

2 International Environmental Common Pool Resources: More Common than Domestic but More Difficult to Manage

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Introduction

This volume's introduction argues that "all international environmental issues that generate international political conflict, show some characteristics of common pool resources." This chapter builds on this argument to develop a framework for understanding the factors that make common pool resource (CPR) dynamics more likely at the international level but make collective management at the international level less likely and less successful. Why are the appropriation and provision problems that bedevil domestic environmental management exacerbated when more than one nation is involved? This chapter argues that nations face greater difficulties in resolving international environmental problems than equivalent domestic ones because the problems are greater and their solutions more elusive. International environmental amenities face greater appropriation problems than corresponding domestic ones because the types of demand placed on the amenity are likely to be more rival, the aggregate level of demand is likely to be higher, and institutional mechanisms to constrain demand are less

likely to be available. These amenities face greater provision problems because the incentives and capacity to create and maintain international institutions that could ensure their provision are weaker than in the domestic context.

Definitions

I refer to "environmental amenities" rather than environmental "goods" or "resources" to capture the notion that humans increasingly conceive of natural systems as providing existence (e.g., biodiversity) and nonconsumptive (e.g., scenic views) benefits as well as traditional consumptive benefits (e.g., lumber or fish).¹ Any given amenity has different "aspects" or "characteristics," and it is these characteristics, rather than the amenity itself, that are the source of its value to humans.² In analyzing the politics of different environmental problems, we may mislead ourselves by classifying a given amenity as a public good or a CPR since that amenity may be a public good in one aspect and a CPR in another. As Robert O. Keohane and Elinor Ostrom note, "The public goods-CPR distinction is more appropriately used to classify specific aspects of a physical resource rather than to characterize the physical resource as a whole."³

Discussing environmental problems in terms of "appropriators consuming environmental resources" causes us to ignore the broader range of environmental problems that involve costs imposed on those who value an amenity's nonconsumptive or existence benefits. Indeed, various ecophilosophies see the human habit of treating nature as a resource as the precise cause of many environmental problems.⁴ To capture consumptive, nonconsumptive, and existence benefits in a single term, I refer to all actors who derive value from an environmental amenity as "beneficiaries" rather than as users or consumers. This chapter addresses the problems that arise from the processes by which humans derive benefits from an existing environmental amenity as well as those that arise from the processes by which humans re-create and maintain those amenities. The former "appropriation" problems involve static, time-independent, allocations of benefits while the latter "provision" problems involve dynamic, time-dependent, problems of ensuring a qualitatively and quantitatively healthy future stock of the amenity.⁵

Environmental Amenities and Their Appropriation

Any environmental amenity may provide three types of benefits to human society.⁶ It may provide humans with the "consumptive benefits" of

using the divisible units of the amenity's resource flow, the "nonconsumptive benefits" of access to the amenity's total stock, or the "existence benefits" from knowledge of the amenity's existence.⁷ A public forest, for example, "may be valued for timber production, for a variety of environmental services [such as hiking], or merely for its existence value" as wilderness.⁸ Consumptive benefits depend on the quantity and quality of the resource flow from an environmental amenity. Nonconsumptive and existence benefits depend on the quantity and quality of the resource stock.

Prior to the creation of a social institution to regulate or exclude appropriators, the existence and type of appropriation problems plaguing an environmental amenity depend on two factors: the type of benefits people derive from the amenity and the level of demand for those benefits. The former determines the potential type of conflict that may arise, the latter whether that conflict actually does arise. Whenever people value an amenity for its consumptive benefits, the potential for quantity rivalry or overappropriation exists; whenever they value it for its nonconsumptive benefits, the potential for quality rivalry or congestion and crowding exists; and whenever they value it for its existence benefits, no potential for rivalry exists. A potential rivalry will develop into an actual rivalry, that is, a CPR issue will become a CPR problem, whenever the demand for certain benefits from an amenity approaches or exceeds the ability of that amenity to supply the benefits derived from that amenity, that is, its carrying capacity. As demand approaches carrying capacity, a group of consumptive beneficiaries face the threat of overappropriation while a group of nonconsumptive beneficiaries face the threat of crowding or congestion. In contrast, a group of existence beneficiaries do not face any similar threat because, no matter how many beneficiaries there are, the nature of their demands on the amenity are such that the amenity has an essentially infinite carrying capacity. Put differently, consumptive beneficiaries impose negative externalities on other consumptive beneficiaries and nonconsumptive beneficiaries do likewise, while existence beneficiaries do not impose such externalities.

Often, people derive value from an environmental amenity by consuming some portion of the flow of resource units from that amenity.⁹ Such beneficiaries are using the amenity as a rival good. The level of consumptive benefits actually derived depends on the quality and quantity of the flow. Consumptive benefits, by definition, preclude others from deriving benefits from the same resource unit. One beneficiary's consumption reduces the resource units available to other consumptive beneficiaries. Although any unit

of a rival good that I consume becomes unavailable to anyone else, if aggregate demand remains sufficiently below the capacity of the amenity to supply resource units (the consumptive carrying capacity), no problem arises. An adequate flow of resource units ensures that other beneficiaries continue to have access to resource units sufficient for their demand and that they do not need to expend additional resources to gain access to those resource units. However, as aggregate consumptive demand approaches the amenity's consumptive carrying capacity, each additional resource unit consumed reduces the resource units available to other consumptive users. Each appropriator begins to impose a negative externality on other actual or potential consumptive beneficiaries. All activities involving consumptive benefits have the potential for such quantity rivalry.¹⁰ Amenities that face the possibility of such overappropriation or quantity rivalry among competing consumptive beneficiaries can be conceived of as CPRs, with open-access fisheries providing the traditional example in which each fisher appropriates some number of fish that are no longer available to others.¹¹

An amenity may also, however, face problems of quality rivalry or "congestion" that differ from the common conception of CPRs as caused by quantity rivalry among consumptive beneficiaries. Nonconsumptive uses depend on the quality and quantity of the whole stock of the amenity rather than the quality and quantity of the units flowing from that stock.¹² Nonconsumptive users do not preclude others from engaging in similar nonconsumptive use. Because such users do not consume units of the amenity, the quantity of the amenity remains uninfluenced by demand. Indeed, at low aggregate levels of demand, nonconsumptive beneficiaries may not even reduce the quality of the amenity. However, when nonconsumptive demand approaches the nonconsumptive carrying capacity of the amenity, the benefits each nonconsumptive user derives decrease. Instead of overappropriation, crowding results. All nonconsumptive beneficiaries still have the same access to the benefits of the amenity but the quality of the amenity and hence of those benefits declines. Indeed, pollution problems (as demonstrated by the cases in this volume) often exhibit congestion-type dynamics, exhibiting quality rivalry problems with quite different incentive structures than quantity rivalry problems. Rather than the symmetry of classic CPR dynamics, degraders of an amenity's quality need not be victims of that degradation: polluters often impose negative externalities on others without experiencing any of those effects themselves. In such situations, incentives and capacity to remedy the problem are delinked: the nonbeneficiary polluter has the capacity to remedy

the problem but would receive no endogenous benefits by doing so, while the beneficiaries of lessened pollution, not being polluters themselves, lack the capacity to remedy the problem other than through side payments.

