

Pollution and Property

*Comparing Ownership Institutions
for Environmental Protection*

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1 Pollution and property: the conceptual framework

This chapter describes the theoretical relations between pollution and property and provides a framework for the analysis that follows in subsequent chapters. Sections 1 and 2, respectively, rehearse and critique the conventional but too simplistic notion that environmental problems are at bottom property problems. In fact, the structure of property rights *and* environmental problems are both largely consequences of other factors, most notably transaction costs, which in turn are substantially determined by institutional and technological circumstances. Section 2 illustrates this point by describing an ideal, frictionless economy, in which well-defined property rights are clearly *not* a precondition to optimal environmental protection. In a world of zero transaction costs, the optimal level of environmental protection would be attained regardless of the existence and initial allocation of property rights. This is not to argue, however, that the structure of property rights is irrelevant to environmental protection. As I will show in section 3, where I take readers from the ideal world of perfect markets and costless transacting to the real world of imperfect institutions and costly transacting, the structure of property rights can significantly influence environmental performance, and has done so throughout history. Section 3 introduces the “tragedy-of-open-access” model and discusses one of its most important but often overlooked implications: that all means of averting the tragedy, including regulatory measures, are property-based. Section 3 also attempts to clarify some terminological issues in defining property rights, and frames the task for subsequent chapters, which is to compare how alternative property systems differentially effect environmental protection in various institutional and technological circumstances. Finally, section 4 sets forth the organizational structure of subsequent chapters.

I Things that are unowned receive the least care

Scholars long ago recognized that the nature, extent, and allocation of property rights can significantly affect rates of resource depletion and

degradation. In the fourth century BCE Aristotle observed that whatever “is common to the greatest number has the least care bestowed on it” (Aristotle 1941, § 1262b34–5). His observation has resonated throughout history, and today is understood (after Hardin 1968) as “the tragedy of the commons.”

Despite Aristotle’s early warning, many environmental goods never have been subject to private ownership for a variety of economic, technological, political, and cultural reasons. Writing 350 years after Aristotle, the Roman poet Ovid (1992, p. 111) put these words in the mouth of Dædalus: “Though he may possess everything, Minos does not possess the air.” Indeed, according to Roman law, it was against natural law for any individual, even the emperor, to own the air or other socially significant environmental goods. The Institutes of Justinian, compiled 1,000 years after Aristotle, decreed “[b]y the law of nature these things are common to mankind – the air, running water, the sea and consequently the shores of the sea” (Grapel 1994, p. 50). In most countries, for most purposes, these environmental goods have ever since remained off limits to private ownership.

If we were to construct a syllogism, positing Aristotle’s observation as a major premise and the rule from Justinian’s Institutes as a minor premise, the conclusion would be that the commonly owned air, running water, sea, and seashore have the least care bestowed upon them. History, unfortunately, has too often confirmed this. In the absence of property rights to protect them, environmental goods have been abused, sometimes to the point of destruction.

Obviously, there is an important connection between pollution and property. But what is the nature of this connection?

II If the absence of property rights explains pollution, what explains the absence of property rights?

It is frequently said that pollution and other environmental problems stem, in the first instance, from the absence of property rights in natural resources (or “environmental goods”) (see, for example, Goodstein 1995, p. 1029). This reductionist assertion is repeated so often that it has become a truism. But it begs a further reductionist question: what accounts for the absence of property rights in many environmental goods? If some other factor is responsible for the lack of completely specified property rights, then the lack of property rights itself cannot be the ultimate “cause” of pollution and other environmental problems. This reflects a standard problem with reductionist arguments: at what point does the process of reduction end?

As economists know (at least since Coase 1960), property rights are not completely specified for all – really any – environmental goods because they are costly to define, sometimes *too* costly.¹ We might legitimately claim, therefore, that the cost of establishing property rights, rather than the absence of such rights, is the ultimate cause of environmental problems. But that only leads us to the next reductionist question: why are the costs of imposing property rights sometimes, but not always, too high? With this question we finally arrive at the twisted root of the matter: the economic, institutional, technological, and ecological *circumstances* that in large measure determine the costs of defining property rights in, and transacting over, environmental goods. Relations between pollution and property are ultimately determined by the economic, institutional, technological, and ecological circumstances that prevail at a given time and place.²

III Property and pollution in an ideal (nonexistent) world

In a world of perfectly defined property rights, optimal environmental protection would be achieved automatically, but only if certain other preconditions were met. Interestingly, those preconditions would obviate the assumption of perfectly defined property rights.

Imagine a society characterized by a perfectly functioning market economy, with attendant institutions such as freedom of contract.³ In this ideal economy, benefit and cost functions are fully known; a social welfare function is completely specified; information costs for all people in society are very low, so that the level of pollution and the distribution of costs and benefits are both always known; and transacting (including bargaining, policing deals, and enforcing contracts and property rights) is costless.⁴ This is the world of the Coase theorem,⁵ and in it social costs and benefits equal private costs and benefits.

