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UNDERSTANDING THE GLOBAL COMMONS

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ABSTRACT

We want to clarify the way in which we think about the global commons, particularly the problem of global warming caused by greenhouse gas emissions and tropical deforestation. We develop a policy framework in which the policy goal is the sustainability of the earth's ability to absorb greenhouse gases. The framework considers the unequal incidence of benefits and costs of particular policies. We identify several resource management regimes and suggest that management under a common property regime is most appropriate. We conclude by identifying and briefly discussing types of policies that can achieve sustainability.

CONTENTS

INTRODUCTION

THE COMMONS AND POLICY

THE PROBLEM OF THE COMMONS

A POLICY FRAMEWORK FOR THE COMMONS

RESOURCE MANAGEMENT REGIMES FOR THE COMMONS

- On Rights and Correlated Duties
- Possible Resource Management Regimes
 - Open Access Regimes
 - Private Property Regimes
 - State Property Regimes
 - Common Property Regimes
- The Hierarchy of Property Regimes
- The Global Commons and Resource Regimes

INTERNATIONAL POLICY FOR THE COMMONS

- Facilitative Policies
- Inducing Policies
- Injunctive Policies
- Choosing the Optimal Policy

CONCLUSIONS

ENDNOTES

REFERENCES

INTRODUCTION

The term "global village" has become popular to suggest that the entire world's population belongs to the same community. Related to this idea is the management of the earth's atmosphere as a "global commons." Following, we focus on the idea of the commons, the concept of common property, and the ability of resource management regimes to deal with the problems of the global commons. We hope to clarify the way in which policymakers think about the global commons. Then, we will suggest appropriate policy measures to achieve certain goals concerning the global commons.

THE COMMONS AND POLICY

What is the "global commons"? One will hear that the global commons consists of, for example, the earth's atmosphere, the oceans, the international tropical forests (especially the Amazon), biological diversity, and Antarctica. It may surprise the government of Brazil to learn that its forests are part of the global commons. Germans may have a similar reaction if told that the Schwarzwald is part of the global commons. Or, indeed, the United States government would react in a similar way on hearing that the forests of the Pacific Northwest are part of the global commons. And governments claiming territory in Antarctica may challenge that continent's inclusion in the global commons.

The problem arises because of conceptual fuzziness--and conceit--on the part of many advocates of environmental policies. Conceptual fuzziness occurs because of a failure to explain why natural resources as diverse as Antarctica, the oceans, and Brazilian forests have suddenly become part of the "global commons." Antarctica and the Brazilian Amazon certainly have a different legal status than the high seas and the earth's atmosphere. How can we justify classifying these diverse natural resources as part of the global commons?

Moreover, conceit enters when, to preserve an extravagant, energy-wasteful lifestyle, affluent people in the northern hemisphere lecture Brazilian farmers about proper land use. Imagine the humor--indeed indignation--had the European gentry tried to interfere with the "taming (and plundering) of the West" in 19th century America.

There are global environmental problems because the actions of people or governments in one location seriously affect people and governments in other locations. Or, put another way, the existing use of certain natural resources threaten individual (and national) interests. Global environmental policy problems occur because these individuals (and governments) try to change activities in far-off places. They either do it because of selfishness or because of their genuine concern for the sustainability of life on earth.

There is nothing inherently wrong with some selfishness. And, of course, it is fine to show concern for sustaining life on earth. The problem comes in crafting a new resource management regime that will change the behavior of individuals by changing the incentives they face. However, change is never easy. And, change under pressure from outside sources is even more difficult. A resource management regime for the global commons will need to appeal to those who will benefit and those who will suffer from a change.

A successful policy for the global commons will require aligning interests so that each party feels as though it has gained. We say that the incentives are aligned when individuals want to pursue the new policy. Incentive alignment is the policy problem; one must find ways to adjust interests through realigning incentives for individual and group behaviors.

THE PROBLEM OF THE COMMONS

"The Dutch electricity industry will plant thousands of trees around the world to compensate for carbon dioxide emissions from a new power station, the association of Dutch electricity producers says. The 600-megawatt coal-fired power station in the Maasvlakte area of Rotterdam is due to come on-stream in the middle of the decade. "The plant will be in operation for about 25 years and during that time it will emit 75 million tons of carbon dioxide," says a spokeswoman for the group. Carbon dioxide is the main contributor to the greenhouse effect that many scientists believe causes global warming. Trees absorb carbon dioxide through photosynthesis. "With our plan we will fully compensate" for the new plant's emissions, says the spokeswoman. The industry will spend \$12 million a year from 1991 to 2015 on the plantings, with the first likely to be in Peru, Bolivia, Colombia or Indonesia" (The Wall Street Journal, European Edition, November 7, 1990).