The threat of crowding or congestion to a nonconsumptive beneficiary comes from other nonconsumptive beneficiaries.¹³ For example, when too many hikers frequent Yosemite National Park, the Park does not have fewer “units of wilderness,” but rather has less of the quality of wilderness. A hiker can still hike for the same number of days but the quality of that experience is decreased. Long before allowing one more hiker into the park requires the removal of an existing hiker from the park (quantity rivalry), the quality of wilderness has been lost. Quality rivalry can be considered as a distinct form of rivalry. Alternatively, it can be considered as a form of partial rivalry, located along a spectrum between purely rival goods for which “an agent’s consumption of a unit of a good fully eliminates any benefits that others can obtain from that unit” and purely nonrival goods for which, when an agent derives value from the amenity, the ability of all other potential beneficiaries remains completely undiminished.¹⁴

Purely nonrival goods exist when people derive exclusively existence benefits from an amenity. The existence benefits derived are a function of the quality and quantity of the amenity stock. However, deriving such “inherently nonrival” benefits does not degrade the quality or quantity of the resource system or its flow.¹⁵ For truly nonrival beneficiaries, the derivation of existence benefits imposes no externality on other existence beneficiaries, regardless of the level of demand for such existence benefits. With respect to existence beneficiaries, the carrying capacity of the amenity is essentially infinite and no risk exists of quantity or quality rivalry. Those people who derive pleasure from knowing that certain species have been preserved even though they never plan to make consumptive (hunting) or nonconsumptive (watching) use of those species will not have less pleasure if additional *existence* beneficiaries know about the preservation of those species. Allowing new or existing actors to derive additional existence benefits from the amenity entails no marginal costs to those already deriving benefits, and does not induce crowding or overappropriation.¹⁶ In short, new beneficiaries leave “as much and as good” for all other beneficiaries.¹⁷

To summarize, consumptive, nonconsumptive, and existence beneficiaries face the potential for quantity rivalry, quality rivalry, and no rivalry, respectively. Potential rivalries become actual when the demand for the benefits of the amenity approach the amenity’s carrying capacity. A particular

environmental amenity will lie along a spectrum of rivalry, ranging from no rivalry to complete rivalry.¹⁸ Appropriation problems never arise for existence beneficiaries. Nor do they arise for consumptive and nonconsumptive beneficiaries so long as the amenity’s carrying capacity sufficiently exceeds demand. Whether inherently nonrival or empirically nonrival, these amenities can be properly characterized as public goods so long as no potential beneficiaries are currently excluded.¹⁹ When demand approaches the carrying capacity, however, potential rivalries become actual. Each actor deriving additional benefits from an amenity reduces the quantity or quality of the benefits available to those already deriving similar benefits from that amenity.²⁰ Although crowding is absent in the winter, during the summer the number of hikers can reduce, even to zero, the pleasure of hiking in Yosemite National Park as each additional hiker reduces the quality of the Park’s “wilderness.” Similarly, relatively low levels of initial demand make a previously unexploited fish stock a public good in which the first harvests from the stock do “not reduce the quantity available to others since the remaining fish have an increased opportunity to grow until maturity. . . . As more and more harvesting occurs, however, rivalry increases and fisheries become CPRs.”²¹

Thus, we can identify the characteristics of any given amenity from which no actors have yet been excluded into three “ideal types.” “Public goods” refer to those environmental amenities valued for their existence benefits regardless of the level of demand as well as those valued for their consumptive and nonconsumptive benefits so long as aggregate demand is low enough to avoid actual rivalry. “Congestion CPR problems” involve those amenities in which the aggregate demand for nonconsumptive benefits approaches the

Table 2:1
RIVAL/NONRIVAL DEMAND

	Consumptive Benefits	Nonconsumptive Benefits	Existence Benefits
Rival: Demand Exceeds Carrying Capacity	Overappropriation problem (quantity rivalry)	Congestion problem (quality rivalry)	Public good
Nonrival: Demand Does Not Exceed Carrying Capacity	Public good	Public good	Public good

nonconsumptive carrying capacity, creating quality rivalry. "Overappropriation CPR problems" involve those amenities in which the aggregate demand for consumptive benefits approaches the consumptive carrying capacity of the amenity, creating quantity rivalry.

Why the International Setting Creates More Difficult Appropriation Problems

CPRs are traditionally characterized by the fact that they face overappropriation or congestion problems as well as underprovision problems. This and the next section explore the reasons why the dynamics characteristic of international relations tend to increase the likelihood of both overappropriation and underprovision. Why should we expect CPR overappropriation problems and CPR congestion problems to be more common at the international level? How does the international context make rivalry, and hence overappropriation, more likely, all other things being equal, than it would be at the domestic level?

To investigate how international dynamics contribute to overappropriation, first consider appropriation of an amenity during a period for which the carrying capacity is fixed.²² The foregoing section argued that overappropriation or congestion will become more likely the greater the share of total demand placed on the amenity by consumptive or nonconsumptive, rather than existence, beneficiaries. In addition, overappropriation or congestion become more likely the greater the total demand on the amenity. International environmental amenities are more likely to experience overappropriation or congestion because both the type and level of demands on an amenity are likely to be greater than at the domestic level.

