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The Global Environment: Institutions, Law & Policy, 3rd Edition

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Global Environmental Policy: Governance through Regimes

David Leonard Downie

As diplomats gathered in Copenhagen in December 2009 for the global climate negotiations, many around the world hoped the meeting would yield the framework for a new global climate treaty—a successor to the Kyoto Protocol that would lead humankind on a path away from very dangerous climate change. These moments—the creation of new environmental treaties—are rightly seen as significant achievements. Indeed, countries must agree to specific goals and policies if real progress is going to be made. However, students and scholars would fail to understand global environmental policy in a given issue area if they focused only on a single treaty rather than the entire evolving set of principles, norms, rules, procedures, and institutions—the “international regime”—that countries and other actors create and implement for a specific issue.

This chapter provides an introduction to “regimes” in the context of global environmental policy. It provides a detailed definition of the term, delineates prominent examples in global environmental politics, and outlines obstacles to creating and implementing effective global environmental regimes.¹

International Regimes

International regimes are dynamic, sector-specific, international regulatory and administrative systems. A useful formal definition is: a system of principles, norms, rules, operating procedures, and institutions that actors create or accept to regulate and coordinate action in a particular issue area of international relations. Principles are beliefs of fact, causation, and rectitude. Norms are standards of behavior. Rules are specific prescriptions or proscriptions for action. Operating procedures are prevailing practices for work within the regime, including those for making and implementing collective choice. Institutions are mechanisms and organizations for implementing, operating, evaluating, and expanding the regime and regime policy.²

These five regime elements are created, structured, and implemented through formal agreements, international organizations, private international law, soft law, accepted norms of international behavior, or a combination of these structures among actors involved in the issue area (governments, international organizations, nongovernmental organizations [NGOs], multinational corporations, and others). States, as the dominant actors in the international system, are the primary and most important creators of international regimes,

but they are not the only source, and the involvement of other actors often proves critical. Similarly, while formal, legally binding treaties often form the core of a regime, a regime can also be based on private international law, soft law, or other arrangements, provided that these are accepted by the actors in the issue areas as creating principles, rules, and procedures that guide their behavior. Examples include certification programs that identify wood and wood products harvested from sustainable forests (rather than clear-cutting old-growth forests or rain forests)³ and the international management and manufacturing standards, such as the ISO frameworks developed under the rubric of the International Organization for Standardization.⁴

A regime is more than patterned interaction, a single international agreement, or a single organization, although each of these is usually part of one. Rather, an international regime consists of the principles, norms, rules, and procedures contained in one or more interrelated agreements, organizations, standard practices, and shared understandings that together regulate international action in a particular issue area. The nuclear nonproliferation regime, for example, consists of the principles, norms, rules, and procedures contained or included in the Partial Test Ban Treaty, the Nuclear Non-Proliferation Treaty, and the relevant activities of the International Atomic Energy Agency. When effective, regimes, through their principles, help to sharpen international goals in an issue area, shape international behavior toward a common goal through their rules and norms, manage state interactions, augment policy coordination and collaboration, reduce conflict, and facilitate the making of further agreements.

The regime that seeks to protect stratospheric ozone—the ozone layer that in turn protects the Earth from ultraviolet radiation—is one of the best-developed and most effective global environmental regimes and can be used to illustrate the definition and its components. Many students and scholars correctly understand the famous Montreal Protocol as a ground-breaking environmental treaty, but global ozone policy consists of much more.⁵

Beginning in the 1970s, scientists discovered that certain man-made chemicals posed a serious threat to stratospheric ozone. Ozone is a gas composed of three oxygen atoms (O_3). While anthropogenic ozone is a harmful air pollutant at ground level, 90 percent of naturally occurring ozone resides in the stratosphere, far above the Earth. This ozone layer helps to shield the Earth from ultraviolet radiation produced by the sun. Because large increases in certain types of this radiation would seriously harm many plants, animals, and humans, the ozone layer is considered an essential component of the Earth's natural systems. Chemicals that threaten the ozone layer include chlorofluorocarbons (CFCs), once very widely used as refrigerants, industrial solvents, aerosol propellants, and in the manufacture of rigid and flexible foam; hydrochlorofluorocarbons (HCFCs), less ozone-depleting CFC substitutes; halons, widely used for fire control; methyl bromide, an inexpensive, widely used, and very toxic soil and structural fumigant used to kill pests across a wide range of agricultural and shipping sectors; as well as other substances such as carbon tetrachloride and methyl chloroform. What these chemicals share

is the ability to release into the stratosphere chlorine or bromine atoms that then act as a catalyst in the destruction of ozone molecules.

The ozone regime is the set of integrated principles, norms, rules, and procedures that nation-states have created to regulate and coordinate action in an attempt to protect stratospheric ozone from human-made chemicals such as CFCs and methyl bromide. The international agreements that delineate the main elements of the regime include the 1985 Vienna Convention for the Protection of the Ozone Layer, the 1987 Montreal Protocol on Substances That Deplete the Ozone Layer, and the binding amendments and adjustments to the Montreal Protocol agreed to during more than twenty meetings of the parties to the protocol. Of these, the most important agreements are the 1987 Montreal Protocol, the 1990 London Amendment and Adjustment, the 1992 Copenhagen Amendment and Adjustment, the 1995 Vienna Adjustment, the 1999 Beijing Amendment and Adjustment, and the 2007 Montreal Adjustment.⁶ The 1987 Montreal Protocol established the mechanism to control ozone-depleting substances (ODSs) and placed binding controls on the production and use of certain CFCs and halons. Subsequent amendments and adjustments to the protocol added restrictions on additional chemicals, such as HCFCs and methyl bromide, and increased the level of controls so that the regime now mandates that countries eliminate the production and use of most of these chemicals. As a result, the production and use of CFCs and several other ozone-depleting chemicals have declined dramatically and have been essentially eliminated in the United States and other industrialized countries.