In this ideal world, the optimal level of pollution control is attained automatically by virtue of the assumptions of perfect markets, nearly perfect

¹ See also Barzel (1989, p. 64).

² I am hardly the first author to recognize this (see, for example, Dahlman 1980, ch. 3).

³ The description of the ideal economy in this section is adapted from Cole and Grossman (1999, pp. 895–6).

⁴ To these assumptions, many scholars would add the further assumption that property rights are perfectly defined. But, as will be shown later, this assumption is unnecessary to ensure optimal efficiency and optimal environmental protection in a world of costless transacting.

⁵ The world of the Coase theorem is not the world Coase was concerned to explain. He posited the “Coase theorem” (the label was coined by George Stigler) as a counterfactual heuristic device, to illustrate the importance of legal institutions in the real world, which is characterized by ubiquitous and often quite high transaction costs. See generally Coase (1960).

information, and costless transacting. Indeed, these assumptions ensure optimal environmental protection even in the absence of well-defined and efficiently allocated property rights. Because transacting is costless, participants in the perfectly functioning market will contract with one another to create, allocate, and reallocate entitlements to resources as needed to achieve and maintain optimal efficiency (see Cheung 1998 and 1986; Coase 1988, p. 15). Moreover, the assumption of perfectly functioning markets means that there are no market failures requiring or justifying corrective action by the government. In this circumstance, government intervention in the market for purposes of environmental protection is both unnecessary and undesirable. Any government-mandated pollution reductions could only reduce social welfare.

Apparently, then, well-defined property rights are not a necessary precondition for optimal environmental protection in an idealized, zero transaction-cost world. Nor are they a sufficient condition. As Steven N. S. Cheung (1998) has pointed out, the very notion of a property system contradicts the assumption of zero transaction costs because the existence of a property system necessarily implies the existence of substantial transaction costs (see also Dahlman 1980, pp. 138–9). Moreover, in a world of costless information and transacting, there would be no basis for choosing between capitalist and socialist organization of economic activity (Cheung 1986, p. 37).⁶ This implies that the property regime itself is irrelevant to the attainment of optimal efficiency and optimal environmental protection in the idealized world of the Coase theorem. Cheung (1986, p. 37) and Coase (1988, p. 15) concur that, in a world of costless transacting, “*the assumption of private property rights can be dropped without in the least negating the Coase Theorem!*”⁷

IV Property and pollution in the real, second-best world

If we inhabited the ideal world described in the preceding section, this book would end here. Environmental protection would be a nonissue; writing about it would serve no purpose. There is, however, much more worth writing about environmental protection and its relation to property systems, because the real world bears no resemblance to that ideal world. In the real world, with which the rest of this book is concerned, none of the conditions described in the previous section as necessary and sufficient for

⁶ This is also an implication of Coase’s (1960) own analysis, according to which the choice between market, firm, or government organization of economic activity depends on transaction costs.

⁷ Italics in original. Barzel (1989, p. 55 n. 11) similarly notes that “[c]ostless transacting . . . is a sufficient condition for clearly defining property rights, rendering redundant the requirement that property rights be well defined.”

optimal environmental protection obtains, ever. Markets do not function perfectly; transacting is costly; the social welfare function is uncertain at best; and property rights are only ever imperfectly specified. This real world is so imperfect that there is little sense talking about, let alone striving after, theoretical “optima.” As Ronald Coase (1964, p. 195) has observed, in our world all of the mechanisms for organizing economic activity – markets, firms, and governments – are “more or less failures.” The best we can realistically hope for is to minimize the sum of market failures and government failures, rather than maximize any presumed social welfare function.

The tragedy-of-open-access model

In the twentieth century economists began to study systematically the relations between the absence of property rights and resource depletion in the real world – specifically, Aristotle’s observation that goods held in common receive the least care. Jens Warming (1911), Scott Gordon (1954), and Anthony Scott (1955) each elaborated on Aristotle’s observation in the context of unowned and overexploited fisheries. In 1968 Garrett Hardin, a biologist, provided the classic economic account of the depletion of open-access resources, including many environmental goods.

Hardin’s “The Tragedy of the Commons” (1968) provides a useful starting point for analyzing the ties between pollution and property in the real world. Its thesis is that resource depletion and pollution problems both stem from the incentives created by open-access (nonproperty) regimes, in which no one can exclude anyone else from using a given resource. Hardin demonstrates the problem with the simple example of a pasture open to unlimited grazing by all cattle ranchers. Assuming that all ranchers who might use the pasture are rational, each will seek to maximize his or her individual benefits from the pasture. Each will ask, “[w]hat is the utility to *me* of adding one more animal to my herd?” In other words, they will conduct a cost-benefit analysis to determine whether adding an additional animal to their herd on the commons will provide a net gain or loss. The benefit side of the equation is “a function of the increment of one animal.” According to Hardin, “[s]ince the herdsman receives all the proceeds from the sale of the additional animal, the positive utility is nearly +1.” The cost side of the equation is “a function of the additional overgrazing created by one more animal.” These costs, however, are not borne solely by the rancher who adds one more head of cattle; rather, they are spread among all the ranchers who use (or might use) the pasture. Thus, “the negative utility for any particular decision-making herdsman is only a fraction of -1” (Hardin 1968, p. 1244).

