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LIBERTY, PROPERTY, ENVIRONMENTALISM

By Carol M. Rose

I. Introduction

In the conventional wisdom, environment and property are opposites. "The environment" consists of a kind of supposedly natural background of resources that are not subject to individual property rights, usually because they are so large or diffuse or distant. The atmosphere, the oceans, groundwater aquifers, remote forests and the wildlife that inhabits them—all these resources often carry the label "environmental." But this label also signifies that they are not owned by any individual, except perhaps metaphorically by "the sovereign,"[1] which in the United States would presumably mean "the people."

Moreover, another aspect of the conventional wisdom is that the absence of ownership is a great source of trouble for environmental resources: since no one owns them, no one invests in them or protects them from overuse. If any of their attributes become valuable, they have no defenders against the archetypical tragedy of the commons.[2] The issue is not lack of value. Quite the contrary, environmental resources are of enormous value, even or perhaps especially in their large and diffuse undivided form. The issue is rather that no one can claim exclusive rights—that is to say, property rights—over these resources in their undivided form. The tragedy ensues because individuals slice away claimable bite-sized portions as individual property, until the whole is ruined. Millions of bison kills drove the once fabulously multitudinous herds to collapse. Millions of exhaust pipes can turn the air into an opaque and unbreathable brew. With respect to environmental resources, the usual utilitarian virtues of property—encouragement of effort, planning, investment, and trade—seem to be totally missing, turning environmental resources into scenes of waste, profligacy, and immiseration.

Given this conventional opposition between property and environment, perhaps it is not surprising that much early environmentalism relied very little on ordinary property rights. Instead, most efforts went into governmental measures like the purchase or retention of park areas, and somewhat later into command-and-control legislation specifying

[1] See William Blackstone, *Commentaries on the Laws of England* (1766; Chicago and London: University of Chicago Press, 1979), 2:14–15 (attributing otherwise unowned things to the ownership of the "sovereign").

[2] Garrett Hardin, "The Tragedy of the Commons," *Science* 162, no. 3859 (1968): 1243–48.

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required measures for the use of a large array of environmental resources, ranging from catalytic converters on automobiles to double liners on hazardous waste sites to turtle exclusion devices on shrimp trawlers.[3]

All the more interesting, then, is the turn to property-rights approaches in the current effort to stave off climate change—reputedly the most gigantic environmental problem yet faced by human beings. Cap-and-trade programs are popping up throughout the international discussions of climate-change controls—that is, programs that cap the total allowable output of particular greenhouse gases, divide the allowable total into smaller individual allowances, and then allow the recipients to treat their allowances as tradable property rights. The Europeans have gone as far as anyone down the road to constraints on greenhouse gas emissions, and while they previously rejected cap-and-trade programs of all kinds as immoral trafficking in bad things, they have now developed their own active (if sometimes problematic) trading programs for greenhouse emissions. In the United States, a laggard with respect to greenhouse emission control, virtually all the legislative proposals of late 2007 and early 2008 embraced some version of market-based approaches to controlling greenhouse gases, generally cap-and-trade.[4] Meanwhile, another form of property-rights approach to environmental protection has grown rapidly both in the United States and in the wider world, namely, conservation easements in private parcels, and conservation reserves orchestrated through nongovernmental environmental groups. The latter in particular may ultimately connect with climate-change initiatives, insofar as forestry protection becomes a larger part of the effort to sequester carbon emissions.[5]

All this property-related activity on the climate-change front raises intriguing questions about the relationship of property rights to environmental protection. Contrary to the conventional view of environmental

[3] The first national park was Yellowstone, reserved in 1872. For a brief history of federal park reservations and related wilderness protection in the United States, see George Cameron Coggins, Charles F. Wilkinson, John D. Leshy, and Robert L. Fischman, *Federal Public Land and Resources Law,* 6th ed. (New York: Foundation Press, 2007), 1009–13. For the general pattern of command-and-control legislation in the generation after 1970 and the more recent move to market-oriented regulation, see Carol M. Rose, "Environmental Law Grows Up (More or Less), and What Science Can Do to Help," *Lewis and Clark Law Journal* 9 (2005): 273–94. For the specifics of turtle exclusion devices (TEDs), for which the United States' requirements have encountered international opposition on free-trade grounds, see George Cavros, "The Hidden Cost of Free Trade: The Impact of United States World Trade Organization Obligations on United States Environmental Sovereignty," *ILSA Journal of International and Comparative Law* 9 (2003): 563, 564–65.

[4] For a summary and analysis of congressional legislative proposals as of late 2007 and some comparisons with European efforts, see Victor B. Flatt, "Taking the Legislative Temperature: Which Federal Climate Change Proposal is 'Best'?" *Northwestern University Law Review Colloquy* 102 (2007): 123–50.

[5] See Mashiro Amano and Roger A. Sedjo, "Forest Sequestration: Performance in Selected Countries in the Kyoto Period and the Potential Role of Sequestration in Post-Kyoto Agreements" (2006), http://www.rff.org/Documents/RFF-Rpt-ForestSequestrationKyoto.pdf. See also Carol M. Rose, "Big Roads, Big Rights: Varieties of Public Infrastructure and Their Impact on Environmental Resources," *Arizona Law Review* 50, no. 2 (2008): 409–43.

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resources as unowned or even unownable, the new initiatives hope to deploy property rights as a central means by which to conserve these seemingly unmanageable, vulnerable, and valuable resources.

Can property rights help to solve environmental problems after all, especially the one problem that currently looms largest in the world's consciousness, climate change? The answer I put forward in this essay is that property-rights approaches are important and feasible, but that there are many pitfalls that will need to be avoided. Those pitfalls can be observed from our experience with property-rights regimes for much less ambitious subjects—subjects like land, minerals, wild animals, and terrestrial water sources.

II. Evolutionary Stories

The "tragedy of the commons" is a pessimistic story, named by the biologist Garrett Hardin in his 1968 essay of that name, but well known to resource economists considerably earlier.[6] The basic idea is that resources subject to open access—like a grazing field, a fishery, or the atmosphere—present potential users with a miniature cost-benefit calculation. Use of these resources (for grazing, fishing, or pollution storage, respectively) brings the full benefit of the taken portion to the user, while costing that user only a fraction of any damage inflicted on the larger resource, since the cost of the damage is spread out among all the other users. Conversely, investing in the larger resource's maintenance or regeneration imposes the entire investment cost on the user while bringing her only a fraction of the benefit, since she shares the benefits with all the other users. These scenarios give powerful incentives to exploit the resource and to refrain from investing. This is particularly true because the user suspects that all or most other users are making the same calculations. Essentially, the tragedy of the commons is a failure of coordination among players who could do best collectively by cooperating and deploying a modicum of self-restraint, but whose individual motivations are all to consume without restraint. Hardin suggested, and his disciple William Ophuls strongly argued, that the solution to this problem was necessarily either a turn to property rights or to the state, Leviathan.[7] More manageable and more easily divisible resources like land might be turned into property, but because large and diffuse environmental resources are so resistant to propertization, the upshot seems to be that only Leviathan can manage them. The problem is that property regimes on a smaller scale, and Leviathan on a larger one, do not simply emerge spontaneously; both

[6] See Hardin, "Tragedy of the Commons." For an earlier and more precise treatment by a resource economist, see H. Scott Gordon, "The Economic Theory of a Common Property Resource: The Fishery," *Journal of Political Economy* 62, no. 2 (1954): 124–42.