What could possibly cause the Dutch to spend \$12 million annually for 25 years in the far-away tropics? The answer lies in their recognition of the interrelations between their emissions of carbon dioxide and global atmospheric chemistry. More significantly, however, it is evidence that the Dutch are taking responsibility for their role in adding to problems in the global commons.

What exactly are the alleged problems of the global commons? The benefits of preventing Antarctica from falling into the territorial system of any one nation are so large as to compel its international administration. Simplistically speaking, some would suggest that Antarctica should become the "private property" of, say, the United Nations. The benefits from Antarctica arise from its role as a refuge for certain important wildlife species and its role as a global research laboratory.

The world's oceans are a global commons in several respects. Millions of citizens from many nations derive a significant

portion of their food supply from marine environments. Pollution of this natural resource would thus threaten a very large number of individuals--many of them now living at the margin of survival. Oceans also provide important transportation benefits and are too critical to permit their control by any one nation.

The forests of the Amazon, and the earth's atmosphere, present a slightly different picture. Some will argue that the forests have intrinsic value, and we ought to preserve them on those grounds alone. That is, regardless of the uses that the forests allow, they are a significant part of our global heritage. Another argument says that we need to preserve the Amazonian forests because their services have global significance. More specifically, the Amazon forests are the "lungs of the earth." This extensive biomass processes the large and increasing global production of carbon dioxide. These forests are the best hope against significant changes in atmospheric chemistry and hence possible global warming.

And so we come to the earth's atmosphere. The linkage between the earth's atmosphere and the Amazonian forests is direct and important to sustaining life on earth. Yet, preserving the forests casts the interests of one group against the interests of another. Lumberers and developers stand united against those who would protect the forests for their own sake--or because life as we know it cannot continue.

We cannot cover fully, here, the problems of the oceans, Antarctica, and the tropical forests as they relate to atmospheric chemistry. Therefore, we concentrate on the problems of tropical land use and how these uses relate to atmospheric chemistry and possible global climate change. The nature of tropical land use is a central factor in atmospheric chemistry. For example, one estimate says that: "...South and Southeast Asia contribute about 25% of the carbon dioxide emissions caused by burning wood, or about 6% of total carbon dioxide emissions" (Archer and Ichord 1989: 13).

However, the industrial world, with its fossil-fuel driven factories and automobiles, is a major contributor to the total annual production of greenhouse gases. In stark terms, we suggest that the wealthy citizens of the industrial north want to protect the Amazonian "lungs of the earth" to process carbon dioxide arising from our lifestyle. Thus, the tropical forests are a free waste-processing facility for the rich--whether in Japan, Europe, or North America. It is crucial to understand how the lifestyle of the industrialized north impacts upon the nature and extent of problems faced in the tropics.

We will, therefore, focus on the issue of greenhouse gases and their effect on atmospheric chemistry and global climate (IGPB 1990). Understanding greenhouse gases and devising workable mechanisms to reduce them, are two very different activities. Developing mechanisms for reducing greenhouse gases requires that we first understand how activities in the contemporary world place demands upon the atmosphere. This means that we need to develop a clear concept of the idea of resource services. These resource services of the global commons make it beneficial for human use, yet they can become over-exploited when human use is excessive. Resource services are the capacity of the earth's

atmosphere and biosphere to absorb and process certain levels of greenhouse gas emissions without triggering long-run chemical changes that will alter global climates. In that sense, the atmosphere and the earth's living plants, represent essential resource services for the global climate. If we overuse those resource services, producing more greenhouse gases than the earth can process, the change in atmospheric chemistry will have catastrophic implications for life on earth.

The most compelling global environmental challenge is to formulate and introduce a coherent management regime over the resource services of the earth's atmosphere. Unlike many local environmental problems, the earth's atmosphere might be extraordinarily difficult and expensive to fix once fouled. Local toxic spills or radiation leakage from nuclear facilities are also important. But a degraded atmosphere represents an environmental problem of a far greater magnitude.

The pertinent example for global climate change concerns the chemical composition of the atmosphere. This chemical composition is largely a function of the rate of uptake and release of several trace gases by the biosphere. Similarly, the sustainability of the biosphere is a function of the earth's climate and the deposition of chemical compounds. Biospheric production of small amounts of carbon dioxide, methane, and nitrous oxide trap terrestrial infrared radiation. This leads to an increase in the earth's surface temperature. The debate about the extent to which human activity is causing global warming is one for earth scientists. We start with the existence of greenhouse gases, accepting the evidence that the chemical composition of the earth's atmosphere is changing. We also accept the evidence of the earth sciences that the production of greenhouse gases has been increasing. To cite an authoritative source:

"The chemical composition of the atmosphere has for the past few centuries been changing, initially under the influence of agriculture, more recently by industrial activities. As a consequence, the atmospheric volume mixing ratio of carbon dioxide has increased from 280 to 350 ppm and for methane from 0.7 ppm to 1.7 ppm over the past two centuries. Currently, the measured annual increases of these gases are equal to 0.4-0.5% and 0.7-1.1% respectively. In addition the atmospheric concentrations of several other trace gases are increasing. The most important among these are the industrially produced chloro-fluorocarbon gases, but also nitrous oxide with annual atmospheric growth rates of about 4%, 0.2-0.3%, respectively. All these gases have long atmospheric residence times, ranging between about 10 years for methane and about 200 years for nitrous oxide. All these compounds are important greenhouse gases. Although carbon dioxide is the single most important among them, the combined greenhouse forcing of methane, chloro-fluorocarbon gases, nitrous oxide, and a few additional gases together is about equal to that of carbon dioxide. In addition, and in contrast to carbon dioxide, which is chemically very stable, methane, nitrous oxide, chloro-fluorocarbon gases are of critical importance for stratospheric and tropospheric chemistry. The observed increases in the above mentioned gases have caused great concern for a rapid climate warming by several degrees in the next century, especially because of the rapid

growth of chloro-fluorocarbon gases, major depletions in stratospheric ozone have already occurred" (IGBP 1990: 2.1-3 - 2.1-4).

A POLICY FRAMEWORK FOR THE COMMONS

The problem is to craft a new resource management regime that, if adopted, would result in improved management of greenhouse gases.

This resource management regime would first stabilize the net production of greenhouse gases attributable to human activities. Then, it would bring the production into balance with the earth's capacity to assimilate such gases. Such a resource management regime would recognize the assimilative capacity for greenhouse gases. It would assure that this assimilative capacity--this resource service--was put to the most valuable use. It also would assure that the long-run capacity of these particular resource services did not diminish.

This imposes a constraint on management regimes that some may regard as too restrictive. Some insist that we should diminish the resource service (the capacity to accommodate certain levels of greenhouse gases). After all, it may be economically efficient to use up this resource service and to undertake some other measure to offset that loss. For instance, we could discover new technology for some massive "gas sink" that would remove the need for tropical forests and the atmosphere to process greenhouse gases. While we encourage efficiency, it is more reasonable to explore institutional alternatives to assure the sustainability of the existing resource services.

The task here is to link human activity to changes in the production of greenhouse gases. We first assume that human activities are the cause of an important proportion of the total annual production of greenhouse gases. Second, we assume that potentially effective mechanisms exist--under the right circumstances--that could change those activities. Third, we assume some action-forcing event occurs that brings the annual net production of greenhouse gases to the forefront of the public policy arena. Finally, we assume that, as with any policy change, there are potential winners and potential losers. The potential winners from a policy change will be the action-forcing dimension of our policy problem, and the potential losers will be the opposing force.

The common thread uniting the oceans, Antarctica, the earth's atmosphere, and Amazonian forests into something called the "global commons" is also the disparity in the incidence of benefits and costs. That is they are divided by space with benefits occurring in place A and costs being felt in place B. This disparity or separation divides the perceived interests of the parties involved in the policy problem. Some individuals (and governments) are paying unwanted costs, while other individuals are reaping benefits at the expense of the former [note 1].

The policy problem has two central elements. The first, just discussed, concerns the size and incidence of the benefits and costs of the status quo. The second element concerns the collective capacity to alter the previous condition. For such institutional change, it is necessary to document the potentially large costs to continue the existing condition.

First, those seeking a change in the status quo may have the legal ability to force that change upon the reluctant parties who now benefit. In this case, it is unnecessary to worry about incentive alignment because some higher legal authority has the power to alter, unilaterally, the resource management regime. "Power" is the capacity for one party to impose a legal arrangement on another party. In this context, those now unhappy with the present resource management have power if they can enact and enforce laws making undesirable activities illegal.

However, without this kind of power, those seeking change may have to encourage the present polluters to change their anti-social actions. Such encouragement may include compensation schemes so the interests of the two parties become compatible. Another potential scheme could include passive punitive inducements. For example, one party threatens to reduce cooperation or aid to the other.

In assessing winners and losers and considering who might benefit from new policies on greenhouse gases, we come immediately to the very core of the problem. That is, the winners are probably in different places than the losers. Winners are those who perceive (or who will reap) benefits from a change in policy. Losers are those who perceive (or who will bear) costs from a change in policy. The status quo policy regime consists of the legal production of greenhouse gases with privilege for those responsible for emissions and no right for those adversely affected.

Those wanting to cut the total annual production of greenhouse gases do not have a legal right to bring about change. But, those operating with the present policies have the legal right to continue without regard for others. Those favoring the status quo have, in legal parlance, privilege.