Also central to the ozone regime are operations of its constituent institutions. The Meeting of the Parties (MOP) is the supreme decision-making authority and can negotiate amendments and adjustments to the protocol as well as make binding decisions on issues related to its implementation. The MOP meets annually and includes representatives of all governments that have ratified the protocol as well as observers (who can participate but do not take part in the decision-making procedures) from nonparty governments, international organizations, environmental NGOs and industry groups; most other environmental regimes call this MOP body the Conference of Parties or COP. The Open-Ended Working Group (OEWG) holds discussions in preparation for the MOP. Three independent assessment panels—the Scientific, Environmental Effects, and Technology and Economic assessment panels—provide the parties and the general public with periodic, comprehensive, and authoritative reviews of key issues, under instructions from the parties.⁷ The Implementation Committee provides a forum for discussing issues of noncompliance and offers recommendations to the MOP. The Ozone Secretariat provides day-to-day administration of the regime and supports the MOP, OEWG, assessment panels, and Implementation Committee. The Multilateral Fund, created in a landmark agreement as part of the 1990 London Amendment and Adjustment, provides financial assistance to developing countries to aid their transition from using ozone-depleting chemicals—under rules established by the protocol and

decisions by the parties.⁸ The Executive Committee, composed of representatives from fourteen governments—seven industrialized-country donor parties and seven developing-country recipient parties—is the decision body for the Multilateral Fund. The World Bank, United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), and United Nations Industrial Development Organization (UNIDO) have been designated as the official implementing agencies that execute work plans approved and funded by the Multilateral Fund. The Multilateral Fund Secretariat performs day-to-day administration functions for the Multilateral Fund and its Executive Committee.

The major principles (beliefs of fact, causation, and rectitude) of the ozone regime are enunciated in the Vienna Convention and the Montreal Protocol, particularly in their preambles. These include statements that the ozone layer is a critical component of the Earth's natural systems and should be protected; that certain human-made chemicals have the capacity to deplete the ozone layer and have already done so; that political action should be based on the best scientific and technical information available; that regulations should be guided, in general, by precaution; and that all states have a common responsibility to help protect the ozone layer but have different responsibilities in doing so.

The norms of the ozone regime include all standards of behavior enunciated in the Vienna Convention, the Montreal Protocol, amendments to the protocol, and decisions by the parties or Executive Committee that do not carry the binding nature of rules. The telling difference is the verb used to proscribe the action. For example, "Parties shall" indicates a rule. "Parties should" or "are requested to" indicates attempts to create norms.

The rules (specific prescriptions or proscriptions for action) of the ozone regime constitute the binding international law of global ozone policy. The rules are enunciated most prominently in the binding provisions of the Montreal Protocol and the amendments and adjustments to the protocol. The most important regime rules establish specific targets and timetables for countries to reduce and eventually eliminate the production and use of nearly all ODSs. They also include a variety of requirements regarding assistance to developing countries, implementation of the treaty, reviews of the efficacy of the regime, and requirements for country reporting on annual production and use of ODSs and efforts to implement the protocol. Rules on a variety of policy and procedural issues are also created by binding decisions of the MOP and the Executive Committee of the Multilateral Fund—decisions that are within the jurisdiction of these bodies and that are established by the protocol.

Finally, the procedures of the ozone regime are the prevailing practices. These include provisions for amending the treaty; deliberating on, agreeing to, and implementing other types of binding and nonbinding decisions made by the MOP and Executive Committee of the Multilateral Fund; as well as the standard operating procedures of the regime's institutions: the MOP, OEWG, Ozone Secretariat, Executive Committee, Fund Secretariat, assessment panels, Implementation Committee, and implementing agencies.

Moreover, because the ozone regime is nearly twenty-five years old, many operating procedures are fully entrenched and provide clear and well-regarded precedents for considering, developing, deciding upon, mandating, and implementing global ozone policy.

International Regimes in Global Environmental Policy

Regimes are found in most areas of international relations, including trade (the World Trade Organization, for example), finance, environment, human rights, managing such global commons as the oceans and Antarctica, communications, travel, and even security.⁹ As a result, regimes have received a good deal of theoretical and empirical attention within the international organization subfield of international relations.¹⁰ Of course, comparative levels of regime development and impact vary significantly across issue areas.

Although some wildlife treaties date from early in the twentieth century, the prominence of transnational environmental politics has risen significantly since the UN Conference on the Human Environment in 1972 in Stockholm. Today, global environmental policy—of varying specificity, effectiveness, and importance—exists for stratospheric ozone climate change, global biodiversity, migratory species, trade in endangered species, protection of individual species such as whales, wetlands protection, ocean dumping, desertification, hazardous waste, toxic chemicals, and other issues. Funding for several of these issues is provided by the Global Environment Facility (GEF), an international organization that distributes funds to developing countries for projects that address biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants (POPs). Negotiations on these and other global issues continue, as do talks on numerous regional and bilateral issues. The section below lists several notable international environmental regimes and their constituent agreements and organizations. This is by no means an exhaustive list, and information on all these regimes and treaties can be found on the treaty Web sites.):¹¹

- The climate change regime seeks to mitigate human-induced climate change by limiting anthropogenic emissions of greenhouse gases such as carbon dioxide and methane and protecting associated sinks. Components of the climate regime include the principles, norms, rules, and procedures contained in the 1992 UN Framework Convention on Climate Change and the 1997 Kyoto Protocol as well as the international organizations interconnected with these agreements, including the Climate Secretariat, which, like the ozone and other secretariats, runs the day-to-day operations of the regime; Intergovernmental Panel on Climate Change; GEF's climate program; and the Conference of Parties and its numerous subsidiary bodies.
- The hazardous waste regime seeks to protect human health and the environment from wastes that are toxic, poisonous, explosive, corrosive, ecotoxic, or infectious. The hazardous waste regime centers on the global 1989

Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal, and related agreements, which requires or urges parties to minimize the generation of hazardous wastes; work to ensure their environmentally sound management and disposal; and control, reduce, or ban their transnational movement, including taking measures to prevent and punish illegal traffic (see Chapter 7).

- The toxic chemicals regime seeks to protect human health and the environment from certain types of toxic chemicals. It consists of several agreements that exist independently but are also increasingly interconnected. The 2001 Stockholm Convention on Persistent Organic Pollutants (POPs) eliminates or restricts the production, use, trade and release of certain chemicals. The original 2001 treaty covered nine extremely toxic substances. A 2009 expansion of the treaty added nine more chemicals, and the treaty's review process will consider adding additional toxic substances in the future. The 1998 Rotterdam Convention on the Prior Informed Consent Procedure for Certain Hazardous Chemicals and Pesticides in International Trade (PIC) facilitates information exchanged regarding hazardous chemicals, promotes shared responsibility among exporting and importing nations regarding their trade, and allows countries to restrict imports of certain substances unless they provide explicit prior informed consent that such imports are allowed. As noted above, the 1989 Basel Convention seeks to protect human health and the environment from wastes that are toxic, poisonous, explosive, corrosive, eco-toxic, or infectious. The Strategic Approach to International Chemicals Management initiative (SAICM) is a policy framework that promotes the sound management of chemicals throughout their life cycle, with the objective that by 2020 chemicals around the world will be produced and used in ways that minimize significant adverse impacts on human health and the environment. The chemicals regime includes several other international organizations and networks—such as the treaty secretariats, UNEP Chemicals, and the Intergovernmental Forum on Chemical Safety—that promote and assist efforts to manage chemicals in an environmentally sound manner.

