biermann 2001a and 2002b.
102 Seneca, *De Otio*, paragraph IV (1).
103 Immanuel Kant, *Zum ewigen Frieden. Ein philosophischer Entwurf* [1795/1983].

seem hardly more realistic today than they were in their days. Yet earth system governance is emerging. More than nine hundred international environmental agreements are in force. Many harmful substances, such as the ozone-depleting chlorofluorocarbons, have been phased out through international co-operation. Mitigation and adaptation projects against global warming are mushrooming in many places, from India to the Netherlands, often inspired, guided or co-ordinated by global collaborative programmes.

Yet how to create a global and effective architecture for earth system governance that is adaptive to changing circumstances, participatory through involving civil society at all levels, accountable and legitimate as part of a new democratic governance beyond the nation state, and at the same time fair for all participants: this research and governance challenge still lies ahead.

References

Adger, W. N., K. Brown and M. Hulme. 2005. Redefining global environmental change (editorial). *Global Environmental Change: Human and Policy Dimensions* 15, 1–4.

Agrawala, S. 1998a. Context and early origins of the Intergovernmental Panel on Climate Change. *Climatic Change* 39, 605–20.

Agrawala, S. 1998b. Structural and process history of the Intergovernmental Panel on Climate Change. *Climatic Change* 39, 621–42.

Alcántara, C. H. de. 1998. Uses and abuses of the concept of governance. *International Social Science Journal* 155, 105–13.

Alcock, F. 2002. Scale crisis and sectoral conflict: The fisheries development dilemma. In *Global Environmental Change and the Nation State: Proceedings of the 2001 Berlin Conference on the Human Dimensions of Global Environmental Change*, ed. by F. Biermann, R. Brohm, and K. Dingwerth. Potsdam: Potsdam Institute for Climate Impact Research.

Aldy, J., S. Barrett, and R. Stavins. 2003. *Thirteen Plus One: A Comparison of Global Climate Policy Architectures*. Regulatory Policy Program Working Paper RPP-2003-04.

Andonova, L. B., and M. A. Levy. 2003. Franchising global governance: Making sense of the Johannesburg Type II partnerships. In *Yearbook of International Co-operation on Environment and Development*, ed. by O. B. Thommessen. London: Earthscan, 19–32.

Andresen, S., and S. Agrawala. 2001. US climate policy: Evolution and future prospects. *Energy and Environment* 12: 2–3, 117–139.

Archibugi, D., and D. Held, editors. 1995. *Cosmopolitan Democracy: An Agenda for a New* World Order. Oxford: Polity Press.

Archibugi, D., D. Held and M. Köhler, editors. 1998. *Re-imagining Political Community. Studies in Cosmopolitan Democracy*. Stanford: Stanford University Press.

Arts, B. 1998. *The Political Influence of Global NGOs. Case Studies on the Climate Change and Biodiversity Conventions*. Utrecht: International Books.

Arts, B. 2002. Green alliances of business and NGOs. New styles of self-regulation or dead-end roads? *Corporate Social Responsibility and Environmental Management* 9, 26–36.

Asselt, H. van, J. Gupta and F. Biermann. 2005. Advancing the climate agenda: Exploiting material and institutional linkages to develop a menu of policy options. *Review of European Community and International Environmental Law* 14: 3, 255–264.

Barnett, M. N., and M. Finnemore. 1999. The politics, power and pathologies of international organizations. *International Organization* 53: 4, 699–732.

Barrett, S. 2001. Towards a better climate treaty. *World Economics* 3: 2, 519–541.

Barrett, S. 2002. *Towards a Better Climate Treaty*. Opinion Pieces. AEI-Brookings Joint Center.

Bartlett, R. V., P. A. Kurian, and M. Malik, editors. 1995. *International Organizations and Environmental Policy*. Westport, Conn.: Greenwood Press.

Bauer, S., forthcoming. Does bureaucracy really matter? The authority of treaty secretariats in global environmental politics. *Global Environmental Politics* 6: 1 (2006).

Bauer, S., and F. Biermann. 2005. The debate on a world environment organization: An introduction. In *A World Environment Organization. Solution or Threat for Effective International Environmental Governance?,* ed. by F. Biermann and S. Bauer. Aldershot, UK: Ashgate, 1–23.

Benedick, R. E. 1998. *Ozone Diplomacy: New Directions in Safeguarding the Planet*. 2nd enlarged edition. Cambridge, Mass.: Harvard University Press.

Benedick, R. E. 2001. Striking a new deal on climate change. *Issues in Science and Technology* (online), Fall.

Benner, T., W. Reinicke, and J. M. Witte. 2004. Multisectoral networks in global governance. Towards a pluralistic system of accountability. *Government and Opposition* 39: 2, 191–210.

Bernauer, T. 1995. The effect of international environmental institutions: How we might learn more. *International Organization* 49: 2, 351–77.

Betsill, M. M., and E. Corell. 2001. NGO influence in international environmental negotiations: A framework for analysis. *Global Environmental Politics* 1: 4, 65–85.

Biermann, F. 1997. Financing environmental policies in the South: Experiences from the Multilateral Ozone Fund. *International Environmental Affairs* 9: 3, 179–219.

Biermann, F. 1998. *Weltumweltpolitik zwischen Nord und Süd. Die neue Verhandlungsmacht der Entwicklungsländer*. Baden-Baden: Nomos.

Biermann, F. 2001a. Big science, small impacts–in the South? The influence of global environmental assessments on expert communities in India. *Global Environmental Change* 11, 297–309.