[7] William Ophuls, *Ecology and the Politics of Scarcity* (San Francisco: W. H. Freeman, 1977), 147–56.

institutions require coordination, and coordination raises the same "tragic" collective-action issues that appear in the original commons problem.[8]

In the opposite corner from the tragedy of the commons, however, is another widely told and much more optimistic story about property, one that does not go deeply into the coordination or collective-action problem but that nevertheless argues that property rights do emerge as the need for them unfolds. An early teller of this optimistic story was the eighteenth-century legal scholar William Blackstone, who described the supposed origin and evolution of property before laying out the details of English property law in his *Commentaries.*[9] A much more recent narrator is the economist Harold Demsetz, whose story about the emergence of property rights in the eighteenth-century Canadian fur trade appeared in a now-classic essay.[10]

A particularly clear exposition of the optimistic story, together with several interesting examples, can be found in an essay by two other modern economists, Terry Anderson and P. J. Hill. They begin with the premise that property rights are not costless, and hence property is unlikely to develop when it is not worth it to anyone, notably when a given resource is plentiful by comparison to the demand for it. But if a resource becomes more valuable (or the cost drops for defining and maintaining property rights), then the relevant parties will expend the necessary effort to subject the resource to property rights, and indeed to ever more refined versions of property rights. Hence, on the account offered by Anderson and Hill, shortly after the middle of the nineteenth century cattlemen began to run their stock on the open range without many signals of ownership. But as the number of stock (and potential thieves) multiplied, cattlemen began to use roundups and branding as rudimentary methods of signaling and enforcing property rights, and finally turned to fenced-in range, particularly after the invention of barbed wire. All these moves, Anderson and Hill argue, occurred in tandem with the increased value of beef and, thanks to barbed wire, the lower cost of defending property rights.[11]

Here as in other versions of this much-told optimistic tale, property regimes emerged to meet increasing needs for resource management. It takes very little to project this story onto new-fangled conservation easements, or onto the almost ethereal property rights created for greenhouse gas allotments. Both can be envisioned as simply another ratcheting up of the level of inventiveness and sophistication, as people

[8] James E. Krier, "The Tragedy of the Commons, Part II," *Harvard Journal of Law and Public Policy* 15 (1992): 325, 336–38.

[9] Blackstone, *Commentaries,* 2:2–11.

[10] Harold Demsetz, "Toward a Theory of Property Rights," *American Economic Review Papers and Proceedings* 57, no. 2 (1967): 347–58.

[11] Terry L. Anderson and P. J. Hill, "The Evolution of Property Rights: A Study of the American West," *Journal of Law and Economics* 18, no. 1 (1975): 163–79.

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meet increasingly intense resource challenges with new kinds of property rights and regimes.

III. What Can Go Wrong?

Tragedy or comedy? Will property stories tend toward a woeful demise or a happy and fruitful ending, for environmental resources as well as others? The pure tragedy story is obviously overly lugubrious. As institutional economists, political scientists, and historians have pointed out repeatedly, people somehow do overcome their collective-action problems to deal with some resource issues—perhaps most dramatically, to manage the very "tragic" example that Hardin used as a metaphor, the medieval agricultural commons, whose common-field governance regimes in fact enjoyed a longevity of almost a thousand years.[12] And the medieval common fields are not the only example. Certain kinds of groups—especially those whose members know one another well and who can observe and interact with one another—often manage to establish effective property regimes, especially when they are working with certain kinds of resources. Robert Ellickson calls these groups "close-knit"; they are likely to be linked together by ties of family, geography, and perhaps religion. All over the world, people in groups like these have organized property regimes to manage common-pool resources, typically in agriculture, grazing, irrigation, fishing, and more modernly, scientific information.[13]

Nonetheless, the comedy or happy-ending story is clearly not always correct either. If it were, we would be unlikely to have evidence of so many decimations of valuable fish and wildlife, desertified former forests and grasslands, polluted waterbodies, or murderously filthy air.[14] No

[12] See Susan Jane Buck Cox, "No Tragedy of the Commons," *Environmental Ethics* 7 (Spring 1985): 49–61 (illustrating the absence of "tragedy" on the medieval common fields). See also Henry E. Smith, "Semicommon Property Rights and Scattering in the Open Fields," *Journal of Legal Studies* 29, no. 1 (2000): 131–69 (describing and offering an economic analysis of the elaborate medieval village systems for scattering individual fields and rotating them in and out of common grazing usage). Smith reports that there is some evidence that particular commons originated with individual farmers who agreed to "common" their holdings.

[13] Robert C. Ellickson, *Order without Law: How Neighbors Settle Disputes* (Cambridge, MA: Harvard University Press, 1991), 177–83. For a variety of examples, see Elinor Ostrom, *Governing the Commons: The Evolution of Institutions for Collective Action* (Cambridge: Cambridge University Press, 1990). For specific examples, see Robert McC. Netting, *Balancing on an Alp: Ecological Change and Continuity in a Swiss Mountain Community* (Cambridge and New York: Cambridge University Press, 1981) (community grazing); Paul B. Trawick, *The Struggle for Water in Peru: Comedy and Tragedy in the Andean Commons* (Stanford, CA: Stanford University Press, 2003) (community irrigation); James M. Acheson, *The Lobster Gangs of Maine* (Hanover, NH: University Press of New England, 1988) (fishing community); and Robert P. Merges, "Property Rights Theory and the Commons: The Case of Scientific Research," *Social Philosophy and Policy* 13, no. 2 (1996): 145–67.

[14] See, e.g., Warren Dean, *With Broadax and Firebrands* (Berkeley, Los Angeles, and London: University of California Press, 1995) (describing the long decimation of the Brazilian Atlan-

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effective property regimes emerged in time to manage these valuable resources when they came under pressure.

In assessing the chances for managing environmental resources—and particularly climate change—through property-rights approaches, it is important to consider what can go wrong with the evolution of property rights to meet resource needs. In the following five subsections, I offer a compilation of some of the major things that can go wrong, though the list is certainly not exhaustive. I use examples from property regimes in resources that are simpler and more easily subjected to property rights than greenhouse gases ever will be, on the theory that if things can go wrong with these resources that are more readily and cheaply brought under a property regime, we should be on the lookout for related problems all the more with respect to climate change.

Here is the list:

A. Potential participants may fail to agree on a property regime

There are, of course, a great number of reasons why people never come to agreement at all on a new or revised system of property rights to give order to their use of resources.

(1) The most obvious reason is that while property rights may be private, a modern property *regime* is a public good, either a formal public good like national defense, or an informal one like the cattle roundups that Anderson and Hill describe. A property regime serves an entire collectivity of people who hold and observe property rights. Nothing is lost to the regime by any individual's participation, a feature that much reduces any motivations to exclude others from the regime.[15] By the same token, however, no one has any particular motivation to create the regime in the first place. A property regime requires investment to get underway—often investment in the form of discussions, committee meetings, and cajoling others—but any such investment is little more than a gift to the others who can participate in the

tic Forest); Joshua Hamer, "A Prayer for the Ganges: Across India, Environmentalists Battle a Tide of Troubles to Clean Up a River Revered as the Source of Life," *Smithsonian* 38, no. 8 (November 1, 2007): 74 (describing the extreme pollution of the Ganges); and William Wise, *Killer Smog: The World's Worst Air Pollution Disaster* (Chicago: Rand McNally, 1968) (recounting London's smog attack in the 1930s).

[15] This is not to say that property regimes do not sometimes exclude particular persons from taking ownership roles. Notable historical examples in U.S. society are slaves and married women, neither of which group was allowed to own property in the past. In other societies, there have been classes of the non-elite for whom some resources were *tabu* or *kapu,* as in Hawai'i until some years into the nineteenth century. Absence of ownership rights keeps these persons in dependent or subordinate roles. Nevertheless, even dependent persons are part of the property regime's system of *obligations*—they are not to disrupt the property of others. For property regimes as a source of obligations on all participants, see J. E. Penner, *The Idea of Property in Law* (Oxford and New York: Oxford University Press, 1997), 25–27.

