EXPANDING THE CHOICES FOR THE GLOBAL COMMONS: COMPARING NEWFANGLED TRADABLE ALLOWANCE SCHEMES TO OLD-FASHIONED COMMON PROPERTY REGIMES

CAROL M. ROSE*

I. INTRODUCTION

In late March 1999, Lois Schiffer, Assistant Attorney General for the Environmental and Natural Resources Division of the Department of Justice, gave a speech at Yale Law School entitled *Environmental Protection Here and Abroad: The View from Justice*.[1] In discussing the international aspects of the Justice Department's environmental work, Ms. Schiffer brought up the enormous problem of trade in illegally captured endangered species, citing an article that appeared in the New York Times Sunday Magazine in 1997.[2] That article used as its central example the endangered species trade from the island of Madagascar—specifically, the trade in the Radiated Tortoise, an exquisite and now increasingly rare animal. It is hunted by local fishermen for pennies, traded up through various dingy half-way houses for a few dollars, vacuumed into the international criminal trade, and then finally sold to collectors for tens of thousands of dollars.[3]

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* Gordon Bradford Tweedy Professor of Law & Organization, Yale University, New Haven, Connecticut.

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Please direct questions or comments to carol.rose@yale.edu. This article is also available at <http://www.law.duke.edu/journals/ 10DELPFRose>.

1. Lois Schiffer, Address at Yale Law School (Mar. 25, 1999).

2. Donovan Webster, *The Animal Smugglers: The LOOTING and SMUGGLING and FENCING and HOARDING of IMPOSSIBLY PRECIOUS, FEATHERED and SCALY WILD THINGS*, N.Y. TIMES, Feb. 16, 1997, § 6 (Magazine), at 26.

3. *See id*. at 27.

Is this story an example of a global commons problem? It seems to be. The "global" aspect of the story is easy to see, since this sad tale describes one piece of the loss of biodiversity throughout the planet. But the "commons" aspect is present as well, in Garrett Hardin's sense of the commons as an unowned resource, open to all.[4] Hardin famously used the example of grazing livestock in an open field.[5] In such cases, he said, each livestock owner takes all the gains from allowing his animals to graze freely in the field, while receiving only a fraction of any gains from conservation, and thus everyone's individual incentives favor overgrazing, even though this course of action leads to collective disaster.[6]

The Madagascar Radiated Tortoise's plight represents a cascade of these scenarios. As in Hardin's commons example, the Madagascar turtle fishermen have no formal title to the larger stock of animals and thus have every incentive to overfish and no incentive to constrain themselves or to invest in turtle habitats. In turn, the various levels of traders in turtles all vie with one another from low to high on the commercial food chain, and at the end of the chain, even the customers compete to get most of these unowned resources before other customers beat them out. In short, the Radiated Tortoise story provides a linked series of examples of what Hardin called the *Tragedy of the Commons*.[7] The tragedy unfolds in any situation in which it would be in the collective interest of all the players to constrain their depredation of some valuable resource—here the turtle population—and instead invest in its preservation; but because no one owns the resource, everyone's incentives are to grab now and let the devil take the hindmost.

A similar analysis, teched up as an *n*-person prisoners' dilemma,[8] can be applied to all kinds of overhunting and overfishing scenarios, air and water pollution, and indeed the whole range of environmental problems. Hardin himself drew the conclusion that "tragedies" of this sort admit of only two possible cures: coercion on the one side, or private property on the other.[9] A follower of Hardin's, William Ophuls, politicized the "coercion" side of this duality into the concept

4. *See* Garrett Hardin, *The Tragedy of the Commons*, 162 SCI. 1243, 1244 (1968).

5. *See id.*

6. *See id.*

7. *Id.*

8. For an analysis of the prisoners' dilemma when a large number of participants are involved, see EDNA ULLMANN-MARGALIT, THE EMERGENCE OF NORMS 25-27 (1977).

9. *See* Hardin, *supra* note 4, at 1247.

of "Leviathan;"[10] taken together, the Hardin/Ophuls position argues that individuals can be kept from re-enacting the "tragedy" only by the direct central command of the state, or alternatively, by the establishment of private property rights that align individual incentives with resource conservation.

By now, of course, we have seen a whole generation of Leviathan's solutions to environmental problems, taking the form of command-and-control regulations. But a certain disillusion about them has set in; the high costs and inflexibility of command-and-control regulations make them problematic even within particular countries. They are even less suited to global problems, where any notion of Leviathan is seriously attenuated. The obvious next question then becomes: What about the Hardin/Ophuls alternative—a property rights regime to govern global common resources? A moment's thought, however, raises an important preliminary question: Does the Hardin/Ophuls choice, coercion or private property, exhaust the possible options?

II. EXPANDING THE CHOICES: COMMON PROPERTY REGIMES AND TRADABLE ENVIRONMENTAL ALLOWANCES

A growing chorus of "new institutional economists" have argued very persuasively that property and coercion are not the only routes out of the dilemma that Hardin describes.[11] Indeed, Hardin's critics begin with his very choice of rhetoric, objecting that he and his followers spoke of "the commons" when they should have used the phrase "open access."[12] As Susan Buck Cox and others have amply illustrated, there was no "tragedy of the commons" in the *real* commons, that is, the historic grazing areas of medieval Europe.[13] Quite

10. *See* WILLIAM OPHULS & A. STEPHEN BOYER, JR., ECOLOGY AND THE POLITICS OF SCARCITY REVISITED 189 (1992) (citing Hobbes' Leviathan for the proposition that in instances of scarcity, governments must allocate resources in order to avoid conflicts); WILLIAM OPHULS, ECOLOGY AND THE POLITICS OF SCARCITY 148 (1977).

11. For a sampling of this literature, see THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES (Bonnie J. McCay & James M. Acheson eds., 1987).

12. *See, e.g.*, ELINOR OSTROM, GOVERNING THE COMMONS 23 (1990) (describing "disastrous" effects of thinking that limited commons is the same as open access); Alison Rieser, *Prescriptions for the Commons: Environmental Scholarship and the Fishing Quotas Debate*, 23 HARV. ENVTL. L. REV. 393, 399-400 (1999) (reviewing critiques by Ostrom and others) [hereinafter Rieser, *Prescriptions*].

13. *See* Susan Jane Buck Cox, *No Tragedy on the Commons*, 7 ENVTL. ETHICS 49 (1985); CARL J. DAHLMAN, THE OPEN FIELD SYSTEM AND BEYOND: A PROPERTY RIGHTS ANALYSIS

the contrary, the medieval commons was a remarkably stable form of resource management, one that lasted many centuries and that has analogs in equally long-lived community fisheries, grazing areas, and irrigation works the world over.[14] Furthermore, critics of Hardin and Ophuls take issue with their proposed solutions to the problems of the so-called commons. One well-known critic, Elinor Ostrom, has particularly leveled her fire at the Hardin/Ophuls dyad—the idea that successful resource management requires either Leviathan on the one hand or individual property on the other. Ostrom rejects this limitation on the choices; her own work describes and analyzes the working structures of common property regimes (CPRs) in all parts of the world, regimes that are neither ordered by Leviathan nor divided into individual property.[15]

Notice that a CPR is itself a type of property institution, that is, a common *property* regime that puts an entire stock of a resource under unitary and exclusive management. Although the members of a commonly used hunting ground or fishery may treat the resource as a "commons" among themselves, with respect to the rest of the world that resource is property. As I have described these regimes elsewhere, they may look like a commons on the inside, but they are property on the outside;[16] what James Acheson calls "perimeter defense" is very much a part of any limited common property regime.[17] Even with respect to the inside, a CPR may not be entirely wide-open; the "insider" participants in a commonly managed fishery or irrigation system are very likely to have access and entitlements only according to strongly held sets of community norms, some of them quite intricate.[18] This is why the CPR literature has bolstered scholarship in New Institutional Economics, fostering a whole new set of in-

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OF AN ECONOMIC INSTITUTION (1980). For a new analysis, see Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131 (2000).

