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Detlef Sprinz & Urs Luterbacher

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principal authors/editors:
Detlef Sprinz and Urs Luterbacher

list of authors:
Daniel Bodansky
Urs Luterbacher
Matthew Paterson
Kal Raustiala
Ian H. Rowlands
Ronald Mitchell
Detlef Sprinz
Hugh Ward

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Contact Address:
Detlef Sprinz
Potsdam Institute for Climate Impact Research
P.O. Box 60 12 03
14412 Potsdam/Germany

Phone: +49 (331) 288-2500
Fax: +49 (331) 288-2600
Email: dsprinz@pik-potsdam.de

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Preface

Since the early 1990s, we have witnessed the growth of a body of knowledge on regulating global climate change. Mitigating global climate change is one of today's major global environmental problems and can only be achieved by substantial collaboration across countries. For this reason, scholars of international relations have become particularly interested in this topic. Their various conceptual, theoretical, and methodological approaches to global climate change contribute to better understanding both the achievements accomplished to date as well as the challenges ahead in accounting for the causes, consequences, and the responses to a pressing problem of international public policy. This article synthesizes much of the knowledge provided by scholars in the field of international studies. It will therefore help to assess the state of the art as well as provide an overview for decision-makers and others interested in climate change and international policy.

From the outset, the concept for this article was developed as a joint venture between co-editors Detlef Sprinz of the Potsdam Institute for Climate Impact Research (PIK, Potsdam/Germany) and Urs Luterbacher of the Graduate Institute of International Studies (Geneva/Switzerland). A review of the state of the art, encompassing a broad diversity of theories and methodologies, has always to rely on specialist authors who contribute their expertise. The contributions of Daniel Bodansky, Urs Luterbacher, Matthew Paterson, Kal Raustiala, Ian Rowlands, Detlef Sprinz, and Hugh Ward provide cutting-edge, up-to-date knowledge on the international response to global climate change in a compressed, non-technical style of presentation.

The project was launched in mid-1994 with funding generously provided by the director of the Potsdam Institute, Prof. H.J. Schellnhuber for two authors' meetings in Geneva and Potsdam in 1994.

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Collaborating on an international relations state-of-the art review on the timely topic of global climate change has been a very rewarding enterprise for the co-editors. Together with the authors, they share the responsibilities for any shortcomings of the manuscript. The contents of this article reflects the opinions of the co-editors and authors and not those of the respective institutions (or their respective funding agencies) with which the editors or authors are affiliated.

Potsdam and Geneva,July 1996
Urs Luterbacher, Detlef Sprinz

1. Introduction

(Detlef Sprinz)

The threat of changes to the global climate system has led to both national and international investigations into their potential as well as attempts by the international system to mitigate the causes or adapt to its potential effects. Substantial, although declining, uncertainties still surround the precise nature of the mechanisms of climate change which are associated with the enhanced greenhouse effect, i.e., the human contribution to natural changes of the climate system. Despite remaining uncertainties in the science of causation as well as estimation of effects, the community of states has begun to build international political mechanisms to address the problem of global climate change. Since no country, by itself, would be able to substantially influence the climate system, international cooperation is sought to overcome this collective goods problem. The purpose of this article is to concisely summarize the efforts undertaken by the international system of states and non-state actors as well as to review the current knowledge of scholars of international studies from a variety of theoretical and methodological perspectives.

This article only includes those strands of scholarly writing that are directly related to the problem of global climate change and which focus on the international aspects involved. Except for explicit linkages between domestic and *international* factors, domestic factors will not be covered. Particular emphasis is placed on the role of states. The role of non-state actors and international organizations is, however, emphasized whenever purely state-centric explanations appear insufficient from a historical and theoretical perspective.

The presentation of the material takes its point of departure from the puzzle posed by the inadequacy of purely national efforts to combat global climate change: In isolation, countries will not be able to adopt optimal policies to cope with global climate change (GCC), and international cooperation is needed to provide an optimal response for the earth's population (Section 2). Since human activities, including economic production, population growth, technological, and political decisions, constitute the anthropogenic contribution to GCC, we will summarize the interaction between humans and the environment (Section 3) before turning to the historical record of international diplomatic efforts to conclude the United Nations Framework Convention on Climate Change (FCCC) and its legal interpretation (Section 4).

International Studies is characterized by a broad variety of theoretical and methodological lenses to the study of GCC (see Section 5). First, we present the major theoretical approaches of international relations as well as formal perspectives in the shape of dynamic, game-theoretic reflections of the historical record. But these perspectives on the international response to GCC provide only partial explanations. This necessitates the consideration of supplemental approaches which focus on (i) the link between domestic and international policies, (ii) the role of non-state actors and international organizations, and (iii) a more normative component, namely equity concerns of international collaborative efforts, including both international and intergenerational justice.

The elaboration and conclusion of legally binding rules do not suffice from either a theoretical or a practical standpoint. In order to reduce the human impact on the climate system, we have to focus in more detail on the implementation mechanisms of the FCCC, compliance with the international obligations, effectiveness of the rules and institutional design, as well as the mechanisms to provide a wide array of resources needed for implementation (Section 6).

Spurred by the discussions of the review of the FCCC at the first Conference of the Parties (COP-1) in early 1995, we provide some trajectories of the framework convention, bearing in mind the challenges outlined in the theoretical and methodological sections as well as the policy positions taken at COP-1 (Section 7). These potential future developments are linked to an array of suggestions for future research - which are both relevant from a scholarly and a policy perspective (Section 8), followed by an overall conclusion of why international actors have become engaged in the international response to climate change (Section 9).

2. Problems of Global Environmental Cooperation

(Urs Luterbacher)

Global environmental change issues raise the question of international cooperation and collaboration to overcome the problems associate with them. In contrast to local environmental questions which affect specific regions or countries, global environmental change results from activities by individuals, firms, social groups, or entire countries that have global consequences. This is true in particular for climate change where local emissions of greenhouse gases, resulting from a variety of human activates, have global effects: The mixing of these gases in the atmosphere is so thorough that they may contribute to global climate change by increasing the greenhouse effect on earth. Because of the human contribution to the naturally occurring greenhouse effect, it is often termed the *enhanced greenhouse* effect. This particular process shows that there is no a priori relation between the quantity of greenhouse gases that a region or a country emits and the consequences for it in terms of climate change. Global climate change raises therefore the issue of the relationship between the general use of resources by human populations and the limits set to resource utilization. This reflection is not particularly new. Indeed, it dates back at least to the 18th century and Thomas Malthus' preoccupation with the relationships between population and resource growth.

The Malthusian conception postulates that after a period of strong initial growth, output as a function of population (labor) tends to hit diminishing returns while population needs increase proportionally to its size. Potential population /resource[1] equilibria exist only at *suboptimal* locations where (i) population needs have grown too strongly with regard to output and where (ii) all the potential productive surpluses achieved by societies have been dissipated. Of course, presumably exogenous technological innovations could push the output curve upward without modifying its basic characteristics and the suboptimal nature of the equilibria.

This is shown in Figure 1 where the relation between population (or any extractive capability) is shown under the assumption of initially increasing but then rapidly diminishing returns of output. Under this assumption, two equilibria are possible, namely A and B. Whereas equilibrium A is

1. A discussion of the population and resource question can be found in Tietenberg (1992, 100-124) and in Lee (1988). Criticisms of the Malthusian conception have pointed out that demand for technological innovation is not necessarily exogenous but could be driven by increased population growth (cf. Boserup 1986). A different point of view would emphasize the advantages of increased population density for innovations resulting from more frequent contacts between people. Nevertheless, Lee (1986) suggests that Malthusian situations might occur at a regional level under certain circumstances even when the above criticisms are taken into account. We will not discuss this issue further, since our purpose here is not to discuss demographic issues but only to analyze the population/resource respectively extraction/resource question as it influences international cooperation and institutions.

unstable, because an increase in extractive inputs results in an increase of output beyond population needs, equilibrium B is stable but inefficient, because all the surplus achieved in C has been dissipated. Only taxation or other regulatory measures could help achieve a surplus by pushing the straight line (representing needs) higher. Moreover the discussion of the relations between population and resources can also refer to any situation of diminishing returns linking extractive efforts to output, a condition that is often verified at least at a local level and that leads to dissipation of production capabilities. Maximization of excess of resources over needs could be achieved if, either through authoritarian means or through cooperation, societies could find a way to limit population growth or other forms of extractive efforts. In the international context, only cooperation appears as the desirable outcome. Such limiting measures could be taken in the form of taxation or some other regulatory instrument at the domestic or international level.

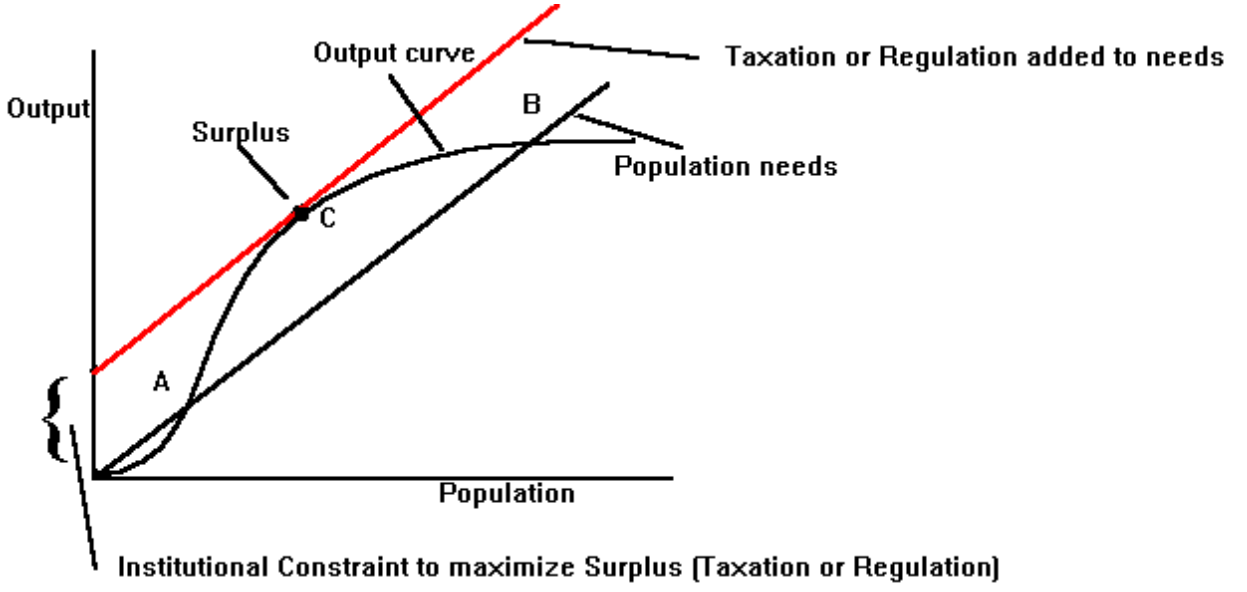


Figure 1: The Malthusian Model

Garret Hardin's metaphor of the tragedy of the commons (1977), in which self-interest and the lack of any constraints on access leads to the overexploitation of open access grazing, constitutes another way to emphasize the resource use dilemma and seems, at first sight, to be a useful alternative way of thinking about the relative lack of action by the international community on GCC. For instance, although some nations are committed to stabilize or even reduce greenhouse heating gas (GHG) emissions within a fixed time frame, others appear intent on doing nothing or delaying the first steps they agreed to at the 1992 United Nations Conference on Environment and Development (see Section 4) as long as possible.

Stabilization of the global climate system is a relatively pure international public good: Nations not paying for the cost of stabilizing GHG emission cannot be excluded from the benefits which natural scientists point to; climate stability is a good in joint supply, because all countries can enjoy it without prejudice to others' consumption (Weale 1992, 193). The heart of the problem is that the impossibility of exclusion from benefits may make it rational to free ride, i.e., taking advantage of the benefits produced by sacrifices (made by other nations) at no cost. Yet this depends on the incentives faced by nations and societies.

National self-interest seems to pressure many nations towards free riding so that we are currently failing by a wide margin to do what may be required for long-run stability of GHG emissions. However, just as many small communities over the millennia have developed institutions which have prevented the tragedy of the commons from occurring (Berkes 1989; Ostrom 1990), the hope of many is that the international community will develop the necessary institutions and agreements to restrain the pursuit of national interests.

Game-theoretical models are quite useful to examine issues of international cooperation, negotiation, and bargaining - especially in the context of international public goods (see Section 5.3). One of the assumptions included in the practical use of game-theoretic models is that participants in international interactions (either nations, subnational, or transnational groups) can be viewed as unitary actors making choices between strategies so as to maximize their expected payoffs[2]. Generally, a nation's payoff from adopting a particular strategy will vary, depending on the strategies chosen by other nations. In order to make a rational choice between strategies, a nation has to be able to predict the responses of other nations. In the simplest models, it is assumed that nations know not only their own payoffs but also those of all the other nations or groups. Also it is assumed to be common knowledge that all nations are rational. Thus nations can predict the responses others will make to any strategy that they choose. The prediction is that rational actors will play strategies corresponding to one of the equilibria[3] of the game because, in an equilibrium, no country has an incentive unilaterally to change strategy.

The game-theoretical conception outlined above includes the assumption of a priori knowledge of the payoff structure. It is quite clear, however, that in the area of climate change such an assumption is not warranted since the benefits of greenhouse gas emission restrictions are very difficult to evaluate. The latter occurs, in part, because the damages associated with global warming are not yet well known. It has even been suggested that some countries or regions might actually benefit from global climate change (see Oberthür 1993). Therefore, payoffs can only be evaluated in a probabilistic rather than deterministic fashion and conceived of as expected utilities. In principle, resorting to expected utilities to define payoffs and assuming a risk-averse attitude (i.e., emphasizing the dangers and uncertainties of global warming) should reinforce the precautionary principle and lead actors to cooperate in taking emission reductions. The precautionary principle is, however, contested by a school of thought that stresses the importance of uncertainty and the variance associated with the expected outcome and not just its mean realization - which is the way the expected utility concept works implicitly.

Including estimated variance as well as averages to evaluate the likelihood of an outcome is part of the conception put forward by Allais (1953) to assess risky situations. In particular, Allais asserts that individuals avoid outcomes which are associated with large uncertainties even if they appear more rewarding than outcomes with small or no uncertainty. The risk-averse nature of actors has also been questioned at the individual level by the studies made by Kahneman, Slovic, and Tversky (1982) who have noticed sudden reversals in risk preferences. It is unclear how group preferences evolve as a result of risky, uncertain and potentially detrimental outcomes. If

2. This assumption is made mostly for practical reasons. It is perfectly feasible to elaborate game-theoretic models that are constructed from the bottom up, starting with individuals or small groups, and then generate preferences for large groups as well as national preferences. However, because of their complexity, models constructed in this way would be difficult to handle and would not illustrate the fundamental questions of international bargaining in an appropriate way.

3. An equilibrium is a strategy vector where each nation's strategy is a best response to what the others are doing.

there are as many differences between groups as there are between individuals, their perceptions of risk and uncertainty might strongly effect bargaining strategies and thus outcomes of attempted international cooperative arrangements. This is clearly an area where more research is needed.

In summary, two major cooperative problems emerge at the international level concerning the environment, in general, and climate change, in particular. First, international cooperation is often needed to achieve a collective good and to create a particular institutional framework to keep free-riding from occurring. The collective or public good problem to be solved is similar to a Prisoner's Dilemma[4] situation where a detrimental equilibrium is obtained in a one shot situation but where mutually beneficial cooperation can emerge over time as a result of successful threat of retaliation strategies. Second, international cooperation often consists of enforcing rules of mutual restriction, such as the reduction of GHG emissions. This leads to the dilemma of common aversion outlined in Section 5.3 and exemplified by the game of "chicken" which contains several equilibria. Paradoxically, such a situation might be more difficult to solve because of the ineffectiveness of retaliation threats.[5] The question of international cooperation is complicated further by the fact that the two categories of collaboration outlined above can often not be separated in the analysis of concrete situations. The creation of an international climate change regime involves both the creation of a public good and the establishment of rules for mutual restriction in order to avoid a mutually detrimental outcome.

The following sections will show how international bargaining processes and the resulting international legal regimes have attempted to solve these problems. In particular, we will focus on the negotiations which ultimately led to the conclusion of the Framework Convention on Climate Change (Section 4) after providing a more general rationale for the existence of the enhanced greenhouse heating effect, namely the human driving forces of global environmental change (Section 3).

3. Environmental Constraints on Human Activities and the Environmental Consequences of Human Activities

(Urs Luterbacher)

3.1 Introduction

Discussions of the causes and effects of global climate change invariably invoke the interaction between the physical environment and human activities. The increase of GHGs in the earth's atmosphere is widely identified as central to the projected warming trends of the next several generations. These temperature changes could also effect precipitation and sea levels and, thus, determine amounts and types of land available for cultivation and the kinds of crops appropriate to grow on them. Ultimately, these changes will influence population size and density as well as various economic and political arrangements. Human activities, in turn, contribute significantly to the amount of GHGs emitted so that changes in populations and their ways of life can alter climate trends. In a way, the question of climate change and other global environmental change

4. See Section 5.3 for a more detailed treatment of various games.
5. Ward (1993) presents a good discussion of these issues.

issues illustrates the more general problem of the human use of environmental resources as conceptualized in the so-called "Social Process Diagram." In this diagram, developed in 1991 in Aspen, Colorado, several driving forces concerning the relations between human activities and global environmental change (GEC) were considered separately and in interaction (Kuhn, Wiegandt and Luterbacher 1992). The driving forces were conceptualized into six main groups which interact directly or indirectly with the global environment (nature):

(i) fund of knowledge and human experience,

(ii) values and expectations,

(iii) economic activities,

(iv) technology and factors of production,

(v) population and social structure, as well as

(vi) political systems and institutions.[6]

All these areas are important at the level of the international system in terms of international social and political movements and organizations, technology transfers and globalization of resources, the internationalization of trade and capital markets, the interaction between states and the design and functioning of international institutions, international migration, and last, but not least, the global nature of environmental processes which presents new challenges to international relations.

The period of economic growth that took place in the international system after World War II as well as the internationalization and acceleration of resource movements increased tremendously the impact of human activities on the environment. This trend was even underscored by the pronounced population growth that took place everywhere, especially in the developing countries of Asia and Africa. The increase in the use of fossil fuels and fluorocarbons, the accentuation of deforestation together with increases in agricultural production, urban development and industrial production led to a great rise in the quantity of GHGs. On the other hand, environmental degradation and the increased use of natural resources have generated social problems such as mass migrations as well as domestic and international conflict. Therefore, the demand for international cooperation and for appropriate international institutions has also become greater (see also Sections 2 and 5). These observations led to the emphasis placed on two aspects in the review of studies concerning international responses to climate change. First a group of studies stresses the influence of GEC on the workings of the international system at all levels as well as the social and political problems raised by it. These include the search for appropriate cooperative and institutional responses as well as for environmental security. Second, other studies are concerned with the impact of social driving forces on the global environment, such as the effect of the globalization of international and interregional transactions in the form of movements of people, goods and services, and capital. We will look at these two kinds of approaches in succession.

6. The authors and contributors to the Social Progress Diagram were fully aware of the fact that, stricto sensu, there is no such thing as an environmental or natural process independently of human understanding. However, "nature" is a convenient analytical category to conceptualize processes that are beyond immediate human control or full comprehension. For instance, decision and game theorists speak about "games against nature."

3.2 Influences of Global Environmental Change on the International System

Previous research into the 1970s oil crisis led to the conclusion that industrial societies had sufficient resilience to resist profound shocks to their economic systems (Luterbacher et al. 1987). However, the evaluation of studies of historical climate change suggest that the impact of future climate change will be most strongly felt in marginal agricultural areas (Leroy-Ladurie 1971; Parry 1990; Rosenzweig et al. 1993), because (i) their production systems lack redundancies that would allow them to adapt to sudden changes and (ii) they have little access to capital (other than land) that would permit rapid changes of production strategies. Yet vast numbers of people are farmers in less industrialized regions, and the human problems engendered by climate changes would be enormous. These aspects of social organization and evolution are more sensitive to climatic factors in less industrialized countries than in industrialized ones. Less industrialized countries with their (often) high population growth rates and their high proportion of marginal producers could experience an overuse of agricultural land or a greater exploitation of previously uncultivated areas, such as forests, grasslands for agricultural, or primitive industrial and mining production. Moreover, massive inland and international migrations (or at least attempts of significant proportions of the population to move) are another potential consequence of a global warming trend. On the other hand, industrialized countries with their low population growth rates, heavy industrial infrastructure, as well as highly productive and technologically advanced agriculture would more easily adapt to the changes to climate and its effect on agricultural productivity.

The conception outlined above suggests the possibility of demographic collapse, i.e., the plummeting of population in marginal areas due to massive emigration into more industrialized regions or countries. This tendency exists independently of any climatic influence, but it could be accentuated by adverse climatic developments, such as deterioration of moisture and temperature conditions or shortage of available land due to flooding. In some sense, population increases in the marginal areas cannot be absorbed by local resources, a situation that leads to dissipations and, eventually, to out- migration. Agricultural production in these regions is subject to diminishing returns and tends to level off. Climate deterioration just increases this trend and accentuates migratory tendencies. However, out-migration leads also to dissipations of resources in the industrialized regions and countries as incomers are not able to use their new environment as efficiently as the old one - while experiencing increases in economic wealth relative to their former home country. If migration occurs on a massive scale to more industrialized regions, this is likely to lead to both absolute and per capita increases of GHG emissions in industrialized regions.

In conclusion, climate change is likely to lead to a more fragile and over-used resource base as well as migratory pressure (see Kuhn 1992; Luterbacher and Wiegandt 1991 and 1994).

3.3 The Impact of International Driving Forces on the Environment

The factors outlined above could also have a significant impact on potential interregional and international conflicts. Uneven resource distribution and differences in natural constraints as well as dissipation of resources can be at the root of social conflicts - both within and between societies. In particular, Homer-Dixon (1991) has pointed to the importance of environmentally induced conflict (see also Homer-Dixon, Boutwell and Rathjeus 1993). Moreover significant

international conflict potential can build up in arid or semi-arid regions of the globe regarding access to water resources. Such conflicts could be exacerbated by climate change as the writing of Gleick (1993) and Lowi (1993) show. More generally, global climate change could alter the present distribution of resources between nations and, therefore, the balance of power between them. Given the fact that major powers belong mostly to the industrialized world, such changes are unlikely to be politically significant at this level. In any case, however, the management of these new types of conflict mentioned above will require adequate types of international interactions and institutions or a reinforcement of existing international security organizations.

The study of the global impact of international driving forces is closely tied to the international aspects of resource use. The latter is basically concerned with (i) how resources are produced, consumed and exchanged within and between societies and (ii) how resource utilization interacts with the human environment. The question of this interaction is indeed crucial -- as some kind of resource uses might lead to their dissipation and perhaps to such profound alterations of the human environment that the existence of some societies could be threatened.[7]

The conception of the social driving forces can be summarized as follows: First, nature[8] sets some limits to the resources which humans can extract, although the precise nature of such limits is not always clear. Second, there is a human tendency to dissipate such resources over time (see Section 2). Third, this tendency can be checked by particular types of social institutions and organizations. The dissipation of resources increases with population growth or any other increase of extractive efforts, because a society is unable to master its relations with its future evolution. However, in coming to grips with their own futures, societies have developed instruments such as interest rates to apprehend the evolution of their resources. The American economist Hotelling pointed to the crucial role of interest rates in terms of the development of social resources in a seminal article published in 1931 (Hotelling 1931). In this context, Hotelling developed the "conservationist dilemma" which states that while high interest (or discount) rates favor the depletion of natural resources (economic agents have an incentive to exchange them for other assets), low interest rates encourage heavy capital investments that can be detrimental to the environment (such as dams and roads). Hotelling also stressed the importance of particular market structures linked to the conservation of natural resources. Later, his studies led to the conclusion that monopoly markets exploit resources on a smaller scale than atomistic (or competitive) markets, a situation which Solow captured by stating "that the monopolist is the conservationist's friend."[9] In summary, Hotelling's analysis points to the crucial role played by capital and market structures in the social (and international) use of resources. To gain in accuracy, any perspective on the social and international dimensions of resource use has to consider how capital and market structures influence the relation between population (or extractive inputs) and outputs.[10]

The considerations presented so far have looked at population and resources in a unidimensional way, emphasizing only their time evolution and the way they influence each other. Clearly, space

7. This statement does not imply a catastrophist vision of environmental change but serves as a reminder that major social upheavals, such as mass migrations, can be triggered by alterations in the living conditions of some societies as witnessed, for instance, by the impact of droughts, floods and volcanic eruptions.

8. The term "nature" refers here again to an analytical category as mentioned further above.

9. The role of energy resource cartels in terms of conservation is explicitly discussed in Tietenberg (1992, 161-185). Energy cartels, such as OPEC, have played a major role in international political and economic relations (Danielsen 1982).

10. For example, high land prices (resulting from low interest rates) could help to keep output and thus population lower and, subsequently, preserve the productive surplus.

as much as time plays an important role in the social dimensions of resource use. The essential role played by property structures in the management of resources was already recognized in Hardin's famous article on the "Tragedy of the Commons" (Hardin 1977) where the author emphasized how productive gains could be dissipated in an open access system of land use. Private property systems have been introduced to deal with such inefficiencies. Some authors have proposed the "privatization" of the international commons to make their use by various nations more efficient (Connybeare 1980).[11] If resource problems can be found in specific locations, it is also clear that they can not only be managed by social institutions but also via exchanges and transactions of goods (i.e., trade of goods including natural resources), people (migration), and financial capital.[12] These transactions will in turn modify the relations between populations and resources and the specific ways of managing their futures in different locations since exchanges of financial capital will modify discount rates. To illustrate this point, one may interpret the depletion of some natural resources, in particular during the late 1970s and the 1980s, as a result of historically high levels of interest rates. The processes that led to the disappearance of significant parts of the Aral Sea in the former Soviet Union (now Uzbekistan) could be directly attributed to needs for hard currency to repay the Soviet debt. Most of the waters previously flowing into the sea were diverted to irrigate fields where cotton was produced as a cash crop for export (Craumer 1992; Fierman 1991; Klötzli 1994). Similar analysis applies to tropical deforestation (Tietenberg 1992, 177-302).

Sometimes social institutions created to avoid inefficiencies and dissipations at the local level will be threatened by an increased recourse to transactions. The transfer of too many resources or people or capital from one location into another social system may lead to the collapse of either system. Such consequences have been evoked with respect to trade liberalization and the recent Uruguay round agreements.[13] A modification of natural constraints might bring about similar results.

The previous discussion emphasizes the importance of dissipation through space and through time. As mentioned further above, these types of dissipation of resources can be countered by appropriate measures that will influence or regulate relations within and between societies. If authoritarian, coercive, or conflictual methods to achieve these goals are excluded or appear highly undesirable, international cooperation has to be initiated (see Section 2). International collaboration has to be organized in order to reduce restrictions on trade, capital, labor flows, or incentives that will attract excessive numbers of people into certain areas - such as urban regions (see Owen 1987). In order to achieve such a cooperation, trade-off possibilities have to exist between regions and countries. Such trade-off situations exist whenever one region enjoys a comparative advantage in terms of some category of goods, e.g., agricultural goods, or has one factor of production in relative abundance with respect to the other country. The last aspect may be illustrated by the possibility for an industrialized country to open up its labor market (and thus eventually lower domestic wages) in exchange for capital exports to less industrialized countries. These cooperative problems and their solutions will be more extensively discussed in Section 5.3.

