

FROM H₂O TO CO₂: LESSONS OF WATER RIGHTS FOR CARBON TRADING

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Interest in climate change has generated many proposals for cap-and-trade programs to control greenhouse gases. Longstanding American water rights regimes may have some lessons for these new proposals. Nineteenth century eastern water law focused on the cap—keeping water instream—and particularly illustrates the importance of mobilized constituencies in any program that entails capping resource use. Western water law focused on individualized and supposedly tradable rights, and its experience shows especially the significance of rights-definition both for the content and for the tradability of rights. As with water rights, both content and tradability in the new rights regimes are likely to match only imperfectly the goals that we want a cap-and-trade program to serve. For that reason, the historical experience of both water regimes also suggests the important role that surrounding and supporting institutions will play to facilitate trade under imperfect circumstances, and to reassure participants of the standards, accountability, and acceptability of the cap-and-trade regime.

INTRODUCTION

What is the cure for our ailing, sweating planet? Quite a number of people seem to think that insofar as law can play a role, the answer lies in market-based regulation, particularly cap-and-trade programs.¹ In a cap-and-trade system, pollution or resource extraction is “capped” at some acceptable level. This acceptable level is further divided into tradable environmental allowances

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1. See, e.g., Richard J. Pierce, Jr., *Energy Independence and Global Warming*, 21 NAT. RESOURCES & ENV'T 68, 70 (2007) (asserting that broad consensus exists on need for market-based approaches to global warming, with choice between cap-and-trade or carbon taxes); see also Kirsten Engel, *State and Local Climate Initiatives: What is Motivating State and Local Governments to Address a Global Problem and What Does This Say About Federalism and Environmental Law?*, 38 URB. LAW. 1015, 1018 (2006) (noting cap-and-trade element in U.S. state-level initiatives to control greenhouse gases).

("TEAs"), and thereafter anyone who wants to use any part of the capped resource must hold the requisite number of TEAs, or alternatively, must acquire them from someone else who holds them.² Want to fish? Just buy a TEA for the pounds (or tons) you want. Need to operate some equipment that necessarily pollutes the air? You can do it, but it will cost you the price of the appropriate number of pollution TEAs. And notice too an obvious point—that when you acquire the TEAs that you need, the previous holder cannot use them any more. Though the allowances can move around, they do so in a zero-sum game. The cap itself stands still.

The poster child for cap-and-trade is now a teenager: the United States' program for reducing sulfur dioxide ("SO₂"), a major acid rain precursor, which went into effect with the 1990 Clean Air Act amendments.³ This regulatory revolution capped the total amount of SO₂ that could be emitted by the major polluters—coal-burning utilities—but it also created tradable allowances that became the subject of a market. The results showed that the people running polluting entities could be quite inventive about reduction. They did not need a nanny state to tell them exactly what kind of scrubbers they had to install to get rid of the gunk. Instead, they tinkered with this machine here and that furnace there, and brought down the noxious gas in their own ways. Low-cost pollution reducers could even sell their excess rights, with the result that only those with relatively high reduction costs continued to pollute, after buying the rights from others—with the further result that overall SO₂ levels came down at a lower cost than anyone originally expected.⁴

The ostensible success of the Acid Rain Reduction program, as well as the success of cap-and-trade programs for certain fisheries in New Zealand and Australia,⁵ have encouraged the view that market-based programs of this sort are the wave of our environmental future. The older command-and-control regulatory systems have certainly had an important impact on pollution reduction, in the United States as elsewhere, but their rigidity and one-size-fits-all character make them seem expensive and old-fashioned by comparison to more nimble, innovative and cost-sensitive market approaches. In the United States, trading regimes have been under discussion for complex resources like water quality, wetlands, and habitat conservation,⁶ and American politicians insist that cap-and-trade must be a

2. See, e.g., Clean Air Act, 42 U.S.C. § 7651–7651o (2006) (statutory sections setting out cap-and-trade program for sulfur dioxide emissions).

3. See, e.g., Elizabeth Burleson, *Multilateral Climate Change Mitigation*, 41 U.S.F. L. REV. 373, 389 (2007) (citing U.S. Acid Rain controls in 1990 Clean Air Act amendments as example of successful cap-and-trade program).

4. See, e.g., Robert B. McKinstry, Jr., *Putting the Market to Work for Conservation: The Evolving Use of Market-Based Mechanisms to Achieve Environmental Improvement In and Across Multiple Media*, 14 PENN ST. ENVTL. L. REV. 151, 154–55 (2006) (describing success of Acid Rain program).

5. John Tierney, *A Tale of Two Fisheries*, N.Y. TIMES MAG., Aug. 27, 2000, § 6 at 38 (describing successful tradable rights systems introduced in New Zealand and especially Australia and comparing Australian success to decline of New England fisheries).

6. McKinstry, *supra* note 4, at 156–57 (describing proposals for water pollution trades, wetland trades, habitat trades, among others); for habitat trading in particular, see Jonathan Remy Nash, *Trading Species: A New Direction for Habitat Trading Programs*, 32

central technique in any world-wide efforts to cut back carbon dioxide and other greenhouse gases.⁷ The Europeans too are now swimming with the tide, adopting a cap-and-trade program of their own to control greenhouse gases,⁸ even though they have resisted extending trade credits to some subjects favored by the United States, particularly forestry.⁹

With all the excitement and enthusiasm about cap-and-trade and TEAs, it behooves us to recall that we have much older versions of caps and tradable allowances in American water law. This body of law could have some longer-term lessons for regulators, as cap-and-trade moves beyond the relatively easy problems of SO₂ control to more complex issues like habitat protection or especially global warming. In American water law, the older version of *caps* comes primarily from the eastern states' "riparian" doctrine, whose central mission was to keep the bulk of any stream's water in the stream from the headwaters all the way to the sea.¹⁰ American water law's older version of *tradable allowances* is visible in the appropriation doctrine in our western states, a doctrine that initially allocates water rights to those who divert water to any location—whether onstream or off—and that then permits diverters to trade their appropriative water rights to any other user.¹¹

A preliminary point: American water rights regimes might be dismissed as a source of examples for more modern cap-and-trade programs, because the American water regimes never did seem to get the whole cap-and-trade regime together in one piece. In the earlier-settled eastern states, the riparian system allocated only a marginal "reasonable use" right to streamside owners, preventing them from diverting the water away from the stream or transferring their water

COLUM. J. ENVTL. L. 1, 19–29 (2007) (describing and critiquing current habitat trading proposals).

7. See, e.g., Amy Schatz, *Democracy Heads to Web Laboratory*, WALL ST. J., Aug. 16, 2007, at A4 (describing endorsement of greenhouse gas cap-and-trade systems by Democratic presidential candidates Barak Obama and John Edwards).