Biermann, F. 2001b. The rising tide of green unilateralism in world trade law: Options for reconciling the emerging North-South conflict. *Journal of World Trade* 35: 3, 421–48.

Biermann, F. 2002a. Common concerns of humankind and national sovereignty. In *Globalism: People, Profits and Progress*. Proceedings of the 30th Annual Conference of the Canadian Council on International Law, Ottawa, 18–20 October 2001. Dordrecht: Kluwer, 158–212.

Biermann, F. 2002b. Institutions for scientific advice: Global environmental assessments and their influence in developing countries. *Global Governance* 8: 2, 195–219.

Biermann, F. 2005. The rationale for a world environment organization. In *A World Environment Organization: Solution or Threat for Effective International Environmental Governance?*, ed. by F. Biermann and S. Bauer. Aldershot, UK: Ashgate, 117–44.

Biermann, F., 2006-a. Between the United States and the South. Strategic choices for European climate governance. *Climate Policy* 5 (2005), 273–290.

Biermann, F., 2006-b. Global governance and the environment. In *International Environmental Politics,* ed. by M. M. Betsill, K. Hochstetler and D. Stevis. Basingstoke, UK: Palgrave Macmillan, 237–261.

Biermann, F., forthcoming. Whose experts? The role of geographic representation in assessment institutions. In *Global Environmental Assessments: Information, Institutions and Influence*, ed. by R. B. Mitchell, W. C. Clark, D. W. Cash and N. Dickson. Cambridge, Mass.: MIT Press.

Biermann, F., and S. Bauer. 2004. Assessing the effectiveness of intergovernmental organisations in international environmental politics. *Global Environmental Change. Human and Policy Dimensions* 14: 2, 189–93.

Biermann, F., and S. Bauer, editors. 2005a. *A World Environment Organization. Solution or Threat for Effective International Environmental Governance?,* Aldershot, UK: Ashgate.

Biermann, F., and S. Bauer. 2005b. *Managers of Global Governance. Assessing and Explaining the Influence of International Bureaucracies*. Global Governance Working Paper 15. Amsterdam et al.: The Global Governance Project. Available at www.glogov.org.

Biermann, F., and R. Brohm. 2005. Implementing the Kyoto Protocol without the USA: The strategic role of energy tax adjustments at the border. *Climate Policy* 4: 3, 289–302.

Biermann, F., and K. Dingwerth. 2004. Global environmental change and the nation state. *Global Environmental Politics* 4: 1 (February), 1–22.

Bodansky, D. 2002a. *U.S. Climate Policy After Kyoto: Elements for Success*. Policy Brief 15 (April). Washington DC: Carnegie Endowment for International Peace.

Bodansky, D. 2002b. *Linking U.S. and International Climate Change Strategies*. Washington DC: Pew Center.

Boer, J. de, and O. Kuik. The logic of sustainability labels. Their functions for stakeholders and their role in markets. In *Sustainability Labelling and Certification*, ed. by M. Campins Eritja. Marcial Pons, Spain, 49–74.

Böhringer, C., and Helm, C. 2004. *On the Fair Division of Greenhouse Gas Abatement Cost*. Unpublished manuscript (on file with author).

Brown Weiss, E., and H. K. Jacobson, editors. 1998. *Engaging Countries. Strengthening Compliance with International Environmental Accords*. Cambridge, Mass.: MIT Press.

Caldwell, L. K. 1984. *International Environmental Policy: Emergence and Dimensions*. Durham NC: Duke University Press.

Cashore, B. 2002. Legitimacy and the privatization of environmental governance: How non-state market-driven (NSMD) governance systems gain rule-making authority. *Governance* 15, 503–529.

Chambers, W. B., editor. 2001. *Inter-Linkages: The Kyoto Protocol and the International Trade and Investment Regimes*. Tokyo: United Nations University Press.

Charnovitz, S. 1997. Two centuries of participation. NGOs and international governance. *Michigan Journal of International Law* 18, 183–286.

Charnovitz, S. 2005. Toward a world environment organization: Reflections upon a vital debate. In *A World Environment Organization. Solution or Threat for Effective International Environmental Governance?*, ed. by F. Biermann and S. Bauer. Aldershot, UK: Ashgate, 87–115.

Chayes, A., and A. Handler Chayes. 1993. On compliance. *International Organization* 47: 2, 175–205.

Chayes, A., and A. Handler Chayes. 1995. *The New Sovereignty: Compliance with International Regulatory Agreements*. Cambridge, Mass.: Harvard University Press.

Clapp, J. 1998. The privatization of global environmental governance: ISO 14000 and the developing world. *Global Governance* 4, 295–316.

Clark, A. M., E. J. Friedman and K. Hochstetler. 1998. The sovereign limits of global civil society. A comparison of NGO participation in UN world conferences on the environment, human rights and women. *World Politics* 51 (October), 1–35.

Clark, W. C., P. J. Crutzen, and H. J. Schellnhuber. 2005. *Science for Global Sustainability. Toward a New Paradigm*. Center for International Development Working Paper no. 120. Cambridge, Mass.: Harvard University.

Commission on Global Governance. 1995. *Our Global Neighbourhood. The Report of the Commission on Global Governance*. Oxford: Oxford University Press.

Conca, K. 1995. Greening the United Nations: Environmental organizations and the UN system. *Third World Quarterly* 16: 3, 441–57.

Cone, S. 1999. The appellate body, the protection of sea turtles and the technique of 'completing the analysis'. *Journal of World Trade* 33, 51–61.