Any environmental amenity is likely to face a wider range of types of demand under conditions of globally common access than under conditions of national access. The diversity in social, cultural, and economic preferences across countries means that, even if citizens of one country value a particular environmental amenity only as a source of existence benefits (or do not value it at all), citizens of other countries may value the amenity for its consumptive or nonconsumptive benefits. Consider the sea urchin population of the west coast of the United States. When considered simply as a domestic environmental amenity, to the extent Americans value this amenity at all, they do so only for its existence value, that is, as one of many species that they would like to preserve. However, with the opening of global free trade, the Japanese

preference for sea urchin meat as a food (known as umi) has placed a consumptive demand on the resource. That demand has been sufficient to produce overappropriation of the sea urchin resource that, in turn, has required governmental regulation of American sea urchin divers. Even very high American demand for the existence benefits of a healthy sea urchin stock would not produce rivalness among Americans because of the inherently nonrival nature of existence benefits. However, the differential preferences introduced when the American sea urchin stock becomes a global, rather than national, amenity places new types of demand on that amenity making overappropriation more likely. Although allowing global access (even if through American divers serving the Japanese market) to a previously national amenity increases the level of demand, the change in the type of demand alone would increase the possibility of appropriation problems. Increasing the number of nations and cultures placing demands on an amenity increases the likelihood that some of that demand will involve consumptive or nonconsumptive benefits, introducing the possibility for quantity or quality rivalry and, hence, overappropriation or congestion.

The different types of demands on an amenity introduced by the greater heterogeneity of cultural values across nations also increase the aggregate amount of demand. In many cases, one nation's demand on an amenity would not, by itself, create an overappropriation or congestion problem. Transforming that resource from a national to a global amenity can create such problems, however, because the combination of that nation's demand with other nations' nonconsumptive or consumptive uses may exceed the amenity's carrying capacity. For example, the aggregate demands on the stock of elephants, tigers, and other endangered species reflects the aggregation of both domestic beneficiaries using the species stock as a source of food, and foreign beneficiaries using the species stock as a source of luxury goods, medicines, or other resources. Similarly, the aggregate demand on a tropical forest reflects the combination of domestic beneficiaries using the forest for firewood and foreign beneficiaries using the forest for lumber. Thus, even when a single beneficiary group's demand does not exceed the amenity's carrying capacity, the aggregation across groups of different types of beneficiaries often can induce CPR overappropriation dynamics. Overappropriation dynamics, therefore, will be more common the greater both the number and the heterogeneity of preferences of the countries with access to the amenity.

Finally, international environmental amenities are subject to greater overall demand as well as a greater likelihood of the rivalry-inducing demands of

consumptive and nonconsumptive beneficiaries. Demand on an international amenity is more likely to exceed carrying capacity, and hence entrain overappropriation problems, simply because more actors will seek to avail themselves of the amenity. Even when transnational preferences are homogenous, that is, for example, if the amenity provides only consumptive benefits, aggregate demand will increase as more humans have access to it.

This discussion raises the importance of exclusion and other mechanisms for limiting demand, and hence averting or mitigating overappropriation or congestion problems. Many governments treat amenities providing consumptive and nonconsumptive benefits for which demand does not exceed carrying capacity (see Table 2:1 above) as public goods, refraining from limiting access or excluding appropriation by their citizens. From an international perspective, however, most such amenities are more accurately viewed as “toll goods” (currently nonrival but excluded). National borders serve as the means to exclude foreign nationals from access to the amenity. Amenities which are, or are treated as if they are, transnational or international lack even this basic mechanism of exclusion to limit demand. In cases where the amenity is inherently nonrival because it provides existence benefits, borders do not provide an effective means of exclusion.

As Barkin and Shambaugh note in the introduction to this volume, “excludability is usually seen as not entirely intrinsic to the good, but contingent on social arrangements.” Put differently, exclusion is a function of both the amenity in question and the rules adopted to regulate access to that amenity. This suggests three classes of amenities. For “nonexcludable” amenities, inherent characteristics of the amenity make creation of social arrangements to control access either technologically impossible or prohibitively expensive. Economists have traditionally viewed lighthouses as such an amenity, since beneficiaries can neither be excluded nor readily charged.²³ Social arrangements separate the remaining excludable amenities into “excluded” amenities and “nonexcluded” amenities. International imperatives pose greater obstacles to the establishment of institutional arrangements to limit demand on the amenity than do domestic imperatives. Therefore, nonexcluded amenities will compose a larger fraction of excludable amenities internationally than domestically.

Successful resolution of CPR problems at the domestic level usually requires either governmental intervention or a strong sense of community with frequent interaction among interested actors.²⁴ Governments can, and sometimes do, exclude access to excludable amenities to reduce demand and keep

the actual level of rivalry below that at which CPR dynamics develop. Access can be excluded by establishing property rights, imposing taxes, or other policies. For example, some governments establish enforceable licenses for fisheries within their exclusive economic zones. Pigouvian taxes and other forms of pollution charges have gained increasing support in the literature as more discriminating mechanisms for reducing overappropriation.²⁵ Incentives, the ability to pay, and self-selection rather than fiat determine who has access to the environmental amenity. Charging for access solves appropriation problems by leading those deriving the least benefits from the amenity (or with the fewest economic resources) to reduce their appropriation levels.

Norms and practice make these domestic solutions to overappropriation uncommon internationally. The absence of centralized regulatory control and enforcement and the obstacles to decentralized control and enforcement through collective action at the international level make it more likely that actors will not, in fact, be excluded from excludable amenities. Even when actors have clear incentives to cooperate, the anarchy of international relations makes formation of appropriate international institutions or regimes difficult. The international realm is divided into the sovereign territory of states, where the state itself has exclusive jurisdiction to dictate the rules of access, and the international commons of the high seas, Antarctica, and the atmosphere where access is determined collectively. Although exclusion is possible, experience in international fisheries and deep seabed minerals illustrates the obstacles to international collective action.²⁶ Though charges or taxes might also be possible, states have proved unwilling to establish the supranational institutions to which those charges or taxes would be paid. In short, the preconditions for resolution of international CPR problems by effective constraints on demand are less frequent internationally, if they exist at all. This inability to constrain demand internationally will make unredressed CPR problems more likely.²⁷

The international arena produces fewer incentives to create constraints on demand as well as less ability to provide them. Rivalry among different nations or nationals of different nations over a given amenity is likely to be more intense than rivalry among nationals of a single nation. Certainly competition among the beneficiaries of an environmental amenity, whether whalers, fishers, or polluters, can be intense even within the domestic context. Even if we admit that relative gains concerns about market share (as well as absolute gains concerns about profits) play an important role in competition among firms domestically, realist theory suggests that these relative gains concerns are even

more prevalent among states internationally. States that view economic activities that extract resources from, or pollute, an environmental amenity as linked to their national survival will be inclined to increase their demands on the amenity to harm other countries as much as to benefit themselves. The relative gains concerns of states therefore will make the demands placed on an international environmental amenity systematically greater than those placed on an otherwise-similar domestic environmental amenity.