11. A criticism of the privatization argument can be found in Luterbacher (1994).
12. A representation of the necessary connections between all these factors can be found in the standard models of migration (e.g., Harris and Todaro 1970).
13. A thorough discussion of the environmental impact of trade liberalization can be found in Anderson and Balckhurst (1992), whereas Rosenzweig and Parry (1993) point to potential positive environmental impacts of trade liberalization.

It is quite clear that several major issues compete with each other for international attention. To the extent that the post World War II international system was initially concerned with security problems resulting from the cold war or with questions of economic growth or trade liberalization, following the reconstruction of Europe and Asia after the war, environmental issues were not seriously considered. This started to change with the beginning of détente in the 1970s and the realization that the unprecedented period of economic and population growth that occurred since the 1950s led to major environmental problems. Initially, the political emphasis was placed more on local and regional pollution problems. For example, the 1972 Stockholm Conference on the Human Environment, which led to the creation of the United Nations Environment Programme (UNEP), was largely concerned with local or regional environmental issues that could concern several countries in a given geographic area such as a particular river basin, a lake, a confined sea, or coastal area. It was only in the 1980s that global environmental issues, such as stratospheric ozone depletion, climate change, and loss of biodiversity, came to the forefront of the international agenda. The end of the cold war and the reduced importance of traditional international security problems helped to change the international agenda in favor of considering GEC and sustainable development, two themes that were largely emphasized at the 1992 United Nations Conference on Environment and Development (UNCED) at Rio de Janeiro. An important aspect of the Rio agenda was concerned with the signing of the Framework Convention on Climate Change, an international treaty whose development will be analyzed in the next section.

4. The History and Legal Structure of the Global Climate Change Regime[14]

(Daniel Bodansky)

4.1 The Development of the Climate Change Regime[15]

The development of the climate change regime in the late 1980s and early 1990s rode a wave of environmental activity, which began in 1987 with the discovery of the ozone hole and the publication of the Bruntland Commission report, *Our Common Future* (World Commission on Environment and Development 1987), and crested at the 1992 UN Conference on Environment and Development (UNCED) in Rio de Janeiro. An earlier wave of international environmental activity, culminating in the 1972 Stockholm Conference and the establishment several years later of the UN Environment Programme (UNEP), had tended to focus on local, acute, and comparably easily reversed forms of pollution – for example, oil spills and dumping of hazardous wastes at sea – by regulating particular pollutants. The more recent cycle of environmental activity has concerned longer-term, irreversible, global threats, such as depletion of the stratospheric ozone layer, loss of biological diversity, and greenhouse warming (Clark 1989, 47), and has focused not merely on environmental protection *per se*, but on the more general economic and social policies needed to achieve sustainable development.

14. This section draws extensively from Bodansky (1993; 1994; 1995).
15. See generally Bodansky (1994), Hecht and Tirpak (1995).

The development of the climate change regime can usefully be divided into five periods: the foundational period, during which scientific concern about global warming developed (Section 4.1.1); the agenda-setting phase, from 1985-1988, when climate change was transformed from a scientific into a policy issue (Section 4.1.2); a pre-negotiation period from 1988 to 1990, when governments became heavily involved in the process (Section 4.1.3); the formal intergovernmental negotiations phase, leading to the adoption of the FCCC in May 1992 (Section 4.1.4); and a post-agreement phase focusing on the elaboration and implementation of the FCCC and the initiation of negotiations on additional commitments (Section 4.1.5).

4.1.1 The Emergence of Scientific Consensus[16]

Although the greenhouse warming theory was put forward almost a century ago by the Swedish chemist Svante Arrhenius (Arrhenius 1896), climate change did not emerge as a *political* issue until the last decade. As late as 1979, efforts by the organizers of the First World Climate Conference to attract participation by policy makers proved unsuccessful, and even in 1985, when a major workshop on climate change was held in Villach, Austria, the US government officials who participated went without specific instructions. By the late 1980s, the US Congress was holding frequent hearings on global warming, the issue was raised and discussed in the UN General Assembly, and international meetings such as the 1988 Toronto Conference, the 1989 Hague and Noordwijk Conferences, and the 1990 Second World Climate Conference attracted numerous ministers and even some heads of government.

The development of the climate change issue took place initially in the scientific arena, as understanding of the greenhouse problem improved. Through careful measurements at remote observatories such as Mauna Loa, Hawaii, scientists established in the early 1960s that atmospheric concentrations of CO_2 – the primary greenhouse gas – are, in fact, increasing. The so-called "Keeling curve" (Keeling 1960), showing this rise, is accepted by all sides in the climate change controversy, and led to the initial growth of scientific concern in the late 1960s and early 1970s. During the 1970s and 1980s, improvements in computing power allowed scientists to develop much more sophisticated computer models of the atmosphere, which, while still subject to considerable uncertainty, led to increased confidence by scientists in global warming predictions. A 1979 report of the US National Academy of Sciences concluded, after reviewing these models, that, if CO_2 in the atmosphere increases, "there is no reason to doubt that climate change will result and no reason to believe that these changes will be negligible" (National Research Council 1979, viii). Moreover, in the mid-1980s, scientists recognized that anthropogenic emissions of other trace gases such as methane and nitrous oxides also contribute to the greenhouse effect, making the problem even more serious than previously believed. Finally, careful reassessments of the historical temperature record in the 1980s indicated that global average temperature had been increasing since the middle of this century. While the causes of this warming are as yet unclear – the enhanced greenhouse effect can neither be conclusively demonstrated nor ruled out as the culprit – a warming trend is at least broadly consistent with the greenhouse theory.

16. For general discussions, see Ausubel (1983), Cain (1983), Kellogg (1987), Revelle (1985), Weiner (1990).

4.1.2 Agenda-Setting, 1985-1988[17]

Despite these advances, whether improved scientific knowledge would have been enough to spur political action is doubtful, particularly given the scientific uncertainties about climate change that persist even now. The growth of scientific knowledge was significant in laying a foundation for the development of public and political interest; but three additional factors acted as the direct catalysts for governmental action. First, a small group of environmentally-oriented Western scientists – including Bert Bolin of Sweden, later the Chair of the Intergovernmental Panel on Climate Change (IPCC) – worked to promote the climate change issue on the international agenda. As major figures in the international science establishment, with close ties to the World Meteorological Organisation (WMO) and UNEP, these scientists acted as "knowledge-brokers" and entrepreneurs, helping to translate and publicize the emerging scientific knowledge about the greenhouse effect through workshops and conferences, articles in non-specialist journals such as *Scientific American*, and personal contacts with policy makers. The 1985 and 1987 Villach meetings, the establishment of the Advisory Group on Greenhouse Gases under the joint auspices of WMO and UNEP, the report of the Enquete Commission in Germany, the testimony of climate modelers such as James Hansen before US Congressional committees in 1987 and 1988 – all of these helped familiarize policy-makers with the climate change issue and convert it from a speculative theory into a real-world possibility.

Second, as noted above, the latter half of the 1980s was a period of increased concern about global environmental issues generally – including depletion of the stratospheric ozone layer, deforestation, loss of biological diversity, pollution of the oceans, and international trade in hazardous wastes. The discovery of the so-called Antarctic "ozone hole," followed by the confirmation that it was due to emissions of chlorofluorocarbons (CFCs), dramatically demonstrated that human activities can indeed affect the global atmosphere and raised the prominence of atmospheric issues generally. Initially, public concern about global warming rode on the coattails of the ozone issue.

Finally, the North American heat wave and drought of the summer of 1988 gave an enormous popular boost to greenhouse warming proponents, particularly in the US and Canada. By the end of 1988, global environmental issues were so prominent that *Time* magazine named endangered Earth "Planet of the Year." A conference organized by Canada in June 1988 in Toronto called for global emissions of CO_2 to be reduced by 20% by the year 2005; the development of a global framework convention to protect the atmosphere; and establishment of a world atmosphere fund financed in part by a tax on fossil fuels.[18]

4.1.3 Early International Responses, 1988-1990

The year 1988 marked a watershed in the emergence of the climate change regime. Until then, the climate change issue had been dominated essentially by non-governmental actors – primarily environmentally-oriented scientists. Although some were government employees, their actions did not reflect official national positions. In 1988, however, climate change emerged as an *intergovernmental* issue (see Table 1).

17. See generally Pomerance (1989).

18. Proceedings of the World Conference on the Changing Atmosphere: Implications for Global Security, Toronto, June 27-30, 1988, WMO Doc. 710 (1989).

The period from 1988 to 1990 was transitional: Governments began to play a greater role, but non-governmental actors still had considerable influence. The IPCC reflected this ambivalence. Established by WMO and UNEP in 1988 at the instigation of governments, in part as a means of reasserting governmental control over the climate change issue, the IPCC's most influential output was its 1990 scientific assessment of global warming (IPCC 1990) – a product much more of the international scientific community than of governments. Cognizant of this fact, Brazil insisted that the report include a disclaimer that it reflected "the technical assessment of experts rather than government positions" – thus at least temporarily reading the "I" out of IPCC.

Among the landmarks of the pre-negotiation phase of the climate change issue were:

- the 1988 General Assembly resolution on climate change, characterizing climate as the "common concern of mankind";[19]
- the 1989 Hague Summit, attended by seventeen heads of state, which called for the development of a "new institutional authority" to preserve the earth's atmosphere and combat global warming;[20]
- the 1989 Noordwijk ministerial meeting, the first high-level intergovernmental meeting focusing specifically on the climate change issue;[21]
- the May 1990 Bergen Ministerial Conference on Sustainable Development, held in preparation for the 1992 UN Conference on Environment and Development (UNCED)[22]; and
- the November 1990 Second World Climate Conference (SWCC) (Jäger and Ferguson 1991).

19. Protection of Global Climate for Present and Future Generations of Mankind, UN General Assembly Res. 43/53 (1988).
20. Declaration Adopted at the Hague, March 1989, reprinted in UN Doc. A/44/340-Annex 5, and International Legal Materials 28, 1308.
21. Netherlands Ministry of Housing, Physical Planning and Environment, Noordwijk Conference Report (1989).
22. Action for a Common Future: Report of the Economic Commission for Europe on the Bergen Conference, U.N. Doc. A/CONF.151/PC/10 (1990).

TABLE 1.Landmarks in the Emergence of the Climate Change Regime

Conference	Date	Organizer	Status	Conclusions and principal recommendations
Villach Conference	1985	WMO & UNEP	Scientific	Significant climate change highly probable States should initiate consideration of developing a global climate convention
Toronto Conference	1988	Canada	Non-governmental	Global CO2 emissions should be cut by 20% by 2005 States should develop comprehensive framework convention on the law of the atmosphere
UN General Assembly	1988	UN	Intergovernmental	Climate change a "common concern of mankind"
Hague Summit	1989	Netherlands	Summit	Signatories will promote new institutional authority to combat global warming, involving non-unanimous decision-making
Noordwijk Conference	1989	Netherlands	Ministerial	Industrialized countries should stabilize GHG emissions as soon as possible "Many" countries support stabilization of emissions by 2000
IPCC First Assessment Report	1990	WMO & EP	Scientific	Global mean temperature likely to increase by c. 0.3˚Cper decade under business-as-usual scenario
Second World Climate Conference	1990	WMO & UNEP	Ministerial	Countries need to stabilize GHG emissions Developed states should establish emissions targets and/or national programs or strategies
UN General Assembly	1990	UN	Intergovernmental	Establishment of INC/FCCC
UNCED Conference	1992	UNCED	Summit	Signature of FCCC
CPO-1	1995	FCCC	COP	Berlin Mandate for negotiations to strengthen FCCC commitments
COP-2	1996	FCCC	COP	Geneva Ministerial Declaration

Source: Bodansky (1995).

Until 1990, Western industrialized countries dominated international discussions of the climate change issue; these countries had conducted the bulk of the scientific research on climate change and had the most active environmental constituencies and ministries. At the 1989 Noordwijk meeting, the basic split among Western countries became apparent. On the one hand, most European countries, joined to some degree by Canada, Australia and New Zealand (the so-called CANZ group), supported adopting the approach that had been used for the acid rain and ozone

depletion problems, namely establishing quantitative limitations on national emission levels of greenhouse gases ("targets and timetables") – initially, stabilizing carbon dioxide levels at current levels. On the other hand, the United States – supported at Noordwijk by Japan and the former Soviet Union – questioned targets and timetables – the US quite adamantly, Japan and the Soviet Union less consistently – on the grounds that targets and timetables were too rigid, did not take account of differing national circumstances, and would be largely symbolic. Instead, the US argued that emphasis should be placed on further scientific research and on developing national rather than international strategies and programs[23]. The differences between the US and other Western states deepened at the 1990 Bergen and Second World Climate Conferences. The US continued to block the adoption of targets and timetables, instead insisting on conference language that was neutral as between targets and timetables on the one hand, and national strategies, on the other.

What accounted for the differences within the West between the US and other OECD countries? To some degree, they resulted from disparities in the perceived costs of abatement. For example, the United States has large reserves of cheap coal (a relatively high source of CO2 per unit of energy), while Germany currently subsidizes coal production and consumption and could potentially save money by switching to natural gas (a relatively "clean" fuel).[24] But a simple explanation in terms of economic self-interest is insufficient, since, from an economic standpoint, a stabilization target would be easier to achieve for the US than for many other Western countries, including Norway and Japan, which have now belatedly backed away from country targets and support, instead, joint implementation. A more sophisticated interest-based approach is that the US was jockeying for a favorable position – and attempting to create a reputation for toughness – in a much larger and longer-term game in which major cuts in emissions levels will likely be on the table.

Another explanation for the differences in national positions lies in domestic politics (see also Section 5.4.1). Following the Montreal Protocol negotiations, international environmental negotiations were coordinated in the Reagan Administration by the White House Domestic Council, where such major domestic players as the Department of Energy, the Office of Management and Budget, and the Council of Economic Advisers were dominant, all of whom stressed the uncertainties of climate change and the economic costs of mitigation measures. In the immediate run-up to the Noordwijk Conference, they wrested control of the climate change issue from the Administrator of the Environmental Protection Agency (EPA), William Reilly, who reportedly supported US acceptance of the targets and timetables approach. In contrast, in countries such as Canada, the Netherlands, and Germany, the climate change issue remained in the hands of the environmental and foreign ministries for a much longer period.[25]

At the Second World Climate Conference, in late 1990, a second fault-line began to emerge in the climate change negotiations between industrialized and less industrialized countries, North and South. Earlier in the year, at the London Ozone Conference, less industrialized countries had

23. The US position on climate change paralleled its position vis-à -vis Canada regarding transboundary air pollution.

24. The FCCC gives Germany additional leverage in overcoming domestic interest groups that oppose reducing coal subsidies.

25. In 1991 and 1992, as economics and energy ministries in countries other than the United States began to recognize the potential implications of the climate change issue, the differences among OECD countries began to narrow.

successfully pressed to establish a special fund to help them implement the Montreal Protocol on Substances that Deplete the Ozone Layer, and, in the UN General Assembly, they insisted that the proposed environmental conference for 1992 give equal weight to environment and development. In the climate context, they sought greater representation, and argued that climate change be viewed not simply as an environmental issue but as a development issue as well. For both reasons, they sought to move the negotiations from the comparatively technical, narrow confines of the IPCC, in which they had found it difficult to participate on an equal basis with industrialized countries, to the UN General Assembly. Their efforts proved successful, and the December 1990 resolution authorizing the development of a convention[26] placed the negotiations under the auspices of the General Assembly rather than the IPCC, UNEP or WMO, as developed countries would have preferred.

Developing countries, however, displayed little more unity among themselves than did the developed countries. They agreed on the need for financial assistance and technology transfer – but on little else. At one extreme, the small island developing states, fearing inundation from sea level rise, strongly supported establishing targets and timetables for developed countries. At the Second World Climate Conference, they organized themselves into the Alliance of Small Island States (AOSIS), which played a major role in the subsequent FCCC negotiations in pushing for CO2 emissions reductions. At the other pole, the oil-producing states questioned the science of climate change and argued for a "go slow" approach. In the middle, the big industrializing countries such as Brazil, India, and China tended to insist that measures to combat climate change not infringe on their sovereignty – in particular, their right to develop economically. They argued that, since the North has historically been responsible for creating the climate change problem, the North should also be responsible for solving it.

4.1.4 Negotiations of the FCCC[27]

Although international environmental law has undergone impressive growth over the past twenty years[28], when the climate change issue emerged in the late 1980s, international environmental law had little to say about it (Zaelke and Cameron 1990). The only existing air pollution conventions addressed transboundary air pollution in Europe[29] and depletion of the stratospheric ozone layer.[30] While customary international law contains general principles relevant to atmospheric pollution,[31] these principles do not have the specificity and certainty needed to address the climate change problem effectively (Magraw 1990a, 8; Developments 1991, 1504-1506). As one leading international scholar has put it, "customary law provides limited means of social engineering"

26. Protection of Global Climate for Present and Future Generations of Mankind, UN General Assembly Res. 45/212, UN Doc. A/45/49 (1990).
27. See generally Mintzer and Leonard (1994).
28. There are now well over 150 treaties on the UNEP Register of International Treaties in the Field of the Environment.
29. Convention on Long-Range Transboundary Air Pollution (LRTAP), adopted Nov. 13, 1979, International Legal Materials 18, 1442 (1979).
30. Vienna Convention for the Protection of the Ozone Layer, Mar. 22, 1985, International Legal Materials 26, 1529 (1987); Montreal Protocol on Substances that Deplete the Ozone Layer, adopted Sept. 16, 1987, International Legal Materials 26, 1550 (1987).
31. For example, the principle that states should "ensure that activities within their jurisdiction or control do not cause damage to the environment of other States or of areas beyond the limits of national jurisdiction." Declaration of the 1972 UN Conference on the Human Environment (Stockholm Declaration), Principle 21.

(Brownlie 1973, 179). Therefore, legal action to address climate change required negotiation of a new treaty.

Initially, two alternative models were considered: (i) a general framework agreement on the "law of the atmosphere," modeled on the 1982 UN Law of the Sea Convention, which would recognize the interdependence of atmospheric problems and address them in a comprehensive manner; and (ii) a convention specifically on climate change, modeled on the Vienna Ozone Convention (Zaelke and Cameron 1990, pp. 272-78). Despite initial Canadian support for the former, the second approach quickly prevailed: The unwieldiness of the law of the sea negotiations compared unfavorably with the step-by-step approach used with great success in the ozone regime (Tolba 1989; Sebenius 1991).

The total time for the formal treaty-making process, from the commencement of negotiations to the entry into force of the FCCC, amounted to little more than three years, a comparatively short period for international environmental negotiations.[32] The process began in December 1990, when the UN General Assembly established the Intergovernmental Negotiating Committee for a Framework Convention on Climate Change (INC/FCCC), to negotiate a convention containing "appropriate commitments" in time for signature in June 1992 at UNCED.[33] Between February 1991 and May 1992, the INC/FCCC held five sessions. It adopted the FCCC on 9 May 1992, and the Convention entered into force less than two years later on 21 April 1994 as a result of its ratification by 50 states.

In understanding the INC process, two factors were critical. First, the June 1992 UNCED deadline exerted substantial pressure on governments. Given the public visibility of the UNCED process, most delegations wished to have a convention ready for signature in Rio. Second, the desire for consensus decision-making gave individual countries (such as the United States) substantial leverage – if not a complete veto – over the final outcome.

The discussions in the INC/FCCC followed a pattern common to international environmental negotiations. At first, little progress was apparent, as states debated procedural issues and endlessly repeated their positions rather than seek compromise formulations. But, while frustrating to those hoping for rapid progress, this sparring process allowed states to voice their views and concerns, to learn about and gauge the strength of other states' views, and to send up trial balloons. Real negotiations, however, began only in the final months before UNCED, when governments realized that they would need to compromise if they wished to have a convention to sign at Rio. Agreement was facilitated by the INC Chairman's preparation of a compromise text for the final session, which cleared away many of the encrustations of alternative formulations proposed during the course of the negotiations. Even so, agreement was not reached until late on the final day of the negotiations, following several late night sessions involving a small group of key delegations.

The initial baseline for the negotiation was the "framework agreement" model used in the preceding decade to address the acid rain and ozone issues: the 1979 Convention on Long-Range Transboundary Air Pollution (LRTAP) and the 1985 Vienna Convention for the Protection of the Ozone Layer (Lang 1991; Morrisette 1991). Both of these conventions are largely procedural.

32. Recent international environmental agreements, however, have typically required less time to negotiate than earlier ones (Weiss 1993, pp. 685-86).

33. Protection of Global Climate for Present and Future Generations of Mankind, UN General Assembly Res. 45/212, UN Doc. A/45/49 (1990).

They establish only very general obligations – for example, to cooperate in scientific research and exchange information. Instead, their main value is to establish a legal and institutional framework for future work through regular meetings of the parties and the possible adoption of more substantive protocols.

Virtually all countries agreed on the need to include, at a minimum, the basic elements of such a framework convention – except for the oil-producing states, who would have preferred not to have a convention at all. The main question was whether a framework convention was sufficient, and, if not, what additional provisions to include. The principal issues included the following:

- **Targets and timetables** – The European Community (EC) and the Alliance of Small Island States (AOSIS) advocated establishing targets and timetables for limiting emissions by industrialized countries, while the US and the oil-producing states opposed this idea. Other less industrialized states generally supported targets and timetables, as long as it was clearly understood that they would apply only to industrialized states.
- **Financial assistance and technology transfer** – Apart from targets and timetables, the financial mechanism issue was the most contentious in the negotiations. Less industrialized countries advocated establishing a new fund, while industrialized countries wished to use the Global Environment Facility (GEF), a joint project of the World Bank, UNEP, and UNDP which was established in 1991. Less industrialized countries, led by India, also sought to include a commitment that industrialized countries provide "new and additional" financial resources to help less industrialized countries implement the Convention – that is, money over and above existing aid flows.
- **Institutions and implementation mechanisms** – OECD countries, including the US, generally sought to establish strong implementation machinery, including regular meetings of the parties, a scientific advisory body, a committee focusing on implementation issues, detailed reporting requirements, and a non-compliance procedure modeled on that of the Montreal Protocol. Less industrialized countries preferred the framework convention approach, fearing that strong institutions and implementation procedures might infringe on their sovereignty.

The Convention reflects a carefully balanced compromise on these and other issues. Many of its provisions do not attempt to resolve differences so much as paper them over, either through formulations that preserved the positions of all sides,[34] that were deliberately ambiguous,[35] or that deferred issues until the first meeting of the conference of the parties.[36] From this perspective, the Convention represents not an end point, but rather a punctuation mark in an ongoing process of negotiation.

34. See, e.g. Article 11 (financial mechanism).
35. See, e.g., Article 4(2) (commitments by industrialized countries to limit emissions).
36. See, e.g., Article 13 (directing COP to consider establishing a multilateral non-compliance procedure).

4.1.5 Postscript: Post-Rio Developments[37]

Recognizing the substantial delays that can result between the adoption of a treaty and its entry into force (Spector and Korula 1993), the INC/FCCC decided to continue to meet prior to the first meeting of the Conference of the Parties (COP-1) in order to elaborate and implement the reporting and review procedure, to address unresolved issues such as the relations between the COP and the financial mechanism, and to begin consideration of the next steps beyond the FCCC. This "prompt start" of the FCCC process may have helped speed the development of the climate change regime by as much as 2-3 years by allowing multilateral negotiations to continue during the interim period before the Convention's entry into force (Chayes and Skolnikoff 1992). In addition, during this interim period, most industrialized country parties submitted national reports and the international review process got underway, including the compilation of a synthesis report analyzing the overall progress by industrialized countries in implementing their commitments and the initiation of in depth reviews of individual national reports.

The Convention entered into force on March 21, 1994, and one year later, COP-1 met in Berlin. Among its significant outcomes, COP-1 decided to:

- establish an *ad hoc* committee to negotiate a protocol or other legal instrument by 1997 containing additional commitments for industrialized countries for the post-2000 period (the Berlin Mandate);
- initiate a pilot phase of "joint activities," which may involve any country (either developed or developing) interested in participating. Credits towards existing emissions limitation commitments, however, will not be given for joint implementation activities (see sections 4.2.2 and 6.1 below);
- continue to use, on an interim basis, the Global Environment Facility (GEF) as the FCCC's financial mechanism; and
- locate the FCCC's permanent secretariat in Bonn.

Following COP-1, the Berlin Mandate negotiating committee (the Ad Hoc Group on the Berlin Mandate or AGBM) began to meet, along with the subsidiary bodies for scientific and technological advice and for implementation. However, little progress was made, as some countries questioned the need for legally-binding commitments either on targets and timetables (now referred to "quantified emission limitation and reduction objectives" or QELROs) or on policies and measures, while others questioned the authoritativeness of the IPCC's Second Assessment Report.

Against this backdrop, the adoption of the Geneva Ministerial Declaration in July 1996 at COP-2 was significant for two reasons. First, from a substantive standpoint, it reasserted the conclusions of the Berlin meeting, thereby countering attempts to backslide. In particular, it (a) reaffirmed the need for legally-binding QELROs; (b) endorsed the IPCC's Second Assessment Report, which it characterized as the "most comprehensive and authoritative assessment of the science of climate change;" (c) found that the Second Assessment Report indicates that the continued rise in greenhouse gas concentrations would lead to dangerous interference with the climate system (and thus be contrary to the objective of the Convention); and (d) instructed delegates to accelerate negotiations on a legally-binding instrument. Second, and perhaps more significantly, the

37. See generally Victor and Salt (1994) and Rowlands (1995).

Declaration marked the first time that countries were willing to act in the absence of consensus. Previously, the desire for consensus had given Saudi Arabia and the other OPEC states a virtual veto power over the negotiations. (Indeed, in the absence of rules of procedure specifying a different voting rule, the structure of the Convention suggested that consensus was not merely a desirable goal but a legal requirement for action by the COP.) In the period following COP-1, however, the OPEC countries overplayed their hand, thereby provoking a backlash. Given the COP's lack of authority to take decisions by majority vote, supporters of the Declaration did not attempt to have it adopted by the COP. Instead, COP-2 merely took note of the Declaration and appended it to the final report, over the opposition of Saudi Arabia (and the other OPEC states), Russia, Australia, and New Zealand. The willingness of the European Union, the United States and most developing states to act in the absence of consensus sends a strong signal to the Berlin Mandate negotiations that these countries are prepared to proceed on their own if necessary, if a small minority continues to block progress.

4.1.6 Conclusions

In reviewing the development of the climate change issue, several general features should be noted.

First, during the agenda-setting phase, the distinction between governmental and non-governmental actors was blurred (see also section 5.4.2 on the role of non-governmental actors). What stands out was the importance both of (i) a small group of "entrepreneurs," who promoted what they viewed as global rather than national interests, and (ii) a series of quasi-official meetings they organized – meetings which were highly influential, due in part to the sponsorship of international organizations such as UNEP and WMO or of sympathetic governments such as Canada, but which were *non*-governmental rather than *inter*-governmental in character. The 1985 Villach meeting and the 1988 Toronto Conference were particularly important – the former in communicating an ostensible scientific consensus about climate change and raising it as a policy issue; the latter in articulating a set of policy responses.

Second, during the actual negotiation of the convention, in contrast, governments were very much in control and non-governmental actors played a quite limited role. Even the IPCC did not have a substantial effect on the actual negotiations. The one exception was the role played by a London-based environmental law group – the Foundation for International Environmental Law and Development (FIELD) – which helped organize and support the newly-formed Alliance of Small Island States.

