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Managing Global Climate Change Through International Cooperation: Lessons From Prior Resource Management Efforts

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ABSTRACT

The impact of CO_2 emissions and other greenhouse gases upon the biosphere is a contentious resource-related issue. International cooperation aimed at furthering awareness has been relatively rapid, but developing strategies for prevention or mitigation has taken more time. The potentially high stakes in this controversy, coupled with uncertainties over specific effects and their time frame, are hastening cooperation. However, the size and distribution of correction costs is making agreement over specific mitigation or prevention measures difficult.

Anthropogenic climate change poses several particularly difficult obstacles to an integrated global strategy. These include: (1) conceiving of the atmosphere as a shared, sustainable resource; (2) agreeing upon the causes, rates, and responsibilities of induced change among national actors (3) minimizing collateral effects of economic development while optimizing growth, particularly in LDCs; and, (4) encompassing the complexity of the problem's various ramifications in a multi-lateral policy.

International cooperation in other such areas as nuclear materials and technology, water pollution, and protecting the ozone layer reveals that effective strategies for managing global-climate change are available but require institutional modification and patience. Efforts aimed at controlling pollution in regional seas, minimizing ozone depletion, and regulating the use and transport of nuclear materials were, at one time, viewed as similarly complex problems. One lesson of these cases is that effective international cooperation in environmental and energy issues is the result of an incremental and iterative learning process among scientists, environmental groups, and political leaders who hold divergent perceptions, interests, and stakes in resource controversies.

Specific lessons from these cases, applicable for the issue of managing global-climate change, include the following: a gradual process of consensus building is most effective when consultation with all affected parties takes place. This would come about after a scientific, technical, economic, and political evaluation of alternative actions by all parties. Once an initial assessment of alternative actions has been carried out, a process of both conflict and cooperation is likely to commence with greater cooperation likely once agreement upon the scope of the problem is reached. Once common action to assess the impact of CO_2 commences, further cooperation is likely to require regulatory agreements based upon acknowledgement of the sovereignty of all nations, and the importance of non-state actors in decision-making. An effective strategy will hinge on accommodating the multiple uses of a common resource while obtaining consensus over rights, responsibilities, and the capabilities of individual nations to establish compliance targets. Nations will continue to comprise the basic vehicles for implementing decisions, but non-state actors often will play a vital role in formulating compliance targets and in prodding states to meet them. Regional seas management and ozone depletion both exemplify this approach.

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LIST OF ACRONYMS

CFC	chlorofluorocarbons
EC	European community
EMP	electromagnetic pulse
EURATOM	European community's Atomic Energy Agency
IAEA	International Atomic Energy Agency
IAMAP	International Association of Meteorology and Atomspheric Physics
ICSU	International Council of Scientific Unions
IPCC	Intergovernmental Panel on Climate Change
IRS	incident reporting system
LDC	less developed countries
LRTAP	Long-range Transport of Air Pollutants
Med Plan	United Nation's Environment Program's Mediterranean Action Plan
NGO	nongovernmental organizations
NPT	Nuclear NonProliferation Treaty
OECD	Organization for Economic Cooperation and Development
OSART	operational safety review teams
SALT I	Strategic Arms Limitation Talks I (Anti-Ballistic Missile Treaty)
SALT II	Strategic Arms Limitation Talks II (Limits on Offensive Strategic Weapons Treaty)
SST	supersonic transports
U.K.	United Kingdom
UN	United Nations
UNCLOS	United Nation's Law of the Sea Convention
UNEP	United Nations Environment Program
U.S.	United States
U.S.S.R.	Union of Soviet Socialist Republics (Russia)
WHO	World Health Organization
WMO	World Meteorological Organization

1. INTRODUCTION: THE SEARCH FOR GLOBAL CONSENSUS THROUGH AN INCREMENTAL AND ITERATIVE LEARNING PROCESS

This report addresses the availability of an incremental and iterative learning process for enhancing international cooperation in the management of global climate change. The process is iterative because carefully formulated agreements are replicated in increasingly larger and diverse contexts. Through an examination of three case studies concerning (1) regional seas, (2) ozone, and (3) nuclear-materials regulation, models for global cooperation are identified that encompass concerns about the size and distribution of correction costs among countries, the uncertainties involved in identifying cause-effect relationships, the vulnerability of shared resources, and the divergent needs of developed and developing countries. The ability of these models to encompass such concerns comes from their emphasis on interactive learning among scientists, environmental groups, international organizations, and governments of nations. Participants bargain not from pre-established positions but from partially formed positions. In many cases, participants enter into negotiations to learn more about a problem. The three cases studies were selected because they share four characteristics that make them relevant to understanding the types of challenges involved in global climate change and thus exemplify this incremental and iterative process:

- Each case was measurably successful in obtaining rapid, fairly comprehensive, and continuing cooperation among diverse participants through development of long-term management strategies.

- At one time, the issues involved in each of these cases were seen as extraordinarily complex and controversial. The transnational management of these issues was viewed as critical not only to environmental protection but to human health and welfare, economic development, and (in some instances) national security.

- Success in each case depended on cooperation among many representatives from national governments, international organizations, scientific groups, policy advocacy groups, and others. In the case of nuclear-materials regulation especially, each representative initially exhibited (sometimes fierce) distrust toward others; yet no single set of participants could effectively manage alone the issues presented. Although less of a problem in the other cases, some distrust was evident.

- The proposed management frameworks involved such activities as regulating peaceful uses of atomic energy, halting water pollution throughout extensive geopolitical areas, and protecting the earth's stratospheric ozone layer. Thus, each of the frameworks addresses problems comparable to those entailed in a global carbon dioxide (CO_2) agreement.

In short, these cases serve as partial precedents that exemplify patterns of decision making that bring together nongovernmental participants as well as political leaders in ways that attenuate ideological or economic conflicts regarding resource management. Of cooperative efforts to manage global climate, the Intergovernmental Panel on Climate Change (IPCC) is the most prominent. The success of the IPCC and of any additional management programs will likely depend on imaginative solutions to global climate management problems.

1.1 CONSENSUS AND DISSENSION ON GLOBAL CLIMATE CHANGE

Scholars and political leaders are beginning to agree that transboundary institutions are required to integrate analytical techniques for understanding the processes of climate change (Dovland 1987). Moreover, diffusion of innovative techniques among countries for regulation, control, and prevention of environmental impacts related to climate change is beginning to occur as a result of formal multinational political conferences, scientific meetings, and informal discussions among environmentalists (Gladwin et al. 1982). These conclusions emerge from an even cursory examination of the efforts of international scientific and political organizations. Some of the ambitious strides made in transcending ideological, economic, and cultural differences in global issues are exemplified by the activities of the International Council of Scientific Unions (ICSU), in the area of global climate-change modeling (Malone 1986); by the Economic Commission for Europe's Convention on Long-Range Transport of Air Pollutants (LRTAP) (Dovland 1987; Gwynne 1982; Protocol to the 1979 Convention 1988); and the United Nations Environment Program's Mediterranean Action Plan (Med Plan), for the mitigation of water pollution (Hulm 1983; Haas 1988a). Despite such broad consensus, however, global climate change poses a Herculean challenge to international decision-making efforts for several reasons.

First, many high stakes are involved in the potential warming of the earth's atmosphere; global warming can help or hurt regions ecologically and economically. For example, whereas a warming of two degrees Celsius might reduce average yields of wheat and maize in the central latitudes of North America and Western Europe, yields of sugar cane and sorghum, produced mostly in the southern hemisphere, may increase by similar orders of magnitude (Jaeger 1986). Other studies have come to similar conclusions (*EPRI Journal*, June 1986). In time, this may cause friction among countries seeking to cooperate to prevent further climate-change impacts beyond the natural range of variability. Uncertainty concerning how global climate change may beneficially or adversely affect various regions may increase nations' cooperating because each party knows it could lose *something* (Fulkerson et al. 1989). For example, a party that would benefit from global climate change could be placed in jeopardy if another country coveted the former's gains (such as the ability to produce more food). Paradoxically, increasing scientific knowledge about the distribution of climate impacts may discourage from efforts to preempt climate change those parties that would benefit from climate-change impacts (Rayner 1988).

Second, diffusion of information about the global carbon cycle may reduce ignorance of the speed and scope of atmospheric warming. However, considerable uncertainty still surrounds the variables affecting anthropogenic climate change. Important questions yet to be answered involve how quickly remaining reserves of fossil fuels will be consumed, how rapidly and to what extent carbon dioxide can be transferred into the earth's oceans, and what effect climate warming will have on the West Antarctic ice sheet. Many scholars have proposed new ways of coping with the problem of uncertainties associated with the variables of climate change, such as emphasizing game-theoretic or scenario forecasts to encourage more scientific cooperation (Bach 1984). Political, economic, and cultural trends are as important to such forecasts as are physical and chemical laws (Jaeger 1986; World Climate Program 1981). Considerable contention persists among scientists concerning negative feedback factors such as cooling effects of some gases, counterbalancing the effects of photosynthesis, ocean currents, and other variables (*EPRI Journal*, June 1986). The rate of fossil-fuel burning, for example, will be influenced by factors of economic cost, for which previous trends pertaining to fossil fuel use may be of little guidance (Schelling 1983). Perceived environmental impact, public acceptability of alternative energy-generating technologies, and rate of technological acceptance are also important factors.

Third, unlike environmental issues concerning Antarctica, the Mediterranean Sea, or U.S.-Canadian boundary waters (all of which are recognized as public goods shared by specific countries for scientific research, economic exploitation, or both), until recently the atmosphere has not been viewed as a universal or global public commodity (Bohm 1982).

Fourth, in most instances, clear links among environmental degradation and specific social consequences, such as human health or economic losses, need to be established to inspire cooperative resource policies. A notable exception would be the LRTAP negotiations on transboundary air pollution that were hastened solely because of anticipated ecological effects, but with the expectation that human health could otherwise be jeopardized. In this vein, recognition of the links between chlorofluorocarbons (CFCs), increases in tropospheric ozone, decreases in stratospheric ozone, and the possibility of increased incidences of skin cancers (anticipated though not yet observed) directly contributed to a political climate amenable to international agreements limiting production and use of some CFCs (Somers 1987). Likewise, circumstantial connections among sulphur emissions, emissions of nitrogen oxides, acid deposition, and *waldsterben* (the destruction of Western European forests) (Sand 1987) led to enactment of treaties to reduce sulphur dioxide and nitrogen oxides in the European community (EC), the United States, and Canada (Sand 1987; Dovland 1987; UNECE 1988a; UNECE 1988b). Disseminating information concerning links among environmental degradation and social consequences encourages people to view the global commons as a shared economic or aesthetic resource and to cooperate to protect it. However, when economic considerations are high, as in LRTAP, countries are likely to consider these links primarily from a national viewpoint (Dovland 1987).

Fifth, the ability of nations to take any deliberate action in response to potential climate change is highly unequal. Many developing countries lack financial and technical resources to stem deforestation or to develop themselves without relying on carbon-based fuels. Moreover, perceived inequities among developed and developing nations vary the degree to which climate-change issues are addressed in national policy-making agendas. Factories in less-developed countries (LDCs) are generally less energy efficient than those in developed countries. In addition, factories in LDCs have access to only a few large-scale electricity-generation processes that do not cause significant environmental problems. Also, searching for alternative sources of energy may exacerbate already intolerable national debts as well as place heavy strains on regulatory agencies and other areas of infrastructures (Kats 1987; Almond and Powell 1978; Energy Information Administration, 1986; Deudney 1981).

Given these problems, how likely is it that cooperation can effectively solve the global climate problem? According to the dominant social-science view of this problem, the realist approach to effective cooperation is likely to be limited by the dominance of major international powers.

1.2 THE CONVENTIONAL MODEL OF GLOBAL DECISION MAKING AND ITS CRITIQUE: REALISM IN THEORY AND PRACTICE

Discussions of international cooperation in environmental policy usually evolve from the premise that the nation must be the basic unit of decision making. Nations generally are perceived as occupying the apogee of political power, even though there is considerable disagreement among social scientists whether nations exemplify the highest level of political development. Nations also are viewed by most social scientists as constituting the highest form of organization to which societies realistically may aspire. Some scholars give four reasons for this assessment.

- Regardless of how they are formed or why, nations are sovereign entities whose behavior supposedly is guided by the desire to preserve the collective self-interest of their citizens from the claims and actions of others (Niebuhr 1935). Present-day nations are authoritarian as well as democratic, and their governments often claim that their purpose is to serve their people or national interests, even though they may serve the interests of only a few. It is difficult to deny that the claim to serve their citizenry signifies the value of popular sovereignty and of self-preservation among virtually all nations. The predominance of national self-interest, while morally distasteful to some, is empirically undeniable. It is based on realism (the way persons behave) rather than on idealism (the way some groups might wish they behaved). Idealism may not be a universal goal.

- Realists contend that because individuals need safety and security, they accept the authority of national governments. In the absence of global authority, only nations can provide such safety because, within its boundaries, each nation claims to possess a near monopoly on the legal use of force (Morgenthau 1974).

- Nations roughly correspond to sets of distinct cultures and ways of life that involve diverse conceptions of justice that are sometimes difficult to reconcile. Often, these cultural differences and conceptions of justice become more, rather than less, intense as modernization occurs because national integration exacerbates nationalism (Niebuhr 1949).

