Climate Change and the Evolution of Property Rights

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I. INTRODUCTION

Climate change will unsettle expectations about both land and water. Those changes will reduce the extent to which existing resource allocations effectively serve societal interests. In the United States, we typically rely on market transactions to adjust property allocations as societal needs and interests change. Markets, however, will not adequately protect the collective, as opposed to the private, interests climate change will put at risk. Changes to underlying property rules will be needed if those interests are to be sustained.

Of course, property rights may be the least of our concerns in a radically changing climate; some scientists predict that large areas of the world may literally

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become too hot to support human life within a few hundred years.[1] Assuming that humanity and its institutions survive, however, property is one of several areas where the law will need to adapt to new circumstances.[2] Adapting property rules may be both more challenging and more important than adapting law in some other contexts. Property rules are especially sticky. They create economic and emotional attachments as well as literal "facts on the ground" which are difficult to remove. But, as explained below, property rules are likely to have especially significant consequences for the ability of human societies to respond to some of the effects of climate change, such as altered precipitation patterns and rising sea levels. Property rules are likely to be critical, in particular, to our ability to carry some part of nature forward to the no-analog future.[3]

There is a familiar story, first articulated by Harold Demsetz[4] and since repeated and elaborated on by a sizeable cadre of economists and legal scholars, suggesting that property rights develop when they are needed and in a form that fits that need. It would be nice to take comfort from that story. Climate change *should* catalyze significant readjustment of property rights. But the evolution of new property rules in response to climate change will be a difficult, and quite probably slow, process. The changes that climate change calls for will largely be toward *weaker*, rather than stronger, individual property rights. Strong property rights encourage moral hazard, increasing the costs of adaptation to a warmer world, and may stand directly in the way of societal adaptation. In addition, the gains from adaptive change are likely to be diffuse, while the losses will be sharply concentrated. In many ways, as a selective pressure on property regimes, climate disruption is reminiscent of the recognition of environmental protection as an important social goal in the second half of the twentieth century. The evolution of property rights in response to climate disruption will face all the hurdles that have plagued the similar evolution over the last several decades in response to environmental protection goals, in heightened form.

This Article examines the need for adaptive evolution of property rights in the face of climate change, the likelihood of adaptive change, and the paths that evolution might take. It begins by recounting the conventional economic story of the evolution of property rights toward increased private ownership. It then

1. *See* Steven C. Sherwood & Matthew Huber, *An Adaptability Limit to Climate Change Due to Heat Stress*, 21 PROC. NAT'L ACAD. SCI. 9552, 9555 (2010).

2. *See, e.g.*, Robin Kundis Craig, *"Stationarity is Dead"—Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9, 61–63 (2010); Holly Doremus, *Adapting to Climate Change Through Law that Bends Without Breaking*, 2 SAN DIEGO J. CLIMATE & ENERGY L. 45 (2010) [hereinafter Doremus, *Adapting to Climate Change*]; Victor B. Flatt, *Adapting Laws for a Changing World: An Approach for Climate Change Adaptation*, 64 FLA. L. REV. (forthcoming 2012); J.B. Ruhl, *Climate Change Adaptation and the Structural Transformation of Environmental Law*, 40 ENVTL. L. 363, 395–99 (2010).

3. *See* J.B. Ruhl, *Climate Change and the Endangered Species Act: Building Bridges to the No-Analog Future*, 88 B.U. L. REV. 1, 27–29 (2008).

4. Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347, 347 (1967).

proceeds to consider how and why climate disruption will require adjustments to the rules of property ownership, and why those adjustments must run in the direction of weakening, rather than strengthening, individual property claims. Finally, it evaluates possible mechanisms for change.

The lesson from this analysis is that there is no room for complacency. J.B. Ruhl predicts that the need for climate adaptation will bring rapid evolution of property rights and liability rules.[5] I am not so sanguine. Biologists know that evolution is not a matter of inevitable rapid progress toward some higher or better state. So do many social scientists—social Darwinism, after all, was rejected long ago. Evolution is a process of random change that is driven by selective pressures but also strongly historically contingent, and therefore path dependent. It is not necessarily unidirectional. It may be slow or fast. It produces as many losers—progeny not well suited to the conditions they face—as winners with increased fitness.

The "evolution" of law is both like and unlike the evolution of organisms. Law evolves like species in the sense that changes are historically contingent; changes in law always proceed from the prior state rather than starting on a clean slate, and can only proceed in certain directions consistent with that state. Legal change is unlike biological evolution, however, in the sense that it is not driven by random processes. Changes in law are always intentional,[6] chosen by some human agency. Theoretically, that should greatly increase the chances that change will be adaptive, but it does not necessarily do so. Human choices about law are fallible, often responsive to crisis rather than carefully thought out, and as likely to be driven by interest group pressures as by the public interest. Perhaps legal changes are more successful than random chance would suggest, but they are far less than perfect. The selection pressures for law are not limited to economic efficiency or the ability to achieve social goals. They include, and may even be dominated by, responsiveness to powerful political interests.

Climate change is an especially difficult problem for property law to respond to because it demands continual change rather than merely a single transition to a new equilibrium. In a stable environment, fine-tuning to external circumstances is the most adaptive strategy for law. In a rapidly changing environment like the one we now face, however, that kind of fine-tuning can be disastrous. What is needed in its stead is agility, the ability to adjust rapidly to changes as they occur. Yet agility is one of the most difficult features for law, and especially property law, to provide. Law by its very nature favors stability over time. Legal rules are supposed to facilitate investment and allow people to make long-term decisions with

5. Ruhl, *supra* note 2, at 395–99.

6. *See* John F. Duffy, *Inventing Invention: A Case Study of Legal Innovation*, 86 TEX. L. REV. 1, 5 (2007); *see also* James E. Krier, *Evolutionary Theory and the Origin of Property Rights*, 95 CORNELL L. REV. 139, 148, 157 (2009) (comparing modern government-mediated changes in property law to intelligent design).

confidence. Property law, which supports long-term, capital-intensive investment, is especially prone to strong entrenchment.[7] As I explain below, the barriers to developing sufficiently adaptable property law are high. If a transition to more agile legal rules is possible at all, the efficiency of that transition, the opportunity to compensate injured parties, and the probability of environmental protection are all likely to be greater if it is planned and gradual rather than a sudden lurch in response to a crisis. It makes sense, therefore, to think proactively about how the necessary transition might be planned and carried out.

Although it has been suggested that markets may facilitate climate adaptation, in my view, markets alone are not likely to do enough. Changes in law will be necessary, and they will be difficult. Federal courts must play the keystone role because they control the interpretation of key constitutional doctrines. They also may be in the best position to do so because they are somewhat insulated from direct political pressures. The chief legal impediment to climate adaptation at the moment is federal court resistance to changes in property rules. If that resistance can be softened, state courts and legislatures can, and likely will, make needed adjustments. Federal courts should be careful not to stand in the way of such adjustments, although they also have a role to play in ensuring that the costs of change are fairly distributed.

II. PROPERTY RIGHTS EVOLUTION

Some of the most fiercely contested questions about property rights relate to change. The extent and rate at which property rules should change are highly controversial. Just as controversial are who should bear the costs of change and what institutions should have the power to determine and implement the necessary changes.

Economists have long viewed property rights as the preferred tool for the orderly allocation of scarce resources. They have developed a conventional, and happy, tale explaining the development of individuated property rights as a matter of seemingly inevitable evolutionary progress. Indeed, this process has come to be described as "the evolution of property rights."[8]

The conventional economic story of the evolution of property rights focuses on the initial recognition of property rights in resources, describing that step as the result of a crude sort of cost-benefit analysis.[9] When the value of a resource

7. Doremus, *Adapting to Climate Change*, *supra* note 2, at 50; Holly Doremus, *Takings and Transitions*, 19 J. LAND USE & ENVTL. L. 1, 21–24 (2003) [hereinafter Doremus, *Takings and Transitions*].

8. *See, e.g.*, Terry L. Anderson & P.J. Hill, *The Evolution of Property Rights: A Study of the American West*, 18 J.L. & ECON. 163, 163 (1975); Saul Levmore, *Two Stories about the Evolution of Property Rights*, 31 J. LEGAL STUD. S421, S421 (2002) [hereinafter Levmore, *Two Stories*]; Gary D. Libecap & James L. Smith, *The Economic Evolution of Petroleum Property Rights in the United States*, 31 J. LEGAL STUD. S589, S589 (2002).

