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Who Owns the Environment?

The objective of this book is to promote greater consideration of property rights and markets in addressing environmental problems. Although there is movement toward increased use of market approaches with the adoption of cap-and-trade in controlling air emissions, fishery harvests, and land use, there have been bumps in the road. Several environmental markets are thin with few trades, in others, prices have trended toward regulatory-set floors, and many have insecure property rights that limit incentives for long-term investment and conservation. We explore why that might be the case and what options exist for, and what benefits may be derived from, expansion. We believe that more can be done to improve the efficient provision of environmental quality through the greater definition of property rights and market exchange.

THE RECIPROCAL NATURE OF THE PROBLEM: NORMATIVE AND POSITIVE ANALYSIS

The manner in which our approach differs from standard presentations is that we recognize environmental problems as ones of reciprocal costs. Natural resource and environmental problems arise when people with diverse demands compete for the use of environmental goods. For example, the policy debate over air pollution levels reveals competition between those who want to use the air for low-cost waste disposal or to facilitate use of certain fossil fuels and those who want to breathe clean air, avoid the health effects of ingesting contaminants, have clear views of the surrounding terrain, or mitigate potential climate

change. Debates over clear-cut forests reflect competition between those who demand wood products at low cost and seek maintenance of timber-based industries and communities and those who prefer forests for hiking trails, wildlife habitat, or carbon sequestration and the expansion of ecotourism.[1] Concerns about overfishing indicate competition between those who want fish now, regardless of stock impacts, and those who want a sustainable yield into the future. In a positive sense, these are competing and conflicting demands.[2] The different effects on welfare if one use dominates the other often are not obvious, although advocates on both sides have clear opinions. The ultimate answer depends upon the benefits and costs of each alternative and their distribution across society.

THE CENTRALITY OF OPEN ACCESS

Before turning to a discussion of various institutions that can help resolve competing demands, it is important to understand that competition and conflict are at their worst when access is open to all – when there are no clear property rights to limit access or moderate use. Economists describe the results of such open access as a "tragedy of the commons."[3] The term is often associated with an article by ecologist Garrett Hardin (1968) about global population growth and individual decisions underlying it, but the idea was first applied to fisheries by economist H. Scott Gordon in 1954. He described the tragedy this way:

> As long as the user of a fishery is sure that he will have property rights over the fishery for a series of periods in the future, he can plan the use of the fishery in such a way as to maximize the present value (future net returns discounted to the present) of his enterprise. From the social point of view it can be said

[1] We recognize that there are other issues, such as erosion from clear-cut areas on down-slope parties, or that clear-cut areas may slow the advance of wildfires and the spread of insect infestation. Addressing these issues does not change our basic point.

[2] Notice that we are not emphasizing "externalities" that by definition arise from incomplete property rights. In our view, addressing externalities occurs when property rights are more completely defined so that all costs and benefits are captured in decision making by resource users.

[3] Garrett Hardin (1968), "The Tragedy of the Commons," *Science* 162: 1243–1248.

that he will bring about the "best" use of the fishery and of all other factors invested in it over future periods by thus allocating outputs and outlays over time in accordance with the current rate of discount.[4]

In 2000, Anthony Scott further clarified the problem of overfishing:

> Consider the fisherman in his role as the owner of a fishing vessel. He has all three powers over it: he can run it, sell it and take the profit from doing these things. But now consider the same fisherman in his role as occupier of the fishery itself. This role does not give him powers to manage it or dispose of it. All he has is the third power, the law of capture: the power to take and keep the fish he catches. The absence of the first two powers deprives him of any incentive to look after the fishery. To illustrate, if he were the kind of fisherman who tried to manage and exploit the fishery with care and prudence, he would not be rewarded. Although his care might have made the fishery more valuable, he would never have the powers needed to capture this extra value. His efforts would have a near-zero yield to him. That is why, lacking the necessary ownership powers, almost everyone in an offshore fishery finds it not worthwhile to look after it.[5]