8. Burluson, *supra* note 3, at 390 (describing European Union's cap-and-trade program).

9. See, e.g., Andrew C. Revkin, *Odd Culprits in Collapse of Climate Talks*, N.Y. TIMES, Nov. 29, 2000, at F1 (describing conflict between U.S. and Europeans over forest conservation, European view that Americans were trying to avoid emissions reduction); cf. Philip M. Fearnside, *Saving Tropical Forests as a Global Warming Countermeasure: An Issue that Divides the Environmental Movement*, 39 ECOLOGICAL ECON. 167, 171–72, 177 (2001) (attributing European position to desire to raise U.S. energy costs to make European industry more competitive, European nongovernmental organizations' view that U.S. should give up immoral consumer lifestyle). Others have viewed cap-and-trade more generally as creating an immoral "right" to pollute. See Thomas Merrill and Henry Smith, *The Morality of Property*, 48 WM. & MARY L. REV. 1849, 1863–64 (2007) (describing view that cap-and-trade programs are immoral); Kirk W. Junker, *Ethical Emissions Trading and the Law*, 13 U. BALT. J. ENVTL. L. 149 (2006) (raising doubts about ethical foundations of emissions trading).

10. Carol M. Rose, *Riparian Rights*, in 3 THE NEW PALGRAVE DICTIONARY OF ECONOMICS AND THE LAW 344, 345 (1998).

11. 78 AM. JUR. 2D *Waters* § 341 (2007) (describing principles of prior appropriation); *id.* § 343 (describing extent of rights, including transfer).

rights to anyone else—with the effect that most of any stream's water use was “capped” and the water continued to flow within the stream.¹² The western states' rule of prior appropriation took an almost diametrically opposed tack: appropriative water rights systems allocated a stream's water to those who diverted it, and then permitted them to trade their diversion-based entitlements anywhere. The result here was that at the end of the day, all the water in any given stream might be appropriated and traded away from the stream. In a sense, eastern systems were all cap and no tradable rights, whereas western systems were all tradable rights and no cap.

In a more subtle way, however, the western system did have a cap: the entire stream. It was a cap that was seemingly dictated by nature, without requiring much thought or effort to establish; but there is nothing in principle that prevents an appropriative system from establishing a more restrictive cap. Indeed, some modern western state laws do so by requiring that some water remain instream.¹³ It is important to consider, though, why the eastern water law system concentrated on the capping feature of the regulatory regime, and why the western system did not, or at least did not do so initially in any obvious way. Here, as we shall see, there are some lessons for modern efforts to establish a cap on greenhouse gases.

Another important question, however, arises from a kind of systematic practical obstacle that appropriative systems face in establishing a more restrictive cap. A cap effectively requires leaving water in the stream. While it is possible to do so, instream rights have turned out to be quite difficult to establish in appropriation systems, due to the internal rules that have developed for recognizing individual rights. This is an issue of rights definition: the way rights are defined affects the things one can do with any given property regime.

The plan of this Essay, then, is first to take up caps in American water systems, contrasting the eastern and western approaches, and then to detour to problems of defining rights in appropriative systems—because, as we shall see, rights definitions are very much tied up not only with the possibility of a cap, but also the availability of trade. At every point I will attempt to point out the lessons for modern cap-and-trade plans to control greenhouse gases. Perhaps the most important lesson concerns institutions. As we shall see, American water rights regimes, and especially the western appropriation system, suggest strongly that tradable rights in environmental resources will require a surrounding set of institutional structures, to provide technical support for trade—and perhaps less expectedly, to provide moral support as well.

12. Rose, *supra* note 10, at 345–46. For a more extensive discussion, see Carol M. Rose, *Energy and Efficiency in the Realignment of Common-Law Water Rights*, 19 J. LEGAL STUD. 261 (1990), revised in CAROL M. ROSE, *PROPERTY AND PERSUASION* 163 (1994) (describing emergence of riparian principles of reasonable use in American law).

13. See Robert Jerome Glennon and Thomas Maddock, III, *The Concept of Capture: The Hydrology and Law of Stream/Aquifer Interactions*, 43 ROCKY MTN. MIN. L. INST., 22-1, 22–33 (1997) (noting minimum streamflows required by Washington state water law).

I. THE QUESTION OF THE CAP

In one view, American water rights regimes taken together could suggest a very pessimistic future for cap-and-trade in environmental resources. One might read American water law to say that if you are going to have a cap, as in the riparian doctrine, you cannot have trade, for the very good reason that trade opens up a resource to everyone in the world and puts too much pressure on the resource. For exactly the same reason—because trading can put great pressure on a resource—if you are going to have trade, as in the appropriation doctrine, you cannot have a cap. The two systems seemingly made opposite choices between two mutually exclusive features. Eastern regimes prohibited trade of water rights in order to preserve the cap. Western water regimes allowed trade, but suppressed any serious consideration of a cap. There is even a standard explanation why they took these opposite paths. The usual story is that in the humid east—unlike the arid west—water was widely available from rainfall, and hence offstream owners could make do without stream water. In the west, on the other hand, where water was scarce, offstream landholders had to use sometimes-distant streams as the only available water source.¹⁴

No doubt this story is true, but there is more to it. By looking at some other factors, we can learn something about cap-and-trade, especially about caps. In the eastern states in the early nineteenth century, at the time that the basic patterns of riparian law took shape, instream water uses already had a constituency, or rather two constituencies: one was for fish, and the other was for power. In colonial times, eastern rivers supported anadromous fish like Atlantic salmon and shad. The eastern colonies and then states long followed the English pattern and granted exclusive fishing rights to specific enterprises, but increasingly they recognized a public claim to fish as well.¹⁵ Both the holders of private rights and public bodies used the law to resist changes to the eastern river flows.¹⁶

The main rival to fishing was actually the other and even more significant instream constituency: manufacturing interests, newly freed from British imperial constraints, and newly fed by southern cotton and the inventions that eased the

14. See, e.g., Terry Anderson & P.J. Hill, *The Evolution of Property Rights: A Study of the American West*, 18 J.L. & ECON. 163, 176–78 (1975) (arguing that appropriative water system arose from greater scarcity of water in west).

15. Dale D. Goble, *Three Cases/Four Tales: Commons, Capture, the Public Trust, and Property in Land*, 35 ENVTL. L. 807, 839–40 (2005) (describing 1633 mill grant including private fishing concession at regulated prices; 1806 case about same mill, requiring payment for fish passage for sake of public fishing).