Third, in the negotiations, it was *not* always possible to correlate the positions taken by delegates with "national positions." Many country delegations from less industrialized countries– and even some industrialized country delegations – did not have detailed briefs from their capitals. Moreover, delegations were not always unified. In many ways, the US Environmental Protection Agency was more closely aligned during the negotiations with the European Community than with the rest of the US delegation.

Finally, although many of the principal issues in the negotiations – including targets and timetables and financial commitments – were real issues with potentially substantial implications for national interests, the negotiations in the INC were often more semantic than substantive in character. Words were debated and selected as much for their political as for their legal significance. Proposed formulations took on a symbolic and even talismanic quality, only

distantly connected to the actual meaning of the words. Linguistic debates became a proxy for political confrontation, with success or failure measured not just by the substantive outcomes, but by the inclusion or exclusion of particular terms.[38] Furthermore, many important issues such as the rules of procedure remain to be resolved.

4.2 Legal Aspects of the International Climate Regime[39]

As its title indicates, the FCCC is a framework agreement. Despite early hopes that it would contain a clear commitment to stabilize or even reduce greenhouse gas emissions, it contains only a very convoluted and ambiguous commitment by industrialized countries to return to their 1990 emissions levels by the end of the decade. Instead, the FCCC's main achievement is to establish a long-term process for addressing the climate change issue, including:

- an overall objective of stabilizing atmospheric concentrations of greenhouse gases at a "safe" level;
- general principles to guide future work, including principles of equity, precaution, and cost-effectiveness;
- a process intended to improve our information base, to encourage national planning and response measures, and to produce more substantive standards should scientific evidence continue to mount that human activities may change the Earth's climate;[40] and
- institutions to oversee the implementation and development of the Convention.

This section will examine the principal legal aspects of the climate change regime (see Sections 5 and 6 for other aspects).

4.2.1 Two Approaches to International Law

Legal scholarship on the climate change problem reflects two contrasting approaches to international law – what could be termed the "hard" and "soft" approaches. The former approach views international law essentially in domestic criminal-law terms, as a command backed by the threat of sanctions, while the latter views international law in facilitative terms.

The "hard" approach to international law reflects the following core propositions:

- The main purpose of international law is to impose specific obligations on states.
- These obligations should be enforceable through compulsory, binding dispute resolution.
- Violators should be subject to sanctions.

38. Some of the intensity of the negotiations regarding the wording of the FCCC and the ensuing negotiations may stem from the fact that the FCCC constitutes a legal document, which states take more seriously than non-binding declarations. Therefore, we will examine the legal implications in the following subsection and attend to the question of implementation in Section 7.

39. See generally Barratt-Brown et al. (1993), Bodansky (1993), Goldberg (1993), Grubb (1992), and Sands (1992).

40. The first step in the process of developing more specific commitments to limit GHG emissions began at COP-1 in April 1995 with the adoption of the Berlin Mandate.

Subscribers to this approach – primarily environmental NGOs – believe that the object of a climate change treaty should be to impose rules with "teeth." For example, the former Prime Minister of New Zealand, Geoffrey Palmer, has argued that the climate change problem necessitates the development of new types of international institutions:

> *First, there must be a legislative process which is capable of making binding rules which states must follow, even when they do not agree. Second, there must be some means of having compulsory adjudication of disputes, if not to the International Court of Justice, then perhaps to a special tribunal. . . . Finally, there needs to be . . . an institutional authority capable of monitoring what the nation states are doing, blowing the whistle on them when necessary, and acting as an effective coordinator of what action needs to be taken* (Palmer 1992).

The 1989 Hague Conference Declaration, which called for the development of a "new institutional authority" to combat global warming, with non-unanimous decision-making and enforcement powers, reflects this approach.

An alternative function of international law is to *facilitate and encourage*, rather than *require*, international cooperation. Instead of attempting to develop supranational institutions, this "soft" approach accepts state sovereignty as a given, and attempts to foster cooperation within that system – in particular, by:

- building scientific and normative consensus incrementally, through joint assessments of scientific knowledge, the creation of regular fora for discussion and negotiation, and the establishment of international organizations (Gehring 1992);
- encouraging rather than enforcing compliance – for example, by addressing barriers to compliance such as mistrust between states and lack of domestic capacity (Chayes and Chayes1993).

These contrasting approaches to international lawmaking are ideal types – international legal regimes generally have elements of both. But some regimes are "harder" than others. For example, the European human rights regime – with its compulsory system of adjudication and its extensive body of decisional law – represents a hard type of international law. In contrast, the World Heritage Convention[41] – which seeks primarily to promote national action and contains only very general international norms – reflects a soft approach.

In the environmental realm, most treaties adopt a rather soft approach. They rarely define strict norms or contain strong enforcement mechanisms. Exceptions include the Convention on the Prevention of Pollution from Ships (abbreviated MARPOL 1973/78), which creates a detailed regulatory regime, including specific technology standards for vessels (Mitchell 1994), and the new Antarctic Environment Protocol, which provides for compulsory dispute settlement. The "framework convention/protocol approach" combines both soft and hard approaches: The framework convention creates a long-term process intended, eventually, to develop protocols containing more specific, hard obligations. The most successful example of this process has been the stratospheric ozone regime, which began with the very soft Vienna Convention on the Protection of the Ozone Layer. Subsequently, this led to the much harder Montreal Protocol on

41. Concluded at Paris on 16 November 1972. See UN Treaty Series 1037, 151.

Substances that Deplete the Ozone Layer (and subsequent amendments), which set forth detailed obligations to limit the use of ozone-depleting substances – with trade sanctions to deter free riders.

4.2.2 Key Provisions of the FCCC

The UN Framework Convention on Climate Change takes a relatively soft approach, like most other first-generation instruments addressing global commons issues. It establishes an infrastructure of institutions and legal mechanisms, intended to create a long-term process to address the climate change problem, rather than impose strict obligations. Indeed, its two main obligations – (i) national reports and (ii) financial assistance by OECD countries to less industrialized countries for preparing reports – are both essentially procedural in nature; they are intended to *encourage* rather than require national action to combat climate change.

The activities that give rise to climate change, and hence are within the purview of the FCCC, mostly take place within areas of national jurisdiction. In this respect, the FCCC is similar to the stratospheric ozone agreements and the Biological Diversity Convention,[42] but differs from international conventions dealing with the high seas or the Antarctic environment. Conventions that address pollution occurring in the global commons often set forth jurisdictional rules (the 1982 UN Convention on the Law of the Seas[43]) or establish detailed international standards (MARPOL 19/73/78; see above). In contrast, the FCCC contains much more limited rules, since it has a much greater potential for infringing on state sovereignty.

The FCCC builds on the experience of existing international environmental regimes in promoting participation through differential obligations and selective incentives (including financial and technological assistance), encouraging regional and national actions, and considering implementation issues even before the convention had entered into force (Sand 1990). Particular features of the FCCC's legal framework are set forth in Table 2.

TABLE 2.Key Provisions of the FCCC

Objective	Stabilize atmospheric greenhouse gas concentrations at a level that would prevent dangerous anthropogenic interference with the climate system, within a time-frame sufficient to: (i) allow ecosystems to adapt naturally, (ii) protect food production, and (iii) allow sustainable economic development (Art. 2).
Principles	Intra- and inter-generational equity; differentiated responsibilities and respective capabilities; special needs of less industrialized country parties; right to sustainable development; precaution; cost-effectiveness and comprehensiveness; supportive and open economic system (Art. 3).

42. Convention on Biological Diversity, opened for signature, June 5, 1992, International Legal Materials 31, 818 (1992).
43. Adopted Dec. 10, 1982, U.N. Doc. A/Conf.62/121, International Legal Materials 21, 1261 (1982).

TABLE 2.Key Provisions of the FCCC

Commitments	*All countries* - General commitments to: develop national GHG inventories; formulate national mitigation and adaptation programs; promote and cooperate in scientific research, education, training and public awareness (Arts. 4(1), 5, 6). *Industrialized countries* (listed in Annex 1) - Recognize that a return to earlier emission levels of CO2 and other GHGs by the end of decade would contribute to modifying long-term emission trends, and aim to return to 1990 emission levels (Art. 4(2)). *OECD countries* (listed in Annex 2) - Commitments to fully fund industrializing country inventories and reports; fund the incremental costs of agreed mitigation measures; provide assistance for adaptation; and facilitate, promote and finance technology transfer (Art. 4(3)-(5)).
Institutions	Conference of the Parties (COP) (Art. 7), Secretariat (Art. 8), Subsidiary Body for Scientific and Technological Advice (Art. 9), Subsidiary Body for Implementation (Art. 10), financial mechanism (Art. 11).
Reporting ("communication of information")	*All countries* - National GHG inventories; steps taken to implement the Convention (Art. 12(1)). *Industrialized countries (Annex I)* - Detailed description of policies and measures to limit GHG emissions and enhance sinks, and a specific estimate of their effects on emissions (Art. 12(2)). *OECD countries (Annex II)* - Details of financial and technological assistance measures (Art. 12(3)).
Adjustment Procedure	Reassessments of the adequacy of commitments every three years, based on the best available scientific information (Art. 4(2)(d)). First reassessment at COP-1 (Berlin, 1995).

Source: Bodansky (1995)

4.2.2.1 Objective

The FCCC defines the climate change regime's "ultimate objective" as the stabilization of atmospheric concentrations of GHGs at safe levels (i.e., levels that would "prevent dangerous anthropogenic interference with the climate system"), within a time frame that allows ecosystems to adapt naturally, does not threaten food supplies, and permits sustainable development. The future development of the climate change regime will involve spelling out the meaning of this objective, in particular (i) what concentration levels and rates of change are safe, and (ii) what emission levels are necessary to achieve these levels and in what time frames (Moss 1995).

4.2.2.2 Principles

The FCCC embodies several general principles of international environmental law (FCCC, Art. 3). First, climate change is the "common concern of mankind." The "common concern" formulation is weaker than the "common heritage" concept in the 1982 UN Convention on the Law of the Sea, which connotes common ownership (Attard 1991). Second, states should protect the climate for the benefit of future as well as present generations, reflecting the principle of inter-generational equity (Weiss 1989b). Third, action to combat climate change should not await full scientific certainty (the precautionary principle) (O'Riordan and Cameron 1994).[44] Fourth, states have differentiated responsibilities (Magraw 1990b) – developed countries should take the lead in

combating climate change, while the emissions of developing countries must be allowed to grow.[45] The first of these principles, common concern, is the basis for international interest in the climate change problem, and the fourth is operationalized in the FCCC through differential commitments for different classes of parties[46]. The principles of inter-generational equity and precaution, in contrast, set forth general orientations, but do not provide any specific guidance for how the climate change regime should develop. Significantly, the Berlin Mandate for the next round of negotiations refers to the FCCC's principles, in particular the principle of equity.

4.2.2.3 National Climate Programs

Under the FCCC, parties must inventory their existing GHG emissions and develop policies and measures to limit emissions and to conserve and enhance sinks (FCCC Art. 4(1)). The main function of the FCCC, at least initially, is to encourage and facilitate these national climate activities.

4.2.2.4 Targets and Timetables

After months of deadlock in the pre-Rio negotiations, the UK and US finally brokered a compromise formulation on the target and timetable issue in late April 1992, shortly before the final session of the INC. The compromise sets forth, in very nebulous language – whose legal status remains uncertain – the general aim of returning anthropogenic emissions of greenhouse gases by industrialized countries to 1990 levels by the year 2000 (FCCC Art. 4(2)). This quasi-target is a uniform target tied to historical emissions, like the targets in the protocols to the Long-Range Transboundary Air Pollution Convention (LRTAP) and in the Montreal Protocol. In the long-run, as stricter commitments are negotiated, this approach may not be acceptable to most states, since it disregards differences between them in starting points, economic structures, resources bases, and other factors relevant to equitable burden-sharing (see Section 5.4.3).

At COP-1, the parties agreed to begin negotiations to strengthen the FCCC's commitments, including "quantified limitation and reduction objectives within specified time-frames" for the post-2000 period (i.e., a new target and timetable).[47] The Berlin Mandates provides that the new commitments may apply only to industrialized countries; no new commitments may be introduced for less industrialized countries.

4.2.2.5 Comprehensive Approach and Joint Implementation

To promote flexibility, the nebulous language of the FCCC leaves open the possibility of trade-offs in emission controls (i) between different GHGs (the "comprehensive approach") (Stewart

44. The Convention, however, does not specify what level of information justifies action, or how much action is warranted, other than to note that action to combat climate change should be "cost-effective" (FCCC Art. 3(3)).
45. The principle of differentiated responsibilities is also reflected in the Montreal Protocol, which gives developing countries a ten-year grace period to comply with its control measures (Montreal Protocol Art. 5).
46. The Convention sharply differentiates between the obligations of industrialized and less industrialized countries. Less industrialized countries have quite limited reporting requirements, along with general obligations to develop measures to limit emissions of greenhouse gases and enhance sinks (FCCC Art. 4(1). Industrialized countries, in contrast, have more stringent reporting requirements, a quasi-target and timetable to limit their emissions of greenhouse gases (FCCC Art. 4(2)), and (for OECD countries) an obligation to provide financial assistance to less industrialized countries for mitigation and adaptation measures (albeit at unspecified levels) (FCCC Art. 4(3)-(5)).
47. Report of the First Conference of the Parties of the FCCC (1994), U.N. Doc. FCCC/CP/1995/7/Add.1.

and Wiener 1992) and (ii) across countries ("joint implementation") (Kuik et al. 1994). The Montreal Protocol contains precedents for both of these regulatory devices. Its limitations apply to specified baskets of chemicals, rather than on a chemical-by-chemical basis, and it allows, to a limited degree, joint attainment of control measures through transfers of production for industrial rationalization purposes.

In the period since the adoption of the FCCC, joint implementation has emerged as one of the major controversies in the climate change regime.[48] Some industrialized countries have sought to obtain credits towards their emissions targets for abatement activities undertaken in less industrialized countries (FCCC, Art. 4(2)(a) & (d)). This would enable industrialized countries to meet emissions targets in the most cost-effective manner, and could lead to substantial transfers of financial resources and technology to less industrialized countries (Kuik et al. 1994). Joint implementation, however, has provoked objections from less industrialized countries and environmental NGOs, who argue that it would be both inequitable and difficult to administer and police (Climate Network Europe 1994). As a result of these concerns, COP-1 authorized only a pilot phase of joint implementation during which industrialized countries may not receive credits towards their existing commitments.

4.2.2.6 Financial Resources[49]

The FCCC, in contrast to earlier framework conventions, provides for transfers of financial resources from OECD to less industrialized countries (FCCC Art. 4(3)) and defines a mechanism for this purpose (FCCC Art. 11). The inclusion of these financial provisions reflects the emergence of a strong North/South dimension in global environmental politics in the late 1980s, which manifested itself in the establishment of the Montreal Protocol Multilateral Fund, the preparatory work for UNCED, and the negotiations to restructure the Global Environment Facility (GEF). In the climate change context, two particular factors accounted for the FCCC's financial provisions: (i) the essential role of less industrialized countries in solving the climate change problem and (ii) the high level of concern of OECD countries. Despite these factors, however, less industrialized countries were unable to give teeth to the Convention's financial provisions – for example, by setting specific amounts or providing for mandatory assessments. While they obtained a commitment from OECD countries to fully finance their required national reports on climate change, the Convention does not require any particular country to contribute any particular amount.

The FCCC entrusted the GEF with the operation of the Convention's financial mechanism pending COP-1. The restructuring of the GEF in 1994 – which made the GEF functionally autonomous from the World Bank and created a 32-member Council, evenly split between less industrialized and industrialized countries – allayed some of the concerns of less industrialized countries about World Bank (and donor country) dominance of the GEF (Jordan 1994). But the nature of the operational linkages between the GEF and the FCCC remains a source of contention, and COP-1 renewed the GEF's role only on an interim basis.

48. See also infra Sec. 6.

49. See also infra Sec. 6.1.

4.2.2.7 Institutions

The Convention goes beyond earlier framework conventions by establishing not only a Conference of the Parties (COP) for decision-making (which met for the first time in March and April 1995 at Berlin) and a secretariat for administrative functions to be located at Bonn, but also standing bodies to provide scientific and technical advice and to assist with implementation (FCCC, Articles 7-10) (see Table 3). The Conference of the Parties is the principal forum for elaborating the climate change regime, through the negotiation of amendments and protocols (Gehring 1992). The subsidiary bodies will perform more technical/analytic functions.

Both the COP and subsidiary institutions are essentially intergovernmental rather than supranational in character; they serve as fora for consensus-building by states, and do not have legislative, adjudicatory or enforcement powers. Nonetheless, as the FCCC's "supreme body," the COP has a broad mandate. COP-1, for example, initiated a new round of negotiations to strengthen the FCCC's commitments (the Berlin Mandate), established a pilot phase of joint implementation, adopted reporting and review procedures, designated a permanent secretariat, and defined the roles of its subsidiary bodies. Given the COP's broad authority, its voting rules have been a source of contention. At both COP-1 and COP-2, the parties were not able to agree on whether to allow supra-majority voting (two-thirds or three-quarters) on all substantive matters, or whether to require consensus for important decisions such as the adoption of protocols; as this article goes to press, this matter is still unresolved.

4.2.2.8 Reporting and Review[50]

For purposes of planning and assessment, and to encourage national action, the INC has established an elaborate system of national reporting and international review for the FCCC. Under this procedure, industrialized states must submit extensive information on their climate change policies, together with projections of how these policies will affect emissions. These national reports are then synthesized in order to determine the parties' overall progress in implementing the Convention, as well as subjected to in-depth reviews by teams of experts nominated by FCCC parties and selected by the Secretariat. The first synthesis report was completed for COP-1.

The reporting and review procedure is intended to be non-confrontational and facilitative in nature. Its functions include promoting transparency and focusing peer and public pressure on states. But, since it relies primarily on self-reporting rather than international monitoring and inspection[51] (in contrast, for example, to the Convention on the Conservation of Antarctic Marine Living Resources), it falls short of the strict verification regime that may be needed to deter free riders should the FCCC eventually develop strict commitments (Wettestad 1991).

50. See also infra Sec. 6.

51. International review teams may, however, visit a country with the country's approval.

TABLE 3.Climate Change Institutions

Name	Abbreviation	Description
Intergovernmental Negotiating Committee	INC	Established December 1990 by UN General Assembly. Negotiated the FCCC. Now replaced by the FCCC Conference of the Parties (COP).
Conference of the Parties	COP	Established by FCCC Art. 7. "Supreme body" of FCCC. Functions: regular review of FCCC implementation; decisions necessary to promote effective implementation; adoption of amendments and protocols. Meets yearly.
Secretariat		Established by FCCC Art. 8. Administrative functions in support of COP and other Convention institutions. Located in Bonn.
Subsidiary Body for Scientific and Technological Advice	SBSTA	Established by FCCC Art. 9. Composed of government experts. Provides assessments of scientific knowledge, reviews scientific/technical aspects of national reports and effects of implementation measures.
Subsidiary Body for Implementation	SBI	Established by FCCC Art. 10. Composed of government experts. Reviews policy aspects of national reports; assists COP in assessing aggregate effect of implementation measures.
Financial mechanism		"Defined" by FCCC Art. 11. Operation entrusted to GEF on interim basis (see below).
Intergovernmental Panel on Climate Change	IPCC	Established in 1988 by WMO and UNEP to provide assessments of the science, impacts and policy aspects of climate change. First Assessment Report in August 1990; Second Report concluded in December 1995.
Global Environment Facility	GEF	Established by World Bank, UNDP, and UNEP in 1991. Restructured in 1994.

Source: Bodansky (1995)

4.2.2.9 Amendment and Adjustment to New Scientific Knowledge

Like other recent international environmental agreements (Weiss 1993, 688-689), the FCCC provides for periodic reviews of the adequacy of its provisions in light of new scientific findings (FCCC Art. 4(2)(d)). COP-1 undertook the first such review and concluded that the FCCC's specific commitments for industrialized countries are inadequate. Accordingly, it created an *ad hoc* negotiating group to develop a legal instrument by 1997 containing additional commitments for industrialized countries. However, unlike the Montreal Protocol, which authorizes its parties to "adjust" control measures through qualified majority voting, the FCCC does not – at this stage – delegate any lawmaking authority to the COP. Consequently, amendments and protocols to the FCCC will apply only to those parties that accept them.

4.2.2.10Dispute Resolution

The FCCC contains the boilerplate dispute resolution provisions found in other international environmental agreements, which in practice are virtually never invoked. Global commons problems – like climate change – do not raise the type of bilateral disputes for which traditional dispute settlement procedures were designed; violations of the Convention would implicate community interests, rather than injure a particular state. For this reason, several recent environmental conventions – including the Montreal Protocol – have developed multilateral non-compliance procedures, involving collective review by the parties, to supplement traditional bilateral dispute settlement by third-party decision-makers. The FCCC calls on the parties to consider developing a multilateral consultative process to address implementation questions, and COP-1 created an open-ended working group of technical and legal experts to study the relevant issues (see Victor 1994b). But, unlike the Montreal Protocol, it does not mandate the development of such a procedure. Moreover, in contrast to the Montreal Protocol procedure, which explicitly focuses on "non-compliance," the FCCC uses the more neutral language of "resolving questions regarding implementation" (FCCC Art. 13).

4.2.2.11Sanctions

The FCCC contains no provisions specifying sanctions for non-compliance. Indeed, although it does not exclude the possibility of trade sanctions like those mandated by the Montreal Protocol, the FCCC lays down a marker for the future by stating that measures to combat climate change should not arbitrarily or unjustifiably discriminate against international trade (FCCC Art. 3(6)). Given developments in the GATT and WTO, where the use of trade measures to promote environmental objectives has been strongly disfavored, the likelihood that trade sanctions will be used to enforce the FCCC appears low.

4.2.2.12Liability

Although the FCCC is officially neutral between possible response strategies, the focus during the negotiations was on abatement rather than adaptation. Despite the urging of island states, represented by AOSIS, the INC declined to establish an insurance or liability scheme for damage resulting from climate change. Historically, states have been able to agree on liability schemes only for discrete, acute pollution incidents, such as oil spills or nuclear accidents. They have generally been unwilling to undertake liability for more distant and open-ended damages resulting from long-term problems such as stratospheric ozone depletion and global climate change, where the potential liability exposure is extremely high and the task of establishing causation a virtual impossibility.

4.2.3 Conclusions

The FCCC – despite its designation as a "framework" convention" – goes well beyond earlier framework conventions. It establishes more extensive commitments than those contained in LRTAP or the Vienna Ozone Convention, but falls short of the specific targets and timetables contained in regulatory agreements such as the 1987 Montreal Protocol. It establishes a relatively rich institutional structure, though with limited explicit powers. And it provides for financial assistance and technology transfer for developing countries, though without setting any specific amounts. In short, it constitutes a good beginning – but only a beginning – to international efforts

to address climate change. The Berlin Mandate negotiations mark the first step to move beyond the FCCC by developing stronger commitments to abate GHG emissions.

The future trajectory of the climate change regime remains hard to predict. If the LRTAP and ozone regimes are any guide, the FCCC will be followed by more specific protocols, addressing particular causes of climate change. But given greater uncertainties and stakes involved in the climate change context,[52] reaching agreement on specific control measures will be more difficult. In the short run, progress will likely be made in elaborating and implementing the reporting and review mechanism, establishing a multilateral non-compliance procedure, conducting inventories and developing national plans, and channeling assistance to less industrialized countries. But, in the longer run, progress in developing strict abatement measures will depend primarily on extra-legal factors – the resolution of scientific and economic uncertainties; the development of technological and policy solutions; and, ultimately, the crystallization of popular and political will at the national and international levels.

The development and elaboration of the FCCC show the importance of understanding the factors that are at the root of collaboration between nations in terms of environmental issues. These factors help determine why a convention has taken a particular direction and if it is likely to achieve its goal. A variety of theoretical interpretations that shed some particular light into the way nations (sometimes with the help of subnational actors) proceed to collaborate. The next section is devoted to these theoretical interpretations.

5. Theoretical Perspectives

5.1 Introduction

The previous discussion in Section 2 showed that global climate change poses particular challenges to state and non-state actors to muster support for coordinated emission reductions (or enhancement of carbon sinks). While responses to GCC are embedded within a broad array of changes of driving forces, occurring on various levels of aggregation of human activities (see Section 3), Section 4 has shown that the scientific community and, subsequently, many governments have been able to agree on the relatively unambitious (although not insignificant) framework convention to mitigate potential effects of climate change. Since the potential range of provisions of the FCCC could be much broader (ranging from continuation of present trends to much more demanding emission reductions), this section highlights - from a broad variety of theoretical and methodological perspectives - how the ultimate outcome and potential future policy trajectories can be evaluated.

The discipline of international relations has long been dominated by analyses of national governments - which are supposed to act as unitary, utility-maximizing actors. In the following Section, we will briefly review these approaches from the perspective of major scholarly traditions - ranging from neorealism to neoliberal institutionalism as well as Marxism (Section 5.2). This Section also forms particular expectations based on these approaches for international climate change policies and compares them with the actual policy record. Furthermore, more recent approaches which accord scientific or epistemic communities an important role in bringing

52. See, for example, the liability issue above.

about internationally coordinated public policies are highlighted. While most of these approaches originally provided only static insights, recent developments in game theory added dynamic considerations so as to improve our understanding of the conditions under which cooperative arrangements persist - or fall apart. Thus, the analysis of supergames (or iterated games) introduced in Section 5.3 builds on a subset of the theories reviewed in Section 5.2 and attends to the prospects of commitment strategies, the role of distrust among actors, and the impact of reciprocity on the prospects of international cooperation.

In many respects, these *largely* state-centric approaches provide an insufficient explanation of GCC policies, and Section 5.4 concentrates on a triad of aspects which many analysts consider to be of major importance in explaining the international response to GCC. The aspects include the

(i) "vertical" disaggregation of nation-states into domestic actors,

(ii) "horizontal" broadening of the actors to be included, namely international organizations and non-governmental organizations, as well as

(iii) equity concerns.

Overall Section 5 is geared to a combination of theoretical and methodological treatment of the diplomatic history of GCC, which was summarized in Section 4. Rather than lamenting the opportunities lost in negotiating the FCCC, Section 5 assists our understanding why major international responses to global public policy challenges appear haphazard for some - and overly ambitious to others.

The FCCC constitutes a good test case to assess the value of the various theoretical approaches that are to be discussed below.

5.2 Major Theoretical Approaches

Ian H. Rowlands

We had already introduced the question of why countries cooperate on protecting the international environment in Section 2. Here we wish to explore some more qualitative scholarly explanations with particular reference to the climate change issue. More specifically, the four approaches that have been most dominant in the post-WWII international relations discipline are examined. The origins, key elements and representative works of each are identified. The expectations for the climate change issue, as generated by the application of each approach, are also presented (see Table 4). Additionally, their respective explanatory utility - as suggested by the progress of the international debate thus far - is assessed. To conclude the subsection, a number of challenges, from both inside and outside the discipline of international relations, are identified. In combination, the elements in this subsection present the state of knowledge from a qualitative perspective on the ways in which international cooperation on climate change might be realized. A more formal approach will be taken in Section 5.3.