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regime without bothering to go to the initial meetings. Under those circumstances, unless some Solon steps up, a property regime may never get off the ground, or if it does, it does so for almost accidental reasons. Anthropologist Bonnie McCay, a student of informal property regimes among fishing communities, has made the very useful observation that these informal property regimes often spring up simply as a means for managing and avoiding disputes,[16] an observation to which I will return. But in the absence of some lasting agreement to solve disputes through a system of mutually recognized entitlements, the relevant parties may simply continue to fight and grab, with the accompanying waste of resources and human efforts.

Similarly, even if people do manage to establish a property regime, they may be unable to change the regime to conform to new situations. Fishermen may agree, for example, on some variation of a first-possession rule favoring the first one to capture an individual fish, or they may develop some other kind of allocation rules for larger and more dangerous marine animals, whose capture requires group efforts. But they may never come up with property rules to manage the stock as a whole. This was a problem for nineteenth-century whalers; the whalers' on-the-spot rules for possessory rights added to the efficiency of the hunt, reducing conflict and encouraging cooperative efforts within small groups, but if anything their localized cooperation exacerbated the never-addressed global problem of declining whale stocks.[17] The global problem involved whaling communities from all over the world, and until very recently, none ever even considered creating the global public good of an overarching property regime to maintain worldwide stocks.

(2) A second reason why people often cannot agree on a property regime (whether initially or at a revision stage) is that they get snarled in the distributional conflicts that a property regime raises. Property rights make obvious the issue of who gets what, and this can cause problems. From a purely utilitarian point of view, the initial distribution of entitlements in a valuable resource is a distinctly secondary issue if the entitlements can be traded, since trade will enhance the movement of goods and services to those who value them most, no matter who received them in

[16] Bonnie J. McCay, "Emergence of Institutions for the Commons: Contexts, Situations, and Events," in Elinor Ostrom et al., eds., *The Drama of the Commons* (Washington, DC: National Academy Press, 2002), 361, 370–71.

[17] At the local point of the kill, whalers adopted different rules for ownership of speared whales. Sometimes the right to the carcass was allocated to the whalers who successfully killed the animal and tagged it with a waif-pole; but for more dangerous whale species, where the first approach was particularly perilous, property in the carcass was allocated to the first whalers to cast a spear that the whale could not throw off, even if the kill were completed by others. Other participants in the hunt received various forms of compensation for their contributions. All these local rules aided any particular hunt, but did not address and may have exacerbated the larger issue of overhunting by all whalers. See Ellickson, *Order without Law,* 196–206.

the first instance. Besides, much wealth is created simply through trade, which encourages specialization in the areas of each trading partner's comparative advantage. On this utilitarian perspective, the important thing is simply to get a new or revised property regime under way for valuable resources, no matter who gets what at the outset.[18]

But distributional issues matter a great deal to the parties involved, both from a perspective of self-interest and from a perspective of fairness and desert.[19] Natural resources are replete with instances in which parties fail to reach value-maximizing agreements over entitlements because they cannot agree on distribution, leading to situations that would be ludicrous if they were not so wasteful. A nineteenth-century case in the early Pennsylvania oilfields gives an example. In *Hague v. Wheeler* (1893), a natural gas developer sued a neighboring landowner to stop him from flaring off the natural gas that underlay both their properties; this was evidently a kind of extortionate effort on the part of the neighboring landowner, aimed at inducing the gas entrepreneur to run a pipeline to his property. The trial court held that flaring off natural gas was an unreasonable use of their common-pool property, but the Supreme Court of Pennsylvania reversed the lower court's decision, holding that the landowner was entitled to do as he pleased—which included wasting the commonly-held resource.[20]

Even in cases like this, when courts step in to allocate entitlements, bad blood may still keep the neighbors from ever coming to terms over a trade.[21] Cap-and-trade systems are now working their way into American fish stock management, but it has taken the biological collapse of many important fisheries to induce fishermen to try these property-rights schemes. A major stumbling block has been the choice of a basis for allocating newly-limited rights: Should the basis be each fisherman's past catch levels? Boat ownership? Boat capacity? Time spent as a crew member? All these possibilities yield different distributions, and the parties involved are acutely aware of the differences.[22] Gary Libecap, an economist who studies such common-pool problems, argues that distributional

[18] For the locus classicus of this argument, see Ronald H. Coase, "The Problem of Social Cost," *Journal of Law and Economics* 3, no. 1 (1960): 1–44.

[19] For an exploration of distributional conflicts that may delay new or revised property regimes, see Gary Libecap, *Contracting for Property Rights* (Cambridge: Cambridge University Press, 1989); see also Robert Cooter, "The Cost of Coase," *Journal of Legal Studies* 11, no. 1 (1982): 1–33. The question of fairness and desert, for example, undoubtedly affected popular attitudes toward Russia's newly wealthy "oligarchs" and cleared the way for President Vladimir Putin's prosecution of these entrepreneurs. See Carol M. Rose, "Privatization—The Road to Democracy?" *Saint Louis University Law Journal* 50, no. 3 (2006): 691, 707.

[20] *Hague v. Wheeler,* 27 A. 714 (Pa. 1893).

[21] Ward Farnsworth, "Do Parties in Nuisance Cases Bargain after Judgment? A Glimpse Inside the Cathedral," *University of Chicago Law Review* 69 (1999): 373–436 (describing the dearth of bargaining after nuisance suits are settled in favor of one party or the other).

[22] See Katrina Wyman, "From Fur to Fish: Reconsidering the Evolution of Private Property," *New York University Law Review* 80, no. 1 (2005): 117, 193–97 (describing some of the conflicts over allocation of fishing rights); see also Tom Tietenberg, "The Tradable Rights

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issues routinely disrupt the process of what he calls "contracting for property rights," and the larger and more heterogeneous the group that must agree, the slimmer the chances and the longer the delay before they arrive (if ever) at property arrangements that can staunch the common-pool hemorrhage.[23]

(3) A third reason why people often fail to come to terms on a property-rights regime is that falling back on Leviathan offers an escape from the knotty problems that property rights present. That is to say, people may settle on a command-and-control regime to manage resources, because command-and-control on the surface appears to require the same performance of all participants, thus evading the difficult distributional issues. Efforts to manage fish stocks often take a command-and-control turn long before turning to property approaches. For example, early-stage regulatory efforts are often prohibitions of certain kinds of gear or permission to fish only in certain time periods, precisely because command-and-control regulations like these avoid difficult confrontations over the distribution of entitlements. The disadvantage of these regulations, however, is that they can be very wasteful, with examples that would again be ludicrous if they were not so sad—like the tightly limited fishing seasons that fishermen turn into "derbies," taking on so many fish that their boats sometimes sink under the weight.[24] And indeed, even the appearance of egalitarianism is deceptive in command-and-control regulation. We learned early on from command-and-control air pollution measures that seemingly equal requirements have great cost differences in different locations and under different circumstances.[25]

Failure to agree is thus an important and multifaceted reason why property regimes never come into place or fail to assimilate to new pressures on resources. But there are other reasons as well for the failure of property regimes.

Approach to Protecting the Commons: What Have We Learned?" in Ostrom et al., eds., *The Drama of the Commons,* 197, 208–9.

[23] Libecap, *Contracting for Property Rights,* 21–23.