Finally, even when states are not specifically concerned with relative gains and conversion of economic resources into military might, rivalries can be intensified by levels of pride and patriotism that do not enter into domestic demands on an amenity. The Turbot War and the Anglo-Icelandic Cod War provide two illustrations of how the rivalry over fish stocks and other environmental amenities have greater potential for rivalry when two or more nations are involved.

Environmental Amenities and Their Provision

The preceding discussion has assumed that an environmental amenity already existed at a given quantity and quality to highlight the difficulties that can arise strictly in relation to appropriation of an existing environmental amenity. Indeed, analysis based on such an assumption is accurate and sufficient for those environmental amenities whose future health does not depend on current human activities. For some environmental amenities, such as total available land, number of satellite slots, or electromagnetic bandwidth, human activity in time period T has little if any influence on the quality or quantity of the environmental resource available in time period $T+1$. Consumptive use of such resources makes them unavailable to other current users but they become immediately re-available as soon as the first actor's consumptive use ends. Such problems may pose grave appropriation problems but pose no underprovision problems. However, the future quantitative and qualitative health of most environmental amenities does depend on present human activities. Indeed, it is precisely because CPRs face both overappropriation/crowding problems and underprovision problems that they prove particularly difficult to resolve.²⁸ This section discusses the different causes for underprovision to provide the foundation for the subsequent section's analysis of why underprovision is likely to be more prevalent at the international level than at the domestic level.

Underprovision of environmental amenities may be driven by three quite different dynamics: demand-side underprovision, beneficiary supply-side

underprovision, and nonbeneficiary supply-side underprovision. Demand-side underprovision involves cases in which the future carrying capacity of an environmental amenity depends on the level of current demand on that amenity. In such problems, actors that derive current benefits from an amenity also wish to derive future benefits from that same amenity, but influence the amenity's future ability to provide those benefits by the very behavior by which they derive current benefits. For the fixed stocks of nonrenewable resources, such as fossil fuels or minerals, each unit consumed by a current beneficiary is neither any longer available to other current consumptive users (the appropriation problem) nor to any future consumptive users (the provision problem). Current use will also reduce the future stocks of renewable resources whenever the current appropriation rate exceeds the amenity's natural renewal or replenishment rate. Whether dealing with living resources, like forests, or nonliving resources, like water for irrigation, current appropriation influences the likelihood of future underprovision. The common failure of open access fisheries to constrain current demand to ensure the future flow of fish from the stock constitutes a "demand-side provision problem."²⁹

"Supply-side provision problems" also plague CPR problems.³⁰ These can take the form of either beneficiary supply-side provision problems or nonbeneficiary supply-side provision problems. In the former, actors that derive current benefits from an amenity wish to derive future benefits from that same amenity but cannot influence the amenity's future ability to provide those benefits except through behaviors independent of the behavior by which they derive current benefits. Thus, they must contribute resources today, not just constrain demand, to ensure the amenity is available in the future. In what is essentially a combination of a collective action problem and an investment problem, actors must contribute current resources to a collective effort to provide for the future of the amenity. Those who expect future benefits from an amenity may need to undertake activities to ensure its provision that are unrelated to the activity by which they will benefit from that amenity. The failure of hikers to help finance trail maintenance or of the nations of the world (as beneficiaries of a stable global climate) to cut back on their emissions of carbon dioxide illustrate such "beneficiary supply-side provision problems."

However, the future health of many environmental amenities requires action by nonbeneficiaries rather than beneficiaries. A clean environment often requires polluters to stop polluting even though they may place no value on the cleaner environment that doing so creates. For example, the waste-disposal

companies that must alter their disposal techniques to protect the marine environment may not view themselves as benefiting from the healthier ocean they help provide. Such nonbeneficiaries will not help supply the CPR unless some pressure *external to the CPR problem* is brought to bear on them.

Underprovision results whenever any of these three sources—beneficiary demand-side provision, beneficiary supply-side provision, or nonbeneficiary supply-side provision—are inadequate to meet future demand for the amenity. Each source of underprovision presents quite different obstacles to resolution, however. Specifically, an amenity whose future health or carrying capacity depends on beneficiary demand-side provision will face incentive but not capacity problems; those in which future health depends on beneficiary supply-side provision problems face incentive and capacity problems; and those in which future health depends on nonbeneficiary supply-side provision face extremely strong incentive problems and may also face capacity problems.

Consider the classic tragedy of the commons: the future carrying capacity of the commons depends on the cowherds reducing the number of cows they currently graze on the commons. We can characterize many overappropriation problems in this way: those who must exercise current restraint on demand are the ones who will benefit if they are collectively able to do so. Future underprovision arises not because of an incapacity for current restraint (the cowherds are capable of grazing fewer cows), but because of the disincentives to exercising such restraint posed by the temptation to shirk or free-ride oneself and the fear that others will shirk or free-ride. The problems of such interactions have been extensively explored in the commons and prisoners' dilemma literature. Despite the many obstacles to resolution posed by such beneficiary demand-side provision problems, the actors who must contribute to future provision of the amenity will benefit if the amenity is adequately provided and so have some, if inadequate, incentives to contribute to its provision, and also have the capacity to contribute to the future provision of the amenity by the restraint of their current demand on it. Beneficiary demand-side provision problems are a major source of underprovision for many CPR problems.

Beneficiaries, being both perpetrators and victims of their own excessive demand, have positive incentives to contribute to such collective action, even if these may not outweigh countervailing incentives to defect from such action. Educational strategies can sometimes overcome these dilemmas simply by providing information that clarifies to perpetrators that they are also victims, a pro-

cess that seems to explain much of why states have reduced sulfur emissions in Europe.³¹ Axelrodian Tit-for-Tat strategies have the virtuous feature that current self-restraint simultaneously contributes to the future health of the amenity by directly reducing demand on the amenity and serves as a contingent threat to revert to overappropriative behavior if others do not also reduce their demand on the amenity. Since future amenity health depends on current demand, beneficiaries have the ability to contribute to future amenity health simply by restraining current demand. There is also an inherent, if not always compelling, logic linking restraint of one's current demand on the flow of benefits from a resource to ensure the future flow of benefits from that resource.