Adding together the component partial utilities, the rational herdsman concludes that the only sensible course of action for him to pursue is to add another animal to his herd. And another; and another . . . But this is the conclusion reached by each and every rational herdsman sharing a commons. Therein is the tragedy. Each man is locked into a system that compels him to increase his herd without limit – in a world that is limited. Ruin is the destination toward which all men rush, each pursuing his own best interest in a society that believes in the freedom of the commons. Freedom in a commons brings ruin to all. (Hardin 1968, p. 1244)

Even an exceptionally foresighted and other-regarding cattle rancher, who recognized the looming tragedy, would not likely forego the opportunity of adding one more animal to her herd. Against her inclination, she would add more cattle rather than conserve the pasture because in this state of nature – that is, in the absence of any property regime – she would be unable to enforce a conservation decision against other current or potential users. Why? Because any other rancher could come right along and exploit the opportunity she nobly bypassed, turning her conservation decision into a futile gesture. Being foresighted, she would comprehend this; and being rational, she would not consciously make the futile gesture.⁸ Instead, she would do what she feels she should not do: add one more animal to the herd.

It is the sociolegal fact of open access – the inability of any user or group of users to enforce their management decisions against any other user or group of users – that obstructs conservation of the resource.

The absence of property rights likewise can lead to pollution. According to Hardin (1968, p. 1245), “[t]he rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of ‘fouling our own nest,’ so long as we behave only as independent, rational, free-enterprisers.”

This process is not inexorable, however. The “tragedy” can be averted, but only if access to and use of the resource are somehow restricted.

Property-based solutions to the tragedy

Hardin (1968, pp. 1247–8) prescribes two means of restricting access and use, which he combines under the heading, “mutual coercion, mutually agreed upon.” The first is privatization: convert the open-access pasture

⁸ Some individuals may derive utility from making futile gestures. For such people it may be rational to forego adding another animal to the herd, even if they believed their gesture would be futile. But even if, say, 90 percent of all potential users of Hardin’s open-access pasture were quixotic conservationists (which is an implausibly high figure), the other 10 percent could still decimate the open-access pasture, depending on the total size of the population and the size and fecundity of the pasture.

to private (but not necessarily individual) ownership. On a privately owned pasture, the costs of any decision to add an extra animal would be internalized by the pasture owner(s). They would continue to use the pasture but not to the point of destruction because, Hardin assumes, overexploitation would generate net costs for the presumptively rational pasture owner(s). Our foresighted rancher, who decided not to graze one more animal in order to conserve *her* pasture, would now be able to enforce her conservation decision. Because she now owns and controls that part of the pasture subject to her decision, no one else can lawfully come along and exploit the opportunity she has decided to forego. Assuming a reasonably cost-effective institutional and organizational structure for enforcing her property rights, her conservation decision would be not futile but rational.

Hardin's second means of averting the tragedy of open access is regulation, which may be either external (government regulation) or internal (self-regulation by the users themselves). Under this regime, the economic incentives favoring overexploitation might be reduced or eliminated through (self-)imposed restrictions on all herders. Assuming that the restrictions are enforceable and that penalties for noncompliance are sufficient, entry and use regulation would raise the (internal) cost of adding animals to the common, but no longer open-access, pasture.

Scholars have discussed and distinguished Hardin's two solutions to the tragedy of the commons, but almost all have failed to recognize that both are property-based: each involves the imposition of property rights on formerly open-access (or nonproperty) resources. This is obviously true of privatization, but it is also true of many forms of government regulation. A government can, of course, assert public rights by explicitly claiming the resource as public property. Most countries have done precisely this in establishing "national parks," "national forests," and other "public lands." In the United States, the lands owned by the federal, state, and local governments comprise 42 percent of the country's total area (Natural Resource Council 1992).

Explicit claims of public ownership are not the only way, however, by which governments establish public property rights in resources. Governments frequently impose public rights through the regulation of private resource use. When the government regulates air pollution, for example, it imposes a system of public rights and private duties with respect to the atmosphere. Whether it chooses to regulate with command-and-control measures (such as technology-based standards), transferable pollution rights, or other "market-based" approaches, the state imposes on air polluters a legally enforceable duty to comply with all restrictions on use of (what amounts to) the public's atmosphere. What distinguishes this

regulatory approach from “privatization” is not the existence or non-existence of property rights but only the *type* of property regime imposed. Privatization converts nonproperty into private (individual or common) property. Government regulation typically (if tacitly) converts nonproperty into public/state property or some mixed form of public and private property. It may be objected that government regulation constitutes an exercise in *imperium* (sovereign authority) rather than *dominium* (ownership) (see Denman 1978, pp. 25, 29–30). However, this old Roman-law distinction marks little practical difference. Property and sovereignty are both forms of power – as Denman (1978, p. 3) puts it, “a sanction and authority for decision-making” – over resources.⁹ Whether the state is purporting to act as sovereign or owner, the rights it asserts are in the nature of property.