[24] Shi-ling Hsu, "Fairness vs. Efficiency in Environmental Law," *Ecology Law Quarterly* 31 (2004): 303, 375–76, notes that uniform restrictions on technology predate market-based regulations because they seem more fair and raise fewer objections. For "derby" or "olympic" fishing practices, see Carrie A. Tipton, "Protecting Tomorrow's Harvest: Developing a National System of Individual Transferable Quotas to Conserve Ocean Resources," *Virginia Environmental Law Journal* 14 (1995): 381, 391–95.

[25] Hsu, "Fairness vs. Efficiency," 370, notes with respect to air pollution control that a coal-burning plant in one location might more cheaply burn low-sulfur coal, whereas another plant elsewhere would install exhaust pipe scrubbers; a uniform technology requirement to install scrubbers favors the latter over the former. Similarly, it is more difficult to meet uniform air quality standards in a heavily populated inversion area like Los Angeles than in a windswept and lightly populated area like the western plains. On this issue, see James E. Krier, "The Irrational National Air Quality Standards: Macro- and Micro-Mistakes," *UCLA Law Review* 22, no. 1 (1974): 323–42.

B. A property regime may be ineffective or inconsistent

There are a number of reasons why property regimes may be ineffective, many leading back to governmental incapacity. In the simplest case, a government may lack the financial resources and administrative capacity to project the basic elements of a modern property regime throughout its territory. Record systems, impartial enforcement, and dispute resolution are elements of a property regime that may not function in a weak government. Corruption can corrode the effectiveness of property systems even further, as when technical objections block land registration until the landowner pays under the table, or when supposedly neutral enforcement agents wink at violations by favored persons or firms.

Of course, formal property regimes are not the only option. Even in the absence of modern forms of property rights, people use informal systems to manage resources that are important to them. These regimes are not perfect, however, either from the perspective of economic development or of libertarian independence. For one thing, informal regimes are generally limited to resources that are relatively easily monitored, usually involving extractive activities of one sort or another, like grazing or water use. Indeed, an important criterion for the success of informal property rights is that individual entitlements can be ordered in such a way that they can be monitored by members of the group, and particularly by the most affected members of the group. As an example, Elinor Ostrom cites the community-based irrigation systems in which each farmer along the channel can observe the time and rough quantity of water that is diverted by the neighboring farmer who precedes him in turn.[26] But informal regimes do relatively little to address issues of pollution, which are much harder to monitor, and in any event, community members may be indifferent to pollution that affects outsiders rather than the community members themselves. In addition, long-lasting informal rights regimes depend for enforcement on the community and its implicit or explicit hierarchies. Customary practices are likely to favor certain groups over others (notably men over women); and they are generally not welcoming to outsiders, since outsiders could disrupt the social relations that hold the community together. Moreover, customary informal property regimes tend to be very complex; these complexities serve a purpose by cementing ties among the community members, but they further limit the ability of outsiders to participate through trade. Hence informal regimes are constrained in a variety of significant ways: for example, in their ability to raise capital or to make room for new ideas.[27]

[26] Ostrom, *Governing the Commons,* 73–74.

[27] For these and other pros and cons of community-based management regimes, see Carol M. Rose, "Common Property, Regulatory Property, and Environmental Protection: Comparing Community-Based Management to Tradable Environmental Allowances," in Ostrom et al., eds., *The Drama of the Commons,* 233–57.

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Modern property regimes depend on governmental intervention. With their formal rights, relatively easy trading conditions, and openness to the participation of strangers, these rights regimes are aimed at overcoming the limitations of informal regimes. Perhaps the worst-case scenario for resource management, however, occurs when a nominally rational and modern central government attempts to impose a modernist system of formal property rights on a customary regime, and succeeds only partially. Under those circumstances, citizens live in a paralyzing situation of what Daniel Fitzpatrick calls "legal pluralism," a condition of conflicting regimes of entitlement that leaves all participants insecure in their claims, and that encourages all to take while the taking is possible. Among his many examples of this problem, Fitzpatrick cites several areas in Africa, where earlier colonial efforts to modernize property rights served chiefly to undermine long-standing customary regimes without providing citizens with effective modernist property institutions.[28] In the absence of a unified and effective system of property protections, natural resources are much at risk.

A variant on the theme of legal pluralism may occur within a national government itself, a situation that is illustrated strikingly in a study of the modern Brazilian Amazon region by economists Lee Alston, Gary Libecap, and Bernardo Mueller. As they argue, the Brazilian legal system provides strong property protection in the civil code, yet not only does that protection go unenforced in remote areas, but it is contradicted by an opposing constitutional policy that allows settlers to claim "unproductive" lands for themselves. These contradictory legal elements result in great uncertainty about property rights, and they fuel the violent confrontations that occur between land-hungry settlers and their proponents on the one hand, and determined owners of outsized land grants, the old *latifundia*, on the other. Caught in the middle is the Brazilian rainforest, subject to burns and clearing as both sides use self-help to staunch their claims with proof of "productive" use.[29]

C. Even an effective property regime may revolve around purposes incompatible with environmental protection

Another major category of things that can go wrong is that people may develop strong and efficacious property regimes, but these regimes may focus on goals that treat environmental resources with indifference or hostility.

[28] Daniel Fitzpatrick, "Evolution and Chaos in Property Rights Systems: The Third World Tragedy of Contested Access," *Yale Law Journal* 115 (2006): 996–1048; for African examples, see pp. 1041–42.

[29] Lee J. Alston, Gary D. Libecap, and Bernardo Mueller, *Titles, Conflict, and Land Use: The Development of Property Rights and Land Reform on the Brazilian Amazon Frontier* (Ann Arbor: University of Michigan Press, 1999), 17, 22–25, 176–77, 202.

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The mining camp rules of the mid-nineteenth-century California gold rush are often used as an example of the spontaneous generation of property regimes not only within a close-knit group, but among complete strangers. Newly arrived prospectors quickly hit upon rules for the size of individual claims, for the events that would count as abandonment, and for the mechanisms to be used in resolving disputes, as well as other rules about the priority of claims to use the waters in nearby streams for mining purposes. Historians have discussed the degree to which the mining camp rules were original to the gold rush participants. But original or not, these rule systems were certainly a remarkable achievement for men who were pouring in from all over the world and who were strangers to one another—a motley collection of men who from all appearances should have turned gold mining into a total free-for-all.[30]

From an environmental perspective, however, one of the notable features of the mining camp rules was that—as anthropologist Bonnie McCay has observed of many informal regimes—they focused entirely on assisting miners to avoid disputes and to invest more or less rationally in their quest for gold. These rules completely ignored the enormous impact that mining had on the surrounding environment. Gold rush miners ripped the hills apart with hydraulic water jets, and they trashed salmon runs with sediments and debris (meanwhile casually murdering complaining indigenous salmon fishers).[31] The detritus left by gold rush miners is still visible to this day in the California hill country. If anything, quite like the whalers' rules, the gold miners' rules increased the environmental depredations simply because they reduced conflicts among miners themselves.

Over the longer run, the gold rush mining camp rules about water set the stage for the creation of the appropriative water rights regimes of the western states, regimes that have been used to provide water for western agriculture as well as mining and a number of other uses. Appropriative systems follow rules of priority, whereby the first to divert water from a stream and use it for a "beneficial" purpose may continue to claim the amount of water diverted in subsequent seasons. The second diverter comes second in priority, and so it goes until the stream water is entirely claimed or, in many cases, overclaimed. It is often said that agriculture would have been impossible in the dry west without this striking deviation from the humid eastern states' "riparian" rules, which linked water

[30] For a very modest sampling of the literature on the generation of legalistic rules among gold rush miners, see John Umbeck, "The California Gold Rush: A Study of Emerging Property Rights," *Explorations in Economic History* 14, no. 3 (1977): 197–226; Richard O. Zerbe and C. Leigh Anderson, "Culture and Fairness in the Development of Institutions in the California Gold Fields," *Journal of Economic History* 61, no. 1 (2001): 114–43; and Andrea McDowell, "Real Property, Spontaneous Order, and Norms in the Gold Mines," *Law and Social Inquiry* 29, no. 4 (2004): 771–818.