Beneficiary supply-side provision problems face similar disincentives exacerbated by the possibility of an incapacity to provide for the health of the environmental amenity. Whether contributing to the future stock of an amenity by restraining their demand or by providing other resources to facilitate replenishment of that amenity, beneficiaries face the same incentive problems of being concerned about possible shirking by others and being tempted to shirk themselves. However, if the behavior by which actors derive benefits from the amenity is unrelated to the behavior by which they ensure the future health of the amenity, the obstacles to successfully remedying the CPR problem will be even greater. First, negotiating rules on how much different beneficiaries should contribute usually proves more difficult than negotiating how much they should restrain demand, even if the latter is rarely simple. Determining the relative benefits each participant is deriving and hence how much they should contribute to the future health of the amenity proves far more difficult than requiring all beneficiaries to reduce their demand by a fixed percent. Compare the relative ease with which the beneficiary demand-side provision problems of acid precipitation or CFC emission reductions have been negotiated with the difficulties in negotiating the beneficiary supply-side provision requirements to provide funds for reductions by developing countries. Second, more actors are more likely to lack the capacity and resources to contribute or, at least, plausibly to argue that they lack such capacity and resources. The restraint required by demand-side provision does not involve such problems. Beneficiary supply-side provision problems are common for both CPRs and for public goods that are nonrival in character. Both beneficiary supply-side provision problems and demand-side provision problems do, however, have the ability to induce beneficiaries to contribute, through positive action or restraint, to the provision of an environmental amenity by excluding shirkers from the benefits of the amenity once provided.

Nonbeneficiary supply-side provision problems face the greatest obstacles to resolution. Such situations can best be characterized as pure negative externalities: the future health of the amenity often depends on the behavior of actors who do not perceive themselves as receiving any direct benefit from the current or future existence of that amenity. In such cases, the perpetrator is not also victim. The loggers who must change their behavior to preserve habitat for certain species may not see any benefit to doing so. The oil companies that must incur costs to prevent oil spills may not value the cleaner ocean that results. This interposes a distributional element that makes political resolution particularly difficult. Perpetrators that truly do not perceive themselves as victims have no incentives whatsoever to contribute to future provision of the amenity that their behavior is depleting. Unlike the shirkers or free-riders who cause beneficiary demand-side and beneficiary supply-side provision problems, nonbeneficiaries do not perceive themselves as benefiting even if the amenity is provided.

In such arenas, even adopting the longer time horizons implied by longer shadows of the future (see chapter 1) will not induce perpetrators to restrain their demands on the amenity. Clarifying the "costs" of an actor's behavior will not produce incentives to reduce that behavior, if the actor is not the one bearing those costs and does not care about those who are. Likewise, strategies of retaliatory noncompliance (Axelrodian Tit-for-Tat) will have no impact on their behavior. Compare fishing to oil pollution. In a fishery (a beneficiary demand-side provision problem), a company can, at least logically, credibly threaten to recommence unrestrained fishing to induce other companies to maintain their commitments to a regime: because of its desire to derive future benefits from a healthy fish stock, the fishing company is a victim of the current behavior of itself and other fishing companies. In oil transportation (a nonbeneficiary supply-side provision problem), threats by one oil transporter to recommence ocean pollution will not influence other oil transporters: an oil transporter is not the victim of its own or others' current behavior and so cannot threaten or be threatened by strategies involving changes in the level of that behavior.³²

Why the International Setting Creates More Difficult Provision Problems

Like appropriation problems, features of the international context exacerbate the provision problems common to CPRs. Why should we expect

underprovision to be more common internationally than domestically? Several reasons present themselves. Whether underprovision results from demand-side problems or supply-side problems, the international context poses the same obstacles that face appropriation problems: low demand for resolution and a low ability to provide resolutions. States face as strong incentives to free-ride on provision of an amenity from which they benefit as they do to free-ride on consumption of that amenity once provided. International anarchy, interstate rivalry, relative gains concerns, and the other factors discussed above reinforce each state's dominant strategy of not contributing to the future health of the amenity. States that will benefit from the amenity face two potential futures: if other states do not contribute, the amenity will not be provided and therefore making a contribution requires the state to incur a present cost with no future benefit; if other states' contributions do provide the future amenity, the noncontributing state can still derive future benefits without incurring those present costs. In the international context, even if the state might realize an absolute gain by contributing (that is, future benefits would exceed present costs), the fears of relative losses increase the dominance of the shirking option. States that must contribute to the health of an amenity but do not benefit from its provision (nonbeneficiary supply-side providers), such as an upstream or upwind polluter, will have no incentives to refrain from activities that are economically advantageous to them.

At the domestic level, governments often serve to aggregate preferences across perpetrators and victims. Although individuals always benefit by externalizing costs, victims of externalized costs who are citizens of a single state can pressure governments to force perpetrators to internalize those costs. Indeed, a common role of government is to eliminate privately optimal, but socially suboptimal, externalities. Governments, at least representative ones, can aggregate preferences across perpetrators and victims of environmental externalities so that they can identify when social costs of an externality exceed social benefits, and can induce the necessary behavioral changes by perpetrators. Governments can mediate conflicts between actors with heterogeneous interests and incentives. Unlike in the international sphere, governments can force actors who have no interest in resolving a problem to contribute to its resolution nonetheless.

In contrast, international institutions are considerably weaker for aggregating such preferences and for inducing necessary behavioral changes, where they exist at all. The provision of international solutions to force the internalization of externalizing behaviors that are nationally optimal but

internationally suboptimal is notoriously wanting. Governments can, and may have incentives to, force individuals who derive no benefits from a given amenity nonetheless to contribute to its provision. In contrast, global governance systems lack the incentives, the ability, or both, to force nations to contribute to the provision of an environmental amenity.