- There is no widely shared concept for an international community universally accepted by all cultures or nations. The only effective basis for transnational cooperation is the assumption that nations, like the persons who compose them, are utility maximizers, which are individuals who seek to maximize economic benefits to themselves without regard for impacts on others. Thus, in the absence of common authority, nations seek peace only when others agree to do so (Plisschke 1964).

The implications of this mainstream, realist view of how nations make decisions concerning anthropogenic climate change are numerous. International society is presumed to operate by rules similar to those characteristic of a *Hobbesian civil society* (Hobbes 1958). To avoid perpetual war, nations agree to formulate and obey rules that grant reciprocal rights and duties seen as universally obligatory. These rules involve acceptance of the sovereignty and equality of all nations, recognition that an unprovoked attack or other adverse action committed by one country against another is an implicit attack on all countries, and belief that it is prudent to submit conflicts to mediation and arbitration so long as the arbitrator acts in a manner consistent with national interest or national survival. In practice, realists normally see the balance of power as a central mechanism for preserving peace. An attack on one nation is not considered an attack on all. Thus, whereas realism predicates more-or-less-unregulated competition among nations, the balance of power achieved justifies the competition as an attempt to forestall or shorten violent conflict (Waltz 1979).

The institutions of international law and the United Nations (UN) are consistent, at least in their origination, with such realist assumptions. In the case of the UN, Articles 24, 25, and 48 of the UN Charter state in part that the role of the Security Council (which includes the five most militarily powerful nations) is to ensure the common peace and safety of humanity. This can be perceived as a concession to the principle that nations obey only collective will that can impose punitive actions (Wight 1987). Although moral suasion may be desirable, the UN has been effective in addressing international environmental and environmentally related problems only when the superpowers and their allies have agreed on conjoint solutions. Generally, before environmental issues are even viewed as problems by the UN, they must be linked to concerns for national security or survival. Thus, major powers serving on the Security Council have agreed in a UN treaty with several LDCs to ban the deployment of mass-destruction weapons in outer space and

Antarctica (The Outer Space Treaty of 1967; The Antarctic Treaty of 1961). In both instances, fear that failure to agree on such a ban would lead to a frantic race to develop such weapons and possibly test them made international agreement possible (Kimball 1985). In addition, nuclear tests conducted in space during the late 1950s and early 1960s that produced electromagnetic pulse disturbances in the Hawaiian Islands may have helped consolidate opinion in favor of international agreements. The tests caused electrical transmission systems to fail (Barash 1987) and thereby generated attempts to prevent irresponsible manipulation of the space environment for military purposes. Moreover, the possibly irreversible depletion of nations' individual ecological resources prompts nations to try to manipulate the environments of outer space and Antarctica to their advantages. Still, each party agreed to avoid potentially jeopardous unilateral activities unless other affected parties consented (Heap 1987).

Likewise, the U.S.-Soviet agreement to ratify the UN-sponsored Nuclear Nonproliferation Treaty (NPT) (1970) was based on mutual fears that failure to regulate the production of fissile materials would destabilize the balance of power. A specific fear was that West Germany's development of the atomic bomb, although potentially beneficial to the short-term security concerns of the United States, would threaten Soviet interests and deepen the strategic arms race (Bundy et al. 1982).

In international law, willingness to submit environmental disputes to international mediation or arbitration exemplifies realist conceptions similar to international cooperation. In the case of either international law or international organizations (the formal institutions, such as the UN, charged with implementing international law), it is less essential for an environmental conflict to be seen as a matter of national security or survival. Instead, a conflict need only be perceived as important but unresolvable by unilateral action. U.S.-Canadian cooperation and conflict over the shared water resources of the Northern Great Plains is cited often as typical of the operation of prudential self-interest in environmental matters (Schneider 1979). Since the turn of the century, each nation has agreed to regulate jointly its boundary waters to prevent activities that would degrade water quantity or quality to the detriment of other nations. An International Joint Commission composed of U.S. and Canadian representatives, in operation since 1911, has established mutually reciprocal standards of pollution control, conducted joint studies of water-resource activities, and suggested policy options for joint water-resource development. Recently, friction arose from U.S. efforts to develop a massive irrigation project (the Garrison Diversion Unit) that could divert return flows from the Missouri River into the Hudson Bay drainage system. Cutbacks in the Garrison Diversion project, made in 1987 to avoid discharges of return flows into Canada, were precipitated by transboundary cooperation between the United States and Canada, not the conflict that realists would have predicted. This cooperation was exemplified by the influence of the Manitoba Province and Canadian federal governments on the U.S. Congress and in the collaboration of some U.S. and Canadian environmental groups in opposing the project (International Joint Commission Report 1977; Oettig 1977; Loch et al. 1979; Peterson 1984; Johnson et al. 1962).

Despite the fact that mainstream realist assumptions do help to further understanding of the workings of international law, the UN, and various international agreements to resolve environmental- and natural-resources disputes, the realist approach is limited in resolving environmental problems. Realism may be simply incapable of illuminating the ways in which nations manage international environmental problems. Realists are most concerned with *high* political issues, which focus on strategic military balances and the prevention of global war.

Many realists admit that realism too often ignores a broad range of issues of national interest, fails to bridge the gap between domestic priorities and international decision making, and places too much emphasis on nations and too little emphasis on other institutions that shape policies (Asheley 1986; Keohane 1986). Finally, realists may neglect the benefit of behaving like an idealist on global-commons issues when nationally important realist goals are perceived as lower in priority.

1.2.1 Summary of Limitations of the Realist Approach

Mainstream realists assume that competition among self-interested actors in the international realm creates a balance of power that approximates the pluralistic balance of interests in a democratic polity. Thus, international conflict reflects the same struggle among narrow interests that presumably characterizes domestic political discourses. This view of how decisions are made is flawed for two additional reasons. First, this view ignores ethical concerns independent of calculations of economic efficiency and thus fails to explain adequately why weaker, disadvantaged interests should accept their losses graciously. In short, such a perspective is supportive of maintaining the status quo (Asheley 1986) regardless of whether that status quo promotes the interests of many or of only a few. As Hendrik Spruyt (1983) indicates, distributional concerns cannot stop at national boundaries; the nation is not sovereign on all issues, as various UN human-rights agreements (both the universal declaration of human rights and subsequent conventions) suggest. Second, this view of how decisions are made assumes that governments and international organizations function merely as impartial arbiters that referee the struggle among competing interests. This is an erroneous assumption because it fails to understand the dynamics of uncertainty, shifting priorities and knowledge, the politics of science in the international realm, and the manner in which international organizations and governments may serve as advocates for particular policy viewpoints (Cobb and Elder 1971; Jones 1975; Rose 1980; Vogel 1986; Caldwell 1984a).

1.2.2 An Alternative Approach: Global Decision Making as an Incremental and Iterative Learning Process

In this section, we will show that effective international cooperation to resolve global-commons problems is most often the result of an incremental and iterative learning process among scientists, citizens, environmental groups, national leaders, and participants in other international governmental and nongovernmental organizations (NGOs). The process is described as iterative because carefully formulated agreements resulting from painstaking efforts at reaching a consensus are replicated in increasingly larger and diverse contexts. This approach, and its divergence from the realist approach, is depicted in Table 1.1.

Table 1.1. Comparison of the Realist and Incremental/Iterative approaches to international decision making on environmental problems

Approach	Participants	Learning ability	National interest	Interactive process
Realist	Nations, international organizations composed of nations, international law systems	Limited; considerable reliance on assumptions that human nature is unchanging. Political agenda influenced by powerful economic interests in domestic and international realms. Learning tends to be rapid for basic security issues; slower for ecological threats	Defined narrowly as concern with direct military conflict or territorial attack and as concern for economic growth and development	Tends to focus on achievement of short-term goals leading to reduction of political and economic conflicts. Interactions tend to be led by diplomatic negotiations among nations that develop agendas for scientific/technical debates. Nations and international organizations are viewed as impartial arbiters of conflict
Incremental/ Iterative	Nations; international organizations composed of nations; scientific, environmental, and and other groups; international law systems; grass-roots political and ecological groups	Advanced; considerable reliance on allowing interactive processes with others to shape perceptions. Less-powerful interests allowed to influence domestic and international agenda. Learning tends to be slow, but after basic understanding of issues is developed, process tends to be replicated in larger contexts. Assumes that human nature is malleable	Defined broadly as concern with the global good, not just national self-interest. National security tends to be broadened to encompass threats to common goods. Ecological views range between sustainable development and preservations	Tends to focus on achievement of long-term ecological security, inter-generational and inter-regional justice. Interactions tend to be led by scientific/technical bodies as well as ecological interests that develop agendas for later diplomatic negotiations. Nations and international organizations are viewed as advocates for various various policies

This incremental and iterative process is distinguished from the realist approach in the following ways. First, whereas the realist approach allows only nations and other formal international organizations to participate in international decision making, the incremental/iterative approach emphasizes the important roles of environmental groups, some of which are composed of members from many countries; international scientific organizations; and even grassroots political organizations within nations. The latter organizations sometimes have significant international influence in prompting recognition of environmental problems even though they may have only marginal political influencewithin their own nations (some *Green* political parties in Western Europe exemplify this paradox).

Second, whereas the realist assumes that parties enter negotiations with well-understood conceptions of what constitutes national interest, the incremental/iterative approach contends that stakeholders often enter the process of making agreements with few preformed ideas or even a solid, established agenda. Instead, participants in such negotiations may intend to form their opinions during the bargaining process. They are receptive to new ideas, in other words, and are responsive to advice from nontraditional stakeholders such as scientists.

Third, the incremental/iterative approach does not define national interest as mostly concern with military conflict or territorial attack, as does the realist, but rather as avoiding threats to the environment and as protecting common goods such as oceans or the atmosphere as well.

Finally, the incremental/iterative view is a longer-term view of management and cooperation than is the realist view. The incremental/iterative view values and is receptive to interactions among scientific, technical, and environmental bodies. Often, these bodies become involved in exploring, analyzing, or resolving problems long before politicians become directly involved in managing the problems.

The incremental/iterative process has at least two important implications for institutional learning. First, if parties concede that mistakes have been made in the past, they may make better decisions next time (for a discussion, see Glantz 1976). Second, they also may learn from perceived successes, as is shown by this decade's accelerated rate of successful environmental negotiations. Participants in this process hold divergent interests in, perceptions of, and stakes in global environmental-problem management. What they all share, however, is a gradually formed commitment to address problems that produce no real winners when unresolved, contrary to a purely stakeholder view of decision making. Rational self-interest in these instances includes reducing the uncertainties of outcomes when full knowledge is lacking.

Most major actors in international environmental decision making are, at some point, committed to a policy that is ethically defensible in ways that transcend personal or national interest. In exploiting and using resources, few governments set out to deliberately decimate the environment, inflict unjust economic burdens on others, or create gratuitous policies that ignore the obligations of one generation, region, or nation to other generations, regions, or nations. Most leaders of environmental organizations and scientific associations, as well as national governmental policy makers, are animated by a sense of public spiritedness and a commitment to finding the most effective and fair solutions to global-commons issues (Kelman 1987). This is not to deny that many interests, even those that claim to speak for the public good, are often narrow or particular in the advantage they seek. However, not all actions are animated solely by narrow, provincial concerns. What inhibits the conventional, narrow political process from addressing environmental problems is the simplistic view that all participants should see themselves only as stakeholders in a zero-sum gain in which one party's gain is another's loss.

Nations and other decision makers often behave in accordance with a longer-term, broader view of national interest than that exemplified by realists. This broader view of national interest is exemplified in international environmental issues in the same ways it is exemplified in domestic political decisions—by (1) opening up the process of decision making to many groups; (2) encouraging and adapting input from various nongovernmental sources to broaden the parameters of policy debate; and (3) seeking to gather the best available technical information to assist in the formation of decisions, even if gathering this information delays decisions or is contrary to the views of some established stakeholders (Kelman 1987).

International cooperation is desired by stakeholders because unilateral action, advocated by some NGOs to prevent environmental degradation may be perceived as arbitrary and as failing to take into account the interests of other groups who favor action but cannot afford the consequences of rapidly abandoning long-established patterns of behavior. United States actions calling for a ban of CFCs exemplify this problem, as shall be seen. It also may be necessary to compensate some groups for economic losses sustained from modifying their behavior for the sake of global welfare. Compensating LDCs may make little economic sense from the standpoint of U.S. short-term national self-interest. However, if compensation enhances the likelihood of gaining cooperation toward resolving environmental problems, then it makes sense from a longer-term perspective.

Transnational action to attack global-commons environmental problems may begin with regional efforts, which are often the initial step in cooperation. Further steps toward global management require a comprehensive approach to regulation. A comprehensive approach implies a strategy that accounts for the use of shared resources while considering criteria for evaluating environmental policies. To be universally accepted, global environmental policies must be normatively defensible in ways that are culturally transcendent. This means that, besides being economically efficient, such policies must be viewed as roughly equitable, able to encompass noneconomic values, sensitive to transaction costs, and politically feasible given the varying levels of institutional development among nations (Young 1982). In essence, resource decisions on the global level can be treated as analytically comparable to those made by a river basin commission within a single nation or a limited region of similar economically developed nations.