[31] Arthur F. McEvoy, *The Fisherman's Problem: Ecology and Law in the California Fisheries* (Cambridge: Cambridge University Press, 1986), 44, 47–48.

usage to adjacent landownership and which generally attempted to keep water in the stream for subsequent streamside users.[32]

There are many critiques of western water law, but for many years the system has served agricultural, mining, and other commercial and municipal activities in the western states. What it has not served well is the set of environmental resources that depend on water that remains in the stream—notably fish and other wildlife, as well as wetlands and their numerous ecological services, not to speak of recreational river rafting. There is a version of "path dependency" in western water law that keeps this body of law from easy transformation toward more conservationist ends—that is, a difficulty in adapting because of prior institutional choices. The central method for claiming appropriative rights is diversion of water from the stream, but this is obviously an activity that is difficult to square with claiming rights for instream uses. This problem of rights-definition can be addressed, as it has been in some states, but it involves a major shift in people's thinking about the ways that water rights can be claimed.[33]

Another kind of path dependency occurs simply because people have acquired rights with one purpose in mind and only later realize that another purpose might have been more valuable; by that time, it may be costly to change course. Resource economist Dean Lueck, for example, writes that farmers generally attempt to make the most valuable uses of their land *net of transaction costs.* Those uses could theoretically include wildlife conservation (e.g., for a birding preserve or hunting club).[34] But the transaction costs are the rub: if farmland has already been divided among a number of farmers, they may find that the high cost of bargaining among themselves impedes them from consolidating their holdings into a single unit that is large enough to be useful for wildlife purposes. Much the same occurs with oil and gas discoveries. As economists Gary Libecap and Steven Wiggins have illustrated, after a number of landowners divide up the surface property that overlays an oil or gas reservoir, they may never succeed in negotiating a voluntary unitization agreement for the most efficient exploitation of a later-discovered underlying resource.[35]

In all these instances, property rights have been defined with certain purposes in mind, while ignoring other possible goals—notably, envi-

[32] See, e.g., David B. Schorr, "Appropriation as Agrarianism: Distributive Justice in the Creation of Property Rights," *Ecology Law Quarterly* 32, no. 3 (2005).

[33] For rights-definition issues in water and their impact on instream flows, see Carol M. Rose, "From H_2O to CO_2: Lessons of Water Rights for Carbon Trading," *Arizona Law Review* 50, no. 1 (2008): 91–110; for some of the practical issues, see Janet Neuman, "The Good, the Bad, and the Ugly: The First Ten Years of the Oregon Water Trust," *Nebraska Law Review* 83 (2004): 432–84.

[34] Dean Lueck, "Property Rights and the Economic Logic of Wildlife Institutions," *Natural Resources Journal* 35 (Summer 1995): 625–28, 635–44.

[35] Gary D. Libecap and Steven N. Wiggins, "Contractual Responses to the Common Pool: Prorationing of Crude Oil Production," *American Economic Review* 74, no. 1 (1984): 87–98.

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ronmental ones—and in fact they may make the vindication of other goals either difficult or impossible.

D. Methods for defining property may not work well for environmental resources

Because property rights must command the respect of nonowners, it is very important that property rights give off signals that are recognizable to the relevant universe of nonowners.[36] One very important reason why environmental resources are often not included in property-rights regimes is that it is difficult to find recognizable markers for environmental resources. Land rights can be signaled relatively easily by fences or cultivation. But water, air, and wildlife stocks are much more difficult to mark in any tangible way. Moreover, the tangible methods of marking out rights often entail the destruction of environmental resources. Diversion from streams under western water law was mentioned above. Diversion is a tangible way to claim a right to a certain amount of water, since nonowners can observe the diversion itself, but diversion necessarily removes the water from the stream. Similarly, a person can claim the right to particular animals or fish in a wildlife stock by killing or capturing them, but this method of rights-marking necessarily removes the animals from the larger stock. Even land rights are often signaled by environmentally destructive methods. Cutting trees or planting crops are common methods of signaling ownership of land, but an uncultivated or un-logged forest lot may appear to be unclaimed or abandoned, even though the owner has purposefully kept the area wild. In general, passive uses are at a disadvantage in property regimes. Nonphysical claim-marking methods like recording or registration systems can ease many of these difficulties, but these systems are apt to be at their weakest in the remote areas in which environmental resources may be most valuable.[37]

Another feature of property rights also undercuts their effectiveness for environmental uses. A very important aspect of modern property rights is that they may be traded widely, because, as I mentioned earlier, trade encourages specialization and allows resources to gravitate to those who most wish to have them. But if property rights are to be tradable to the world at large, they must also be maintained in relatively simple and standardized form; otherwise, potential buyers will be uncertain what they are getting, and they may be frightened out of transactions where they have to be on guard for idiosyncratic forms of property.[38] Idiosyn-

[36] Henry Smith, "The Language of Property: Form, Context, and Audience," *Stanford Law Review* 55 (April 2003): 1105–91. See also Carol M. Rose, "Property and Language," *Yale Journal of Law and the Humanities* 18, no. 1 (2006): 1–28.

[37] See Rose, "Big Roads, Big Rights."

[38] Thomas W. Merrill and Henry E. Smith, "Optimal Standardization in the Law of Property: The *Numerus Clausus* Principle," *Yale Law Journal* 110, no. 1 (2000): 1–70.

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cratic and complex property regimes can work reasonably well in small and close-knit groups, where the members are familiar with local complexities, but they will not serve a larger market well. But it is larger marketability that adds to the value of entitlements.

The problem for environmental resources is that these resources themselves are often complex, and they are not easily shaped into fungible, standardized rights that can be traded back and forth over a wide range. For example, if a wetland is to provide such ecosystem services as flood control or fish spawning, its location matters, as does the consistency of its plant and animal life. Tradable environmental property regimes within the United States have functioned reasonably well for sulfur dioxide emissions, the major precursor gases to acid rain, although even here there are important nonfungibilities of location; trades from downwind to upwind are considerably more damaging than trades in the opposite direction. Trades have been far more problematic for wetlands or habitat. These more complex resources cannot be traded against one another without significant alterations in the very features that make them valuable: location makes a difference, for example, to a wetland's ability to tame floodwaters or provide fish spawning grounds. One may take other measures to assure against losing the distinctive ecosystem values of wildlife habitat, old growth forests, or wetlands (for example, by allowing trades only within restricted specifications), but such specifications necessarily limit the pool of potential trading possibilities.[39]

Considerable thought has gone into the ways that various aspects of environmental resources might be broken down and classified in trade—for example, creating elaborate point systems for the different ecosystem services performed by wetlands, which are the subjects of trade under some legislation.[40] If a real estate developer of, say, a beach hotel cannot avoid destroying legally protected wetlands, the ecosystem damage can be added up and the developer can purchase an offsetting quantity in a "wetlands bank" established elsewhere by an environmental entrepreneur. Flood protection would receive a certain number of points, aquifer recharge a certain amount more, bird habitat still more, and so on. Property-rights regimes of this sort are certainly conceivable, but they are likely to be complex and expensive. Indeed, wetlands banks exist now for purposes of real estate development trades, but with a few exceptions, these

[39] James Salzman and J. B. Ruhl, "Currencies and the Commodification of Environmental Law," *Stanford Law Review* 53 (2000): 607, 637.