A digression on the conventional typology of property systems

At this point, it will be useful to review the conventional typology of property systems, according to which there are four basic property regimes: private, common, state, and nonproperty (or open access).¹⁰ In the law and economics literature, “private property” (*res privatae*) typically denotes property owned by individuals holding rights to use (in socially acceptable ways), dispose of, and exclude others from resources. “Common property” (*res communes*) refers to collective ownership situations, in which the owners cannot exclude each other, but can exclude outsiders. “Public” or “state” property (*res publicae*) is a special form of common property supposedly owned by all the citizens, but typically controlled by elected officials or bureaucrats, who determine the parameters for access and use. Finally, “nonproperty” or “open access” (*res nullius*) denotes a situation in which a resource has no owner: all are at liberty to use it; no one has the right to exclude anyone else. Strictly speaking, open access is not a property regime at all; it signifies the absence of any property regime.

⁹ Marchak (1998, pp. 3–4) lists state and international regulations as separate “ownership regimes,” distinct from outright public ownership of resources. Schmid (1999, p. 236) notes that “[r]egulation is not a denial of property rights, but rather a means of rights distribution.”

¹⁰ Michael Heller (1998) adds a fifth category, which we might refer to as “no access.” This regime results when the right to exclude is held by so many people or organizations that no one can gain entry to use the resource. The result may be *underexploitation* of the resource, resulting in what Heller calls the “tragedy of the anti-commons.” Whether this constitutes a separate category of property rights or is just a special form of *res communes* is an issue we need not resolve here. For present purposes, problems of closed access – the “tragedy of the anti-commons” – have no significance. Indeed, from an environmental point of view, closed access may in some cases constitute a boon, rather than a tragedy.

Table 1.1. *The conventional typology of property regimes*

State property	Individuals have <i>duty</i> to observe use/access rules determined by controlling/managing agency. Agencies have <i>right</i> to determine use/access rules
Private property	Individuals have <i>right</i> to undertake socially acceptable uses, and have <i>duty</i> to refrain from socially unacceptable uses. Others (called “nonowners”) have <i>duty</i> to refrain from preventing socially acceptable uses, and have a <i>right</i> to expect that only socially acceptable uses will occur
Common property	The management group (the “owners”) has <i>right</i> to exclude nonmembers, and nonmembers have <i>duty</i> to abide by exclusion. Individual members of the management group (the “co-owners”) have both <i>rights</i> and <i>duties</i> with respect to use rates and maintenance of the thing owned
Nonproperty	No defined group of users or “owners” and benefit stream is available to anyone. Individuals have both <i>privilege</i> and <i>no right</i> with respect to use rates and maintenance of the asset. The asset is an “open-access resource”

Source: Bromley 1991, p. 31

One major problem with this conventional typology of property regimes is that it simply does not fit many real-world circumstances.¹¹ Actual property regimes invariably combine features from different ownership categories (see Feeny et al. 1996). Even fee-simple absolute landownership – the highest level of ownership an individual can possess in common-law jurisdictions – is always and everywhere subject to public rights of access, use, or control, including public utility easements, zoning authorities, and property taxes. The concept of *allodial* ownership, which refers to completely unregulated and unregulatable private control, is nowhere to be found in the world today, if ever it did exist.¹²

The academic typology of property regimes also differs significantly from the ways in which people ordinarily distinguish property regimes. In common parlance “private” property is not counterpoised to “common” property as it is in much of the academic literature. Co-owned property, including joint tenancy, partnership, and corporate property,

¹¹ It is for this reason primarily that some scholars (including Hanna et al. 1996 and McCay 1996) offer more elaborate typologies of property regimes.

¹² As Dahlman (1980, pp. 70, 71 n. 3) explains, “There is no such thing as absolute ownership, not even in an economic system characterized by complete private ownership.” Rights to use, exclude, and exchange “are attenuated in one way or the other in every known economic system.” Coase (1960, p. 44) observes that “[w]hat a landowner in fact possesses is the right to carry out a circumscribed list of actions.” And he doubts the very possibility of allodial rights by noting that “[a] system in which the rights of the individual were unlimited would be one in which there were no rights to acquire.”