9. Anderson & Hill, *supra* note 8, at 164–65.

exceeds the costs of identifying and enforcing property rights, the story goes, people get together and formally or informally create some kind of property right. The call for recognition of property rights can result from crowding on the commons, an increase in the value of an exploited resource, a decrease in the cost of dividing the commons, or some combination of factors.[10] The resulting property rights may be formal legal rights, enforced by the state. Or, in a smaller, homogenous group, they may be informal social norms, enforced by the social community. The key is that a cost-benefit threshold is crossed: when the losses due to externalities imposed by uncontrolled access exceed the costs of delineating and enforcing individuated rights, those rights are invented. Property rights arise when they are needed, and in the form needed.[11] The invisible hand of economic forces imposes selection pressure which guides the evolution of property rights, through unspecified mechanisms.

Harold Demsetz was the first to articulate this evolutionary theory of property,[12] although he did not use that term. Over the years, others have refined Demsetz's story, pointing out the importance of interest group politics,[13] and more generally of political institutions and the rules through which decisions are made.[14] Still, the focus has remained primarily on the initial emergence and subsequent strengthening of individuated property rights as a reaction to the inefficiencies of collective ownership.[15] The tacit assumption seems to be that change should uniformly run in the direction of increased property rights, because stronger property rights mean increased economic development and growth.[16] In

10. *Id.* at 167 ("[A]nything which reduces the quantity of resources or lowers the opportunity cost will shift the marginal cost curve. Changes in technology, changes in resource endowments, and changes in the scale of operation all could cause such a shift."); *see also* Levmore, *Two Stories*, *supra* note 8, at S423 (changes in technology or value can trigger changes in property rights); Svetozar Pejovich, *Towards an Economic Theory of the Creation of Property Rights*, 30 REV. SOC. ECON. 309, 316 (1972) ("Some important factors which govern changes in the content of property rights are asserted to be: technological innovations and the opening of new markets, changes in relative factor scarcities, and the behavior of the state."); Carol M. Rose, *Rethinking Environmental Controls: Management Strategies for Common Resources*, 1991 DUKE L.J. 1 (1991) (explaining that increasingly costly management strategies, culminating in the creation of individual property rights, become appealing as congestion of the resource increases); Katrina Miriam Wyman, *From Fur to Fish: Reconsidering the Evolution of Private Property*, 80 N.Y.U. L. REV. 117, 135–44 (2005) (describing the Demsetzian approach as focusing on characteristics of the resource, including price, monitoring costs, and degree of utilization).

11. Demsetz, *supra* note 4, at 350; *see also* Anderson & Hill, *supra* note 8, at 172–76 (noting development of cattle branding laws in the West but not in the East).

12. *See generally* Demsetz, *supra* note 4.

13. *See, e.g.*, Saul Levmore, *Property's Uneasy Path and Expanding Future*, 70 U. CHI. L. REV. 181, 183–84 (2003) [hereinafter Levmore, *Property's Uneasy Path*]; Levmore, *Two Stories*, *supra* note 8, at S422; Libecap & Smith, *supra* note 8, at S597; Robert P. Merges, *Intellectual Property Rights and the New Institutional Economics*, 53 VAND. L. REV. 1857, 1869 (2000).

14. *See generally* Wyman, *supra* note 10.

15. *See, e.g.*, Anderson & Hill, *supra* note 8; Gary D. Libecap, *Economic Variables and the Development of the Law: The Case of Western Mineral Rights*, 38 J. ECON. HIST. 338 (1978).

16. *See, e.g.*, Merges, *supra* note 13, at 1871. Weakening of private property rights is understood to happen, but is regarded as an aberration. Professor Levmore, for example, presents the reopening

general, the economic story of property rights evolution continues to be presented as a relentlessly positive one, in which property rights progress toward stronger and more hard-edged individual property rights, which facilitate the efficient distribution of resources. Even those who notice that the classic story hides substantial opportunities for unhealthy political interest group maneuvering nonetheless think that evolutionary pressures will keep property rights reasonably close to the path of efficiency.[17]

The conventional Demsetzian story, however, is radically incomplete as a description of property rights evolution. First, evolution does not necessarily happen just because it would be desirable. The historical story, because it inevitably sees the successes and does not see the failures, cannot help but overestimate the probability of adaptive change. Imagine looking backward at the process of biological evolution on earth, based only on species that currently exist. Because every current species necessarily managed to evolve, it would look as if evolution is always successful. But once you found fossilized remains of species that had gone extinct, you would know that was too optimistic of a conclusion.[18]

Legal evolution, despite the fact that it is consciously directed by human agency, should not be expected to be any more reliably successful. Changes in property regimes create losers as well as winners. If the losers have sufficient political power, change will not occur no matter how efficient it would be.[19] Not surprisingly, there are circumstances in which individual property rights have not developed, or have substantially lagged the changes that made them necessary.[20]

Eventually, proponents of Demsetzian evolutionary theory tend to assume, economic selection pressures will overcome even entrenched resistance.[21] Perhaps that will happen, but it is unlikely to happen quickly. Based on his study of the

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of a commons as the product of abandonment or interest group politics. Levmore, *Two Stories*, *supra* note 8, at S425–28. Although he concedes that "[w]e do not know that interest groups do more harm than good," Professor Levmore believes that at a minimum they raise suspicion. *Id.* at S428. In fairness, I should note that Professor Levmore also recognizes that suspicious interest group activity can be at the root of inefficient privatization. *Id.* at S429–31. He notes that any change in property rights, strengthening or weakening, might arise either to maximize efficiency or as a result of interest group maneuvering, and that "the emergence, as well as rearrangement [of property rights], is as suspicious as their devolution." *Id.* at S451.

17. Saul Levmore, *Property's Uneasy Path*, *supra* note 13, at 184.

18. According to some scientific estimates, no more than one to two percent of all the species that have existed in the earth's history remain in existence today. Douglas H. Erwin, *Extinction as a Loss of Evolutionary History*, 105 PROC. NAT'L ACAD. SCI. 11520, 11520 (2008).

19. *See* Anderson & Hill, *supra* note 8, at 168 ("Institutionally organized externalities do play an important part in what actually happens to the property rights structure.").

20. *See, e.g.*, Daniel Fitzpatrick, *Evolution and Chaos in Property Rights Systems: The Third World Tragedy of Contested Access*, 115 YALE L.J. 996 (2006) (describing the slow evolution of property rights in third world countries); Dean Lueck, *The Extermination and Conservation of the American Bison*, 31 J. LEGAL STUD. S610 (2002) (claiming that property rights never emerged for wild bison); Wyman, *supra* note 10, at 190 (explaining the slow development of property rights in U.S. fisheries).

21. *See, e.g.*, Levmore, *Property's Uneasy Path*, *supra* note 13, at 184.

history of patent law, John Duffy concludes, "Legal innovations take decades, even centuries, to develop. Moreover, legal doctrines later seen to reflect deeply flawed policy can remain stable law for large portions of a century before their downfall."[22] Indeed, it may not happen at all. The evolution of law, like biological evolution, is highly path dependent. New law is never written on a blank slate. Existing rules and institutions necessarily constrain the forms that future rules and institutions can take, and shape perceptions of whether change is needed and what form change *should* take. As with biological evolution, the fact that legal evolution may produce results, which are stable given the starting point and available path, does not mean those results represent the best possible outcome.

The forces that prevent adaptive change need not be seen as evil. Egalitarianism and widespread access to the political process are powerful inhibitors of change. Because efficient rule changes are not always fair, evolution of property rights toward efficiency may be slowest in the most egalitarian societies.[23] Where the victims of change do not have enough power to block it, they also may not have the power to demand recompense. Some major property transitions may have been feasible precisely because social stratification allowed the elite winners to ignore costs to the downtrodden losers.[24] It is not necessarily bad if fairness concerns slow efficient changes in property rights. I mention the possibility here simply to show that the evolution of property rights is hardly a straight march to an objectively desirable "climax community."[25]

Another problem with the conventional Demsetzian theory is that stronger individual property rights are not necessarily either more efficient than collective rights or more desirable in other ways. Private rights do not necessarily solve the problem of overexploitation of the commons. Demsetz's own primary illustration of his thesis, recognition of family hunting grounds when the fur trade brought increased demand for beaver pelts,[26] provides an example. Privatization of hunting grounds did not prevent beaver populations from falling sharply due to overhunting following introduction of the fur trade.[27] That might be because the

22. Duffy, *supra* note 6, at 4.

23. *See* Levmore, *Property's Uneasy Path, supra* note 13, at 184.

24. Stuart Banner, *Transitions Between Property Regimes*, 31 J. LEGAL STUD. S359, S360–61 (2002).

25. Ecologists once believed that ecosystems "evolved in a predetermined set of stages (known as succession) toward a stable 'climax community.'" Mary Jane Angelo, *Embracing Uncertainty, Complexity, and Change: An Eco-Pragmatic Reinvention of a First-Generation Environmental Law*, 33 ECOLOGY L.Q. 105, 140 (2006). For additional explanation of the concept of climax communities, see Judy L. Meyer, *The Dance of Nature: New Concepts in Ecology*, 69 CHI.-KENT L. REV. 875, 876 (1994).