Cooper, R. 1998. Toward a real treaty on global warming. *Foreign Affairs* 77: 2, 66–79.

Cooper, R. 2001. The Kyoto Protocol. A flawed concept. *Environmental Law Reporter* 31, 11,484–11,492.

Cutler, C. A. 2002. Private international regimes and interfirm cooperation. In *The Emergence of Private Authority in Global Governance,* ed. by T. J. Biersteker. Cambridge, UK: Cambridge University Press, 23–40.

Cutler, C. A., V. Haufler and T. Porter, editors. 1999. *Private Authority and International Affairs*. Albany: State University of New York Press.

Deutscher Bundestag. 2002. *Schlussbericht der Enquete-Kommission 'Globalisierung der Weltwirtschaft* [Final report of the Enquete Commission 'Globalization of the World Economy']. Opladen, Germany: Leske and Budrich.

Dingwerth, K. 2005. The democratic legitimacy of public-private rule-making. What can we learn from the World Commission on Dams? *Global Governance* 11: 1, 65–83.

Dryzek, J. S. 1999. Transnational democracy. *The Journal of Political Philosophy* 7: 1, 30–51.

Dunoff, J. 1992. Reconciling international trade with preservation of the global commons: Can we prosper and protect? *Washington and Lee Law Review* 49, 1407–1454.

Ebbin, S. 2002. Enhanced fit through institutional interplay in the Pacific Northwest salmon co-management regime. *Marine Policy* 26: 4, 23–29.

Edwards, M., and S. Zadek. 2003. Governing the provision of global public goods: The role and legitimacy of nonstate actors. In *Providing Global Public Goods. Managing Globalization,* ed. by I. Kaul, P. Conceicao, K. Le Goulven and R. U. Mendoza. New York, Oxford: Oxford University Press, 200–224.

Egenhofer, C. and Fujiwara, N. 2003. *The Emerging Climate Change Regime: The UNFCCC, the Kyoto Protocol Forever, Kyoto Modified … Or Yet Something Else?* Final Report of a Study Prepared for Environmental Studies Group Economic and Social Research Institute, Cabinet Office, Government of Japan.

Eisenack, K. 2003. Qualitative viability analysis of a bio-socio-economic system. In *Working Papers of 17th Workshop on Qualitative Reasoning*, ed. by P. Salles and B. Bredeweg. Brasilia, 63–70. Available at http://www.pik-potsdam.de/%7Eeisenack/downloads/QR-2003.pdf

Eisenack, K., J. Kropp and H. Welsch. 2005. A qualitative dynamical modelling approach to capital accumulation in unregulated fisheries. *Journal of Economic Dynamics and Control* (accepted).

Evans, A. 2002. *Fresh Air? Options for the Future Architecture of International Climate Change Policy*. London: The New Economics Foundation.

Falkner, R. 2003. Private environmental governance and international relations: Exploring the links. *Global Environmental Politics* 3, 72–87.

Farrell, A. and J. Jäger, editors, forthcoming. *The Design of Environmental Assessments: Choices for Effective Processes*. Washington, DC: Resources for the Future.

Finkelstein, L. S. 1995. What is global governance? *Global Governance* 1: 3, 367–72.

Finnemore, M. 1996a. Norms, culture and world politics: Insights from sociology's institutionalism. *International Organization* 50: 2, 325–47.

Finnemore, M. 1996b. *National Interests in International Society*. Ithaca, NY: Cornell University Press.

Finnemore, M., and K. Sikkink. 1998. International norm dynamics and political change. *International Organization* 52: 4, 887–917.

Florini, A., editor. 1999. *The Third Force: The Rise of Transnational Civil Society*. Tokyo and Washington: Japan Center for International Change and Carnegie Endowment for International Peace.

Fuchs, D. 2003. *Understanding Business Power in Global Governance* (habilitation thesis). München: Ludwig-Maximilians-Universität.

Gehring, T., and S. Oberthür. 2005. Reforming international environmental governance: An institutional perspective on proposals to establish a World Environment Organization. In *A World Environment*

Organization. Solution or Threat for Effective International Environmental Governance?, ed. by F. Biermann and S. Bauer. Aldershot, UK: Ashgate, 205–234.

Gibson, C., E. Ostrom, and Toh-Kyeong Ahn. 2000. The concept of scale and the human dimensions of global change: A survey. *Ecological Economics* 32, 217–239.

Gordenker, L., and T. G. Weiss. 1996. Pluralizing global governance: Analytical approaches and dimensions. In *NGOs, the UN, and Global Governance*, ed. by T. G. Weiss and L. Gordenker. Boulder: Lynne Rienner, 17–47.

Grijp, N. M. van der, and L. Brander. 2004. The role of the business community and civil society. In *Sustainability Labelling and Certification*, ed. by M. Campins Eritja. Marcial Pons, Spain, 223–243.

Grijp, N. M. van der, forthcoming. Regulating the use of pesticides: A review of private approaches focused on the fruit and vegetables sector. In *International Food Security and Global Legal Pluralism*, ed. by F. Snyder. Bruylant, Belgium.

Gupta, A. 2001. Advance informed agreement: A shared basis to govern trade in genetically modified organisms? *Indiana Journal of Global Legal Studies* 9: 1, 265–81.

Gupta, A. 2004. When global is local: Negotiating safe use of biotechnology. In *Earthly Politics. Local and Global in Environmental Governance*, ed. by S. Jasanoff and M. Long Martello. Cambridge, Mass.: MIT Press, 127–148.

Gupta, J. 1997. *The Climate Change Convention and Developing Countries—From Conflict to Consensus?* Kluwer Academic Publishers, Dordrecht.