TABLE 4.
Major Theoretical Approaches

approach	key concept(s)	hypothesis on interstate cooperation on GCC	evaluation of GCC policy
realism/ neorealism	power and interests; hegemonic stability	major powers determine the international rules of GCC regulation	major powers successfully blocked major GHG emission reduction rules
neoliberal institutionalism	international regimes; institutional factors	international regime on GCC will emerge and assist the strengthening of international rules of GCC regulation	international regime on GCC in existence; premature to judge the effect of international institutions on strengthening GHG emission reduction rules
Marxism	power asymmetries in the world economy	wealthy countries will determine international rules on GCC	partial support, but non-OECD countries do not have to participate in reducing GHG emissions
cognitive approaches	epistemic community	experts with access to decision-makers will strongly influence international rules	hypothesis supported at the stage of agenda setting, not at the stage of concluding international rules of GCC regulation

5.2.1 Realism and Neorealism

For many practitioners of international relations, and within much of the discipline as well, the most influential approach during the first quarter-century after World War II was "realism". Arising as a reaction to the perceived failure of the policy of appeasement (and idealism) during the 1920s and 1930s (Carr 1983), realists argued that international society was anarchical (Bull 1977), being dominated by individual states which were each striving to maximize their own power and security. Because these states were predisposed towards conflict and competition, international cooperation would usually prove elusive, even when the potential benefits of such arrangements were universally recognized. Any cooperation that might occur would most likely take the form of transitory alliances, which would balance the power among opposing blocs of states (see Morgenthau 1973).

During the past two decades, "neo-realists" have developed further many of the basic assumptions of traditional realism (Waltz 1979; Keohane 1986). As part of the neorealist research programme, some scholars have extended the approach from traditional security questions to the international political economy domain. Though still pessimistic about the prospects for cooperation, some scholars have nevertheless argued that international cooperation on world economic dilemmas might be possible if a single actor with superior power exists and is willing to use its power resources (Kindleberger 1973; Gilpin 1975). This actor is identified as a "hegemon", and the theory of "hegemonic stability theory" (Keohane 1980) predicts that the degree of international cooperation will be directly proportional to the degree to which one actor dominates international politics. Acting either benevolently or malevolently (Snidal 1985), the hegemon has the resources

to transform international structures so that coordinated policies result. Work within this tradition continues today, (e.g., Grieco 1990 and Lake 1993).[53]

Applied to the climate change issue, an international relations realist or neorealist would look to the distribution of power among the world's states in order to assess future prospects. Given the nature of the climate change issue, however, it is difficult to ascertain the most appropriate measure of power. Certainly, the possession of military strength could still be relevant: One actor may be able to issue threats and cajole another into changing its activities that contribute to climatic change. Indeed, war has often been used as a means to achieve foreign policy goals related to natural resource issues (Westing 1986). Similarly, "power", defined in economic terms, could well be pertinent: One major actor might threaten to use trade sanctions against a "climate violator," and, if implemented, deprive the target country of welfare. This has already occurred on other environmental issues, for trade restrictions are key components of three major international agreements (Montreal Protocol, Basel Convention, and the Convention on International Trade in Endangered Species of Flora and Fauna). More important, however, may be the ability of actors to use their power to transform environmental resources. Porter and Brown (1991, 44), for example, argue that such a state possesses "veto power" and thus may be particularly influential on environmental issues.

Do realism or neo-realism explain the course of the climate negotiations? First, it has become quite common during the early 1990s to identify the United States as the world's sole remaining superpower. At face value, it might appear that we have a hegemon within the international political system. This, in turn, would suggest that the chances for international cooperation on climate change are high. These expectations, however, have not been fulfilled by events in the real world. Although the USA has been an important individual player in the international politics of climate change to date, it has not used its resources to transform international structures in favor of international cooperation on climate change. Instead, the United States has resisted efforts to reach an international agreement that contains a timetable for greenhouse gas emission reductions. Largely because of the US position, the members of international society could only agree to the ambiguous wording of provisions for capping emissions (FCCC, Article 4(2)) for the 1992 Climate Change Convention (see Section 4.2). In this way, the USA was not a hegemon, per se, but was nevertheless able to block inclusion of certain clauses in an international agreement. Because of the desire for consensus decision-making during the negotiations, the USA occupied the role of a quasi veto power.

Besides the USA, did other actors possess resources sufficient to influence the outcomes unilaterally? The discussion above suggests that any actor that has access to the open access resource (or the ability to destroy that resource) could equally influence international outcomes. Taking emissions of greenhouse gases as an indicator of potential influence in the climate change issue, this suggests that (in addition to the United States) China, Russia, Japan, and Germany (with each emitting at least 4 per cent of the global total) might be able to wield considerable authority during the negotiations (World Resources Institute 1992). In reality, the record is mixed: Though Germany and China have been pro-active during much of the negotiations (working, of course, towards different goals), Russia has been relatively dormant (Nilsson and Pitt 1994), and Japan has not lived up to the leadership expectations that were held by some before the 1992 Earth Summit (Fermann 1993).

53. For a critical commentary, see Snidal (1985).

An analysis of states, on their own, might cause other important sources of power to be overlooked. Together, the fifteen countries of the European Union are another potentially important player. To date, however, internal differences of opinion - e.g., on the utility of a carbon-energy tax - have prevented it from fulfilling this potential role. Using the same logic, other groupings - either formalized (like the G77 of less industrialized countries) or *ad hoc* - could also be potentially important. A number of scholars have suggested that bargaining blocs, supported by different instruments of power, have been (and may continue to be) important during the negotiations (Paterson and Grubb 1992; Hampson 1989-90; Sebenius 1991; Young 1993).

5.2.2 Neoliberal Institutionalism

While the power of states is the most important explanatory factor in the anarchical world of neorealists, especially in the field of international security, "neoliberal institutionalists" have mainly focused on explaining the emergence of cooperation in the field of international political economy, including the field of international environmental policy. Neoliberal institutionalists insist that - besides the role of national governments in international relations - international institutions play an important role either by (i) intervening between "basic causal variables" (power and interests), on the one hand, and behavior and outcomes (inter alias, international environmental agreements), on the other hand, (ii) being simultaneously caused with behavior and outcomes by the "basic causal variables," or even (iii) being a causal variable by themselves (Krasner 1983a; 1983b).

The resurgence of international institutionalism became most prominent under the label of "international regimes" which have been most commonly defined as "sets of implicit or explicit principles, norms, rules, and decision-making procedures around which actors' expectations converge in a given areas of international relations" (Krasner 1983a, 2). Since this definition is rather broad (and ambiguous in delimiting if phenomena fall under the rubric of international regimes in empirical research), it both includes formal international governmental organizations (IGOs, see Section 5.4.2) as well as regularized forms of policy coordination in a specific issue area (Young 1989a).

International institutions, it has been argued, will provide a network of interactions which "once established, will be difficult either to eradicate or drastically to rearrange" (Keohane and Nye 1989, 55) - a position which is in stark contrast to neorealist predictions which belittle the independent role of international institutions and largely describe them as an instrument at the disposal of powerful countries. Thus, while major powers may provide international regimes as a public (and a partially private) good, these institutions are likely to outlive the eventual decline of the countries which originally created them (see Keohane 1984). This permanency adds predictability to the interactions among nations, especially. by providing or creating, some or all of the following:

- public and government concern for an international problem, such as global climate change,
- physical and logistical facilities,
- rules of interaction or procedure (a public good by itself which reduces the costs of interaction),
- enhancing the time horizon for interaction (thus reducing the scope for being exploited in sequential interactions),

- resources for operational and redistributive purposes (e.g., technology transfer or interregional redistribution of costs),
- information provision, validation, intercalibration, and dissemination,
- creation of property rights,
- linkage of issues (i.e., enhancing the prospects for arriving at international agreements),
- monitoring of compliance with agreements,
- enforcement mechanisms (including negative media attention, trade sanctions, etc.) (see Axelrod and Keohane 1986, Haas Keohane and Levy 1993, Jacobson 1984, Krasner 1983b).

These factors, in combination, suggest that we should expect good prospects for an international regime for global climate change to emerge, and that after its creation, institutional factors (see above) will substantially enhance the probability for arriving at international rules which will mitigate global climate change.

International non-governmental and governmental organizations, especially the WMO, UNEP, and IPCC, have been powerful in setting the international agenda and provided the informational context in which national positions were formulated. However, as Section 4.1 has argued, national governments became active players by 1990 with the creation of the INC. In turn, the INC can be seen as a bargaining forum created by the UNO - thus highlighting the role of international organizations in the process which eventually led to the conclusion of the FCCC. However, beyond providing a forum for bargaining, information and resources for the reporting requirements of less industrialized countries, did organizational variables substantially influence the basic rules of the international climate regime?

First, it seems premature to judge on these issues because the international GCC regime is still at a relatively early stage of its potential trajectory (see Section 7). Second, at the time of writing, it appears that governments could not be easily pushed to accept positions beyond their own proclaimed self-interest, as the USA could essentially avoid the introduction of provisions for substantial emission reductions and non-OECD countries were quite successful - for equity reasons (see Section 5.4.3) - in avoiding an undue burden being imposed on them. Even the discussions at COP-1 point more towards prolonged, incremental interactions, with the FCCC's Secretariat providing important information and monitoring functions, but even the absence of agreed upon rules of procedure point to the fragility of the impact of institutional factors on interstate GCC policies. This is also highlighted by the designation of the GEF as the holder of the financial instrument of the FCCC - outside the immediate scope of the organizational structure of the FCCC, but linked to the Convention. Furthermore, in case the international community makes only very incremental progress towards more stringent rules on pollution emissions in the future, it will become rather difficult to decide if factors associated with international institutions rather than properties of countries will explain this effect.

In conclusion, it remains premature to comprehensively assess the validity of liberal institutionalist reasoning in the field of GCC. However, the creation of the FCCC and the GCC regime is certainly supportive of aspects of neoliberal institutionalist reasoning in international relations.

5.2.3 Marxism

The third approach identified in this section has not attracted as much attention in the field of international relations, particularly within the United States. Labelled, among other terms, "Marxism" or "historical materialism," this approach comprises diverse authors and ideas. Most authors are united by their concentration upon economic relations within a global and historical context. They agree that international cooperation can be explained by concentrating on the most powerful actors within the capitalist world economy (a system which favors wealthy, industrialized countries). Consequently, only those problems (Palma 1981) which do not endanger the world capitalist system will be dealt with (see Lenin 1939; Amin et al. 1982). As a consequence, the rules of international "cooperation" will reflect the interest of the industrialized "North" at the expense of the "Southern" less industrialized countries. Indeed, one highly-visible strand of Marxist writings, namely dependency theory, concluded that Northern domination and exploitation of the South continued during the so-called "post-colonial period." As compared to colonial times, political domination was replaced by economic influence.

With respect to Global Climate Change, Marxists encourage us to look at the relationship between "environment" and "development" in international negotiations. Interests defined along the North-South axis and questions of equity, subjects heretofore overlooked in many studies of international cooperation, are the subject of much scrutiny by Marxists (see also Section 5.4.3).

Applied to the climate change issue, it has to be noted that substantial disagreements between industrialized and less industrialized countries emerged in the negotiations on the FCCC. Debates about the size, composition and governance of any resource transfers have been especially heated. Marxists argue that, as predicted, the North-South arrangements that have been concluded have reflected the interests of the capitalist, industrialized countries. For example, the international funding mechanism concerned with North-South transfers on climate change, namely the Global Environment Facility, gave the impression that less industrialized countries posed a major problem for regulating GCC, not the industrialized countries (Tickell and Hildyard 1992). A more appropriate focus on the GCC emissions of the OECD countries has in this way been effectively diverted (Sklair 1994).[54]

Marxist analyses nevertheless still encounter difficulties. On the climate change issue, the interests of industry do not consolidate to the extent suggested by these theorists. Some industries - for example, coal - feel distinctly threatened by the possibility of emission reduction goals. Others - for example, renewable energy technologies - see it as a commercial opportunity. Even within something as relatively restricted as "the fossil fuels industry", views differ. The petroleum industry is certainly being challenged, but natural gas, at least in the short-term, may find its global appeal heightened. Finally, nuclear power evokes polarized views, but for different reasons. Indeed, negotiating coalitions on the climate change issue have often cut across the North-South divide: The United States has sometimes been allied with oil-producing and exporting states, and the more environmentalist Europeans have often had more in common with AOSIS rather than with other OECD countries.

54. For other critiques along Marxist lines, see Lipietz (1992); and Tanzer (1992).

5.2.4 Cognitive Approaches

A fourth set of approaches directs attention to the ways in which actors receive, process, interpret and adapt to new information about their environment and about each other. Cognitive factors, its proponents argue, are the keys to understanding the decision-making process. Those who are perceived to have control over knowledge or privileged access to it are highly valued during times of political uncertainty and may be given greater access to decision-makers. Therefore, to explain international cooperation on pollution abatement, one should look to those who control knowledge and the ways in which they interact with decision-making circles. Although such theories have gained significant prominence only relatively recently, the basic ideas date back to the "inter-paradigm debate" of the 1970s and 1980s (Banks 1985; Deutsch 1966; Steinbruner 1974). In response to recent critiques that their explanatory value had yet to be fully explored (Keohane 1989; Young 1992), cognitive approaches have been more widely used during the past couple of years (Haas 1992). In particular cognitive explanations have attracted considerable interest among those studying international cooperation on environmental issues, because environmental issues, including GCC, are often remarkably complex, accessible only to those with expertise in particular branches of the natural sciences. Consequently, considerable reliance may be placed on experts to assist policy decisions, and the cognitive approaches suggest that transnational networks of scientists and policymakers would exert particularly strong influence on writing international rules.

Has this expectation been fulfilled? It has - to some extent. As the scientific consensus on climate change has developed over the past four decades, members of the "epistemic community"[55] have been important in setting the political agenda. As has been shown in Section 4, these environmentally-orientated scientists were instrumental in raising the climate change issue. With close links to WMO and UNEP, they acted as "knowledge brokers", helping to translate and publicize the emerging scientific knowledge about global warming through various means (Lunde 1991).

But the influence of the epistemic community has effectively been curtailed since 1988. In that year, national governments became more strongly involved in the climate change issue - most importantly, by forming the IPCC. As a consequence, the participation of most atmospheric scientists became subsumed under this intergovernmental umbrella. Science was still important as the IPCC effectively became the "scientific supreme court" in the climate change issue, but the independence of the community may have been sacrificed (Boehmer-Christiansen 1994).

5.2.5 Challenges

The above classification of the major contributions to the international relations discipline is by no means unchallengeable. Some would argue (for good reason) that the boundary between the work of the Marxists and the cognitivists may be more illusionary than justified (Cox 1977). Additionally, the traditional dominance of the first two sets of theories (Krasner 1991) may mean that they should have an elevated position or lessened position (both because of their tradition) in this typology. Critical theorists and post-modernists, meanwhile, would lament these efforts to classify different approaches, and argue that post-Enlightenment Western thought itself is in crisis

55. Epistemic communities are transnational networks of knowledge-based communities that are both politically empowered through their claims to exercise authoritative knowledge and motivated by shared causal and principled beliefs' (Haas 1992, 41).

(Brown 1994). For their part, gender analyses in international relations also have difficulties with these traditional categories (Tickner 1992).

Beyond the borders of the discipline, as defined by academic structures, challenges also arise. Many argue that, in order to explain world events, the study of the state system should not be privileged to the extent that it is by the mainstream of scholarship in international relations. The international system of states is but one set of social relations that have global breadth. Consequently, any efforts to understand what we have (perhaps mis-)labelled international relations must be cognizant of the whole range of social relations, including global commodity production and exchange and global culture, which together make up world society (Shaw 1994; Sklair 1994). Leading logically from these efforts to conceptualize a global sociology, many focus upon social movements as key agents of any change (Yearly 1994), an analysis that has particular relevance for international environmental issues (Gerlach 1991). Finally, cultural theorists have argued that multiple rationalities can simultaneously exist (for the case of sustainable development, see Thompson 1993). They maintain that the "participation of governments in treaties is likely to be influenced by the relative strengths of each type of institutional culture in the national decision-making arena as well as by the more obvious factors of political and economic self-interest" (Rayner 1991, 92). In these ways, challenges are forthcoming from a variety of directions.

This section has reviewed the state of knowledge with respect to the ways in which international cooperation on climate change might ensue. To this end, brief synopses of the major approaches within the international relations discipline have been presented. Each of the four perspectives seems able to offer some explanation as to the developments to date of the international negotiations on climate change. This suggests that each may be able to offer insights. At the same time, however, each approach encountered its own particular anomalies, which it was not able to explain adequately. This suggests that faith should not be exclusively placed in any one approach. Finally, a range of challenges to the four main approaches were offered, revealing the debate is not only lively, but also highly multidisciplinary as well. Indeed, though substantial differences of opinion persist, academic activity has advanced our knowledge about the processes associated with the realization of international cooperation. This is of great utility as policy-makers and scholars continue to confront the challenges of climate change.

5.3 Formal Approaches

(Hugh Ward)

Game theory has been used by several authors to theorize about the possibilities of international environmental cooperation (e.g., Taylor and Ward 1982; Livingston 1989; Livingston and von Witzke 1990; Mäler 1990; Hoel 1991; Ward 1993; Soroos 1994). However, relatively little has been written with specific and detailed application to the global climate change problem. In the following, we will present a simple iterated model from a game-theoretic perspective ("supergame"), apply it to global climate change, relate the model to the debate between realism and neo-liberalism about the role of institutions, and finally raise some issues of institutional design.

5.3.1 The Supergame Model

It has been widely recognized that the one-shot games (see also below) are inadequate models of international cooperation, although they provide important metaphors for certain forms of collective action failure at the international level (Keohane 1984, ch. 5; Snidal 1986, 48). Even if an international agreement has been signed, the possibility that some countries may overtly break away from it or more or less covertly fail to implement it remains a clear possibility. Thus nations should be pictured as having repeated opportunities over time to make decisions about whether or not to cooperate. They play so-called "supergames" in which they repeatedly play a one-shot game - with the number of rounds being infinite or uncertain. For clarity of presentation, we assume in this Section on formal approaches that cooperation refers to positions favoring GHG emissions reductions and vice versa.

The basic idea of the model is that the players choose strategies so as to maximize the sum of their own supergame payoffs through time. In calculating this sum, future payoffs weigh less heavily, i.e., they are discounted. A supergame strategy consists of a plan of how to play in each future round given every pattern of play which could have preceded that round. For a formal statement of the supergame model, see Table 5.

The key to cooperative collective action in supergames is the possibility of making the choice of cooperation conditional on the *past* cooperation of others (Taylor 1987, ch. 3). If others did not cooperate in the past, this triggers retaliation in the form of refusal to continue to cooperate in the future. Conditionally cooperative strategies of this sort embody threats. If the penalty is large enough, it may pay others to conditionally cooperate. In the context of global climate change, an example of such a strategy might be that the European Union (EU) would press ahead with cutting GHG emissions as long as the other major industrialized economies were doing the same; but if they failed to cooperate in this way, the EU would switch its strategy, i.e., it would abandon its plans to make further emissions cuts. It is important that the threat built into conditional strategies is credible, which places restrictions on plausible strategies and equilibria (Fudenberg and Tirole 1991, ch. 5).

TABLE 5."The Supergame Model"

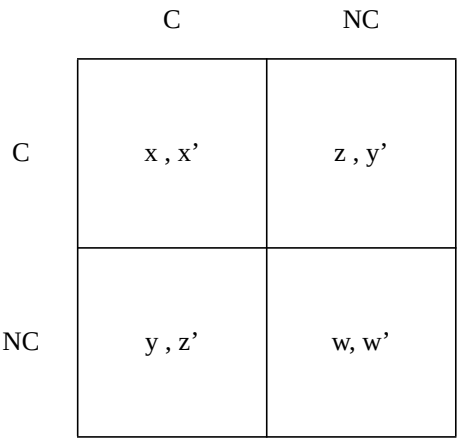
The game matrix in Figure 2 may represents row and column's payoffs whether they have Prisoners' Dilemma (PD), Chicken or Assurance preferences. For PD the ordering of the payoffs is as shown in the diagram. If $y > x > z > w$ the player has PD preferences. If $y > x > z > w$, the player has Chicken preferences. If $x > y$ and $w > z$, the player has Assurance preferences. There are two versions of Assurance depending on whether $w > y$ or $y > w$. The players play an infinite number of rounds of the game, discounting future payoffs. For row from the perspective of round 1, a payoff of "p" gained in round "t" is worth $d^t p$, a smaller value of "d" meaning heavier discounting of future payoffs. Column's discount parameter is d'. Players aim to maximize the discounted sum of their payoffs in each round, taken over the infinite number of rounds. Thus, for example, if both players cooperated in each round, row's supergame payoff is

$$\lim_{t^* \to \infty} \sum_{t=1}^{t^*} (dx + d^2x + d^3x + \ldots + d^{t^*}x) = \frac{dx}{1-d}$$

and column's supergame payoff is $\frac{d'x'}{1-d'}$

To illustrate these conclusions, it is assumed that negotiations are bilateral or that two groups of countries contemplate the merits of mutually beneficial agreements. Call the groups or blocs "row" and "column." Each side has two strategies - to cooperate in some measure which it is believed will help stabilize the global climate (C) or not to cooperate (NC). Suppose for the moment that both countries favor "NC" over "C" regardless of the strategy chosen by the other country and the game is played only once - a one-shot (or single round) game (see Figure 2). The resulting equilibrium for this Prisoners' Dilemma game is where both players choose NC. Pareto - efficient outcomes are such that there is no alternative which is better for one side without making the other side worse off. Thus, the outcome is not efficient in this sense. As in Hardin's tragedy of the commons (Hardin 1977), there is a collective action failure in which the rational pursuit of interests leads to an inefficient outcome. While this analysis concerns often the national level, it can also be carried out at the group or political movement level. For instance, Hillman and Ursprung (1992) show how policy coordination between environmentalist green movements can take a Prisoners' Dilemma type form and how this inefficient outcome can sometimes be overcome.

In a so-called Chicken game, it is rational for "row" to choose (i) NC if "column" chooses C and (ii) C if "column" chooses NC. Column has the same preference pattern. There are two equilibria in pure strategies, and in each of these one side plays C and the other side plays NC. Each side has an incentive to commit to NC in order to "hijack" the other side into cooperation (Schelling 1960, 22-26). It can be expected that each side will be tempted towards brinkmanship, only "swerving" at the last minute, if at all, away from the strategy NC. It is possible that one side will swerve, so that the equilibrium is reached where one side free-rides and the other cooperates. However, the danger is that both sides cannot reverse commitments from NC to C, again leading to a collective action failure. It has been argued that Chicken is an example of a 'dilemma of common aversion' in which the key problem is that of coordinating strategies so that one of the equilibria - which all sides agree is better than both sides not cooperating - emerges (Stein 1982, 299-324). While coordination is crucial, to characterize Chicken and related games with multiple equilibria in this way ignores the potential dangers of commitment tactics and brinkmanship.



Where y > x > w > z and y' > x' > w' > z'

Figure 2: The one shot Prisoner's Dilemma Game payoff matrix

Beside the Prisoners' Dilemma and Chicken games discussed above, some other one-shot games have also been found helpful in general discussions of international cooperation (Oye 1986, 6-9). One important alternative to Prisoners' Dilemma and Chicken is "Assurance", in both variants of which it is rational to choose C if the other side chooses C, and to choose NC if it chooses NC. In the one-shot game, we say that a player has

(i) Prisoners' Dilemma (PD) preferences if it always prefers NC - no matter what the other side does;

(ii) Chicken preferences if it prefers NC if the other side chooses C, and C if the other side chooses NC; and

(iii) Assurance preferences if it prefers NC when the other side chooses NC, and C when the other side chooses C.

One-shot games in which the two sides have different preference patterns are a plausible possibility, too (Taylor 1987, 52-55). For instance, one side might have Chicken preferences and the other side PD preferences.

The one-shot game underlying the supergame may take a number of different forms when each player has either PD, Chicken, or Assurance preferences. Nevertheless, perpetual cooperation can typically only be sustained by conditional strategies. (The exception is the case in which both players have Assurance preferences.) Consider a case where players are conditionally cooperating. Suppose one side considers free riding, i.e., not cooperating in some round. In the next round and in some subsequent rounds, the other side would punish it by changing to NC. Whether it would choose to stick with its original strategy of conditional cooperation in the face of this threat depends on

(i) the short-term benefits from free-riding versus

(ii) the long-term costs to itself if cooperation breaks down.

In turn, the long-term costs depend on how much weight is attached to the future payoffs relative to current payoffs, i.e., it depends on how heavily future payoffs are discounted. If

(i) gains from short-term free-riding are low,

(ii) penalties per-round from the breakdown of cooperation are high, and

(iii) payoffs in future rounds are not too heavily discounted, there will be an equilibrium in which everyone conditionally cooperates.

Variation in these factors across issue areas and across time may help explain differences in levels of cooperation (Lipson 1984; Axelrod and Keohane 1986). For example, it is often suggested that it was easier to achieve cooperation in relation to stratospheric ozone depletion than it will be in relation to global warming because the total economic costs of abatement are much higher in the second case.

The conditionally cooperative equilibrium is never the only one. For instance, if the game being repeated is Prisoners' Dilemma, non-cooperation is always an equilibrium; and if the game being repeated is Chicken, the picture is not fundamentally altered, since the two possible patterns in which one side free-rides on the other through time are always equilibria. In fact, if any Pareto - efficient outcomes are equilibria, there will generally be an infinity of equilibria, as we will now illustrate.

Suppose that two blocs of countries repeatedly play the Prisoners' Dilemma game shown in Figure 2. Then the feasible payoffs for the supergame all lie within the shaded region of Figure 3 (Fudenberg and Tirole 1991, 152-153). The average payoff per-round if both blocks always fail to cooperate is w for row and w' for column. These payoffs are the security levels of each side: No matter what happens, they can never get a lower payoff even if the other side is carrying out a threat against them because of their failure to cooperate. The "Folk Theorem" (so called because no one can recall who first proved it) shows that each payoff point in the shaded region can be an equilibrium as long as each bloc puts a high enough weight on future payoffs and each side gets more than its security level (see Fudenberg and Tirole 1991, 153-155). The intuition is that, as long as sufficient weight is placed on future payoffs to make the punishment substantial and if it lasts long enough, the threat to drive payoffs down to the security level will deter both sides from breaking away from any pattern of play.

For some, the existence of multiple equilibria calls into question the explanatory power of game-theoretical approaches. It may be necessary to resort to an institutional or sociological account of equilibrium selection (Keohane 1988, 387; Sebenius 1992, 348). In fact, the existence of multiple equilibria gives explanatory insights into bargaining tactics! The existence of multiple equilibria and conflict of interest over which of those equilibria is best, in combination, generate incentives to use commitment tactics. Just like in a one-shot Chicken game, each actor will try to reach an equilibrium with the highest possible payoff. This can be illustrated as follows. Point p1of Figure 3 is associated with each side cooperating in every round, getting average payoffs of x and x' for row and column respectively. At p2, row cooperates less often. For instance it might start cooperating after column does, free riding for a number of rounds on column's actions before it is willing to resume to cooperate. At p3, column gets a higher payoff than at p1. Row prefers p2 to p1 to p3; column prefers p3 to p1 to p2. Suppose each of these payoff points can arise in equilibrium. Then row might try to get p2 and column might try to get p3, each side committing to delaying cooperation until after the other had moved, for instance. The threats implicit in these strategies of both sides may be triggered, resulting in a worse-all-round outcome in which only security level payoffs of w and w' are enjoyed. This is analogous to the "collision" which occurs in one-shot Chicken games when both sides are committed to non-cooperation. It has been argued that repeating an underlying Chicken game increases the dangers of non-cooperation, because it creates incentives to build and maintain a reputation for toughness (Oye 1986, 14). Actually, the same arguments apply to other cases, including the Prisoners' Dilemma game.