An example is Med Plan, the first major regional seas treaty sponsored by the UN Environment Program. Informed observers regard this plan as one of the more-successful cases of concerted international environmental cooperation ("MAPS: signs of international recognition" 1987; Morgan 1987). As shall be seen, the Med Plan works well because regional political leaders view the achievement of economic development and environmental protection as intrinsically related. Ordinary political differences were set aside to resolve common problems of pollution management. It is now assumed by Med-Plan participants that one cannot have balanced economic development in the Mediterranean region without effective environmental preservation. A series of regulations designed to encompass the varying levels of economic development and political institutionalization of participants has been implemented through this plan.

At present, the most advanced phase of international cooperation characterizing global-commons management is one partially exemplified by nuclear materials and technology management and as yet unfulfilled by ozone or regional-seas initiatives. Although these efforts have yet to formulate a broad consensus of goals, viable regulatory systems have been implemented. Moreover, the infrastructure of this regulatory system is composed of experts who formulate decisions independent of national self-interests and who perform the transfer of regulation technology to all participants. Thus, varying levels of economic development need not pose barriers to international cooperation.

Although it constitutes a direct challenge to the predominant mainstream realist view of decision making, this alternative paradigm does not reject either the importance or inevitability of national self-interest in decision making. I will argue that close examination of three global resource policies—management of nuclear materials and technology, controls on ozone depletion, and regional-seas regulation—exemplify this alternative paradigm. As shall be seen, these three policy areas share common characteristics and have been widely recognized as ambitious and partly successful schemes for international energy and environmental cooperation.

2. REGULATING NUCLEAR ENERGY: FUNCTIONALISM, HIERARCHY, AND TECHNOLOGY TRANSFER IN GLOBAL DECISION MAKING

The UN International Atomic Energy Agency (IAEA), in conjunction with other transnational groups originally designed to halt the production of fissile materials, constitutes an important framework for international resource cooperation. Although the IAEA's original purpose was to deter weapons proliferation, the founders clearly intended the IAEA to also constitute a global safety net to protect persons from the health hazards of the nuclear-fuel cycle (Epstein 1985). In fact, from the beginning, deterring proliferation was viewed as the cornerstone for promoting peaceful uses of nuclear energy. The promotional aspect of this task was crucial to its effectiveness. IAEA's success in both of these ventures shows that a unilateral decision-making framework based on cold-war calculations of national self-interest can evolve into a multilateral decision-making entity able to articulate a code of conduct accepted by many parties. IAEA's decisions are largely viewed as equally legitimate by nations that want to deter nuclear proliferation and by scientific organizations concerned with formulating nuclear safety standards.[1] The current IAEA framework is depicted in Table 2.1.

IAEA began with President Dwight Eisenhower's Atoms for Peace program introduced in December 1953. This program proposed the establishment of a U.S. dominated nuclear-fuels pool that would limit transfers of fissile materials to nations friendly to the United States (Titus 1986). Initially, the character and tone of the program was very much unilateral. The United States dominated the nuclear-materials market in the early 1950s and, in the field of peaceful applications of nuclear energy, clearly monopolized access to nuclear technology. In addition to providing radioisotopes for medical, scientific, and industrial purposes, Atoms for Peace established the first internationally accepted standards for the handling of nuclear materials.

Following passage of Pub. Law 42, U.S.C. 2011, in 1954, which empowered the United States to conduct bilateral agreements for the transfer of fissile materials, there began an earnest attempt to mobilize support within the UN for a multilateral system of radiological safeguards. Much of this effort stemmed from the hope that initial attempts to obtain global nuclear cooperation after World War II (which failed because of superpower disagreements) could be revived through conscientious American economic and

[1]Moreover, the success of IAEA in establishing a framework for safeguarding nuclear materials and preventing their diversion to clandestine weapons programs has attracted the attention of those concerned with the possibility of an international regime to control the spread of chemical and biological weapons (Keeley 1988; Keeley and Schiefer 1988).

Table 2.1. The evolution of nuclear materials and technology cooperation: 1945 to present

Year	Activity	Instrument	Result
1945	Acheson-Lilienthal Report	Western allies conference proposing transfer of atomic energy development to UN destruction of U.S. A-bomb stockpile	Stimulated discussion on need to deter proliferation and share nuclear technology
1946	Baruch Plan	Proposal of UN AEC to establish international authority to own and manage all components of nuclear-fuel cycle. Authority's inspectors would be able to assess penalties not subject to UN Security Council veto	Stimulated discussion. Precursor, to a degree, of International Atomic Energy Agency system, despite its failure to prevent proliferation by U.S.S.R. and U.K. in 1949 and 1952 respectively
1953	Atoms for Peace	U.S. proposal before UN general assembly to establish international atomic pool for peaceful purposes that would be equipped with nonproliferation safeguards	Stimulated discussion on peaceful uses of atomic energy, provided impetus for IAEA's creation
1954	Atomic Energy Act (42 U.S.C. 2011)	Established safeguarded U.S. isotope and technology pool through bilateral agreement among United States and other countries	First transfers of fissile materials and technology outside United States to non-Manhattan project participants
1955	International Congress on Peaceful Uses of Atomic Energy	U.S.-sponsored scientific meeting of 3000 scientists, political leaders, and engineers to exchange ideas on peaceful nuclear-energy uses	Further impetus for IAEA creation

Table 2.1. (continued)

Year	Activity	Instrument	Result
1957	Establishment of IAEA	Formulated as an Independent Inter-governmental Organization within UN system to promote international nuclear cooperation, assistance, and safeguards against weapons proliferation. Now has 115 members	Permanent headquarters estab-lished in Vienna, Austria; 115 signatories currently bound to safeguard agreements consisting of inspections, audits, and inventory controls
1958	(A)Euration Treaty enters into force	Establishment of a regional European Atomic Energy Commission to provide for joint development of nuclear energy among EC members	First intergovernmental nuclear cooperation instrument among developed nations in a single region
	(B) 2nd UN Con-ference on Peace-ful Uses of Atomic Energy	International meeting of nuclear specialists	Discussion of possible uses for nonmilitary nuclear explosions
1959	1st international guidelines for safe transport of radioactive sub-stances proposed by UN Law of the Sea Conference	IAEA draft agreement on *Order Concerning Transport of Radioactive Substances*	Constitutes a basis for guidelines for national and international regulations on nuclear wastes
1961	Plowshare Program	U.S. AEC proposal to develop peaceful nuclear explosives for civil engineering purposes	Began a series of experiments that stimulated international discussion of uses for non-military nuclear explosions

Table 2.1. (continued)

Year	Activity	Instrument	Result
1963	Partial Test Ban (Moscow) Treaty	International agrement prohibiting nuclear-weapons tests in the atmosphere, under water, or in space	International acknowledgement of health/environmental risks of nuclear testing by non-weapon and weapon nations
1968	Nonproliferation	Prohibition of diversion, through bilateral and multilateral agreements, of special nuclear material for use in nonweapons	Incorporation of IAEA safe-guards into treaty, primarily enforceable by IAEA itself. More than 120 nations are signatories including 3/5 nonweapons nations
1970	NPT takes effect	Ratification by 3/5 nuclear-weapons nations under IAEA statute and non-proliferation treaty; nuclear-weapons nations are nations that have declared nuclear arsenals. Only five nations are in this category—U.S., U.S.S.R., Britain, France and China	IAEA safeguards applied to some nuclear-weapons facilities
1972	London Convention of Waste Dumping at Sea	Treaty prohibits high-level nuclear-waste disposal in oceans; took effect when U.S., U.K., and western Europeans abandoned dumping in mid-1970s	Criteria for high-level waste defined by IAEA. IAEA issues permits for dumping of low-level waste
1974	Nuclear Materials Suppliers Group formed	Joint cooperation between IAEA and Organization for Economic Cooperation and Development's NEA by several developed countries to provide "trigger list" safeguards of sensitive materials/technologies	Prohibited weapons-useable materials transaction and provided uniform regulatory framework to detect violators

Table 2.1. (continued)

Year	Activity	Instrument	Result
1976	Code of practice on mining of uranium and thorium ores	IAEA agreement on mining and milling that ensures financial guarantees to maintain and monitor tailings and other wastes	Emerging consensus on trans-boundary implications of nationally owned mines and mill radioactive pollution
1978	Formalization of Nuclear Safety Standards (NUSs) by IAEA	Establishment of a code of information and methods for sharing research on nuclear safety among nations	Assistance to smaller nations' nuclear agencies, especially those in third world
1979	IAEA establishes international Incident-Reporting System	In response to the Three Mile Island accident, IAEA establishes database on various nuclear-plant mishaps among IAEA members to identify design and operations problems	Recognition of IAEA's usefulness as a clearing house on nuclear information unavialable by other means. Data base was made compatible with OECD's nuclear-energy agency
1983	(A) Formal implementation of OSART's IAEA operational safety review team	Inspection teams are sent on request to support national nuclear-regulatory bodies in maintaining and strengthening safety standards	1st IAEA Operational Safety and Review team was sent to inspect Korean nuclear reactors
	(B) Unannounced IAEA safeguard inspections of uranium-enrichment facilities	IAEA implementation of Nuclear Nonproliferation Treaty mandate to prevent diversion of fissile materials for weapons. Prompted by fears of imminent nuclear-weapons breakthroughs by Pakistan	Designed to deter diversion of U-235 from gas centrifuge enrichment plants to weapons programs

Table 2.1. (continued)

Year	Activity	Instrument	Result
1983	(C) Joint IAEA/U.S. Department of Energy Conference on Nuclear Waste Management	Agreement on need for internationally accepted generic criteria for waste management	Confirmed broad international consensus on adequacy of available technical solutions to waste problems
1985	Fusion Energy Summit	U.S.-Soviet Conference on Fusion Research	Collaboration by national laboratories, universities, and government energy agencies on development of workable fusion reactor. Significant step in cooperative energy development
1986	Series of IAEA-sponsored meetings in response to Chernobyl	(A) IAEA INSAG members	See text on IAEA conferences.
		(B) World Health Organization Copenhagen meetings	WHO: focus on health precautions relative to iodine-131 and cesium-137 releases
		(C) NEA (OECD) meeting	NEA: need to strengthen OECD cooperation on nuclear safety and citing of differences between Chernobyl plant design and current western plant designs
		(D) General conference meeting of IAEA members on emergency response, early warning and notification, and disaster assistance	

scientific example rather than words alone. Culminating in the formation of the IAEA in 1957, this multilateral safeguard system consists of two components: an independent, intergovernmental organization (the IAEA) with the power to inspect nuclear facilities of nonweapons nations as well as a system of bilateral agreements among so called supplier nations and import-dependent recipient governments.

There are 130 signatory nations in the multilateral safeguards system of the IAEA and a similar number of participants in the bilateral component. Safeguards consist of on-site inspections conducted by either IAEA officials or representatives from supplier nations, audits of nuclear-facility records, and inventory controls (Caldwell 1984b; U.S. and the Future of the Nonproliferation Regime 1984; Keeley 1988; Fischer and Szasz 1985).

The effectiveness of this framework hinges on the IAEA's ability to persuade signatory nations that safeguards are formulated and enforced in a manner designed to benefit all nations, not the interests of a few. The IAEA's structure as an independent, intergovernmental organization is important. It is a UN agency, not a specialized agency of the UN. It reports directly to the UN, not to a UN body, which has helped reinforce its reputation as an independent agency. UN-specialized agencies are highly political. Appointments, budgetary considerations, and voting records of proceedings are all affected by the shifting priorities of member nations' concerns, as well as by the shifting fortunes of coalitions. Dominant UN blocs (such as LDCs, western nations, and the Soviet Union and its satellites) vie for control of patronage appointments and votes on major decisions. Although intergovernmental organizations such as the IAEA are by no means totally immune from such influences, they are relatively insulated from them. The IAEA structure, especially the independence of its director general, was designed to avoid politicization as much as possible (Fischer and Szasz 1985).

An example of this insulation is offered by the IAEA's response to the Chernobyl nuclear accident (Conteh and Feldman 1987). Prior to any General Assembly resolutions or discussions, and within only nine days of the accident, IAEA Director General Hans Blix was able to offer emergency response assistance to the Soviet Union. An IAEA delegation held extensive talks with the Soviet State Committee on the Utilization of Atomic Energy (an interministerial agency approximately equivalent to the U.S. Department of Energy), consulted with Ukrainian nation ministers, inspected the damaged Unit Four reactor from the air, and met with Soviet on-site disaster investigators (Petrosyants 1986). More importantly, at the conclusion of this visit, a joint IAEA-Soviet communiqué was issued in which the Soviet Union promised to provide information on all accident impacts "as it became available" to the IAEA, which would then disseminate the information to member nations at a meeting convened in Vienna to discuss the accident.

Within four months of the Chernobyl accident, the IAEA concluded two agreements concerning emergency response and notification following future nuclear-power accidents. The first of these was the Convention on Early Notification of a Nuclear Accident, and the second was the Convention on Assistance in the Case of a Nuclear Accident or Radiological Emergency. The most significant features of both agreements (formulated in August 1986) are their scopes of coverage and comprehensiveness, given the short time devoted to their deliberation. The first agreement encompasses all nuclear-fuel-cycle facilities, including military-related installations. Participating nations agree to provide to the IAEA timely information on the exact nature and time of an accident, the characteristics of the release, appropriate meteorological information, and off-site measurements of accident containment (Special Session of the General Conference, IAEA 1986). The second agreement encourages bilateral and multilateral agreement among nations to provide on request emergency assistance for a nuclear accident. The requesting nation agrees to provide immunity from liability to personnel from responding nations, and further agrees to compensate the assisting party for injuries sustained. In addition, both parties agree to protect the confidentiality of military- and trade-related nuclear information.