The Stockholm, Rotterdam, and Basel conventions can be considered to exist as centerpieces of distinct POPs, PIC, and hazardous waste regimes, respectively, but they are closely related; and parties to these regimes have agreed to coordinate their continuing development and implementation in pursuit of more effective global management of toxic chemicals and wastes.¹² Along with related activities in the SAICM process, those supporting this process seek to create a broader global chemicals regime that seeks to reduce the harmful impacts of toxic chemicals at all points in their life cycles, including production, use, trade, management of stockpiles and wastes, and disposal.¹³

- The global biodiversity regime seeks to protect the global diversity of species, ecosystems, and genes. The regime centers on the 1992 Convention on Biological Diversity (CBD), the Biodiversity Secretariat, and associated

funding activities by the GEF. The CBD has three core objectives: to conserve biological diversity, to use biological diversity in a sustainable fashion, and to share the benefits of biological diversity fairly and equitably.

- Several endangered species and habitat protection regimes exist that seek to protect specific species from extinction or specific types of ecosystems. In its broadest sense, the biodiversity regime could be considered to include the species and habitat regimes, as they are crucial to preserving biodiversity. However, unlike the toxic chemicals regime, the various wildlife and habitat regimes engage in far less official coordination, so it is useful to consider them as individual but mutually supporting entities. They include:

- The 1973 Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which seeks to ensure that international trade in specimens of wild animals and plants does not threaten their survival; it currently seeks to protect more than 30,000 species;
 - The 1979 Bonn Convention on the Conservation of Migratory Species of Wild Animals, which seeks to protect a variety of marine, bird, and land-based species that migrate across international borders;
 - The 1991 Ramsar Wetlands Convention, which provides the framework for national action and international cooperation for the conservation and wise use of wetlands, which are important and diverse natural resources that provide unique habitats and ecosystem services; and
 - The 1946 International Convention for the Regulation of Whaling, which originally sought to protect whale stocks and thus make possible an orderly whaling industry but has come to focus primarily on prohibiting whaling except for particular species.
- The ocean pollution regime seeks to reduce the amount of pollution dumped from ships. It includes the London Dumping Convention (which regulates waste disposal in the oceans); the 1973, 1978, and 1990 International Conventions for the Prevention of Marine Pollution from Ships (which regulate discharges from ships); and relevant activities of the International Maritime Organization (IMO). The IMO is a small, specialized agency of the United Nations that addresses various aspects of international shipping, encourages cooperation among governments, supports high standards of safety, and encourages the control and prevention of marine pollution. The IMO is unusual in that it has some power to enforce and administer matters relating to these issues.
- The Mediterranean Sea regime consists of more than a dozen individual agreements designed to protect and improve the water quality and general environmental condition in the Mediterranean Sea.¹⁴ Several other regional sea regimes have also been created.¹⁵

- The desertification regime seeks to reduce land degradation and desertification. It includes the 1994 UN Convention to Combat Desertification, its constituent institutions, and the associated funding activities of the GEF.
- The Antarctic Treaty regime arose from broader political and economic issues but includes important environmental components, including the 1972 Convention for the Conservation of Antarctic Seals, the 1980 Convention on the Conservation of Antarctic Marine Living Resources, the 1988 Wellington Convention on the Regulation of Antarctic Mineral Resource Activities, and the 1991 Protocol on Environmental Protection.
- The pan-European air pollution regime, which also includes Canada, Russia, and the United States, has built upon the 1979 Geneva Convention on Long-Range Transboundary Air Pollution (CLRTAP).¹⁶ CLRTAP has provided the forum for creation of eight issue-specific protocols, including the 1984 Protocol for Long-Term Financing of Monitoring; the 1985 Sulfur Protocol; the 1988 Nitrogen Oxides Protocol; the 1991 Volatile Organic Compounds Protocol; the 1998 Heavy Metals Protocol; and the 1998 POPs Protocol.

Obstacles to Effective Global Environmental Policy

The existence of international regimes in many environmental issue areas should not obscure the fact that creating and implementing effective global environmental policy are not easy tasks. It took many years to create each of the environmental regimes listed in the first section of this chapter, and several of them remain weak and rather ineffective (for example, the climate change, desertification, and global biodiversity regimes). It is important, therefore, to understand the obstacles to effective global environmental policy.

This section outlines factors that make it difficult for governments to create and implement effective international environmental policy and regimes. Four types of factors stand out: (1) systemic obstacles, (2) procedural obstacles, (3) lack of necessary and sufficient conditions, and (4) obstacles characteristic of international environmental issues. These broad categories are obviously interrelated, and the individual and relative impact of each characteristic varies across countries and issue areas. Nevertheless, they are a useful starting point for discussing why governments have not created more effective global policy for many environmental issues despite increasingly compelling evidence of serious and dangerous environmental problems.

Systemic Obstacles

Several significant impediments to creating and implementing effective global environmental policy can be traced to core elements of the global political, ecological, and legal systems.¹⁷

The International Political System: Effective Cooperation Is Difficult. Anarchy is one defining characteristic of the structure of the international system. Anarchy in this sense does not mean chaos but rather the absence of hierarchy. In international politics, the absence of a world government with recognized authority to create common rules, maintain order, and punish violators demands that states ultimately rely on self-help to ensure their safety. Many theorists and national leaders argue that the exigencies of this situation and the resulting security dilemma that states face have broad consequences for international relations.¹⁸ Among the most familiar are that states tend to balance the power of others through alliances and armaments, states prefer and strive for independence over interdependence, and effective cooperation among states is difficult to achieve.¹⁹

It is the last of these consequences that concerns us here. Even without fully ascribing to strict interpretations of classic or structural "realist" international theory, one can make strong theoretical arguments and cite a history of unfortunate examples that support the proposition that the structure of the international system can make it difficult for states to follow cooperative paths.²⁰ For example, states sometime do not cooperate successfully, or they fail to develop effective rules to govern their behavior in a particular issue area productively, because they fear another state might not follow the rules and then double-cross them.²¹ States sometimes fail to cooperate if they fear that another country might benefit more from the arrangement, even if they themselves benefit, because this would erode their relative economic, military, or political position in relation to that country.²² At other times, a country might be tempted to free ride or gain benefits without paying a fair share of the costs (for example, it might continue to emit a certain pollutant when others agree to stop), or it will fear others might free ride, thereby destroying the ability to create and implement effective rules.²³ Anarchic situations also produce incentives that cause actors to pursue actions that might be rational individually but result in destruction of a collective good or common-pool resource²⁴ (think about the destruction of certain stocks of ocean fish as certain countries and fishing fleets try to get as much fish as they can even as the resource runs out for all). In international relations, it is also easy to misperceive the motives, intentions, or actions of other governments,²⁵ which can contribute to states missing the opportunity to make mutually beneficial deals (a type of situation known as market failure)²⁶ or in extreme cases contribute to actual conflict.