Nonbeneficiary supply-side provision problems pose the clearest distinction between the domestic and international spheres. A firm that pollutes a river through the discharge of its chemical wastes imposes an externality on downstream farmers who use the river for irrigation. As Coase would predict,³³ the farmers may have adequate resources and incentives to offer the firm side payments to reduce or eliminate the pollution. However, when such Coasian bargains are impossible or involve excessive transaction costs, governments have often legislated pollution control because they view the benefits to the farmers of pollution reduction as greater than the costs to the firm. Externality victims that lack the economic or coercive resources needed to induce perpetrators to contribute to an environmental amenity can use political resources to bring their government's economic or coercive resources to bear on the perpetrator. The "polluter pays principle" provides an important normative and legal justification that reinforces a victim's economic disincentives for footing the bill for environmental cleanup. Nonetheless, Coasian resolutions to international externalities can and do take place, as evident in Dutch payments to France to reduce Rhine River pollution.³⁴ However, such bargains only occur when victim states have adequate resources. Unlike their domestic counterparts, victim states that are too weak to induce perpetrators to contribute to provision of an environmental amenity have no institutional recourse. Domestically, underprovision of an amenity will be remedied whenever the victim either has more power than the perpetrator or can access the power of the state and the state has more power than the perpetrator. Internationally, only the former possibility exists.

Even in issue areas where regimes or other international institutions exist, remedies to induce shirkers to contribute to the provision of an amenity tend to be less available. Policies for exclusion or charges to restrict access and demand to remedy overappropriation can also remedy underprovision. Exclusion can redress demand-side underprovision by decreasing current demand to a level that ensures future health of the amenity. In addition, exclusion can remedy beneficiary supply-side underprovision by threatening to exclude beneficiaries from access to the amenity unless they contribute. In essence, if possible and properly implemented, exclusionary policies can provide solutions to allocation

problems, demand-side provision problems, and beneficiary supply-side provision problems. Indeed, property rights, and the enforcement of them as a means of exclusion, have been regularly referred to as the panacea for many environmental problems, from pollution to wildlife loss and everything in between.³⁵ McGinnis and Ostrom's³⁶ first design principle for robust CPR institutions is a requirement for "clearly defined boundaries" that distinguish between those with, and those without, rights to withdraw resource units from a CPR.

For nonrival amenities, exclusion and charges deter "provision free-riding" or "shirking."³⁷ Although nonrival amenities do not face even the possibility of overappropriation, effective threats to exclude or charge for usage can induce potential beneficiaries of such an amenity to contribute to its provision.³⁸ In such cases, the goal is not to reduce the aggregate benefits people derive from the amenity, but to ensure that beneficiaries contribute sufficiently to provide a socially beneficial amenity. Indeed, once a policy has induced contributions adequate to provide the socially optimal level of a nonrival amenity, potential beneficiaries should not be excluded from deriving benefits from that amenity, since those benefits impose no externalities on other actors.

A rival amenity in which overuse poses both a current overappropriation or congestion problem and a future underprovision problem requires exclusion policies that restrict demand sufficiently to redress both problems. However, an exclusion policy that remedies current overuse may be drastically inadequate to remedy future underprovision, since the latter depends on natural replenishment rates as well as overappropriation. For example, enforceable national whaling quotas adequate to remedy the overcapitalization (i.e., overappropriation) problem of the whaling fleets of the 1960s would not necessarily have been low enough to remedy the demand-side underprovision problem of declining whale populations.

Charges often provide a means of remedying supply-side provision problems even when exclusion and other forms of access control are not possible. As Coase's classic description illustrates, governments remedied the problem of underprovision of lighthouses (a beneficiary supply-side provision problem) by inventing ways to charge most ships benefiting from the light enough to provide the amenity, even when exclusion from the light's benefits was not possible.³⁹ Charges can help remedy beneficiary supply-side provision problems by leading current beneficiaries of the amenity to provide the resources needed to provide for the future stock of the amenity. However, charges will

not work with nonbeneficiary supply-side provision problems because non-beneficiaries, by definition, derive no value from the amenity and so will be unwilling to pay any amount for its use. When underprovision arises because of the shirking of *nonbeneficiaries*, exclusion simply does not address the underlying source of the underprovision problem. Strategies of selective incentives may provide a mechanism for resolving this problem, by linking “private benefits or inducements to the provision of the collective good. Such private benefits would motivate any member (of any size) to contribute, inasmuch as the private benefits can only be obtained by assisting provision. Although collective benefits are nonexcludable, the private benefits are excludable.”⁴⁰ Unfortunately, recent empirical work suggests that selective incentives or “bribes” do not work when aid recipients’ preferences diverge from aid donors’.⁴¹

Although a compelling logic exists for only requiring beneficiaries of an amenity to contribute to its provision, governments often force nonbeneficiaries to contribute to provision of an amenity because of the practical problems and costs of selectively identifying and charging beneficiaries. Governments can tax or charge even those who do not benefit from the amenity provided. In contrast, no similar arrangements of governance exist at the international level. When states can benefit most by not contributing to a particular amenity (e.g., by not restraining a polluting activity), no higher-level actor can force them to contribute to its provision.

In cases of supply-side underprovision, the natural replenishment rate rather than current appropriation rates are major determinants of future amenity health and carrying capacity. In such cases, policies need not remedy current overexploitation or congestion so long as they generate adequate contributions to ensure future provision of the amenity. For example, one can avoid restraining a polluter in any way, but charge all actors equally (and at levels unrelated to the benefits they derive from the lack of pollution) for some form of cleanup technology. Wetland replacement programs often seek to avoid restricting development while ensuring the future health of wetlands. General revenue taxes are often applied to pollution cleanups or wildlife rescue efforts, even when the source of the pollution remains unaddressed. The ability to force people to contribute to provision of a good need not involve exclusion, especially if the possibility for central enforcement exists.⁴² Indeed, such policies are often the only available remedy to nonbeneficiary supply-side provision problems. When those harmed by an externality have no direct power vis-à-vis the perpetrators of that externality, as is the case in many non-beneficiary supply-side provision problems, the internalizing of that externality

may require some form of governmental power to force private actors who influence but do not benefit from an environmental amenity to contribute to provision of that amenity.

Benefits to nonbeneficiary suppliers of an environmental amenity, by definition, are not the natural and noncontingent benefits provided by the amenity itself but rather the manipulated and contingent benefits of rewards that the beneficiaries promise to provide to those who contribute or avoiding the sanctions they threaten to impose for those who do not contribute. Where underprovision arises because of a failure to restrain activities that harm the amenity (like pollution) rather than because of a failure to induce contributions to the amenity (like cleanup campaigns), governments often use force to coerce restraint. The threat or imposition of sanctions can induce polluters to contribute to provision of a cleaner environment. However, huge obstacles exist to centralized or decentralized sanctioning in the international sphere, a fact evidenced in the rarity of such efforts.⁴³ Collective action problems plague the provision of contingent benefits as well, as evidenced in the small magnitude of most financial mechanisms to date and the frequency with which governments have failed to meet even these limited financial commitments. In this context, promises and threats are likely to lack credibility with the nonbeneficiary and therefore not induce the desired behavioral change.