26. Demsetz, *supra* note 4, at 351–53.

27. *See* John C. McManus, *An Economic Analysis of Indian Behavior in the North American Fur Trade*, 32 J. ECON. HIST. 36, 39 (1972) (noting that beaver populations were depleted by overhunting in Eastern Canada even though most of the indigenous bands in the region recognized "individual, exclusive rights to take furs from well-defined hunting grounds").

private rights were incomplete,[28] or because territory owners myopically discounted the benefits of future hunting,[29] or optimistically overestimated the sustainable yield of beaver.[30] The reasons are less important than the reality that the introduction, or strengthening, of private property rights does not automatically eliminate problems.

Indeed, imperfectly designed private rights can create their own pathologies. The counterpart of the tragedy of the commons is the tragedy of the anticommons, in which fragmented property rights create transaction costs that block efficient resource use.[31] Some kinds of property can realize their highest value only through collective use.[32] Furthermore, privatization will not align the owner's interests with society's interest with respect to nonmarket resources because owners cannot fully capture the benefits of those resources even with strong property rights.[33]

Third, because property rights evolution must follow a prescribed institutional path, institutional failures can stand in the way of adaptive change. Evolution requires mechanisms that generate change. Without mutation and selection, there could be no biological evolution. Without mechanisms for creating new or modified types of property rights, there can be no evolution in that sphere. Although there remain substantial difficulties in determining how property institutions arise for the first time,[34] once a stable government exists there are clear

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28. McManus hypothesizes that they were subject to what he calls a "Good Samaritan" exception—any member of the band could hunt on another's territory if necessary for personal consumption. The "owner" of the territory enjoyed only the exclusive right to take animals for sale. *Id.* at 50–51.

29. On myopic discounting, see Eric Biber, *Climate Change and Backlash*, 17 N.Y.U. ENVTL. L.J. 1295, 1320–21 (2009); R.H. Strotz, *Myopia and Inconsistency in Dynamic Utility Maximization*, 23 REV. ECON. STUD. 165 (1956); Barton H. Thompson, Jr., *Tragically Difficult: The Obstacles to Governing the Commons*, 30 ENVTL. L. 241, 262–65 (2000); Gordon C. Winston, *The Reasons for Being of Two Minds: A Comment on Schelling's "Enforcing Rules on Oneself,"* 1 J.L. ECON. & ORG. 375, 377–78 (1985) (noting that people myopically discount future benefits).

30. Even with access to good scientific information, modern resource managers are prone to allow excessive harvests. This phenomenon has been documented for U.S. fisheries, for example, in Josh Eagle & Barton H. Thompson, Jr., *Answering Lord Perry's Question: Dissecting Regulatory Overfishing*, 46 OCEAN & COASTAL MGMT. 649, 671–72 (2003).

31. *See* Michael A. Heller, *The Tragedy of the Anticommons: Property in the Transition from Marx to Markets*, 111 HARV. L. REV. 621 (1998).

32. *See* Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 723 (1986).

33. Biodiversity, for example, is a classic public good. In contrast to traditional goods, people enjoy the benefits of biodiversity, which are primarily option value and existence value, in a nonrivalrous way. "[T]he investor in [such public goods] will often have difficulty in appropriating the returns that the investment generates for society as a whole." Geoffrey Heal, *Discounting: A Review of the Basic Economics*, 74 U. CHI. L. REV. 59, 75–76 (2007).

34. Professor Krier has concisely explained the major strands of the debate about how property rights initially arise, and offered an explanation that combines an initial self-interested search for clear markers with a subsequent, more deliberate development of nuanced property institutions. Krier, *supra* note 6, at 148–59.

institutional mechanisms for refining, adding, or eliminating property rights. Those institutions are crucial to whether evolution occurs and on what path.[35]

Fourth, evolution is not a unidirectional process. Yet in the literature on property rights evolution there is little discussion of how or why changes that weaken property rights might occur. That may be because the economists primarily responsible for that literature are not interested in the relaxation of property rights. Or, it might be because descriptively they believe change in the direction of increasing private rights is more common.[36] That would not be unexpected. Cognitive framing suggests that there should be less political resistance to changes that appear to strengthen rights than to those that appear to weaken or remove rights, even those rights that no longer function efficiently.[37]

Of course, any creation of property rights from what had been an open access commons in effect deprives commoners of something they previously had, but it does so in favor of the focused interests who gain individual rights. If adaptive change requires the loosening of existing property rights in favor of the general public, it will face significant political barriers, no matter how efficient it might be.[38] If those changes do not generate direct market returns, it will be difficult to compensate the losers. Those losers, as current property owners, are not likely to be the relatively powerless whose claims can be ignored. Imposing concentrated losses on the poor is unattractive;[39] imposing concentrated losses on the rich is likely to prove impossible. Once they emerge, therefore, property rights are expected to be sticky.[40] Even stickier, as environmental advocates have learned, are attitudes that attend historic property rights and even property claims that have never had the robust backing of law.[41] People cling tenaciously to what

35. *See, e.g.*, Wyman, *supra* note 10, at 135 (arguing that prevalence of "veto points" in political institutions governing U.S. fisheries has slowed the emergence of individual property rights).

36. *See, e.g.*, Banner, *supra* note 24, at S361 ("Over the long run, transitions between property regimes do generally seem to have run in the direction of efficiency."); Harold Demsetz, *Toward a Theory of Property Rights II: The Competition Between Private and Collective Ownership*, 31 J. LEGAL STUD. S653, S658 (2002) ("In most parts of the world, private ownership has generally grown in importance relative to collective ownership.").

37. *See* Jonathan Remy Nash & Stephanie M. Stern, *Property Frames*, 87 WASH. U. L. REV. 449, 492–501 (2010).

38. *See, e.g.*, Levmore, *Property's Uneasy Path*, *supra* note 13, at 190–92 (2003) (arguing that interest groups will effectively defend property rights even if they cannot organize to grab new ones).

39. *See* Banner, *supra* note 24, at S368–69 (describing how British reorganization of property rights in New Zealand took administrative shortcuts that caused the only significant asset of thousands of Maori to suddenly vanish).

40. *See* Fitzpatrick, *supra* note 20, at 999 (explaining that under the Demsetzian theory, "the likelihood of reversion to open or contested access will be relatively low because the benefits of property are continuous, and other institutions emerge to protect its existence"). Fitzpatrick notes that in the Third World, common property breakdowns are sometimes followed by reversion to open access rather than progression to individual property. He attributes that reversion to a lack of social order endemic to Third World societies. *Id.* at 999–1001; *see also* Thomas W. Merrill, *Introduction: The Demsetz Thesis and the Evolution of Property Rights*, 31 J. LEGAL STUD. S331, S337 (2002).

41. *See* HOLLY DOREMUS & A. DAN TARLOCK, WATER WAR IN THE KLAMATH BASIN:

they believe are their entitlements.

Finally, there is one more important and asymmetric barrier to changes in property rules: the Takings Clause of the Federal Constitution (and its state analogues). As interpreted by the Supreme Court, the Constitution requires compensation not only when the government physically appropriates property, but also when it changes the rules of property ownership too drastically or too quickly. Compensation is required for permanent physical invasions of property, no matter how minor.[42] It is also categorically required for regulation that eliminates all economically beneficial use of property, unless it simply makes explicit pre-existing background property restrictions.[43] If neither of these categorical rules apply, the Court uses a generalized fairness test that looks primarily to the economic impact of the regulation, especially the extent of interference with investment-backed expectations, and the character of the government action.[44]

Nominally, takings review does not impede legal change, but simply allocates the costs of transitions between the government and property owners.[45] In practice, however,

> [r]equiring compensation increases the barriers to change in two ways. First, it superimposes a budgetary check on existing political hurdles. Second, it suggests that property owners hold entitlements to act that government should not infringe. By reframing the debate, judicial declaration that compensation is required is likely to raise political, as well as budgetary, barriers to regulation.[46]

As a practical matter, takings doctrine imposes a powerful check on changes to property rules to the extent that those changes reduce individual property entitlements. There can be no takings challenge to new rules that strengthen property rights or create new ones where none previously existed. Regulatory

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MACHO LAW, COMBAT BIOLOGY AND DIRTY POLITICS 74–76 (2008) (describing the extent to which irrigators in the Klamath Basin internalized the idea that they had strong rights to water despite the weakness of their legal claims); Nash & Stern, *supra* note 37, at 458 ("In instances where property attitudes prove costly, law has struggled to alter perceptions and change behavior."). Nash and Stern explain that new property rights can be made less sticky by publicly forewarning their holders of the possibility of change. It is more difficult, however, to "reframe" views of longstanding property rights. *Id.* at 458, 501.

