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978-0-521-00109-0 - Pollution and Property: Comparing Ownership Institutions for Environmental Protection

Daniel H. Cole

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## 1 Pollution and property: the conceptual framework

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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

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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?

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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.<sup>1</sup> 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.<sup>2</sup>

### 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.<sup>3</sup> 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.<sup>4</sup> This is the world of the Coase theorem,<sup>5</sup> 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

<sup>1</sup> See also Barzel (1989, p. 64).

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

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

<sup>4</sup> 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.

<sup>5</sup> 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).

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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).<sup>6</sup> 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!*”<sup>7</sup>

#### 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

<sup>6</sup> 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.

<sup>7</sup> 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.”

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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).

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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.<sup>8</sup> 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

<sup>8</sup> 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.

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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

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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.<sup>9</sup> 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).<sup>10</sup> 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.

<sup>9</sup> 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.”

<sup>10</sup> 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.



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The conceptual framework

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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.<sup>11</sup> 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.<sup>12</sup>

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,

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

<sup>12</sup> 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.”

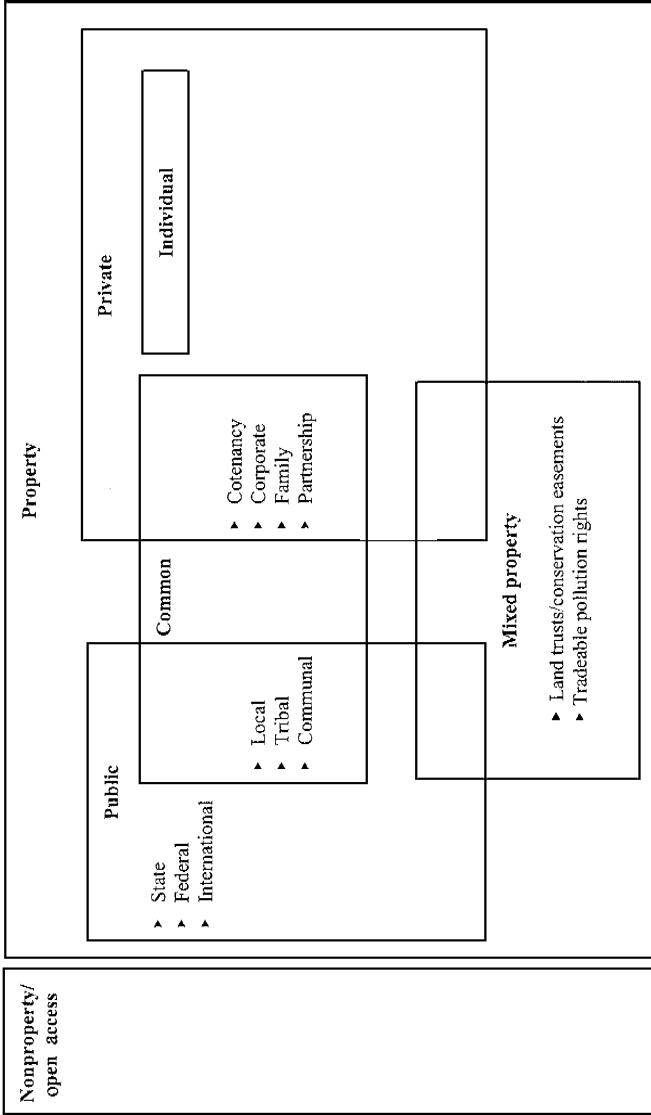


Figure 1 Relations among property regimes.