Beside the general commitment problem, there is also a general problem of *distrust* in iterated games of qualitatively the same sort as in a one-shot Assurance game. In the one-shot Assurance game, there is a potential problem of distrust (Sen 1969; Ward 1989, 274-275): In order to cooperate, each side has to be assured that the other will also do so. If they believe that there is a large enough probability that they will not, it may be rational to choose NC rather than risking the worst outcome in which you cooperate and the other side free rides. Distrust on both sides may be so high that each "plays safe" by choosing NC. In the supergame, the same problem arises. Assurance may be lacking, because it is suspected that the other side's declarations of intent to cooperate are a tactic to lure the other actor into cooperation with a view to getting a short-term free ride. For instance, the outcome in which both sides always defect must be an equilibrium if the underlying game is Prisoners' Dilemma. Even if players suspect that cooperation in every round is stable, distrust may prevent cooperation from occurring (Ward 1989, 281). The general problem of distrust can arise in other cases, too. "Relatively uncooperative" equilibria may exist

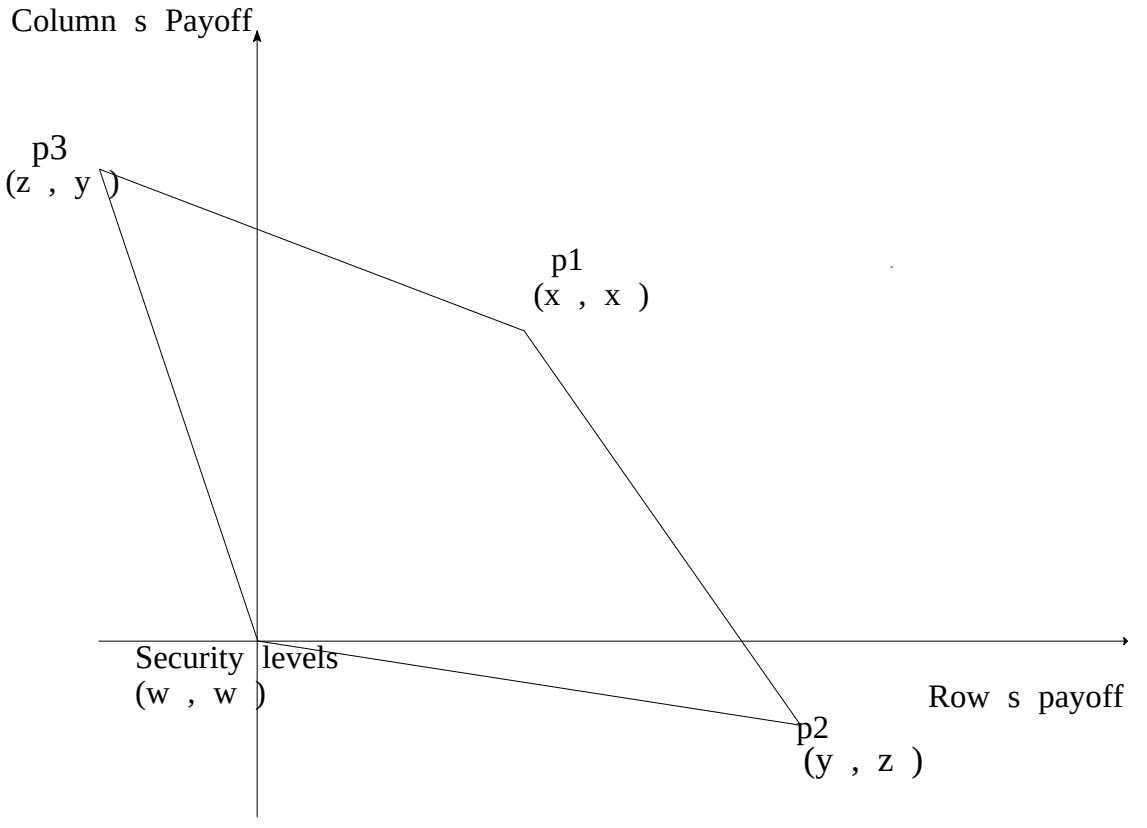


Figure 3: Feasible Average Payoffs

which are worse-all-round than "more cooperative" equilibria; and distrust may lead to collective action failure.

5.3.2 Applying the Supergame Model to Global Climate Change

Despite its simplicity, the supergame model provides useful insights into global climate change. Many of the conclusions carry over when the model is made more realistic. For instance, there are clearly multiple levels at which nations could cooperate in relation to global climate change, so that the choice is not the binary one of "cooperate" versus "not cooperate." Emission levels could range from further increases, through a freeze, the 20% cuts discussed at the Toronto Conference, to the 60 to 80% cuts advocated by the IPCC for the long term. In addition nations might agree to varying degrees of resource transfers to facilitate monitoring and joint implementation, or varying degrees of transfer of control of policy implementation to international agencies. Yet the problems of shortermness, commitment, and distrust identified in the binary choice supergame model are still predicted to exist so long as:

- there are several discrete levels of cooperation;
- the outcome where all sides cooperate to a high degree is among the efficient outcomes; and
- the outcome where all sides cooperate to a high degree is not necessarily an equilibrium.

One interpretation of the current state of play in relation to global climate change politics is that there has been a collective action failure. It is true that, on paper, signatories to the FCCC appear to have moved beyond the cooperative zero point. Moreover, some nations will probably go further, developing policies actually to cut their emissions of greenhouse gases. Even supposing that nations intend to carry out their current commitments, the equilibrium is one where the level of cooperation is generally low, and a case can be made that all round cooperation at a higher level would be a good collective insurance policy against the risks of global warming. Also many nations seem to be forgoing national benefits from "no regrets" energy efficiency policies. This seems irrational at first sight, yet it may be explained by the desire to gain a reputation for doing little with a view to getting an outcome closer to their national interest in the long term.

The supergame model identifies heavy discounting of future payoffs and uncertainty about benefits as likely causes of the low level of cooperation. Politicians discount future payoffs particularly heavily, because their focus is on the short-run dynamics of support and the reaction of capital markets in which heavy discounting of future investment returns are the norm. The problem of shortermness is exacerbated by a time pattern in which the financial and other benefits from current cooperation arise in the future. Also uncertainty about the level of future benefits makes risk-averse decision makers less prone to take gambles to get them.

While recognizing the limitations of the FCCC, some see it as a first step to a solution - analogous to the process leading ultimately to the Montreal Convention. The hope is that levels of cooperation will gradually be increased as scientific certainty and trust between nations increases (e.g., Lang 1993, 18-19). Distrust is clearly a problem in relation to global warming just as it was in the case of stratospheric ozone depletion (Ward 1993, 205). From the viewpoint of supergame analysis, a graduated reduction in tension strategy (e.g., Osgood 1979; Ward 1989) may be a way to get from the status quo to a more efficient equilibrium. Nations may be willing to increase their level of cooperation once they see others actually reciprocating cooperation at the current level. Theory suggests that it may pay to make cooperative probes, pushing somewhat further than others to gain valuable information about whether they will reciprocate (Ward 1989). The unilateral policy initiatives to cut emissions of greenhouse gases entered into by some states may be interpretable in this way, although playing to domestic electoral sentiment and seeking energy efficiency gains are alternative explanations.

Comparing the likely direct abatement costs measured, for simplicity, as the share of Gross Domestic Product (GDP) committed to emission reductions, some nations are currently cooperating more than others. This might be due to the unilateral pursuit of "no regrets" policies by some and the lack of such easy gains for others. However, the supergame model suggests another explanation: We ought to observe nations committing themselves to relatively low levels of cooperation in order

(i) to try to bring about a pattern where they currently do relatively little and

(ii) to build and to maintain a reputation for tough bargaining.

The actual use of commitment tactics lends some support to this idea (Ward 1993, 203-204). For instance, while the CANZ group was willing to take the first steps of setting targets and timetables for stabilizing emissions of greenhouse gases in the late 1980s, the Bush government of the USA (as part of a block which then included Japan and the former Soviet Union) committed itself to do little in the short term by denying the existence of sufficient scientific evidence. The USA then

ensured that no specific timetables were written into the FCCC. Even under the more environmentally active Clinton/Gore administration, the difficulty of steering anything but the most anodyne legislation through Congress effectively binds the USA to relative inaction, even though the administration has proposed a plan for stabilization within a definite time frame. The member states of the EU may move more rapidly. However, there are currently difficulties in the EU over burden-sharing and the carbon tax, partly due to the United Kingdom (UK) committing itself to the position that it will not pick up any of the burden of poorer member states. Again, the Rio Earth Summit saw potentially important actors like Brazil, China, and India committing themselves to inaction unless the North paid a substantial part of the abatement costs. Thus, one incentive to build a reputation for toughness is, over time, to remain part of a larger bloc which can *avoid* major abatement costs.

When all sides are committed in such a way that collective action failure is likely, the worse the "collision outcome" resulting from non-cooperation (relative to joining in cooperation) the more likely a nation is to back down by switching to cooperation. Nations that stand to lose little from failure or can make others believe they see things in this way are in a powerful bargaining position. Whatever the degree of impacts of climate change in the less industrialized countries, the bargaining power of this group will be enhanced if the strenuous attempts it made in the process of negotiating the FCCC to convince others that it was relatively unconcerned about failure actually work.

5.3.3 Game Theory, International Regimes of Cooperation, and Dilemmas of Institutional Design

While some liberal institutionalist come close to seeing international law as binding, others have moved closer to the realist assumption that the world is in some sense anarchic (Waltz 1979, 103-104; Oye 1986, 1-2; Grieco 1988, 295). However, even if the international system is anarchic, states can cooperate together with the assistance of international regimes. Regimes of cooperation consist of formal and informal institutions, shared principles, norms, rules, rights, and decision-making procedures (Krasner 1982, 185; Young 1989a, 12-13 and ch. 2; List and Rittberger 1991, 89-90) and can provide more favorable circumstances for the existence of conditionally cooperative equilibria, even though they cannot enforce binding agreements. Neo-realists agree that regimes help solve collective action problems, but they are generally more pessimistic about the extent and stability of cooperation (Grieco 1988, 493; Baldwin 1993, 5).

Regimes constrain interdependent decision-making in a way which makes inefficient outcomes less likely by coordinating actions and fostering various forms of collaboration (Stein 1982). First, regimes may alter the incentives to free ride by threatening to reduce the payoffs for free riders (Axelrod and Keohane 1986; Oye 1986, 9-11). Second, they provide an institutional context within which a reputation for trustworthy cooperation and for carrying out threats can be built up and then "cashed in" both in future rounds and in related bargaining forums (Young 1989a, 75). Third, monitoring arrangements are typically built into the regime (Levy, Keohane and Haas 1993, 402-3), and this encourages conditional cooperation by making free riding more visible (Oye 1986, 17; Lipson 1984, 8). Fourth, diplomatic activity on the part of the secretariats of institutions associated with regimes may help to dispel distrust and increase the capacity of nations actually to meet commitments (Levy, Keohane and Haas 1993, 405-407). Even if a regime has no current value, nations may maintain it because the regime may be useful in the future or

because it has attained legitimacy in its own right (Stein 1982, 315-316; Keohane 1984; Young 1989a, 26).

At first sight, there appears to be a major difference between neorealists and liberal institutionalist, because the former emphasize payoff differentials while the latter emphasize absolute payoffs (Powell 1991, 1303-1304). Neorealists argue that liberal institutionalist are too optimistic about the possibilities of cooperation, because they ignore relative gains (Grieco 1988). One has to realize however that the relative gains perspective opens up difficult issues of inter-actor comparison of utilities which might be better treated in the form of a classical but non-cooperative game perspective. While some have argued that negotiations over environmental problems do not involve relative assessments of payoffs (List and Rittberger 1991, 93-94), this would probably seem implausible to neorealists in the light of the economic and strategic implications of the very large flows of resources involved in, for example, moving away from a fossil fuel economy. One argument is that relative payoffs count, because they translate into differentials in future power capacities to remain secure and to alter outcomes (Waltz 1979, 105; Powell 1991, 1312).[56] Thus they affect long-run absolute payoffs. The weight placed on relative payoffs goes up in times of uncertainty and insecurity (Grieco 1988, 498), an argument which may well become pertinent if the fears of some authors about the adverse effects of climate change on international security are realized (Homer-Dixon 1991, 76-116).

Too much can be made of the apparent difference between the two sides over relative gains. Liberal institutionalist regard regimes as normative orders (Jervis 1988, 342-45; Weale 1992, 206) in which considerations of fairness have a major impact on states' behavior (Stein 1982, 316; Krasner 1982, 187). This inevitably implies that comparisons between payoffs and relative deprivation matter to nations, as the discussion of equity in Section 5.4.3 suggests. Albeit for different reasons, neorealists and liberal institutionalist both need to take the relative gains issue seriously.

As relative payoff differences become more and more important, the conditions under which conditionally cooperative equilibria generally exist become more restrictive (Powell 1991, 1313-1314; Nicholson 1994; but cf. Snidal 1991, 711-718). As time goes by, an asymmetric equilibrium in which some are perceived as cooperating to a much greater extent than others will provoke greater concern for relative gains: It will eventually become apparent that some nations do not honor their obligations. As in the case of burden-sharing in NATO (Olson and Zeckhauser 1966), there may be growing domestic perceptions of unfairness in nations which shoulder a large part of the collective burden or explain what they are.

This argument suggests that it is important to try to design international regimes in such a way that they steer attention away from asymmetric equilibria and towards equilibria in which no major player gains in relative terms. Bounded rationality may make it difficult if not impossible for players to know what the full range of equilibria is or what the best response to others' current strategy is (Simon 1982). If liberal institutionalist are right to suggest that international regimes can steer the agenda in relation to problems in the global commons (Keohane, Haas and Levy 1993, 12; Weale 1992, 198-200), they may also be able to produce equilibria in which the relative gains perspective is not as much of a problem as a focal point for bargaining (Schelling 1960, ch. 3; Levy, Keohane and Haas 1993, 414; Weale 1992, 194). While formal theory illuminates the problems here, the question of what ought to be, or might actually be, considered a fair outcome is

56. The relative gains argument assumes the possibility of interpersonal comparisons of utility.

treated in more detail in Section 5.4.3. Despite the prominence of the North-South split in the politics of global climate change, there are arguably more than two bargaining blocs, and there is evidence that the coalition structure shifted both before and during the Earth Summit (Paterson and Grubb 1992, 293-310; Nilsson and Pitt 1994, ch. 6; Mintzer and Leonard 1994, ch. 1). A split emerged in the Northern bloc between the USA and other nations, the picture being further complicated by the fact that the U.K., to name one example, often seemed to be close to the USA position. Also newly developed economies with large fossil fuel reserves and forests like China, Brazil, the OPEC countries, and India took a tougher line than others in the South, notably the AOSIS group. However, the conclusions reached from supergame analysis tend to be strengthened if there are more than two blocs of players. Firstly, the commitment problem seems to be even more likely to arise. When the underlying game is a version of Prisoners' Dilemma (Taylor 1987, ch. 4) or a version of Chicken, there is typically a multiplicity of equilibria where some players always free-ride and some cooperate in every round. There are additional dangers in attempts by nations to free-ride permanently by using commitment tactics when increased numbers make the commitment scramble even more chaotic. Increased numbers also pose difficulties for regimes: Problems of mistrust are more likely to arise as the number of players goes up, because the amount of information necessary to be assured that your cooperation will be reciprocated increases; it becomes more complex and difficult to apply conditional sanctions (Axelrod and Keohane 1986, 237; Oye 1986, 19); transaction costs in deal making rise (Oye, 1986, 19); the (second order) collective action problems surrounding who should punish defectors become harder to solve (Axelrod and Keohane 1986); and under provision of compliance mechanisms becomes more likely (Young 1989a, 21).

Another reason for pessimism about the chances of collective action in relation to global climate change as compared to the stratospheric ozone depletion problem is the relatively large number of major players in the global warming game. The arguments relating numbers of players to successful collective action make it tempting to go for a less inclusive regime than the one constructed at Rio - or a "fast track" option within the existing convention. Relatively small numbers of like-minded countries (probably members of the OECD, with the USA being a less plausible member of the group) could push cooperation among themselves to relatively high levels (Andresen and Wettestad 1992, 277-278; Sebenius 1994, 311-314). The assumption is that once a high level of cooperation is firmly institutionalized, other countries would be pulled in. However, there is no good reason from a game-theoretic perspective to suppose that the coalition would eventually grow to include all the significant players, as is typically assumed. Given that there are likely to be equilibria where some nations cooperate and others never cooperate, a point will be reached where it does not pay additional nations to join the group of ambitious pollution reducers. It might be possible to break such a pattern of the non-growth of the cooperative group by using trade sanctions against those outside the cooperative coalition (Sebenius 1994, 313), but this would require an amendment of the General Agreement on Trade and Tariffs (GATT) or the World Trade Organisation (WTO). Once it becomes apparent that asymmetric cooperation is permanent, the relative gains effect may arise, leading to the erosion of the cooperative coalition. With more than two players, conditionally cooperative strategies are liable indiscriminately to punish both defectors and cooperators, so that their activation may provoke a general breakdown in cooperation (Oye 1986, 20). The dilemma for institutional design (see Section 6.2 for a broader treatment) is

- short-term progress is highly desirable given irreversibilities in the damage being done to the global commons;
- such progress may be more likely with less inclusive deals among like-minded countries; but
- stable cooperation in the long run may require taking the grave risk of holding out for an inclusive deal where all major players are perceived as pulling their weight.

Neorealists and liberal institutionalists also disagree about the role of leadership in regimes. While some realists associate leadership with superpower hegemony and see hegemony as a necessary condition for cooperation, for some liberal institutionalists leadership can be provided even in the absence of a hegemonic power in the international system and leadership is just one factor among others increasing the likelihood of cooperation (Keohane 1984; Snidal 1985; Young 1991a, 286-287; Weale 1992, 201-202). On both sides, there is acceptance that leadership is potentially important to the success of regimes. Leaders may provide or distribute selective incentives which go only to other countries which cooperate (Young 1991a, 288-93). Regimes typically produce an array of private goods as well as public goods, and these can be selectively directed to ensure compliance, either by leaders or by regime institutions (Young 1989a, 72; Levy, Keohane and Haas 1993, 400-401). In the context under discussion these private goods might include technology transfers, payment of monitoring costs, and loans to fund transitions to less polluting technologies. Also leaders with entrepreneurial skills can put together attractive packages of policies across different issue areas (Young 1991a, 293- 298). The idea is that players with different perceptions of the importance of issues can be induced to trade concessions on areas that are of relatively low salience for a better deal on an important issue dimension.

Commentators on global climate change have already noted dilemmas of institutional design associated with trading. Despite its potential benefits in facilitating progress, the agenda may become impossibly crowded leading to the sort of long delays observed when the Law of Sea was being negotiated; transaction costs increase; the package deal implicitly proposed at Rio by the South, whereby they concede on global climate change if their demands about the international economic order and development (some of which gained expression in Agenda 21) are met, may provoke the emergence of a blocking coalition in the North (Andresen and Wettestad 1992, 278-279; Sebenius 1994, 303-307). From the viewpoint of formal theory there are additional dangers.

Commentators on global environmental cooperation have put forward, in informal terms, the idea that it may be crucial to success that deals are put together which prevent the emergence of blocking coalitions (Sebenius 1991; Sebenius 1994). Also power differentials effect the ability of states to get outcomes on the Pareto frontier which asymmetrically favor their interests (Krasner 1991, 341-343; Sebenius 1992, 341-342). Ideas about winning and blocking coalitions receive more formal treatment in theories of weighted games (Ordeshook 1986, ch. 7). According to this approach winning coalitions are inherently unstable when trade across different issue dimensions is possible, because members can be seduced away by a sweeter deal, no matter what the current deal that has been struck (Peterson and Ward, 1995). The practical consequences of this are inaction, with negotiations being limited only by nations' rational capacity and information to put together new deals and coalitions.

Formal theorists acknowledge that institutional rules and decision-taking structures may keep issues apart and defuse this problem (e.g., Shepsle and Weingast 1981). The thrust of formal

theory is, then, further to strengthen the arguments for designing the climate regime so that it deals sequentially with well-defined issues and encourages package deals only when this seems unlikely to destabilize the whole edifice (Sebenius 1994, 303-307).

Liberal institutionalist understanding of regimes places them in a constitutive or mutually constitutive position (Krasner 1982, 193-194) with respect to the actions of nation-states, while neorealists regard regimes as derivative. For institutionalists, regimes are seen as constraints, "facts of life" facing nations that may not be dispensed with, or ignored, even when there are incentives to do so (Keohane 1988, 389; Young 1989a, ch. 3). They are able to alter states' world view and their preferences (Keohane 1988, 383-384; Young 1991a, 298-302; Levy, Keohane and Haas 1993, 398-399). From this perspective cooperation can literally become a matter of socialization (Young 1989a, 20) or policy habit rather than something continually scrutinized for its costs and benefits (Stein 1982, 315; Young 1989a, 79). These arguments also make liberal institutionalist more optimistic about the chances of regimes bringing about stable cooperation at relatively high levels over global climate change. They also begin to call into question the utility of formal approaches such as game theory.

5.3.4 The contribution of formal theory

While the supergame model can provide useful insights into international cooperation, in general (Snidal 1986, 27-28), and global climate change, in particular, its limitations need to be acknowledged. First, supergame analysis has not been extended to cover the cases where players' level of cooperation can vary continuously over several dimensions (Jervis 1988, 329-332; Sebenius 1992, 327-328) or current-round payoffs depend on past choices, as they may do in a world where certain forms of environmental damage are irreversible. The ability of nations to rationally pursue national self-interest may be severely limited by pathologies in dealing with information and bounds on rational capacity to process it (Jervis 1988, 334-340). Because of this, some have raised doubts about states' abilities to articulate, communicate, and carry through even simple conditionally cooperative strategies (Lipson 1984, 15; Oye 1986, 15-6), suggesting the need to further develop models of collective action which assume bounded rationality (Keohane 1984, ch. 7).

Game theory cannot constitute a free-standing explanation, because it takes states' preferences, beliefs, and strategic opportunities as given (Jervis 1988, 325-9). Existing attempts formally to model how nations' preferences over global climate change arise from domestic political competition (e.g., Ward 1993) are poorly integrated with the structural and systemic basis of states' interests which concerns realists (Waltz 1979; Jervis 1988, 320-22; Lang 1993, 17-18). In defense of game theory, it could be argued that it is no part of the remit of this approach to explain where preferences, beliefs, and strategic opportunities originate. However, there does not seem to be a clean break empirically between strategic choice and the processes which mold the underlying parameters of the game. For example, empirically preferences may change during the bargaining process.

In practice, game theorists rarely attempt to model the internal divisions within particular governments which were important in negotiating the Climate Change Convention (List and Rittberger 1991, 100), suggesting the need to take further and to formalize Putman's idea (1988) of two-level games (e.g., Dupont 1994; see also Section 5.4.1).

Although arguments about commitment and trust seem empirically relevant to the analysis of negotiations, the supergame model tells us little about the patterns of offer and counter-offer observed in negotiations and the coalitional structures which emerge. The problem is that there are numerous competing formal models of the bargaining process and associated accounts of coalition formation (e.g., Coddington 1968, 30; Ordeshook 1986, chs. 7- 9) most of which assume quite implausibly that binding agreements can be struck and that the efficient outcomes are known (Sebenius 1992, 333-37). While some progress has been made by using formal bargaining models (Hoel 1991, 60-64), the most fruitful approaches to bargaining dynamics are likely to be those which are informed by empirical observation and experimental work as well as by game-theoretic ideas and which do not stick rigidly to standard assumptions, such as perfect information and perfect rational capacity to make decisions (e.g., Raiffa 1982; Sebenius 1992).

We have shown that game theory provides considerable insight into the bargaining around the FCCC. It poses important questions about institutional design. While it does not propose clear-cut solutions to these questions, it adds to the rigor of the debate about these vital issues. Game theory cannot stand alone, but it may have a symbiotic relationship with other approaches. In the final analysis, the most important contribution of game theory is the logical rigor it brings to an area dominated by description, namely it

- brings sharply into focus the implications of approaches like realism and liberal institutionalism;
- points to potential inconsistencies in informal verbal arguments; and
- is a mode of analysis which is able to reach conclusions which seem surprising, yet stem from widely accepted assumptions and, on deeper reflection, appear significant.

5.4 Challenges to Major Approaches

If a beam of light is directed at a prism, it will be decomposed into a broad range of rays. Similarly, focusing our intellectual attention on explanations of GCC policies leads to a broad array of aspects to be included in any assessment. The purpose of this subsection is to *selectively* focus on particular arrays which are considered by academics and practitioners to be of major importance in explaining the current shape of the FCCC. As the previous two subsections have shown, each major theoretical approach only provides a *partial* explanation of the range of policies undertaken by countries, and the results of supergame analysis do not project a *particular* projected shape for the FCCC - or how future rounds of negotiations on specific abatement protocols might proceed.

The aspects to be included in this section revolve around properties of actors. In Section 5.4.1, we begin to vertically disaggregate national actors by attending to the interconnection of positions taken in international negotiations as a result of electoral pressures and the activities of organized interest groups. Therefore, this subsection attends to the process of national preference aggregation. Following a presentation in more abstract terms, Section 5.4.2 provides both a horizontal "broadening" of formally recognized actors beyond the nation-state (e.g., international governmental organizations) as well as international non-governmental organizations.

Finally, Section 5.4.3 will deal with the equity or justice aspects of international relations. Both aspects play a role within the same time domain, e.g., between industrialized and less industrialized countries, as well as across time. We are thus reminded of the fact that international

environmental agreements do not only assume a Pareto-efficient structure (i.e., improving the welfare of at least one actor without sacrificing the welfare status of the others), but also of the relevance of the distribution of property rights between countries and generations.

5.4.1 Domestic-International Linkages

(Detlef Sprinz)

National governments may represent their countries in international environmental negotiations, however, they are unlikely to take positions as they please. While they may ignore various domestic constituents during the process of deriving positions prior to international negotiations, national governments need majorities in legislatures to ratify international agreements. Furthermore, ratification of international environmental agreements (IEAs) is no assurance of their successful implementation, since industries, courts, and interest groups often find sufficient leeway to delay and, potentially, avoid substantive implementation of international obligations.[57] Therefore, both from a theoretical and a practitioner's perspective, it seems prudent to explicitly relate domestic policies and international policies.

5.4.1.1 The Metaphor: Domestic-International Linkages

International relations often distinguishes between three conceptual lenses in the conduct of research, namely the individual (e.g. the chief of government), the state or domestic factors (e.g., influence of interest groups or type of electoral system), and the international system, i.e., the composite of countries (Waltz 1959). In the following, we will largely concentrate on the state and international system levels (Singer 1969) as well as the interactions among them.[58] The two-level metaphor of domestic-international linkages was most vividly described by Putnam as follows:

> *At the national level, domestic groups pursue their interests by pressuring the government to adopt favorable policies, and politicians seek power by constructing coalitions among those groups. At the international level, national governments seek to maximize their own ability to satisfy domestic pressures, while minimizing the adverse consequences of foreign developments. Neither of the two games can be ignored by central decision-makers, so long as their countries remain independent, yet sovereign* (Putnam 1988, 434).