14. *See generally* OSTROM, *supra* note 12.

15. *See id.* at 8-15, 58-61. Ostrom also uses the abbreviation CPR, but for "common-pool resources." *Id.* at xiv, 13. For a brief discussion of the terminology, see Paul Seabright, *Managing Local Commons: Theoretical Issues in Incentive Design*, 7 J. ECON. PERSP. 113, 114 n.1 (1993).

16. *See* Carol M. Rose, *The Several Futures of Property: Of Cyberspace and Folk Tales, Emission Trades and Ecosystems*, 83 MINN. L. REV. 129, 144, 155 (1998) [hereinafter Rose, *Several Futures*].

17. James M. Acheson, *The Lobster Fiefs Revisited: Economic and Ecological Effects of Territoriality in the Maine Lobster Industry*, *in* THE QUESTION OF THE COMMONS, *supra* note 11, at 37, 41.

18. *See, e.g.*, Fred P. Bosselman, *Limitations Inherent in the Title to Wetlands at Common Law*, 15 STAN. ENVTL. L.J. 247, 283-84 (1996) (describing complex rules developed by residents of medieval "fen" wetland areas for exploitation of various resources).

tellectual endeavors that combine economics with sociology and that analyze the evolution of the social norms that guide collective social action.

An unspoken political agenda may well unite Hardin's critics—an agenda that reacts negatively to his suppression of the possibility that people can work together voluntarily to overcome collective action problems. To the contrary, the CPR literature forcefully asserts that people can and do come together in uncoerced common action for the management of commonly held resources.[19] Nevertheless, issues concerning the global commons pose a particular challenge to the social optimism of the CPR literature: however effective CPRs might be for small-scale resources, they could be entirely ineffectual on a large scale. A new literature on social norms seems to be converging on the view that while community regimes for managing common property are not at all unusual, such regimes are very likely to develop only under certain favorable circumstances.[20] These circumstances can be predicted from transaction cost analysis. Critically important are opportunities for mutual monitoring and social leverage; small group size helps to produce these opportunities, as do preexisting familial and social relations. Robert Ellickson, a leading figure in the new norms literature, predicts that norms are likely to emerge to overcome collective action problems in what he calls "close-knit groups," but he is agnostic about whether this can occur on a larger scale or among strangers.[21]

According to the new norms literature, then, we should expect that CPRs might emerge to govern small-scale resource stocks, such as local reef fisheries or mountain pastures, but that these governance regimes will be more problematic for large-scale stocks like ocean fisheries or the atmospheric ozone layer. Indeed, CPRs may even damage those larger resource stocks. Ellickson, for example, has described the evolution of norms among nineteenth century whalers. Whalers' norms clearly fostered cooperative efforts that permitted groups of seamen to capture whales efficiently, but if anything, their

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19. *See, e.g.*, Smith, *supra* note 13, at 152-54 (describing medieval peasants' agreements to adopt scattered plots as an efficient way to manage collective use of common fields).

20. *See, e.g.*, ROBERT C. ELLICKSON, ORDER WITHOUT LAW: HOW NEIGHBORS SETTLE DISPUTES 177-78 (1991) (describing preconditions for effective social norms) [hereinafter ELLICKSON, ORDER WITHOUT LAW].

21. Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1320-21 (1993) (noting the limitation of his norms thesis to close-knit groups) [hereinafter Ellickson, *Property in Land*]; ELLICKSON, ORDER WITHOUT LAW, *supra* note 20, at 177-78.

group hunting efficiency only hastened the decimation of the larger whale populations.[22]

Taken together, these points seem to suggest that the CPR literature is simply irrelevant to global environmental issues, where the problems require the coordinated management of vast and far-flung resources that are used by diverse and heterogenous groups. This unfortunate fact, if true, would seem to cast us back on the Hardin/Ophuls dual alternatives, the choice between coercion and individual property.

On closer inspection, however, global commons problems have many components that are much more localized. Global warming from carbon dioxide may be a planet-wide environmental issue, yet forests that sequester carbon can be highly localized. The world's fisheries taken together are in danger, but many specific fisheries are located in local shoals. Water pollution is a problem throughout the earth, but each watershed can be broken down into a number of specific communities. Biodiversity loss has worldwide consequences, but species extinction often plays out in highly localized areas, like Hawaiian forests,[23] or indeed like the remote areas of Madagascar where Radiated Tortoises breed.

These local densities in the global commons have already given rise to some thought about the role of CPRs in global environmentalism. Alison Rieser, for example, has suggested that some fishing quotas be allocated to communities rather than to individuals,[24] while Lee Breckenridge has argued that in some cases, both human rights and global environmental problems might be addressed simultaneously by allocating collective property rights in rainforest ecosystems to local indigenous communities.[25]

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22. *See* ELLICKSON, ORDER WITHOUT LAW, *supra* note 20, at 206.

23. *See* W.S. Merwin, *In Hawaii's Trees, Little Gems of Diversity are Dwindling*, N.Y. TIMES, Dec. 8, 1998, at G4 (describing Hawaii's great loss of biodiversity); A.P. Dobson, *Geographic Distribution of Endangered Species in the United States*, 275 SCI. 550, 551 (1997) (reporting findings that Hawaii is one of a few areas of concentration of endangered species, and more generally, that most endangered species in U.S. are concentrated in relatively limited land areas or "hot spots").

24. *See* Alison Rieser, *Property Rights and Ecosystem Management in U.S. Fisheries: Contracting for the Commons?*, 24 ECOLOGY L.Q. 813, 824-29 (1997) [hereinafter Rieser, *Property Rights*].

25. *See* Lee Breckenridge, *Protection of Biological and Cultural Diversity: Emerging Recognition of Local Community Rights in Ecosystems Under International Environmental Law*, 59 TENN. L. REV. 735, 739-53, 775-85 (1992); *see also* Gregory F. Maggio, *Recognizing the Vital Role of Local Communities in International Legal Instruments for Conserving Biodiversity*, 16 U.C.L.A. J. ENVTL. L. & POL'Y 179, 226 (1997).

In spite of these suggestions about the usefulness of CPRs, however, the market-oriented and property-based solutions now most discussed for global commons problems have not been derived from CPRs at all, but rather from models that focus on individual property rights. Among these are the privatization proposals from free market environmentalists.[26] In one much-discussed instance, for example, the Merck pharmaceutical firm contracted with Costa Rica to preserve rainforests, reserving bio-prospecting rights for itself and remunerating Costa Rica's preservation efforts by the promise of royalties in future medicines.[27] But the veritable poster-child for property and market solutions is the set of models referred to as "hybrid property" by Richard Stewart;[28] here the most notable example is the regime of tradable emission allowances that the United States has instituted to control the acid rain precursor sulfur dioxide.

In the years since 1990, when the Clean Air Act Amendments[29] instituted this highly acclaimed scheme of tradable emissions allowances, proponents of tradable environmental rights have spread the idea to other areas, including matters of global environmental concern. Tradable allowances have been widely discussed and partially implemented in ocean fisheries, where they appear as individual fishing quotas (IFQs) for some fish stocks.[30] Similarly, tradable allowances are a key issue in the current worldwide debate over the reduction of greenhouse gases. Even the resistant industrialists of the United States seem to be more willing to go along with global greenhouse gas reduction schemes if these schemes permit emissions trading.[31]

This article focuses in part on these hybrid property schemes, or "tradable environmental allowance" (TEA) systems, not only be-

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26. *See, e.g.*, ROBERT H. NELSON, PUBLIC LANDS AND PRIVATE RIGHTS: THE FAILURE OF SCIENTIFIC MANAGEMENT 218-24 (1995) (advocating a turnover of some public land to private ownership).

27. *See* Roger A. Sedjo, *Property Rights, Genetic Resources, and Biotechnological Change*, 35 J.L. & ECON. 199, 209-10 (1992).