42. *See* Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419, 421 (1982).

43. Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1004 (1992).

44. Lingle v. Chevron U.S.A., 544 U.S. 528, 538–39 (2005); Penn. Cent. Transp. Co. v. New York City, 438 U.S. 104, 124 (1978).

45. *Lingle*, 544 U.S. at 536–37 ("As its text makes plain, the Takings Clause does not prohibit the taking of private property, but instead places a condition on the exercise of that power. In other words, it is designed not to limit the governmental interference with property rights *per se*, but rather to secure compensation in the event of otherwise proper interference amounting to a taking.") (internal quotation marks and citations omitted).

46. Doremus, *Takings and Transitions*, *supra* note 7, at 11.

takings doctrine therefore further skews the evolution of property rights in the individualistic direction favored by Demsetzian economists.

III. CLIMATE DISRUPTION AS A CHALLENGE TO PROPERTY RIGHTS

Human activity has radically altered the global climate system over the last two hundred years. Greenhouse gases resulting from the combustion of fossil fuels have accumulated in the atmosphere at an accelerating rate; the atmospheric concentration of CO_2, the primary greenhouse gas, is now more than a third higher than it was before the industrial revolution.[47] Greenhouse gases trap energy that would otherwise be radiated away from the earth, causing global mean temperatures to rise.[48] A variety of other effects follow from temperature change, including sea level rise, glacial melting, changes in precipitation levels and storm intensity, earlier snowmelt and associated runoff, and changes in the behavior and ranges of plants and animals.[49]

The physical and biotic changes resulting from greenhouse gas accumulation will disrupt the expectations of property owners in a variety of ways, undermining the security of their investments and putting pressure on current definitions and distributions of property rights. Two examples, vulnerable coastal lands and freshwater, illustrate this phenomenon. Each is already the center of property rights disputes; global climate change will inevitably heighten those tensions.

A. Coastal Lands

Sea level has been rising roughly two millimeters per year since 1950, and more than three millimeters per year since 1990.[50] Global sea level rise represents the sum of two different processes. First, as air temperatures increase, so do water

47. Atmospheric CO_2 has been continuously monitored at Mauna Loa, Hawaii, since 1958. In that time, the mean CO_2 concentration has increased from 315 to 390 ppm; currently, CO_2 levels are rising at about 2 ppm per year. Pieter Tans & Ralph Keeling, *Trends in Atmospheric Carbon Dioxide*, NAT'L OCEANIC & ATMOSPHERIC ADMIN., EARTH SYS. RES. LABORATORY, GLOBAL MONITORING DIVISION, http://www.esrl.noaa.gov/gmd/ccgg/trends/co2_data_mlo.html (last visited Aug. 18, 2011). The preindustrial (AD 1000–1750) atmosphere ranged from about 275 to 285 ppm CO_2. P. Forster et al., *Changes in Atmospheric Constituents and in Radiative Forcing, in* CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS 137 (Susan Solomon et al. eds., 2007), *available at* http://www.ipcc.ch/publications_and_data/publications_ipcc_fourth_assessment_report_wg1_report_the_physical_science_basis.htm.

48. Global mean temperature has increased roughly 0.8º C (roughly 1.4º F) since the industrial revolution. *GISS Surface Temperature Analysis*, NASA GODDARD INST. FOR SPACE STUD., http://data.giss.nasa.gov/gistemp/graphs/ (last visited Nov. 6, 2011).

49. *See* GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES: A STATE OF KNOWLEDGE REPORT FROM THE U.S. GLOBAL CHANGE RESEARCH PROGRAM 9 (Thomas R. Karl et al. eds., 2009); Intergovernmental Panel on Climate Change, *Summary for Policymakers*, *in* CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY 8–12 (Martin Parry et al. eds., 2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/wg2/ar4-wg2-spm.pdf.

50. Robert J. Nicholls & Anny Cazenave, *Sea-Level Rise and Its Impact on Coastal Zones*, 328 SCIENCE 1517, 1517 (2010).

temperatures. And as water warms, it expands. Second, rising temperatures mean melting ice sheets. To the extent those ice sheets are land based and the melted water runs off to the oceans, sea level will increase. The first phenomenon, thermal expansion, is well understood, but the second one, glacial loss, is not.[51] Overall, therefore, the "extent of future [sea level rise] remains highly uncertain."[52] Recent estimates of sea level rise by the end of this century range from as little as ten centimeters to as much as 215 centimeters (roughly four inches to seven feet).[53]

Perhaps surprisingly, sea level rise is not uniform across the globe. Absolute sea level rise varies with local ocean temperatures, currents and winds, and other local variables. Sea level rise relative to land also varies locally depending upon whether the land is uplifting (from, for example, loss of the weight of glaciers as they melt) or subsiding (for example, as a result of groundwater withdrawals).[54] Small island states and the coasts of Africa and Asia are especially vulnerable to sea level rise because their populations are heavily concentrated in coastal zones and they lack the financial resources to adapt.[55] But sea level rise will also affect developed nations, including the United States.

Roughly one-third of Americans "live in counties immediately bordering the nation's ocean coasts."[56] Sea level rise is expected to be especially pronounced along the Atlantic coast and the Gulf of Mexico.[57] Major U.S. cities including New York, Boston, Miami, and New Orleans are at high risk of inundation.[58] Although sea level rise on the Pacific coast is expected to be less extreme, heavily populated areas around Puget Sound[59] and San Francisco Bay[60] are at significant risk. Sea

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51. *Id.* at 1518; GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES, *supra* note 49, at 25.

52. Nicholls & Cazenave, *supra* note 50, at 1519.

53. *Id.* at 1518; Aslak Grinsted et al., *Reconstructing Sea Level from Paleo and Projected Temperatures 200 to 2100 AD*, 34 CLIMATE DYNAMICS 461, 469 (2010); Stefan Rahmstorf, *A New View on Sea Level Rise*, 4 NATURE REP. CLIMATE CHANGE 44, 45 (2010).

54. GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES, *supra* note 49, at 25–26; Nicholls & Cazenave, *supra* note 50, at 1518.

55. Nicholls & Cazenave, *supra* note 50, at 1519.

56. GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES, *supra* note 49, at 149.

57. *Id.* at 37.

58. *Id.* at 103, 109, 150.

59. *Id.* at 138. In southern Florida, sea level rise of twenty-seven inches, well within the range of forecasts for the next century, would inundate a large proportion of southern Florida; more than 1.5 million people currently make their home in parts of the state which would be underwater. ELIZABETH STANTON & FRANK ACKERMAN, TUFTS UNIV., FLORIDA AND CLIMATE CHANGE, at v (2007), *available at* http://www.ase.tufts. edu/gdae/Pubs/rp/Florida_hr.pdf.

60. *See* CAL. NATURAL RES. AGENCY, 2009 CALIFORNIA CLIMATE ADAPTATION STRATEGY 68 (2009); MATTHEW HEBERGER ET AL., CALIFORNIA CLIMATE CHANGE CENTER, THE IMPACTS OF SEA LEVEL RISE ON THE CALIFORNIA COAST 13 (2009), *available at* http://www.pacinst.org/reports/sea_level_rise/report.pdf; Tim Eichenberg et al., *Climate Change and the Public Trust Doctrine: Using an Ancient Doctrine to Adapt to Rising Sea Levels in San Francisco Bay*, 3 GOLDEN GATE U. ENVTL. L.J. 243, 245–46 (2010).

level rise can flood coastal communities, cause saltwater to contaminate surface or groundwater resources, interfere with the functioning of septic systems,[61] and drown coastal wetlands.[62] It can break barrier islands in pieces or cause them to move rapidly shoreward.[63] It increases coastal erosion and damage from storm surges.[64] Synergistically, warmer ocean waters are likely to increase the intensity of hurricanes and tropical storms, making them even more damaging.[65] Homes, roads, rail lines, power lines, pipelines, and other built infrastructure are all at risk, as are coastal ecosystems.[66]

B. Fresh Water

The problem of adaptation to climate change is in many ways a water problem, and one that will hit regions already at or near the limits of their water resources, such as the American West, especially hard. Global warming will alter many factors that are important to water management and use. Most obviously, warmer air temperatures mean warmer water temperatures. That may not be much of a problem for most human water users, but it can be a matter of life or death for cold-water fishes such as salmonids.[67]

The effects of climate change on water go far beyond direct changes in temperature, however. Higher atmospheric temperatures mean that a higher proportion of precipitation will fall as rain, rather than snow.[68] The shift from snow to rain will be especially pronounced in areas like California's Sierra Nevada mountains, where current winter temperatures commonly hover near the freezing

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61. U.S. CLIMATE CHANGE SCI. PROGRAM, COASTAL SENSITIVITY TO SEA-LEVEL RISE: A FOCUS ON THE MID-ATLANTIC REGION 174 (2009).

62. GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES, *supra* note 49, at 62, 114; Nicholls & Cazenave, *supra* note 50, at 1518.

63. U.S. CLIMATE CHANGE SCI. PROGRAM, *supra* note 61, at 22.

64. GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES, *supra* note 49, at 10. One report from a decade ago estimates that 1,500 shoreline homes are lost to erosion each year, at a total cost to landowners of about $530 million. THE HEINZ CTR., REPORT BRIEF: EVALUATION OF EROSION HAZARDS 2 (2000).

65. It is still difficult to predict whether global warming will increase the number of storm events globally or in particular regions, but most observers think it will increase storm intensity. GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES, *supra* note 49, at 35–36; Thomas R. Knutson et al., *Tropical Cyclones and Climate Change*, 3 NATURE GEOSCIENCE 157, 161 (2010).

66. GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES, *supra* note 49, at 57, 62, 84.

67. *See, e.g.*, M.D. Bryant, *Global Climate Change and Potential Effects on Pacific Salmonids in Freshwater Ecosystems of Southeast Alaska*, 95 CLIMATIC CHANGE 169 (2009); B. Jonsson & N. Jonsson, *A Review of the Likely Effects of Climate Change on Anadromous Atlantic Salmon* Salmo Salar *and Brown Trout* Salmo Trutta*, with Particular Reference to Water Temperature and Flow*, 75 J. FISH BIO. 2381 (2009); Dale A. McCullough et al., *Research in Thermal Biology: Burning Questions for Coldwater Stream Fishes*, 17 REV. IN FISHERIES SCI. 90 (2009).

68. LEVI D. BREKKE ET AL., U.S. GEOLOGICAL SURV., CIRCULAR NO. 1331, CLIMATE CHANGE AND WATER RESOURCES MANAGEMENT: A FEDERAL PERSPECTIVE 6 (2009).

point and local warming is expected to exceed the global average.[69] The fraction of winter precipitation falling as snow has decreased significantly since the mid-twentieth century across much of the western United States;[70] that trend is expected to accelerate. As a result, the winter snowpack, which serves as an important natural reservoir, is forecast to decrease dramatically, losing as much as ninety percent of its present storage capacity by 2100 in some places.[71] Together, the shift from winter snow to rain and warmer spring temperatures will push peak flows and spring runoff earlier in the year. Because, especially in the West, "water management strategies for supply and flood control are . . . highly attuned to streamflow timing," such changes will be problematic for both water management[72] and aquatic ecosystems.

Climate change will also alter the total amount of precipitation. In general, the northern and eastern portions of the country are expected to get wetter, while the already arid Southwest gets drier.[73] Uncertainty about precipitation changes remains high,[74] especially at the regional scale. It is still difficult to forecast the direction or magnitude of precipitation changes at temporal and geographic scales relevant to water management.[75] On a worldwide basis, however, scientists have high confidence that climate change will substantially alter hydrology. A committee of the National Research Council recently offered quantitative estimates: for every one degree Celsius increase in global mean temperature, we should expect five to ten percent changes in precipitation and streamflow in many areas.[76]

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69. MICHAEL KIPARSKY & PETER H. GLEICK, PAC. INST. FOR STUDIES IN DEV., ENV'T, & SEC., CLIMATE CHANGE AND CALIFORNIA WATER RESOURCES 6 (2003), *available at* http://www.waterplan.water.ca.gov/docs/cwpu2005/vol4/vol4-globalclimate-climatechangeandcaliforniawater.pdf.

70. Noah Knowles et al., *Trends in Snowfall Versus Rainfall in the Western United States*, 19 J. CLIMATE 4545, 4557 (2006).

71. MICHAEL ANDERSON, CAL. DEP'T OF WATER RES., THE STATE OF CLIMATE CHANGE SCIENCE FOR WATER RESOURCES OPERATIONS, PLANNING, AND MANAGEMENT 1 (2009), *available at* http://www.waterplan.water.ca.gov/docs/cwpu2009/0310final/v4c02a16_cwp2009.pdf. The spring snowpack in the Sierra Nevada has already lost about ten percent of its historic volume. CAL. DEP'T OF WATER RES., MANAGING AN UNCERTAIN FUTURE: CLIMATE CHANGE ADAPTATION STRATEGIES FOR CALIFORNIA'S WATER 3 (2008), *available at* http://www.water.ca.gov/climatechange/docs/ClimateChangeWhitePaper.pdf.

72. BARRY NELSON ET AL., NATURAL RES. DEF. COUNCIL, IN HOT WATER: WATER MANAGEMENT STRATEGIES TO WEATHER THE EFFECTS OF GLOBAL WARMING 6 (2007), *available at* http://www.nrdc.org/globalwarming/hotwater/hotwater.pdf.

73. TETRA TECH, INC., EVALUATING SUSTAINABILITY OF PROJECTED WATER DEMANDS UNDER FUTURE CLIMATE CHANGE SCENARIOS 14 (2010), *available at* http://rd.tetratech.com/climatechange/projects/doc/Tetra_Tech_Climate_Report_2010_lowres.pdf; BREKKE ET AL., *supra* note 68, at 6–7.

74. Gerald A. Meehl et al., *Global Climate Change Predictions*, *in* CLIMATE CHANGE 2007, *supra* note 47, at 768.

75. ANDERSON, *supra* note 71, at 1; Julia M. Slingo et al., *Introduction: Food Crops in a Changing Climate*, 360 PHIL. TRANSACTIONS ROYAL SOC'Y. B 1983, 1985 (2005).

76. NAT'L RESEARCH COUNCIL, COMMITTEE ON STABILIZATION TARGETS FOR

In addition to changing average precipitation levels, climate change is expected to increase precipitation variability. Both drought and flood will become more common. "Normal" water years may become the exception, rather than the rule. Precipitation is likely to come in more intense events, even in areas where total rainfall goes down.[77]

C. The Property Rights Challenge

The examples of coastal lands and fresh waters illustrate the extent to which climate change is a legal as well as practical problem. It is a legal problem because law inhibits society's ability to respond to the changes climate disruption brings. In each context, individuated property rights butt up against common rights that cannot be effectively privatized. In each, adapting to climate change will be more difficult, and will reach a different endpoint, if current property holders enjoy rigid rights which cannot be adjusted without consent or compensation. In each context, even without climate change, the extent of those individuated rights is already contested and property law, which strives for stability, struggles to cope with what are already dynamic systems. Climate change further emphasizes the dynamic nature of land and water, raises the economic and emotional stakes, and increases the likelihood of conflict.

1. Coastal Lands

With respect to coastal lands, conflict centers on the rights to build structures and to armor the coast in order to protect those structures. Their proximity to the ocean makes coastal lands both especially attractive for residential construction[78] and especially vulnerable to storms and erosion.[79] The aesthetic attractions of coastal property seem to carry more weight in the marketplace than its vulnerability. The value of coastal lands has risen dramatically.[80]

ATMOSPHERIC GREENHOUSE GAS CONCENTRATIONS, CLIMATE STABILIZATION TARGETS: EMISSIONS, CONCENTRATIONS, AND IMPACTS OVER DECADES TO MILLENIA 6 (prepublication copy, 2010).

77. Meehl et al., *supra* note 74, at 750.

78. In general, home value substantially increases with water frontage, and decreases with distance from the water. *See, e.g.*, George R. Parsons & Michael Powell, *Measuring the Cost of Beach Retreat*, 29 COASTAL MGMT. 91, 98 (2001) and references cited therein; *see also* Oliver A. Houck, *More Unfinished Stories: Lucas, Atlanta Coalition, and Palila/Sweet Home*, 75 U. COLO. L. REV. 331, 358 (2004) ("Oceanfront property, raw land, and sand, sells for up to half a million dollars an acre, and highly desirable property even more.").

79. *See, e.g.*, Meg Caldwell & Craig Holt Segall, *No Day at the Beach: Sea Level Rise, Ecosystem Loss, and Public Access Along the California Coast*, 34 ECOLOGY L.Q. 533, 539 (2007) (describing the vulnerability of California's coastal bluffs); Donna R. Christie, *Of Beaches, Boundaries, and SOBs*, 25 J. LAND USE & ENVTL. L. 19, 24–25 (2009) (noting that beaches are generally dynamic systems).