16. John F. Hart, *Fish, Dams, and James Madison: Eighteenth Century Species Protection and the Original Understanding of the Takings Clause*, 63 MD. L. REV. 287, 292–95 (2004) (describing eighteenth century fish passage protections); Carol M. Rose, *A Dozen Propositions on Private Property, Public Rights, and the New Takings Legislation*, 53 WASH. & LEE L. REV. 265, 265–66 (1996) (same); Goble, *supra* note 15, at 841 (same in early republic); THEODORE STEINBERG, *NATURE INCORPORATED: INDUSTRIALIZATION AND THE WATERS OF NEW ENGLAND* 173–76 (1991) (describing private fishing rights holders' demands for concessions from dam builders).

transformation of raw cotton to finished cloth.¹⁷ Mill developers built dams to power a burgeoning textile industry along the eastern rivers, particularly in the northeast. Prior to and during the early years of New England's industrial growth, courts and public officials sometimes required mill-builders to construct fish passages to placate the other major instream users, that is, fishing interests, even though these conservation efforts were not successful on the big new manufacturing dams.¹⁸ Vis-a-vis offstream water users, mill owners in the east had a clearer upper hand: as New England manufacturing mills proliferated, the courts recognized that river water was at its most valuable when treated as a weighty bulk, first stored behind dams, then released through millstreams to power the new textile factories and ultimately returned to the river to power more mills downstream. Given this understanding, the courts developed the riparian doctrine to accommodate the new water-driven mills of the 1810s, 1820s, and 1830s. Riparian law kept the river water in the stream, feeding successive mills all the way down the length of the stream, thus maximizing the use of water for power.¹⁹

Western rivers had an instream constituency as well, but it was a constituency that the new miners and settlers cared little about—Indian fishing communities. Gold miners in California were massively indifferent to Indian complaints about the miners' damage to the river fisheries.²⁰ Other miners and agriculturalists with offstream uses for the water similarly ignored the Indian interests in the fisheries, and Indian concerns were vindicated only very partially in later treaties with the United States.²¹

This sad history punctuates an important fact about property: property is a social institution, and property claims depend on the recognition and respect of the surrounding community.²² But the fate of Indian fisheries exemplifies one of the

17. Carol M. Rose, *A Tale of Two Rivers*, 91 MICH. L. REV. 1623, 1624–25 (1993) (book review) (describing early nineteenth-century New England industrialists interest in water power).

18. STEINBERG, *supra* note 16, at 175 (describing failure of fish passage on large industrial dam).

19. ROSE, PROPERTY AND PERSUASION, *supra* note 12, at 183–84, 186–87 (describing relation of riparian doctrine to power uses).

20. ARTHUR MCEVOY, THE FISHERMAN'S PROBLEM: ECOLOGY AND LAW IN THE CALIFORNIA FISHERIES 1850–1980, at 53–58 (1986) (describing gold miners' heedless decimation of Indian fishing).

21. See, e.g., Holly Doremus & A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 ECOLOGY L.Q. 279, 289–92, 296–300, 303–05 (2003) (describing decimation of Indian fisheries in Upper Klamath Basin due to irrigation projects, in spite of reservations and reserved fishing rights); see also Michael C. Blumm, David H. Becker & Joshua D. Smith, *The Mirage of Indian Reserved Water Rights and Western Streamflow Restoration in the McCarran Amendment Era: A Promise Unfulfilled*, 36 ENVTL. L. 1157, 1162–69 (2006) (describing Indian water rights adjudication on Klamath).

22. See Carol M. Rose, *Canons of Property Talk, or, Blackstone's Anxiety*, 108 YALE L.J. 601, 632 (1998) (describing property as embedded in social recognition); Carol M. Rose, *Property and Expropriation: Themes and Variations in American Law*, 2000 UTAH L. REV. 1, 28–33, 37 (same); Carol M. Rose, *Introduction: Property and Language, or, The Ghost of the Fifth Panel*, 18 YALE J. L. & HUMAN. 1, 6–7 (2005) (same).

least attractive historical results of that social character: in the era when western appropriative rights were established, settlers regarded indigenous peoples as outside the relevant community; they had little respect for Native American claims for instream uses and simply rode roughshod over them.²³

As among themselves as well, western American settlers and their legislatures generally rejected the riparian concentration on maintaining instream flows, with the exception of the more humid parts of the west, like California. Indeed, the idea that *any* available water should remain in a stream must have seemed out of place in the driest parts of the west, where settlers undoubtedly thought then (as some do now) that it was unreasonable and even immoral to leave water for fish when the same water could grow crops to feed multitudes.²⁴ Recent scholarship by the Israeli scholar David Schorr has stressed the populist and moralist impulses behind the foundation of the American appropriative rights systems.²⁵ Those impulses focused not on a cap but on who would have what rights to the water. Here the principle concern was to quell the monopolistic power that riparian systems would have given to streamside owners, and instead to distribute water rights to those individuals who could put water to productive use, whether on stream or off.²⁶

With respect to the cap in cap-and-trade, the contrast between eastern and western water rights yields an important practical lesson—a cap is effectively a requirement that water remain instream, and it needs a viable constituency. Political economists might add that constituencies follow comparative resource values: historically, instream uses were more valuable in the east, offstream uses more valuable in the west; hence western water law permitted the total appropriation of western streams. But it is well to remember that there are moral components lurking behind resource valuation as well. First, western settlers simply ignored the instream values of Indian fisheries. Second, as Schorr's scholarship has shown, as between riparians and offstream settlers in the west, populist and egalitarian sensibilities overwhelmed the exclusive legal claims of

23. Cf. Rachel D. Godsil, *Race Nuisance: The Politics of Law in the Jim Crow Era*, 105 MICH. L. REV. 505, 512–13, 549, 555 (2006) (describing disrespect for African American property rights in Jim Crow era but partial vindication through courts' refusal to treat African Americans as nuisance).

24. See Marci Morden, Letter to the Editor, *Needs of Humans vs. Nature*, SACRAMENTO BEE, Aug. 31, 2001, at B6 (supporting irrigators in dispute between irrigators and protection of endangered fish, arguing that farmers' water use is more important because they feed their families and meet needs of others); *NPR Morning Edition: Protests over Restrictions on Water to Farmers* (National Public Radio broadcast Aug. 22, 2001) (transcript from LexisNexis); Doremus & Tarlock, *supra* note 21, at 321–22 (describing entire incident, including farmers' forcible re-opening of irrigation gates); see also STUART BANNER, *HOW THE INDIANS LOST THEIR LAND: LAW AND POWER ON THE FRONTIER* 157–59 (2005) (describing early 19th century settlers' view that agriculture was highest moral use of resources because most productive, giving justification for dispossessing Indian hunters).

25. David B. Schorr, *Appropriation as Agrarianism: Distributive Justice in the Creation of Property Rights*, 32 ECOLOGY L.Q. 3 (2005).