Environmental politics takes place within the international arena. The fact that governments are discussing the environment does not divorce these interactions from the pressures that system structure places on state actors. Even in environmental politics, cooperative international solutions do not arise without concerns for comparative costs. The national negotiating positions of many countries on climate change provide numerous examples. States do engage in distributive bargaining—they often try to pay less than the other side and to get more benefits. They do compromise possible solutions by linking them to extraneous political, security, and economic issues. They do fail to locate mutually advantageous policies (market failure). In short, international

environmental politics is still international politics, and, therefore, creating and implementing effective global policy and regimes remain difficult.

Global Political and Ecological Systems. Ecological systems have their own logic and laws and exist independent of the international political and legal systems. Simply put, the causes, consequences, and geographic scope of environmental problems do not respect national boundaries. Maps of the two systems do not match up. This somewhat simplistic observation nevertheless captures an important truth: the structure of the global political system, composed of independent sovereign states, is not structurally well suited to address complex, interdependent, international environmental problems whose causes, impacts, and solutions transcend unrelated political boundaries.

Global Legal Systems and the Requirements for Effective International Environmental Policy. Principle 21 from the 1972 UN Conference on the Human Environment in Stockholm is often cited as one of the most important foundations of modern international law. It reads: "States have, in accordance with the Charter of the United Nations and the principles of international law, the sovereign right to exploit their own resources pursuant to their own environmental policies, and the responsibility to ensure that activities within their jurisdiction or control do not cause damage to the environment of other states or of areas beyond the limits of national jurisdiction"²⁷ (such as the atmosphere or oceans). Note the profound contradiction between the two halves of this sentence. The fundamental principle of international law is sovereignty. States have, to a significant extent, unique and unfettered legal control over activities within their borders. This has been, and continues to be, particularly true when it comes to economic development and the use of natural resources (as both raw materials and as sinks for pollution).

At the same time, actions taken within a country—from emitting greenhouse gases to clearing rain forests to discharging pollutants into the air or water—can have international environmental implications. Legitimate actions within one country can create environmental problems for another. Effective international policy, therefore, often requires limiting what a state does within its own borders. Climate change presents the classic example. Both China and the United States possess enough coal within their borders to meet their energy needs for two hundred years or more. Blessed with this natural resource, each country has the sovereign right to exploit it for the benefit of its citizens. Burning so much coal, however, would produce massive amounts of carbon dioxide, producing climate change that would have dangerous global impacts. Thus, the structure of international law, in the form of sovereign legal control of resources within one country's borders, conflicts with the requirements for effective international environmental policy.

Procedural Obstacles

The structural obstacles outlined above give rise to specific procedural problems when nation-states actually attempt to address an international

environmental issue. Two problems stand out: the lowest-common-denominator problem and the time-lag problem.

Lowest Common Denominator. Because, states are sovereign entities, they can choose to join or not join international environmental agreements. At the same time, the active participation of many countries is usually necessary to address a regional or global problem. This often means that the countries most interested in addressing a problem must gain the cooperation of countries with less, little, or even no interest. Thus international and global environmental policy often represents, at least at the start, the lowest-common-denominator measures that the relevant countries are willing to accept.

During the early stages of negotiations on protecting the ozone layer, from 1983 to 1985, for example, there were two major coalitions. The United States, the Nordic states, Canada, and Switzerland supported creating international controls on CFCs and other ODSs, while the European Community and its Member States, supported quietly by Japan and the Soviet Union, largely opposed them. (Most other countries were either undecided or, as in the cases of China and India, uninterested in regulation and largely uninvolved in the negotiations.) In March 1985, representatives of forty-three states and dozens of international governmental and nongovernmental organizations met in Vienna to review and adopt a framework treaty that affirmed the importance of protecting the ozone layer but did not include specific measures on potential threats. Until the last moments, the United States, Canada, and the Nordic countries considered forcing delegates to vote on adding a protocol mandating binding controls on certain uses of CFCs. They abandoned this strategy, however, understanding that such controls without participation by the European Community, and probably without Japan and the Soviet bloc, would not significantly impact the global problem and probably threaten the ability of the planned framework treaty, the Vienna Convention, to produce a binding protocol in the future. The most reluctant, necessary actor, Europe, set the lowest common denominator for global policy.

We see this today in climate change politics as well. The world cannot prevent dangerous climate change without concerted efforts by all the major emitters of greenhouse gases, including China, Europe, India, and the United States. The greenhouse gases from any one of these countries could eventually lead to significant global climate change, so all must eventually participate for the world to address this issue successfully. However, the United States, China, and India have been very reluctant, at least until 2009, to even discuss substantive actions to curb their domestic emissions. This has limited the ability of Europe and other countries to move forward with aggressive global policies. They could create an agreement without U.S., Chinese, and Indian participation, or act on their own domestically, as the European Union has done, but effective global policy will require the eventual participation of the least willing but necessary actors. Such actors, the necessary but least willing, are thus in position to have a lowest-common-denominator impact on global policy.

As a result, proposals to increase emissions reductions for industrialized nations were significantly impeded by opposition to such efforts by the United States during the George W. Bush administration. The U.S. position acts as a lowest common denominator in these negotiations. India and China have consistently refused to begin action until the United States and other industrialized countries initiate steps beyond the Kyoto Protocol, a position that has made it difficult for other developing countries, even those that have supported more aggressive climate policy, to initiate greenhouse gas reduction efforts. China's and India's positions act as a lowest common denominator in talks among developing countries.

This obstacle also impacts the chemical regime. Many countries wanted the complete elimination of all production and use of most chemicals addressed in the 2001 Stockholm Convention and its 2009 expansion, but many states also made claims that particular uses of certain chemicals were essential. The need to create a treaty with global participation necessitated accepting the lowest common denominator in the form of a series of different official exemptions that allowed the continued use of certain chemicals by particular countries.

Slow Development and Implementation: Time Lags. The sovereignty of states and the fact that each can choose to join or not join an international environmental agreement also contribute to a significant time lag between the identification of an international environmental problem and the impact of international policy. In short, it is neither an easy nor a quick process to create and implement global policy. Negotiations must be convened, policies agreed to, and treaties formally ratified by governments—and by enough governments so that the treaty can enter into force and be effective, treaty implementation initiated, and policy implemented effectively over a long enough period of time to impact the environmental problem.