Gupta, J. 2003. The role of non-state actors in international environmental affairs. *Heidelberg Journal of International Law* 63: 2, 459–86.

Haas, P. M. 1992. Banning chlorofluorocarbons: Epistemic community efforts to protect stratospheric ozone. *International Organization* 46, 187–224.

Haas, P. M. 1993. Introduction: Epistemic communities and international policy coordination. *International Organization* 47, 1–35.

Haas, P. M., R. Keohane, and M. A. Levy, editors. 1993. *Institutions for the Earth: Sources of Effective International Environmental Protection*. Cambridge, Mass.: MIT Press.

Habermas, J. 1998. Die postnationale Konstellation und die Zukunft der Demokratie. In *Die postnationale Konstellation. Politische Essays*, by J. Habermas. Frankfurt am Main: Suhrkamp, 91–169.

Hale, T. N., and D. L. Mauzerall. 2004. Thinking globally and acting locally: Can the Johannesburg partnerships coordinate action on sustainable development? *Journal of Environment and Development* 13: 3, 220–239.

Hall, R. B., and T. J. Biersteker, editors. 2002. *The Emergence of Private Authority in Global Governance,* Cambridge, Engl.: Cambridge University Press.

Haufler, V. 2000. Private sector international regimes. In *Non-State Actors and Authority in the Global System,* ed. by R. A. Higgott, G. R. D. Underhill and A. Bieler. London, New York: Routledge, 121–137.

Heijden, H.-A. van der. 2002. Political parties and NGOs in global environmental politics. *International Political Science Review* 23, 187–201.

Held, D. 1995. *Democracy and the Global Order: From the Modern State to Cosmopolitan Governance*. Cambridge, UK.

Held, D. 1997. Democracy and globalization. *Global Governance* 3: 3, 251–67.

Held, D. 1999. The transformation of political community. In *Democracy's Edges*, ed. by I. Shapiro and C. Hacker-Cordon. Cambridge, England.

Held, D. 2004. Democratic accountability and political effectiveness from a cosmopolitan perspective. *Government and Opposition* 39: 2, 364–391.

Helm, C., and D. F. Sprinz. 2000. Measuring the effectiveness of international environmental regimes. *Journal of Conflict Resolution* 44: 5, 630–52.

Helm, C. 2000. *Economic Theories of International Environmental Cooperation*. Cheltenham: Edward Elgar.

Higgott, R. A., G. D. Underhill and A. Bieler, editors. 1999. *Non-State Actors and Authority in the Global System*. London: Routledge.

Hirschman, A. O. 1945/1980. *National Power and the Structure of Foreign Trade*. Berkeley: University of California Press.

Hisschemöller, M., R. Hoppe, W. N. Dunn and J. R. Ravetz, editors. 2001. *Knowledge, Power and Participation in Environmental Policy Analysis*, New Brunswick and London: Transaction Publishers.

Howse, R. 1998. The turtles panel: Another environmental disaster in Geneva. *Journal of World Trade* 32, 73–100.

Institutional Dimensions of Global Environmental Change Project. 1999. *Science Plan*, by O. R. Young with contributions from A. Agrawal, L. A. King, P. H. Sand, A. Underdal and M. Wasson (= IHDP Report No. 9): Bonn: IHDP. Available at www.ihdp.org.

International Law Association. 2002. *New Declaration of Principles of International Law Relating to Sustainable Development*. UN General Assembly Doc A/57/329 of 31 August 2002.

Jäger, J. 1998. Current thinking on using scientific findings in environmental policy making. *Environmental Modeling and Assessment* 3, 143–53.

Jänicke, M., P. Kunig and M. Stitzel. 1999. *Lern- und Arbeitsbuch Umweltpolitik: Politik, Recht und Management des Umweltschutzes in Staat und Unternehmen*. Bonn.

Jänicke, M., and H. Jörgens. 2000. Strategic environmental planning and uncertainty: A cross-national comparison of green plans in industrialized countries. *Policy Studies Journal* 28: 3, 612–32.

Jänicke, M., and H. Weidner, editors. 1997. *National Environmental Policies: A Comparative Study of Capacity-Building*. Berlin: Springer.

Jasanoff, S. 1996. Science and norms in global environmental regimes. In *Earthly Goods: Environmental Change and Social Justice*, ed. by J. Reppy. Ithaca: Cornell University Press, 173–197.

Jasanoff, S., and M. Long Martello, editors. 2004. *Earthly Politics. Local and Global in Environmental Governance*. Cambridge, Mass.: MIT Press.

Johnson, B. 1972. The United Nations institutional response to Stockholm: A case study in the international politics of institutional change. *International Organization* 26: 2, 255–301.

Kant, I. 1795/1983. *Zum ewigen Frieden. Ein philosophischer Entwurf*. In: Werke in 6 Bänden hrsg. von Wilhelm Weischedel. Darmstadt: Wissenschaftliche Buchgesellschaft, 191–251.

Kates, R. W., W. C. Clark, R. Corell, J. M. Hall, C. C. Jaeger, I. Lowe, J. McCarthy, H.-J. Schellnhuber, B. Bolin, N. M. Dickson, S. Faucheux, G. C. Gallopin, A. Grübler, B. Huntley, J. Jäger, N. S. Jodha, R. E. Kasperson, A. Mabogunje, P. Matson, H. Mooney, B. Moore III, T. O'Riordan and U. Svedin. 2001. Sustainability Science. *Science* 292, 641–2.