80. Dana Beach & Kim Diana Connolly, *A Retrospective on* Lucas v. South Carolina Coastal Council*: Public Policy Implications for the 21st Century*, 12 SOUTHEASTERN ENVTL. L.J. 1, 11 (2003) (noting dramatic price increases "on an especially unstable part of the Isle of Palms" in South Carolina just prior to David Lucas's purchase of his lots). In Florida, the total value of coastal parcels,

Coastal development affects both public and private interests. Coastal lands lie at the intersection of public and private lands; in most coastal states, the state owns lands below the mean high-water mark, or at least the public holds an easement to access those lands for purposes of navigation, fishing, and recreation.[81] Private landowners who have developed coastal lands often want to "armor" their shoreline with seawalls and similar structures to halt erosion before it threatens their structures.[82] But such armoring can destroy the public beach seaward of the wall[83] and block access to the remaining public beach.[84] Armoring can also cause erosion on adjacent lands, which may be privately owned.[85]

There has already been considerable controversy and litigation over government-imposed restrictions on rights to build on and armor privately owned coastal lands. Coastal development restrictions produced one of the iconic Supreme Court takings decisions of the late twentieth century, *Lucas v. South Carolina Coastal Council*.[86] *Lucas* grew out of a challenge to South Carolina's Beachfront Management Act, which prohibited building on two lots owned by David Lucas, which lay seaward of the historic erosion line established by the state. Finding that Lucas had been deprived of all economic use of his property, the Court concluded that he was entitled to compensation unless "the proscribed use interests were not part of his title to begin with"[87] based on background principles of state law.[88] Although the Beachfront Management Act was supported by legislative findings that development too close to the beach "accelerated erosion, and endangered adjacent property,"[89] on remand the South Carolina Supreme Court found no common law basis for the state to bar Lucas from building on his lot.[90]

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defined as those seaward of the road closest to the shore, was $181 billion in 2007, more than double what it was in 2002. JUDITH KILDOW, NAT'L OCEAN ECON. PROGRAM, PHASE II: FLORIDA'S OCEAN AND COASTAL ECONOMIES REPORT 83–88 (2008), *available at* http://www.dep.state.fl.us/oceanscouncil/reports/Florida_Phase_II_Report.pdf.

81. Eichenberg et al., *supra* note 60, at 247–50.

82. *See, e.g.*, Niki L. Pace, *Wetlands or Seawalls? Adapting Shoreline Regulation to Address Sea Level Rise and Wetland Preservation in the Gulf of Mexico*, 26 J. LAND USE & ENVTL. L. 327, 328–29 (2011).

83. Caldwell & Segall, *supra* note 79, at 540; Madeline Reed, *Seawalls and the Public Trust: Navigating the Tension Between Private Property and Public Beach Use in the Face of Shoreline Erosion*, 20 FORDHAM ENVTL. L. REV. 305, 307–10 (2009).

84. Caldwell & Segall, *supra* note 79, at 540.

85. Omar Defeo et al., *Threats to Sandy Beach Ecosystems: A Review*, 81 ESTUARINE COASTAL & SHELF SCI. 1, 6 (2009).

86. 505 U.S. 1003 (1992).

87. *Id.* at 1027.

88. *Id.* at 1029.

89. *Id.* at 1021 n.10.

90. Lucas v. S.C. Coastal Council, 424 S.E.2d 484 (S.C. 1992). Blake Hudson has suggested that the state Coastal Council argued its case badly on remand, failing to present what might have been a persuasive argument that the venerable public trust doctrine supported the coastal building prohibition. Blake Hudson, *The Public and Wildlife Trust Doctrines and the Untold Story of the* Lucas *Remand*, 34 COLUM. J. ENVTL. L. 99, 130–35 (2009).

Conflicts about the right of property owners to armor their coastal property and the legal effect of armoring have also reached the courts. Several states have barred or substantially restricted coastal armoring.[91] Courts in Oregon and North Carolina have upheld armoring prohibitions against takings challenges.[92] But such restrictions remain controversial, legally contested, and in tension with federal incentives and a general bias toward "hard solutions"[93] to coastal vulnerability. There is some venerable authority for the proposition that coastal landowners have a right to erect structures to defend their property from the inroads of the sea;[94] according to Peter Byrne, in the most prominent modern cases rejecting such a right state courts "have had to resort to creative interpretations" of precedent.[95] Professor Joseph Sax has suggested that neither traditional common law rules nor the Takings Clause offer a helpful way of conceptualizing modern conflicts over armoring to protect lands from rapid sea level rise driven by global warming.[96] Yet they continue to be fought on precisely that legal landscape.

As with rights to armor, the legal effect of migration of the shoreline, with or without armoring, has spawned conflict. In the absence of armoring, the mean high water mark, vegetation, or whatever line of demarcation the states regard as separating public and private rights, can move both coastward and seaward as sand accumulates (accretes) and erodes away. Under this "rolling easement" or ambulatory public trust approach, as erosion moves the coast back the public trust easement accompanies it, so that public rights neither increase nor decrease.[97] Texas recognizes what may be the most extreme version of this doctrine. There,

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91. Caldwell & Segall, *supra* note 79, at 572–74; Eichenberg et al., *supra* note 60, at 271.

92. Shell Island Homeowners Ass'n v. Tomlinson, 134 N.C. App. 217 (1999); Stevens v. City of Cannon Beach, 317 Or. 131 (1993). The U.S. Supreme Court declined to take up the Oregon case, with Justices Scalia and O'Connor expressing some skepticism about the validity of the state court's determination that an established "background principle" of state law, the public's customary use to utilize the dry-sand beach for recreation, justified denial of a permit to build a seawall on the dry sand. Stevens v. City of Cannon Beach, 114 S. Ct. 1332, 1334 (1994).

93. U.S. CLIMATE CHANGE SCI. PROGRAM, *supra* note 61, at 165 (Federal, state, local, and private institutions generally have a strong bias *favoring* shore protection over retreat in developed areas.); *id.* at 169 (noting that there are clear institutional paths for federal permits for armoring, while more environmentally sensitive "soft" solutions must be sought individually).

94. *See* Katenkamp v. Union Realty Co., 59 P.2d 473, 477–78 (Cal. 1936); Revell v. People, 52 N.E. 1052, 1059–60 (Ill. 1898).

95. J. Peter Byrne, *Rising Seas and Common Law Baselines: A Comment on Regulatory Takings Discourse Concerning Climate Change*, 11 VT. J. ENVTL. L. 625, 638 (2010).

96. Joseph L. Sax, *Some Unorthodox Thoughts About Rising Sea Levels, Beach Erosion, and Property Rights*, 11 VT. J. ENVTL. L. 641 (2010).

97. *See* Feinman v. State, 717 S.W.2d 106, 110–11 (Tex. App. 1986); Matcha v. Mattox, 711 S.W.2d 95, 100 (Tex. App. 1986) ("An easement fixed in place while the beach moves would result in the easement being either under water or left high and dry inland, detached from the shore. Such easement, meant to preserve the public right to use and enjoy the beach, would then cease functioning for that purpose."). For a general description of the rolling easement concept, see James G. Titus, *Rising Seas, Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches Without Hurting Property Owners*, 57 MD. L. REV. 1279, 1313–17 (1998).

the state claims a public easement on the dry sand beach of its Gulf Coast up to the vegetation line under the common law and the Texas Open Beaches Act.[98] When hurricanes erode the beach, that line can move landward to the extent that shorefront homes are suddenly located on the state's dry sand, at which point the state may demand their removal from the public easement.[99] Texas's intermediate courts of appeals have upheld this application of a rolling easement against a series of takings challenges,[100] but the issue remains unsettled in the Texas Supreme Court and the federal courts.[101]

Recently, the Ninth Circuit concluded that the boundary between private and public rights may continue to move even if a seawall halts the encroachment of the tidelands. In *United States v. Milner*,[102] it held that an upland landowner could not "permanently fix the property boundary" with a seawall absent consent of the tidelands owner. Affirming a district court finding that the seawall was now trespassing on the tidelands, the circuit court wrote, "Once the shore has eroded so dramatically that the property owner's shore defense structures fix the ambulatory boundary, the upland owner cannot expect to permanently maintain the boundary there without paying damages to the tideland owner or working out an agreement with the tideland owner."[103] Because the *Milner* case arose in the unusual context of an Indian reservation, with the federal government rather than

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98. The Open Beaches Act was first passed in 1959. David J. Bederman, *The Curious Resurrection of Custom: Beach Access and Judicial Takings*, 96 COLUM. L. REV. 1375, 1414 (1996). The precise relationship between the Act and common law public easements by custom or prescription is not entirely clear, but that is not unusual. Statutes and the common law are often intricately intermingled in the creation and definition of property rights. Roderick E. Walston, *The Constitution and Property: Due Process, Regulatory Takings, and Judicial Takings*, 2001 UTAH L. REV. 379 (2001).

99. *See* Severance v. Patterson, 566 F.3d 490, 494 (5th Cir. 2009).