Yet during this process the issue at hand does not wait. While the policy process drags on, greenhouse gases continue to pour into the atmosphere, biodiversity continues to decline, and toxic pollutants continue to accumulate. To prevent very serious and perhaps irreversible environmental damage requires addressing such issues before they pass particular tipping points. Those timelines follow the laws of nature, not politics. Thus, the years, even decades, required by the global policymaking process, even when it reaches a successful conclusion in a new agreement, present a significant procedural obstacle to effective global environmental policy and regimes because by the time the policy is put into place, the situation is often far worse.

The Absence of Necessary Conditions: Concern, Contractual Environment, and Capacity

As Peter Haas, Robert Keohane, and Marc Levy argue, effective international environmental policy, when reduced to its most basic and obvious elements, requires three fundamental conditions.²⁸ First, government “concern

must be sufficiently high." States do not have infinite resources of time, money, and diplomatic attention. For international environmental policy to be successful, many governments must decide to devote resources to addressing a particular problem, resources they could use on other competing political or economic issues. Second, a sufficiently "hospitable contractual environment" must exist. Because of the obstacles (outlined above) associated with the international system, international environmental cooperation requires that states "be able to make credible commitments, to enact joint rules with reasonable ease, and to monitor each other's behavior at moderate costs . . . without debilitating fear of free riding or cheating by others." This can be difficult. Third, states must possess the scientific, political, and administrative "capacity" to understand the issue, to negotiate international policies that can address it successfully, and then to implement the policies within their own countries effectively and within the necessary time frame.

Capacity in this context is a broad term that encompasses the bureaucratic, scientific, and economic resources a country possesses to address a particular issue as well as the physical and political ability to deploy those resources effectively. Understanding the many aspects of capacity and the role it plays is an increasingly important issue in the study and practice of international environmental politics. It is often discussed in terms of the importance of building economic, political, and governmental capacity within developing countries to address particular issues, including by officials from those developing countries who regularly argue at international negotiations that increased financial and technical assistance is necessary to build capacity in their countries and otherwise assist them to implement particular international environmental regimes. Capacity can be considered more broadly, however, to include, from different perspectives, the political capacity or political will of industrialized states to enact environmental policies even when they run counter to the economic interests of key political and economic constituencies, the ability to make difficult decisions in the presence of considerable uncertainty about future events, or the ability of human society to address very complex, long-term environmental issues through collective decision making and action.

These conditions can be considered necessary (but not sufficient) for effective international environmental policy. Although it is easy to oversimplify the terms, it is a fact that concern, contractual environment, and capacity encapsulate important, even critical, requirements for successful environmental policy. Thus, while they are not obstacles themselves, the absence of any one of them presents significant obstacles to the creation and implementation of effective environmental regimes.

General Characteristics of International Environmental Issues

International environmental issues also possess inherent characteristics that make effective cooperation difficult. These characteristics are not unique to environmental issues, but they are prominent in, and common to,

environmental issues. Individually or in combination, these characteristics can exacerbate systemic or procedural constraints on international cooperation as well as inhibit the creation of sufficient concern, a hospitable contractual environment, and sufficient capacity. Of course, the individual and relative impact of each characteristic in obstructing effective environmental policies varies across countries and issue areas.

This section delineates these obstacles and illustrates their impact with the use of examples from the development of the ozone regime. Note that the categories represent somewhat artificial but useful heuristic divisions. Thus their components and impacts are interrelated rather than mutually exclusive.

Scientific Complexity and Uncertainty. Environmental issues often involve both complex scientific issues and significant uncertainty about their ultimate impact. New environmental issues often exist, almost by definition, at the edge of current knowledge of chemistry, biology, physics, and natural systems.

Scientific complexity can create uncertainty concerning the content, scope, severity, and time frame of individual problems. In such situations, reaching agreement on international policy can be difficult. It can be difficult to understand the extent of the threat, to determine all cause-and-effect relationships, and to design solutions. Lack of firm knowledge can undermine concern as uncertainty allows other, more certain economic or political interests to maintain priority in the policy hierarchy. Complexity can challenge the capacity of government bureaucracies to understand the problem or to implement common solutions properly. Uncertainty and complexity can lead different states to perceive the payoff matrix differently, perhaps reducing incentives to risk cooperation and increasing incentives to free ride, thereby harming the contractual environment.

Climate change, biodiversity loss, ocean fish stocks, and toxic chemicals are examples of issues in which complexity and uncertainty continue to hamper international negotiations despite general agreement that complete inaction could lead to significant if not disastrous outcomes. Scientific complexity and uncertainty also affected the development of the global ozone regime. The initial claim that a relatively small number of inert molecules released near ground level would threaten stratospheric ozone in the next century through a complex set of chemical reactions appeared to many an unlikely proposition.²⁹ For many years, scientists investigated and debated many issues surrounding the CFC-ozone theory, including reaction rates, secondary reactions, feedback mechanisms, CFC sinks, and related points of atmospheric chemistry and physics—all with no actual depletion being observed in the stratosphere and during a period when atmospheric science was far less developed than it is today. The complexities and uncertainties provided opponents of CFC controls with significant leverage to argue that national and international regulations were unnecessary and that further discussion should wait for atmospheric chemistry to become better understood and for scientists to provide proof that CFCs had caused measurable ozone depletion.³⁰

Debates on climate change, particularly in the United States, proceeded along obviously similar lines.

Linked Economic and Political Interests. A second and equally critical obstacle is that environmental problems are inextricably linked to important economic and political interests. Environmental issues, and therefore environmental negotiations, do not exist independent of other economic and political activities and interests. Rather, environmental issues exist *because* of these activities and interests. Environmental problems are produced as externalities of individuals, corporations, and nations pursuing other important interests such as energy production, mining, manufacturing, farming, fishing, transportation, resource consumption, livestock husbandry, urbanization, weapons production, territorial expansion, and military conflict. The fact that many of these activities could be pursued successfully while producing less environmental degradation does not erase the links between the issues.

Thus international cooperation on environmental issues must also entail *de facto* cooperation on important economic and even security concerns. Addressing climate change requires controlling fossil fuel consumption. Preventing more serious declines in stocks of ocean fish requires limiting fishing economies. Safeguarding biodiversity requires addressing the economic pressures that lead to habitat destruction. Protecting or restoring regional seas and waterways, such as the Mediterranean, Baltic, and Red seas, the Nile, and the Danube, requires cooperative agreements and coordinated regulatory policy among large numbers of states with very different economic interests concerning the use of these waters.