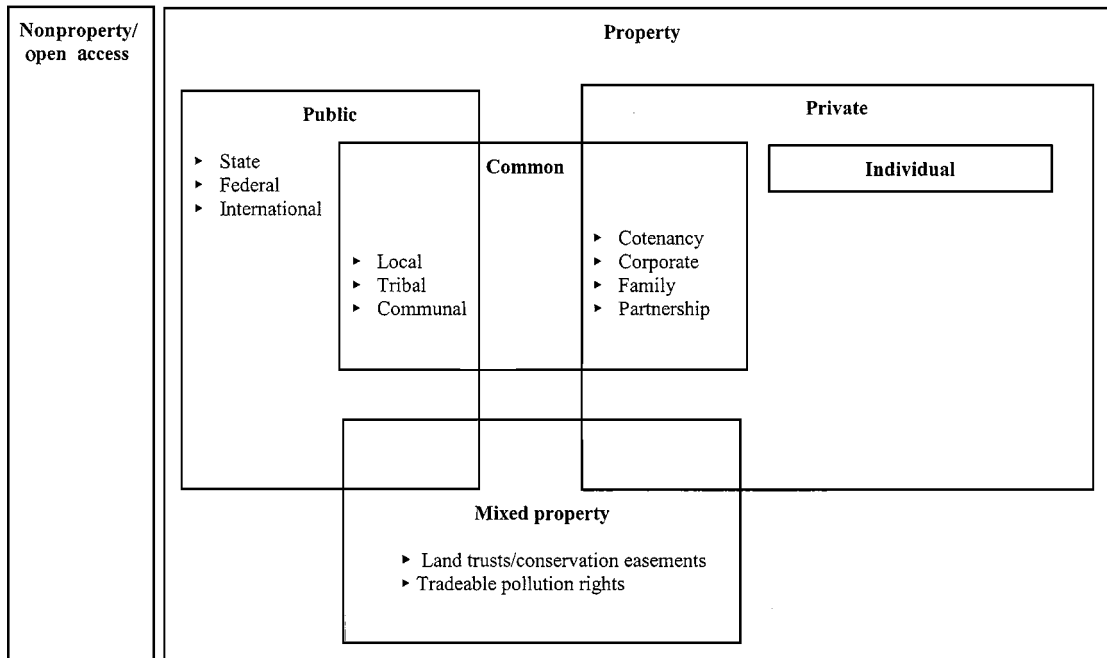


Figure 1 Relations among property regimes.

is usually referred to as “private,” so long as it is not owned by the state or some public entity (see Denman 1978, p. 102). From another point of view, however, co-ownership simply denotes multiple individual ownership, with each co-owner possessing individual rights in, or attributes of, the resource (see Bromley 1991, pp. 25–6; Barzel 1990). Thráinn Eggertsson (1996, p. 161) suggests that the distinction between private and common (or, in his terms, “communal”) ownership has less to do with the number of owners than with the comparatively free transferability of private property rights.

A more vexing terminological problem in the academic literature is the conflation of common property with nonproperty or open access.¹³ This conflation is understandable because in the vernacular nonproperty resources are typically described as “commons” or “common pools.” Indeed, they *are* commonses in the sense that they are common to all; no one can exclude anyone else.¹⁴ However, the labels “common property” and “open access” denote very different systems. They differ primarily in the size of the group entitled to access and use the resources (see Seabright 1993, p. 114 n. 1). In order for property to be common (*res communes*) rather than open access (*res nullius*) there must be at least two groups, one of which collectively controls the resource with the authority and ability to exclude the other (Ciriacy-Wantrup and Bishop 1975, p. 715; Stevenson 1991, p. 51). Daniel Bromley (1991, p. 149) claims that “[a] common property regime for the group becomes an open access regime for the individuals within the group.” But this is not typically the case. In most (if not all) existing common property regimes, the individuals comprising the group of co-owners do not possess unfettered rights to access and use, as they would to an open-access resource; rather, the group collectively regulates the access and use of its own members. Bromley (1991, pp. 25–6) correctly notes, however, that “common property represents *private property for the group of co-owners* because all others are excluded from use and decision making.”

Common property is also sometimes confused with public or state property. The state may be viewed as a group of co-owners, like partnerships, collectives, or villages. But those, such as Elinor Ostrom (1990), who write extensively about common property resources, seem to distinguish between state and common ownership based on the size of the ownership group and its location with respect to the resource. When a

¹³ Cox (1985) and Bromley (1991, pp. 22 and 137) are among those who criticize Hardin (1968) and North and Thomas (1973), among others, for conflating open access with common property.

¹⁴ Michaelman (1982, p. 9), for example, defines a “commons” as “a scheme of universally distributed, all-encompassing privilege.”

group of self-governing villagers controls access to a fishery, for example, that is considered common ownership. But when nonusers, far removed from the village, control access and use, that is state or public ownership. Moreover, depending on the political circumstances and management practices, state or public property may more closely resemble individually owned private property than common property (see Eggertsson 1990, p. 37; Rose 1994, pp. 116–17; Denman 1978, pp. 3–4).

Another conceptual problem with the conventional typology of property regimes concerns the general neglect of a crucial question: just what specific rights and corresponding duties do the various property regimes entail? As Bromley (1989, p. 187) notes, those who write about property and property rights rarely are “specific about the content of those terms.” Economists in particular often adopt (explicitly or implicitly) definitions of property rights that diverge significantly from legal definitions (see Cole and Grossman forthcoming a). Some facetiously assume that private property means Blackstonian absolute dominion.¹⁵ But as Harold Demsetz (1988, p. 19) explains, “full private rights, full state rights, full communal rights are notions that are very elastic with respect to the substantive bundle of entitlements involved.”