Open access to a groundwater aquifer produces a similar result. Groundwater supplies more than 50 percent of the drinking water in the United States and is a major source for irrigation.[6] In most cases, water is pumped from a common aquifer under the rule of capture, in this case through pumping. The result of competitive pumping is analogous to several children with their straws in a cold soda on a hot day. Each might have an incentive to savor the flavor and avoid drinking so fast as to get a headache. However, without constraints on drinking, any restraint by one will be met by faster drinking by another to capture more of the cool drink. In the same way, multiple pumpers from the same aquifer can overpump. Similarly, water left in the aquifer will cost less to lift, will be available for future use, and will continue to support the ground above, thereby limiting subsidence. However,

[4] H. Scott Gordon (1954), "The Economic Theory of a Common-Property Resource: The Fishery," *Journal of Political Economy* 62(2): 124–142; Anthony Scott (1955), "The Fishery: The Objectives of Sole Ownership," *Journal of Political Economy* 63(2): 116–124.

[5] Anthony Scott (2000), "Introducing Property in Fishery Management," Section 3.2 in Ross Shotton, ed., *Use of Property Rights in Fisheries Management*, Rome: FAO Fisheries Technical Paper 404/1 http://www.fao.org/docrep/003/X7579E/x7579e03.htm.

[6] The Groundwater Foundation, http://www.groundwater.org/gi/whatisgw.html.

if access to pumping is open to all, any water left by one pumper is available to another, thus creating a race to the pump house.

Currently, the major approach for achieving environmental quality and natural resource conservation is the use of government regulations and, to a far lesser extent, tax policies. Part of the motivation for reliance on government regulations or taxes is the notion that providing environmental benefits and avoiding the depletion of natural resources are public goods. It is well known that markets may not provide enough public goods, and that this so-called market failure is a reason for government intervention. As we argue, however, regulation and tax policies are not always the most efficient or timely alternatives. There can be government failure as well when policies are molded by interest-group politics and by political and regulatory agendas that may do little for the environment or the provision of public goods. Regulations often include uniform standards that do not reflect differences in abatement costs, subsidies that distort incentives for efficient exploitation and production, and mandates for product characteristics and energy sources that have little consumer appeal or long-term environmental protection potential.[7] In fact, most of the recent market innovations in providing environmental quality or natural resource conservation have resulted from either the high cost of government regulation or its ineffectiveness.[8]

In either case, however, when comparing government regulations and environmental markets, we will be considering imperfect arrangements or second-best solutions. Transaction costs make all responses to

[7] CAFE standards that require minimum vehicle fleet mileage mandates not only have many exemptions that subvert the goal of improving fuel efficiency and reducing oil imports, but also lead to costly investment in vehicles that may have little demand, at least in the short run. The slow sales of the Chevy Volt and Nissan Leaf are an example with high up-front costs and long payback periods for consumers. http://www.nydailynews.com/autos/electric-vehicle-market-struggles-slow-sales-article-1.1178155.

[8] This was a major reason for the 1990 Clean Air Act amendments that allowed for the establishment of the SO_2 emissions market. More broadly, the costs of regulation with regard to fisheries are addressed by Frances R. Homans and James E. Wilen (1997), "A Model of Regulated Open Access Resource Use," *Journal of Environmental Economics and Management* 32: 1–27 in their discussion of fishery regulation and rent dissipation.

environmental and natural resource concerns incomplete.[9] The issue at hand is which approach can bring the greatest environmental and natural resource benefits at least cost. The answer will be determined on a case-by-case basis, and we provide many examples of market opportunities and limits in this volume.