It is this interrelationship between the domestic and international levels which constrains the actions taken by the chief of government, namely the range of feasible international agreements ("win sets"). With respect to the actual negotiations on the FCCC, it is important to keep in mind, that countries may not be willing to enter international accords (voluntary defection), but they may also involuntary defect by failing to comply with international obligations they signed earlier. The latter may arise from lack of ratification of the international accord by domestic actors, e.g., defeat of the international agreement in a referendum or a defeat in the legislature (ibid., 438; see also the formal models reviewed in Section 5.4.1.3). As we saw further above,

57. Although international agreements often need domestic ratification, failure to arrive at an international agreement does not necessitate formal domestic "ratification". This built-in asymmetry of international and constitutional law has rarely been attended to in international relations theory.

58. The general academic debate on incorporating domestic factors in international relations research is, inter alias, reflected in the writings of Almond (1989), Ferguson and Mansbach (1991), Karns and Mingst (1991), Mastanduno, Lake and Ikenberry (1989), and Rosenau (1967; 1989). For an application to international environmental policy, see Economy and Schreurs (1994).

threats of *voluntary* defection from the FCCC (i.e., withholding signature) were used by some pivotal governments - supposedly on behalf of their domestic agents - to push the climate convention from an abatement agreement to a treaty which only requires advanced industrial countries to freeze their emissions.[59] In fact, this also applied to the politics of some countries when negotiating the further strengthening of the FCCC at the COP-1 at Berlin. Furthermore, as Moravcsik suggests, national governments may be interested in influencing the domestic constituencies of their international counterparts, for example by providing resources to environmental NGOs (Moravcsik 1993, 32). In conclusion, the two-level metaphor may provide a more complex representation of those factors which allow countries to avoid or conclude IEAs.

In the following, I will review some of the qualitative-empirical as well as formal approaches to the domestic-international link.

5.4.1.2 Qualitative and Empirical Perspectives

It is often argued that countries most adversely affected by environmental degradation will pursue strict environmental policies. In fact, Jänicke and Mönch (1988) argue that the degree of environmental problem pressure as well as the level of economic wealth (in addition to other factors) determines the level of effective policies undertaken by industrialized countries to ameliorate environmental problems. Extending this analysis, Prittwitz develops the "capacity hypothesis" of environmental policy which combines socio-economic aspects (see above) with the political-institutional capacity of states in order to explain governmental responses to environmental challenges (Prittwitz 1990, 108).

In particular, Prittwitz developed a compact way to characterize the interests of states which are derived from the expected behavior of domestic political actors. In particular, he focuses on

- polluter interests (welfare gains from continued pollution; e.g., CO_2 emissions from the combustion of fossil fuel),
- victim interests (welfare losses induced by pollution effects, e.g., devastation of or geographical shift in agricultural regions), as well as
- third party interests ("Helferinteressen"; including, inter alias, the capacity to monitor, provide and use pollution abatement technology, or substitute the polluting activity or product)[60] (Prittwitz 1984; 1990).

As a consequence, countries with dominant polluter interests are expected to behave as laggards in international environmental negotiations, whereas victim countries are expected to push for stringent international environmental negotiations.[61] Under most circumstances, third party interests will favor pusher rather than laggard interests (see Table 6).

The implications of this typology were tested for the case of GCC policies in two empirical studies by Oberthür (1993) and Fischer (1992). Their analyses showed that countries with strong polluter interests were trying to retard provisions for emissions reductions in the FCCC (e.g., the

59. International negotiations can also be used to alter domestic coalitions - and, thereby, to negotiate agreements which were not feasible beforehand (see Putnam 1988, 447).

60. For this specification, see Oberthür (1993).

61. For a typology of governmental positions in international environmental negotiations based on environmental vulnerability (victim interests) and abatement costs (combination of polluter and third party interests), see Sprinz and Vaahtoranta (1994).

Arabic OPEC members, the USA, and some less industrialized countries), whereas countries holding major victim interests (such as AOSIS, the USA, and some European countries) were strongly pushing for emissions reductions to be incorporated in the FCCC. While many industrialized countries also show a high potential for third party interests to influence their position, this did not materialize on an equal level with polluter and victim interests during the international negotiations (Oberthür 1993, 93-94).[62]

In the domestic political process, interests are represented by political actors. Building on prior work by Prittwitz (1984; 1990) and Sprinz (1992, ch. 6), the following synthesis of interests, political actors, and likely effect on a country's position in international environmental negotiations is suggested (see Table 6). While this synthesis seems to be corroborated in exploratory analyses of the FCCC by Fischer (1992), Nilsson and Pitt (1994), and Oberthür (1993), this scheme only sheds light on partial aspects of a country's position, however, it does not explain the composite position taken by a country (e.g., the USA) or why countries (or blocs of countries) with the same interest configuration take different policy positions (e.g., the EC/EU vs. the USA; see Oberthür (1993, ch. 4)).

TABLE 6. International Environmental Negotiations and Domestic Political Interests

Interests	Important Factors	Domestic Political Actor	Expected Effect on Country Position ("strong" regulations)
polluter	polluting industry or pollution-inducing consumer activity	- political strength of major polluting industry - electorate (as consumer)	negative
victim	environmental effects	- electorate (as victim of env. impacts) - environmental NGOs and professional NGOs of adversely effected sectors - green parties (or "greened" traditional parties)	positive
third party	inter alias, substitution interests for the production and/or consumption of the polluting activity	actors representing - monitoring, - abatement technology, and - substitution technologies	(mostly) positive

62. It shall be emphasized that countries may simultaneously hold a combination of interests. In particular, the US delegation showed fragmentation along representations of polluter and victim interests.

5.4.1.3 Formal Perspectives

Recent developments in non-cooperative game theory provide a more differentiated perspective regarding the conditions under which governments or electorates should take particular decisions. These approaches assume that governments face constrained win sets due to domestic politics or the hurdles of formal ratification procedures (such as referenda). While theses approaches have originally been developed to explain the degree of European integration, their reasoning can be easily adapted to the case of international negotiations on GCC.

In their work on negotiations regarding the deepening of European integration, Schneider (1994) as well as Schneider and Cederman (1994) lay out a sequential game with limited information. In particular, they assume that some countries (laggards) are less willing to abide by strong international regulations (i.e., the "strong treaty" which stipulates emission reductions and is favored by environmental lead countries), in particular, because domestic constituencies prefer a treaty with less stringent obligations ("weak treaty"), e.g., to freeze GHGs emissions. In addition, two different types of laggards exist, a *strong* laggard who prefers a "weak treaty" to a "strong treaty" (e.g., 20% reduction of GHG emissions during 1990-2005 - the Toronto target) and who can credibly threaten to exit negotiations (associated with unchanged policies for this country as well as loss of utility to the lead country); and a *weak* laggard which also prefers a "weak treaty" to a "strong treaty," but also prefers to back down in favor of a "strong treaty" rather than exit.[63] The central problem is for lead countries to find out if the laggard is either of the "strong" or the "weak" type. Since such knowledge is not available ex ante, lead countries are playing a game with "incomplete information." As Schneider and Cederman (1994) show, up to a certain level of beliefs that the laggard is of the strong type, strong laggards will sometimes find a "weak treaty" accepted by the lead country and sometimes not (resulting in exit), whereas weak laggards will randomize their call for a weak treaty and a "strong treaty" as will the lead country; these weaker laggards will either succeed in mimicking the strong laggard, resulting in a "weak treaty" or back down in favor of a "strong treaty." Beyond a certain threshold of belief that the laggard is of the strong type, the lead country will accept a "weak treaty" with both types. Applied to the case of the domestic-international link in negotiations on GCC, strong laggards will be able to coerce ambitious lead countries to either permit it to accede to a less stringent treaty or risk exit - with unfortunate outcomes for both sides in the latter case. As we saw in Section 4, the USA may be seen as a strong laggard during the UNCED negotiations because of the influence of their domestic constituencies, and this also extends to its position at COP-1 in Berlin.

After potentially concluding an international agreement, countries have to ratify the treaty. Unlike the case of enlarging or modifying the basic rules of the European Union (EU), this may not take the form of a referendum. However, relevant decisions taken by legislatures or the desire to reap a popularity bonus from the population can be thought of as ratification games. Often, a "weak treaty" is more desirable than a "strong treaty" to many domestic constituents given the magnitude of the changes being called for as well as the political hurdles to be overcome for a "strong treaty."[64] In a limited information model by Schneider (1994), the electorate does not know if it faces a "strong" or a "weak treaty", but it receives signals in the form of a campaign by the government to convince the electorate or the legislature of the benefits of a treaty. The

63. In order to avoid misinterpretation, "weak" and "strong treaties" refer to freeze vs. pollution abatement treaties, whereas a "weak" vs. "strong" actor refers to the degree of willingness to exit from international environmental obligations rather than accept a "weak treaty."

equilibrium solutions of this incomplete information game show that, inter alias, constituents reject any agreement that is not followed up by a campaign. Only beyond a certain threshold of believing that the government presents a "weak treaty," the government will always campaign and the electorate will always ratify. Below this threshold, it is possible that even "weak treaties" are rejected by constituents (ibid.). As long as a national government anticipates such problems for the ratification stage, a pivotal country may clearly use either justified threats or bluffs to bolster its bargaining position in international negotiations. Empirically, this may be partially supported by the lack of enthusiasm of many legislatures in OECD countries to cede sovereignty to international institutions regarding the potential income generated by an international carbon tax scheme.

As the work of Dupont shows, the last analytical conclusion may not always be warranted. In a two-period sequential bargaining model, he demonstrates that it may depend on the type of actor that these threats or bluffs are directed at (Dupont 1994). In particular, if the target country is "dovish," threats based on domestic constraints will work, but this result does not necessarily hold for the "hawkish" type of target country, because the latter type is willing to potentially forgo an international agreement (ibid.).

Finally, a direct link between international non-crisis bargaining on the environment and electoral success is demonstrated in a sequential, incomplete information model of Wolinsky (1994). In particular, her model sheds light on the impact of the evaluation of governments by the electorate. Concluding international environmental agreements is perceived as a signal to the electorate that the government is effective - rather than not. Her model shows, inter alias, that

> *... (less effective governments) make high concessions in equilibrium when the electorate is uninformed about the agreement, cares little about the effectiveness of the government, and has higher costs of replacing the government. Less effective governments are thus likely to make high concessions even when such concessions are not necessary for reaching an agreement, as long as the issue under negotiation is not very salient"* (ibid., 7).

Very little empirical research exists on this topic, however, many observers of the climate change negotiations agree that the less industrialized countries have participated in the climate negotiations in return for the willingness of the industrialized world to participate in negotiations on the development agenda. Thus, this concession can be seen as possibly an example of relatively little pressure exerted by domestic constituents of less industrialized countries on their governments regarding the climate change agenda.[65]

Recent game-theoretical developments have begun to formalize the domestic to international link, both with respect to (i) international negotiations as such as well as (ii) the formal ratification procedure. Electorates and domestic interests are shown to have substantial impact on the position of respective governments. Regrettably, the models have not yet been directly applied to negotiations of the FCCC, however, future research is expected to build on these models in order

64. Lead Countries may already be unilaterally on the way of implementing more ambitious GHG reductions. In this case, the international treaty is unlikely to impose new far-reaching changes for this group of countries. See Sprinz (1992, ch. 5) for the similar case of the international regulation of transboundary air pollution in Europe.

65. It should be noted that the obligations for the less industrialized countries under the FCCC are minor - and assisted by not precisely specified resource transfers from industrialized countries (see Sections 4 and 6). This seems to also apply to the "Berlin Mandate" concluded at COP-1.

to explain the stringency of the requirements proscribed by the FCCC and potential successor agreements.

5.4.1.4 Conclusions

This subsection provided a brief overview of qualitative-empirical and formal models relevant to the domestic-international policy linkage found in decision-making on international environmental regulation. By way of conclusion, it seems difficult to assume that, in negotiating the FCCC, countries just follow a rather narrow policy of "national interest" or that country positions could be adequately captured by a unitary actor model. While there is a growing number of qualitative-empirical studies on the FCCC, they still lack an aggregation mechanism for arriving at a composite governmental position. Formal models have decision-making procedures built-in, however, they normally focus on just one domestic policy variable and, at the present stage, they have not yet influenced empirical analyses of the FCCC. Thus, there seems to be scope for formal models to guide comparative empirical research on GCC policies.

5.4.2 Non-state Actors

(Kal Raustiala)

While international responses to climate change are primarily the product of state or governmental action, non-state actors also play an important role in international policy formation and implementation. Many observers have suggested that this role is especially pronounced in environmental policy. In this section we examine the roles of various non-state actors: non-governmental (or private) organizations (NGOs), "epistemic" or expert communities, and intergovernmental organizations (IGOs). These categories encompass an enormous number of organizations of myriad type and size, so the discussion is necessarily cursory. The aim of this subsection is to identify some of the major actors and types of actors, describe and analyze their activities, and assess their influence on the international response to global climate change.

The term "NGO" can refer to any non-governmental actor or group. For the purposes of this article, we shall consider NGOs to be organized non-state groups which seek to effect change in the types, shape, or scope of international as well as national and local responses to climate change. NGOs vary along many dimensions, but perhaps the most salient is in terms of research vs. (campaign) activism. A simple tripartite topology of ideal-types would include

- "pure-research" NGOs,
- "mixed" research/activist NGOs, and
- "pure-activist" NGOs.

NGOs also vary in their territorial focus: some are locally-based with local concerns, some locally-based with international concerns, etc. For global climate change, the most influential have been those with an expressly international focus combined with an international base. But many US-based NGOs, because of their size, level of expertise, and influence on the government of the United States, were particularly influential.

A third dimension of variance among NGOs relates to their substantive positions: more or less "pro-environment" is a crude way to dimensionalize this notion. While common-usage in the literature on NGOs frequently reserves the term NGO to "pro-environment" or "pro-

development" NGOs, business-based groups are NGOs as well, and played a very important role in the climate change debate.

The term "IGO" can also refer to an enormous number of very different organizations. The United Nations is perhaps the most important IGO, but under the UN umbrella other, smaller informal groupings (such as AOSIS), and formal organizations (such as UNEP) exist. And many IGOs exist outside of the UN umbrella altogether (e.g., the Association of South East Asian Nations). The main distinction to be drawn is between IGOs which are general intergovernmental groupings, such as the Group of 77 (less industrialized countries), and specialized international organizations which are run internationally (usually through the UN) such as the World Health Organization. The IPCC is a particularly important IGO of this type; it has a very specialized role, namely assessing the state of climate science. The European Union is a special international organization which is in many ways resembles a federal state and which acts as a supranational organization.

In addition, some NGOs (IUCN, IIASA) are ‘hybrids' in the sense that governments also play a role and at times are members. The International Union for the Conservation of Nature (IUCN) in particular has played a major role for fostering international environmental cooperation, especially for biodiversity issues.

5.4.2.1 NGOs and the international response to climate change

There are several reasons why an examination of international responses to climate change would be incomplete without examining the role of NGOs. NGOs effect international policy towards environmental problems as shown in Table 7.

TABLE 7. Functions of NGOs in the GCC Policy Field

- agenda setting
- monitoring of government actions
- providing information
- policy recommendations
- acting as government delegates or advisors

Moreover, since international responses are the collective result of many national decisions, it is important to recognize that NGOs influence national preferences as well. Particularly in the industrialized democracies, NGOs are often powerful organizations with a large, politically active membership. They play an important role - in conjunction with the news media - as disseminators of scientific research on climate change to the general public and as critics of certain policies or positions.

In the field of climate change policy, NGOs have been quite visible participants in treaty negotiations. NGOs were in attendance at nearly all the sessions of the climate INCs and the COP as observers, and have been participants as well, making statements, responding to debates, and acting as members of government delegations. This subsection, therefore, will explore some roles NGOs have played in the climate talks and how they shaped the international responses discussed in this article.

There are several general ways in which NGOs are influential in shaping international responses. Negotiations, particularly those over climate change, take place in an environment characterized

by high levels of uncertainty and low levels of information. In addition, the climate talks have been of major political significance since many important economic interests are involved. As a result of these two factors, governments are cautious about undertaking commitments. Environmental NGOs are often an important counter-weight to these economic interests, and often alleviate uncertainty through the provision of information. Business NGOs, such as the Global Climate Coalition or the World Coal Institute, work to bolster the visibility and attention paid to economic costs, and ensure that policies taken are cost-effective and based on sound scientific understandings.

More specifically, NGOs have influenced the international response by

(i) "Setting" the Agenda[66]

NGOs have been great popularizers of environmental problems, and as such have focused - in conjunction with the news media and with scientific epistemic communities - public and government attention on climate change. They have often been the conduit between climatologists and the public, providing (at times oversimplified) distillations of the latest research and stimulating political action. In doing so, they have kept the issue of climate change alive as one of the important problems governments must address (or at least appear to address). In the words of one former US official, describing the NGO-organized Villach and Bellagio meetings (see Section 4.1)

> *The two workshops, the meetings of the Advisory Group on Greenhouse Gases and other activities ... indeed played a significant catalytic role in establishing the IPCC ... Governments could no longer permit...NGOs to drive the agenda on the emerging climate issue*.[67]

(ii) Monitoring Government Actions

The FCCC does not contain any finalized implementation review mechanism, though one may develop in the future. In the meantime, governments are self-reporting on their actions with little collective oversight. Other governments, therefore, have few ways by which they can assess their counterparts' actions, at least in a formal and public way. NGOs have helped "multilateralize" information about national actions by preparing detailed analyses of what governments have claimed to do, what they have actually done, and what they are likely to do in the future. Furthermore, they distribute this information widely. For example, the Climate Action Network (CAN), a consortium of many environmental NGOs, has prepared a comprehensive report of climate pledges and actions, and has made it readily available to governments, private interests, and the media (Climate Action Network US and Climate Network Europe 1994). The Climate Action Network (CAN) is active in many areas of the world, including CAN-US, Climate Network Europe, CAN-SA (South Asia), etc. (see Rahman and Roncerel 1994). While "enforcement" is too strong a word for this role, NGOs such as CAN do have the potential to aid in achieving compliance with the FCCC.

(iii) Providing Information

66. In this context, this applies primarily pro-environmental NGOs.

67. Letter from William H. Nitze, former US Dept. Assistant Secretary for Environment, to Michael Oppenheimer; cited in Navroz Dubash and Michael Oppenheimer (1992).

Formal negotiations, such as those leading to the FCCC, are lengthy, detailed, and often tedious. Delegates sometimes cannot, and often do not want to, attend all sessions. NGOs, by providing summary reports of each session, provide very useful information for the delegations. Two such reports have existed in past climate negotiations: the Earth Negotiations Bulletin and Eco. Appearing daily during the negotiations, they are often one of the first things delegates read each negotiating day. ECO also provided an informal forum for airing new or controversial ideas, thereby encouraging constructive debate and facilitating the negotiations process.

(iv) Making Policy Recommendations

Many governments, particularly those in the developing world, often do not have sufficient resources to provide expertise on how to address climate change. There is great uncertainty over their proper policy response, given some level of uncertain (yet expected) change. Many NGOs have devoted attention to this issue. At the INCs, they have made use of the access they have received to provide government delegations with extensive policy analyses and recommendations, as well as critiques of proposed policies. For governments which lack resources and expertise in this area, especially the smaller less industrialized states, the NGOs provide useful information that is relatively "costless." Additionally, NGOs are often well-placed to discover and suggest innovative solutions to bargaining impasses between delegations, expediting negotiations and improving outcomes. They also frequently serve as a "voice for the voiceless," or for those with limited political power, and thereby seek, in their own view, to provide both a human face and a concern for justice to the often technocratic and abstract process of negotiation (Tolbert 1991).[68] Just as frequently, however, they are voices for the powerful.

(v) Acting as Government Delegates and Advisors.

Members of NGOs have appeared on several government delegations, and have acted as official and unofficial consultants for governments. One of the most prominent examples is the relation between the London-based Foundation of International Environmental Law and Development (FIELD) and the Association of Small Island States (AOSIS). Members of FIELD, all international lawyers, consulted extensively with members of AOSIS, appeared on their delegations until Rio (and to a much lesser degree at COP-1), and at times acted as the delegation of certain AOSIS members. The tiny member governments of AOSIS, which originally often lacked any indigenous expertise about climate change and the policy possibilities, became a more powerful negotiating force in conjunction with FIELD.

While these activities have provided useful information and services to states, and thereby encouraged and fostered the participation of NGOs, NGOs are also political actors. To varying degrees they provide political pressure on governments, and may threaten to scuttle agreements at home (or try to) if their demands are not adequately addressed. Governments will respond to these pressures to varying degrees as well, depending on the type of government, the size of the NGO, and its type (business or public interest). Indeed, the political power of environmental NGOs - and the access they have gained in the climate negotiations - have stimulated the activities of "counter" NGOs and of business interests more broadly. Thus it is important to remember that the

68. As Tolbert also notes, NGOs have in other issue-areas (including human rights) played an important role in "standard-setting" and in the drafting of proposed text for conventions. This sort of influence has been less apparent in climate change. A group of NGOs did draft a model climate convention under the auspices of the Climate Institute, but it did not have great impact on the provisions of the FCCC.

international response to climate change has taken place in a politicized atmosphere, with many divergent interests. NGOs are important domestic actors that governments listen to in addition to, and regardless of, the "useful" roles enumerated above. And while environmental NGOs may be more prominent at international meetings, business NGOs are often very important players in the domestic context.

While NGOs have been influential in shaping the *international* response to climate change, it should be remembered that the international response is not the only "global" response. Rather, many NGOs - on their own, but usually in consortia with other like-minded organizations - have taken action to alleviate or address climate change without the help of governments (Wapner 1996). State responses, as embodied in the FCCC, are clearly important, and this subsection has illustrated the ways used by NGOs to influence the international response. But NGOs do not merely seek to *influence* action; they take action as well. One of the most important actions they take is the dissemination of information. By acting to educate the public around the world of the problem and potential solutions of climate change, NGOs may effect as much change as that achieved by law.

5.4.2.2 IGOs and the International Response to Climate Change

It is difficult to assess or describe in general terms the role of international organizations in shaping the international response to climate change, because the roles of IGOs were quite varied. The negotiations over the FCCC occurred within the context of an IGO: the Intergovernmental Negotiating Committee (INC). And the INC was in turn the creation of the UNO. Yet IGOs were also "actors"; the IPCC, UNEP, the OECD and others participated in various important ways. Rather than discussing in general terms the influence of IGOs, it is more fruitful to focus on the most prominent examples and examine their role in greater detail.

The IPCC

The IPCC was formed in November of 1988 in an effort to organize (and thereby control) the assessment of global climate change as a scientific phenomenon. Previous informal assessments had come out of non-governmental meetings, such as those in Villach, Bellagio, and Toronto (see Section 4.1).[69] The ability of scientific assessments to play a role in shaping international environmental regimes was evident from the negotiations over stratospheric ozone depletion. The creation of the IPCC, a panel of climate experts entrusted with the task of assessing and summarizing the state of scientific knowledge on climate change,[70] represented an attempt to centralize and formalize the interaction between science and politics, and to put governments in charge. Nevertheless, the IPCC leadership was not completely passive, and the IPCC's work served as the major reference in nearly all debates.

The IPCC was initially divided into three working groups: (i) scientific assessment of climate science, (ii) climate change impacts, and (iii) on response strategies. Powerful states dominated

69. The Toronto conference statement included the following: "Far reaching impacts will be caused by global warming and sea level rise which are becoming increasingly evident as a result of atmospheric concentrations of carbon dioxide and other greenhouse gases." It was precisely the effect of statements like these that prompted the creation of the IPCC.

70. The IPCC was asked specifically to provide "internationally coordinated assessments of the magnitude, timing, and potential environmental and socio-economic impact of climate change and realistic response strategies," UN General Assembly Resolution 43/53.

the leadership positions of the IPCC. The US, Russia, and the UK held three of the top five positions (the others were Sweden and Australia). The first IPCC assessment was presented to the UN General Assembly in October 1990, and involved the work of nearly 500 scientists (Bolin 1993). Working group I was widely considered the most important, and the group's assessment that the "business-as-usual" scenario would lead to a rise in global average surface temperature of 0.3C per decade was widely quoted. However, the IPCC provided political ammunition for all sides: the assessment stated that the size of the (observed) warming (0.3 to 0.6C over the last 100 years) is broadly consistent with the predictions of climate models, but it is also of the same magnitude as natural variability. Thus those opposing and those supporting strong commitments in the FCCC could look to the first IPCC report for support. The nature of the IPCC process serves to weed out outlying and extreme views, and to provide a conservative and central position. New rules for subsequent reports of the IPCC have strengthened this tendency. Only papers which have been published can be included in future assessments, which means most of the research will therefore be at least one to two years old. The second series of IPCC assessments now lends more weight towards GCC actually occurring.

In sum, the IPCC's conservatism and the release of its reports after major international negotiations have resulted in a lesser impact for the IPCC than might be expected. Moreover, until more conclusive evidence of anthropogenic climate change is uncovered, the debate over international policy will focus mainly on issues of finance and modes of implementation, issues about which the IPCC may have little input. This may actually suit the majority of the members of the IPCC, who do not seem to desire an active role as advisors to the ongoing international negotiating process. But the assessments of the IPCC have continued to be the scientific benchmark against which all proposed policy responses have been evaluated, and the respect with which the IPCC is held - leading to few governmental disputes over the basic science of the issue - ensures that it will continue to play an active advisory role.

The G77

The G77 is now a group of well over a hundred developing nations, originally formed in the 1970s. The G77 and China often work as a group in the UN and in UN-affiliated bodies, and have played an important role in the resolution and debate of many international issues. In climate change, the nations of the G77 stood apart from the advanced industrialized nations, and apart from the "economies in transition" as well. But the G77, despite some efforts to the contrary, was unable to provide a coherent front to the rest of the world regarding climate policy. Instead of the traditional unified front of less industrialized and non-aligned states, a set of new coalitions developed along previously undiscovered fault lines.

Due mainly to the heterogeneous impact of climate change, the fracturing of the G77 was significant, because it reduced the strength in numbers and the unity which was the source of the G77's (albeit limited) power. AOSIS member nations pushed hard for a strong treaty with clear commitments to emissions reductions. They used as their primary weapon their status as the likely victims of climate change, but this proved to be less effective than many had hoped. The petroleum-exporting nations reemerged as important international players, committed - particularly in the case of the Saudi Arabia - to resisting any commitments to reduce emissions of carbon dioxide. Another bloc, the "Kuala Lumpur Group" consisting of those nations with extensive territorial forests, sought to reinforce sovereign control over forests. In short, the economic and social ramifications of climate change, and of abatement and mitigation policies,

divided the less industrialized world as clearly as it divided the US and Germany. As a result, the G77's leverage was reduced, and it was unable to play its customary role as a uniting force for the less industrialized world.

UNEP

Under the leadership of Mostapha Tolba, UNEP had played a major role in bringing about coordinated international responses to environmental problems throughout the 1980s (Downie 1994). The Montreal Protocol on Substances Which Deplete the Ozone Layer is probably UNEP's outstanding achievement, although, potentially because of it, the power and influence of UNEP on climate change policy was limited.

As the need for an international response to climate change became more apparent, UNEP was asked, along with the World Meteorological Organization (WMO), to organize and establish the IPCC. In 1989, the UNEP Governing Council adopted a resolution requesting UNEP to begin preparations for the negotiations. In 1990, UNEP and WMO convened an ad hoc working group of government representatives which would consider the various ways in which negotiations could be structured. Most analysts expected UNEP, possibly in collaboration with WMO, to run the negotiations, but this ignored the development side of the equation which was critically important to many poorer countries. UNEP's technocratic reputation also seemed at odds with the enormous political and economic ramifications of the climate change problem. In the end, the UN General Assembly chose to create a new body, the INC, to conduct the negotiations under the auspices of the General Assembly. UNEP's role was limited to "making appropriate contributions" to the negotiating process (UN Gen. Res. 45/212).