Toni Honoré (1961) lists eleven distinct “sticks” in the *complete* bundle of property rights: the right to exclusively possess; the right to use; the right to manage; the right to the income; the right to the capital; the right to security; transmissibility; absence of term; the prohibition of harmful use; liability to execution; and the right to residuary character. None of these rights is strictly necessary, in the sense that one cannot be considered an owner of property without it. Even if one or more sticks are missing from a particular bundle, someone may still meaningfully be said to “own” property. It is not good enough, therefore, to recommend a certain property regime for environmental goods; one must also specify just what rights and corresponding duties that regime would entail (see Ostrom 1990, p. 22). Those rights and duties may well vary from one environmental good to another, or, with respect to any particular environmental good, from one context to another.

Although the problems arising from the conventional typology of property rights regimes are troublesome, especially when they are neglected, they do not become the ultimate concern of law and economics scholars, which is not the ownership regime *per se* but the costs of transacting

¹⁵ Blackstone (1779, vol. II, p. 2) wrote of property as the “sole and despotic dominion which one man claims and exercises over the external things of the world, in total exclusion of the right of any other individual in the universe.” Carol Rose (1998) has explained, however, that Blackstone could not have meant this literally, given the significant constraints on property he acknowledged in subsequent passages of the *Commentaries*.

(or refraining from transacting) over resources. The ownership (and management) regime is important only insofar as it impacts on externalities and transaction costs (see Coase 1960; Demsetz 1967; Dahlman 1979; Terrebonne 1993).

In view of the terminological confusions arising from the conventional typology of property regimes, which arguably reflect ideological issues more than real distinctions, the economist J. H. Dales (1968, p. 61) sensibly abandons the conventional typology. Rather than opposing private to common and public/state property, he merely refers to “‘property rights,’ by whomever exercised.” Depending on the circumstances, property rights may best be vested in individuals, groups (collectives or firms), or the state (on behalf of the public at large). The implication is that distinctions between individual, group, and state property tend to be more informative and less ideologically loaded than the conventional distinction between private and common property (also see Goetze 1987, p. 187).

This book relies on the conventional typology of private, common, and public property despite its manifest insufficiency, but with an important caveat: when I refer to public or private property, I should not be taken to mean *purely* public or private. There is no such thing as a pure or unadulterated public or private property system. As Charles Geisler (2000) has noted, all existing property regimes are more or less admixtures, comprising various individual, group, and public rights. A property regime can only be *relatively* public or private. Public/state property regimes are never unalloyed by private (individual or common) interests (see Huffman 1994). Similarly, private property is never devoid of public or common rights (see Dahlman 1980, p. 70). As Albert Church (1982, p. 93) has written, nominal “ownership is but one of the components of property rights in natural resources.” So, when I refer to “private” property in this book, I do not mean allodial property, devoid of public rights, but property nominally owned by private individuals, subject to various group or public interests.

To the extent that all existing property regimes are actually admixtures of private, group, and public rights, we might legitimately conclude that all regimes really boil down to common property. Such a conclusion, however, would mask significant differences between actually existing property regimes. Therefore, I use the label “common property” only in its conventional understanding of property owned corporately or by a group of persons, who do not constitute a state agency.

The mere fact that I am compelled to parse these definitions is yet another manifestation of the insufficiency of the conventional typology of property regimes. Perhaps, in the end, we will be forced to conclude with

Dales (1968, p. 61) that the conventional typology must be abandoned in favor of a messier but more accurate description of property rights, “by whomever exercised.”

Regulatory instruments as property-based regimes

Having rehearsed the basic structure of property systems, we now return to the treatment of environmental regulations as property-based solutions to the tragedy of the commons. There are, of course, a wide variety of regulatory instruments for averting open-access “tragedies.” One environmental law casebook (Percival et al. 1996, pp. 154–8) lists twelve distinct regulatory approaches, including: design standards or technology specifications; performance standards or emissions limits; ambient or harm-based standards; product bans or use limitations; marketable allowances (which I refer to in chapter 3 as transferable pollution rights); challenge regulation or environmental contracting; pollution taxes or emissions charges; subsidies; deposit-refund schemes; liability rules and insurance requirements; planning or analysis requirements; information disclosure (e.g., labeling) requirements. The regulatory approaches in this expansive typology combine varying amounts of commands, controls, and economic incentives. But this categorization should not mislead us into thinking that certain regulatory approaches are “property-based,” while others are not. They are all more or less property-based to the extent that they recognize or establish enforceable rights and duties in otherwise unowned resources. This may not be obviously true of pollution taxes, for example, but even they can be – and, perhaps, should be – viewed as a property-based approach, in which the government provides polluters with what amounts to an option to purchase limited rights to pollute. The key point is that those who are subject to the pollution tax have an enforceable *duty* not to pollute the public’s atmosphere without paying the price set by the agent (the government) of the owner (the public).¹⁶

From a strictly economic perspective, conventional distinctions between “economic” instruments and command-and-control, for example, are immaterial. All approaches to environmental protection – from technology-based command-and-control regulations to effluent taxes, transferable pollution rights, and complete privatization – create economic costs and benefits that are distributed among polluters, the government and its taxpayers, and various other groups and individuals that comprise the “public.” The only truly meaningful distinction between one

¹⁶ This property-based conception of regulation is further elaborated on in chapter 2.

approach and another lies in their differential cost and benefit structures. On a practical economic level, the decision rule for choosing from among alternative regulatory approaches to attain a given environmental protection objective is their relative cost-effectiveness or regulatory efficiency: in a certain situation, how much pollution control or resource conservation would alternative property/regulatory regimes buy for the buck?