Kaul, I., and K. Le Goulven. 2003. Institutional options for providing global public goods. In *Providing Global Public Goods. Managing Globalization*, ed. by I. Kaul, P. Conceicao, K. Le Goulven and R. U. Mendoza. New York, Oxford: Oxford University Press, 371–409.

Karkkainen, B. C. 2004. Post-sovereign environmental governance. *Global Environmental Politics* 4: 1, 72–96.

Kates, R. W., T. M. Parris, and A. A. Leiserowitz. 2005. What is sustainable development? Goals, indicators, values, and practice. *Environment: Science and Policy for Sustainable Development* 47: 3, 8–21.

Keck, M., and K. Sikkink. 1988. *Activists beyond Borders: Advocacy Networks in International Politics*. Ithaca, N.Y.: Cornell University Press.

Kennan, G. F. 1970. To prevent a world wasteland: A proposal. *Foreign Affairs* 48: 3, 401–13.

Keohane, R. O., editor. 1986. *Neorealism and Its Critics*. New York: Columbia University Press.

Keohane, R. O. 2002. *Political Accountability*. Working paper, Duke University, available at www.poli.-duke.edu/people/Faculty/docs/millpaper.pdf.

Keohane, R. O., and M. A. Levy, editors. 1996. *Institutions for Environmental Aid: Pitfalls and Promise*. Cambridge, Mass.: MIT Press.

Keohane, R. O., and J. S. Nye. 1977. *Power and Interdependence: World Politics in Transition*. Boston: Little, Brown.

Keohane, R. O., and J. S. Nye. 2003. Redefining accountability for global governance. In *Governance in a Global Economy*, ed. by M. Kahler and D. A. Lake. Princeton and Oxford: Princeton University Press, 386–412.

Kerkhof, M. van de. 2004. *Debating Climate Change. A Study of Stakeholder Participation in an Integrated Assessment of Long-Term Climate Policy in the Netherlands*. Utrecht: Lemma.

Kerkhof, M. van de and A. J. Wieczorek. 2005. Learning and stakeholder participation in transition processes towards sustainability. Methodological considerations. *Journal of Technological Forecasting and Social Change* 72: 2, 733–747.

Kersbergen, K. van and F. van Waarden. 2004. 'Governance' as a bridge between disciplines: Cross-disciplinary inspiration regarding shifts in governance and problems of governability, accountability and legitimacy. *European Journal of Political Research* 43, 143–171.

Khagram, S., J. V. Riker, and K. Sikkink, editors. 2002. *Restructuring World Politics: Transnational Social Movements, Networks, and Norms*. Minneapolis: University of Minnesota Press.

Korten, D. 1995. *When Corporations Rule the World*. London: Earthscan.

Lee, K., D. Humphreys and M. Pugh. 1997. Privatisation in the United Nations system: Patterns of influence in three intergovernmental organisations. *Global Society* (Jan.), 339–359.

Levy, D. L., and A. Kolk. 2002. Strategic responses to global climate change: Conflicting pressures on multinationals in the oil industry. *Business and Politics* 4, 275–300.

Levy, D. L., and P. J. Newell. 2002. Business strategy and international environmental governance. *Global Environmental Politics* 2, 84–101.

Levy, D. L., and P. Newell. 2000. Oceans apart? Business responses to global environmental issues in Europe and the United States. *Environment* 42, 8–20.

Liftin, K. T. 1994. *Ozone Discourses: Science and Politics in Global Environmental Cooperation*. New York: Columbia University Press.

Lodewalk, M., and J. Whalley. 2002. Reviewing proposals for a world environmental organisation. *The World Economy* 25: 5, 601–17.

March, J. G., and J. P. Olsen. 1989. *Rediscovering Institutions. The Organizational Basis of Politics*. New York: Free Press.

March, J. G., and J. P. Olsen. 1996. Institutional perspectives on political institutions. *Governance. An International Journal of Policy and Administration* 9: 3, 247–64.

March, J. G., and J. P. Olsen. 1998. The institutional dynamics of international political orders. *International Organization* 52: 4, 943–69.

Martin, L. L., and B. A. Simmons. 1998. Theories and empirical studies of international institutions. *International Organization* 52: 4, 729–57.

Mavroidis, P. C. 2000. Trade and environment after the *Shrimps-Turtles* litigation. *Journal of World Trade* 34: 1, 73–88.

Miles, E. L., A. Underdal, S. Andresen, J. Wettestad, J. B. Skjærseth, and E. M. Carlin, editors. 2002. Environmental Regime Effectiveness. Confronting Theory with Evidence. Cambridge, Mass.: MIT Press.

Mitchell, R. B. 1994. *Intentional Oil Pollution at Sea: Environmental Policy and Treaty Compliance*. Cambridge, Mass.: MIT Press.

Mitchell, R. B. 2002. Of course international institutions matter: But when and how? In *Global Environmental Change and the Nation State: Proceedings of the 2001 Berlin Conference on the Human Dimensions of Global Environmental Change,* ed. by F. Biermann, R. Brohm, and K. Dingwerth, 16–25. Potsdam: Potsdam Institute for Climate Impact Research. Available at www.glogov.org/publications/-bc2001/mitchell.pdf.

Mitchell, R. B. 2003. International environmental agreements. A survey of their features, formation and effects. *Annual Review of Environment and Resources* 28, 429–461.

Mitchell, R. B., and T. Bernauer. 1998. Empirical research on international environmental policy: Designing qualitative case studies. *Journal of Environment and Development* 7: 1, 4–31.