28. *See* Richard B. Stewart, *Privprop, Regprop, and Beyond*, 13 HARV. J.L. & PUB. POL'Y 91, 93 (1990); *see also* James E. Krier, *Marketable Pollution Allowances*, 25 U. TOL. L. REV. 449, 453 (1994); Rose, *Several Futures*, *supra* note 16, at 164.

29. Clean Air Act Amendments, 42 U.S.C. §§ 7651-51(o) (Supp. 1999).

30. *See, e.g.*, Shi-Ling Hsu & James E. Wilen, *Ecosystem Management and the Sustainable Fisheries Act*, 24 ECOLOGY L.Q. 799, 807 (1997); RIGHTS-BASED FISHING (Philip A. Neher et al. eds., 1989). IFQs are also often referred to as "individual transferable quotas" or "ITQs." *See* Carrie A. Tipton, Note, *Protecting Tomorrow's Harvest: Developing a National System of Individual Transferable Quotas to Conserve Ocean Resources*, 14 VA. ENVTL. L.J. 381 (1995).

31. *See* Margaret Kriz, *After Argentina*, 30 NAT'L J. 2848, 2851 (1998).

cause they are currently a matter of considerable interest in global environmentalism, but also because they offer especially interesting contrasts and comparisons with CPRs. First, TEAs are like CPRs in that they depart from the Hardin/Ophuls dyadic commons solution. Instead of choosing between Leviathan and individual property, TEAs *combine* the two: even though they allocate individual quotas of the resource in question, TEAs are created and policed by governments to a degree far surpassing conventional property rights.[32] Second, and more interestingly, each TEA regime confronts exactly the same problem that a CPR does—the problem of managing a large renewable resource stock in a unitary fashion.

For both CPRs and TEAs, the dominating management task is to retain the "core" or bulk of the resource stock—*e.g.*, the fishery, the clean air mantle, or the groundwater aquifer—so that it can renew itself regularly. But at the same time, both CPRs and TEAs must also permit some use of the "fringe" of the resource in a limited manner, so that consumption is compatible with the renewability of the underlying resource stock.[33] The CPR protects the core and allocates the fringe through complex community norms; the TEA regime, however, protects the core while allocating the fringe through individual tradable allowances.[34]

III. COMPARING TEAS TO CPRS

Shortly before the 1990 Clean Air Act Amendments, Bruce Ackerman and Richard Stewart described the steps that would be necessary to put a TEA scheme in motion for the acid rain program.[35] Borrowing loosely from their description, the process requires that some governmental agency must do at least four things: first, set the

32. *See, e.g.*, Rieser, *Prescriptions*, *supra* note 12, at 407-08 (describing governmental definition and distribution of tradeable quota in fisheries).

33. Another way to describe this relationship is that of a "stock" and "usufruct," where ownership of, e.g., a larger fishery stock resides with the community or the public, while individuals may claim the usufruct. *See id.* at 416 (describing the individual entitlement in fishing TEAs as "in the nature of a usufructuary right," *i.e.*, the right to the fruits of someone else's property).

34. One precursor to modern hybrid property regimes was the scheme for managing hunting. State statutes allocated individual hunting licenses annually, allowing some animals to be taken but only at the level compatible with the stock's regeneration the following year. Modern tradable allowance schemes differ from the hunting license chiefly in that they make these "licenses" tradable, so that entitlements presumably gravitate to those who most value them. *See* Rose, *Several Futures*, *supra* note 16, at 171.

35. *See* Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law: The Democratic Case for Market Incentives*, 13 COLUM. J. ENVTL. L. 171 (1988).

total "fringe" amount of the resource that may be safely and sustainably used; second, divide up and allocate that usable total in the form of individual tradable allowances; third, set up a system for monitoring and record-keeping; and fourth, enforce the limits both externally (to exclude interlopers) and internally (to constrain insiders' overuse).[36] "And that's that," said Ackerman and Stewart.[37]

Naturally, implementation of such a scheme has not been quite as simple as "that's that." In both actual and proposed measures for TEAs, each of these steps has presented controversies and difficulties.[38] This article will not go into all the issues involved. Instead, it will highlight the points at which these steps contrast with the methods of CPRs, because that contrast reveals much about both of these forms of resource management.

A. *Step 1: Setting the Total Allowable Resource Use*

Clearly this is a task that is critical for maintaining a renewable resource. A mistake that sets the allowable "fringe" too high could eat away at the core resource (*e.g.*, too many fish landings destroy the fish stock), while a mistake that sets the allowance too low could needlessly thwart resource uses that are actually harmless. Twentieth century resource economists have considered this issue of total allowable use at length; according to the conventional wisdom, the correct level of resource use should match a "maximum economic yield" (MEY), reflecting a steady resource use level that creates greatest revenue at lowest total cost.[39]

But more recent thinking on renewable resources suggests that environmental factors are subject to "dynamic" or "chaotic" fluctuations, and this considerably changes the picture of appropriate resource management.[40] According to this new thinking, there may be

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36. *See id*. at 184 (listing four distinct bureaucratic functions required by a new system of marketable permits).

37. *Id*.

38. *See, e.g.*, Gary E. Marchant, *Global Warming: Freezing Carbon Dioxide Emissions, An Offset Policy for Slowing Global Warming*, 22 ENVTL. L. 623, 645-46, 648 (1992) (describing monitoring and administrative issues with respect to sulfur dioxide trading programs).

39. For an accessible description, see Ralph Townsend & James A. Wilson, *An Economic View of the Tragedy of the Commons*, *in* THE QUESTION OF THE COMMONS, *supra* note 11, at 311, 317. Notice that MEY is a proposal of economists, replacing the earlier desideratum of maximum sustainable use, MSY, proposed by biologists. *See id*. at 311-12, 317; H. Scott Gordon, *The Economic Theory of a Common-Property Resource: The Fishery*, 62 J. POL. ECON. 124, 128 (1954) (discussing and criticizing the biological literature on economic grounds).

40. The implications of this new ecological paradigm were the subject of a prior Cummings Colloquium. *See* Colloquy, *Beyond the Balance of Nature: Environmental Law Faces the New*

no smooth relationship between human catch levels and the remaining stock of, say, a fish population. Instead, the stock size may undergo a much more jagged set of dynamic changes because of ebbs and flows of weather conditions, changes in interrelated predator or prey populations, or any of a number of other factors. By the same token, forests might have no natural climax state from which to calculate a regular optimal cut. Similarly, air or water pollution levels, grazing, or species depredations might have unanticipated feedback effects that bring about irreversible change. If resource conditions fluctuate in these discontinuous and unpredictable ways, then it may be that the best management is not some optimal MEY, but rather a procedural strategy of adaptive management, one focusing on shifting away from stressed resources before their consumption reaches a point of no return.[41]

1. TEAs

How do the modern TEA regimes deal with this problem of fluctuation, particularly with respect to the issue of setting the allowable total human use? Interestingly enough, one of the most provocative features of Ackerman and Stewart's work was that they departed from the resource economists' argument for a particular periodic total and instead discussed the matter in procedural terms. They argued that in contrast to command-and-control regimes, an advantage of a tradable allowance scheme is that it has what are in effect beneficial procedural consequences: a TEA proposal brings into the open the all-important issue of permissible totals and encourages democratic consideration of this issue.[42]

In taking a procedural tack, however, Ackerman and Stewart were not particularly concerned about the dynamic pattern of environmental change. Moreover, their procedural hopes were not borne out in the best-known example of a TEA regime, the 1990 reductions in acid rain emissions; in the course of that legislation, there was very little democratic discussion of appropriate total pollution levels at all, much less a discussion of dynamic factors. Instead, the consensus on total allowable use converged on a "rollback" solution, setting a total

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Ecology, 7 DUKE ENVTL. L. & POL'Y F. 1 (1996). *See also* A. Dan Tarlock, *The Nonequilibrium Paradigm in Ecology and the Partial Unraveling of Environmental Law*, 27 LOY. L.A. L. REV. 1121 (1994); Jonathan Baert Wiener, *Law and the New Ecology: Evolution, Categories, and Consequences*, 22 ECOLOGY L.Q. 325 (1995)

41. *See* Townsend & Wilson, *supra* note 39, at 321-25.