As suggested, it is difficult to change greenhouse gas emission policies because of the areas in which they are produced. Industrial activity and automobile exhaust, major contributors of greenhouse gases, are more prevalent in industrialized nations. In the tropics, greenhouse gases result from the rapid rates of land-use changes and the associated burning of large quantities of biomass. Additionally, nitrogen fertilizers and deforestation may increase atmospheric nitrogen significantly. As the agrarian nations become industrialized, they will probably add even more greenhouse gases. Disturbing the chemistry in the tropical atmosphere is particularly significant since convective cloud systems can rapidly transport emissions to other regions of the world.

The policy problem is beginning to take shape. Human activities in the industrialized world generate large quantities of greenhouse gases. The tropical forests process much of that production. However, land uses in the agrarian tropics threaten

the sustainability of much of that forest cover. This links land use decisions in the agrarian nations to activities in the industrialized nations of the world. In the remainder of this document, we will adopt the convenient shorthand of "North" to denote the industrialized nations of the developed world and "South" to denote the agrarian nations of the developing world.

Those in the North want to protect tropical forests as a means to process the large and increasing production of greenhouse gases. People in the North have one primary interest with two implications. Their primary interest is to maintain their lifestyle and their fossil-based energy system. They want to find a way to: (1) maintain tropical forests to process greenhouse gases and (2) discourage those living in the tropics from increasing production of greenhouse gases.

People in the South have a primary interest in achieving economic development. This seems to imply: (1) cutting down tropical forests to earn foreign exchange or to clear land for agriculture and (2) building factories and buying automobiles for the newly prosperous masses. We could not have a more pronounced conflict of interests between the two regions.

RESOURCE MANAGEMENT REGIMES FOR THE COMMONS

The problem of the global commons is that people in both the North and South are free to engage in activities that produce greenhouse gases without regard for the interests of their fellow citizens. They can also proceed without caring about people living in other countries or in the future. Public policy for the global commons would change the rules and laws facing people in both North and South. Recall that all individual actions take place within an institutional context that defines choices for citizens of each country.

If electric utilities are free to emit large quantities of carbon dioxide into the atmosphere, then this defines the choices for other economic agents. For instance, some people will have to spend more money to reduce the undesirable effects from these emissions. People concerned with atmospheric chemistry and global warming will seek to change current behaviors. Those pleased by the status quo will claim that they have a "right" to those emissions. But people worried about global warming will object that traditional use of the airshed for waste disposal does not constitute a "right" for the electric utilities. Rather, they will say that the electric utilities have imposed their actions on others long enough. Indeed, those who care about greenhouse gases will probably say that they have a "right" to be free from harmful emissions of electric utilities and other industrial polluters.

The basic issues at hand are the actual and presumed rights that define the positions of the two parties. Current property arrangements cause existing behaviors that result in conflicts with those who believe that their "rights" have been violated.

On Rights and Correlated Duties

A right is the capacity to call upon the authority of the group (the state) to protect one's claim to a benefit stream. Notice that rights are only effective when there is an authority system that will defend a right-holder's interest in a particular outcome. If you have a right in some particular situation, then it means that you can turn to the state to have your claim protected. The protection you receive from this authority is simply the reciprocal obligation for all others interested in your claim.

A right is a three-part relationship that encompasses a person, the object of that person's interest (whether a physical object or future benefits), and all others who must respect that person's right. Rights are not relationships between a person and an object. Rather they are relationships between a person and others interested in that object. Rights can only exist when there is a social mechanism that gives duties and binds individuals to those duties.

When one has a right in something, it means that the state consciously protects the benefits arising from that situation. The state gives and takes away rights by its willingness--or unwillingness--to agree to protect one's claims in something.

Returning to the global commons problem, the ability of an electric utility to discharge carbon dioxide is properly characterized as a privilege. The electric utility enjoys the benefits of low-cost waste disposal.

The electric utility's costs to produce energy are low because it can discharge carbon dioxide without compensating people harmed by the discharge. Since harmed individuals have no effective way to prevent the utility from discharging harmful gases, the utility enjoys a gas-emissions privilege. In this situation, people have no rights because they cannot call upon the state to stop the emissions. The utility therefore has no duty to stop its emissions. These concepts require further clarification.

Environmental policy is about rights and duties. It is also about benefits and costs to various interests. This perspective focuses attention on the struggle over rights and duties as correlated ideas. In 1917, W. N. Hohfeld recognized their correlation when he proposed four sets of relationships that he considered the essence of legal standing among individuals in a society.

First, we should note the difference between legal relations and a legal system. No society is a "going concern" without a certain degree of social order. The institutional arrangements of that going concern --its working rules-- create the social order that allows it to function and to survive. The ways in which those institutions are formulated and enforced make up the legal system of that society. Society's recognition of a specific set of ordered relations among individuals is a legal relation.