Such issue linkage also affects concern, contractual environment, and capacity. For example, governments and their constituencies often express greater concern for the underlying economic and political interests than for the environmental consequences. In addition, as high economic costs become associated with collaborative action, actors face fears that others might try to free ride, thus harming the contractual environment. Many governments lack the capacity to negotiate, enact, and enforce environmental regulations in the face of significant economic or political costs.

Cooperation to protect stratospheric ozone first appeared to be an extremely difficult case for exactly these reasons. Many of the world's largest and most influential corporations produced or used CFCs.³¹ Many believed CFCs were technically or economically essential to products and processes intimately associated with modern life, including refrigeration, air conditioning, flexible and rigid foam, aerosol sprays, and the manufacture of transistors and computer chips.³² In addition, production of CFCs and many of the products that make use of them had become standardized, creating new actors that valued their continued availability. Production and use in the developing world were rising rapidly, particularly in China, India, Argentina, Brazil, and the newly industrialized countries of the Pacific Rim.³³ Many observers were convinced that very large production increases in developing countries were inevitable without further international agreements and, thus, that the success

of global ozone policy depended on addressing the associated economic and political interests of developing countries.³⁴

Unequal Adjustment Costs. Addressing the underlying economic activity that caused an environmental problem can produce broad benefits to the environment, human health, and even the economy. For example, replacing fossil fuel power plants with wind, solar, and geothermal energy reduces carbon dioxide emissions that cause climate change; cleans the air of other air pollutants that impact human health; reduces energy imports from other countries, which improves countries' balances of trade; and creates new, sustainable jobs in the alternative-energy industry.

At the same time, however, those with economic interests attached to the old, polluting energy industries will incur economic costs, sometimes very significant costs. Thus, solving a common problem might produce many common benefits, but that does not mean there will be equal costs. The costs of change—of adjusting to the new policies and practices—can vary significantly within a country and across different countries, and this can produce obstacles to effective policy.

Solutions to international environmental problems thus frequently involve unequal adjustment costs. This accentuates the difficulties inherent in international cooperation and significantly impacts the contractual environment. Because states can be concerned with relative or positional advantages, they may reject solutions that ask them to bear a relatively larger burden than other states.³⁵ Alternatively, they may demand special compensation for joining the regime. Such difficulties are common in the creation of trading regimes but their importance in environmental issues must also be recognized.

Comparative costs vary depending on the environmental issue area, level of industrialization, method of energy production, resource base, transportation policy, and other factors. For example, Saudi Arabia will bear a much greater burden than Japan in global attempts to combat climate change. Indeed, one could argue that Saudi Arabia would be put out of business, while Japan could sell energy-efficient technology. The severe adjustment costs that Saudi Arabia would face if the world were to convert to electric vehicles to address climate change is one reason Saudi Arabia works so diligently at the global climate negotiations to slow the process down. Brazilian cattle and farming interests that convert forests to farmland or Indonesian companies that clear-cut old forests would be impacted far more than sustainable tree farms if the world were to succeed in creating policy that truly protected forests or critical biodiversity habitats. Western societies, particularly the United States, would bear a higher burden in any systematic global attempt to reduce or equalize energy and resource consumption. The industries that rely on toxic chemicals face more severe adjustment costs than does the expanding organic industry as the POPs, PIC, and Basel regimes continue to expand. Managing the impacts of these and other unequal adjustment costs is a critical and difficult part of global environmental negotiations.

Extended Time Horizons and Time Horizon Conflicts. For many environmental problems, the most serious impacts will not occur for many years. This extended time horizon can make it difficult for societies and policy-makers to bear short-term costs to fix such a problem, despite the fact that it would often be most effective and least costly to take significant action to address the problem before the most serious consequences occur.

In addition, the elected officials and government bureaucrats who are responsible for making decisions on when and how to address environmental problems often operate in a much shorter time frame—a two-, four-, or six-year election cycle and a one- or two-year budget cycle—than do global environmental problems. This is not to cast aspersions on these individuals, their abilities, or their priorities, but rather to acknowledge that even the most enlightened officials usually face time pressures and perspectives far different from those required to address a problem with a fifty- or a one-hundred-year horizon.

These conflicts present political difficulties, especially if the threat is not well defined or the costs of abatement measures are very high. Policymakers can find it difficult to enact policies that entail significant short-term costs in order to achieve long-term benefits. They and the electorate will definitely bear the short-term costs (perhaps threatening the policymaker's reelection), but they may not be around to enjoy the long-term benefits. This can reduce concern and harm the contractual environment. In the late 1970s and 1980s, for example, many corporations and governments, facing the prospect of incurring high short- and medium-term costs if they had to reduce CFC use to prevent ozone depletion from emerging sometime in the next century, came out against CFC controls and instead proposed further study. Currently, some opponents of climate change policy still argue that rather than transition to clean energy now, we should save money by delaying action until the most serious impacts begin and then adapt.

Nonlinear Patterns of Change. Many environmental problems do not develop in a linear, predictable pattern. Sudden declines in fish stocks, the surprise appearance of the ozone hole above Antarctica, and the recent, rapid acceleration of melting of northern sea ice owing to climate change are but a few examples. Nonlinear change makes it difficult to predict the timing and impact of environmental problems. This, in turn, can make it difficult to develop and implement effective policy. This is particularly true if the proposed policy is controversial or expensive, as opponents can cite the uncertainty of the impact and its timing as reasons to forgo action.

Large-Number Problems. Solutions to international environmental problems often require the participation of a large number of state and private actors. The problems associated with creating cooperation in such situations are well known. Large numbers present significant incentives for free riding—not participating in the policy, and thereby avoiding the costs, while hoping to enjoy the benefits. This can be particularly dangerous when the environmental policy aims to manage and protect a common pool resource—such as oceans or the atmosphere, which all can use but no one controls—if

fears that others will cheat can lead actors to believe they face a use-it-or-lose-it situation.³⁶ Large numbers can also harm the contractual environment and decrease the possibility of effective environmental cooperation because of increased transaction costs, difficulties in identifying and reaching consensus, increased likelihood of free riding, and problems in detecting and sanctioning violators. Large numbers also increase the likelihood of significant differences in culture, environmental values, and economic and institutional development among the states. Again, the logic tempting states to cheat (and continue to pollute) is exacerbated if the benefits of cooperation are suspect or the adjustment costs high or uneven.

Global issues such as biodiversity, climate change, ozone depletion, ocean issues, and population expansion present special problems. Solutions must not only involve a large number of state and private actors but also overcome North-South divisions. Although neither group is uniformly cohesive, many global negotiations exhibit strong differences between industrialized and developing nations on issues such as the targets and timetables required for different types of parties, financial assistance, technology transfer, and the relative importance of environmental protection versus other issues (see Chapter 12 for a detailed discussion).