42. *See* Ackerman & Stewart, s*upra* note 35, at 188-89.

limit at something less than the then-current sulfur dioxide levels.[43] The more recent discussions of global greenhouse gas emissions seem to have had a somewhat similar pattern: the consensus is that the total allowable carbon dioxide emissions should simply be *less*, or more precisely for the industrialized nations, emissions should be rolled back to a few percentage points below 1990 levels.[44]

This is not to denigrate the concept of rollback. Existing pollution levels may be an inevitable benchmark in the intensely political opening stages of regulatory change, when current stakeholders have so great an influence on policy decisions.[45] Further, the rollback approach may indeed entail very considerable reductions in pollution, as was the case with the 1990 Acid Rain amendments to the Clean Air Act in the United States.[46] Finally, a rollback can be readjusted in the future, for still further rollback.[47] Nevertheless, while the rollback method does respond to the realities of a human political economy, it does not address in any systematic way the new dynamic thinking about environmental change, which rejects a "balance of nature" or "steady state" view of environmental resources, whether established by rollback or something else.

2. CPRs

What about CPRs, which must address the very same issue of figuring out some total allowable consumption? The impression one has from much of the CPR literature is that the total "take" is only rarely discussed explicitly in CPR communities. Instead, the total consumption derives from the normative constraints that the community places on its individual members, rather than the other way around.[48] For example, in the Swiss village of Toerbel, the citizens—themselves limited in number—may not send any more cows to the

43. *See* Lisa Heinzerling, *Selling Pollution, Forcing Democracy*, 14 STAN. ENVTL. L.J. 300, 323-28 (1995) (arguing that debates over acid rain did not genuinely engage issue of total allowable pollution, instead relied on reduction from a particular annual baseline).

44. *See* Kriz, *supra* note 31, at 2850.

45. *See* GARY D. LIBECAP, CONTRACTING FOR PROPERTY RIGHTS 19 (1989) (describing motivations of stakeholders in a regulatory change and their tendency to evaluate the change by comparison to the status quo).

46. *See* PETER S. MENELL & RICHARD B. STEWART, ENVIRONMENTAL LAW & POLICY 255 (1994) (noting that the 1990 amendments adopted a proposal to reduce total sulfur emissions loading in air by 50 percent over a ten year period by requiring phased emissions reductions).

47. *See* J.W. Anderson et al., *At Buenos Aires and Beyond*, RESOURCES (Resources for the Future, Washington, D.C.), Winter 1999, at 6, 8-9, *available at* <http://www.rff.org/resources_archive/1999.htm>.

48. The relationships between totals and individual quotas are discussed in Seabright, *supra* note 15, at 116-17 (describing how "production plan" is affected by "implementation plan").

hemselves limited in number—may not send any more cows to the summer pasture than they can feed by themselves through the winter,[49] a constraint on individual farmers that naturally limits the total pasturage consumed. Similarly, the total number of lobsters fished around Monhegan Island seems not to be discussed much by the lobstermen in any comprehensive manner, but rather derives from the intricate norms about when, where, and how individuals may fish.[50]

Perhaps the question of total allowable use goes largely undiscussed simply because so many CPRs are enmeshed in community tradition and rely on long-standing patterns of trial and error. Or perhaps the matter goes undiscussed because total stocks in many environmental resources, such as fish or wildlife, are not directly visible.[51] Perhaps too, in at least some cases, the absence of specific thinking about total use may reflect a pattern that has been noted regarding some traditionalist resource management, namely the belief that human action has no effect on the natural environment. In some hunting and fishing communities, if the animals become scarce, the reason is thought to be that the animals are displeased and are hiding or that perhaps God simply wishes it to be so. Scarcity in animals is thus attributed to external factors or to the wildlife itself, rather than to the hunt or to the actions of humans. Indeed, in many hunting and fishing communities it is thought to be disrespectful to the animals to suggest otherwise.[52]

Although these views may reveal an attractive humility *vis-á-vis* the environment, they also threaten to paralyze any effort to control human encroachments on nature. For that reason, such views could make at least some CPRs vulnerable over the long run, particularly to changes in human demand on resources. This may be especially true among isolated traditionalist peoples, whose CPR resources may have been protected hitherto precisely by their isolation and low level of

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49. *See* OSTROM, *supra* note 12, at 62 (citing Robert McC. Netting, *What Alpine Peasants Have in Common: Observations on Communal Tenure in a Swiss Village*, 4 HUMAN ECOLOGY 135, 139 (1976)).

50. *See* Acheson, *supra* note 17, at 40, 46, 48-51.

51. By contrast, one CPR resource in which communities do appear to be attentive to periodic totals is water level, which is more easily and directly discernible than the level of pollution or the stocks of wildlife. *See, e.g.*, OSTROM, *supra* note 12, at 72-74 (describing irrigators' responses to overall water shortage); Bosselman, *supra* note 18, at 281-82 (describing medieval English "fen" peoples' responses to high or low water levels in wetlands).

52. *See* Carol M. Rose, *Given-ness and Gift: Property and the Quest for Environmental Ethics*, 24 ENVTL. L. 1, 16 (1994); James G. Carrier, *Marine Tenure and Conservation in Papua New Guinea: Problems in Interpretation*, *in* THE QUESTION OF THE COMMONS, *supra* note 11, at 142, 153.

commercial contacts with a wider world. Opening these communities to commerce could subject their resources to previously unheard-of demand, and indeed to demand surges that could prove to be unmanageable under their traditional CPR practices. A dramatic increase in human demand seems to be the chief factor at work among the Madagascar fishermen who are now hunting out the Radiated Tortoise; their traditional hunting practices presented no serious depletion problems as long as the animals were killed only for an occasional local feast, but those same practices have become an engine of extinction now that worldwide demand encourages much more aggressive capture of the animals.[53]

As will be discussed below, the complex structure of CPR entitlements may sometimes provide a measure of insulation against demand surges for endangered resources, even though structural complexity is not always effective in preventing depletion.[54] But aside from complexity, there are other features of CPRs that offset their relative haplessness about human demand change. Even if some CPRs are dangerously oblivious to changes in *human* demand—especially in isolated communities with little history of commercial contact—their response to *non*-human, natural changes is quite another story.

At least some CPRs seem remarkably adept at adjusting the total take of a resource in ways that curiously presage the new thinking about dynamic factors in environmental resources. The old Swiss villagers' rule, permitting summer grazing only by those animals that could be fed over the winter,[55] is a prescription that is very likely to track the fluctuating fertility of the pasture lands. Similarly, participants in ancient Spanish irrigation areas employed and continue to employ allocation rules that are keenly linked to amounts of water available at any given time;[56] Cree fur trappers regulate their catch with close attention to the wildlife stock;[57] indigenous hunting and fishing communities extract various resources in successive "pulses,"

53. *See* Webster, *supra* note 2, at 27.

54. *See* discussion *infra* Part III.B.2.

55. *See* OSTROM, *supra* note 12, at 62.

56. *See id.* at 72.

57. *See* Fikret Berkes, *Indigenous Knowledge and Resource Management Systems: A Native Canadian Case Study from James Bay*, *in* PROPERTY RIGHTS IN A SOCIAL AND ECOLOGICAL CONTEXT: CASE STUDIES AND DESIGN APPLICATIONS 99, 101 (Susan Hanna & Mohan Munasinghe eds., 1995).

readily shifting from one resource stock to the next at early signs of scarcity.[58]

None of this is to romanticize CPRs, and certainly not to suggest that all traditionalist practices are conservationist. But it may be that the chief weaknesses of CPRs revolve around unexpected shifts in *human* demand—especially new confrontations with hitherto unknown larger markets—rather than with dynamic shifts in other *natural* circumstances. In general, what we know of the practices of long-standing CPRs suggests that many are quite adaptive to the latter circumstances. These practices are marked by close attention to local environmental conditions, by a fair number of periodic revisions, and by rapid shifts to other resources in a diverse resource base when particular targets become scarce.