Much of the international relations literature to date has seen fostering reciprocity within a system of collective regulation as the solution to underprovision of a CPR.⁴⁴ Enhancing transparency and reciprocity allows actors to engage in retaliatory Tit-for-Tat strategies that, in iterated interactions, can resolve the externality.⁴⁵ Such strategies only exist, however, when actors are symmetrically positioned as both perpetrators and victims. Only those who are victims of another’s externality have incentives to retaliate, and only those who are perpetrators of an externality that harms the other have the capacity to retaliate. Indeed, classic Tit-for-Tat assumes similarly-situated consumptive users can and do respond to consumptive defection through consumptive defection of their own. Whalers have the potential to overcome their collective action problem by threatening resumption of whaling to induce other whalers to cooperate. However, this simplified model of interaction misconstrues the dynamics of many environmental problems. Victims of pollution, for example, are frequently not polluters themselves. They must bring to bear sanctions other than their ability to pollute in order to force polluters to desist. Whale-watchers and whale-lovers cannot pose, through their actions, potent retaliatory threats to whale-hunters’ interests. If they have sufficient power,

they may be able to threaten exogenous sanctions but they cannot alter their use of the resource as a means of inducing restraint by whale-hunters. Internationally, recourse to a source of power above that of the victim is simply not the option it is domestically. In short, underprovision problems are simultaneously more likely and more difficult to resolve internationally.

Conclusions

Features characteristic of international relations cause a given environmental amenity to face a greater likelihood of appropriation and provision problems than if the same problem was confined within a single nation's borders. Overappropriation and congestion problems arise when the demands placed on an amenity exceed its carrying capacity. International factors simultaneously increase the demands on an amenity and decrease the availability of mechanisms to restrict that demand. Cultural, economic, social and political differences cause the diversity of demands placed on an environmental amenity to be greater across nations than within a nation. In addition, simply allowing more people access to an amenity increases the demands placed on it. Thus, for any particular level of an amenity, the greater demands placed on it at the international level cause aggregate demand all too often to exceed the carrying capacity of the amenity, with the resultant overappropriation of consumptive amenities or congestion of nonconsumptive amenities.

At the same time, remedies to appropriation problems are less attractive and less possible internationally. In an international system characterized by anarchy, relative gains concerns, and inherent rivalry, governments find it difficult to accept international versions of the same policies they often use domestically to reduce demand and control overappropriation. In the rare cases in which states agree to limit access to an amenity through property rights, charges, or other policies, collective action dynamics undercut and imperil the enforcement of such agreements.

The incentives and ability to remedy the second important aspect of common pool resources, namely underprovision, are also weaker at the international level. Whether involving excessive demand that reduces the future health of the amenity, insufficient contributions to the health of that amenity from beneficiaries, or insufficient contributions to that amenity's health from nonbeneficiaries, international dynamics exacerbate underprovision problems. Governments often have the incentives and capacity to internalize the externalities that one subset of national actors imposes on another. Governments

often aggregate preferences, costs, and benefits across individuals and can force perpetrators of an externality to desist if the social benefits exceed the social costs of doing so. Domestically, weak actors can use the state to force powerful actors to stop imposing externalities on them. No corresponding institution exists internationally to aggregate preferences, costs, and benefits across states or to force a state perpetrating such an externality to desist. Weak states can rarely use international regimes or institutions to force powerful states to stop imposing externalities on them.

An extensive literature has demonstrated the difficulties of remedying common pool resource problems at the domestic level. This volume suggests that, however formidable the problems and scarce the solutions to CPR problems domestically, the international environmental sphere is likely to pose even more formidable problems and make solutions even more difficult to find.

Notes

This chapter has benefited from helpful suggestions from Sammy Barkin, George Shambaugh, Barb Connolly, Beth DeSombre, and the other contributors to this volume.

1. Robert Cameron Mitchell and Richard T. Carson, *Using Surveys to Value Public Goods: The Contingent Valuation Method* (Washington: Resources for the Future, 1989); A. Myrick Freeman, *The Measurement of Environmental and Resource Values: Theory and Methods* (Washington: Resources for the Future, 1993), pp. 2–6; Peter S. Burton, “Land Use Externalities: Mechanism Design for the Allocation of Environmental Resources,” *Journal of Environmental Economics and Management* vol. 30 (1996), p. 174.
2. Fred Foldvary, *Public Goods and Private Communities: The Market Provision of Social Services* (Brookfield, VT: Edward Elgar Publishing Company, 1994), p. 11.
3. Robert O. Keohane and Elinor Ostrom, “Introduction,” in *Local Commons and Global Interdependence*, eds., Robert O. Keohane and Elinor Ostrom (Boulder: Sage, 1995), p. 14.
4. See, for example, Arne Naess, “The Shallow and the Deep, Long-Range Ecology Movement: A Summary,” *Inquiry* vol. 16 (1972), pp. 95–100; Bill Devall, “The Deep Ecology Movement,” *Natural Resources Journal* vol. 20 (1980), pp. 299–313; and the selections in Irene Diamond and Gloria Feman Orenstein, eds., *Reweaving the World: The Emergence of Ecofeminism* (San Francisco: Sierra Club Books, 1990).
5. Duncan Snidal, “Public Goods, Property Rights, and Political Organizations,” *International Studies Quarterly* vol. 23 (1979), p. 549; Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge, England: Cambridge University Press, 1990), pp. 46–48.
6. Mitchell and Carson, *Using Surveys to Value Public Goods*, pp. 64–65.
7. Richard Cornes and Todd Sandler, *The Theory of Externalities, Public Goods, and Club Goods* (Cambridge, England: Cambridge University Press, 1986), p. 241.
8. Burton, “Land Use Externalities,” p. 174.
9. This discussion of appropriation, provision, resource units, and resource systems draws extensively on the excellent treatment of the subject in Ostrom, *Governing the Commons*.
10. Foldvary, *Public Goods and Private Communities*, p. 13.
11. Thomas H. Tietenberg, *Environmental and Natural Resource Economics*, 2nd ed. (Glenview, IL: Scott, Foresman, 1988), ch. 12.
12. Todd Sandler, *Collective Action: Theory and Applications* (Ann Arbor: University of Michigan Press, 1992), p. 74.
13. Crowding occurs when “a marginal user increases the resources required to maintain the quality of the public good.” Foldvary, *Public Goods and Private Communities*, p. 13, note 4.
14. Cornes and Sandler, *The Theory of Externalities, Public Goods, and Club Goods*, p. 6.
15. Foldvary, *Public Goods and Private Communities*, p. 13.