Different Core Beliefs. States and groups within states (including cultural, religious, regional, economic, and political groups) sometimes possess different core beliefs and values relevant to environmental cooperation. Religions differ. Cultural beliefs differ. Values differ. Opinions differ regarding the environment and the relative importance of precaution in setting public policy. These differences matter and can create obstacles to effective global environmental policy. Some individuals in certain Asian societies, for example, believe products from certain endangered animal or plant species have significant medicinal, psychological, or sexual properties. This creates a market for these animals and undercuts international controls designed to protect them. Many Catholics and members of other religious groups oppose certain policies designed to control human population growth. Some countries or groups within them have no ethical concerns with hunting whales; others have very strong concerns. Some groups have strong cultural links to fishing, timbering, or hunting certain animals. Some political ideologies treat economic development and freedom from government regulations as higher priorities than environmental protection. Others contend the reverse.

Core beliefs, values, and cultures are clearly important in international environmental negotiations, perhaps to a degree greater than most discussions acknowledge. They not only can inhibit the identification and implementation of cooperative solutions but also can obstruct attempts to begin discussions by limiting concern for particular environmental issues.

Intersecting Obstacles. In addition to their individual impact, the characteristics of global environmental issues outlined above can also create intersecting or crosscutting obstacles to effective cooperation. For example, complexity, uncertainty, issue linkages, and the possibility of unequal adjustment costs offer

opportunities for aggressive or less risk-averse states to seek positional advantages while enhancing fears of positional disadvantages (sucker's payoff) among risk-averse or less-well-informed states. Long time horizons and scientific complexity offer policymakers opportunities to postpone economically and politically expensive solutions. Complex, lengthy, and expensive remedies, involvement by many actors, and disparate state interests and capacities reduce the likelihood of agreement and increase the opportunity for, and attractiveness of, free riding (should an agreement be created).

Conclusion

International environmental regimes are dynamic and sector-specific international regulatory and administrative systems that states create to manage policy on particular issues. They comprise sets of integrated principles, norms, rules, procedures, and institutions. Some environmental regimes, like those for protecting stratospheric ozone, are of long standing, are well developed, and are increasingly successful. Most, however, face significant challenges, and it is unclear whether they will meet their objectives.

It is important to understand the obstacles to effective global environmental policy—systemic obstacles, procedural obstacles, a lack of necessary and sufficient conditions, and characteristic obstacles—so that we can better understand the successes as well as the significant challenges that remain. It is also important to look at global environmental policy, particularly the type of policy created and implemented by states and international organizations, not as a single, static international treaty but as a complex regime. By examining and understanding the comparative creation, content, evolution, and impact of these regimes, students and policymakers can gain insight into the sources of effective global environmental policy.

Effective global environmental policy is not easy to design or implement, but it does exist. Protection of the ozone layer, reducing trade in endangered species, and addressing pollution in regional seas are three increasingly successful examples. These and other global regimes prove that the international community has the ability to address complex global environmental problems with innovative and successful policies. These lessons will have to be learned if humankind is to be successful in addressing long-standing issues such as climate change and new issues such as endocrine-disrupting toxic chemicals.

Notes

1. This chapter draws extensively on previous work by the author. See, in particular, Chapter 3 in Pamela Chasek, David Downie, and Janet Welsh Brown, *Global Environmental Politics*, 4th ed. (Boulder: Westview, 2006), sections of which this chapter follows closely; David Downie, "Understanding International Environmental Regimes: Lessons of the Ozone" (PhD dissertation, University of North Carolina, 1996); "Opportunities and Obstacles to Effective International Environmental Cooperation" (paper presented to Institute for Defense Analyses conference on environmental issues, Washington D.C., July 28, 1995); David Downie, "Road Map or False Trail:

- Evaluating the Precedence of the Ozone Regime as Model and Strategy for Global Climate Change," *International Environmental Affairs* 7 (Fall 1995): 321-345; and Pamela Chasek, David Downie, and Janet Welsh Brown, *Global Environmental Politics*, 5th ed. (Boulder: Westview, 2010).
2. Chasek, Downie, and Brown, *Global Environmental Politics*, 4th ed., 17. As noted in that volume, and previous writing by the author, it can be useful to compare definitions and the use of the term "regime" in John Gerard Ruggie, "International Responses to Technology: Concepts and Trends," *International Organization* 29 (1975): 557-583; Ernst Haas, "On Systems and International Regimes," *World Politics* 27 (1975): 147-174; Robert Keohane and Joseph Nye Jr., *Power and Interdependence: World Politics in Transition* (Boston: Little, Brown, 1977); Oran Young, "International Regimes: Problems of Concept Formation," *International Organization* 32 (1980): 331-356; Stephen Krasner, *International Regimes* (Ithaca, N.Y.: Cornell University Press, 1983); Robert Keohane, *After Hegemony* (Princeton: Princeton University Press, 1984); Jack Donnelly, "International Human Rights: A Regime Analysis," *International Organization* 40 (1986): 599-642; Stephan Haggard and Beth Simmons, "Theories of International Regimes," *International Organization* 41 (1987): 491-517; Thomas Gehring, "International Environmental Regimes: Dynamic Sectoral Legal Systems," in *Yearbook of International Environmental Law*, vol. 1, ed. G. Handl (London: Graham & Trotman, 1990); and Downie, "Road Map or False Trail."
 3. See, for example, the Forest Stewardship Council at www.fsc.org/about-fsc.html.
 4. See the homepage for the International Organization for Standardization at www.iso.org/iso/home.htm.
 5. For discussions of the Montreal Protocol and the ozone regime, see Downie, "Understanding International Environmental Regimes: Lessons of the Ozone"; David Downie, "UNEP and the Montreal Protocol: New Roles for International Organizations in Regime Creation and Change," in *International Organizations and Environmental Policy*, ed. Robert V. Bartlett, Priya A. Kurian, and Madhu Malik (Westport, Conn.: Greenwood Press, 1995); Richard Benedick, *Ozone Diplomacy*, 2nd ed. (Cambridge: Harvard University Press, 1998); David Downie, "The Power to Destroy: Understanding Stratospheric Ozone Politics as a Common Pool Resource Problem," in *Anarchy and the Environment: The International Relations of Common Pool Resources*, ed. J. Samuel Barkin and George Shambaugh (Albany: State University of New York Press, 1999); Downie, "Road Map or False Trail"; and Stephen O. Andersen and K. Madhava Sarma, *Protecting the Ozone Layer: The United Nations History* (Sterling, Va.: Earthscan, 2004).
 6. Texts of the ozone treaties, amendments, and adjustments as well as reports from each Meeting of the Parties, OEWG meeting, and Implementation Committee meeting are available online from the UNEP Ozone Secretariat, at www.unep.org/ozone/index.shtml.
 7. For more information on the panels as well as recent reports, see www.unep.ch/ozone/Assessment_Panels/index.shtml.
 8. See the Multilateral Fund home page at <http://www.multilateralfund.org/>.
 9. See Krasner, *International Regimes*.
 10. Influential early discussions of regimes in international relations include Ernst Haas, "Why Collaborate? Issue-Linkage and International Relations," *World Politics* 32 (1980): 357-405; Robert Keohane, "The Theory of Hegemonic Stability and Changes in International Economic Regimes," in *Changes in the International System*, ed. Ole Holsti (Boulder: Westview, 1980); Krasner, *International Regimes*; Keohane, *After Hegemony*; Friedrich Kratochwil and John Gerard Ruggie, "International Organization: A State of the Art on an Art of the State," *International Organization* 40 (1986): 753-776; and Haggard and Simmons, "Theories of International Regimes."
 11. Chasek, Downie, and Brown, *Global Environmental Politics*, 5th ed., provides detailed summaries of the development and content of these and other environmental regimes.