26. *Id.* at 11, 24 (arguing that appropriation system aimed at equal distribution and prevention of monopolistic control of water sources).

riparians,²⁷ which might have preserved instream uses. And third, insofar as instream uses are now making a comeback, they are linked to new and higher valuations on environmental goods, as well as a belated recognition of past injustices to indigenous peoples.²⁸

Are there parallels with respect to a cap on greenhouse gases? Is there a viable constituency for the passive use of the air environment, as a CO₂- and methane-free reserve would require, a sort of atmospheric counterpart to unappropriated instream flows? To be sure, there are quite a variety of constituencies, all potentially affected by the seemingly dire effects of continuing to fill up this atmospheric reserve with greenhouse gases. Pacific Islanders have reason to worry about rising sea levels, as do coastal population centers around the world.²⁹ Europeans have reason to worry that the Gulf Stream will stop pumping warm air northward.³⁰ Environmentalists have reason to worry about vanishing habitat for polar bears and the plants and animals that occupy increasingly warmer mountain slopes.³¹ Cities have reason to worry about uncertain water supplies when mountain snowpack melts too early in the spring.³²

In short, the world faces the prospect that deserts will grow, permafrost will melt, glaciers will fall into the sea—all with frightening and unknowable consequences on many different kinds of people.³³ Getting those constituencies to work together is of course a major issue.³⁴ But their very diversity is in some ways a strength: concerned citizens on the New Jersey shore are not going to let the Pacific Islanders' claims be treated as a laughing matter, because they too have an interest in keeping the ocean levels from rising. Indeed, much progress has already

27. *Id.* at 24 (asserting that Colorado rejected riparian rights system in order to prevent riparian owners' monopoly).

28. See ROSE, PROPERTY AND PERSUASION, *supra* note 12, at 188 (noting turn of western states to instream water conservation for fishing and scenic purposes); Blumm et al., *supra* note 21 (describing efforts to account for Indian fishing rights on Klamath River).

29. Sara C. Amindzadeh, Note, *A Moral Imperative: The Human Rights Implications of Climate Change*, 30 HASTINGS INT'L & COMP. L. REV. 231, 244–45 (2007) (noting peril to Pacific Islanders, also to Inuit peoples).

30. Richard A. Posner, *Efficient Responses to Catastrophic Risk*, 6 CHI. J. INT'L L. 511, 517–18 (2006) (referring to possibility of shift in Gulf Stream).

31. Kirsten H. Engel, *Climate Change Litigation (Other than Under the Clean Air Act)*, Global Warming: Climate Change and the Law, A.L.I.-A.B.A. Continuing Legal Educ., Mar. 22–23, 2006, at 141, 149–50 (describing polar bear populations and litigation initiatives).

32. Matthew D. Zinn, *Adapting to Climate Change: Environmental Law in a Warmer World*, 34 ECOLOGY L.Q. 61, 68–69 (2007) (describing effects of warmer climate on urban water supplies).

33. Posner, *supra* note 30, at 518 (describing impacts of global warming as unknowable).

34. See GARY LIBECAP, CONTRACTING FOR PROPERTY RIGHTS 22–23 (1989) (noting that heterogeneity of affected groups makes it more difficult to arrive at solutions to common pool problems).

been made in the international community, with the basic elements of international treaty obligations already in place through the Kyoto Protocol.³⁵

The conspicuous absence of the United States and China from the Kyoto Protocol limitations, however, represents another parallel with the cap problem in western water rights. That parallel plays out in groundwater: groundwater is the silent but all important absent player in appropriative rights to surface water. From the start, western water doctrine tacitly assumed a kind of cap: total water use would basically take up the water in the stream. But groundwater is the great underground storage system that feeds the streams.³⁶ If groundwater usage goes uncapped, appropriative rights to surface waters may be reduced dramatically.

This fact is not a secret. It has long been known that groundwater and surface water are hydrologically related, and there have long been calls to link their legal treatment.³⁷ The only real reason for the differences in their treatment stems from the greater difficulty of regulating groundwater. Groundwater is invisible and elusive, and because it is relatively easy to tap from a great variety of locations, its use is hard to monitor. As a result, for many years groundwater essentially went unregulated.³⁸ This was true even in very dry states like Arizona, where surface water has long been subject to the appropriation system. The sun is setting on this era of neglect, though perhaps not fast enough to avoid severe water problems.³⁹

Just as groundwater is the elephant in the room for appropriative rights to surface waters, efforts to contain climate change have an elephant in the room too: the nonparticipation of the United States, as well as the nonparticipation of several rapidly industrializing countries, notably China and India. A greenhouse gas cap that ignores these major players is like a surface water regime that discounts groundwater: the hoped-for cap will rapidly seep away.

Nevertheless, these current non-players do have a stake in slowing down global warming. For example, China and the United States have coastal areas at risk, as Hurricane Katrina so dramatically illustrated. But once again, moral factors could play a role in nonparticipation. Putting to one side the resistance of the United States, leaders in less-developed countries (“LDCs”) have expressed the view that the currently-more-developed countries have already endangered the

35. Kyoto Protocol to the United Nations Framework Convention on Climate Change, Dec. 11, 1997, U.N. Doc. FCCC/CP/1997/L.7/Add.1, *available at* <http://unfccc.int/resource/docs/convkp/kpeng.pdf>.

36. ROBERT GLENNON, WATER FOLLIES: GROUNDWATER PUMPING AND THE FATE OF AMERICA'S FRESH WATERS 42 (2002).

37. *Id.* at 39–44 (discussing hydrologic link); Barton H. Thompson Jr., *Institutional Perspectives on Water Policy and Markets*, 81 CAL. L. REV. 671 (1993) (citing calls for common regulation going back to 1920s).

38. *See, e.g.*, GLENNON, *supra* note 36, at 89–90 (describing lack of groundwater regulation in Texas).

39. *See, e.g.*, Chris Avery et al., *Good Intentions, Unintended Consequences: The Central Arizona Groundwater Replenishment District*, 49 ARIZ. L. REV. 339 (2007) (describing groundwater management, replenishment efforts, and problems).

atmospheric balance, and that it should not be the task of the LDCs to halt *their* development to make up for the past sins of others.⁴⁰

One way to satisfy the LDCs' complaint is to recognize them as entitlement-holders and to compensate them for participation, either through clean energy technology or through trades that pay them for conservation. But that kind of solution brings up the other half of cap-and-trade, namely trade. What can be traded for what? The first issue in trades is that of defining rights, the issue to which I now turn, once again looking to our own water-right systems for guidance.