16. *Ibid.*, p. 13; Duncan Snidal, “Public Goods, Property Rights, and Political Organizations,” p. 535.

17. David Reisman, *Theories of Collective Action: Downs, Olson and Hirsch* (New York: St. Martin's, 1990), p. 200; Cornes and Sandler, *The Theory of Externalities, Public Goods, and Club Goods*, p. 160. Although some have argued that intrinsic values “should be excluded from benefit measurements” of environmental amenities because they are in fundamental normative opposition to any form of economic analysis, humans certainly willingly pay to receive such benefits (see Mitchell and Carson, *Using Surveys to Value Public Goods*, p. 65). Although such preferences may be economically nonrational or irrational, considerable evidence suggests that people actually do derive existence value from environmental amenities (Reisman, p. 147).

18. “A true dilemma exists only when demand for use of a commons exceeds some threshold beyond which one user interferes with the availability of the commons for other users or, in the extreme case, total use begins to exceed the commons' carrying capacity. . . . Only as the supply becomes constricted relative to demand does the potential for individual actions to generate externalities exist.” David Goetze, “Comparing Prisoners' Dilemma, Commons Dilemma, and Public Goods Provision Designs in Laboratory Experiments,” *Journal of Conflict Resolution* vol. 38 (1994), p. 82.

19. Foldvary, *Public Goods and Private Communities*, p. 13.

20. *Ibid.*

21. Keohane and Ostrom, “Introduction,” in *Local Commons and Global Interdependence*, p. 15; Michael McGinnis and Elinor Ostrom, “Design Principles for Local and Global Commons,” unpublished manuscript (Bloomington, IN, 1992), p. 5.

22. The next section relaxes this assumption, examining how carrying capacity in one time period depends on provision and appropriation in previous time periods.

23. Ronald H. Coase, “The Lighthouse in Economics,” in *The Theory of Market Failure: A Critical Examination*, eds., Tyler Cowen (Fairfax, VA: George Mason University Press, 1988), p. 258.

24. Ostrom, *Governing the Commons*.

25. Cornes and Sandler, *The Theory of Externalities, Public Goods, and Club Goods*, p. 30; Ernst U. von Weizsacker and Jochen Jesinghus, *Ecological Tax Reform: A Policy Proposal for Sustainable Development* (Atlantic Highlands, NJ: Zed Books, 1992); Thomas A. Barthold, “Issues in the Design of Environmental Excise Taxes,” *Journal of Economic Perspectives* vol. 8 (1994), pp. 133–51; Robert Repetto, *Green Fees* (Washington: World Resources Institute, 1992).

26. This logic would predict a greater frequency of overexploitation of international fisheries than of domestic fisheries, even if many domestic fisheries are overexploited.

27. Keohane and Ostrom, “Introduction,” in *Local Commons and Global Interdependence*, p. 15.

28. Ostrom, *Governing the Commons*, pp. 46–50.

29. *Ibid.*, p. 49.

30. *Ibid.*

31. See Barbara Connolly's contribution to this volume, and also Marc A. Levy, "International Cooperation to Combat Acid Rain," *Green Globe Yearbook: An Independent Publication on Environment and Development* (Oxford: Oxford University Press, 1995), pp. 59–68.

32. Ronald B. Mitchell, *Intentional Oil Pollution at Sea: Environmental Policy and Treaty Compliance* (Cambridge, MA: MIT Press, 1994).

33. Ronald Coase, "The Problem of Social Cost," *Journal of Law and Economics* vol. 3 (1960), pp. 1–44.

34. Thomas Bernauer, "Protecting the Rhine River Against Chloride Pollution," in *Institutions for Environmental Aid: Pitfalls and Promise*, eds., Robert O. Keohane and Marc A. Levy (Cambridge, MA: MIT Press, 1996).

35. Andreas A. Papandreou, *Externality and Institutions* (Oxford: Clarendon, 1994), p. 78; Cornes and Sandler, *The Theory of Externalities, Public Goods, and Club Goods*, p. 33; Snidal, "Public Goods, Property Rights, and Political Organizations," p. 545; Robert L. Bish, "Environmental Resource Management: Public or Private?" in *Managing the Commons*, eds., Garrett Hardin and John Baden, (San Francisco: W. H. Freeman, 1977), p. 218; Terry L. Anderson and P.J. Hill, "From Free Grass to Fences: Transforming the Commons of the American West," in *Managing the Commons*, pp. 200–16.

36. McGinnis and Ostrom, "Design Principles for Local and Global Commons."

37. Ostrom, *Governing the Commons*.

38. "Consumers have no incentive to pay to receive the good since they cannot be prevented from consuming it once it has been produced. Nor can they be properly induced to contribute to its production since the incentives point toward a 'free ride' on the contributions of others." Snidal, "Public Goods, Property Rights, and Political Organizations," p. 548.

39. Coase, "The Lighthouse in Economics," p. 77.

40. Sandler, *Collective Action: Theory and Applications*, p. 58.

41. Barbara Connolly and Robert O. Keohane, "Institutions for Environmental Aid: Politics, Lessons, and Opportunities," *Environment* (June 1996).

42. Snidal, "Public Goods, Property Rights, and Political Organizations," p. 551.

43. Gary Clyde Hufbauer and Jeffrey J. Schott, *Economic Sanctions Reconsidered: History and Current Policy* (Washington: Institute for International Economics, 1985); Elizabeth DeSombre, "Baptists and Bootleggers for the Environment: The Origins of United States Unilateral Sanctions," *Journal of Environment and Development* vol. 4 (1995), pp. 53–76.

44. Robert O. Keohane, "Reciprocity in International Relations," *International Organization* vol. 40 (1986), pp. 1–27.

45. Robert Axelrod, *The Evolution of Cooperation* (New York: Basic Books, 1984); Robert Axelrod and Robert O. Keohane, "Achieving Cooperation Under Anarchy: Strategies and Institutions," in *Cooperation Under Anarchy*, ed., Kenneth Oye (Princeton, NJ: Princeton University Press, 1986).