Criticisms of Hardin's allegory of the "tragedy of the commons"

Hardin's tragedy-of-the-commons model and his institutional mechanisms for averting the "tragedy" have been extensively criticized for conflating open access with common property (see, for example, Cox 1985; Taylor 1992; Dasgupta 1982, p. 13). What Hardin calls the "tragedy of the commons" is, in fact, a "tragedy of open access," to which common-property regimes may comprise a solution. This criticism is valid but facile. As I have already shown, open-access resources are conventionally referred to as "common pools" or simply as "commonsens." Most importantly, Hardin's (1968, p. 1244) article makes crystal clear that the issue is open access, rather than common property: he writes about a "pasture open to all," not a pasture open to one group, but closed to all others. At worst, Hardin is guilty of an unfortunate choice of words. It would have been better if he had entitled his article, "The Tragedy of Open Access," which is how this book will hereafter refer to the central problem of environmental protection. This purely semantic quibble has no real bearing, however, on Hardin's analysis.

Hardin has also been criticized (by Berkes et al. 1989; Feeny et al. 1990; Feeny et al. 1996; Taylor 1992; McCay 2000) for preferring private and state ownership over common ownership. In fact, Hardin's analysis in "The Tragedy of the Commons" provides no basis for any such preference. His analysis calls for the creation of property rights where none previously existed, but does not suggest in whom – individuals, groups, or the state – those rights should be vested. In a later writing, Hardin (1978) lists private and state ownership (or "private enterprise" and "socialism") as the only two viable solutions to the "tragedy of the commons," implying that "common" property regimes (as defined earlier in this section) would not suffice. But nothing in "The Tragedy of the Commons" supports such a claim; and numerous empirical and theoretical studies dispute it (including Ostrom 1990; Bromley 1992; Hanna and Munasinghe 1995). In any case, as noted earlier, the appropriate distinction is not between common property and private property but between individual ownership – where a single person holds the right

to exclude all others – and joint ownership – where no member of the group can exclude any other, but any single member of the group can exclude any and all nonmembers.

A more legitimate criticism of Hardin relates to his assumption that rational private owners would not knowingly overexploit their resources. This assumption is empirically and theoretically dubious. Empirically, individual private owners have often done exactly what Hardin assumes they would not do. Daniel Bromley (1991, p. 171) reminds us of the dust bowls that resulted when supposedly “‘omniscient’ private entrepreneurs” plowed up the American prairie against the advice of agricultural experts. More recently, in the 1990s private timber owners in the American Pacific northwest increased harvesting to unsustainable levels either to avert or to pay for junk bond financed hostile takeovers (see Power 1996, p. 138). According to economic theory, meanwhile, it is entirely rational for resource users to extinguish rather than conserve resources in some circumstances (see Gordon 1958). Colin Clark (1973a, pp. 950–1) has shown, for example, that the “extermination of an entire [animal] population may appear as the most attractive policy, even to an individual resource owner,” when “(a) the discount (or time preference) rate sufficiently exceeds the maximum reproductive potential of the population, and (b) an immediate profit can be made from harvesting the last remaining animals.” The outcome may not be socially optimal, but private property owners make decisions to maximize private, not social, benefits (see Clark 1973b; Larson and Bromley 1990; Schlager and Ostrom 1992). I will revisit this point in chapter 5, when reviewing claims that privatization of all environmental goods would lead to optimal conservation.

Even if all the criticisms leveled at Hardin’s model of environmental degradation were true, his chief insight would remain nonetheless valid: open-access resources tend to be unsustainably exploited unless *some* property regime is imposed for their protection.¹⁷ But which property regime? Open access may be replaced by a traditionally conceived private-property regime, in which entitlements to units of the resource are allotted to individual owners. Or the resource may be kept intact as common property, with entry and use restrictions imposed by some governing body. This governing body may be private, constituting collective self-government by the group of resource users *cum* “owners,” or public, constituting state ownership or regulation.

¹⁷ In addition to the criticisms discussed above, we might also fault Hardin for his advocacy of regulatory controls on human procreation (Hardin 1968, p. 1248). Interestingly, on this point most of his environmentalist critics are silent. In any case, the prescription of compulsory birth control is not central to his analysis of the problem of open access.

Which property-based approach?