[40] Lisa Wainger, Dennis King, James Salzman, and James Boyd, "Wetland Value Indicators for Scoring Mitigation Trades," *Stanford Environmental Law Journal* 20 (2001): 413–78. For a more general discussion of the issues of valuation, see James Salzman, "Valuing Ecosystem Services: Notes from the Field," *New York University Law Review* 80 (2005): 870–961. The chief U.S. legislation allowing trades is the Clean Water Act (Federal Water Pollution Control Act, 1972), sec. 404, which protects wetlands but under certain circumstances permits unavoidable damage to wetlands, so long as the damage is offset by wetlands created elsewhere. See Salzman, "Valuing Ecosystem Services," 908–9.

banks use only very simple comparative-value calculations, resulting in trades that may in fact forfeit substantial wetlands values.[41]

Efforts to turn complex environmental resources into property rights thus face serious obstacles, and these can only be overcome in ways that are all at least somewhat unattractive. First, one can ignore the differences among various environmental resources and allow trading in gross rights, despite potential losses. Second, one can account for the differences through constraints and hedges on trading. And third, one can pay the costs of property definitions that take into account the distinctive features of particular environmental resources. The first option is one that the United States has taken with the cap-and-trade program in sulfur dioxide; the second with wetlands trades; the third is still under development, no doubt because of the expense.

E. Modern property regimes tend to create resource monocultures, and these may undermine environmental resources

Private property and freedom of contract are the basic building blocks of capitalism. The relative simplicity of modern property rights makes them tradable to a worldwide pool of bidders, and this feature in turn means that goods and services can circulate all over the globe. Moreover, the possibility of trade encourages individuals as well as regions to specialize in the activities in which they have a comparative advantage.

By the same token, however, trade and specialization also reduce local diversity in production. By contrast, small-scale economies are by necessity diversified and more or less self-sufficient on a local scale, because people in such economies must produce on the spot most or all of what they consume. But wider trade seriously modifies local diversification. Why buy the local leather goods if imported goods are cheaper and better? Indeed, this question raises one of the chief complaints against globalized trade: that products from elsewhere outcompete the array of locally grown or locally manufactured products, and this competition ultimately forces the locality to die off or to find a specialization of its own. The complaint is not a new one; a growing international trade in woolens encouraged the enclosure movement in sixteenth-century England, when landowners disrupted diversified common-field agricultural communities and enclosed the fields for the sole purpose of raising sheep.[42] Just as trade allowed those landowners to produce wool for distant markets, trade obviated their need for locally diversified goods. Then as now, local diversification is unnecessary where trade allows consumers to satisfy their needs from better if more distant sources.

[41] Salzman, "Valuing Ecosystem Services," 909–10.

[42] Carl J. Dahlman, *The Open Field System and Beyond: A Property Rights Analysis of an Economic Institution* (Cambridge and New York: Cambridge University Press, 1980), 153–70.

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The pattern described above is typical of an expanding capitalism: it tends toward localized monocultures. Another example is the relationship between the city of Chicago and its hinterlands during the nineteenth century, admirably described in William Cronon's 1991 book *Nature's Metropolis.* In order to feed the city's enormous appetites, both in its own right and as a trading depot for other parts of the United States, midwestern farmers turned the diverse tallgrass prairie into monocultures of wheat and corn; Michigan and Wisconsin loggers stripped bare the old-growth forests; while ranchers in the west turned the public lands into a vast feeding ground for beef cattle.[43]

Needless to say, these particular specializations had serious consequences for native plants and animals. But more generally, insofar as environmental resources (e.g., wildlife stocks) require diversified ecosystems, they are likely to suffer under an expanding capitalist resource regime that tends toward specialization and regional monocultures. This is not to say that modern property rights and freedom of contract, the essential elements of capitalism, are the bane of environmentalism. They are not, or at least not necessarily. Capitalism makes societies wealthier, and wealthier societies tend to lavish much more concern on environmental issues than poor ones do.[44] It is simply to note that one important aspect of capitalism—specialization—can run contrary to the well-being of environmental goods that require a diversified resource base.

IV. Climate Change and What May Go Wrong with Property Regimes

With this incomplete listing of potential problems that property-rights regimes may pose for the environment, let us turn to climate change, and to the efforts to use property-rights regimes to combat global warming. Are these efforts likely to encounter similar issues? Clearly they are. Very briefly, the following subsections illustrate how climate change control efforts map onto the environmental problem areas for property regimes more generally.

A. The first problem: Potential participants may fail to agree on a property regime

Climate change is a worldwide issue, and there could scarcely be a more daunting task than garnering worldwide agreement on any prop-

[43] William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: W. W. Norton, 1991), 97–102, 151–55, 200–204, 213–25.

[44] See Daniel C. Esty, "Bridging the Trade-Environment Gap," *Journal of Economic Perspectives* 15, no. 1 (2001): 113, 115, 119 (describing the "Kuznets curve" of worsening followed by improving environmental protection over the course of new economic development).

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erty regime, about any subject. Since the Rio Conference on climate change in 1992, a mix of national governments and nongovernmental organizations (NGOs) has been at work on crafting some kind of property regime to govern the emissions of the chief greenhouse gases (GHGs). But major disagreements still split the international community on what must be the most basic issue of all: Shall there be a worldwide cap on greenhouse gas production, to which all are committed? The United States has insisted on such a universal cap, to which less-developed countries (LDCs) must also commit, whereas the LDCs themselves adamantly refuse, taking the view that the major responsibility for emission control lies with already-developed economies.[45] A partial accord was reached in the 1997 Kyoto Protocol; this agreement binds the developed countries to reduce GHGs by an average of just over 5 percent by 2012, but it has placed no binding obligations on LDCs.[46] The United States refused to ratify the protocol. As a result, as of the writing of this essay in 2008, neither the United States nor major LDC producers of greenhouse gases, notably China and India, had committed to curb emissions to a particular capped level. This lag may well prove to be only temporary, but it suggests some of the difficulties of coming to agreement on the most basic property-rights issues for environmental protection.

Negotiations over a cap-and-trade property regime for greenhouse gases have also illustrated how wrangles can develop over much subtler issues, many of them, quite predictably, involving distributional questions. For example, if GHG caps are to be determined on the basis of a rollback of existing emissions—the most prevalent method for setting caps—then the choice of a rollback date matters a great deal, since any given target date affects different countries quite differently. The chosen rollback date of 1990 favored the European signatories while disfavoring the nonratifying United States; during the 1990s, the Europeans had made a number of moves toward non-carbon-based energy for other reasons, and thus fortuitously had already met more of their obligations.[47] Further disagreements have occurred over what counts or does not count as a suitable offset for GHG emissions—that is, what

[45] Paul G. Harris, "Common but Differentiated Responsibilities: The Kyoto Protocol and United States Policy," *New York University Environmental Law Journal* 7 (1999): 27–48.

[46] For background about the Kyoto Protocol as well as extensive up-to-date information on this and other efforts to deal with climate change, see the Pew Center on Global Climate Change Web site, www.pewclimate.org. The chief features of the Kyoto Protocol are that during the period 2008–2012, it requires developed countries to reduce greenhouse gas emissions by an average of 5.12 percent below 1990 levels, with further reductions to be negotiated in later rounds; it permits compliance via emission trades; it also permits emitters in developed countries to offset their own emissions by undertaking projects in LDCs that reduce GHGs there below the emission levels that would have otherwise occurred (the "additionality" requirement).