In our discussion we distinguish between positive analysis (what is factual) and normative analysis (what policies should be, on the basis of political or value judgments). Within the realm of environmental and natural resource policies, it is very easy to cross the line between positive and normative analysis and believe that what is self-evidently preferable to one party is the social optimum. It may or may not be, but these beliefs are strongly held, and this is one reason why environmental policies often are so contentious.[10] Another related reason for disagreement is the distributional impact of environmental policy. Although environmental justice can be portrayed as an effort to provide improved conditions for poor and underserved populations, environmental regulations themselves raise costs and are often regressive.[11] Although many of the policy suggestions made in this volume are normative, our analysis of the underlying reciprocal source of any environmental problem and the potential for secure property rights to address it reflects positive assessment. We hasten to add that the transaction costs of defining and enforcing property rights that are critical for markets may be too costly relative to the benefits,

[9] Ronald Coase (1960), "The Problem of Social Cost," *Journal of Law and Economics* 3: 1–44. Transaction costs are more precisely defined in Douglas W. Allen (1991), "What Are Transaction Costs?" *Research in Law and Economics* 14: 1–18 and Douglas W. Allen (2000), "Transaction Costs," in Boudewijn Bouckaert and Gerrit De Geest, eds., *The Encyclopaedia of Law and Economics*, Vol. 1. Cheltenham: Edward Elgar, 893–926.

[10] For a discussion of positive and normative analysis, see Charles D. Kolstad (2011), *Environmental Economics*, 2nd edition, New York: Oxford University Press, 30–42.

[11] There is the notion of a "double dividend," that environmental policies can provide improvements and at the same time encourage development of new technologies and economic growth. Assessing whether this is an outcome requires empirical investigation, and the results are likely to vary case-by-case. There clearly will be temporal differences, with costs rising initially and any economic benefits being generated later. See Kolstad (2011, 255–259). The effects of macroeconomic conditions on environmental demand are discussed by Matthew E. Kahn and Matthew J. Kotchen (2010), "Environmental Concern and the Business Cycle: The Chilling Effect of Recession," NBER working paper 16241, July.

and if so, a regulatory alternative may be more cost-effective. Or it might not be, depending on the transaction costs of lobbying to mold public policy and enforcement.

In most cases, environmental problems arise from overproduction so that constraints are required to achieve more optimal output levels, and some parties potentially will be made worse off unless compensated. In government regulation, distributional implications can be obscured because interest group politics reward groups that are well-organized and wealthy relative to other groups.[12] To be sure, the assignment of property rights and the use of markets also have distributional consequences. This is what makes the use of property rights controversial. Nevertheless, the process can be far more transparent, and if environmental markets are more cost-effective, there are greater surpluses to compensate those who are harmed by the policy.

To continue, environmental and natural resource problems often are portrayed in a normative sense – the polluter must pay; natural resources should be exploited sustainably; fossil fuel use should stop in order to halt greenhouse gas (GHG) emissions and possible global climate change. The trade-offs involved in confronting these challenges in a positive sense generally are not made clear by advocates. Consider the conflict between developing oil and gas deposits in Alaska and environmental quality. Tapping oil and gas reserves in the Arctic helps supply U.S. energy demands that are inherent in a growing economy that provides for goods and services, employment, and opportunities for citizens. At the same time, oil and gas extraction has its costs. To mention a few, there are risks of oil spills damaging fisheries, increased air emissions including carbon, and fewer pristine places. Disallowing oil and gas development in Alaska will eliminate the environmental costs, but will come with possibly higher energy charges, more dependence on foreign oil supplies, and perhaps slower economic growth, at least in some areas.[13] In short, environmental problems are inherently wrought with trade-offs. The question is: How

[12] Sam Peltzman (1976), "Toward a More General Theory of Regulation," *Journal of Law and Economics* 19(2): 211–240.

[13] Matthew J. Kotchen and Nicholas E. Burger (2007), "Should We Drill in the Arctic National Wildlife Refuge? An Economic Perspective," *Energy Policy* 35: 4720–4729.

can these trade-offs be weighed against one another to promote efficient provision of environmental quality?