12. For details, see the relevant decisions by the COPs for the Rotterdam and Basel conventions in 2008 and the COP for the Stockholm Convention in May 2009 as well as the extraordinary combined COP of all three conventions held in February 2010.
13. Delegates attending recent meetings associated with the Stockholm, Rotterdam, and Basel conventions, communications with the author; author's observations. In addition, see the relevant sections of the official meeting reports from the COPs for the Rotterdam and Basel conventions in 2008 and the COP for the Stockholm Convention in 2009 as well as the extraordinary combined COP of all three conventions held in 2010.
14. These include the 1976 Barcelona Convention for the Protection of the Mediterranean Sea against Pollution; the 1976 Protocol Concerning Cooperation in Combating Pollution of the Mediterranean Sea by Oil and Other Harmful Substances in Cases of Emergency; the 1976 Protocol for the Prevention of Pollution of the Mediterranean Sea by Dumping from Ships and Aircraft; and the 1980 Protocol for the Protection of the Mediterranean Sea from Land-Based Sources.
15. Examples include the Baltic Sea regime, which emerged from the 1974 Helsinki Convention on the Protection of the Marine Environment of the Baltic Sea Area.
16. For updated and detailed information, see the Web site for the Convention on Long-Range Transboundary Air Pollution, www.unece.org/env/lrtap.
17. Some would also argue that the current structure of the international economic system—particularly a global capitalism that emphasizes consumerism, lowest-cost production, globalization, and resource extraction while largely failing to cost in environmental degradation—also presents a structural impediment to effective global environmental policy. Although these characteristics can present obstacles to effective policy, I believe that they are not as structurally inherent as the other factors. Indeed, at times, such as in the expansion of the ozone regime, they have supported global environmental policy by helping to speed the introduction of environmentally friendly technology.
18. Classic examples include Thucydides, Machiavelli, and Hobbes. Influential modern examples include Hans Morgenthau, *Politics among Nations*, 5th ed. (New York: Knopf, 1973); Robert Jervis, "Cooperation under the Security Dilemma," *World Politics* 30 (1978): 167–186; Kenneth Waltz, *Theory of International Politics* (Reading, Mass: Addison-Wesley, 1979); and Glenn Snyder, "The Security Dilemma in Alliance Politics," *World Politics* 36 (1984): 461–495.
19. Waltz, *Theory of International Politics*.
20. For example, Reinhold Niebuhr, *Moral Man and Immoral Society* (1932; repr., New York: Scribner, 1960); and Morgenthau, *Politics among Nations*.
21. Glenn Snyder and Paul Diesing, *Conflict among Nations: Bargaining, Decision Making, and System Structure in International Crises* (Princeton: Princeton University Press, 1977); Jervis, "Cooperation under the Security Dilemma"; and Kenneth Oye, ed., *Cooperation under Anarchy* (Princeton: Princeton University Press, 1986), 1–22.
22. Joseph M. Grieco, "Anarchy and the Limits of Cooperation," *International Organization* 42 (Summer 1988): 485–507.
23. Mancur Olson, *The Logic of Collective Action* (Cambridge: Harvard University Press, 1965).
24. J. Samuel Barkin and George Shambaugh, eds., *Anarchy and the Environment: The International Relations of Common Pool Resources* (Albany: State University of New York Press, 1999).
25. Robert Jervis, *Perception and Misperception in International Politics* (Princeton: Princeton University Press, 1976).
26. Keohane, *After Hegemony*.
27. *Report of the United Nations Conference on the Human Environment*, UN Document no. A/CONF.48/14, June 1972, 118. This principle later became Principle 2 of the Rio Declaration, but with the words "and developmental" inserted before "policies," thus making it even more self-contradictory.

28. Peter Haas, Robert Keohane, and Marc Levy, eds., *Institutions for the Earth: Sources of Effective International Environmental Protection* (Cambridge: MIT Press, 1993). All quotations in this paragraph are from pages 19–20.
29. Mario Molina and F. Sherwood Rowland, "Stratospheric Sink for Chlorofluoromethanes: Chlorine Atomic Catalyzed Destruction of Ozone," *Nature* 249 (June 28, 1974): 810–812.
30. The best secondary literature on the interplay of scientific and technical debates in the early development of the ozone regime includes Lydia Dotto and Harold Schiff, *The Ozone War* (New York: Doubleday, 1978); Paul Brodeur, "Annals of Chemistry: In the Face of Doubt," *New Yorker*, June 9, 1986, 70–87; and Karen Litfin, *Ozone Discourses: Science and Politics in Global Environmental Cooperation* (New York: Columbia University Press, 1994).
31. These corporations include, for example, DuPont, ICI, Atochem, General Motors, Toyota, General Electric, and Procter and Gamble.
32. Estimates of specific figures vary widely.
33. As far back as 1976, ODSs were produced in Argentina, Brazil, Czechoslovakia, East Germany, Mexico, and India, although the United States, the United Kingdom, West Germany, France, Japan, the Soviet Union, and the Netherlands accounted for more than 90 percent of total production. For discussion, see David Downie, "Comparative Public Policy of Ozone Layer Protection," *Political Science* 45 (1993): 186–197.
34. Based on personal communications, global ozone negotiations, London, June 1990; see also Benedick, *Ozone Diplomacy*.
35. Grieco, "Anarchy and the Limits of Cooperation."
36. Downie, "The Power to Destroy."