In short, CPRs sometimes demonstrate a kind of adaptive management that interestingly echoes the new thinking about dynamic ecosystem change.[59] In this critical dimension of responsiveness to complex natural factors, some CPRs may have an advantage over TEA regimes. The great importance of the resource in CPRs, the habits of constant attention to the resource and to other users, the fact that users themselves are also the victims of any overuse, and the generally diversified resource base—all these factors may permit CPRs to adapt more effectively to chaotic environmental factors.

B. *Steps 2 and 3: Defining, Allocating, and Keeping Track of Individual Entitlements*

The subjects of defining and allocating individual resource use entitlements, as well as monitoring and keeping track of those individual entitlements are all collapsed into a single discussion here. Even though the interconnections among these aspects of entitlements are not always immediately obvious, they are closely intertwined and have a number of feedback effects.

1. TEAs

Proponents of TEAs have devoted a considerable quantum of intellectual energy to the question of how these hybrid rights might be

58. *See, e.g.*, ARTHUR F. MCEVOY, THE FISHERMAN'S PROBLEM: ECOLOGY AND LAW IN THE CALIFORNIA FISHERIES, 1850-1980, at 27-32 (describing California native populations seasonal use of different natural resources).

59. *See* Townsend & Wilson, *supra* note 39, at 321-25 (describing how new dynamic ecosystem thinking stresses early species-switching rather than effort to maintain particular resource quantities); *see also* Bosselman, *supra* note 18, at 285-86 (noting medieval English fen people's practices to preserve wetlands water levels, describing same as "adaptive management").

allocated at the outset to individual rights-holders. Ackerman and Stewart, like economic thinkers generally, proposed that TEAs be allocated initially by auction,[60] but in fact, historical use and pre-existing practice have carried much more weight. In the 1990 Acid Rain amendments to the Clean Air Act, emission allowances were effectively "grandfathered" on the basis of historic emissions, even though this seemed rather like granting the fox his previous ration of chickens.[61] Individual fishing quotas, both those in current practice and those under discussion, are also allocated according to historic catch or some other measure of pre-existing resource use.[62] In current discussions of greenhouse gases, we see some measure of reverse grandfathering, as less developed countries insist that they should have a chance either to catch up or be paid by those who are already emitting large amounts of greenhouse gases.[63]

But however politically charged the initial allocation may be at the opening stages of TEA regimes, in principle, *successor* entitlement is vastly more important. Indeed, this is the point of creating TEAs. Successor allocations are to be made through trade, and hence, according to classic Coasean analysis, over time it will not matter what the initial entitlements were, because trade will allow entitlements to flow toward those who place the highest value on them.[64] That is what is supposed to make TEAs so useful; as with ordinary private property, the prospect of trade should enhance the incentives of rights-holders to innovate, specialize, and manage resources carefully.

The possibility for trading, however, means that questions concerning rights-definition, record keeping, and monitoring are critically important in TEA regimes. Perhaps nowhere is this more true than in global environmental schemes, due to their size and the distances between relevant parties. If rights are to be traded, they must be defined in a simple fashion, so successors in interest will understand the package of rights that they acquire.[65] Further, transparent records

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60. *See* Ackerman & Stewart, *supra* note 35, at 180-82.

61. *See* Clean Air Act Amendments, 42 U.S.C. §§ 7651(b)-(c) (Supp. 1999); Heinzerling, *supra* note 43, at 331.

62. *See* Tipton, *supra* note 30, at 400-01.

63. *See* Kriz, *supra* note 31, at 2849 (noting that less developed countries are not required to reduce greenhouse gases, though some have adopted voluntary limits in order to receive control investment from more developed countries).

64. *See* R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 2-8 (1960).

65. *See* Carol M. Rose, *What Governments Can Do for Property (and Vice Versa)*, *in* THE FUNDAMENTAL INTERRELATIONSHIPS BETWEEN GOVERNMENT AND PROPERTY 209, 213

must be kept so that various successive claimants can be apprised of the claims that others have against their investments. Still further, monitoring is critical to reassure purchasers that they are not paying for rights that others might be taking for free—a scenario that would cause the whole tradable allowance scheme to unravel.

In existing and proposed TEA regimes, there are a number of acute practical problems regarding this cluster of issues—rights-definition, record-keeping, and monitoring—all of which cannot be discussed here.[66] But one systematic problem is that the need for simplicity may run contrary to the ability to monitor. For example, with respect to fishing allowances, a TEA regime may employ a relatively simple measure, as would be the case where an individual fishing quota is measured in pounds or tons of a particular target fish. But fishermen know that bigger fish bring more at the market than smaller ones, and this can induce them to "high-grade," keeping the bigger fish and simply discarding the smaller (and now dead) specimens, with potentially disastrous effects on the fish population as a whole.[67] "Pounds" of fish is a simple definition of entitlement, and it can be measured easily at dockside; but as highgrading shows, this kind of measure cannot be monitored easily where it matters environmentally, that is, at the time of the catch at sea.

A second and particularly intriguing problem is a kind of "wag the dog" issue: the quest for simplicity in TEAs has feedback effects on what actually gets preserved. Each TEA, in a sense, is like a "chunk" of the consumable portion of the protected larger resource. But because the chunks must be made simple and transparent, their content may necessarily diverge from the overarching goal of preserving the core resource; entitlements must be created in resource features that can be identified, measured, and monitored, but careful management of those features does not necessarily overlap with the best protection for the resource in question. For example, tradable sulfur dioxide allowances are calculated in tons of emissions, because

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(Nicholas Mercuro & Warren J. Samuels eds., 1999); *see also* Michael A. Heller, *The Tragedy of the Anticommons: Property in Transition from Marx to Markets*, 111 HARV. L. REV. 621, 664 (1998) (describing the importance of keeping property from "decomposing" into shards of separate rights); Frank I. Michelman, *Ethics, Economics and the Law of Property*, *in* 24 NOMOS 3, 9 (1982) (same).

66. For compliance issues with TEAs in the international arena, see Jonathan Baert Wiener, *Global Environmental Regulation: Instrument Choice in Legal Context*, 108 YALE L.J. 677, 771-75 (1999).

67. *See* Philip A. Neher et al., *Introduction* to Ian N. Clark et al., *The Development and Implementation of New Zealand's ITQ Management System, in* RIGHTS-BASED FISHING, *supra* note 30, at 113, 115.

emissions by weight are relatively easy to measure and monitor. But, because of wind and weather conditions, emissions in some places cause more damage to forests and lakes than do emissions in other places. Trading in the wrong direction, as it were, from emitters in downwind or forested areas to upwind emitters, thus has the potential to create greater damage than would be the case if rights could not be traded and moved about.[68] For this reason, some states' efforts to "meddle" with trades in emission rights are not simply frivolous, even though these efforts can compromise trading regimes.[69] In principle, tradable rights could be more closely calibrated to location, but, in practice, such closer refinements would be likely to make rights considerably more complex and hence less easy to define, trade, and monitor.

A similar problem is one that in another context I have called "too much property."[70] This problem is really one of lopsidedness between what counts as property and what does not. If certain environmental subjects are defined as property (in part because the rights are relatively easy to define), they will be treated carefully. Sometimes, though, this occurs at the expense of non-"propertized" resources that may be used with abandon.[71] Owners of fish and shellfish farms, for example, treat their stock with care, since those fish are headed to market; but they feed their stock from wild fish that they take indiscriminately as an unpropertized "free good."[72] The same kind of problem can affect TEAs. Consider water pollution: it is much easier to define pollution allowances for end-of-the-pipe "point" sources of pollution than for non-point sources, because point sources can be measured and monitored much more easily than non-point sources. But, if point source discharges become propertized as TEAs, dischargers might respond by evading the purchase of the

68. For a discussion of how trading can concentrate environmental harms in certain areas or communities, see Richard Toshiyuki Drury et al., *Pollution Trading and Environmental Injustice: Los Angeles' Failed Experiment in Air Quality Policy*, 9 DUKE ENVTL. L. & POL'Y F. 231, 251-58 (1999).