II. DEFINING RIGHTS

How does one originally acquire water rights in a western water regime? The answer is that one has to *do* something: most western water statutes require the appropriator to make an actual diversion from the stream, then to use it in a "beneficial" manner (e.g. mining or agriculture), and then to continue to use it, subject to the threat of loss for nonuse.⁴¹ In the typical appropriative regime, the first appropriator has first claim to the amount s/he diverts, then the second appropriator, and on down the timeline until the stream is completely appropriated—or as in the case of many western streams, more than completely appropriated.⁴²

Because property is a social institution, property rights all require some signaling of their presence and quantity to the persons that are supposed to recognize them.⁴³ Your immediate neighbor knows how much water you are taking, at least roughly, but a stranger may not, unless your activities give off conventionally understood markers of your claims. While the appropriation requirements serve other functions as well, they all act as signals or markers, helping an outsider to discern not only the fact of a rival water claim, but also the quantity of water that any given user is claiming. An outsider can see the diversion equipment and measure the water that enters the sluice (the diversion requirement); she can see the mine or agricultural use and get some sense of how much water is required (the beneficial use requirement); she can be certain that unseen claims—those not diverted and/or used—will drop from the books and not surprise a new claimant such as herself (the use-it-or-lose-it requirement).

On the other hand, the very signaling function of these requirements constrains the uses to which water rights can be used. Appropriative rights are a

40. Todd B. Adams, *Is there a Legal Future for Sustainable Development in Global Warming? Justice, Economics, and Protecting the Environment*, 16 GEO. INT'L ENVTL. L. REV. 77, 106 (2003) (noting LDC objections to allocations based on historic use); *id.* at 116–17 (complaints that wealthier nations will buy up all rights, leaving LDCs undeveloped).

41. 78 AM. JUR. 2D *Waters* § 341 (2007) (defining prior appropriation doctrine and requirements).

42. See, e.g., Janet C. Neuman, *The Good, the Bad, and the Ugly: The First Ten Years of the Oregon Water Trust*, 83 NEB. L. REV. 432, 436–37 (2004) (describing frequent overappropriation of western streams, encouraged by the use-it-or-lose-it rules of prior appropriation doctrine).

43. Carol M. Rose, *Possession as the Origin of Property*, 52 U. CHI. L. REV. 73, 81–82 (1985).

variant on the rule of capture in property, and as a number scholars have noted, the rule of capture is unfriendly to passive uses—like instream uses for fish and habitat maintenance—because the rule of capture generally requires some alteration of a resource from its natural state.⁴⁴ The alteration signals the claim, whereas leaving the resource in its natural state is ambiguous. How much water are you claiming for an instream use? It is hard to tell, since you have no diversion equipment that can be assessed at a glance, and no crops whose water needs can also be roughly calculated. How much water does a fish need? Hydrologists and biologists may know, but for farmers and miners who might assert rights to the river water, it is not easy to tell by direct observation how much water these uses claim, or even whether a claim is being made.

More modern signaling systems, notably recording and registration, can act as markers and measures of rights claims without the need for physical alterations to a given natural resource. That is a great advance for preserving the passive uses so important for environmental protection; if a record system is in place, a stranger can find out about your claims to a forest without your having to cut down the trees. By the same token, a stranger can find out about your instream water claims without your having to divert the water.

There is an obvious lesson here for climate change control programs. For example, it now appears that augmenting and perhaps (more controversially) maintaining forest cover is to be a part of climate change control programs, for purposes of sequestering ambient carbon dioxide (“CO₂”);⁴⁵ but if so, the trading programs will need some way to mark out the forestry allowances that count toward compliance. The easiest marker of forest ownership is cutting down the trees, the forestry equivalent of capturing water by diverting it, but this is obviously counterproductive, just as diversion would be counterproductive for claiming instream rights. As between growing new trees and maintaining old forest cover, growing new trees has some similarity to diverting water, in that reforestation involves a physical change, and thus it gives off a better-defined signal than merely leaving an old forest alone. Indeed, in the negotiations over the Kyoto Protocol, Europeans complained that American ideas of credits for forest cover allowances were too vague. As the German environment minister complained, the Americans would create a forest road, fly a plane over it, and then say that they were sequestering greenhouse gases in the forest.⁴⁶ The objection echoes the problems with claiming instream rights—if there is no physical alteration, how can anyone delineate the claim or its extent?

44. *Id.* at 85–88 (describing relationship of rule of capture to developmental uses); John G. Sprankling, *An Environmental Critique of Adverse Possession*, 79 CORNELL L. REV 816, 856–57 (1994) (noting property rules’ hostility to natural uses).

45. *See, e.g., Columbia, World Bank Sign Accord on Carbon Credits*, 17 BNA INT’L ENV’T REP. 637 (Aug. 22, 2007) (reporting on agreement on carbon credits for forest maintenance and reforestation, with reforestation eligible for Kyoto Protocol Clean Development credit).

46. Andrew Revkin, *Treaty Talks Fail to Find Consensus in Global Warming*, N.Y. TIMES, Nov. 26, 2000, § 1, at 11.

But as we have learned from both land and water, markers are certainly not impossible for passive uses. The most advantageous method would be a recording or registration system, together with a system of monitoring to make certain that the trees are not removed surreptitiously. These measures should not present insuperable difficulties in more developed countries, where registration and recording are long-established, and where there is a history of well-recognized rights to passive land uses for hunting, fishing, and park recreation.

But record systems are likely to face substantial hurdles in some less developed countries. In some areas, weak legal systems have to compete with informal local institutions in cross-cutting patterns that confuse all kinds of property claims.⁴⁷ Moreover, record-keeping officials may have a vested interest in making the registration of property rights complicated and difficult, as a cash cow for legal or sub rosa payments, or as a method to placate powerful interest groups.⁴⁸ In remote areas—the very places where forest cover is most important to maintain for global climate control—recording and registration systems may languish both because few have demanded them in the past for the usual purposes of land development, and because the extension of formal systems surpasses the capacity of governmental institutions.⁴⁹

Finally, one might expect to find moral objections to the use of trees for carbon sequestration—moral objections that take quite different directions. In the Kyoto negotiations, the Europeans complained about forest cover allowances not only because these allowances would be difficult to define and delineate; they also suspected that the United States was trying to evade what they saw as its responsibility to reduce greenhouse gas emissions from factories and autos.⁵⁰ In currently undeveloped areas, on the other hand, one might expect quite different kinds of moral objections, some aimed at residents of industrialized countries who claim that they can offset their carbon emissions by maintaining trees in LDCs. At least some of the affected locals are likely to ask: Who are those fat cats to tell us that *we* have to keep trees for the sake of *their* industries and *their* air conditioned cars? And besides, who could really prefer a stand of trees to a farm, especially when farms produce food for hungry people? The latter complaint, of course, would echo American agriculturalists' grievances about preserving instream water for fish.

47. See Daniel Fitzpatrick, *Evolution and Chaos in Property Institutions: The Third World Tragedy of Contested Access*, 115 YALE L.J. 996, 1040 (2006) (describing confusion and rights-degradation in areas where formal and informal property institutions overlap).

48. See, e.g., *id.* at 1041 (describing official “pandering” to important interests); Michael Phillips, *Raising the Roof: In Africa, Mortgages Boost an Emerging Middle Class*, WALL ST. J., July 17, 2007, at A1 (describing corruption in Zambian land ministry as former obstacle to land transactions).