When discussing the four fundamental legal relations, we start with two individuals (Alpha and Beta). Table 1 shows the four fundamental legal relations.

Table 1. The Four Fundamental Legal Relations

	Alpha	Beta
Static Correlates	right	duty
	privilege	no right
Dynamic Correlates	power	liability
	immunity	no power

(Bromley 1991)

A right means that Alpha can call upon the state to enforce a claim to protect against the claims of Beta. A duty means that Beta must behave in a specific way with respect to Alpha. Alpha's ability to make the state enforce a right compels Beta's duty.

The second correlate is that of privilege and no right. With privilege, Alpha is free to behave without regard for Beta's interests. In the present context, electric utilities (Alpha) can discharge greenhouse gases without regard for people who care about the fate of the biosphere (Beta). The opposite of privilege is no right. In this case, Beta has no recourse if Alpha emits large quantities of carbon dioxide. Privilege and no right are static, meaning they exist at a point in time.

Turning now to the dynamic aspect, power means that Alpha may create a new legal relation affecting Beta. That is, Alpha can force Beta into a new situation that may be disadvantageous to Beta. The correlate of power, liability, means that Beta is subject to a new legal relation created by Alpha. Finally, immunity means that Alpha is not subject to Beta's attempt to create a new legal relation affecting Alpha. The correlate of immunity, no power, means that Beta may not create a new legal relation affecting Alpha. Power, liability, immunity, and no power are dynamic, meaning they change over time.

This situation is perfectly symmetrical with respect to the positions of Alpha and Beta. The legal relation is identical regardless of whether you view it from Alpha or Beta's position. The difference lies "...not in the relation which is always two sided, but in the positions and outlook of...(Alpha and Beta)...which together make up the two converses entering into the relation" (Hoebel 1942: 955).

Note that you can reduce the four fundamental legal relations into two further categories that are either active (positive) or passive (negative). The right/duty and the power/liability relations are active in that they represent dual expectations subject to the authority of the state.

On the other hand, the privilege/no right and immunity/no power relations are passive because they are not subject to direct legal enforcement. Instead, they limit the state's activities by defining the types of behavior that are beyond the interest of the state. As seen in the privilege instance, the state declares that it has no direct concern if Alpha imposes costs on Beta. In a sense, we have legal relations that are statements of no law. Every right that Alpha has upon Beta is reinforced by accompanying pressure on courts to compel Beta to perform his/her duty.

Possible Resource Management Regimes

Natural resource management regimes evolve over time to mediate conflicting interests among users. The essence of a resource management regime is that it defines--or fails to define--a structure of rights to benefit streams. At the same time, a resource management regime defines a vulnerability (exposure) to--or the absence of vulnerability--to a stream of future costs. The regime, the human creation, defines a structure of legal correlates. The above concepts of right, duty, privilege, and no right operate within, indeed define, what we mean by a resource management regime.

We call a set of rights to a benefit stream property rights. Now let us specifically explore the scope and nature of property rights in four possible resource management regimes. We emphasize regimes as human creations whose purpose is to manage people in their use of environmental resources.

Remember that a resource management regime is a structure of legal relations comparing the standing of individuals to one another with respect to that particular environmental resource. The resource could be fish, an oil pool, or the assimilative capacity of the atmosphere.

Institutional arrangements are continually established (and redefined) to determine (and to modify) the scope and nature of the property regime over natural resources. Recall that we have defined property relations between two or more people (or groups) by stating that one has a right only when all others have a duty.

We must understand that property is not an object, such as land. Instead, it is a right to a benefit stream that is only as secure as the duty of others to respect the conditions that protect that stream.

If you have a right, you expect that those with duty will respect both the law and your claims. And it is the function of the state to restrain those with duty. If the state is unwilling, or unable, to assure compliance to duty, then rights are meaningless.

Much of the confusion in environmental policy stems from a fundamental misunderstanding of possible resource regimes. The "tragedy of the commons" idea has helped confuse scholars and prevent meaningful understanding of resource management regimes.

Among these possible regimes, common property carries the misplaced blame for "inevitable" resource degradation that really lies with open access regimes. Hardin's symbol of the "tragedy" has been remarkably durable. It confuses an open access regime (a free-for-all) with a common property regime (which specifies behavioral rules). This comparison ignored the possibility that resource users could act together and institute checks and balances--rules and sanctions--for their own interaction within a given environment.

The traditional analysis is not only socially and culturally naive, it is historically false (See Ciriacy-Wantrup and Bishop 1975, Baker and Butlin 1973, and Dahlman 1980). To emphasize the "tragedy of the commons" is to deflect analytical attention from one class of social arrangements that could overcome resource degradation. Some observers may well attribute resource degradation to an assumed (but non-existent) regime of "common property."