Because all solutions to the tragedy of open access inevitably involve the imposition of property rights on previously unowned environmental goods, the choice in environmental protection is not *whether* to adopt a property-based approach but *which* property-based approach(es) to adopt. To what extent should the state assert public rights (*res publicae*) as opposed to vesting (limited or unlimited) private property rights in individual users (*res individuales*) or groups of users (*res communes*)? An adequate theory of property rights in natural resources must consider the full range of possible property-based solutions to the tragedy of open access, recognizing that, in this second-best world, no single regime is likely to be the first-best solution for every resource in every institutional, technological, and ecological setting. What is required is a *comparative institutional analysis* of various property solutions to the tragedy of the commons – not a comparison of some *idealized* theoretical institution against other, imperfect institutions but “a *comparative institution* approach in which the relevant choice is between alternative real institutional arrangements” (Demsetz 1969, p. 1).

Such an approach is entirely consistent with Coase’s (1960, pp. 15–18) suggestion that efficiency is maximized sometimes by private market transactions, sometimes by transactions organized within firms, and sometimes by government regulation. As several authors (including Noll 1989; Komesar 1984; Eggertsson 1996, p. 166) have noted, every individual circumstance requires a comparative assessment of the costs of production, exclusion, and administration. A private property regime based on individual ownership may be appropriate in cases where the costs of governance are relatively high but exclusion costs are relatively low. Some form of common or state ownership may be preferable, however, in the converse situation of high exclusion costs and relatively low costs of administration. Finally, where the costs of either exclusion or governance would be extraordinarily high – reflecting, perhaps, the technological infeasibility of exclusion – or the resource itself is superabundant, open access may be inevitable, maximally efficient, or both (see Coase 1960, p. 39; Libecap 1989, pp. 13–14).

Stated as a rule (to be further elucidated in chapter 7): that property regime is best which, in the circumstances, would achieve exogenously set societal goals at the lowest total cost, where total cost is the sum of compliance, administrative, and residual pollution or consumption costs. Stating a rule is one thing, however; implementing it is another. As Gary Libecap (1989, p. 5) points out, society will not always, and may never, select the “best” property regime for conserving environmental

goods: “examination of the preferences of individual bargaining parties and consideration of the details of the political bargaining underlying property rights institutions are necessary for understanding why particular property rights institutions are developed and maintained, despite imaginable alternatives that would appear to be more rational.” This has obvious public choice implications that are explored in chapters 5 and 8 as they relate, respectively, to “free market environmentalism” and the “takings” problem.

Natural resources in most (if not all) countries historically have been subject to multiple and mixed property regimes. Some environmental goods, such as land, have been protected primarily (though not exclusively, and not at all in most socialist economies) by private (individual and common) property rights. Many other environmental goods, such as the atmosphere, have for various reasons never been allotted to private owners. Thus, societies have relied on both of Hardin’s proffered solutions – privatization and regulation – to avert the tragedy of open access. As already noted, most property regimes governing access to and use of natural resources are admixtures of individual private ownership, common property management, and state ownership and management, including regulation. These actually existing systems of property rights on environmental goods hardly resemble the idealized typology presented earlier in this chapter.

One purpose of this book is to explain, beyond facile public choice rhetoric about special interests seeking economic rents in political markets, why this is the case. To what extent, if at all, are mixed property/regulatory regimes economically and environmentally preferable to either private property/nonregulatory regimes or public property/regulatory regimes in many, if not most, circumstances? What leads societies to employ different property-based solutions to the tragedy of the commons in various circumstances? And what normative implications do their choices suggest for policy?

V Structure of the book

The following four chapters describe the utility and limits of each of the four basic property-based approaches to environmental protection. Chapter 2 addresses the public property/regulatory approach, as represented by outright public ownership of resources and by command-and-control regulation. Chapters 3 and 4 discuss, respectively, the utility and limitations of mixed private and public property/regulatory approaches, as represented by transferable pollution right programs and conservation easements. Chapter 5 deals with the private property/ nonregulatory

approach, promoted by self-styled “free market environmentalists.” And chapter 6 assesses common property/regulatory systems, as discussed in the work of Elinor Ostrom (1990), Daniel Bromley (1992), and others.

Each approach, I will show, has advantages and disadvantages, which make it suitable – preferable, even – for some circumstances but not others. In other words, no single property regime is preferable to all others across all economic, institutional, technological, and ecological contexts. This finding should not surprise us. It would be far more surprising if we discovered that the opposite were true: that a single property regime constituted the universal, first-best choice for avoiding the tragedy of open access, regardless of the wide variety of circumstances in this decidedly second-best world.

Based on the analyses in chapters 2 through 6, chapter 7 sets out a rudimentary model for property regime choice, based primarily on the relative costs of exclusion and coordination. Those costs are determined not just by characteristics of the resource itself but also by its ecological, technological, institutional, and cultural setting. Because of the almost infinite variety and complexity of settings, however, the model possesses, at best, very limited prescriptive or predictive utility. As J. H. Dales (1968, p. 77) notes, every approach to environmental protection (or averting the tragedy of open access) is “in the nature of a social experiment.”

Chapter 8, finally, addresses an ancillary but nonetheless important aspect of the complex relation between pollution and property: the “taking” problem. “Taking” issues tend to arise, in the context of efforts to protect the environment, when incompatible property regimes collide. When that happens, property, which is a necessary institution for effective environmental protection, may become, paradoxically, an impediment to it.