69. *Cf.* Wiener, *supra* note 66, at 787-88 (describing state efforts to prevent sales of pollution allowances to upwind sources as "meddling"). Command-and-control regulation also often focuses on things that can be measured and monitored, rather than on direct harms (*e.g.*, point sources rather than non-point sources); but, under such regulations, no trades exist to concentrate harms.

70. Rose, *Several Futures*, *supra* note 16, at 169-70.

71. *See id*. at 169-74.

72. *See* Biksham Gujja & Andrea Finger-Stich, *What Price Prawn? Shrimp Aquaculture's Impact in Asia*, ENV'T, Sept. 1996, at 13, 15. The article also cites careless uprooting of mangrove trees and other elements of the aquatic ecosystem.

TEA, and instead disperse wastes via non-point outlets—perhaps in turn necessitating a second layer of command-and-control regulations that mandate re-collection methods, such as lagoons for non-point run-off materials.[73]

Ocean fishing or carbon dioxide emissions provide other examples of this phenomenon. TEAs for specific ocean species may encourage careful treatment of those species, but they do little to encourage careful treatment of the "by-catch" of non-target species.[74] Moreover, once a particular fish species is identified as the subject of a TEA, fishermen may switch to other species that they can take "for free," even if over-fishing these non-target species disrupts the greater habitat and ecosystem that nourishes all these species.[75] Similarly, if fuel-burning utilities have to buy air pollution TEAs for carbon dioxide emissions, they might find hydroelectric dams more attractive—perhaps with the result that regulators must pay closer attention to dams and to the harms they inflict on fish populations and surrounding ecosystems. In these instances of incomplete "propertization," TEAs in one area may necessitate further regulation in related areas, perhaps taking the form of new TEAs, but perhaps also taking the form of new command-and-control regulation. [76]

Finally, the imperative of rights-definition—and especially the need for simplicity and security—can impede the ability of the regulatory regime to adapt. For example, writers on fishing ITQs[77] have pointed out that, for the sake of security and investment, well-defined individual fishing allowances might be allocated to a fixed number of pounds per year over a long period of time. The unhappy trade-off is that these relatively simple and secure rights could make the fishing regime as a whole rigid and less capable of dealing with future ecological change. On the other hand, more flexibly defined allowances, such as those employing an annual percentage of the catch as a measure or those adopting allocations for a shorter period, are unfortunately also less certain and hence less likely to encourage investment.[78]

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73. *See* Rose, *Several Futures*, *supra* note 16, at 171-2.

74. *See id*. at 170.

75. *See id*.

76. *See id*. at 174; *see also* Hsu & Wilen, *supra* note 30, at 809 (arguing for IFQs in fishing, but suggesting that other regulations might have to supplement them to control by-catch and highgrading issues).

77. *See supra* text accompanying note 30.

78. For the arguments on these issues in New Zealand, see Tipton, *supra* note 30, at 411-12.

2. CPRs

On all these issues surrounding individual entitlements, CPRs regimes raise a very different, indeed almost diametrically opposed, cluster of issues. One important contrast concerns the allocation of individual entitlements. Unlike the explicit allocations under TEA schemes, individual entitlements in CPRs may well be buried in tradition. Moreover, some version of those traditions—rather than sales and purchases—continue to dominate in successor entitlements, so that the distinct between initial allocations and successor allocations is not so marked as in TEAs. In a CPR, what matters most for individual entitlement is established membership in the community and recognition under that community's norms. Although newcomers may sometimes enter CPRs, perhaps through purchase of land within the community, these would-be new entrants may well have to undergo a seasoning period before being allowed full participation. Thus, among the Monhegan lobster fishermen, land purchase on the island can begin the entrance process into the fishing community, but kinship relationships, long residence, and acknowledged skill are the bases for the pecking order of choice fishing spots.[79] This is not to say, by the way, that these norms are always attractive or egalitarian; women, for example, may be excluded.[80]

In another contrast, unlike the single-subject TEAs, CPR entitlements are set in the context of multi-dimensional resource uses. For example, CPRs for grazing may fold together such additional practices as gathering, farming, and multi-species hunting and fishing.[81] In this context, CPR norms about individual uses tie the members of a community to a whole complex web of economic resources, rather than to any single one. This pattern has consequences for resource conservation. While CPR norms for resource use do not necessarily guard against waste, irreversible exhaustion is less acute an issue in a community whose members regularly drop one resource and move on to another, in the way, for example, that traditional

79. *See* Acheson, *supra* note 17, at 40-45. For other CPR rights transferred by sale of land, see OSTROM, *supra* note 12, at 76 (mentioning that some Spanish community irrigation rights may accompany sale of particular property).

80. For non-egalitarianism in communal living arrangements, see Ellickson, *Property in Land*, *supra* note 21, at 1356.

81. *See, e.g.*, MCEVOY, *supra* note 58, at 27-32 (describing complex resource base of California tribal peoples).

fishing communities readily switch to more bountiful stocks, allowing the more depleted ones to recover.[82]

With such a complex web of resources, monitoring is certainly an important issue in CPRs, as in TEAs. Indeed, monitoring engages and implicates the entire social structure of CPRs, since CPRs are likely to exist only where there are rich opportunities for mutual monitoring throughout the community.[83] Moreover, as in TEA regimes, monitoring issues have feedback effects on the ways that individual entitlements are delineated. This is visible in the case of the old Spanish irrigation systems, where rights-holders are located in positions in which they can monitor one another.[84] More generally, CPRs tend to focus on "taking out," or extractive, commons problems such as forestry or fisheries, whereas they rarely if ever center on "putting-in" commons problems like pollution. This may be because products of extractive activities—the logs cut or the fish caught—are much easier to monitor than pollution; indeed, pollution may go unnoticed (even by the polluters themselves), particularly insofar as CPRs lack the sophisticated measurement technologies that are available to modern TEA regimes.

Unlike TEAs, CPRs' norms for resource use do not generally aim at simplicity. Instead, CPRs can be very complex and can baffle outsiders entirely. Even with respect to a single resource, individuals in a CPR may hold nothing so simple and straightforward as a TEA; they are more likely to have a series of complicated entitlements that overlap with those of many other rights-holders. For example, fishermen in Palau have rights to fish in certain places along with other rights to fish with certain equipment, and they are subject to an overarching norm of generosity that limits their ability to exclude others.[85] Similarly, prior to European settlement in New Zealand, the Maori had overlapping rights even in individual trees, where one family could take the berries while another could take the fowl.[86]

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82. *See* Townsend & Wilson, *supra* note 39, at 323-24 (describing the benefits of fishermen switching stocks as one or other becomes more scarce).

83. *See* ELLICKSON, ORDER WITHOUT LAW, *supra* note 20, at 177-78 (describing "close-knit" groups as the likely locus for common solutions to collective action problems).

84. *See* OSTROM, *supra* note 12, at 95 (describing manner in which Spanish irrigation rights place participants in a position to monitor one another).

85. *See* Carrier, *supra* note 52, at 142, 147, 157-58.

86. *See* Stuart Banner, *Two Properties, One Land*, *in* 24 L. & SOC. INQUIRY 807, 811 (1999) (describing pre-settlement Maori ownership rights as "functional" rather than geographically bounded and explaining their overlap on particular locations).

Rights with these complex and interwoven characteristics can detract from efficient resource use in important ways. Because individuals' entitlements overlap with one another, individual incentives to invest are diminished. Equally important, because complex entitlements cannot be easily traded, specialization and new entry are both discouraged. Essentially, complexity acts as a restraint on alienation; as Michael Heller's important new work points out, overly complex entitlement structures can lead to a "Tragedy of the Anticommons," a situation of stasis in which overlapping rights-holders all can block one another's use of a given resource.[87] CPRs seem to run this risk.