[47] Bruce Yandle and Stuart Buck, "Bootleggers, Baptists, and the Global Warming Battle," *Harvard Environmental Law Review* 26, no. 1 (2006): 177, 217–19.

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can be traded for what under the Kyoto Protocol. Credits for forests (as so-called carbon sinks, removing carbon dioxide from the air) have been particularly contentious, again pitting Europe, with its few forests, against the much more forested United States.[48] With these numerous serious disagreements, it is remarkable that any movement at all has occurred with respect to property-rights-oriented greenhouse gas controls.

B. The second problem: A property regime may be ineffective or inconsistent

The great advantage of cap-and-trade programs is that they allow for substitute performance. A GHG emitter has the option of reducing emissions or buying emission permits from some other source, but purchased permits necessarily come from other sources which have reduced or otherwise sequestered GHGs. Here as in all trading regimes, the great advantage of substitute performance is that it allows all parties to take advantage of the lowest-cost options for pollution reduction, and it encourages multiple parties to experiment in developing those low-cost options.[49] The credibility of the entire system, however, depends on reliable monitoring and enforcement at the business end—that is to say, where the emission reduction or sequestration is supposed to take place. It is at that point that ineffective or weak property rights could be most damaging. Greenhouse gas emitters in developed countries could well find numerous opportunities to purchase emission rights by contracting for reduced emissions in less-developed countries (LDCs); among other things, it is likely to be cheaper to install controls on new plants in LDCs than to retrofit older ones in more-developed countries. But LDC leaders may well have conflicting motives about such trades, given their sense of urgency about enhancing economic growth; meanwhile, on-the-scene local actors may well disdain what they regard as do-gooder meddlers from far away. Those patterns could well lead to widespread surreptitious flouting of the terms of GHG trades, coupled with lax enforcement on domestic industries that are purportedly decreasing emissions.[50] LDCs are not the only offenders, of course. In all parts of the world, unverified promises to offset GHGs by reduced emissions

[48] Ibid., 221–23.

[49] Bruce A. Ackerman and Richard B. Stewart, "Reforming Environmental Law," *Stanford Law Review* 37 (1955): 1333, 1341–42.

[50] Flatt, "Taking the Legislative Temperature," 143. Keith Bradsher, "Outsize Profits, and Questions, in Effort to Cut Warming Gases," *New York Times,* December 21, 2006, A1, describes a notorious example in which payments were made to dismantle a Chinese air-conditioning chemical production plant, but were then applied to the expansion of the manufacturing operation.

are already a feature of trading regimes, and much hucksterism may be expected in the future.[51]

C. The third problem: Even an effective property regime may revolve around purposes incompatible with environmental protection

With respect to questions of climate change, this third problem is nowhere near as serious as the first two, i.e., garnering agreement and securing consistent and effective enforcement. Cap-and-trade programs for GHGs are obviously aimed directly at a serious environmental problem, and quasi-property rights under these programs will be a central element of any climate-change regime that includes the world's major industrial powers.[52] Nevertheless, we have learned from other environmental endeavors that efforts to solve one kind of environmental issue can create other environmental problems. In a well-known example, technology to reduce sulfur dioxide from factory emissions has created large quantities of toxic sludge, resulting in a kind of trade-off between air cleanup and land disposal.[53] Experience with the Kyoto Protocol has already hinted at another such displacement problem that affects cap-and-trade: the sidelining and potential disturbance of old-growth forests. The protocol allows GHG emitters in developed countries to meet their emission reduction requirements by "offsetting" their own emissions with certain kinds of approved carbon sequestrations elsewhere, both within the developed countries and in LDCs. These offsetting sequestrations include newly planted vegetation, which absorbs and fixes carbon dioxide from the air, but the offset plantings must be an addition to what might have been planted in the ordinary course of what is called "business as usual."

Since the preservation of old-growth forests is not an "additional" form of carbon sequestration, however, parties to Kyoto have been unable to use old-growth forestry conservation activities as offsets, eliminating an important potential source of funds for LDC forest conservation. Newly planted trees, in contrast, do count as additional offsetting measures under Kyoto, so that it is certainly conceivable that old-growth forests could be clearcut or burned to make way for newly planted tree monocultures, losing the benefits of old-growth biodiversity while possibly causing a net increase in atmospheric GHGs. Such results cause dismay among rainforest conservation experts, who point out that the burnoffs of old-growth

[51] For example, Jeffrey Ball, "The Carbon-Neutral Vacation," *Wall Street Journal,* July 28, 2007, P1, P5–6, describes resorts that offer varying strategies for carbon-neutrality, including investment in "offsets" in vaguely defined carbon sequestration projects.

[52] Flatt, "Taking the Legislative Temperature," 135–38.

[53] Lakshman Guruswamy, "Integrating Thoughtways: Reopening of the Environmental Mind?" *Wisconsin Law Review* (1989): 463, 490–92, notes some early cases in which the cross-boundary pollution issue, including scrubber sludge disposal, was raised but dismissed.

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forests are already contributing heavily to worldwide carbon dioxide formation. They cause dismay as well among the leaders of some less-developed countries, who fear that their old-growth forests are doomed without the infusion of resources that eligibility for offset credits might provide. The Kyoto signatories are aware of this forestry problem and have begun to address it since the followup Bali conference in 2007, but solutions may be difficult or incomplete, for reasons to be addressed next.[54]

D. The fourth problem: Methods for defining property rights may not work well for environmental resources

This fourth problem, like the third, amounts to a vexing set of peripheral problems in climate-change programs rather than the kind of deal-breaking difficulties presented by agreement and enforcement. Nevertheless, the vexation is a durable one: as with other environmental resources, it can be difficult to find good property-rights markers for contributions to climate change. The United States' widely acclaimed cap-and-trade program for acid rain control has shown a comparable feature. The real problem of acid rain is the acidification of soils and waterbodies, but we are unable to measure and mark those damages directly, so we instead control acid rain by measuring and permitting trades of tons of emissions. So too with climate change. The main object of course is to avoid damage, but damage, in the form of contribution to climate change, is far too difficult to measure, so that cap-and-trade programs use tons of GHGs as a proxy for damage.[55] But the use of these proxies raises other problems. For example, carbon is relatively easy to measure, but methane is not. Hence carbon trades against other carbon sources are relatively straightforward, but carbon emissions offset by methane necessarily involve a metric that is at best approximate.[56] An even more troublesome situation faces the prospect of using forestry sequestration to offset GHGs. Forests differ greatly in their capacities to absorb GHGs, depending among other things on location, composition, and the age of the trees involved.[57] Indeed, some believe that while forests in the earth's cold regions do sequester GHGs,

[54] Amano and Sedjo, "Forest Sequestration," 8–9, 31–32 (describing narrow forestry credits actually allowed for trade credit under Kyoto Clean Development Mechanism). On new verification technology, as well as increased concern to permit credits for existing forests, see Tom Wright, "New Tool May Help in Fight to Curb CO_2: Radar Enables Better Monitoring of Commitments to Preserve Forests," *Wall Street Journal*, January 3, 2008, B3.

[55] Rose, "From H_2O to CO_2: Lessons of Water Rights for Carbon Trading," 91, 104.

[56] Salzman and Ruhl, "Currencies and the Commodification of Environmental Law," 627–30.