49. Fitzpatrick, *supra* note 47, at 1039 (asserting that record systems are beyond governmental capacity in some remote areas).

50. Andrew C. Revkin, *U.S. Move Improves Chances for Global Warming Treaty*, N.Y. TIMES, Nov. 20, 2000, at A6 (quoting a Greenpeace representative who described U.S. forest cover proposals as a “major free ride for the U.S.”).

Moral objections of this sort could undermine efforts to maintain forest cover for carbon sequestration. Unfortunately, carbon sequestration is not an obvious or tangible aspect of a plant's value, particularly if it seems to be required only to satisfy some rich person far away. In that moral climate, surreptitious deforestation may not count as cheating at all, but rather as the right thing to do. And as in any circumstance where collective action is important, noncompliance in one region can create its own dynamic in others: noncompliance induces competitors to give up conservation too, so as to avoid being left behind, thus potentially causing the entire collective effort to unravel. Here too the social aspect of property rights emerges as an important factor: rights claims for standing trees will mean little without the respect and cooperation of the people on the spot, who can control access to those trees.

In appropriative water regimes, then, the methods of defining and measuring property rights create obstacles for protecting passive uses. Those obstacles have lessons for other environmental property regimes. Cheap signaling systems—diverting water, cutting trees—often undermine or destroy the very passive uses that we now want to protect as property. But more effective signaling systems are costly and depend on a political infrastructure that is not always available. Added to those problems are social and moral aspects of property—particularly moral views that reject passive resource claims.

This same cluster of obstacles finds echoes in cap-and-trade programs to control climate change. Registration and recording are possible answers, but these will not be costless—particularly in the remote forested areas that are a likely element in global carbon sequestration. Moreover, registration and recording are only partial answers; the residents of those areas will need to be persuaded to respect passive resource uses.

III. RIGHTS DEFINITION AND TRADE

Record systems can alleviate the passive use problem, if record systems can be established. But water rights regimes reveal another issue that is also difficult to solve: the exercise of water rights has different consequences in different locations and circumstances, and that fact complicates trades. This problem too stems in large part from the way water rights are defined and measured.

The quantity of an appropriative water right is generally measured by diversion, even though some of the diverted water gradually returns to the stream as a "return flow." I will ignore here the widely-noted anti-conservation character of the definition of water rights by diversions, and simply note the consequences if the right is traded. Suppose there are three farmers, A, B, and C. Suppose further that upstream farmer A trades his highest-priority water right to downstream farmer C, who until now had the lowest priority as between A, B, and C. If A attempts to trade away the entire diversion amount, intermediate farmer B, with a lower or "junior" priority right vis-à-vis A, cannot divert the return flow from A's fields, and he finds himself watching the entire amount float down to the now-senior C. Farmer B is aggravated, and he complains that the trade has damaged his junior rights. Farmer B's claim is cognizable under the general rule that juniors are not to be harmed by trades, but in the meantime, fisherwoman X is happy, because

she will have a longer stretch of stream to fish without having to pay a nickel (that is, the trade will create positive externalities for her, illustrating that a trade downstream can create some free riders).⁵¹

The positive and negative externalities of this trade are a function of the imperfect definition of property rights. Some commentators have called for a more precise definition of the rights at issue by saying that the right for all purposes should be a consumptive one, in which return flows are subtracted from diversion (with the happy effect of encouraging conservation, since the water claimant would only be charged for water actually consumed).⁵² But that redefinition would not account for some other issues, e.g. the way in which varying the location of diversion alters the soil's storage capacity and hence the timing profile of water availability.⁵³ And in any event, return flow is much more difficult to measure than diversion—possible, but more difficult and of course more expensive.⁵⁴

These problems bring into focus some of the general issues with property rights definitions. First, of course, property rights are not costless; the more precisely rights are defined, the higher the cost of defining them and communicating their content.⁵⁵

Second, because precision is expensive, we often make do with property rights that do not exactly match all the resource attributes that are important or even central to issues of concern. Instead, we use proxies that are measurable in order to approximate the resource attributes that are harder to measure. In water rights, a central issue is consumption, but diversion is a more easily measured proxy, so we have historically used diversion as a proxy for consumption, inexact though the proxy may be.⁵⁶ For sulfur dioxide, the central issue is acid rain damage to faraway vegetation and aquatic life, but that damage is extremely difficult to measure and to attribute to any given source, so we use the source's emissions instead, a more measurable proxy than damage.⁵⁷

51. See Neuman, *supra* note 42, at 456–58 (discussing complex interactions of water rights on any given stream, including problems for creating instream flow rights).

52. Timothy Tregarthen, *Water in Colorado: Fear and Loathing of the Market*, in WATER RIGHTS: SCARCE RESOURCE ALLOCATION, BUREAUCRACY AND THE ENVIRONMENT 119, 126 (Terry L. Anderson & Jack Hirschleifer eds., 1983).

53. See George A. Gould, *Water Rights Transfers and Third-Party Effects*, 23 LAND & WATER L. REV. 1, 25–28 (1988) (outlining this and other difficulties with consumption definition).

54. *Id.* at 26 (noting administrative costs of defining consumption rights); Thompson, *supra* note 37, at 707 (same).

55. See Henry E. Smith, *The Language of Property: Form, Context and Audience*, 55 STAN. L. REV. 1105, 1161–62 (2003) (analyzing property rules through linguistic theory and information theory, arguing that more complex rights are information intensive and may be too costly for large audiences to process).

56. See, e.g., Barton H. Thompson, Jr., *Markets for Nature*, 25 WM. & MARY ENVTL. L. & POL'Y REV. 261, 268 (2000) (describing consumption as “the name of the game” in western water law, but defined by diversion).

57. James Salzman and J. B. Ruhl, *Currencies and the Commodification of Environmental Law*, 53 STAN. L. REV. 607, 623–24 (2000) (noting use of proxies in environmental regulation, using example of acid rain); see also Jonathan Remy Nash and

There is an additional matter, and one that points us toward a third problem: as with water rights, place often matters. Sulfur dioxide rights exercised in one location (upwind) are more damaging than the same rights exercised elsewhere (downwind), and one result has been that downwind recipients have tried to prevent trade to upwind sources.⁵⁸