Mitchell, R. B., W. C. Clark, D. Cash, and N. Dickson, editors, forthcoming. *Global Environmental Assessments: Information, Institutions, and Influence*. Cambridge, Mass.: MIT Press.

Mol, Arthur P. J. 2001. *Globalization and Environmental Reform. The Ecological Modernization of the Global Economy*. Cambridge, Mass.: MIT Press.

Moltke, K. von. 2001. The organization of the impossible. *Global Environmental Politics* 1: 1, 23–8.

Moltke, K. von. 2005. Clustering international environmental agreements as an alternative to a World Environment Organization. In *A World Environment Organization. Solution or Threat for Effective International Environmental Governance?*, ed. by F. Biermann and S. Bauer. Aldershot, UK: Ashgate, 175–204.

Najam, A., S. Huq, and Y. Sokona. 2003. Climate negotiations beyond Kyoto. Developing country concerns and interests. *Climate Policy* 3, 221–231.

Oberthür, S., and Th. Gehring, editors. 2006. *Institutional Interaction in Global Environmental Governance. Synergy and Conflict among International and EU Policies*. Cambridge, Mass.: MIT Press.

Organisation for Economic Co-operation and Development. 1997. *Process and Production Methods (PPMs): Conceptual Framework and Considerations on Use of PPM-based Trade Measures*. Paris: OECD.

Ostrom, E., J. Burger, C. B. Field, R. B. Norgaard, D. Policansky. 1999. Revisiting the commons: Local lessons, global challenges. *Science* 284, 278–282.

Pattberg, P. 2004. *The Institutionalisation of Private Governance. Conceptualising an Emerging Trend in Global Environmental Politics*. Global Governance Working Paper No 9. Amsterdam et al.: The Global Governance Project.

Pattberg, P. 2005a. The Forest Stewardship Council: Risk and potential of private forest governance. *Journal of Environment and Development* 14: 3, 356-374.

Pattberg, P. 2005b. The institutionalization of private governance: How business and non-profits agree on transnational rules. *Governance: An International Journal of Policy, Administration, and Institutions* 18: 4, 589–610.

Princen, T., and M. Finger. 1994. *Environmental NGOs in World Politics. Linking the Local and the Global*. London: Routledge.

Princen, T., M. Finger, and J. Manno. 1995. Nongovernmental organizations in world environmental politics. *International Environmental Affairs* 7: 1, 42–58.

Pritchard, L., J. Colding, F. Berkes, U. Svedin and C. Folke. 1998. *The Problem of Fit between Ecosystems and Institutions*. IHDP working paper no. 2. Bonn: IHDP.

Raustiala, K. 1997. States, NGOs, and international environmental institutions. *International Studies Quarterly* 42: 4, 719–40.

Rechkemmer, A., editor. 2005. UNEO–Towards an International Environment Organization. Approaches to a Sustainable Reform of Global Environmental Governance. Baden-Baden: Nomos.

Reinalda, B., and B. Verbeek. 2001. Theorising power relations between NGOs, inter-governmental organisations and states. In *Non-State Actors in International Relations*, ed. by B. Reinalda. Aldershot: Ashgate, 145–159.

Reinicke, W. H. 1998. *Global Public Policy. Governing without Government?* Washington DC: Brookings Institution.

Reinicke, W., and F. Deng, editors. 2000. *Critical Choices. The United Nations, Networks, and the Future of Global Governance*. Ottawa: International Development Research Centre.

Risse, T., S. C. Ropp, and K. Sikking, editors. 1999. *The Power of Human Rights: International Norms, and Domestic Change*. Cambridge, UK: Cambridge University Press.

Rosenau, J. N. 1995. Governance in the twenty-first century. *Global Governance* 1: 1, 13–43.

Rosenau, J. N. 2002. *Globalization and Governance: Sustainability Between Fragmentation and Integration*. Paper presented at the *Conference on Governance and Sustainability: New Challenges for the State, Business, and Civil Society*, Berlin, 30 September.

Rosendal, G. K. 2001a. Impacts of overlapping international regimes: The case of biodiversity. *Global Governance* 7: 1, 95–117.

Rosendal, G. K. 2001b. Overlapping international regimes: The case of the Intergovernmental Forum on Forests (IFF) between climate change and biodiversity. *International Environmental Agreements: Politics, Law and Economics* 1: 4, 447–68.

Rowlands, I. H. 2001. Transnational corporations and global environmental politics. In *Non-State Actors in World Politics*, ed. by W. Wallace. London: Palgrave.

Sand, P. H. 2004. Sovereignty bounded: Public trusteeship for common pool resources? *Global Environmental Politics* 4, 47–71.

Scharpf, F. W. 1996. Demokratie in der transnationalen Politik. *Internationale Politik* no 12, 11–20.

Schellnhuber, H.-J. 1998: Earth system analysis: The scope of the challenge. In *Earth System Analysis: Integrating Science for Sustainability*, ed. by H.-J. Schellnhuber and V. Wenzel, 3–195. Berlin: Springer.

Schellnhuber, H.-J. 1999. Earth system analysis and the Second Copernican Revolution. *Nature* 402 (= Millennium Supplement, 2 December 1999), C19–C23.

Schellnhuber, H.-J., and F. Biermann. 2000. Eine ökologische Weltordnungspolitik: Globales Umweltmanagement statt Untergangskultur. *Internationale Politik* 55: 12, 9–16.

Schellnhuber, H.-J., P. Crutzen, W. C. Clark, M. Claussen, and H. Held. 2004. *Earth System Analysis for Sustainability*. Cambridge, Mass.: MIT Press.