To further illustrate, the Ogallala aquifer system, which underlies 174,000 square miles from South Dakota to Texas and supplies irrigation water to 27 percent of the irrigated land in the United States and drinking water to 82 percent of the population living above it, is a poignant example of groundwater overdraft. Thousands of pumpers extract from the aquifer across the Great Plains. Their uncoordinated withdrawals and increasing demands on the Ogallala aquifer have outstripped the recharge rate, causing water levels to fall. Since pumping intensified in the 1940s, water levels have declined more than 100 feet in parts of Kansas, New Mexico, Oklahoma, and Texas, making irrigation impossible or cost-prohibitive in some areas. Total storage has also declined significantly. The United States Geological Survey (USGS) estimated that total water storage in the aquifer was about 3,178 million acre-feet in the 1950s. By 2005, it had declined by 9 percent to about 2,925 million acre-feet. Unfortunately, these results are mirrored around the world, where groundwater is an open-access resource, but is also a critical source for water.[14]

Subsurface oil and natural gas provide yet another example. Since the first discovery of oil in the United States in 1859, competitive pumping has generated enormous waste. Oil and gas are found in subterranean hydrocarbon formations through which the minerals migrate at faster or slower rates depending on subsurface pressure, oil viscosity, and the rock formation's porosity. As pumpers puncture the formations, the oil and gas migrate to the pumping source, making it more costly for others to pump. Recognizing this, all pumpers have an incentive to drill and drain as fast as they can. In other words, the incentive is to get the oil before someone else does. Not only does excessive pumping reduce subsurface pressures, making it more difficult to release trapped oil from the rock, it can also cause a glut on the market resulting in price volatility and increase surface storage costs, where oil is less vulnerable to drainage than underground, and reduce overall oil recovery. An estimate of the magnitude of the

[14] See Terry L. Anderson, Brandon Scarborough, and Lawrence R. Watson (2012), *Tapping Water Markets*, Washington D.C.: Resources for the Future; Chapter 9 for a discussion of these issues.

overpumping waste was provided by a 1914 U.S. Bureau of Mines study placing the costs of excessive wells alone at one quarter of the value of total annual U.S. production.[15]

In all of these cases, property rights to the resource are either absent or very incomplete so that users inflict costs on one another (and the resource) and do not consider those effects in their decisions. The tragedy of the commons as it relates to the atmosphere is even more complex than it is for fisheries, groundwater, or oil. With resources where impacts occur in the vicinity of the nets, groundwater pumps, or oil wells, the parties can observe one another and potentially take collective action for mitigation. With broad-based pollution, however, both users and their effects on each other are separated by long distances (and in some cases, long time periods, perhaps generations). Accordingly, competing parties do not see their impacts on others or may not believe they are significant – especially when there are many confounding factors in large natural systems that can affect the status of the resource – and therefore have less incentive to adjust their behavior. Those who demand and receive cleaner air (perhaps through regulation) raise the cost for those who use it for the disposal of waste. And it works the other way. As we illustrate, if those who advocate for cleaner air do not bear the costs involved, they can demand air quality standards that are too high. Similarly, those who emit and do not bear the costs will overpollute. Both are examples of the tragedy of the commons. In a positive sense, it is a reciprocal problem. To return to the importance of spatial distribution, in cases where emissions are concentrated in particular areas, such as in the Los Angeles basin, they can create significant health hazards, and the problem may generate action, through either regulation or markets. CO_2 emissions, on the other hand, intermix all around the planet, making the entire Earth's atmosphere a commons. In this case the solution requires multilateral cooperation across the globe, and therefore is far more complicated.

Open access then is the source of environmental and resource problems. When it exists, decisions on use are made that do not reflect the full social benefits and costs involved, but rather are molded by

[15] Gary D. Libecap and James L. Smith (2002), "The Economic Evolution of Petroleum Property Rights in the United States," *Journal of Legal Studies* 31 (2, Pt. 2): S589–S608, S592.

private net-benefit considerations. This setting leads to overfishing, overextraction of groundwater or oil and gas deposits, overgrazing, too-rapid deforestation, depletion of habitat critical for biodiversity, and too much air pollution. Given the explanation of a common or open resource provided some time ago by Scott, Gordon, and Hardin and the potential size of the losses involved (rents dissipated), one might think that the tragedy of the commons would have been solved by now, but solutions have been elusive. The main reason that open-access problems persist is that it is costly to define and enforce rules via regulation or environmental markets regarding who has access, who bears the costs and benefits of decision making, and who can capture the value of scarce environmental resources.