On the other hand, in the CPR context, complexity may have some virtues that offset its defects. Complex entitlement structures encourage continuity in a CPR's membership, because outsiders cannot easily buy in and insiders cannot easily sell out. This structure provides a background condition of "repeat play" among group members, often said to be an important factor in solving collective action problems; repeat play helps participants to build up cooperation and trust, and hence it impedes breakdown from internal shirking and cheating.[88]

Complex entitlement structures thus reinforce the *internal* stability of CPRs, but just as important for environmental protection is the *external* protection that institutional complexity sometimes advances, although not always effectively. Earlier in this article it was mentioned that some commonly held resources may be preserved simply by a low level of commercial exploitation and market penetration.[89] Complex rights structures reduce commercial access because complex entitlements are difficult to trade, but where commercial access is limited in a given resource like, say, walrus tusk or turtle shell, the market for those items remains undeveloped. In turn, a constricted market holds down the level of exploitation of the resource. This means that the complex entitlement structure of a CPR may also be resource-conserving, in spite of the loss of specialization and investment that results from thwarting trade and commerce. In that

87. *See* Heller, *supra* note 65, at 624; *see also* Banner, *supra* note 86, at 832-34 (arguing that Maori division of property into many functional rights impeded shifts to potentially more profitable uses, diminishing individual incentives). *But see* Smith, *supra* note 13, at 146-52 (arguing that overlapping entitlements in medieval scattered fields helped to limit opportunistic overuse of commons by individuals).

88. *See* Seabright, *supra* note 15, at 117-18 (describing economists' view that repeat play can induce players to overcome the Prisoners' Dilemma), 122-23 (discussing trust in local common property regimes).

89. *See* discussion *supra* Part III.A.2.

sense, however crude the mechanism, complex entitlement structures may offset some of the vulnerability of CPR resources to changes in human demand—a demand change that is especially likely to flow from commercial contact.

More generally, Robert Ellickson points out that common property regimes effectively pool access to resources, and for this reason these regimes are particularly adapted to managing risk.[90] This is a very useful insight for some environmental resources. Environmental resources are likely to be riskier than, say, land, the quintessential subject of property rights—and as all farmers know, land itself is plenty risky.[91] But the annual wild berry supply or the year's salmon run may be riskier still. As between the pooled claims of CPRs on the one hand, and the individual claims of TEAs on the other, it could be that CPR pooling is at least sometimes better adapted to human interactions with these risk-laden and highly variable resources. That is, at least in some instances of human interaction with fluctuating environmental resources, the value of risk spreading may dominate the payoffs from individual incentives and specialization—payoffs that are associated with more sharply defined and permanent property entitlements.

C. *Step 4: Enforcement*

Within particular governments, enforcement in TEA regimes can borrow from the whole range of civil and criminal processes. In the international arena, on the other hand, appropriate sanctions are especially difficult to attain, since the underlying institutional structure for sanctions is so attenuated. Putting aside that important and much-discussed problem,[92] there is another difficulty that pervades the enforcement of TEAs, even within existing sovereign governments. TEAs envision impartial enforcement by governmental agents, but one systematic concern about such enforcement, even within well-

90. *See* Ellickson, *Property in Land*, *supra* note 21, at 1341-44, 1392-93 ("Group ownership . . . pools risk. Because most individuals are risk-averse, the risk-spreading feature of group property is advantageous – even decisive in certain situations.").

91. *See* Douglas W. Allen & Dean Lueck, *The Nature of the Farm*, 41 J.L. & ECON. 343 (1998) (arguing that natural fluctuations and diverse stages of resource production limits the advantages of specialization, often making the unspecialized "family farm" more appropriate than more rationalized agribusiness).

92. For a discussion about constructing and enforcing international environmental agreements, see Scott Barrett, *International Cooperation and the International Commons*, 10 DUKE ENVTL. L. & POL'Y F. 131 (1999); David G. Victor, *Enforcing International Law:Implications for an Effective Global Warming Regime*, 10 DUKE ENVTL. L. & POL'Y F. 147 (1999).

organized governments, is that of motivating the enforcers. Ackerman and Stewart expressed the hope that in TEA regimes, this motivation would come from the regulated entities themselves, since buyers of environmental allowances would have an interest in monitoring cheaters and making sure that the rules were enforced for all.[93] But in fact, these endogenous incentives for enforcement are rather limited. They do operate where resource users are in competition. For example, if a mining company has to buy TEAs for pollution discharge, it wants to be sure that its competitors have to bear this expense as well. But it is hard to see why the company would care very much if a non-competitor, such as a paper mill or a municipality, were to dump still more pollutants into the water, unless their pollution was so great as to raise the price of the mining company's TEAs. When TEAs apply to large numbers of heterogeneous uses of a resource, enforcement is likely to have to come from government officials acting on their own.

In CPRs, once again, things are quite different. Here, with respect both to overreaching insiders and encroaching outsiders, enforcement is classically all a matter of self-help. CPRs have a great range of enforcement techniques, ranging from gossip to ostracism to violence.[94] The milder forms of enforcement against norm-violating insiders, notably gossip, probably present few incentive problems, because these activities are likely to be enjoyed by the members of the CPR community. But at the more serious end of the spectrum, enforcement can be an arduous, unpleasant, and dangerous task, and even CPRs do not escape problems regarding motivating enforcement.

Serious under-enforcement can unravel a CPR, just as it can undermine a TEA regime. Hence, successful CPRs often develop secondary enforcement norms; that is, the participants think they are duty-bound to chastise shirkers, cheaters, and interlopers. But even when successful at motivating enforcement, these secondary norms can have problems as well. Jon Elster describes "norms of revenge" in Balkan communities, where honor dictates norm enforcement against violators, but where the more violent forms of reprisal can cycle into wasteful and disruptive vendettas.[95] Such problems are in some measure the result of self-help and the accompanying lack of

93. *See* Ackerman & Stewart, *supra* note 35, at 183.

94. *See* ELLICKSON, ORDER WITHOUT LAW, *supra* note 20, at 56-59.

95. Jon Elster, *Norms of Revenge*, 100 ETHICS 862, 866-71 (1990) (describing norm enforcement through "honor" among Montenegrans and their pervasiveness of feuds); *see also* OSTROM, *supra* note 12, at 74-76 (noting similar problems in irrigating communities).

impartial, third-party arbiters. That is why, as John Locke mildly put it, self-help can be "inconvenient."[96] It is significant that the members of one frequently mentioned CPR, the lobster fishermen of Monhegan Island in Maine, very much desired the state's help in keeping out interlopers, and they ultimately convinced the state to help them ban outsiders from their lobster-fishing grounds.[97]

Thus, once again, CPRs and TEAs offer contrasting strengths and weaknesses: TEAs are at a disadvantage with respect to internal motivation to enforce, but at an advantage with respect to impartiality and the containment of vendettas; CPRs are just the reverse, having an advantage with respect to motivation but a disadvantage with respect to partisanship and feuding.

IV. SUMMARY AND CONCLUSIONS

What do we learn from this comparison of TEAs and CPRs? A very interesting point is the degree to which these organizational forms are mirror images; the strengths of one are apt to be the weaknesses of the other, and vice versa.

TEA regimes are clearly advantageous for organizing interactions among strangers. They can mediate relationships among those strangers and encourage new entrants to participate in environmental management, and they seem especially suited to widely dispersed and more or less fungible resources like sulfur dioxide or perhaps carbon dioxide. CPRs, on the other hand, depend on and take advantage of close and stable existing relationships, and they seem especially suited to complex and locally dense resource clusters. Insofar as global environmental problems concern resources that have local densities—where, for example, a local forest ecosystem may absorb greenhouse gases or provide habitat for a particular species—CPRs may have special salience. Moreover, they may be especially attractive where there are independent reasons to hold together a particular community, as for example in the efforts to maintain threatened indigenous or traditional peoples.