Schellnhuber, H.-J., and D. Sahagian. 2002. The twenty-three GAIM questions. *Global Change Newsletter* (International Geosphere-Biosphere Programme) 49, 20–1.

Schellnhuber, H.-J., and V. Wenzel. 1998. Preface. In *Earth System Analysis: Integrating Science for Sustainability*, ed. by H.-J. Schellnhuber and V. Wenzel. Berlin: Springer, vii–xvi.

Scholte, J. A. 2002. Civil society and democracy in global governance. *Global Governance* 8: 3, 281–304.

Scholte, J. A. 2004. Civil society and democratically accountable global governance. *Government and Opposition* 39: 2, 211–233.

Schrijver, N. 1997. *Sovereignty over Natural Resources: Balancing Rights and Duties*. Cambridge, UK: Cambridge University Press.

Sell, S. K. 1999. Multinational corporations as agents of change: The globalization of intellectual property rights. In *Private Authority and International Affairs*, ed. by C. Cutler, V. Haufler and T. Porter. Albany: State University of New York Press.

Siebenhüner, B. 2002a. How do scientific assessments learn? Part 1. Conceptual framework and case study of the IPCC. *Environmental Science and Policy* 5, 411–20.

Siebenhüner, B. 2002b. How do scientific assessments learn? Part 2. Case study of the LRTAP assessment and comparative conclusions. *Environmental Science and Policy* 5, 421–27.

Siebenhüner, B. 2003. The changing role of nation states in international environmental assessments: The case of the IPCC. *Global Environmental Change* 13, 113–123.

Siebenhüner, B. 2004. Social learning and sustainability science. Which role can stakeholder participation play? *International Journal of Sustainable Development* 7: 2, 146–163.

Simmons, P. J. 1998. Learning to live with NGOs. *Foreign Policy* (Fall), 82–95.

Simonis, Udo E., editor. 1999. *Weltumweltpolitik. Grundriß und Bausteine eines neuen Politikfeldes*, 2nd edition. Berlin: edition sigma.

Simonis, Udo E. 2001. Global governance and sustainable development. *Environmental Values* 10: 3, 285–287.

Simpson, B. 2002. Participation of developing countries in a climate change convention protocol. *Asia Pacific Journal of Environmental Law* 7: 1, 39–74.

Smouts, M.-C. 1998. The proper use of governance in international relations. *International Social Science Journal* 155, 81–89.

Social Learning Group, W. C. Clark, J. Jaeger, J. van Eijndhoven, N. Dickson, editors. 2001. *Learning to Manage Global Environmental Risks*. 2 Vols. Cambridge, Mass.: MIT Press.

South Centre. 1996. *For a Strong and Democratic United Nations: A South Perspective on UN Reform*. Geneva: South Centre.

Spiro, P. J. 1994. New global communities. Nongovernmental organizations in international decision-making institutions. *The Washington Quarterly* 18: 1, 45–56.

Steffen, W., A. Sanderson, P. D. Tyson, J. Jäger, P. M. Matson, B. Moore, III, F. Oldfield, K. Richardson, H. J. Schellnhuber, B. L. Turner, II, and R. J. Wasson. 2004. *Global Change and the Earth System: A Planet under Pressure*. New York: Springer.

Stewart, R. B., and J. B. Wiener. 2003. *Reconstructing Climate Policy*. Washington DC: AEI Press.

Stokke, O. S. 2000. Managing straddling stocks: The interplay of global and regional regimes. *Ocean and Coastal Management* 43: 2–3, 205–34.

Sustainability Science—Statement of the Friibergh Workshop on Sustainability Science. 2000. Friibergh, Sweden, 11–14 October 2000. Available at http://sustsci.harvard.edu/keydocs/fulltext/-FW_statement.pdf.

Tetarwal, S. K., and P. S. Mehta. 2000. *Process and Production Methods (PPM) Related Environmental Standards: Implications for Developing Countries*. Briefing Paper no. 8. Jaipur: Centre for International Trade, Economics and Environment.

Tóth, F., editor. 1999. *Fair Weather? Equity Concerns in Climate Change*. London: Earthscan.

Tussie, D. 1999. The environment and international trade negotiations: Open loops in the developing world. *The World Economy* 22, 535–545.

Tussie, D., editor. 2000. *The Environment and International Trade Negotiations: Developing Country Stakes*. New York: St. Martin's Press.

Underdal, A. 2002. One question, two answers. In *Environmental Regime Effectiveness: Confronting Theory with Evidence*, ed. by E. L. Miles, A. Underdal, S. Andresen, J. Wettestad, J. B. Skjærseth, and E. M. Carlin, 3–45. Cambridge, Mass.: MIT Press.

Underhill, G. R. D. 2001. *States, Markets, and Governance. Private Interests, the Public Good, and the Democratic Process*. Inaugural Lecture delivered at the Universiteit van Amsterdam on 21 September 2001. Amsterdam: Vossiuspers Universiteit van Amsterdam.

Vaillancourt Rosenau, P., editor. 2000. *Public-Private Policy Partnerships*. Cambridge: MIT Press.

Velasquez, J. 2000. Prospects for Rio+10: The need for an inter-linkages approach to global environmental governance. *Global Environmental Change* 10: 4, 307–12.

Victor, D. G. 1996. *The Early Operation and Effectiveness of the Montreal Protocol's Non-Compliance Procedure*. Laxenburg: International Institute for Applied Systems Analysis.