The IAEA system has other advantages as well. When further UN-sponsored attempts to strengthen the nonproliferation regime were implemented, the existing IAEA administrative framework was used. In 1970, three of the five publicly acknowledged nuclear-weapons nations—the United States, the Soviet Union, and the United Kingdom—ratified the NPT, sponsored by the UN General Assembly. Their ratification established additional regulations that have strengthened the IAEA's ability to regulate nuclear materials and technology. Ratified by more than 120 nations, the NPT requires each nonweapons nation to prevent the diversion of fissile material to clandestine weapons operations. It also obliges supplier nations not to provide materials for producing a nuclear weapon (Major Provisions of the Treaty on NonProliferation, July 1968; Spector 1985).

In fact, the IAEA is absolutely powerless to prevent the diversion of fissile materials for a weapons program if a nation is determined to obtain a nuclear weapon. As Weinberg discusses (1988), the IAEA can only do what its members allow it to do. India's diversion of plutonium from a Canadian-built reactor in 1974 exemplifies this problem. However, because one of the main incentives for obtaining a nuclear weapon among smaller, weaker LDCs would be to restore a balance of power lost if a neighboring nation obtained one first, the IAEA has had a curious deterrent on proliferation. Because clandestine attempts to divert fissile materials are likely to be discovered by the IAEA, the vast majority of signatory nations have agreed to open their facilities to inspection to provide an early warning against cheating by their adversaries (Keeley 1988; Keeley and Schiefer 1988).

The fact that many nuclear facilities built without the assistance of supplier signatory nations remain unsafeguarded and outside the realm of international inspection suggests that some countries (both NPT and non-NPT signatories alike) want to have the option of obtaining nuclear weapons (Spector 1985; Fieveson et al. 1986). This distinctly military aspect of the IAEA's regulatory framework has not been (and probably cannot be) more restrictive, given the realities of international political tensions between countries such as India and Pakistan. This military aspect is also consistent with a realist framework of decision making because the military aspect assumes that national security and survival are at stake and, as a result, countries that believe they would be more secure with nuclear weapons are unlikely to agree to international inspection of potentially military activities. In other areas, however, the IAEA has made significant strides in encouraging cooperation in nuclear-materials and -technology concerns. These areas include post-Chernobyl nuclear-emergency planning and establishing guidelines for the transport and disposal of nuclear waste. These strides cannot be explained adequately within a realist framework alone because an incremental learning process was involved that required a reduction of uncertainties and an opening of the decision-making process to new and different participants. The same process took place under the Med Plan as well.

In conjunction with two major regional organizations that have had an early interest in nuclear-energy regulation, the Organization for Economic Cooperation and Development (OECD) and the EC, IAEA has established guidelines for the transport and disposal of nuclear wastes. These efforts are largely confined to maintaining a register of radioactive substances introduced into surface waters through routine power-plant emissions and the nonroutine but widely practiced ocean disposal of low-level radionuclides. The IAEA has not attempted to supplant the responsibility of individual nations for waste management, but has encouraged regional cooperation for various waste storage schemes to better incorporate variables of geology and possible transboundary disputes into national waste-management plans (Caldwell 1984b; Handl 1981). International cooperation in these areas has resulted for two reasons. First, the erosion of the American nuclear monopoly has given other nuclear-supplier nations an incentive to find an alternative arbiter for establishing and enforcing standards of safety and security. Second, these transnational organizations have provided a means of independently verifying the safety assessments and standards of national nuclear agencies. Simply stated, many countries were eager to participate in this process because it gave them a chance to develop methods for safeguarding nuclear materials and technologies they were unable to provide for themselves.

The 24-member OECD has promulgated a set of rules for the encapsulation and storage of low-level wastes through its Nuclear Energy Agency. These rules have largely been adopted by the EC's own Atomic Energy Agency (*Nuclear Safety in the EC* 1986). This particular activity exemplifies the incremental and, especially, the iterative character of nuclear-materials management. Most EC members also hold membership in OECD. In 1973 and 1980, the EC Council of Ministers adopted sets of low-level waste management guidelines involving joint laboratory research, monitoring of repositories, and cost-sharing measures. In each case, the Council of Ministers acted in response to prior OECD studies (Nuclear Safety in the EC 1986). These studies, in turn, were funded and encouraged by the IAEA to nurture regional cooperation. Participants in these organizations have consistently tried to obtain the best technical information available and to make decisions without regard for political expediency.

Major challenges impede efforts to manage this situation. First, as the trend toward nuclear-fuel reprocessing increases, so does the risk of transboundary contamination through accident or terrorist action (Fieveson et al. 1986; Ramberg 1980; Cords et al. 1984; Frank 1980). Second, the long-term risks of high-level radionuclide storage are as far reaching as those entailed by rapid anthropogenic climate change. The long-term and intergenerational character of the waste-storage problem transcends both the boundaries and historical reaches of nations (Handl 1981). Nuclear wastes will likely outlast all present-day political institutions, and nations are increasingly becoming aware of this dilemma. Third, as in global air-pollution monitoring (discussed in Sect. 4), there is no internationally sanctioned method for monitoring nuclear waste. This lack of agreement has occurred because of the absence of a comprehensive database of nationally operated waste sites, fear among some countries of sharing waste-management technologies (and thus betraying patent secrets), and considerable variation in national regulatory policies for assessing health risks (Handl 1981; Hoffman 1987).

Considerable progress has been made in two areas of radioactive waste management, largely as the result of an incremental learning process and through the willingness of decision makers to obtain the best available data for formulating decisions. These areas are (1) mining and milling of uranium and thorium ores and (2) banning both shallow- and deep-seabed emplacement of low- and medium-level nuclear wastes. A code of practice for developing safety standards in mining has been widely adopted by IAEA members. Establishing specific cost-benefit and risk-analysis standards has still eluded decision makers, but the desire to adopt such measures does exist (Handl 1981). Partial suspension of waste dumping has resulted from concerted opposition by nondumping nations and a general change in attitude toward the marine environment (Deese 1977). Success in these areas can be attributed to common concern that unregulated action by one party stands to harm all other parties and may lead to retaliation, perhaps in other environmental areas.

An example of further cooperation prompted by this activity is the issue of nuclear terrorism. Some movement toward active IAEA-supervised cooperation in averting terrorist activities has taken place. Though the efficacy of such cooperation remains to be proven, an antiterrorist convention applying to fissile materials (adopted by several nuclear nations in 1979) encourages the recovery of fissile material, the confidentiality of military information, and the proper and swift detention and extradition of nuclear terrorists (Convention on Physical Protection 1987).

However, the incremental learning process has not succeeded in those instances in which national economic interest promotes certain practices that have no viable alternatives. The United Kingdom continues to dispose of radionuclides from the Sellafield (Windscale) nuclear-research and -development facility into the Irish Sea despite strong opposition by Ireland and the EC Parliament (Markham 1986; De Young 1986; Winder 1986). Labour-party opposition, and even some internal Conservative-party dissension, has failed to force the government of Prime Minister Thatcher to undertake major changes in the operation or management of Sellafield. Sellafield, like the French Cap la Hague reprocessing plant based on a similar design, engages in a robust international nuclear-fuels-reprocessing business with Japan and other nations. The British government is not prepared to sacrifice this business for stronger environmental regulations, especially because it claims that radionuclide emissions have been incidental and pose little danger to public health (Winder 1986).

Considerable progress needs to be made in several areas of IAEA activity before IAEA and its attendant organizations will compose an effective regulatory system for global nuclear energy. Forty nations, many of which have active nuclear programs, lie outside the IAEA and NPT safeguards system. Many LDCs are reluctant to join the system for fear that it will challenge their domestic control of nuclear energy (Tenth Special Session, UN 1978). As a result, safeguards are narrowly defined (Scheinman 1987; Weinberg 1988). Nuclear information systems need to be better integrated, and inconsistent and restrictive measures for radiation safety need to be rectified (Hoffman 1987). Finally, better physical-protection measures for nuclear facilities need to be established, and a system of compensation for nuclear damages needs to be implemented (Henkin et al. 1980; Yearbook of International Law Commission 1978). Nevertheless, optimism for IAEA's accomplishments and for the likelihood of continued progress is warranted.

The IAEA has created an effective system of open decision making that is widely exemplified by its incident reporting system. To be completely effective, it needs more personnel and resources than have been available so far (Spector 1985). Moreover, operational safety review teams (OSARTs) have shown great promise in reviewing the safety of LDC nuclear programs and have created heightened confidence in countries bordering those with nuclear-power plants. OSARTs require an invitation by an IAEA member nation. Two recent signs are especially encouraging regarding OSARTs. The Soviet Union, in a reversal of previous policy, voted against a Nigerian-led resolution in the IAEA in 1987 that would have expelled South Africa from the organization. Moreover, the Soviet Union, the United Kingdom, the United States, Hungary, and Czechoslovakia recently consented to allow the IAEA to conduct limited inspections of a select group of civilian nuclear facilities (Battersby 1987; Lewis 1987). Participants in this system recognize that without such inspections, confidence in the safety of nuclear power may decline, and nuclear energy may no longer be a viable energy option anywhere.

Finally, Sweden has taken the lead in using the IAEA as a review body to supervise high-level nuclear-waste disposal plans. This is an especially ambitious initiative. An international review group appointed by the agency examines the design, the anticipated operation features, and the security systems surrounding Sweden's plans for direct disposal of spent reactor-fuel assemblies (Positive Safety Features 1986). Because of the Swedish commitment to abandon nuclear power and to close all operating nuclear-power plants by the end of the century, the imperative for such unprecedented action is clear.

IAEA demonstrates that an international framework for technical cooperation would be viable if the benefits it produced were broadly shared by developed and developing nations and if it were insulated from the short-term pursuit of partisan political advantages. To achieve these characteristics, such a framework would have to rely on the best available scientific expertise, incrementally pursue modest goals, cooperate with other agencies involved in the same issues, and judiciously enter into areas where it would be appropriate to do so by expertise and the scope of the problem.

3. REGIONAL SEAS: SUSTAINABLE DEVELOPMENT AND ENVIRONMENTAL PROTECTION

The United Nation's Environment Program, formed in 1972, launched its regional-seas program in 1974 as one of its first major initiatives in the field of international environmental cooperation. Program participants include 120 nations, 14 UN agencies, and a dozen other regional intergovernmental bodies. The program was based on a simple and compelling principle: the best way to foster transnational cooperation in environmental management is to focus first on those pollution problems that lie outside single national boundaries but close enough to land resources to pose clear and present dangers (Hulm 1983). At the time, the most imminent dangers were defined as oil-tanker spills and the dumping of untreated municipal wastes.

The original models for regional seas were provided by the 1972 Oslo Convention, which was signed by all North Sea nations (Ditz 1988), and the 1974 Helsinki Convention on the Baltic Sea (Hulm 1983). These agreements were designed to obtain international cooperation in combating marine pollution. Although the latter agreement was not effective until 1980, it initiated a pattern of cooperation incorporated into regional-seas models. Agreements for joint scientific research typically were followed by provisions for allocating responsibility for controlling emissions and for settling disputes. These phases were incorporated directly into the first regional-seas system, the Med Plan.

The Med Plan is an excellent example of an iterative process of cooperation because the basic framework established in one region, among a distinct set of nations, served as an experimental model: problems associated with the Med Plan were avoided in subsequent regional-seas systems. Since 1985, when Albania was included, all Mediterranean littoral nations have participated in regional-seas frameworks (Sand 1988a). Also, additional regional-seas frameworks have been implemented in the Red Sea, the Persian Gulf, the Caribbean, West and Central Africa, East Asia, the Southeast and Southwest Pacific, East Africa, and the Southwest Atlantic.

The Med Plan provides a good overview of how each of the regional-seas programs is designed to function. Following the model of the Helsinki Plan, the initial Med Plan was formulated by several Mediterranean nations in February 1975 and had four components: a set of regional treaties, coordinated research and pollution monitoring, integrated planning, and joint administrative and budgetary support (Haas 1988a). The evolution of regional-seas plans and of Med Plan is depicted in Table 3.1. (For complete texts of regional-seas agreements, see Sand 1988b).