They then suggest that, if only private property rights could replace the common property regime, the problem would be solved. Yet, when they observe resource degradation, such as soil erosion or water pollution on private lands, they do not assume the cause is the property structure. Instead, they blame the owner's unduly short planning horizon or some incentive problem that they can fix with taxes or bribes. In other words, they claim private property is the salvation in one setting. Yet, when private property is present, the blame always seems to lie elsewhere. This asymmetry of logic obscures the real issues.

The serious erosion of the 1930s Dust Bowl years during the American economic depression has never been blamed on the private ownership of land. Rather, "drought" caused the problem. However, if private ownership of land is socially optimal--as many claim--how did this disaster happen? If similar land abuse occurs under an institutional regime other than that of private property, the blame immediately shifts to "common property." It is obvious that we need a more careful analysis of property regimes.

We will consider four resource management regimes: (1) non-property regimes (open access), (2) private property regimes, (3) state property regimes, and (4) common property regimes. They will provide organizing concepts to help us think about the global commons.

Open Access Regimes

Open access regimes are situations in which each user has privilege regarding the use of the resource. It follows, therefore, that each user also has no right. In an open access regime, there is no authority system to enforce behavioral norms among participants concerning the natural resource. When "the rule of capture" allows early users to control the future of valuable natural resources, it may be because those resources were never part of a regulated social system. They also could have become open access resources through institutional failures that have undermined former collective or individual management regimes.

Advocates for the so-called "tragedy of the commons" imagine that "property" is a physical object such as a fish, a forest, a piece of land, or the atmosphere. By confusing the social dimension and the concept of property [note 2] with a physical object, it is easy to see how they conclude that open access constitutes "common property." If we mistakenly think of fish as "property," and if fishing is available to everyone, then we think "property" is "commonly available." It is this conceptual confusion that allows people to allege that "everybody's property (fish) is nobody's property (fish)." Since no one owns the fish, they seem to be common to all. But property is not a physical object; instead, it is a social relation defined by the above legal correlates.

Private Property Regimes

While most of us think of private property as individual property, we need to remember that all corporate property is also private property. We also tend to think that the owner has absolute control of private property. However, owners face many restrictions in the use of so-called "private" land and its natural resources; few owners are free to do as they wish with their assets.

The advantages of private control of land and natural resources is that the owner can manage and invest knowing that good stewardship will bring positive returns. There can be no mystery about this, and its appeal is practically as old as recorded history.

A few assumptions make this property regime preferable under most circumstances. First we must assume that the owner chooses to manage well and to produce those objects valued by society. As long as landowners produce wheat, tomatoes, trees, and cotton all is well. When they begin to produce marijuana, opium, and cocaine, then the automatic goodness of private property rights disappears. So, we moderate the compelling nature of private property regimes depending on its end result.

Second, private property is socially compelling as long as the interests of the owner agree with the interests of non-owners. That is, if we assume there are no negative effects coming from the land and natural resource use, then the owner has complete control. If soil erosion, polluting smoke, clangorous sounds, or insufferable odors come from a private property regime, then once again the control of that institutional set-up will be under scrutiny.

Third, private property is socially useful as long as it induces industry rather than substitutes for it. To quote Tawney in a historical treatment of private property:

"Property was to be an aid to creative work, not an alternative to it.... The patentee was secured protection for a new invention, in order to secure him the fruits of his own brain, but the monopolist who grew fat on the industry of others was to be put down. The law of the village bound the peasant to use his land, not as he himself might find most profitable, but to grow

the corn the village needed.... Property reposed, in short, not merely upon convenience, or the appetite for gain, but on a moral principle. It was protected not only for the sake of those who owned, but for the sake of those who worked and of those for whom their work provided. It was protected, because, without security for property, wealth could not be produced or the business of society carried on (Tawney 1978: 139)."

The case for private property regimes, as with all property regimes, ultimately rests on judgments concerning its social utility [note 3]. Private property is the legally- and socially-sanctioned ability to exclude others--it allows the fortunate owner to force others to go elsewhere. Using a private property regime to deal with problems of the global commons is unrealistic. Obviously, it is impossible to define individual property rights in the atmosphere. Therefore, we must search for an alternative institutional structure--a different resource management regime.

State Property Regimes

In a state property regime, the state owns and controls use. Individuals and groups may be able to use the natural resources but only with permission of the government representing the state. State (or "national") forests and parks and military reservations are examples of state property regimes. The government may directly manage and control the use of state-owned natural resources through its agencies. Or, it may lease the natural resource to groups or individuals who then have use rights for a specified period.

For the global commons, the parallel of a state property regime would be a supra-national body with authority over otherwise sovereign states. That is, we would add one more "layer" to the structure to create--in essence--a super state. Presently some international regimes work to subordinate national interests for transnational interests (Young 1989). At the opposite pole of state (or supranational) property regimes, we find individual property rights regimes--most commonly but imprecisely referred to as private property.