Victor, D. G., K. Raustiala and E. B. Skolnikoff. 1998. *The Implementation and Effectiveness of International Environmental Commitments. Theory and Practice*. Cambridge, Mass.: MIT Press.

Vogel, D. 1995. *Trading Up: Consumer and Environmental Regulation in a Global Economy*. Cambridge, Mass.: Harvard University Press.

Waddell, S. 2003. Global action networks: Building global public policy systems of accountability. *Accountability Quarterly* 20, 19–26.

Wapner, P. 1996. *Environmental Activism and World Civic Politics*. Albany: State University of New York Press.

Whalley, J., and B. Zissimos. 2001. What could a World Environmental Organization do? *Global Environmental Politics* 1: 1, 29–34.

Woerd, K. F. van der, D. Levy and K. Begg, editors. 2005. *Corporate Responses to Climate Change*. Sheffield: Greenleaf Publishing.

Wolf, Klaus D. 1999. The new raison d' État as a problem for democracy in world society. *European Journal of International Relations* 5: 3, 333–63.

WTO—World Trade Organization Appellate Body. 1998. *United States—Import Prohibition of Certain Shrimp and Shrimp Products*. Report of the Appellate Body, AB-1998-4. WTO Doc. WT/DS58/AB/R of 12 Oct. 1998. *International Legal Materials* 38, 118 (1999).

Young, O. R. 1980. International regimes: Problems of concept formation. *World Politics* 32: 4, 331–356.

Young, O. R. 1990. Global environmental change and international governance. *Millennium. Journal of International Studies* 19: 3, 337–46.

Young, O. R. 1994a. *International Governance. Protecting the Environment in a Stateless Society*. Ithaca, NY: Cornell University Press.

Young, O. R. 1994b. The problem of scale in human/environment relations. *Journal of Theoretical Politics* 6, 429–447.

Young, O. R. 1999. *Governance in World Affairs*. Ithaca: Cornell University Press.

Young, O. R. 2001. Inferences and indices: Evaluating the effectiveness of international environmental regimes. *Global Environmental Politics* 1: 1, 99–121.

Young, O. R. 2002. *The Institutional Dimension of Environmental Change: Fit, Interplay and Scale*. Cambridge, Mass.: MIT Press.

Young, O. R., editor. 1997. *Global Governance. Drawing Insights from the Environmental Experience*. Cambridge, Mass.: MIT Press.

Young, O. R., M. A. Levy and G. Osherenko, editors. 1999. *Effectiveness of International Environmental Regimes: Causal Connections and Behavioral Mechanisms*. Cambridge, Mass.: MIT Press.

Young, O. R., E. F. Lambin, F. Alcock, H. Haberl, S. I. Karlsson, W. J. McConnell, T. Myint, C. Pahl-Wostl, C. Polsky, P. S. Ramakrishnan, M. Scouvart, H. Schröder, and P. H. Verburg. 2005. *Beyond Regression. Methods for Analyzing Complex Human-Environment Interactions*. Unpublished manuscript (on file with author).

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Reprinted excerpts from Frank Biermann and Steffen Bauer, editors. 2005. A World Environment Organization: Solution or Threat for Effective International Environmental Governance? Aldershot (UK): Ashgate.

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Appeared revised in *International Environmental Politics*, edited by Michele M. Betsill, Kathryn Hochstetler and Dimitris Stevis. Basingstoke, UK: Palgrave Macmillan, 2006, 237–261.

11 *Proceedings of the 2002 Berlin Conference on the Human Dimensions of Global Environmental Change: 'Knowledge for the Sustainability Transition. The Challenge for Social Science'*. Edited by Frank Biermann, Sabine Campe and Klaus

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Appeared revised in: *Governance. An International Journal of Policy, Administration, and Institutions* 18: 4 (2005), 589–610.

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Appeared revised in: *Global Environmental Change* 13 (2003), 113–123.

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Appeared in: *Zeitschrift für Internationale Beziehungen* 10: 1 (2003), 69–109.

The Democratic Legitimacy of Global Public Policy Networks. Analysing the World Commission on Dams. By Klaus Dingwerth. Global Governance Working Paper No 6 (English version). 2003.

Appeared revised in: *Global Governance* 11: 1 (2005), 65–83.

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Appeared shortened and revised in *Climate Policy* 4: 3 (2005), 289-302.

4 *Global Environmental Change and the Nation State: Proceedings of the 2001 Berlin Conference on the Human Dimensions of Global Environmental Change*. Edited by Frank Biermann, Rainer Brohm and Klaus Dingwerth. PIK Report No 80. 2002.

Selected articles appeared as special issue of *Global Environmental Politics* 4: 1 (2004), 1–114 (edited by Frank Biermann and Klaus Dingwerth).

3 *Strengthening Green Global Governance in a Disparate World Society: Would a World Environment Organization Benefit the South?* By Frank Biermann. Global Governance Working Paper No 3. 2002.

Appeared revised in: *International Environmental Agreements* 2:4 (2002), 297–315.

2 *Weltumweltpolitik: Global Change als Herausforderung für die deutsche Politikwissenschaft* [World environmental policy: Global change as a challenge for German political science]. By Frank Biermann and Klaus Dingwerth. PIK Report No 74. 2001.

Appeared revised and shortened in *Zeitschrift für Umweltpolitik und Umweltrecht* 4 (2004), 505–29.

1 *The Rising Tide of Green Unilateralism in World Trade Law: Options for Reconciling the Emerging North-South Conflict.* By Frank Biermann. PIK Report no 66. 2000.

Appeared revised in *Journal of World Trade* 35: 3 (2001), 421–48.