The Med Plan was officially launched with approval of the Barcelona Convention of 1976, which asked governments to ban the dumping of wastes by aircraft and ships into the Mediterranean Sea. The Barcelona Convention also called for establishment of commonly prescribed limits on exploration and exploitation of the seabed, continental shelf,

Table 3.1. The evolution of regional-seas cooperation: 1969 to present

Year	Activity	Instrument	Result
1969	Food and Agriculture General Fisheries Council for the Mediterranean (10th session)	Adopted decision to study marine pollution and legislative controls	Completed in 1972
1970	FAO Technical Conference on Marine Pollution and its Effects on Living Resources and Fisheries	Adopted recommendation of scientific basis for international legislative control of marine pollution	Continued prior initiatives
1971	Preparatory meeting for United Nations Environment Program (UNEP) Formation Conference (London, June 1971)	Ten Mediterranean nations called for regional agreement on marine-pollution control	Continued initiatives
1971	*Pacem in Maribus* Conference in Malta discussed "Mediter-ranean model"	Meeting of Mediterranean nations	First discussion of a "Mediterranean model"
1972	Oslo Convention	Treaty signed by North-Sea nations to prohibit dumping of hazardous wastes	Led to protocols banning dumping of wastes
1972	Formal UNEP formation in Stockholm	Several governments proposed formation of regional conferences to focus on environ-mental health of coastal waters	Led to 1975 Mediterranean Action Plan (Med Plan)

Table 3.1. (continued)

Year	Activity	Instrument	Result
1973	Beirut Conference of the United Towns Organization	Adopted Charter for Protection of the Mediterranean	Established framework
1974	Helsinki Convention	Baltic-Sea nations agreed to cooperate to combat marine pollution	First regional treaty to address several water-pollution sources
1974	Med Plan	Mediterranean-basin nations, scientific and environmental leaders, UNEP officials	Proposed a Med Plan to address basin-wide pollution problems
1974	FAO Intergovern-mental Consultation on the Protection of the Mediterranean Marine Environment	Adopted guidelines for framework convention on the protection of the marine environment against pollution in the Mediterranean	Established framework
1974	Third Diplomatic Conference of Mediterranean States on the Law of the Sea (Athens)	Mediterranean-nations meeting	Continuous Law of the Sea initiative
1974	FAO/ICSEM/IOC/UNEP workshop on marine pollution in the Mediterranean (Monaco)	Mediterranean-nations meeting	Adopted action plan for pollution monitoring and research

Table 3.1. (continued)

Year	Activity	Instrument	Result
1974	Interparliamentary Conference of Coastal States on the Control of Pollution in the Mediterranean Sea (Rome)	Meeting of Mediterranean nations	Followed by IPU Special Committee for the Study of Means to Control Pollution of the Mediterranean (Monaco 1975)
1974	First UNEP Task Force meeting on the Mediterranean	Draft convention	Followed by second meeting in January 1975
1975/ 1976	UNEP Working Group of Government Experts	Meeting of government scientists	Prepared convention and protocols
1975	Med Plan	Meeting of government scientists	Established formal framework for research, monitoring, and integrated planning
1976	Barcelona Convention	General treaty calling on Mediterranean-basin nations to prevent, abate, and combat pollution	Required signatories to comply with one or more enforcement protocols
1976	1st and 2nd Barcelona Conventions	(1) Banned marine dumping of extremely hazardous wastes and (2) Established a regional oil-spill center on Malta	First real binding agreements under Mediterranean Action Protocols Plan
1976	Red Sea Convention	Conference to establish a regional antipollution program in Red-Sea region	Convention adopted by Red-Sea nations

Table 3.1. (continued)

Year	Activity	Instrument	Result
1976	UNEP Task Forces on Legal Instruments for Regional Seas (Nairobi)	UNEP Task Force on Legal Instruments for Regional Seas (Nairobi)	
1977	Integrated Development Planning Protocol for Mediterranean basin	UNEP-established center to combat pollution through better planning	First Med-Plan agreement supported entirely by member nations' contributions
1978	Kuwait Region Action Plan	Convention adopted by Persian-Gulf nations to combat pollution	Led to creation of a Persian Gulf regional-seas agreement and organization, both of which were patterned after Med Plan. Established with UN assistance
1979	Mediterranean Plan Priorities Action Program (Split, Yugoslavia)	Established marine-culture research centers throughout basin	Research centers were broadly distributed throughout basin
1980	Athens protocol banning land-based pollution affecting the Mediterranean Sea.	Adopted by European Community and its member nations	Concluded outside the Med-Plan framework, but hastened further Med-Plan nations' cooperation
1981	Wider Caribbean, West and Central Africa, East Asian Seas, and Southeast Pacific Regional Action Plan	Conventions adopted to combat pollution	Patterned after Med Plan, with protocols banning specific practices

Table 3.1. (continued)

Year	Activity	Instrument	Result
1982	Southwest Pacific Regional Action Plan	Convention adopted to combat pollution	Patterned after Med Plan, with protocols banning specific practices
1982	Mediterranean Action Plan Endangered Species Protection Protocol	Concluded by Mediterranean-Action-Plan basin nations	Led to preparation of special training manuals, exercises, and programs for LDC technicians
1983	Land-Based Sources Protocol	Agreement among basin nations to limit wastes	Set limits on industrial, municipal, and agricultural wastes for Mediterranean-basin nations
1985	Montreal Guidelines on Land-based Sources of Marine Pollution	Meeting of government scientists	Prepared convention and protocols
1985	East Africa–Nairobi Action Plan/Convention/Protocols	Meeting of government scientists	Prepared convention and protocols
1985	South Pacific Noumea Convention/Protocols	Meeting of government scientists	Prepared convention and protocols

and subsoil of the Mediterranean basin (Sand 1975–76; 1988a). One reason such an ambitious plan, though general in its initial consensus, was taken seriously was that it converged with the well-publicized Law of the Sea Convention (UNCLOS) then taking place. UNCLOS participants included many of the nations of the Mediterranean basin. This convention had already laid the groundwork for many of the Med-Plan initiatives (Morgan 1987). Most importantly, the Barcelona Convention prompted nations to recognize that maritime resources are sustainable but depletable. It also established consensus that maritime resources are common properties that could be more efficiently and equitably managed by contiguous nations through sets of regional political configurations. Finally, the Barcelona Convention established an important international political precedent of its own. No nation could become a party to the convention without signing and ratifying one or more of the action-initiating protocols identifying pollution sources and appropriate mitigating policies.

Following the Barcelona Convention, two protocols were signed by several Mediterranean-basin nations. The first of these protocols explicitly banned marine dumping, and the second encouraged multinational cooperation to fight oil spills. The first protocol caused a special blacklist of extremely hazardous substances to be prepared, and second protocol caused a regional oil-combating center to be established on the island of Malta (Hulm 1983). In 1977, another center was established to promote integrated development planning in Geneva under United Nations Environment Program auspices. This center was later moved to Athens and given autonomous headquarters and funding through Mediterranean-nation contributions (Haas 1988a). This center was intended to foster preventive measures to combat pollution by incorporating environmental-protection measures in national-development plans.

To this end, four other measures were adopted by Med-Plan nations. First, a Priorities Action Program was instituted in Split, Yugoslavia, in 1979 to establish mariculture research centers throughout the basin (Hulm 1983). Second, in 1980, the EC independently adopted a protocol (to be monitored by national environmental agencies) that banned Mediterranean pollution from land-based sources. This pushed UNEP toward a more-ambitious protocol of its own, as shall be seen. Third, an endangered-species protection protocol was adopted that led to the preparation of training manuals, technical exercises, and special training programs in LDCs to protect endangered species (Haas 1988a). Unlike the IAEA nonproliferation inspection system, safeguards in this protocol are provided by officials from national government ministries from both developed and underdeveloped countries. In accordance with the Med Plan, developed nations have agreed to transfer prevention technology to the LDCs, thus lessening the economic burden of compliance and enforcement. Fourth, a land-based sources protocol that is more extensive than the EC's 1980 agreement sets explicit limits on industrial, municipal, and agricultural emissions, which account for about 85% of basin pollution. This has long been a contentious issue in the basin among developed nations and LDCs. Such technology transfers have usually occurred on a smaller scale than would be needed for climate-change mitigation; nevertheless, the land-based sources protocol provides a precedent for large-scale action. Moreover, until adoption of the Med Plan and its protocols, international environmental cooperation in the area of regional water-pollution mitigation was limited to the functional framework of the

UN Food and Agriculture Organization's General Fisheries Council for the Mediterranean (Sand 1975–1976; 1988a).

The Med Plan has been most effective when it has closely adhered to a clearly articulated set of goals, when it has approached the implementation of these goals incrementally, and when it has used past successes and failures as a learning process. One observer has suggested that the plan and its protocols succeeded in this case because they were eclectic comparisons rather than radical innovations (Sand 1975–76; 1988a). In its early stages, the Med Plan had to overcome a critical obstacle—the concerted opposition of LDCs such as Egypt and Algeria toward strong pollution controls. In the beginning, these countries and some others saw emission controls as antithetical to economic development (Haas 1988a). However, this opposition was overcome in three ways.

First, the UNEP incorporated the idea of regional-seas systems and promoted the systems' success as a way of enhancing the credibility of its own holistic view of political development. The UNEP secretariat conducted most of the early Med-Plan meetings, provided background documents for problem discussion, and even subsidized the early costs of these meetings and related research activities (Haas 1988a). Curiously, because UNEP was a strong ecological advocate, it encouraged competing LDCs and developed national perspectives on pollution to broaden interdisciplinary perspectives, foster frank discussions and a sense of openness, and ensure equitable distribution of benefits and costs in proposed basin-wide antipollution plans. Headquarters for various Med-Plan activities would, in fact, become regionally distributed (Haas 1988a), and official plans for long-term pollution control would be based on the premise that economic development and environmental protection should be pursued simultaneously, even if no one actually knew how to do this at the time (Hulm 1983). In a sense, the dominant paradigm was viewing governments and intergovernmental organizations as effective political forces characterized by a small group of converts guiding policy (Perry 1986).

Second, gradual recognition of the severity of environmental degradation actually modified many of the preconceived ideas of various parties. As realists would contend, most national and international officials and scientists wanted to aggrandize self and national interests. However, these individuals were also generally open minded and earnestly sought a resolution to pollution problems that threatened to endanger their well-being. This attitude is consistent with the alternative paradigm supported in this paper. Thus, in the opinion of participants, both sets of goals had to be reconciled. The Med Plan worked because it accomplished this reconciliation. During later phases of this process, politicians supplanted scientists in major decision-making roles. Recognition of the severity of the problems required strong political negotiation skills for which politicians were better equipped than scientists (Perry 1986).

Originally, UNEP wanted only to promote a greater awareness among countries of the interrelationships among ecological and social factors. Scientists from Mediterranean-basin countries who monitored the program wanted to further their research agendas and to obtain additional funding for their activities. Foreign-ministry personnel wanted to ensure that traditional parameters of international law were respected in all agreements and that the sovereignty of their countries would not be threatened by any agreements.

The joint participation of all three groups—scientists, ministry officials of various governments, and representatives from UNEP—changed the perceptions and approach of UNEP by convincing it to accept technical consensus and political compromise as the best means of accomplishing its goals because it lacked the authority, staff, and resources to achieve its goals by itself. Joint participation changed the perceptions of scientists by convincing them to realize that differences in comparability of pollution data made their cooperation with each other necessary to foster advancement of knowledge. In short, meetings of scientists created a system of checks and balances on databases (Hulm 1983). If a scientist were excluded from negotiations, he would risk being excluded from the forefront of pollution-control research. Finally, national political leaders and diplomats came to realize that gains accrued from other benefits of the Med-Plan program—such as technology transfer and protection of fisheries—were contingent on the leaders' willingness to alleviate pollution. Moreover, technical uncertainty concerning the effects of pollution encouraged rather than retarded cooperation. Foreign-ministry officials wanted access to the most-recent and -useful information about the seriousness of pollution. Because they also were eager to learn whether abatement methods used by other nations controlled pollution more efficiently and effectively, foreign-ministry officials attended meetings on the problems of pollution. In short, "UNEP adroitly wedded various interests by satisfying everyone's goals" (Haas 1988a).

The third element in overcoming initial opposition to the Med Plan was that the LDCs became as compelled to pursue a proactive policy of environmental protection as were the developed nations of the basin. This transpired because the political and bureaucratic stature of LDC scientists and other technical personnel was elevated because they participated in environmental-protection activities. In short, an institutional agenda for environmental protection was nurtured by scientists' participation in scientific research and conjoint experiments (Cobb and Elder 1971; Haas 1988a). One measure of this growth in stature is the fact that within 10 years after the creation of Med Plan, basin countries (except Albania) had a unified, omnibus environment ministry (although Tunisia's Environmental Affairs Department is still part of another ministry). These agencies were often staffed with many of the same scientists and technical personnel involved in Med-Plan activities. Although these agencies do not have complete control over their countries' antipollution activities, they are influential among themselves. Another measure of growth is the fact that the seven worst polluting countries—France, Italy, Israel, Greece, Tunisia, Algeria, and Egypt—constructed new, expensive sewage-treatment plants after 1974 (Haas 1988a).

Agreement on the formulation of an institutional agenda is one thing; proactive cooperation on the implementation of pollution-control standards is quite another. Governments have failed to adopt comprehensive forms of planning that would better anticipate and identify the environmental consequences of industrialization (Haas 1988a). In most instances, this is because individual countries, especially LDCs, still lack the means for comprehensive analysis of their own environmental problems (Hulm 1983). Although progress has been made in structural measures of pollution control (such as sewage-treatment plants), costly deballasting port facilities that would alleviate oil pollution, common standards for water-pollution monitoring, and nonstructural (preventive) methods of pollution abatement are still far from being implemented.

Developed and developing nations still disagree about Med-Plan emissions standards. Much of this debate stems from national economic concerns: developed countries want more-stringent controls placed on new industries and less-stringent controls placed on older, established ones; LDCs take just the opposite position because they have few established industries to elevate to standards. Likewise, LDCs have shown far more concern over airborne sources of pollution in the Mediterranean than over riverborne emissions because their own industries, such as fisheries, are impacted to a greater degree by airborne pollution (Haas 1988a). Finally, developed nations have shown a greater willingness to attack pollution through point-source-emission controls than have LDCs, which prefer establishment of ambient standards that would allow individual nations to choose abatement methods according to what they could afford.