Common Property Regimes

The final resource management regime is the common property regime. First, common property represents private property for the group of co-owners. Others can neither use the resource or make decisions about it. Second, individuals have rights (and duties) in a common property regime (Ciriacy-Wantrup and Bishop 1975). In one important sense then, common property has something very similar to private property; they both exclude non-owners.

In that sense, we may think of common property as corporate group property. The property-owning groups vary in nature, size, and internal structure across a broad spectrum. But they are social units with definite membership and boundaries and with certain common interests. They have at least some interaction among members, some common cultural norms, and often their own internal

authority systems. Tribal groups or sub-groups, sub-villages, neighborhoods, small pastoral groups, kin systems, or extended families are all possible examples. These groupings hold customary ownership of certain natural resources such as farm land, grazing land, and water sources (Netting 1976, McKean 1992, Stevenson 1991, Wade 1992).

The Hierarchy of Property Regimes

Earlier, we suggested that the four types of property regimes may be too distinct. However, they often overlap in practice. For example, corporate group property regimes can be compatible with individual use of a resource held under common property.

For instance, in usual tenure systems over much of Africa, a group may own certain farmland. The group's leaders then assign land use rights to individuals or families. As long as those people cultivate their plots, no one else has the right to use it or to benefit from its produce. But, the cultivator holds use rights only (usufruct) and cannot alienate or transfer the ownership or the use of that land to another person. When the current cultivator stops using the land, it reverts to the control of the corporate ownership of the group.

Common property regimes in the developing world often have group "ownership," with management authority from the group or its leaders. In many developing countries, some of the resources in the public domain (non-private land) are managed as common property. The public sector manages some as state property. And some are not managed at all but are open access.

For any property regime, it is essential that an authority system can meet the expectations of rights holders. Private property would be nothing without the requisite authority system that makes certain the rights and duties are adhered to. The same requirements exist for common property. When the authority system breaks down, management of the natural resource fails, and common property degenerates into open access.

The common property regime as a system also includes use rights, exchange rights, distribution rights, a management subsystem, and authority instruments. When any part of this system breaks down, the entire system changes. The management subsystem, with its authority mechanisms and capacity to force compliance, insures compliance with and integrity of the property regime.

This is the same way in which the other property regimes operate as systems. In private property regimes, the owner also relies on state authority and its coercive power to assure compliance and prevent intrusion by non-owners. Without this (or other) authority, the private property regime would collapse and become an open-access regime.

The Global Commons and Resource Regimes

In an open-access regime, such as the current global commons, each individual can produce greenhouse gases without regard for the interests of those adversely affected. We say that each individual has, at the same time, both privilege and no right. The individual has privilege in that he/she may disregard the concerns of others. At the same time, any one individual has no right in that it is impossible to force others not to discharge greenhouse gases.

The policy problem with greenhouse gases is to find a new resource management regime other than the present open access. If there were a meaningful supra-state, then it would be possible to imagine a state property regime over the global airshed. This regime adds, in effect, one more layer of authority over the existing regimes of sovereign nations. It is the regime we find concerning a variety of natural resources (Young 1989). For instance, the International Whaling Commission provides a supra-state management regime which protects the interests and choices of each state. This, in turn, compels each state to redefine the range of choice open to its individual whaling operations (Young 1989).

Lacking the creation of a supra-state property regime, the next possible regime is one of common property. Under this regime, there would be no external source of compliance. But the two states, North and South, would structure an institutional regime that would modify choices for their citizens. Let us now consider that problem.

INTERNATIONAL POLICY FOR THE COMMONS

In international policy there is no supra-state authority system that can force the government of the South to abide by the interests of the government of the North. But, of course, the two states have mutual interests. The problem is to explore the nature and extent of those interests. New policies can take advantage of any mutuality of interests.

Facilitative Policies

We can use facilitative policies when the two governments (or the two parties) have compatible interests. The government of the South might desire a certain technology that would make large industry more efficient in its consumption of fossil fuels.

For instance, the government of the South could seek nuclear power generating facilities to reduce its dependence on imported petroleum. This alternative technology would reduce greenhouse gases and please the government of the North. Moreover, the

government of the North may want to export certain technologies to other nations. A mutual trade and technical assistance pact might help to alter the production regime of greenhouse gases in the South.

Inducing Policies

Inducing policies are relevant when the interests of the government of the North and of the South are incompatible. In domestic policy, governmental authority is usually sufficient to enforce new policies that may not satisfy everyone. For instance, as long as there is sufficient support for the action, the government can impose pollution taxes on an industry which strenuously objects.

In the international domain there is usually no similar capacity to coerce unwilling participants. However, redefining the interests of the two governments can make inducing policies self-enforcing on the part of the reluctant government.