[57] Brandon Scarborough, "Trading Forest Carbon: A Panacea or Pipe Dream to Address Climate Change?" *PERC Policy Series* PS-40 (July 2007): 7–10, 20.

they may actually make global warming worse by substituting dark green ground-cover for reflective white snow.[58] If forests are to be incorporated into GHG cap-and-trade programs as offsets, some unit or units of measurement must be found. A simple measure like acreage is highly advantageous for purposes of creating thick market trading, but highly disadvantageous for purposes of precision in offsets. All these issues add up to a problem that one might call "proxy slippage": the things we can measure for purposes of defining property rights have only an inexact relationship to the objects for which we create the property regime in the first place. This will be true in GHG cap-and-trade programs as it is in other property regimes.

E. The fifth problem: Modern property regimes tend to create resource monocultures, and these may undermine environmental resources

A generic pattern in property regimes is that modern tradable rights promote regional specialization, and specialization tends toward monoculture. One environmental version of this pattern is the "hotspot" problem. This can occur, for example, if pollutants are treated as tradable rights and then traded toward one direction, leading some particular area to "specialize" in toxicity. Hotspots have been a particular focus for environmental justice concerns, since the pollutants in question may well gravitate toward locations occupied by the poor, where the concentration of pollutants may make them more hazardous than they would have been if still dispersed. However, this hotspot pattern is much less serious for climate change cap-and-trade programs than it can be for other kinds of property or quasi-property regimes. Carbon dioxide, the main GHG, is immune from the hotspot problem, because carbon dioxide mixes into a uniform mass in the atmosphere, no matter where it comes from or where it goes. Moreover, certain kinds of trading-induced regional specialization can actually be of benefit to biodiversity. It is widely thought, for example, that even though there are many problems about wetlands trades, nevertheless wetlands trades can result in larger, concentrated wetland areas that have more benefits to wildlife than do smaller and isolated wetland fragments. Insofar as GHG offset trading does come to include old-growth forestry, specialization could be a particular benefit for biodiversity. GHG emissions in any part of the globe could be traded for the preservation of large tracts of intact old-growth forest.

In sum, then, property-rights approaches to climate change can be expected to face many of the same environmental issues as do property-

[58] Ken Caldeira, "When Being Green Raises the Heat," *New York Times,* January 16, 2007, A21.

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rights regimes in other resource domains. These issues vary in seriousness, however, from extreme to much less serious. Taken together, they suggest that property-rights regimes can be very important contributors in confronting climate change, but that they cannot be adopted without overcoming significant obstacles, and that they will never be perfect once adopted.

V. Conclusion

I conclude this essay with two sets of observations. The first set concerns the place of ordinary property and environmental property regimes in a more general libertarian project. The second set concerns the scale on which property rights—and environmental property regimes—are most meaningful.

First, the libertarian project: Property rights loom large in libertarian thinking because property preserves a zone of freedom for the owner. But from the same libertarian perspective, property rights pale to almost nothing by comparison to open access. In a regime of open access, anyone can do anything. The philosopher J. E. Penner is a great advocate of property, but his work suggests strongly that property rights for the most part define not rights in the owner, but duties in the nonowner. He gives the very prosaic example of an amble through a parking lot where the person on foot knows nothing about the vehicles or their owners except one thing: the vehicles do not belong to him, and he had better keep his hands off.[59] Game theorists make much the same point in rather different language. They define property rights as a hawk/dove "game" in which the owner gets to play hawk, while all nonowners play dove.[60] In a functioning property regime, one plays dove vastly more frequently than one plays hawk. How much more liberating, then, is the grand free-for-all of open access, where one can hunt and fish and roam about at will! To be sure, open access has its inconveniences, all those aggravating interlopers and that damned tragedy of the commons. From a certain perspective, however, property regimes are a distinct retreat from the freedom of open access, a concession to reality that, yes, rewards effort and investment, but that still preserves only a little zone of freedom. By comparison to open access, that zone can only be considered, in the vernacular, dinky.

By the same token, the grand environmental dream is the vast wilderness, untamed, unowned, and unsullied. Environmental management regimes of any sort are a distinct wet blanket on such romantic dreams of the wild, a kind of stern reminder that, like it or not, it is all a zoo out

[59] Penner, *The Idea of Property in Law*, 75.

[60] Zerbe and Anderson, "Culture and Fairness," 133–35. Zerbe and Anderson call the game a "chicken/hawk" game rather than a "dove/hawk" game, but the game is the same.

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there—no part of the globe is safe from the baleful impact of human activity. Efforts to mitigate the damage of climate change are only the latest and the largest of such wet-blanket reminders. Under the circumstances we face, though, property-based regimes like cap-and-trade offer the same kind of limited consolation that ordinary property offers after the retreat from open access: at least a bit of freedom, a small opportunity to decide for oneself how to allocate one's allotment, and how to augment that allotment by striking up agreements with others. And as with ordinary property, planning and trading can open up vast new arenas of activity and opportunity. Putting to one side all the practical difficulties that environmental property regimes may present—the main subject of this essay—a system of free choice in tradable environmental rights may uncover whole new realms of now unexpected and even unimagined conservationist innovation, if only a vanishingly faint glimmer of the romance of the wild.

A second set of observations concerns the parallels between property rights and environmental concerns with respect to scale. While property rights may be generated spontaneously in nongovernmental groups and communities, the property that counts, both for wealth creation and for liberty, is not bottom-up but top-down, that is to say, state-sponsored. There are small-scale community-based property regimes the world over, but they define rights that are excruciatingly detailed, that are policed by nosy neighbors and local bosses, and that cannot be traded or even understood by outsiders. By and large, the rights that count for amassing commercial wealth are modernist: these property rights are relatively simple; they are capable of being recorded and registered; they can be traded anywhere and to anyone; and they depend on science, technology, and literacy for monitoring, and on agencies and courts for enforcement.

By the same token, small communities may have only a light impact on the environment, and they may coexist for long periods amid abundant environmental resources. But the environmental friendliness of small-scale communities is easily overwhelmed by shifts in market demand or changes in technology. Such communities often lack the knowledge, power, or desire to protect environmental resources in the face of market or technological alterations, leading some to conclude that community-based environmentalism exists only because of isolation and technological limitations.[61]

[61] Two contributions in *The Question of the Commons: The Culture and Ecology of Communal Resources,* ed. Bonnie J. McCay and James M. Acheson (Tucson: University of Arizona Press, 1988) sharply question the idea that community-based resource regimes are conservation-oriented in any systematic way: Raymond Hames, "Game Conservation or Efficient Hunting?" 92–107; and James G. Carrier, "Marine Tenure and Conservation in Papua New Guinea," 142–67. Rose, "Common Property, Regulatory Property, and Environmental Protection," 233, 248–50, describes some of the weaknesses of traditional community-based regimes with respect to commerce—including communities with some conservationist practices.

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These observations coalesce in environmental property rights regimes like cap-and-trade. These regimes offer great promise for innovation and cost-saving, and in some cases they can even be deployed to reenergize community-based environmentalism, as in community-based fishing quotas.[62] The rights they put in play are tremendously sophisticated, however, and they depend critically on modernist property instruments of definition, recordkeeping, and enforcement. We may dream of perfect liberty and a natural equilibrium in an undisturbed commons. But that is not the stuff of modern environmental protection, including environmental protection based on property rights. For modern environmental property rights to function, the central object of concern must be accountable, clean, willing, capable, and energetic government.

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[62] Alison Rieser, "Property Rights and Ecosystem Management in U.S. Fisheries: Contracting for the Commons?" *Environmental Law Quarterly* 24 (1997): 813, 830–32, approvingly describes the allocation of fishing quotas to some Alaskan native communities. See also John Tierney, "A Tale of Two Fisheries," *New York Times Magazine,* August 27, 2000, 38. Among other things, the latter describes the way in which holders of individual tradable fishing quotas in Australia have come together to form a new common-property regime for managing the tuna fishery.

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