The Athens protocol on Land-Based Sources of Pollution (adopted in 1980) partially resolved this issue of emission-control standards. A set of standards (the black list) was established for extremely hazardous substances. These standards expressly forbid dumping and provide for rigorous emission controls to be enforced by all member nations. However, a list (the gray list) of less-hazardous substances contains substances more likely to be found in considerable quantities in developing countries. LDCs can engage in some forms of uncontrolled emissions of substances on this list. However, ambient-water-quality standards are supposed to be maintained by joint coordination efforts managed by the World Health Organization (Haas 1988a). In other words, for the sake of incremental success, a double standard of pollution control is in effect in the basin. Eventually, it is hoped that as the economic capacity of LDCs increases, they will be able to enforce more-rigorous point-source standards more vigorously.

Four important lessons about making decisions on global climate change can be learned from Med Plan. First, although nations constituted the primary instruments through which cooperation took place, as in the field of nuclear-energy regulation, they were not the only important actors in Med Plan. In fact, possibly the most important initiators of the Med Plan were scientists and personnel from international organizations such as UNEP. Once scientists were given access to individual governments through their elevation onto the institutional agenda, and they encouraged colleagues in other countries to engage in greater environmental cooperation. Moreover, their actions reinforced the perceived legitimacy of UNEP and thus enabled it to foster cooperation in the Mediterranean basin. In a sense, these scientists were able to set the diplomatic agenda on which their governments would resolve differences (Haas 1988b).

Second, policy uncertainty did not reinforce unilateralism, as realists would have contended. Instead, policy uncertainty fostered cooperation and (more importantly) compromise and helped empower scientists as decision makers because basin nations believed that the scope, causes, and effects of pollution and other water-resource problems could be grasped only on a regional basis. Uncertainty is also the reason government officials were encouraged to gather more information on the problems of water pollution by attending conferences. Implicit in these meetings was the assumption that pollution controls might be more effective if they were based on economies of scale and on eliminating a common-properties market failure rather than frantically pursued by individual governments that cannot control their neighbors' activities. Had these governments not believed that the problems being discussed were real, however, no significant cooperation would have occurred. In this instance, uncertainty might have bred suspicion that some countries were using the excuse of pollution fears to retard the economic growth of LDCs.

Third, unanticipated elements of the institutional policy agenda are important factors in international-commons issues. The problems of oil pollution, fisheries damage, and other activities received extensive publicity from the media throughout the Mediterranean basin. This publicity generated grassroots support for concerted action to alleviate serious problems (Hulm 1983; Ditz 1988). There is a parallel here with similar regional-seas efforts, such as the banning of deep-sea trash burning in the North Sea (Ditz 1988), for which institutional structures also cooperated to ban an insidious practice.

Finally, as in the banning of ocean dumping of radioactive wastes discussed in Sect. 2, economics continues to play a paramount role in shaping informational constraints. If technical changes offered more economically efficacious methods of trash disposal, pollution bans would gain acceptance more easily. Meanwhile, limited budgetary allocations for transnational pollution research may impede the development of alternative methods of abatement. The example of less-developed regional-seas frameworks in other areas such as West Africa and South America suggests that budgetary constraints may be a problem (Hulm 1983; Bliss-Guest and Keckes 1982). Simply stated, many LDCs cannot afford to develop substitute industrial-development practices that would conserve energy and lessen pollution.

Nonetheless, as with IAEA, the levels of cooperation thus far achieved in regional-seas plans provide reason for optimism if the process is seen for what it is—iterative and incremental. National-self-interest desires were not acknowledged in advance and did not form the basis of negotiating positions. Hence, the realist model did not apply. A similar pattern of cooperation may characterize the initial stages of global climate-change decision making.

4. OZONE DEPLETION: AGENDA SETTING AND INTERNATIONAL CRISIS MANAGEMENT

It frequently is suggested that the depletion of stratospheric ozone through emissions of CFCs parallels the issue of anthropogenic climate change through CO_2 emissions. The establishment of the ozone issue on the decision-making agenda of international organizations caused controversy and revealed the difficulty of obtaining cooperation among nongovernmental actors. Table 4.1 depicts ozone-related international activities. For example, one of the earliest attempts to address CFC impacts was an international meeting of stratospheric chemists and physicists held in Kyoto, Japan, in the fall of 1973. When the issue of chlorine in the atmosphere was raised, the International Association of Geomagnetism and Aeronomy and its parent organization, the International Union of Geodesy and Geophysics, agreed to sponsor a symposium to address causes and consequences of chlorine in the atmosphere (Dotto and Schiff 1978).

This commitment to sponsorship immediately provoked contention with the International Association of Meteorology and Atmospheric Physics (IAMAP), which had already planned to hold such a meeting in 1974. This dispute was temporarily suspended by mutual agreement that there was a sufficient range of problems encompassed by ozone depletion to justify holding scientific meetings on different aspects of the issue. Nevertheless, the controversy is significant because issues of specialization and research funding remain very much a part of the ozone controversy. For example, the significant divergence in approach between the United States and the EC in moving to eliminate CFC use is partly rooted in contending methods of analysis [including debates over predictive models of various types (Engelmann 1982)] and mitigation as well as different perceptions of the importance of CFC use (Gladwin et al. 1982). In addition, the need to distinguish anthropogenic vs natural causes of ozone-layer depletion and the need to understand the varying consequences of ozone in the tropospheric as opposed to stratospheric layer complicate management of CFC emissions and stratospheric ozone depletion (Jaeger 1986).

International political concern with stratospheric ozone depletion is traceable to the UN Conference on the Human Environment held in Stockholm in 1972. This is the same UN-sponsored meeting that led to the formation of UNEP. During preparations for the Stockholm meeting, attention was focused on the possible effects of supersonic transports (SSTs) and some space vehicles on the stratospheric ozone layer. It was suggested that the scientific communities of individual nations cooperate to develop a global ozone-monitoring system (Thacher 1988).

At Stockholm, scientists and government officials raised concerns about globally monitoring a variety of transboundary pollutants as well as the effects of aircraft and space craft on the stratospheric ozone layer. At the first session, convened in 1974, of UNEP's Governing Council, the ozone issue was explicitly addressed as a challenge to the

Table 4.1. The evolution of cooperation to prevent and mitigate ozone-layer depletion: 1971 to present

Year	Activity	Instrument	Result
1971	Initial discussions on dangers to ozone layer by supersonic transports and fertilizers [not motivated by chloroflourocarbons (CFCs)]	Preparatory meetings for Stockholm Environment Conference	Led to formal inclusion of ozone topic at Stockholm meeting in 1972
1972	Stockholm Environment Conference	Call for research papers on stratospheric transport and distribution of ozone	Initial international research coordination on ozone depletion began
1973	1st Session of United Nations Environment Program (UNEP) General Council	Address by UNEP Executive Director Maurice Strong on "Outer Limits" problems	Led to continued interest in ozone depletion and first calls for addressing potentially catastrophic issues in a global manner
1973	International Stratospheric Chemists and Physicists meeting	Call for major scientific conference on ozone	Caused dissent on research among the scientific community
1974	2nd Session of UNEP General Council	Further global monitoring of ozone layer based on US initiative	Led to continued interest, especially by United States, in global monitoring
1975	3rd Session of UNEP General Council	General support for more-detailed research and detailed understanding of techniques	Led to refinement of research agendas and monitoring of ozone levels

Table 4.1. (continued)

Year	Activity	Instrument	Result
1975	World Meteorological Organization (WMO) calls for more ozone studies.	WMO-established Commission for Atmospheric Sciences to prepare a detailed research agenda	Statement on most-recent review of the ozone problem was submitted to UNEP's governing council
1976	Review of the status of the ozone program	UNEP General Council	Referred to WMO working-group activities; adopted the recommendations and called an international conference
1977	UNEP-sponsored meetings of experts in Washington, DC	32 nations	Adopted a "World Action Plan" and included ozone depletion as an "outer limits" issue
1977	U.S. Clean Air Act (Sects. 122 and 126)	Requirement that United States must unilaterally introduce some controls on CFC use	U.S. ban on nonessential CFC use. Scientific investigations were continued
1981	UNEP Governing Council's establishment of an ad-hoc working group of legal and technical experts for formation of a global framework convention for protection of the ozone layer	Seven meetings, attended by 50 countries and 11 intergovernmental and nongovernmental organizations	Led to Vienna Convention for Protection of the Ozone Layer

Table 4.1. (continued)

Year	Activity	Instrument	Result
1983	Submission of draft protocol on CFC emissions by United States, Canada, Nordic Countries	1983 meeting of nations and scientific experts	Led to split between so called Toronto and European Community groups
1985	Vienna Convention on Protection of the Ozone Layer	21 treaty articles and technical annexes. No specific controls	First comprehensive agreement on need for concerted study and action on the ozone issue led to Montreal protocol
1987	Montreal Protocol to the Vienna Convention	Approval of 24 nations and formal ratification by the United States	First specific establishment of guidelines for reduction of CFC production. Entered into force January 1989
1988	U.S.-French industrial cooperation substitute	Allied Signal–Elf Aqutaine agreement to develop non-ozone–depleting CFC substitute	Transnational industrial cooperation to expedite research on CFCs for ways to protect ozone layer
1988	Ozone trends panel report (U.S.)	NASA-formed commission of more than 100 scientists to investigate the chemical composition of the stratosphere	Confirmed ozone hole in antarctic; reanalyzed trace-gas emission trends; argued that evidence suggests need for strengthening CFCs ban and Montreal Protocol process

sustainability of the biosphere. In 1974 and 1975, UNEP Governing Council meetings urged continued global monitoring of the ozone layer, further development of techniques for measuring its depletion and the parameters affecting its character, and the development of a shared database on ozone-layer information (Thacher 1988).

Although U.S. concerns prompted a CFC-aerosol ban in 1978, worldwide political action (beyond calls for more research) did not begin until a World Action Plan on the Ozone Layer was adopted in 1977. Significantly, this effort was initiated not by UNEP, which lacked experience in coordinating scientific research, but by the World Meteorological Organization (WMO). A WMO working group, the Commission for Atmospheric Sciences, submitted a proposal to UNEP in November 1975 that urged a review of the ozone problem, a global monitoring program, a study of long-term trends of ultraviolet-radiation exposure, and identification of research gaps (Thacher 1988). In April 1976, the Governing Council of UNEP fully adopted this resolution and scheduled a 1977 meeting in Washington, D.C. that was attended by both governmental and nongovernmental authorities on climatological issues.

Participants in this meeting adopted the World Action Plan, which provided that, in subsequent UNEP General Council meetings, a special section of the agenda would be devoted to outer-limits problems, which result from human activities that could endanger the continuation of life on earth. CO_2 emissions were included in these discussions, as was ozone depletion through CFC use. The inclusion of ozone in Governing-Council-meeting agendas was important because it hastened international discussion to form a mitigation program (Sand 1985).

UNEP resources are limited, so complex treaties and conventions are rarely used to address global-commons issues, because such treaties and conventions are far too expensive to negotiate. Instead, bilateral cooperation between countries directly affected by an environmental problem is urged whenever possible, and regional cooperation to resolve more-extensive issues is also encouraged. An outer-limits problem, however, represents a special class of issue: one given high priority for discussion and action because it is global in scope and potentially catastrophic in impact. In other words, UNEP members agreed that the ozone-depletion problem necessitated unusually broad cooperative action because the problem posed grave risks to the global environment. In essence, the evidence on ozone depletion was stronger than that for chemical carcinogens and other toxic-substance issues.

The World Action Plan was also facilitated by a parallel effort conducted by the OECD to identify the impact of CFC use on the biosphere. OECD's Environment Committee had for some time been collecting data on CFC production and use. Because OECD countries were among the largest producers and users of CFCs, any action taken to reduce the global impact of CFCs would, essentially, constitute an OECD reduction of CFC production. This is significant because, although the impacts of the problem were global, many of its most serious causes could be narrowed to activities of a limited subset of nations; in particular, those countries (United States, Canada, Japan, U.S.S.R., and several EC nations) that produce the greatest amount of CFCs (Englemann 1982). This focus would prove to be an essential feature of the Montreal protocol.

The World Action Plan encompassed 32 countries and was composed of three components: plans to develop global monitoring of the ozone layer and of human activities affecting it; plans to study the effect of changes in the ozone layer on ultraviolet radiation propagation, skin cancer, terrestrial and aquatic ecosystems, and regional climate; and the collection of production and emission data to determine the relationship between CFC use and ozone depletion (Thacher 1988). The 1977 action plan also called for annual reports on the ozone problem, UN sponsorship of continuing research, and subsequent meetings (Sand 1985).

The next phase in significant multilateral activity to stem ozone depletion occurred between 1981 and 1985. In May 1981, the UNEP Governing Council established an ad hoc Working Group of Legal and Technical Experts for the Elaboration of a Global Framework Convention for Protection of the Ozone Layer (Sand 1985). Its purpose was to implement the World Action Plan by establishing a formal international regulatory system for ozone management. Its initial efforts focused on the complexities of natural variations in ozone, the effects of other compounds on ozone-layer depletion, refinement of the statistical analysis of the ozone record, and the effect of other gases on ozone-layer depletion (Engelmann 1982). After seven meetings that were attended by 50 nations and 11 intergovernmental and nongovernmental organizations, a draft convention was prepared in January 1985. The model for this convention was UNEP's regional-seas program—evidence of both the iterative process involved in consultation among the nations and other organizations involved in these meetings and of the desire to draw on the lessons of a successful model of cooperation (Sand 1985).