This role for UNEP was far smaller than many had expected when climate change first appeared on the international agenda. Of course, part of the salience of the climate issue as a major policy issue is attributable to the work of UNEP. But when UNEP sought a leading role in the climate negotiations, this role was denied, and the negotiations placed under the aegis of a new, more political intergovernmental body, namely the INC. Much like the role of NGOs discussed above, the experience of UNEP in the climate issue illustrates the limitations of non-state actors in a world dominated by states.

5.4.2.3 The Role of Non-State Actors in International Climate Change Policy: General Conclusions

Given the present structure of the international system, an international response to climate change remains mainly an affair for governments. The roles of all the non-state actors discussed in this subsection was limited to ways in which they tried - successfully or not - to influence the actions and beliefs of governments, namely by shaping and influencing policy. While much of the activity of non-state actors is devoted to attempting to shape government action, it is important to stress that non-state actors often try to directly influence human behavior. Space limitations do not allow an in-depth treatment of these roles. Education programs, for instance, by teaching individuals about the likely consequences of their actions, may result in higher reductions of carbon emissions than would a government-imposed carbon tax. This remains an open question, subject to empirical testing. But many NGOs, epistemic communities, and IGOs appear to think otherwise. As evidenced by their own allocations of resources and efforts, they believe that

international agreements are the best route to positive human change and, in turn, to limited global change.

This review of the theoretical perspectives and of the role of state and non-state actors emphasizes the importance of how the negotiation and construction of international environmental agreements effects the distribution of power and wealth between the various relevant entities. Problems of distribution raise the issue of equity which should characterize successful international cooperative efforts. This notion will be discussed in the next subsections.

5.4.3 Equity or Justice

(Matthew Paterson)

Equity, or distributive justice, is commonly perceived as central to any successful response to global climate change (Young 1989b; FCCC, Article 3(1); see also Section 5.3).[71] In particular Shue (1992) shows how purely rational interest-based bargaining will both (i) fail to address questions of justice, primarily because the less industrialized countries with potential leverage in climate negotiations are not necessarily the poorest developing countries who would be the recipients of justice, and (ii) create new injustices as the poorest countries will have the least resources to adapt to climate change, and injustices caused by the unequal distribution of wealth in the world economy will thus be exacerbated. This can be interpreted as reflecting a dominance of liberal institutionalism within academic writing on global environmental politics, as outlined already in Section 5.2. The focus on norms and conceptions of fairness comes out of an understanding of how institutions shape both the informal understanding of a particular issue - such as climate change - and the formal bargains which states may strike. While it is generally understood that equity is important, this does not necessarily lead to a shared understanding of its contents. Therefore, we will first address this issue, subsequently attend to intergenerational justice, and conclude with the implications of justice concerns for international policies on GCC.

5.4.3.1 The content of justice

In a series of works on this question, Shue poses four questions which provide the most useful framework for discussing the subject (Shue 1992; 1993a, 51; 1993b, 19; 1994, 344):

(i) What is a fair allocation of the costs of preventing the global warming that is still avoidable?

(ii) What is a fair allocation of the costs of coping with the social consequences of the global warming that cannot be avoided?

(iii) What background allocation of wealth would allow international bargaining to be a fair process (e.g., on issues 1 and 2.2) and

(iv) What is a fair allocation of emissions of greenhouse gases (over the long term and during the transition to the long-term allocation)?

71. There is a substantial literature on this question. For reasons of space, this review will only cover select writings. However, for aspects of those not discussed in this article, consult Bergesen (1991); Global Environmental Change (1992); Goodin (1990); Hayes and Smith (1993); Malnes (1990); Springer (1993); Kasperson and Dow (1991); as well as Burtraw and Toman (1991).

There are a number of perspectives on how to decide these questions. Within the literature on GEC agreements, a range can be identified. Grubb et al. (1992, 312-314) give the most comprehensive list. These 7 points comprise:

(i) polluter pays rationales (based either on current emissions or historically accumulated contributions to global warming);

(ii) equal entitlements approach (all individuals have an equal right to use the atmosphere commons);

(iii) willingness-to-pay justification (derived from welfare economics);

(iv) each participant should shoulder a comparable burden;

(v) recognition of distributional implications of any agreement (a position drawing explicitly on John Rawls 1973);

(vi) preservation of the status quo (present emitters have established some common law right to use the atmosphere as they presently do); and

(vii) reasonable emissions compatible with (a fairly generous interpretation of) basic needs (Grubb et al. 1992, 312-314).

In comparison, within the more general literature on distributive justice in International Relations, six approaches to justice are often identified.

(i) rights-based approach (which suggests we have rights to a stable climate);

(ii) responsibility (those causing a problem have a responsibility to resolve it (Brown 1992));

(iii) utilitarian (we should act to maximize overall human welfare, which most commonly will involve transferring resources from rich to poor (e.g., Singer 1972));

(iv) Kantian categorical imperative (justice requires that we act on principles which can be universally applicable, such as not endangering the global climate system) (O'Neill 1986; 1991);

(v) Rawlsian (the distributional effects of social institutions should benefit the worst off; Rawls 1973); and

(vi) Barry's position (Barry 1989b). This last position emphasizes that agreements should be negotiated not in a Rawlsian veil of ignorance, but in order to reach agreements which none could reasonably reject.[72] [73]

Most of the literature concerning equity in climate negotiations and justice in general argues that justice requires policy responses which significantly address existing international inequalities. The climate change literature, being more policy-oriented, tends to favor a position of equal per capita emissions as the most equitable solution. However, it is considered, at least in the short

72. This integrates notions of power and intersubjectivity into the question of justice.

73. For an overview of these positions, see Brown (1992). For an extended analysis of how they apply to climate change, see Paterson (1994).

term, politically infeasible. Thus a mixture of the egalitarian with the "comparable burdens" position is advocated (e.g., Grubb et al. 1992, 321; Young H.P. 1991): Emissions are to be distributed over time in a fashion which moves from the existing distribution towards an egalitarian one. However, an egalitarian position (at least in the sense that radical reductions in existing inequalities are advocated) is still seen as the primary implication of justice; the "comparable burdens" position is seen as a consequence of practical politics.

5.4.3.2 Intergenerational justice

The discussion so far has focused on justice *within* generations. However, *intergenerational* justice is also important from a normative perspective, since many of the likely impacts of climate change will be felt by people in future generations to a larger degree than by current generations. As a consequence, most writers on this subject suggest that present generations have also major obligations to future generations (e.g., Weiss 1989; Barry 1989a). The argument used is a Rawlsian one, since we should consider (under the Rawlsian veil of ignorance) the *future* effects of actions by *present* generations. Given this, we would create institutions and rules which would involve

- conservation of options (conserving the diversity of the natural and cultural resource base),
- conservation of quality (leaving the planet no worse off than received), and
- conservation of access (equitable access to the use and benefits of the legacy) (Weiss 1989, 320).

This argument is not in general shared among economists. For example, Schelling (1994) stresses that people discount the future for two reasons. Firstly, they simply prefer immediate consumption to postponed consumption, and, secondly, the marginal utility of consumption declines with increased per capita consumption. Although he rejects these arguments and, in particular, suggests that pure time preference is inappropriate for intergenerational questions (since we are not postponing our own consumption, but that of others), he still suggests that it appears unreasonable to value the consumption of future generations over our own. He suggests that time is like distance - just as we do value the consumption of people close to home more than those far away, we value the consumption of people close in time over that of people further into the future. For the purposes of this section, there are two important weaknesses in this argument. Firstly, Schelling's time-distance analogy rests on a particular communitarian version of justice, which is unconvincing in relation to climate change. Secondly, he simply constructs arguments based on (his assessment of) people's preferences. This is arguably not an argument about equity or justice, which requires us to make normative claims rather than descriptive ones.

Little attention was paid to intergenerational justice within the climate negotiations as compared to intragenerational justice. This is largely because questions of justice within existing generations clearly affect the bargains states can make and the power relations between them, as emphasized by Paterson (1992) and Young (1994, 48-50). However, intergenerational equity can primarily operate as a normative argument which, if taken seriously, would make arguments for aggressive global action to reduce GHG emissions much more forceful and might possibly lead to the creation of an insurance fund to compensate victims of global climate change impacts (see below).

5.4.3.3 Implications of Justice for Global Climate Change Negotiations

The argument in favor of at least a significantly more egalitarian world leads to a number of conclusions on how to address equity concerns in relation to GCC. Shue's four questions have been addressed both by other analysts and by negotiators in terms of three practical questions. The first concerns the distribution of emissions reductions and the costs associated with them. There seems to be a consensus that the primary costs should be born by industrialized countries, and the historical responsibility argument has been invoked most often in climate negotiations. This is also reflected in the FCCC, especially Article 3 (1) and in the division within Article 4 between obligations on all parties, and obligations only for industrialized country parties. Conflict has arisen over the fair allocation of long-term emissions; less industrialized countries, and some commentators (e.g., Agarwal and Narain 1990; Kraus, Koomey and Bach 1989) have argued that long-term emissions should be allocated on an equal per capita basis, a position explicitly rejected by most industrialized country negotiators as unjust and by many commentators as politically impractical (because of the objections of powerful states).

The second question raised in the negotiations concerns financial resources and technology transfers. Here, the implication of justice is seen to involve substantial financial and technological transfers from North to South, in order to assist less industrialized countries' in minimizing the growth of their GHG emissions during phases of accelerated economic growth. By way of example, Grubb puts likely North-South transfers to address global warming at $100bn per year (Grubb 1990, 287). The magnitude of transfers and the general argument are justified on the basis of the Northern countries' primary responsibility for producing GCC. As a consequence, actions by the South must be conditional on financial and technological assistance from the North (see FCCC, Article 4(7)). However, in practice, it has been much more conflictual. While accepting (in principle) this distribution of the burden as justifiable, industrialized countries have refused to donate anything more than nominal sums.

A fairly strong consensus exists among analysts that one of the most practical ways to address these two questions is by way of a system of tradeable permits for greenhouse gas emissions (e.g., Grubb 1989). This would enable an egalitarian principle of the distribution of emissions to be matched with minimizing the costs to the North of meeting reduction targets, and it would also facilitate North-South financial and technological transfers. Furthermore, the tradeable permits approach has the advantage of meeting the concerns of economists and policy-makers for efficiency in implementing obligations.

The third implication of justice concerns compensation. It follows from the responsibility-based principle, and relates to Shue's first question. The AOSIS countries advocated in the negotiations the establishment of a fund, provided for by those who have caused GCC, to compensate those who will suffer as a consequence. This suggestion, however, has been ignored by most states, and in the convention is reduced to the following:

> *The developed country Parties ... shall also assist the developing country Parties that are particularly vulnerable to the adverse effects of climate change in meeting costs of adaptation to those adverse effects (FCCC, Article 4(4)).*

In other words, compensation is only formulated here as a vague principle without any concrete implementation scheme.

In summary, the FCC addresses quite a few equity questions and recognizes, in part, their validity but then often fails to back them up with concrete and binding measures.

5.5 Conclusions

In explaining the international responses to GCC, we have focused our analytical lenses on a wide range of major theoretical as well the distributional aspects in the international and intergenerational context. In many respects, we conclude with more challenges than may be envisioned originally.

First, the theoretical approaches presented have only provided partial explanations of a major case of international non-crisis bargaining. Therefore, it remains an open question if we need further development of theories which are appropriate for the explanation of the regulation of international open access regimes or if subsequent developments of present general theories of international relations will be adequate for this class of cases.

Second, in many respects, we still have to develop better methodologies to disaggregate actors and aggregate preferences - within nations, across nations, incorporating transnational actors and international organizations (as actors in their own right and influence), and across generations. This should allow for a better understanding why extremely ambitious global policies rarely materialize - and how the opportunities to reduce the human impact on the environment can be optimized.

Third, it would be beneficial to academics and practitioners to get a better theoretical and empirical understanding of the dual aspects of a contract, namely the simultaneous efficiency and distributional implications. It could well be the case that the lack of distributional acceptability impedes the conclusion of a sizable number of (otherwise efficient) contracts.

The conclusion of successful negotiations does not mean that the agreements that have been reached by the various parties will necessarily be followed. Incentives will exist for the actors involved to cheat or to twist the agreements in their favor in such a way that the equity problems mentioned above will reappear. Moreover, the perceptions by others of serious equity problems in the way the agreements are followed will lead others not to observe them either. The inclusion of self-enforcing mechanisms and special disposition that will deter parties from reneging is crucial here. Institutions will have to be designed and implemented in such a way that incentives for cheating are minimized. Furthermore, even if parties faithfully abide by the rules of the agreement, there is no guarantee that it will reach its goals, especially if complex environmental phenomena are involved. If this is the case, adjustment and revision mechanisms would be desirable features of international conventions. These problems are discussed in the next section with reference to the FCCC.

6. Implementation of the FCCC - Compliance, Effectiveness and Institutional Design

(Ronald Mitchell)

6.1 Theoretical Aspects of Compliance and Effectiveness

As the climate change regime develops, the regime's "effectiveness" will become an increasing focus of concern. What commitments governments have accepted will become less important than the degree to which they have adopted new behaviors to fulfill those commitments and the

degree to which those new behaviors have prevented climate change. Indeed, the FCCC will eventually be evaluated against many standards and evaluative criteria.[74] One common-sense standard for judging success would use the criteria of "problem-solving effectiveness," i.e., that global warming was averted and that the convention was the cause of that accomplishment. Less stringently, a "counterfactual" standard for success could demand that the treaty caused environmental improvements that would not have happened otherwise, even though they fall short of completely solving the problem, as if the FCCC delayed climate change by several decades but failed to avert its eventual arrival (Young 1991b). This latter standard highlights that the convention, especially initially, may only be "somewhat effective" in solving the problem, but will thereby provide insights into its own improvement (Underdal 1992; Levy, Young and Zürn 1994). Relatedly, the treaty may succeed at achieving compliance and its stated goals, but not solve the true environmental problem because of shortcomings in those goals themselves reflecting scientific uncertainty, failures of political will, or other factors. For example, even if the Convention on International Trade in Endangered Species completely eliminates trade in threatened wildlife, non-trade factors, such as habitat destruction, may still frustrate the ultimate goal of protecting endangered species. A currently vibrant literature suggests that a treaty's problem solving effectiveness depends on:

(i) Whether the treaty's goals were adequate to solve the environmental problem?

(ii) Whether the treaty's goals were achieved?

(iii) Whether the treaty caused the accomplishment of those goals? and

(iv) Whether, if the treaty did not accomplish its goals, it caused environmental improvements that would not have happened otherwise?

A necessary, but not sufficient, condition of problem-solving effectiveness is the treaty's ability to induce positive behavioral change, or behavior-changing effectiveness (Young 1991b). Behavior-changing effectiveness incorporates common notions of treaty implementation and compliance, i.e., treaties should induce states to promulgate laws, regulations, and policies and make their behavior conform with specific rules (Nollkaemper 1992, 49). But it captures the notion that we should also deem a treaty effective if it induces positive behavioral changes that

(i) fall short of full compliance (partial or good faith compliance);

(ii) comply with the spirit but not the letter of the treaty; or

(iii) exceed treaty-mandated standards (overcompliance).

Like effectiveness, compliance is often a matter of degree, with countries complying with one treaty provision while ignoring another. High compliance with the "wrong" rules can clearly inhibit treaty effectiveness. Conversely, partial or low compliance with the "right" rules may still help avert the problem, especially if the climate system proves to be resilient. However, more compliance is usually preferred to less and usually leads to greater effectiveness (ceteris paribus).

Much of the current research on environmental treaty implementation, compliance, and effectiveness is motivated not least by a desire to provide lessons for the climate change convention.[75] Since a treaty normally improves the environment by inducing new behaviors, and

74. This subsection draws extensively on Mitchell and Chayes (1995).

since the climate treaty is likely to specify behaviors which are desirable even if ultimately inadequate to prevent global warming, the balance of this section reviews the factors that will influence compliance, identifies institutional design criteria for facilitating positive behavior change, and ends by delineating specific policy aspects crucial to the implementation of the FCCC.

Once the FCCC adopts clear requirements, some actors will have several reasons to act consistently with the FCCC (Mitchell 1994, 32-46). Required behaviors will coincide with the independent self-interest of those actors who perceive the rules as reflecting their pre-existing interests, who do not need to make behavioral changes, or who view treaty rules as legitimate standards for action (Franck 1990). The incentives and capacities of countries already committed to reducing GHG emissions and other "unilateral compliers" will lead them to comply independent of the treaty's compliance system. Other "contingent compliers" will base their behavior on whether other actors' behavior conforms to treaty dictates and on how other actors respond to the failure to conform with their obligations.

Despite such compliance by some actors, others are likely to fail to comply with regime provisions for a variety of reasons (Mitchell 1994, ch. 2; Mitchell and Chayes 1995; Koskenniemi 1992). Even for actors committed to complying, the breadth and complexity of activities that contribute to global warming mean that compliance will take time. Some actors will fail to comply because they lack the financial, administrative, or technological capacity to comply (Greene 1994; Chayes and Chayes 1993; Kimball 1992, 43). Other actors may inadvertently fail to meet treaty standards, because policies they adopt do not achieve sincerely intended results which is particularly likely in cases such as carbon taxes to reduce GHG emissions (Epstein and Gupta 1990; Victor and Salt 1994, 8). Some actors will view climate change policies as a virtuous goal that is simply less pressing than other needs. For other governments and private actors, the present costs of required behavioral changes will exceed the uncertain and future benefits. Such "intentional violators" will fail to sign an agreement or will violate it regardless of its supporting compliance systems.

What mix of such unilateral and contingent compliance, and intentional, incapacity, or inadvertent noncompliance the FCCC will experience depends on how treaty rules are framed, the size and incidence of compliance costs and benefits, the actions of other actors, political forces, and an actor's infrastructure and resources. An effective compliance system will require a coherent, integrated approach that:

(i) makes initial compliance likely,

(ii) identifies and responds appropriately to noncompliance when it occurs, and

(iii) proves robust against free-riding.

75. For an overview, see Bernauer (1995). Published books include Cameron, Werksman, and Roderick (1996), Chayes and Chayes (1995), Lee (1995), and Mitchell (1994). Projects investigating questions of treaty compliance and effectiveness include those being conducted at, or with funding from, Dartmouth College (Oran Young and Marc Levy); the European Science Foundation (Kenneth Hanf and Arild Underdal); the Fridtjof Nansen Institute (Steinar Andresen and Joergen Wettestad); the International Institute for Applied Systems Analysis (David Victor and Eugene Skolnikoff); the National Science Foundation (Edith Brown Weiss); and the Social Science Research Council (Edith Brown Weiss and Harold Jacobson).

FCCC designers have several regulatory approaches to maximize the chances of positive behavioral change.[76] Parties to the FCCC could seek to alter behavior by manipulating the consequences for those already capable of complying: either through creating *deterrents* to noncompliance that identify and severely sanction violations or through creating *positive incentives* for compliance (Chayes and Chayes 1991, 318-20; UN/ECE 1994, 133). Alternatively, the FCCC could adopt *preclusive* strategies that reduce the opportunities to engage in climate altering activities, e.g., through restricting trade in high-sulfur coal, or *generative* strategies that create opportunities for beneficial behaviors, e.g., the programs for technology transfer to developing countries already established. Finally, the FCCC could seek to alter actor's perceptions regarding treaty-relevant behavior, either using information to induce *cognitive* shifts or more value-directed efforts including ongoing dialogue to induce *normative* shifts. For example, the LRTAP Convention appears to have altered behavior by improving knowledge of environmental conditions and increasing the level of environmental concern (Victor 1994a; Levy 1993; Sand, 1990, 16-17; French 1994, 96; Underdal forthcoming, 15-16).

Implementing any of these different strategies or some combination of them requires that negotiators integrate the strategy into the three components of the convention's compliance system:

(i) the primary rule system,

(ii) the compliance information system, and

(iii) the noncompliance response system.

The primary rule system comprises the treaty's substantive behavioral requirements. An effective primary rule system would seek to design proscriptions and prescriptions that require those behavioral changes by actors most susceptible to regulatory pressures which will have the biggest impact on the climate change problem (Mitchell 1994, ch. 9; Nollkaemper 1992, 52). When different actors, activities, or points in the regulatory process offer equal environmental benefits, an analysis should identify those actors most likely to conform their behavior to the regulatory standard. Clear standards that correspond with current monitoring capabilities also increase the prospects for behavioral change (Greene 1994; Tietenberg and Victor 1994, 25-27). Of particular concern is the fact that regulating all greenhouse gas emissions, rather than carbon dioxide alone, will be difficult for some time because of the obstacles that would hinder even an emitter of such gases from knowing the quantities emitted (Grubb 1993; Victor and Salt 1994, 11). Instead of regulating emission levels, directly regulating the levels of activities responsible for climate change (such as fossil fuel use or even precursor activities such as coal mining and oil drilling) would facilitate monitoring efforts while providing time for responses by other parties to either deter the undesirable behavior or encourage more desirable ones.

FCCC negotiators will face considerable pressures to adopt regulatory strategies that reflect traditional conceptions of enforcement as the best means of eliciting greater compliance (Sands 1993). Indeed, proposals have already been made to use economic sanctions, legal penalties, and private enforcement to improve the FCCC (Dudek and Tietenberg 1992, 241-245; Tietenberg and Victor 1994, 32). However, adopting a deterrent strategy that responds to noncompliance with sanctions faces several problems. First, as noted above, in the many cases in which noncompliance arises from factors other than intentional violation, sanctioning seems an

76. This section builds on Mitchell (1996).

inappropriate, and therefore unlikely, response. Second, even when noncompliance can be shown to be intentional, governments rarely have sufficient incentives to offset the costs of sanctioning noncompliance by other states (Axelrod and Keohane 1986). Third, countries that support the FCCC would be unlikely to make their greenhouse gas emissions subject to some form of Tit-for-Tat strategy, due to both the high domestic political costs and practical obstacles to actually doing so. In short, centralized sanctioning is unlikely to occur, and if it does, will generally fail to be severe. The FCCC will most likely need to rely on mild forms of collective opprobrium, such as diplomatic shaming and jawboning, which may prove adequate to induce compliance in some cases and on providing legal authority for decentralized sanctioning by nonstate actors (Chayes and Chayes 1993; Mitchell 1994, ch. 5; see Section 5.3).

New views on the sources of noncompliance have prompted interest in response strategies that address incapacity or inadvertence problems (Chayes and Chayes 1993). Trade incentives, technology transfer, and funding mechanisms have become increasingly popular, although empirical evidence on their effectiveness remains scant and funding for the GEF and technology transfer projects has fallen short of initial expectations (French 1994, 96; Anonymous 1994, 104; Victor and Salt 1994, 15). The European Union's eco-labeling program suggests that the FCCC could adopt forms of positive incentives other than financial transfers to induce actors to achieve or exceed treaty standards (Salzhauer 1991; Anonymous 1991).

Although the FCCC has a wide range of such options, to date, FCCC design decisions have reflected a primarily "soft-law" approach (see Section 4.2 above), hoping to elicit compliance without resorting to traditional deterrent approaches. Given these choices the following discussion seeks to highlight some of the current - and likely future - problems that joint implementation and tradable permits, financial and technological assistance, and reporting and verification will face in fostering the goals of the agreement.

Joint implementation and tradable permits

In preparing for COP-1, negotiators sought to allay the initial concerns of developing countries that joint implementation was "a means for Annex I Parties to avoid domestic action to meet current commitments under the Convention" (Earth Negotiation Bulletin 1995b). The joint implementation debate reflects an important political tension between the economic goal of minimizing the global cost of emission reduction and the equity goal of avoiding exclusive reliance on developing states to take the practical actions to limit emissions, especially since only Annex I countries "have obligations to limit GHG emissions" (UN Doc. A/AC.237/91/Add.1 1995).

Parties at COP-1 agreed to expand the concept of joint implementation from efforts between Annex I parties (as laid out in Art. 4(2)) by establishing a pilot phase for "activities to be implemented jointly" by Annex I parties working with non-Annex I parties (United Nations and INC/FCCC 1995). Initially, activities implemented jointly are to be taken voluntarily and in addition to existing obligations of Annex II (OECD) parties and existing flows of Official Development Assistance (ODA). Annex I parties also receive no credit for emission reductions during this initial period (Earth Negotiation Bulletin 1995a). The hope is that this pilot phase, and its review by the SBSTA and SBI, will provide the foundation for a subsequent, more extensive, formal phase that would "promote an international market in low-emissions technologies" (United Nations and INC/FCCC 1995; Earth Negotiation Bulletin 1995a).

Beyond these official activities of the COP, governments and nonstate actors (see Section 5.4.2) including businesses, academics, and NGOs have undertaken joint implementation projects and programs (Jepma 1995). The Netherlands' Forests Absorbing Carbon Dioxide Emissions Project has projects in Malaysia, the Czech Republic, Ecuador, and Uganda. The US Initiative on Joint Implementation approved seven projects in early 1995. Costa Rica's Office on Joint Implementation has administered projects since 1994, and a consortium of non-governmental groups formed the Foundation Joint Implementation Network in 1994 to host workshops, provide documents, and publish a quarterly journal on joint implementation issues.

The economic efficiency gains of joint implementation and the tradable permit schemes often discussed with regard to the FCCC are attractive because they promise to reduce compliance costs and increase compliance levels correspondingly (Victor and Salt 1994, 26). However, both these regulatory strategies pose special political problems for the compliance system (see Section 5.4.3). A tradable permit scheme will require negotiation of specific targets and timetables, measuring each country's annual emissions, and tracking all trades to determine each country's final "adjusted emission limit" based on permits allocated, bought, and sold (Tietenberg and Victor 1994). For either tradable permits or joint implementation projects, independent evaluation will be required, both to certify compliance with particular trades and to support the credibility of the market itself (Tietenberg and Victor 1994, 17-18). The FCCC will also need to clarify which party to an emissions trade or joint implementation project is responsible for compliance. Eventually, the FCCC will need to develop some mechanism to evaluate the claims of states that have sold allocated emissions rights but claim their noncompliance is due to inadvertence or an incapacity to comply. In short, tradable permit and joint implementation schemes raise new and difficult issues to which the FCCC will need to adapt and respond.

Financial and Technological Assistance

A crucial element of FCCC implementation is an incentive-based strategy of financial and technological assistance. This strategy starts from the dual assumptions (i) that Annex I (industrialized) parties will meet both emission reduction as well as financial and technological transfer requirements and (ii) that the failure of non-Annex I parties to comply will arise primarily from incapacity problems, not intentional violation. Following the lead of the Montreal and LRTAP protocols, the FCCC has devised a system "to avoid confrontation, to be transparent," and eschew sanctions in favor of cooperative measures for "assisting Parties to comply with the Protocol" (UN Doc. FCCC/CP/1995/Misc. 2 1995, 6).

Aside from questions about the institutional linkage between the GEF (administrator of the finanical mechanism) and the FCCC (see Section 4.2.2), effective implementation raises questions about the provision of funds. Most of the twenty-four Annex II parties appear to be fulfilling their commitments to contribute to the GEF pilot phase and to the subsequent "replenished GEF" phase from 1994-1997. However, the failure of some parties to report on their contributions, the failure of others to report contributions accurately, and the absence of specific criteria to permit evaluation of the type, timing, and amount of contributions confounds evaluation of whether commitments are being fully carried out. The FCCC does not specify the size of total contributions or each country's allocated share, although the parties have agreed to indicative scales of contributions (Earth Negotiation Bulletin 1995a). Indeed, COP-1 discussions highlighted the lack of sanctions for Annex II parties that do not contribute and the view of some

countries, most notably Japan, that contributions are "voluntary" (Earth Negotiation Bulletin 1995a).