100. *See* Brannan v. State, No. 01-08-00179-CV, 2010 WL 375921, at *20 (Tex. App. Feb. 4, 2010).

101. *Severance*, 566 F.3d at 498–500. In *Severance*, the Fifth Circuit found a federal takings claim unripe because the plaintiff had not sought compensation in state courts, and it was not certain that such a claim would fail. *Id.* at 500. The court concluded, that a related "unreasonable seizure" claim under the Fourth Amendment might be ripe, but that like a takings claim that argument could not be resolved without clearer understanding of the relevant state law. It therefore certified to the Supreme Court of Texas several questions about whether Texas in fact recognizes rolling easements, the legal basis for those easements, and the extent to which the prior owners of property that becomes subject to such an easement would be entitled to compensation. *Id.* at 503–04. A strong dissent would have found that, because any taking or unreasonable seizure had occurred long before plaintiff Severance purchased the property and she had full notice of it at the time of her acquisition, she had no grounds for complaint. *Id.* at 504–15 (Wiener, J., dissenting). In response to the certified questions, the Texas Supreme Court initially answered that the public trust easement moves automatically with gradual erosion but not with avulsive storm events. Severance v. Patterson, 345 S.W.3d 18 (Tex. 2010), *reh'g abated*, No. 09-0387, 2011 Tex. LEXIS 573 (S.W.3d, July 29, 2011), *reh'g reinstated*, No. 09-0387, 2011 Tex. LEXIS 779 (S.W.3d, Oct. 7, 2011).

102. 583 F.3d 1174 (9th Cir. 2009).

103. *Id.* at 1190. The court further held that the United States has a right under the Rivers and Harbors Act to demand removal of seawalls which come, because of the movement of the tidal boundary, to be located in navigable waters. *Id.* at 1191–94.

the state owning the tidelands and holding them in trust for the tribe, the court acknowledged that its decision might have limited application.[104] Its reasoning, however, would appear to apply in any state that has recognized an ambulatory boundary between private and public lands and rejected application of the common enemy doctrine to the waters of the sea.[105]

Finally, coastal land property rights illustrate the tension between flexibility and stability in property law. The coasts have always been dynamic; shorelines have moved landward and seaward with storms and sediment deposits. In order to deal with that dynamism, the common law long ago developed doctrines to readjust property rights as the physical reality shifted. Although the reasoning behind the doctrines may have been lost or misconstrued over time and application of the rule has shifted over time,[106] the principle is well established at common law that if the shore moves gradually (by erosion or accretion) the title boundary moves with it, but if it moves rapidly (by avulsion) title does not shift.[107]

The accretion/avulsion rules are dynamic in the sense that they allow property boundaries to change under certain circumstances according to a set of principles that are easy to state but more challenging to apply. There is considerable resistance within the judiciary, however, to another kind of shift: changes in the principles that govern property. In *Lucas*, Justice Scalia, writing for the majority, explained that restrictions so severe as to deny all economically beneficial use of property "cannot be newly legislated or decreed (without compensation), but must inhere in the title itself, in the restrictions that background principles of the State's law of property and nuisance already place upon land."[108] As Professor Sax noted shortly after the decision, Scalia's opinion "seems deliberately calculated to cut off arguments that changing times create changing needs, and with them changing (diminished) expectations that property owners must internalize. Indeed the question, how responsive must property owners be to changing public goals and values, is the central point of dispute between the majority and the dissent in *Lucas*."[109]

At the time, most observers focused on Justice Scalia's transparent hostility to legislative redefinition of property rights. In the Supreme Court's most recent takings decision, however, Justice Scalia made clear that he is just as skeptical of judicial revision of property law, at least to revision in the direction of limiting

104. *Id.* at 1190 n.11.

105. The U.S. Supreme Court declined to review the Ninth Circuit's decision. Sharp v. United States, 583 F.3d 1174 (9th Cir. 2009), *cert. denied*, 130 S. Ct. 3273 (2010).

106. For a thorough and careful explication of the development of the doctrines of accretion and avulsion in English law, see Joseph L. Sax, *The Accretion/Avulsion Puzzle: Its Past Revealed, Its Future Proposed*, 23 TUL. ENVTL. L.J. 305, 311–43 (2009).

107. *Id.* at 306; Christie, *supra* note 79, at 26–27.

108. Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1029 (1992).

109. Joseph L. Sax, *Rights that "Inhere in the Title Itself": The Impact of the* Lucas *Case on Western Water Law*, 26 LOY. L.A. L. REV. 943, 945 (1993).

individual rights. In *Stop the Beach Renourishment v. Florida Department of Environmental Protection*,[110] the Court took up a claim that Florida's Supreme Court had unconstitutionally taken private property without compensation when it upheld a state beach restoration program under which sand is added on the state's submerged lands, extending the beach seaward, and the boundary between private and state property is fixed at the mean high-water line before the renourishment.[111] Plaintiff, a nonprofit composed of owners of beachfront property in a renourishment project area, objected that the project eliminated their property rights to have accretions add to their property and to have their property touch the water. The Florida high court rejected those claims, ruling that Florida law did not give coastal property owners a vested right either to accretion or to contact with the sea. Plaintiff then sought review in the U.S. Supreme Court, asserting that the Florida decision had worked a judicial taking. The Court unanimously rejected that claim in this case, but in a plurality opinion that garnered four votes, Justice Scalia wrote that state courts are subject to the same prohibition on takings as legislatures.[112] He went so far as to deny Justice Kennedy's assertion that "[s]tate courts generally operate under a common-law tradition that allows for incremental modifications to property law."[113] As John Echeverria has pointed out, Justice Scalia's opinion in *Stop the Beach Renourishment* could be read to announce the sweeping rule (albeit not yet a majority rule) that "every judicial change in the legal *status quo* is a taking."[114] Justice Scalia does not view that prospect with alarm. He thinks that "courts have no peculiar need of flexibility;" rather than change property law, they should do no more than "clarify and elaborate property entitlements."[115]

As it currently stands, the law that applies to coastal properties is hardly clear, but does stand in the way of efficient and effective response to the problem of rising seas. *Lucas* makes it difficult to prohibit building on coastal lots without paying compensation, even where the evidence establishes that development will accelerate erosion of the public beach or nearby private property. The law does seem to permit at least some restrictions on armoring, but there is considerable confusion about the limits on such restrictions and their effect on property boundaries, which would otherwise be ambulatory.

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110. 130 S. Ct. 2592 (2010).

111. *Id.* at 2599–600. The details of Florida's beach renourishment program, implemented under its Beach and Shore Preservation Act, are explained in Christie, *supra* note 79, at 39–43.

112. *Id.* at 2602 ("If a legislature *or a court* declares that what was once an established right of private property no longer exists, it has taken that property, no less than if the State had physically appropriated it or destroyed its value by regulation.").

113. Justice Kennedy's assertion appears at *id.* at 2615 (Kennedy, J., concurring). Justice Scalia's sharp rejoinder, which characterizes Justice Kennedy's statement as "astounding," is at *id.* at 2606.

114. John D. Echeverria, *Stop the Beach Renourishment: Why the Judiciary is Different*, 35 VT. L. REV. 475, 477 (2010).

115. *Stop the Beach Renourishment*, 130 S. Ct. at 2609.

2. Fresh Water

With respect to fresh water, property rights conflicts have focused on the balance between rights to divert water for use and obligations to leave water in streams to maintain aquatic ecosystems. Like the coastal lands disputes, the water conflicts have not coalesced around a common understanding of the relevant principles.

In contrast to the coastal lands context, the U.S. Supreme Court has not recently weighed in on conflicts over property rights in water. In two important cases, *Tulare Lake Basin Water Storage District v. United States*,[116] and *Casitas Municipal Water District v. United States*,[117] the Court of Claims and the Federal Circuit have struggled to define the relevant principles.

In the western United States, where the doctrine of prior appropriation replaced English riparianism in the nineteenth century, water is the subject of a complex set of property rules. The state holds title to water,[118] but usufructuary rights can be obtained by diverting water from streams and putting it to beneficial use. In theory, prior appropriation applies a rigid form of the familiar property allocation rule of "first in time, first in right."

> Under the law of prior appropriation, water rights are allocated to the first person to put a specific quantity of water to beneficial use. The user obtains a temporal priority, and in times of scarcity, the right to withdraw or pump water is curtailed in reverse order of the manifestation of an intent to appropriate. The most junior user . . . must yield to the more senior and so on along a stream system . . . .[119]

In practice, strict enforcement of priority rights is the exception rather than the rule.[120] Nonetheless, courts are reluctant to tamper openly with the priority system.[121]

Prior appropriation, like other "first in time" rules, sets up a race to capture the resource. Capture rules tend to result in inefficient overexploitation and excessively rapid development of the resource.[122] As economists would have

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116. 49 Fed. Cl. 313 (2001).