Essentially, this draft convention merely called for the sharing of information and data on the monitoring of activities affecting the ozone layer; it provided no instrument for mitigation. The proponents of the draft convention thought it could function as an umbrella treaty that could be supplemented by more-detailed protocols to be adopted as a package or separately by individual nations (Sand 1985). The use of a framework treaty was drawn directly from Med Plan, which is discussed in Sect. 3.

Unlike the Med Plan, however, consensus over agreements made after 1985 proved exceedingly difficult to obtain. In 1983, a draft protocol on CFC emissions was introduced to the working group. An immediate split arose between two factions, the Toronto Group (Canada, United States, Finland, Norway, and Sweden) and the Common Market Group (composed of Western European nations and a few non-European nations). This 1983 draft protocol on CFC uses was tabled by Norway, Sweden, and Finland.

The Toronto Group, following the U.S. lead, offered an approach predicated upon the elimination of nonessential CFC uses, such as aerosol sprays. This tactic had already been followed by the U.S., in 1978, and a few other nations (the Toronto Group). The elimination process would reduce CFC production from 70% to 80% and would ban CFC exports throughout a six-year period (Sand 1985). Although the Common Market Group also favored a protocol, they preferred to limit production of the two major forms of CFCs (the fully halogenated compounds CFC-11 and CFC-12) and reduce nonessential CFC uses by 30%. This would conform with the group's own community-imposed regulations approved in 1982 (Szell 1985).

The Toronto Group opposed the Common Market proposal because countries in the latter group were producing at only 60–65% of total CFC-production capacity and would not need to further reduce CFC production to contribute to a net global reduction in CFC output (Sand 1985; International Cooperation 1986). In other words, the burden of reduction would fall on countries like the United States, which would have to reduce their production by a similar percentage to reach agreed-on targets. The U.S. view was that other countries should be willing to do that to which the United States had committed itself—namely, eliminating aerosols. The United States also wanted further multilateral steps to be taken whenever the availability of substitutes could define nonessential uses of certain CFCs. If this action were taken, export competition for CFCs would be essentially eliminated.

The heart of the controversy appeared to be economic and characterized by scientific uncertainty and thus conformed to the realist approach to global problem solving. On deeper examination, however, the controversy was a function of varying institutional agendas among parties who genuinely wanted to address the problem but were confronted with conflicting domestic priorities.

An alternative interpretation of European resistance to the Toronto Group strategy is that in Western Europe, as in the United States prior to 1986, there was a general lack of awareness and concern about CFC dangers among the general public; a lack of scientific consensus that drastic measures were warranted; and a higher ranking given to other environmental priorities at the time (such as the energy crisis, oil tanker spills, and air pollution) (Gladwin et al. 1982). The EC's view was that, by ignoring a production limit on CFCs, such a strategy failed to address nonaerosol-CFC usage and its longer-term environmental problems (Szell 1985).

Nevertheless, despite the absence of international cooperation between these two factions, unilateral measures have induced changes similar to those urged by the Toronto Group. In the United States, use of CFCs declined more than 30% from 1978 to 1980. In the Federal Republic of Germany, the government and the chemical industry have reached accord on reductions of CFC production. Also, in France and the United Kingdom, additional research funds have been devoted to the search for alternatives to CFCs (Gladwin et al. 1982) even though many EC governments remain intransigent toward any CFC control (Haas 1988b).

In other words, unilateral actions accomplished at least a part of what publicly scrutinized multilateral action could not. This helped set the stage for a further step toward global harmonization of policy in 1985—the Vienna Convention on Protection of the Ozone Layer. Because most of the conflict centered on the economic and policy aspects of alternative control strategies, there was general agreement that it would be useful to convene a series of international workshops (International Cooperation 1986).

The Vienna Conference established a global framework convention, which consisted of 21 treaty articles and a series of technical annexes, to protect the ozone layer. This framework convention specified the general responsibility of nations to reduce actions that adversely affect the ozone layer, specified duties for further cooperation, and created a permanent Conference of the Parties to the Convention and Secretariat position within the UNEP as permanent instruments through which the Vienna Convention accord is accomplished (Sand 1985). The Vienna Conference, however, neither incorporated specific national control obligations in its articles nor included a specific protocol of control measures. The position of the Toronto and Common Market Groups continued to be too opposite to allow agreement (Sand 1985).

Despite this apparent ineffectiveness of the Vienna Convention accord, however, the failure to adopt such a protocol was actually an ironic diplomatic success, especially from the standpoint of future agreements. In 1985, neither the Toronto nor the EC group wanted a weak protocol that would be unenforceable because of the lack of consensus among CFC producers. Both sides instead agreed to continue discussions to establish such a protocol while individual nations sought substitutes for CFC use. This discussion eventually led to the Montreal Protocol of 1987, which established a specific mitigation plan for banning CFC use and production as well as a timetable for implementing this ban.

What made the Montreal Protocol possible was the emergence of a new factor on the systemic agendas of many countries, the belief that a slow but inexorable sequence of atmospheric events may have begun that could not be easily reversed (Gleick 1988). This factor, in turn, generated a sense of impending crisis that affected the institutional agenda of political decision making. Although each country's institutional agenda was affected in unique ways, evidence suggests that American reaction was not untypical. In the United States, several national scientific agencies—including the National Aeronautics and Space Administration, the Environmental Protection Agency, and the National Oceanic and Atmospheric Administration—became convinced that increases in ultraviolet radiation and faster losses of ozone than earlier anticipated by various models posed serious policy problems that required urgent attention and immediate transnational cooperation to confirm (Gleick 1988; Science, April 1988; Tirpak 1986). In the Soviet Union, an apparently similar trend developed, nurtured in part by the elevation of the stature of environmental scientists discussed in Sect. 3 (Ziegler 1987; Tirpak 1986). Moreover, a British scientific survey in the Antarctic documented the existence of an ozone-layer hole believed to be caused by CFCs (Tolba 1987). Five months prior to the Montreal protocol, a scientific meeting held by UNEP in Wurtzburg, West Germany, concluded that more-drastic action than required by the Vienna Convention was needed because guidelines still permitted some degree of ozone depletion. Participants in the meeting also concluded that stronger regulatory restraint on the production of compounds CFC-11 and -12 was needed, that changes in the vertical distribution of ozone affecting the troposphere could contribute to global warming, and that ozone-depletion impacts appeared to be directly related to control strategies adopted (Tolba 1987).

Two things are significant about the Montreal Protocol. First, 24 nations, including the United States, signed the accord within a few months after its negotiation (the United States did so in April 1988 and was only the second nation to ratify the treaty) [Szell 1988; Fed. Regist. 1987 52 (pt. 239), p. 47486 (December 14)]. Second, and more striking, is that the protocol was negotiated directly under Vienna-Convention guidelines and was enforced in a relatively short period of time. The 24 nations that ratified the treaty (including the eight EC countries that ratified it in December 1988) composed the two thirds of producer countries necessary for the agreement to take effect (Engelmann 1988).[2]

In essence, there was sufficient consensus among some (although not all) national scientific communities to force the issue of reduction to a climax and spur the negotiation of the protocol in September 1987. Sufficient domestic political support to compel rapid ratification was also obtained.

The lessons of the ozone accords are threefold. First, the elevation of global climate-change issues to a high position on the decision-making agenda of international institutions is partly shaped by a perception of impending crisis. This is how ozone became an issue worthy of treaty making in a transregional context. It was first viewed as an outer-limits problem challenging the principle of global sustainability. Although countries disagreed about many things, most agreed on the goal, however defined, of not exceeding the sustainability of the biosphere. In addition, the perception of rapid, irreversible climate change generated movement toward a specific protocol banning production. The Vienna and Montreal conventions symbolize the ability of a community of nations to take action to prevent a crisis before irrefutable proof of a causal link between CFCs and ozone-layer depletion is shown (Tolba 1987; Benedick 1988).

A second lesson is that scientific uncertainty does not necessarily impede cooperation but rather may accelerate it. For example, such uncertainty appears to have accelerated formation of the IPCC (UN General Assembly, Resolution 43/53 January 27, 1989). Many European political leaders shared the view of their Toronto Group counterparts that CFCs were responsible for ozone depletion and that production should be reduced. However, it was simply easier to negotiate directly and informally with industries in their own nations to achieve that goal than to undertake international effort that might draw attention to the issue but would also adversely strengthen the resistance of companies that felt publicly threatened. Although this strategy was less direct than multilateral negotiations (it may have impeded agreement during the early- to mid-1980s), it did help lay the groundwork for research on CFC substitutes.

Finally, the availability of technologies for timely compliance continues to be a barrier in the ozone issue just as it served as an incentive in nuclear-materials regulation

[2]The protocol requires a near-term production freeze of most CFCs at 1986 levels followed by a phased reduction that would lower production to approximately half the 1986 level by 2000 (Krutilla 1990). Measures and timetables of compliance are designed to accommodate the different capabilities of developed countries and include the freezing of production and consumption of fully halogenated CFCs, which are most threatening to the stratospheric ozone layer (e.g., CFC-11, -12, -114, and -115), at the 1986 level in 1989. This freeze would be followed by a reduction to 80% of the 1986 level by 1994 and a further reduction to 50% by 1999. A freeze on relevant Halon-compound production and consumption (Halons-1211, -1301, and -2402) at 1986 levels by 1993 is also required by the protocol (Morrisette 1989).

through IAEA and pollution control in the Med Plan. The failure to develop viable alternatives to CFCs for *nonfrivolous* uses poses a barrier to reducing CFC manufacture. DuPont, the world's largest CFC manufacturer, has begun to introduce substitutes for CFCs (Environmental Science and Technology 1988), and other manufacturers are developing alternatives to keep a significant market share in sales of alternative compounds. It is uncertain whether other companies will also try to develop alternatives to CFCs. It would appear, however, that other companies' actions will be predicated at least in part on the alternative paradigm put forth in this paper—that institutional self-interest need not be the sole motive for action. DuPont, for example, is urging other companies to "treat the new scientific information [on ozone depletion] seriously" and to cooperate in the search for substitutes to CFCs (Science, April 1988). Elements of the private sector appreciate the gravity of the problem.

Moreover, the problem of the diffusion of technologies to produce suitable substitutes for CFCs that is relative to developed and developing countries has also been acknowledged in the Montreal Protocol. At the onset of negotiations, developing countries were permitted a 10-year grace period before compliance (Szell 1988). In addition, controls for different CFC compounds are to take effect throughout a decade. It is clear that any global-environment agreement calling for reductions in any emissions, including CO_2, must acknowledge a distinction in the ability of advanced industrial vs underdeveloped or newly industrializing countries to comply as well as unique national problems involved in meeting the Montreal Protocol's requirements.

5. CONCLUSIONS: GENERAL AND PARTICULAR LESSONS

Even if a framework convention for reducing greenhouse gas emissions were achieved through the efforts of the IPCC, cooperation to address global climate-change policy would likely take place through an incremental, iterative process on the regional level. Participants may not have national, preformed positions that would characterize decision making under a realist model. This incremental, iterative process may take several years to produce agreement and perhaps several more years to generate positive results (i.e., mitigation of the causes of global climate change). Nevertheless, as evidenced by the case studies discussed in this report, the agreements that will ultimately be produced are likely to bring about a greater degree of compliance among participants than is usually the case for arms control or other strategic military agreements and are likely to be more durable. This compliance would result because the agreements would be based to a great degree on mutual trust of the participants and would be characterized by less-intransigent stakeholder positions that may actually make negotiation easier. Because participants in these environmental agreements would have to view the process of negotiation as a learning process, they would likely be receptive to new arrangements of cooperation based upon relatively unrestricted exchanges of scientific and technical information.

As a result, compared with realist-based security treaties such as the Strategic Arms Limitation treaties (SALT I and II) agreements between the United States and the Soviet Union or various nuclear-test-ban treaties, these environmental agreements may be quickly achievable. Comparing the time used to adopt the Med-Plan agreement, create IAEA, and ratify the Montreal Protocol with the time used to ratify the first Atmospheric Test Ban Treaty and SALT agreements, the advantages of the incremental, iterative approach can be appreciated. From the time it was first proposed at Malta in 1971 to its establishment in 1975, the Med Plan took fewer than four years to implement. Between President Eisenhower's Atoms for Peace proposal in 1953 and the creation of IAEA in 1957, three years elapsed. And, from the first international scientific conference to propose action on CFCs in 1973 to ratification of the Montreal Protocol (in many respects the most complex of the environmental agreements discussed in this report) in 1988, 15 years elapsed. These figures compare favorably with the Atmospheric Test Ban Treaty, which was first proposed as a campaign issue in the 1956 U.S. presidential election and took eight years to become a reality (Titus 1986); SALT I (1972), which was first proposed in 1967 by Lyndon Johnson and Alexsei Kosygin and took five years to be ratified; and SALT II, which was also proposed in 1967 and which remains unratified (though its terms are largely heeded).