We might think of this as international "cooperation." Put in those terms, it is not surprising that areas of willing bargaining exist among states that have very different interests in particular behaviors. Here we mean that the interests do not have to match exactly. But one can map the interest of one into the interests of the other.

Consider the preservation of tropical biomass to process greenhouse gases. We assume that the government of the North has a deep and abiding interest in preserving as much tropical biomass as possible. The more tropical biomass to process greenhouse gases, the less strict the North has to be in a new environmental policy for greenhouse gases.

Perhaps the government of the South has little interest in preserving tropical biomass. Preserving expanses of forest may deprive the government of the chance to earn large amounts of foreign exchange. It also may force the government to undertake other economic development policies to deal with the problems of the landless peasants clamoring for new land. Indeed, preserving the tropical forests may require the South to take over large estates of wealthy ranchers and then redistribute these lands to the landless. The tropical frontier now provides a "safety valve." It allows the government of the South to offer land to the poor without having to confront the landed gentry.

However, these two incompatible interests have a common element. The desire of the North to protect the tropical forests suggests that it may be willing to pay the South to preserve its tropical biomass. Unlike domestic policy, where government coercion is possible, international policy requires reciprocity between the principal (the North) and the agent (the South).

The government of the South might seek a large increase in economic assistance to promote economic opportunities for its landless poor. That is, foreign aid may be useful in breaking the difficult choice between taking over haciendas and savaging

the forest. Similarly, if preserving forests means confronting the powerful timber industries then maybe payments from the North could redirect these contractors into other lines of work.

Injunctive Policies

It may be, of course, that the mutual interests area is too small to accomplish what the principal (the North) seeks. Perhaps political pressure on the government of the South to continue timbering is too overwhelming to be overcome by payments (or policy concessions) from the North. In this case, and depending upon the resolve of the North, we begin to approach the domain of injunctive policies.

If the North is importing the timber from such practices, the solution is straightforward. The government of the North could simply decide to ban exports from the South. If, however, the South is exporting the timber to a third country, then that government will also need to take part in the negotiations. The problem now becomes more complex. The North could undertake a whole range of policy options, facilitative, inducing, or injunctive, to persuade this third government to change its timber-importing policies.

Injunctive policies are the last resort because they create "winners" and "losers." The essence of long-run international policy is to seek outcomes that allow both governments to interpret their new position as that of a "winner." With facilitative and inducing policies there is a potential for both parties to consider themselves winners in that they both got something they desired. With injunctive policies one party will always feel coerced.

Besides the psychic problem of creating winners and losers, injunctive policies have the great disadvantage that they are not self enforcing. International policy is, to a large extent, dealing with parties in a "state of nature." By a state of nature, we mean a situation in which there is no state to enforce agreed-upon bargains. There is an emerging literature on how to enforce agreements in a state of nature (Kronman 1985)[note 4]. The problem is that self-enforcement is unlikely when one or more parties (states) believe that they have been forced into a situation different from their long-run interests. Then the tendency for defection from the agreement is strong and likely to grow over time.

Choosing the Optimal Policy

Facilitative and inducing policies have the great advantage in that both parties stand to gain something from the agreement. This practical advantage can hold the agreement together when normal events may make the parties begin to doubt. Knowing that defection will deny access to something of very great value, facilitating and inducing policies--when structured well--make

defection too costly. Therefore, an optimal international policy regime is one in which the costs of defection exceed the costs of remaining in the agreement.

CONCLUSIONS

In some instances, we have seen an interest in solving problems of the global commons originating from citizens in the industrialized countries of the world. People in the poorer countries, on the other hand, may regard economic development as their first priority. Potential conflicts arise when those in the North encounter reluctance on the part of governments in the South to undertake actions to preserve forests. These Southern governments, facing serious economic development pressures, may regard the forests as a source of foreign exchange and as a possible site for agricultural expansion.

Sustainable international agreements for the global commons will only emerge when all parties sense a fair sharing of the benefits and costs of new policy regimes. The industrialized North should be ready to offer financial inducements to governments of the South in exchange for more stringent environmental regulations. At the same time, the North must reduce its use of environmental resources if it hopes to solve the problem of greenhouse gases and global climate change.

ENDNOTES

1. Economists will recognize this situation as one of externalities.

2. Kant calls this "intelligible possession."

3. See Becker (1977) for a discussion of the philosophical foundations of private property. His work is also summarized in Bromley (1991). See Sax (1983) for a discussion of recent changes in perceptions regarding the social utility, in certain situations, of private property rights.

4. The literature on international regimes tends to refer to a state of nature as one of anarchy--a term that may conjure up notions of total chaos. However, by anarchy this literature simply means the absence of an overarching authority system to enforce agreements (Young 1989).

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