The central question addressed in this book is how competition over scarce environmental resources can be resolved in a civil, timely, and cost-effective way so that more of the costs and benefits are incorporated in decision making. Accounting for all of the costs and benefits of any resource use is very costly, and it is not clear a priori whether regulation or greater definition of property rights and use of markets will be the better solution. We can say that neither will be ideal. What is important is to explore the transaction costs of both options to determine which is more likely to address the environmental challenge in the most complete way at least cost.

When we are comparing the outcomes of government regulation and environmental market alternatives, we are not contrasting a situation where government plays a role to one where it does not. It is a question of the degree of government involvement and who the ultimate decision makers are. As we describe in Chapter 2, with regulation, politicians, regulatory officials, and judges determine the range of resource uses to achieve political goals, usually as defined by interest-group politics. Once regulatory legislation is enacted by politicians, agency officials who implement it typically set uniform performance or technology standards for the industry and then monitor compliance. Adjustments in standards and other regulatory discretion depend on the nature of the enacting legislation and the position of parties who have adjusted to the rules. Judges may intervene if some parties believe that the law is not being implemented or administered as required by statute. New rounds of political action stimulated by additional benefits and costs perceived by interest groups – industry, labor

unions, environmental nongovernmental organizations, regional and state governments, professional associations, and so on – can result in changes in the law. These are characteristics of the legislative histories of the major federal environmental regulations: the Clean Air and Clean Water acts, CAFE (Corporate Average Fuel Economy) or fleet standards, renewable fuel standards, renewable energy portfolio standards, and the Endangered Species Act.[16]

As we describe in Chapter 3, with environmental markets, politicians enact legislation recognizing property rights of existing users of land, water, or other natural resources through grandfathering or use of prior possession rules.[17] They may also distribute property rights through lotteries, auctions, or other mechanisms, especially if there are no present claimants. Finally, politicians may create property rights by setting total allowable harvests, emissions, or habitat removal as an annual cap, and distribute shares in that cap. This is the basis for cap-and-trade regimes for fisheries, air quality, and land use.[18] Regulatory agencies and courts may monitor resource use to ensure that it complies with the property rights authorized. Once the rights are defined, the locus of decision makings lies with users, rather than regulators. The principal mechanism for achieving environmental quality or protecting the natural resource lies in the incentives of owners and the exchange of assets in markets. As we explore in Chapters 6 and 7, property rights can be exchanged to provide instream flows, habitat conservation, water quality, fish stock improvements, and reductions in air pollution at the lowest mitigation cost.

The question that arises, then, is whether regulation or markets more efficiently addresses the environmental or natural resource

[16] Clean Air Act Extension of 1970 (84 Stat. 1676, P.L. 91–604); Clean Water Act of 1972 (86 Stat. 816, P.L. 92–500); CAFE Standards (89 Stat. 871, P. L.94–163), Endangered Species Act (87 Stat. 884, P.L. 93–205). Renewable Energy Portfolio Standards vary by state.

[17] For examples of this process, see Gary D. Libecap (2007), "The Assignment of Property Rights on the Western Frontier: Lessons for Contemporary Environmental and Resource Policy," *Journal of Economic History* 67(2): 257–291. Prior possession is discussed by Dean Lueck (1995), "The Rule of First Possession and the Design of the Law," *The Journal of Law and Economics* 38(2): 393–436.

[18] Tom Tietenberg (2007), "Tradable Permits in Principle and Practice," in Jody Freeman and Charles D. Kolstad, eds., *Moving to Markets in Environmental Regulation: Lessons from Twenty Years of Experience*, New York: Oxford University Press, 63–94.