As shown by nuclear-materials regulation, agreement on a single, centralized regulatory authority is easier to obtain when there is an identifiable set of resources (fissionable materials) desired by several countries but which only a few countries can provide. A sort of hierarchy between nuclear-supplier and -nonsupplier nations has worked in the IAEA system because non-nuclear countries have been willing to relinquish development of weapons if (1) a system of safeguards is established that would prevent non-nuclear countries' adversaries from obtaining nuclear materials and (2) non-nuclear countries can receive the benefits of nuclear energy with assurances that nonmilitary nuclear technology and fissile materials would not be restricted.

In global climate change, systems of decision making must be candid, trustworthy, and verifiable. To create such a system for nuclear-energy regulation, scientific experts' opinions had to be incorporated directly into the regulatory framework from its very inception. In fact, scientists were the principal lobbyists for a system of international regulation at the inception of the nuclear-cooperation movement after World War II. Their status as advisors and supporters of decision makers was thus assured from the beginning of the IAEA system.

This balance between a realist and incremental/iterative paradigm is also exemplified by nuclear-safety regulation and emergency response. The IAEA has gradually obtained consensus on several standards for response to future nuclear accidents because the erosion of citizen trust and confidence in nuclear energy has encouraged the formation of better forms of cooperation to avert harm to other nations. Ironically, national self-interest has driven historically incompatible nations together because a nuclear emergency in one country erodes public confidence toward nuclear energy in others. For global climate change, however, such unification is uncommon. A rise in the belief that particular activities responsible for a climate-change environmental crisis are avertable may, eventually increase this perception. Clearly, national and international scientific unions have taken a leadership role in environmental-protection activities (Perry 1986).

The most important lesson to be learned from Med Plan is that a common, shared resource is at once both an economically sustainable and ecologically fragile commodity. If scientists could establish that economic growth and environmental protection are compatible, they could possibly elevate their political stature on this issue and thus generate support for international cooperation on global climate change.

Med Plan has functioned effectively in this vein because once awareness of regional water pollution was developed, no one could afford to be excluded from decision-making efforts to mitigate the problem. If new data on pollution were available to only some countries and others could not afford to collect it on their own, would it not make sense to cooperate to develop an economy of scale for mitigation and to eliminate a common-property market failure? In other words, despite some countries' skepticism concerning the gravity of the problem, every country was aware that the failure to do anything constructive in the immediate future might make long-term change exceedingly difficult or even impossible. Initial scientific cooperation in the Mediterranean basin was, at any rate, enthusiastic. Every country benefitted from the exchange of information with every other nation and there was little to lose from exchanging data.

By the same token, political leaders in the Mediterranean basin cooperated because, despite differences in levels of economic development, there were certain impacts of environmental degradation that neither developed nor lesser-developed countries could afford to ignore. Developed countries had to agree to be flexible on pollution standards in order to reduce ambient emissions from LDCs. On the other hand, LDCs could not ignore the impact of developed nations' emissions or oil-tanker spills affecting their shores, tourism, and fisheries industries. Once all parties agreed that emissions needed to be reduced, the manner by which reductions could be achieved was subject to political compromise rather than ideological posturing.

Differences among developed and developing nations about climate change may be more difficult to resolve than was the problem of water pollution in the Mediterranean Sea. For example, a relatively sudden onset of serious drought in North Africa prompted global scientific consensus in the 1970s and 1980s about the need to better understand the sources of climate variability in some regions but did not generate much interest in other regions (Hare and Sewell 1986; Glantz 1976). Many LDCs view western concepts of environmental protection as restrictive to LDCs' economic development and as serving to reinforce LDCs' economic dependence on developed nations for finished, manufactured goods. Developed countries such as France have based decisions about substituting one basic energy resource for another on a combination of mobilization of public consent and the exploitation of technological capability (Feldman 1986). Few LDCs are able to rapidly substitute energy resources because they lack the ability to quickly mobilize public support for radical policy shifts (Almond and Powell 1978; Enloe 1973). Moreover, technological capacity is very much a function of institutional as well as economic development. Some LDCs simply lack the bureaucratic infrastructure necessary to satisfy basic economic needs through regulation or fiscal incentive (Skocpol and Finegold 1982). LDCs also lack capital resources to support such an infrastructure and, to continue to industrialize, must use unsatisfactory economic, resource-development, and energy options.

On the one hand, in order to lessen its contribution to global warming, an LDC may seek to develop large, technology-intensive substitutes for fossil fuels, such as nuclear energy or hydropower (both of which may entail high economic and environmental costs). The nuclear option may generate inflationary pressures, deepen national debt, and place burdens on regulatory infrastructure that few LDCs can afford (Energy Information Administration 1986). Extensive use of hydropower may entail unforeseen ecological and economic impacts such as destruction of riparian habitat and massive social dislocation (Deudney 1981). On the other hand, some LDCs try to conserve energy whenever possible (Kats 1987). Although such conservation is well intended, it may be exceedingly difficult in LDCs. Third-world factories often consume two to five times more fuel for a given industrial process than do modern factories in developed nations. Moreover, leeway for conservation is more likely in northern- than southern-hemisphere nations. Although conservation can reduce CO_2 without long market-penetration times for new energy-saving technologies (assuming energy demand can be decreased), developed countries are better equipped than LDCs to do this quickly (Bach 1984).

Some LDCs (Brazil, for example) have aggressively developed alternative energy-supply programs such as hydropower and alcohol fuels. These energy developments have led to large debts to developed countries (Flavin 1985). In addition, other LDCs that have attempted to reduce fossil-fuel use (especially oil) have found that their industrial and transportation systems are not energy efficient. Because their economies often depend on one or two major export commodities, the prices of which are set by developed-country demand, LDCs have not been able to raise enough capital to improve energy efficiency.

These problems are compounded by LDCs' lack of control of oil prices, international monetary policies, or the direction of energy-project funding agencies (Goldemberg et al. 1987). LDCs may require some form of compensation to shift to greater conservation programs (as exemplified by Med Plan) because economic aid and technology transfers have not been sufficient to help them catch up to developed countries.

The ozone treaties illustrate the development of a global consensus that CFC production and use must be lessened, for nations agreed on ways to reduce CFC production. The basic scientific consensus on probable CFC impacts on ozone already has been established, and scientists and national environmental-policy leaders have agreed that action should be taken.

International consensus on environmental issues was not reached merely because of economic self-interest, but because of scientific uncertainty and the lack of immediately perceptible health and economic-welfare crises. A major concession—that scientific information can no longer be ignored—by companies such as DuPont and an increasing perception that some ozone depletion has already occurred, possibly with grave consequences, have been catalysts for consensus. Again, however, unlike the CO_2 issue, Montreal Protocol negotiators perceived that continued use of CFCs—substances for which substitutes should eventually become available—posed a clear danger to human health and welfare. Costs to society of CFC bans are minor and certainly less severe than those entailed in possible reductions in fossil-fuel use.

There is a positive trend in this activity. CFC producers like DuPont have suggested to international bodies such as UNEP that the Montreal Protocol's timetable be shortened (*Chemical and Engineering News* 1988). In essence, the legitimacy of the international framework is being increasingly recognized by the very parties most likely to lose short-term economic benefits from the international framework's authority. This may be a concession to the principle that only such a cooperative framework can reconcile a realist perspective with the need to view the global environmental as public goods and may also symbolize that new market opportunities will become available through the development of CFC substitutes. Such opportunities are exemplified by the joint efforts of two companies that have traditionally been on opposite sides of the CFCs control issue—Allied Signal (from the United States) and ATOCHEM (of France). These firms have agreed to jointly research, develop, and demonstrate non-ozone-depleting substitutes for CFCs (and the processes for their manufacture) that may eventually forestall any economic dislocations that would be caused by eliminating CFCs (BNA, Environment Reporter April 1, 1988).

5.1 SOME SUGGESTED STEPS FOR INTERNATIONAL COOPERATION: LESSONS FROM CASE STUDIES

To expedite development of an iterative framework to address greenhouse gas emissions and climate-change impacts, two concerns must be considered by all parties. Indeed, each and every participant will be confronted with these problems soon. The first of these problems is that a hierarchical accord of cooperation, such as an IAEA type of framework, is unlikely to work for mitigating global climate change because one set of countries does not possess a monopoly on some set of public goods desired by all. Instead, all countries have some power to mitigate and have tangible stakes in global climate change. Thus, some means of maintaining equality among nations is required. NGOs such as scientific unions and other participants will be important for providing informational support on environmental and human-health effects.

Second, in the case of reconciling the divergent interests of developed countries and LDCs, it is clear that no agreement will be acceptable if, on the agenda of appropriate public-goods problems, one does not rank higher levels of industrial and energy-producing activity for LDCs at least equally with higher degrees of environmental protection for all countries.

As negotiations progress, five issues will likely constrain cooperation: legitimacy, accessibility and verifiability of agreements, the role of national self-interest, short time frames for decisions, and the appreciation that apparent setbacks can be positive.

- **Legitimacy.** International cooperation on the issues of global climate change will require rules and organizations regarded by nations and international organizations as rightful authoritative decision makers. These parties are divided on numerous issues, as has been seen. Thus, to attain legitimacy, laws, rules, and regulatory organizations must not be swayed by the interests of any single group or country and must be rooted in the best available scientific knowledge.

  IAEA is viewed as equally legitimate by nations wishing to deter proliferation of nuclear weapons, by those merely wanting to exploit the benefits of nuclear power, and by international organizations concerned with safety standards and safety-standards enforcement. Med Plan is viewed as legitimate by industrialized countries concerned with pollution, developing nations that want balanced development, and scientific organizations promoting pollution research. The Montreal Protocol has gained the consensus of CFC-producing and non-CFC–producing nations (by adjustments in implementation made for levels of development), scientific organizations (because of the Montreal Protocol's emphasis upon research), and—perhaps most importantly—CFC manufacturers such as DuPont (because the Protocol emphasizes gradual CFC elimination).

- **Accessibility and Verifiability.** A system of international decision making should be readily accessible by any interested party. Verifiability refers to the ability of all parties to monitor realistically the compliance of other parties to an agreement with standards agreed on through international deliberation. To ensure openness and the verifiability of a system of agreements, actors other than nations must be welcomed into agreement negotiations (Gerlach and Rayner 1988). A recent example of this phenomenon is the important role that citizen monitoring groups played in implementing the Helsinki accord.

In each case, scientific and policy-advocacy groups initially propelled environmental issues onto the political agenda and nurtured them until they became legitimate. Although the groups' influence was eventually eclipsed by nations and international government organizations at the treaty-making stage of discussion, the groups' inclusion made agreements immeasurably more effective and acceptable.

- **The Role of National Interest.** Transboundary environmental problems cannot be resolved by countries acting alone, as most nations are willing to acknowledge. Effective cooperation depends on a willingness to cooperate with other countries. However, there is no reason an incremental, interactive approach and a realist approach could not both function together, at least during the early stages of the development of a durable environmental agreement.

  The Soviet Union welcomed the IAEA in the investigation of the Chernobyl accident partly to alleviate international and domestic criticism that the crisis was not taken seriously. In this instance, the IAEA invitation could be termed a conventional concession to narrow national self-interest and image. At the same time, however, the incorporation of IAEA in emergency response was also caused by the Soviet's high regard for IAEA because of its reputation for political neutrality and independence.

- **Short Time Frames for Decisions.** The longer the time line for a crisis, the less likely it is that political leaders will sustain intense interest. Each of our cases suggests that it is the responsibility of international scientific organizations to sustain this attention.

  A decade ago, author Michael Glantz suggested that because global CO_2 was viewed as a noncrisis, slow, cumulative issue, crisis decision making that could facilitate rapid action and appropriate institutional change was unlikely (Glantz 1979). However, recently some leaders have come to view global climate change as a crisis. However, in either case, assuming that some leaders could be convinced to take a prudent approach to the problem, then good scientific advice could produce dividends through long-term international planning and quiet diplomatic maneuvering. Both the Med Plan and the ozone agreements show this to be possible. In the Montreal protocol, for example, there are provisions for re-evaluation of its milestones in light of additional scientific evidence and economic considerations such as the feasibility of CFC substitutes. Since entering into force the protocol has undergone continued refinement in light of both sets of developments. The original timetable prescribed by the protocol is currently the focus or renegotiation (Randal 1989; Dickson and Marshall 1989).

- **Appreciation that Setbacks Can be Positive.** Major international agreements to promote the peaceful uses of atomic energy, to reduce regional-seas pollution, and to protect the ozone layer are, as we have seen, halting and iterative. A legitimate question that can be raised is, how does one measure the success of such ventures relative to the time available to resolve a particular problem?

  A preliminary answer is that success is measured not by how quickly the problem becomes effectively managed, which may be unmeasurable in our lifetimes, but how permanent a part of the policy landscape these initiatives become. A venture can be considered successful if policy makers propose initiatives that acknowledge that the stakes involved in the problem can be high for many parties. When a government has imposed standard-setting regulation, emissions taxes, and fiscal incentives to promote a change of behavior, it has admitted that a problem is severe and merits continued attention. In other words, the government demonstrates a willingness to make tangible sacrifices such as banning CFCs, passing all waterborne effluents through at least primary methods of sewage treatment, and allowing international inspection of nuclear facilities.

Although such sacrifices in the area of CO_2 reduction might seem remote, one must consider that, at one time, so did other policy initiatives. Thus, even if changes evolve slowly or with occasional difficulty, their general direction may be positive.

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