At COP-1, the Parties blessed the GEF decision to implement, in consultation with the FCCC Secretariat and the COP, a two-track strategy for the Financial Mechanism "to develop a long-term comprehensive operational strategy... [along with] some project activities" (UN Doc. FCCC/ CP/1995/4 1995, 4). The GEF report makes it clear, however, that considerable latitude exists in determining what criteria should be used in prioritizing the allocation of funds to proposed projects, with significant trade-offs needing to be made between short and long term cost-effectiveness, the need for capacity-building, the size of emissions reductions, and other factors (ibid.). To date, the GEF pilot phase of the Financial Mechanism has spent $250 million to fund over forty country, regional, and global projects that include "enabling activities and preparations for national communications" of developing country Parties as well as "a small number of preferential, demonstration or innovation projects that contribute to the transition from the pilot phase to the longer-term operational strategy" (ibid.).

Beyond financial transfers, FCCC technology transfer issues have been mainly linked to current discussions in the Commission on Sustainable Development and to issues of joint implementation (UN Doc. A/AC.237/ 81, 1994, 49). Indeed, most discussions at COP-1 framed the technology transfer issue as best facilitated through the joint implementation procedures rather than as a stand-alone process (Earth Negotiation Bulletin 1995a). To date, transfers appear to be primarily bilateral with increasing attention focusing on the need for public-private partnerships to facilitate them (UN Doc.A/AC.237/81, 1994, 49).

Reporting and verification

Regular, accurate information is needed on behaviors contributing to climate change, on the environmental status of the climate system itself, and on behavioral responses to regulations (Ausubel and Victor 1992, 14-15; see Section 4.2.2). The transparency provided by such information permits actors making interdependent decisions to coordinate their behavior, reassures actors whose compliance is contingent on other participants, and deters actors contemplating noncompliance (Chayes, Chayes and Mitchell 1995, 5). Yet, the difficulties of ensuring governments make such information available have already become obvious. Of the countries required to provide "initial communications" to the COP, only twenty-four provided reports on time, eight provided reports late (UN Doc.FCCC/1995/Inf.3 1995) and five countries did not provide information at all.

Of the twenty-four Annex II (OECD) countries required to report on actions taken to provide financial and technical assistance to developing states, only fourteen (58%) had submitted these communications by two months after the deadline (UN Doc. A/AC.237/81 1994, 44). Two countries that contributed to the GEF did not report this fact (ibid., 45). The data in the reports received by the Interim Secretariat made it "difficult to draw clear conclusions about the nature and level of contributions and assistance..., was not comparable in terms of figures provided and time-frames..., [lacked distinctions] between activities undertaken before and after adoption of the Convention", and often conflated sustainable development activities with climate change activities (ibid., 1994, 44). Reports could not be used to confirm whether these countries had provided the "new and additional financial resources" required by Article 4(3), because FCCC parties still had not established an "agreed benchmark against which such verification could take place" (ibid., 45).

These problems will increase as new reporting requirements are added. Draft protocols to the FCCC have included more extensive reporting requirements, even though not requiring data on actual GHG emission reductions (UN Doc. A/AC.237/L.23, 1994, 6). Indeed, "independent verification" has become of "crucial importance" if joint implementation is to be accepted (Michaelowa 1995, 13; Anderson 1995, 16; Luhmann et al. 1995, 10). Experience to date suggests that, as with other environmental treaties, the FCCC regime will need to address the following problems:

(i) non reporting will occur,

(ii) even some compliant countries will not report,

(iii) many reports will be late, and

(iv) report formats themselves and/or the ways states fill them out will inhibit useful analysis by the secretariat (Mitchell 1994, 143-146).

Remedies will require the FCCC to take three policy steps. First, required data must be made easier to collect and report, must be based on clear formats, and must facilitate subsequent evaluation. Second, the secretariat needs to process and disseminate this information in ways that further the goals of those entities responsible for reporting, a task that might be facilitated by electronic submissions. Third, the secretariat needs to establish mechanisms for encouraging informational inputs from third parties, including both industrial and environmental NGOs, as noted in Section 5.4.2.1 (Mitchell 1994, 318-322). The ability of the FCCC secretariat to develop well-working reporting mechanisms will prove crucial to its ability to induce positive behavioral changes to protect the global climate as well as to its ability to know whether such behavioral changes are taking place.

As the regime develops, negotiators will need to design a coordinated compliance information system that goes beyond self-reporting, to independent reporting, monitoring, verification, and on-site inspection (General Accounting Office 1992; Fischer 1991; Sachariew 1991; Di Primio and Stein 1992). Involving actors with independent incentives to monitor policies, behaviors, and environmental quality -- such as the environmental NGOs and corporate actors involved in Agenda 21 implementation -- will dramatically improve the amount of data available (French 1994, 96; Tietenberg and Victor 1994, 28-29; Mitchell 1994, ch. 9). Further, the Secretariat or SBI will need to develop procedures for review and assessment of the information that is collected if that system is to contribute to the regime's credibility and success over time (Avenhaus and Canty 1992; Chayes 1991; Grubb and Steen 1991; Victor and Salt 1995). Over the next decade, the FCCC will face the difficult task of resolving the tension between the need to verify treaty-related behaviors and reports thereof through independent and intrusive measures such as satellite monitoring, atmospheric sampling, and on-site inspections; significant political resistance to such procedures is expected (Hönsch 1992; Lewis 1992; Victor and Salt 1994).[77] Monitoring precursor activities that precede actual greenhouse gas emissions would allow the FCCC to prevent climate-damaging activities rather than merely sanction them after damage occurs. Ongoing monitoring of environmental quality and links to human activities will provide the feedback needed to revise regulations while educating states and nonstate actors of the costs of current activities.

77. On-site environmental inspection procedures are not unprecedented, as evident in the wetland, whaling, and atomic energy treaties (Ramsar Convention Bureau 1990; Ausubel and Victor 1992, 18-19).

6.2 Institutional Design

Refining the FCCC into an agreement that is effective at both changing behavior and mitigating, if not averting, global warming will require establishing a process and institutions that can accomplish several complex tasks. Most fundamentally, convention (re)designers should consciously identify the best regulatory strategy, or combination of strategies, that can address the range of reasons why nations and subnational actors will fail to fulfill treaty commitments. The three compliance system elements - the primary rule system, the compliance information system, and the noncompliance response system - must place relevant actors in a strategic triangle of political and material incentives, practical ability, and legal authority for undertaking the compliance, monitoring, and response activities essential to treaty effectiveness (Mitchell 1994, 307).

Inattention to how primary rules affect the ease and likelihood that actors will change their behavior, collect information, and respond to noncompliance will make an effective treaty unlikely. To negotiate more ambitious commitments, negotiators will need to evaluate alternatives -- from pledge and review, targets and timetables, and tradable permits, to carbon taxes, global warming insurance, and damage compensation schemes -- in terms of how likely they are to alter behavior as well as in terms of economic efficiency, cost, and equity (Barthold 1994; Peck 1993; Grubb 1993; Stone 1992; Grubb and Steen 1991; Pearce 1991; Epstein and Gupta 1990; see also Section 5.4.3). Although the COP frequently will seek advice on scientific and technical complexities, the COP would do well to establish either a formal process for systematically evaluating alternative proposals against such criteria. Within their political and economic constraints, negotiators should seek to regulate those sectors most likely to comply within those countries which are most likely to implement and enforce treaty commitments.

Within the compliance information system, self-reporting systems can be made to elicit honest responses when tied to positive incentives and cognitive strategies, since these approaches do not create disincentives to reporting. In contrast, deterrent and preclusive strategies require much greater reliance on independent sources of information. Until convention commitments become more specific, generating useful information and clear identification of noncompliance will remain unlikely (see Section 6.1). The Subsidiary Body on Implementation (SBI) will need to induce effective and accurate reporting; review, verify, and synthesize data provided; determine the existence, causes, and proper responses to noncompliance; and determine how and to whom to disseminate information. The Subsidiary Body for Scientific and Technological Advice (SBSTA) could aid evaluation of treaty effectiveness by coordinating national and international collection of time-series environmental quality data that can document ecological trends to produce recommendations about corresponding policy redirection (Victor and Salt 1994, 14).

Nations are unlikely to cede the sovereignty necessary to a centralized FCCC noncompliance response system or enforcement agent (Sands 1993, 389). However, financial mechanisms may provide an appropriate and effective response even to intentional violation, assuming the major obstacle of eliciting contributions can be overcome (Chayes and Chayes 1993). When sanctions prove to be an appropriate response, the FCCC can facilitate it by removing legal barriers that inhibit those predisposed to enforce, e.g., GATT and WTO rules that restrict the use of trade sanctions (Mitchell 1994, 322). The convention's current strategy of leaving responses to ad hoc decisions of the COP is likely to produce few harsh words, let alone harsh actions. Preclusive strategies can identify and stop noncompliance before it occurs, thereby reducing the

noncompliance incidents that require a response. Better yet, cognitive or normative strategies increase the internal commitment of states and other actors to regime goals, inducing more actors to adopt new behaviors - even while mitigation costs remain constant. Research into technologies and processes that reduce greenhouse emissions, including technology diffusion, could also promote new mitigation policies.

To succeed, the FCCC will need to identify some combination of strategies that produce primary rules, compliance information systems, and noncompliance response systems that facilitate compliance, reporting, verification, and responses to noncompliance by those actors already predisposed to perform these tasks. These represent considerable demands for a secretariat and associated institutions that are likely to be consistently underfunded, understaffed, and overworked (Mitchell and Chayes 1995). The demands of such a system will be extensive and will require nations, corporations, NGOs, and individuals to dedicate significantly greater resources to the task than they have committed to other environmental problems.

7. The Future of the Framework Convention

(Detlef Sprinz)

In Section 5 we have shed some light on why the FCCC was concluded and analyzed the degree of international cooperation on GCC from the perspective of a wide range of perspectives. Furthermore, Section 6 focused on the aspects of implementing the current obligations, their effectiveness, and institutional design questions. In combination, this provided us with a retrospective view of international climate change policies. In this section, we take a forward-looking perspective by speculating about the potential futures of international policies on GCC.

Parallel to the COP-1 as well as the prior meeting of the INC, an academic debate between Victor and Salt (1995a, 1995b), on the one hand, and Hare et al. (1995), on the other, started regarding the advice of these groups of authors for near-term actions to be taken by the parties to the FCCC. Summarized in very terse form, Victor and Salt emphasize (i) the built-up of a more complete institutional review mechanism for assessing the obligations of parties and (ii) prefer a flexible mechanism for so-called "soft commitments" as the priority issues for the next half decade, whereas Hare et al. strongly prefer the negotiations of hard law "targets and timetables" as the best way to reduce the human impact on the climate system (see also Section 4).

Various advantages of these approaches have been mentioned in their supporting documents. In particular, Victor and Salt favor commitments which countries know that they can implement (or comply with), and given the current lack of enthusiasm to conclude further emission reductions, they suggest that building a high-quality implementation review mechanism as a control device on the ambitions of countries as well as permitting a "softer" way of commitments will allow countries to approach their maximum concessions more easily than in a hard law approach. Conversely, Hare et al. contend that countries cannot afford to spend half a decade on experimenting with building a review mechanism without making new, more stringent commitments. In particular, the latter group suggests that (i) international rules are important to restructure domestic alliances in favor of more stringent policies and (ii) the natural science assessment of the state of the climate system calls for immediate, steep cuts in GHG emissions. In turn, these hard targets, enshrined in formal international environmental agreements, will automatically further the creation of an implementation review mechanism. Both schools of

thought assume that their particular recommendations serve the protection of the global climate system best, however, the "conventional wisdom" - called upon by both sides - necessarily rests on a rather small case domain to draw their conclusions from.

In some respects, this discussion seems to point to the ambiguity among the policy community of what to do next. Clearly, the suggestions of Victor and Salt appear to show higher chances of implementation than the position taken by Hare et al. However, these positions are not necessarily contradictory: A much improved, high-quality information review mechanism is needed for evaluating the performance of parties to the FCCC, and it seems reasonable to assume that some time is needed to accomplish this goal. However, this should not lead to giving up on a true mitigation protocol in the medium term, since formal treaties do not permit countries to renege on their commitments easily.

In our view, three broad trajectories can be envisioned in terms of the contents of the mitigation measures taken - or avoided. First, following the often cited history of the regulation of transboundary air pollution in Europe as well as the agreements to protect the stratospheric ozone layer (see also Section 4), it appears that a broad framework convention is followed by more stringent substantive protocols. These will follow a path of sequential strengthening of rules and broadening the scope ("comprehensive" approach), with implementation review mechanisms assessing prior accomplishments. Regrettably at the time of writing, there appears little evidence in support of such a trajectory, although the diplomatic histories of the referent cases also suffered from periods of stagnation.

Second, a period of prolonged stagnation may ensue with countries debating the rules of procedure rather than developing GHG abatement protocols or making progress on other conflictual issues of substance. In fact, this stagnation trajectory may be pursued by some OPEC countries - with the rules of procedure serving as a proxy for avoiding abatement of GHGs and as a way to control the opportunities of other countries to pursue new agreements. While it appears unlikely that many countries will accept such a form of stagnation for a longer period of time, it remains a real possibility, especially if major emitters (such as the USA) are not acting as enthusiastic pushers for more stringent mitigation protocols. The stagnation outcome may also arise, although to a lesser degree, due to other major issues capturing the attention of national agendas. International war, the international spread of hard to cure diseases, nuclear accidents, and other themes may legitimately distract national elites and publics from the GCC issue.

Third, a partial combination of the former two trajectories envisions a "stagnation and lead group" trajectory in which some OECD countries respond to prolonged stagnation at the bargaining table with the threat to opt out of the current global climate regime - and, potentially, subsequently building a parallel regime on their own. As long as crucial developing countries (e.g., India, China, Brazil, etc.) follow major industrial countries on this path, such a small core group is likely to write the major rules of global climate policy. It would be expected that such a trajectory includes a strong implementation review mechanism to avoid defection among the key countries as well as some rules of equitable contributions to the collective effort (see Sections 5.4.3 and 6).

Which of these three trajectories will ultimately best reflect the future of the FCCC remains unclear. Besides the suggestions made in prior sections of this article on how to enhance the chances of more stringent GHG emission policies in the international context, a few key issues will need to be tackled under any circumstances if new substantive agreements are to be concluded.

First, international GCC policies will remain high on the international agenda only if scientists can demonstrate that mitigation (as opposed to adaptation) matters in terms of benefits. Otherwise, major investments in GCC mitigation policies are unlikely to occur.

Second, among the major emitters, OECD countries will have to drastically reduce their per capita emissions of GHGs over time, whereas the rising GHG emissions of poorer countries should approach some long-term global average without following the GHG-intensive route of the present major emitters. In essence, this calls for a convergence of per capita emissions of GHG in the very long run for reasons of equity. Even this "narrowing of the gap" in per capita emissions will be costly for wealthy and presently poor countries.

Third, efficiency in implementing international accords on GCC is a precondition for new substantive agreements in the medium term. Only if part of the benefits of joint implementation (or "joint activities") are accrued by the investor (i.e., countries with high abatement costs which compensate countries with low abatement costs for their additional efforts), we should find substantive GHG emission reductions to be attractive to major emitters. Prohibitive prices normally lead to lack of voluntary provision of a public good. By lowering the price to present major emitters, low abatement cost countries can make a major contribution to stabilizing the present climate system.

Fourth, implementation review mechanisms are needed to (i) assess the degree of success of international rules, (ii) assist compliance, and (iii) explore more successful avenues of reducing the GHG emissions in case of non-compliance. Project evaluation is necessary both in the domestic and the international political arena - and it should not be left to circumstances if an effective review mechanism is built.

Ultimately, we cannot predict easily which trajectory the international policies on GCC will take. Our limited knowledge does not permit us to be too optimistic, but there seems little reason to use pessimism as an excuse for not taking decisions to lessen the human impact on the global climate system. Because our knowledge is presently still limited, we suggest in the following Section a few core issues which merit further research.

8. Suggestions for Future Research

(Urs Luterbacher and Detlef Sprinz)

By historical standards, research on international responses to global environmental challenges is a comparatively new phenomenon. In fact, it faces slightly different challenges as compared to most "intra-" social science research, because a minimum understanding of the interface between the anthroposphere and the environment serves as a prerequisite.

Based on the material presented above, we suggest a range of themes for subsequent research so as to refine our understanding of the human driving forces of global environmental change, decision-making of collectivities, and the prospects of implementation. In particular, we suggest to conduct research on the

- comparability of national efforts on GCC policies,
- comparative assessment of the domestic-international linkages in decision-making on international GCC policies,

- implementation of GCC policies in less industrialized countries, especially. the applicability of debt-for-nature swaps,
- attitudes of collectivities (e.g., countries) towards risk and the applicability of the precautionary principle,
- effect of changing scientific knowledge on the preferences of decision-making units, and
- problems of international negotiation and implementation to avoid free-riding and to set up efficient monitoring practices.

Comparability of National Efforts on GCC Policies

As Section 4 has shown, we encounter a broad range of national policies regarding emission reductions and enhancement of carbon sinks. What appears to some observers as varying preferences for stringent GCC policies may, at second sight, appear less clear cut. For example, Germany favors relatively strong emission abatement policies as compared to the USA - although both countries hold major coal reserves. The difference may, in part, be explained by the differences in the willingness of populations to accept high energy prices - as resulting from energy policies developed in the 1970s. Thus, the political costs of pushing major emitters to reduce their emissions and to levy relevant taxes on consumers appear, for a broad range of mitigation policies, to be lower for the German federal government as compared to the US federal government. It could well be the case that the policies of both countries are both yielding their respective governments positive marginal "political revenue," however, the maximum yield may be reached in the USA at a comparatively lower percentage reduction rate for GHG emissions as compared to Germany.

Overall, this suggests that cross-national research should be undertaken to compare the relative efforts of countries not only in terms of "% emission reductions" (or equivalent enhancement of GHG sinks), but also in terms of the political costs to achieve them. Some current research into "political cost-benefit analysis" (Helm and Sprinz 1995; Pastor and Wise 1994) may point into this direction, but needs further elaboration for cross-national assessment and in terms of measurement. While governments often have to overcome different hurdles, they may undertake equivalent political efforts to reduce the human impact on the climate system.

Domestic-International Linkages in Decision-Making on International GCC Policies

While sharing an interest in the assessment of comparable political hurdles, we actually know relatively little about the domestic decision-making process on national GCC policies. As Section 5.4.1 has shown, various interest groups and NGOs influence governmental decision-making on international environmental policies. However, there is a clear need to show with the help of a comparative case study design, both conceptually as well as empirically, how major emitting countries (as well as countries reducing GHG sinks) arrive at their policies. Furthermore, it is necessary to build research from "cradle to grave" - implying an integrated research design encompassing, inter alias, the international driving forces, the domestic origins of international bargaining positions, international negotiations, and the implementation of national policies by local emitters.

In addition, this domestic-international link undergoes autoregressive processes as international environmental regimes "develop" over time. In particular, specific protocols on pollution

abatement may build on each other (as is the case of European acid rain or the regime to regulate stratospheric ozone depletion), and the particular effects of these feedback loops on the domestic-international linkages may provide insights about the potential for upgrading international commitments -- as well as the limits to compliance with international obligations.

Debt-for-Nature Swaps

Economically more advanced countries may actually reduce their impact on the climate system at some time in the future. However, given the rather weak provisions of the FCCC for economically less industrialized countries (see Sections 4), it remains unclear how potential major future emitters of GHGs could be convinced to undertake policies which freeze or reduce their GHG emissions. Implementation of world-wide emission reduction strategies may necessitate compensation for late industrializing countries for efforts to reduce their impact on the international climate system. Besides international technology assistance, subsidized credit arrangements (i.e., below market costs), and extraterritorial control of the emission policies of transnational corporations, debt-for-nature swaps may constitute one way to induce less industrialized countries to consider emission abatement (or enhancement of GHG sinks).

Debt-for-nature swaps are essentially arrangements to convert international debt into (financial) obligations to protect the domestic environment. The conversion rate between external debts to funds for domestic environmental protection is essentially a measure of the rate of subsidization by the foreign country. In fact, this conversion rate has a dual effect. If it is set close to parity (expressed in international currencies), less industrialized countries will generally show little inclination to accept international debt-for-nature swaps as compared to a situation with relatively minor environmental protection obligations for the less industrialized country. From an environmental standpoint, parity would be preferred due to its larger impact, while a lower conversion rate might ease the implementation and acceptability of debt-for-nature swaps for less industrialized countries. Thus, more research is needed to determine under which conditions international lending countries can reasonably hope to conclude debt-for-nature swaps with substantial environmental impacts. In a wider sense, this is of relevance to the contested terrain of joint implementation, since such implementation policies are also concerned with "conversion" rates of attributing project results to the donating and the receiving country. Since successful contracts have to satisfy both an efficiency component (contract curve) as well as an equity concern (acceptance of the distributional implications of the contract), this field of research would be of particular interest to North-South relations on international GCC policies.

Attitudes of Collectivities Towards Risk and the Precautionary Principle

Even though the study of the attitude of individuals toward risk has received considerable attention (see for instance Kahneman, Slovic and Tversky 1982), the same cannot be said about collectivities who depend upon a form or another on collective decision-making. Voting, bargaining, the use of threats and violence, or a complex combination of all these constitute examples of such decision-making processes. Do certain types of collective decision-making practices encourage risk-taking or risk-averse types of actions? A very good review of that central question is provided by Davis (1992) who emphasizes the fact that group decisions are sometimes more extreme than individual ones but that key players within groups can heavily influence decision-making. The answer to the questions of group decision-making would be particularly

relevant in terms of environmental issues and the type of measures and instruments to deal with GHG emissions and global warming in different societal and cultural contexts.

Effect of Changing Scientific Knowledge on the Preferences of Decision-Making Units

As demonstrated by the increasing amount of scientific evidence on ozone depletion and its effects, scientific knowledge seems to influence the preferences of decision-makers both at a domestic, international, and transnational level. Government, business, international, and transnational organizations have modified their preferences accordingly but not everywhere and not necessarily in the same way. Research would help us to respond to questions such as to what extent does improved scientific knowledge in the area of climate change influence preferences and perceptions? And what are the effects of false predictions or faulty reasoning (e.g, the mistakes surrounding the so-called "death of the forests")?

Problems of International Negotiation and Implementation

So far, the analysis of international negotiation, implementation, and institutional design have mostly taken the Prisoner's Dilemma as their model of preference arrangements at the international level. Other preference structures arising through the considerations presented above such as Chicken might lead to more complex problems of institutional designs and monitoring. These problems have largely been evoked in Section 6. The question of negotiation strategies and the design of institutions and monitoring mechanisms best suited to these preference structures has barely begun. Solving such problems constitutes a major challenge for research. Analogies with other questions such as disarmament treaties and the kind of monitoring devices created within their framework might be useful.

The list of research questions presented above is far from exhaustive and many other issues could also be evoked. Nevertheless, it illustrates the complexity of some of the problems that remain unsolved in the area of international responses to climate change. As elsewhere in this vast area, answers to these research questions involve the collaboration of a wide variety of disciplines ranging from political science to law, economics, sociology, and history. For this reason, it remains important that these various disciplines can eventually settle on the use of a common language of research. Such a language should not only be useful in bringing the social scientists together but should also aim at establishing the essential linkages with natural scientists. If such a language could be established, a major obstacle to collaborative scientific research on the international responses to climate change could be lifted.

9. Conclusions

(Detlef Sprinz and Urs Luterbacher)

In this article, we have undertaken a comprehensive assessment of the international responses to global climate change by focusing on its most visible results, namely the UN Framework Convention on Climate Change.

In doing so, we reviewed the strategic problem of international coordination to control the anticipated changes to the global climate system caused by human interference with the atmosphere; the international human driving forces which effect the dissipation of resources in

time and space; the political process leading to the FCCC; theoretical, methodological, and legal treatment of the process leading to this international environmental agreement; and implementation of the FCCC as well as institutional design of the international response to global climate change.

Focusing on the international response to GCC confronts the strategic problem of preserving a global open access commons as well as the shortcomings of international coordination to do so. Rather than lamenting the absence of a uniform and sustained response, a variety of theoretical and methodological approaches have sharpened our understanding under which circumstances a comparatively weak response may emerge internationally. To some degree, we should not be surprised that "so little" has been accomplished in a comparatively short amount of time, since it is very difficult to attribute causal factors to particular effects (except in the world of integrated models). This poses an additional strategic problem which is similar to the regulation of the depletion of the stratospheric ozone layer: It is very difficult to "experience" global climate change per se, as most of the phenomena associated with it (e.g., change in sea level and agricultural productivity) have received scholarly attention long before climate change emerged on the international agenda. While the depletion of the stratospheric ozone layer can be displayed visually, climate change affects a much broader set of parameters. In effect, regulating climate implies the use of known means of intervention to regulate a phenomenon which is only incompletely understood by most humans.

The considerable body of knowledge represented in this article should not obviate the need for future research in this field as many critical issues remain open for further exploration. In particular, we know comparatively little about the likely future trajectory of the "evolution" of the climate regime and the determinants of national choices between mitigation and adaptation. Furthermore, many attempts of integrated modeling of global and regional climate change remain comparatively uninformed of the knowledge base developed by the broad range of disciplines contributing to international studies. In a broader sense, more explicit involvement in such modeling efforts will allow us to contribute to more adequate trajectories of the human contribution to global environmental change and the opportunities to preserve a habitat for humanity.

10. List of Acronyms

AOSIS	Alliance of Small Island States
CAN	Climate Action Network
CANZ	Canada, Australia, and New Zealand
CFC	Chlorofluorocarbon
CLRTAP	Convention on Long-Range Transboundary Air Pollution
COP	Conference of the Parties
EC	European Community
EPA	Environmental Protection Agency
EU	European Union
FCCC	Framework Convention on Climate Change
FIELD	Foundation of International Environmental Law and Development
GATT	General Agreement on Trade and Tariff
GCC	Global Climate Change
GDP	Gross Domestic Product
GEC	Global Environmental Change
GEF	Global Environment Facility
GHG	Greenhouse Heating Gas
G77	Group of (formerly) 77 (Less Industrialized) Countries
IGO	International Governmental Organization
IIASA	International Institute for Applied Systems Analysis
INC	International Negotiating Committee
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for the Conservation of Nature
JUSCANZ	Japan, USA, Canada and New Zealand
LRTAP	Long-Range Transboundary Air Pollution
NGO	Non-Governmental Organization
ODA	Overseas Development Assistance
OECD	Organisation for Economic Cooperation and Development
OPEC	Organisation of Petroleum Exporting Countries
PD	Prisoners' Dilemma

QELROs	Quantified Emission Limitation and Reduction Objectives
SBI	Subsidiary Body on Implementation
SBSTA	Subsidiary Body for Scientific and Technological Advice
SWCC	Second World Climate Conference
UK	United Kingdom
UN	United Nations (Organisation)
UNEP	United Nations Environment Programme
UNCED	United Nations Conference on Environment and Development ("Rio Conference",1992)
USA	United States of America
WMO	World Meteorological Organisation
WTO	World Trade Organisation

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