The upstream/downstream complaints exemplify a third general issue in property rights definition: efforts to improve the *precision* of property rights limit their *alienability*. Imprecise proxies may be more easily traded, but they fail to account for the externalities that will occur if the right is exercised in some new way or at some new location or some different time. Others have called this issue the “nonfungibility” problem. That is, entitlement X is nonfungible in the sense that it has different effects when carried out in some new circumstance.⁵⁹ One solution is to tailor the rights more precisely in order to parse desired resource attributes and separate them from undesired ones. But the more costly and difficult it is to tailor precise proxies, the more likely it is that any tailoring will take one of two related paths—and both affect trade adversely. The *ex ante* solution is to delineate rights more specifically—e.g., designating when and where air emission rights may be exercised—but doing so reduces the pool of potential trading partners, since fewer and fewer meet the exact specifications.⁶⁰ Alternatively, the *ex post* solution—familiar, for example, in local subdivision approval processes⁶¹—is to leave the rough proxy more or less as it is, but to add a series of post-hoc specifications and conditions that must be negotiated before the rights can be exercised. But these *ex post* conditions once again add to bargaining costs and narrow the trading pool to those with sufficient interest and patience to deal with

Richard Revesz, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 *ECOLOGICAL L.Q.* 569, 619–20, 624–32 (2001) (noting high administrative costs of tradable permits for damage, proposing instead marketable emissions rights as proxies for damage, with trades “constrained” through complex computer model of effects); Nash, *supra* note 6, at 38–39 (proposing similar “constrained development permit” scheme for habitat trades, as opposed to degradation permits).

58. See, e.g., *Clean Air Mkts. Group v. Pataki*, 338 F.3d 82 (2d Cir. 2003) (striking down on federal preemption grounds New York State’s effort to prevent sale of SO₂ allowance to upwind states).

59. Salzman & Ruhl, *supra* note 57, at 613.

60. *Id.* at 646.

61. See, for example, Connecticut’s subdivision approval requirements, at *CONN. GEN. STAT. ANN.* § 8-25 (West 2007) (requiring planning commission approval for subdivisions, including assurance that proposed subdivision has adequate water, sewer, grading, streets, drainage, parks, playgrounds, open spaces, among numerous other matters).

the requirements.⁶² In either case, constraints on the exercise of proxy-based rights limit the tradability of those rights, either indirectly or directly.⁶³

Among the current candidates for cap-and-trade, there are probably no better examples of the proxy or nonfungibility problem than wetlands and habitat trades, in which differences in location and surroundings can result in very different patterns of species conservation. As a consequence, wetlands and habitat trade proposals are hedged with numerous restrictions and conditions.⁶⁴ The more ex post conditions affect these trades, of course, the thinner the trading market and the more cumbersome the trade itself. At the far end of the spectrum, conditions can become so numerous that the rights themselves are untradable—inalienable, as it were.⁶⁵

Do climate change cap-and-trade programs suffer these proxy or fungibility issues? At first glance, it would seem that they do not. Unlike water rights, carbon dioxide production seems to have more or less the same results wherever it is produced. CO₂ all floats up into a uniform atmospheric soup, so that cutbacks anywhere in the world should be equally beneficial. This is wonderful for trade: high-cost CO₂ preventers can pay low-cost preventers to cut back, and we are all better off with lower costs. But would tradable CO₂ rights really be so blissfully free of the fungibility issue? It depends on what is traded for what.⁶⁶ CO₂ itself may indeed be fungible: CO₂ reduction at a factory in Russia could trade one-on-one for oil-shale-related CO₂ in Canada. But it could be a different story if the trade were for something else, say, trading Canadian CO₂ for Russian cutback in methane, which is much harder to measure.⁶⁷ An equally tricky offset is the much-discussed possibility of planting a tree.⁶⁸ True, trees in Russia will sequester

62. See Thomas Merrill & Henry E. Smith, *What Happened to Property in Law and Economics?*, 111 YALE L.J. 357, 395–96 (2001) (describing property as a relatively simple “exclusion” strategy for resource management, arguing that crude characteristics of property can be refined by regulatory add-ons but with the disadvantage of higher information costs and implicitly smaller numbers of users).

63. See also Salzman & Ruhl, *supra* note 57, at 637 (positing that there is an inverse relationship between strategies that complexify the proxy or “currency” ex ante and strategies that limit alienability ex post).

64. See, e.g., Lisa A. Wainger, Dennis King, James Salzman & James Boyd, *Wetland Value Indicators for Scoring Mitigation Trades*, 20 STAN. ENVTL. L.J. 413, 419–20 (2001) (describing heavy regulatory control over wetland trades, proposing a complex set of “value indicators” for trades).

65. See Michael Heller, *The Tragedy of the Anticommons: Property in Transition from Marx to Markets*, 111 HARV. L. REV. 621 (1998) (arguing that an “anticommons” of too many and diverse legal interests can freeze use of any given resource).

66. See, e.g., Salzman & Ruhl, *supra* note 57, at 627–30 (stating that carbon trades have no nonfungibilities of space, though they do have nonfungibilities of type, i.e., what is traded for what).

67. *Id.* at 629 (noting that different greenhouse gases have very different characteristics with respect to monitoring).

68. See, e.g., John Leicester, *Many Warm to “Carbon Neutral,” but Opponents Say Individual Efforts Not Enough to Reduce Pollution*, HOUS. CHRON., Feb. 11, 2007, at A26 (noting that celebrities Leonardo DiCaprio and Al Gore say that they offset carbon use by planting trees elsewhere in world; article also notes other trades with differences of type, e.g., CO₂ for methane).

carbon, so as to offset the Canadian CO₂ production. But trees are also green, and green things get hot. Trees in northern climates (unlike those in the tropics) may even get hot enough to raise the global temperature, at least according to some current studies, so that to some degree, increased green-ness in the north may offset the heat-reducing effects of carbon sequestration.⁶⁹

More studies will undoubtedly reveal more information about this and other fungibility issues, but it appears that global warming control measures may not escape the rights-definition issues that we see in appropriative water rights. Like water rights, most property rights are imperfect proxies for at least some of the resource attributes that we want to control, and nowhere are they likely to be more imperfect than in complex environmental resources. Because they are imperfect proxies, these rights, exercised under different circumstances, have different effects with respect to the very resource attributes we care about. This in turn means that trading those rights can present us with a set of alternatives, none of which are very attractive: shall we try to define the rights more perfectly, footing the expense of greater precision and perhaps limiting trading opportunities? Shall we try to clean up the externalities *ex post*, with conditions on trades, thereby directly reducing alienability and the ease of trades? Shall we go ahead and trade the rights we have, and just live with the externalities? Or finally, shall we abandon the idea of trading altogether, forgoing the efficiency advantages and innovations that trade might bring?

A 2007 news story suggests that these options are already emerging with respect to efforts to mitigate climate change.⁷⁰ The story features a “carbon neutral” resort that manages its carbon neutrality “in-house,” with the result that in one instance, the resort management told a very wealthy and quite astonished patron that no, he could not hire an extra boat for his fishing party—too many carbon emissions. Meanwhile, another resort also promotes carbon neutrality, but by permitting trades to a charity that supports various emission control initiatives elsewhere. But in the trade-permitting resort, participants remain a bit vague on what the charity is and how much of the funds actually go to emission reduction.⁷¹ In short, one resort’s choice is to keep tight control, but at the cost of trade and the flexibility that trade gives; the other choice is for greater flexibility through trade, but at the cost of uncertainty about outcomes. Water rights in appropriation systems have given us a preview to these and other tradeoff options, and so at least we should not be surprised to see them again with climate control.