Still other important contrasts between TEAs and CPRs emerge in their very different entitlement structures. Precisely because they

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96. JOHN LOCKE, TWO TREATISES OF GOVERNMENT 396-97 (Peter Laslett ed., Cambridge Univ. Press 1960) (1690) (arguing that people's partiality to themselves mean that "Passion and Revenge is very apt to carry them too far" and noting the "inconveniencies" of self-help).

97. *See* Acheson, *supra* note 17, at 60 (describing the islanders' wish for state enforcement); *Maine Limits Fishing for Island's Lobster*, N.Y. TIMES, Mar. 1, 1998, at A25 (describing law for the first time limiting lobster fishing to the islanders).

are contemplated to be tradable among strangers, TEAs are designed for simplicity and security. But while those features encourage trade and investment, the very same features can impede TEAs' adaptability in the face of overlapping and interacting environmental factors or of natural environmental change over time. By contrast, CPR entitlement structures, while much more complex and a much greater impediment to investment and trade, are also more multidimensional, and for that reason they may also allow more flexible responses to intermixed resources and to dynamic environmental change.

Questions of enforcement offer yet more contrasts between TEAs and CPRs. TEAs can deploy a great range of impersonal enforcement devices, with the advantages that impersonality brings; but they enlist private enforcement only sporadically, at best in overtly competitive situations. CPRs, on the other hand, are enforced at closer range and enlist personal and community policing. But they may unravel in the case of non-enforcement, or decline into vendetta in the case of personalized enforcement; just as seriously, they may be simply incapable of dealing with resource problems like many forms of pollution, whose monitoring is beyond the technical capacity of a small community.

If there is one feature that may give an overall advantage to TEA regimes, it is the simple fact of their greater *explicitness*. TEAs are much more explicit than CPRs about goals, procedures, rights structures, and enforcement. In this explicitness, TEAs can encourage an open and educative discussion of all their elements, even though the opportunity for discussion does not always result in close practical consideration, as in the case of sulfur dioxide totals in the 1990 Clean Air Act.[98] By contrast, CPR regimes are not so explicit, and hence they may not be geared to learning about *new* resource problems, particularly those induced by human ingenuity and human demand; there are far too many examples of CPRs that simply fail to respond to new levels of demand on some resource previously thought unimportant, as in the case of Madagascar's Radiated Tortoises. Over time, communities with CPRs obviously do learn about ways to manage new environmental problems. If they did not, CPRs would not exist at all and certainly would not exist over their sometimes very long histories. One cause for concern, however, is that communities with CPRs will not learn quickly enough to deal with rapid changes induced by new market penetrations. The complex structure of CPRs

98. *See* discussion *supra* Part III.A.1.

sometimes shields them from such market-driven changes, but this clearly is not always enough.

TEAs and CPRs, then, present a study in contrasts. The strengths of TEAs derive from their impersonality, their simplicity and explicitness, their usefulness for diffuse and wide-ranging resources, their openness to new entry, and their adaptability to changes in human demand. CPRs' strengths are just the reverse: their deployment of personal bonds and deeply felt norms, their complexity, their stability of membership, their usefulness for locally dense and interactive resources, and their responsiveness to natural change in interwoven resources. By these very contrasts, CPRs and TEAs signal both the dimensions in which each will be effective, as well as the dimensions in which each may require supplementation.

One interesting development in global environmentalism is the dawning realization that these two different management structures can to some degree be combined or at least mixed. This is exemplified in Alison Rieser's suggestion that some tradable fishing quotas might be allocated to communities rather than to individuals, and in Lee Breckenridge's argument that both ecosystem and human rights concerns might be advanced by recognizing communal resource rights in some indigenous peoples.[99]

There are still more opportunities for combining hybrid property and CPRs. One such opportunity is reflected in an intriguing development that has emerged from the new TEA regimes for fishing: some holders of individual fishing quotas, realizing the need to preserve the surrounding ecosystem, are coming together to form what are effectively new CPRs for the conservation of fishing habitat.[100] This voluntary joint action is rather similar to a phenomenon that Robert Merges describes in connection with copyright and patent pooling: in that arena, owners of governmentally-created individual intellectual property rights have joined forces in organizations that help to solve common problems.[101]

This same basic structure—a combination of hybrid, governmentally created property rights and CPRs—underlies the programs that

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99. *See* Rieser, *Property Rights*, *supra* note 24; Breckenridge, *supra* note 25.

100. *See* Rieser, *Property Rights*, *supra* note 24, at 823-24. Rieser apparently does not think these *ad hoc* agreements are sufficient for ecosystem preservation. *Cf.* Rieser, *Prescriptions*, *supra* note 12, at 417 (criticizing ITQs for failing to incorporate institutional frameworks within which holders can cooperate with other parties to maintain a healthy ecosystem).

101. *See* Robert P. Merges, *Contracting Into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CAL. L. REV. 1293, 1293-1330, 1355-58 (1996).

currently enlist local villagers and agricultural communities in the preservation of game parks and forests.[102] Communities that receive new rights to wildlife revenues have a stake in preserving the stock of animals, and they may also create new CPR norms among themselves and among other communities to address common problems, as, for example, in the reporting of poachers.[103] These kinds of combinations are among the most interesting developments in environmental law and property law as well, and they deserve the support of our legal institutions.

Here it is appropriate to return to Garrett Hardin and his view of the "tragedy of the commons," because the comparison of TEAs and CPRs sheds light on that famous metaphor. As was observed earlier in this article, the New Institutional Economics literature takes direct issue with Hardin for his failure to notice CPRs as an intermediate approach to commons problems. The TEA regimes of recent years constitute an indirect reproach of Hardin's work as well, since TEAs contemplate hybrid regimes that combine Leviathan with individual property. Moreover, it now appears that these two quite different commons management schemes can sometimes be mixed in further combinations. All of these variations argue strongly that the Hardin/Ophuls dyadic approach to commons management—private property or Leviathan's coercion—is far too narrow.

But there is another criticism of Hardin that is particularly relevant to issues of the global commons. Hardin's chief concern was the largest of global commons, population growth, or as he bluntly put it, the unfettered "freedom to breed."[104] On this subject of population growth, however, neither coercion (as in legal limits on childbearing) nor property rights (as in tradable licenses to have children) seem either feasible or attractive.

But, upon reflection, Hardin stated the problem far too grossly. Population pressures can be broken down into much more specific pressures on particular resources, such as human pressures on air, water, forests, and wildlife. In some ways, the control of these pressured resources is more manageable than direct constraint on population itself. And upon still further reflection, those more specific resources

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102. One well-known program is Zimbabwe's Communal Areas Management Programme for Indigenous Resources (CAMPFIRE). *See* Victoria Butler, *Is This the Way to Save Africa's Wildlife?*, INT'L WILDLIFE, Mar.-Apr. 1995, at 38, 38; Karl Hess, Jr., *Wild Success: African Wildlife*, REASON, Oct. 1997, at 32, 36-41.

103. *See* Butler, *supra* note 102, at 38-39; Hess, Jr., *supra* note 102, at 38.

104. Hardin, *supra* note 4, at 1246.

themselves can be further broken down into even more localized or locally dense resources: the local forest that can purge air pollutants, the local wetland ecosystem that can purify water, and the network of localized ecosystems and forests that can provide wildlife habitat.

To be sure, these locally dense resources require larger coordination. But when we subdivide the most general commons issues into more local ones, and when we then recombine these local commons into larger networks, it becomes clear that it is not simply the commons *solutions* that are more variegated than the Hardin/Ophuls dyad of "property or Leviathan." The very idea of the *commons itself* is enormously variegated. The comparison of newfangled tradable environmental allowances to old-fashioned common property regimes, and the recombinations of these approaches into still new mixtures, allows us to see an expanded set of choices for global environmental management. But just as important, the comparison and combination of these regimes is a reminder that there is not a single commons or even a few global commons in the world; rather, there is a tapestry of constituent large and small commons, interacting and overlapping in ways that are as subtle as the environment itself.