In fact, western appropriation rights have chosen the second and fourth alternatives—reducing alienability and even abandoning trade—more than one might think from the everyday description of appropriative water rights as tradable. Formal trades of individual water rights do not actually occur very frequently within the legal system; they are too subject to objections and generally

69. Ken Caldeira, Op-Ed, *When Being Green Raises the Heat*, N.Y. TIMES, Jan. 16, 2007, at A21 (arguing that northern forests reduce carbon but may raise heat, unlike tropical forests which also encourage heat-lowering cloud production).

70. Jeffrey Ball, *The Carbon-Neutral Vacation*, WALL ST. J., July 28, 2007, at P1, P5–6.

71. *Id.* at P5–6.

too complex to get much traction.⁷² Where trades *have* occurred in fact is within institutions, both formal and informal.⁷³ In the west, water districts have existed since early in the twentieth century to receive water from Reclamation Act dams, and water rights have been traded actively within these districts.⁷⁴ Trades appear to work out in these institutions because the members know one another and the institutions themselves provide pathways for dispute resolution.

In the very recent past, water rights have suggested another potential trading pattern: trades can engage large institutions. In populous but water-scarce areas like southern California, it has become increasingly clear that the greatest demand for water is in the cities, and the most logical suppliers are the agricultural users, whose heavy water use produces a number of crops of relatively low value.⁷⁵ California has pioneered so-called “ag-to-urban” water trades, with plans for the city of San Diego to buy up rights to water once allocated to the Imperial Irrigation District.⁷⁶

Water, like greenhouse gases, is a complicated and elusive resource—difficult to capture, measure, and monitor. Perhaps even more than greenhouse gases (although there is much to be learned about the latter), water uses can have different characteristics, effects, and interactions with other water uses when they occur in different locations and environments. The American experience with appropriative water rights suggests that property rights are indeed possible with respect to such elusive substances, but that trading regimes for them may not work so well in a one-on-one context between individuals who are strangers to each other. Those kinds of trades work reasonably well for land and for physical objects; but with respect to more complex substances, trades may function most smoothly when mediated by other institutions.

The reason once again relates to the issue of property rights definitions. With elusive substances like water, quantities and consequences are difficult to measure in any fine-grained manner. Institutions can mediate small-scale trades by

72. Gould, *supra* note 53, at 4–5 (noting limited market activity in water, particularly because of third party effects); Thompson, *supra* note 37, at 704–07 (same).

73. Thompson, *supra* note 37, at 676–77 (arguing that while there are few formal water trades, there are many within institutions); Neuman, *supra* note 42, at 456–57 (noting that longstanding neighbors along river are accustomed to informal give-and-take without formal purchases of rights). Highly localized contracting has some of the same features as trading within institutions; even in the eastern states where riparian law prohibits sale of water itself, early nineteenth century mill owners in particular locations entered elaborate agreements about shares of the water’s power. See ROSE, PROPERTY AND PERSUASION, *supra* note 12, at 178 (noting mill owners’ contractual arrangements for water-power sharing); STEINBERG, *supra* note 16, at 85–88 (same).

74. Thompson, *supra* note 37, at 719–23.

75. Robert Jerome Glennon, *Water Scarcity, Marketing, and Privatization*, 83 TEX. L. REV. 1873, 1884–85, 1887–88 (2005) (documenting low value agricultural uses of water compared to high value urban uses).

76. A. Dan Tarlock & Sarah B. Van de Wetering, *Western Growth and Sustainable Water Use: If There are No “Natural Limits,” Should We Worry About Water Supply?*, 27 PUB. LAND & RESOURCES L. REV. 33, 61 (2006) (noting plans for water for San Diego).

providing a locus where the parties can trust one another and where they can be assured of mechanics for solving disputes *ex post*. Larger-scale trades, between institutions rather than within them, can function too, but for a somewhat different reason: while fine-grained measurement may be difficult, larger amounts can indeed be approximated. For example, it is difficult to measure the exact amount of pollution emitted by a particular automobile, but it is much easier to estimate the total pollution levels of the entire fleet of autos of that make and model.

Finally, intermediating institutions may also play a role in assuaging moral hesitations about trading. As in the news story mentioned above, individuals who attempt to reach “carbon neutrality” in their own activities are already contributing to institutions that assist in emission reduction activities in less developed countries, providing a redistributive and philanthropic aspect to the raw trades. What is needed, of course, is assurance that the institutions themselves function as advertised.

An important lesson from water rights trades, then, is that greenhouse-gas trades will require a substantial institutional component. When we talk of cap-and-trade programs for greenhouse gases, we may need more than simply a recording system and a market; we will need to have appropriate institutions that can mediate trades both locally (as water districts mediate local trades) and at a longer distance (as California’s major water districts can trade with big cities). Trading institutions of this sort are already developing for greenhouse gases, even in the United States, where participation is voluntary⁷⁷—a development whose relative lack of coercion again suggests that moral factors can be significant in cap-and-trade programs.

CONCLUSION

American water rights systems have several lessons for the new thinking about cap-and-trade schemes to control greenhouse gases. First, any cap that exceeds a natural limit (like the total quantity of water in a western stream) requires powerful constituencies. Those constituencies are now growing for caps on greenhouse gases, but they have not yet coalesced entirely. Second, tradable emission rights, like western water rights, will almost certainly involve rights-definitions that only imperfectly capture the climate-affecting aspects of the emissions traded; this will entail choices about whether we will accept imperfect trades or attempt to improve them in ways that might enhance the ease of trade itself. Third, American water experience teaches that a trading regime will entail the development of institutions that can mediate trades, bringing together trading partners and assuring them, as well as third parties, that the trades are reasonable, accurate, and fair.

Finally, the history of American water institutions suggests that cap-and-trade regimes are likely to be subject to moral objections from two almost diametrically opposed sources: a pro-development argument that any resource cap is immoral so long as there are still mouths to be fed; and a pro-environmental

77. Most notable in the United States is the Chicago Climate Exchange (“CCX”), a voluntary greenhouse gas trading program, whose participants commit themselves to certain percentage reductions in greenhouse gases. See Overview, <http://www.chicagoclimateexchange.com/content.jsf?id=821>.

charge that it is immoral to trade away one's bad actions. Appropriate institutions can help here too, to persuade the first of the need for moderation, and the second of the need for flexibility. To perform those tasks, of course, we need to pay attention to the institutions themselves—their standards, accountability, and transparency. But as our water law has shown, cap-and-trade will not go far without them.