117. 543 F.3d 1276 (Fed. Cir. 2008).

118. Nicole L. Johnson, *Property Without Possession*, 24 YALE J. ON REG. 205, 218 (2007).

119. A. Dan Tarlock, *Prior Appropriation: Rule, Principle, or Rhetoric?*, 76 N.D. L. REV. 881, 882 (2000).

120. *Id.* at 883 (Priority "is often more rhetoric than rule"; its importance "lies more in the threat of its application rather than the application.").

121. *See id.* at 908–09 (describing California Supreme Court opinion overturning a lower court's imposition of an equitable apportionment solution on groundwater claimants).

122. *See, e.g.*, Joseph W. Dellapena, *The Law of Water Allocation in the Southeastern States at the Opening of the Twenty-First Century*, 25 U. ARK. LITTLE ROCK L. REV. 9, 23–24 (2002) (describing the effects of the rule of capture as applied in western prior appropriation law); Jason Scott Johnston, *The Rule of Capture and the Economic Dynamics of Natural Resource Use and Survival Under Open Access Management Regimes*, 35 ENVTL. L. 855, 858–60 (2005) (describing capture rules as generally creating incentives for

predicted, the West's waters were quickly appropriated, and overappropriated.[123]

The rush for surface waters has created another legacy problem. Once gained, appropriative water rights persist forever so long as water continues to be put to beneficial use.[124] That means that early appropriators retain the most senior rights, even as societal goals and the relative value of their use change.[125] As Robert Adler puts it, "[A] system in which the winners are defined entirely by who got there first may become increasingly irrational."[126] The holders of the most senior rights are typically irrigators,[127] and not necessarily those with the best lands or the highest-value crops. Most of the water used for agricultural purposes goes to low-value crops like alfalfa, pasture forage, and cotton. This allocation is economically irrational by any measure.[128]

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an inefficient rush to develop).

123. *See, e.g.*, WESTERN WATER POLICY REVIEW ADVISORY COMM'N, WATER IN THE WEST: CHALLENGE FOR THE NEXT CENTURY 6-1 (1998), *available at* http://wwa.colorado.edu/western_water_law/docs/WaterintheWest_WPPRAC.pdf ("The West's waters are overappropriated in many places."); Reed D. Benson, *Rivers to Live By: Can Western Water Law Help Communities Embrace Their Streams?*, 27 J. LAND RESOURCES & ENVTL. L. 1, 6 n.24 (2007) ("Overappropriation is quite common in western river systems."); Janet C. Neuman, *The Good, the Bad, and the Ugly: The First Ten Years of the Oregon Water Trust*, 83 NEB. L. REV. 432, 437 (2004) (noting that in Oregon, many streams became overappropriated with nineteenth-century settlement, and today "[a]n imbalance between paper water rights and wet water means that many streams are dry in the summer and some water rights go unsatisfied, even though they may have priority dates reaching back into the 1800s"); Jason S. Wells, *Leasing Water Rights for Instream Flow Protection: The Opportunities and Impediments to Improved Public Interest Involvement in Colorado's Instream Flow Protection Regime*, 7 U. DENV. WATER L. REV. 309, 350 (2004) ("There are few areas in Colorado, if any, where more water flows than has been claimed for consumptive uses; almost every stream in the state is overappropriated.").

124. Benson, *supra* note 123, at 6.

125. Christine A. Klein et al., *Modernizing Water Law: The Example of Florida*, 61 FLA. L. REV. 403, 413 (2009) ("[M]any senior water rights have been locked into relatively inefficient, traditional uses—agricultural flood irrigation, for example—even as cities are scrambling to find future water supplies.").

126. Robert W. Adler, *Climate Change and the Hegemony of State Water Law*, 29 STAN. ENVTL. L.J. 1, 24 (2010).

127. Agriculture, which was established across the West before cities grew up, remains responsible for the vast majority of western water use. In California, for example, although the precise ratio varies from year to year, agriculture generally consumes about four times as much water as urban uses. *See* 1 CAL. DEP'T. OF WATER RES., CALIFORNIA WATER PLAN UPDATE 2005: A FRAMEWORK FOR ACTION 3–9 (2005), *available at* http://www.waterplan.water.ca.gov /previous/cwpu2005 /index.cfm.

128. An acre-foot of water in the hands of a semiconductor manufacturer can generate nearly a million dollars in revenue, while the same acre-foot in the hands of an alfalfa farmer would produce only about sixty dollars. Robert Glennon, *Water Scarcity, Marketing, and Privatization*, 83 TEX. L. REV. 1873, 1887 (2005). In a more typical setting, prices for market transfers that have occurred reveal that the marginal value of water in municipal or industrial use is three to four times its value in agricultural use. Stephen N. Bretsen & Peter J. Hill, *Water Markets as a Tragedy of the Anticommons*, 33 WM. & MARY ENVTL. L. & POL'Y REV. 723, 724–25 (2009). That differential appears to be increasing. *Id.* at 725. Yet low-value agriculture continues to hold the bulk of the water rights. Such inefficiencies persist in part because the barriers to water rights marketability are formidable. *See, e.g.*, *id.* at 730–37 (describing transaction costs introduced by institutional structures of western irrigation and state statutory provisions); Holly Doremus & Michael Hanemann, *The Challenges of Dynamic Water Management in the*

Frozen in the past as it is, the allocation of water rights under prior appropriation fails to account for modern views of the value of environmental protection. Environmental values were scarcely in the picture when the West's waters were being divided, and their protection is fundamentally at variance with the rule that diversion is required to gain rights. As competition for limited waters has intensified and environmental protection obligations have become more stringent, conflicts over rights to divert at the cost of aquatic ecosystems have become more frequent and more intense.

Until recently, how the Takings Clause would be applied to restrictions on the exercise of appropriative water rights was a theoretical and speculative question. On one hand, water rights have always been formally more tenuous than land rights. "[P]roperty rights in water are not only restrictively defined, but the definitions openly anticipate changes that may diminish or abolish uses that were once permitted."[129] The understanding of beneficial uses might narrow over time, or the definition of public trust interests expand.[130] On the other hand, "[t]he appropriation doctrine has long emphasized security of water rights to encourage investment in water development projects."[131]

In 2001, the Court of Claims brought the water takings issue out of the hypothetical world into the real one. In *Tulare Lake Basin Water Storage District v. United States*, it held that the United States had taken the property of water users when it imposed restrictions on deliveries from state and federal water projects to protect endangered fish.[132] Two conclusions about the nature of water takings analysis were crucial to the result: first, the court decided that limits on diversions should be considered physical takings of water rights, meaning that they would categorically require compensation;[133] second, although it granted that California had the power to modify plaintiffs' water rights "at any time . . . to reflect the changing need of the various water users," it refused to anticipate those revisions before the state formally made them.[134]

The G.W. Bush administration did not appeal *Tulare Lake*.[135] Critics of the

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American West, 26 UCLA J. ENVTL. L. & POL'Y 55, 63–66 (2008); Robert Glennon & Michael J. Pearce, *Transferring Mainstem Colorado River Water Rights: The Arizona Experience*, 49 ARIZ. L. REV. 235, 236 (2007); Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445, 471 (2008) ("[T]he interconnectedness of uses makes modularization of the water rights very difficult. And the low level of modularization of rights makes them less easily transferable.").

129. Sax, *supra* note 109, at 951.

130. *Id.* at 951–54.

131. Douglas L. Grant, *Western Water Rights and the Public Trust Doctrine: Some Realism About the Takings Issue*, 27 ARIZ. ST. L.J. 423, 461 (1995).

132. The court subsequently awarded plaintiffs nearly $14 million in damages, plus interest. 59 Fed. Cl. 246, 247 (2003).

133. Tulare Lake Basin Water Storage Dist. v. United States, 49 Fed. Cl. 313, 319 (2001).

134. *Id.* at 324.

135. John D. Echeverria, *Is Regulation of Water a Constitutional Taking?*, 11 VT. J. ENVTL. L. 579, 581 (2010).

decision contended that it was "unlikely to be of further significance."[136] That intuition seemed to be confirmed a few years later, when the judge who had decided *Tulare Lake* reversed course in *Casitas Municipal Water District v. United States*, holding that the nuanced balancing test for regulatory takings, rather than the categorical physical takings rules, should be applied.[137] But the Federal Circuit reversed[138] in a decision that leaves considerable uncertainty about the test for takings in the context of water rights.

Casitas, like *Tulare Lake*, arose out of a conflict between irrigation and conservation of endangered fish in the operations of a federal water project. In the Federal Circuit,[139] it focused on a requirement that the water district construct a fish ladder and divert some of the water it took from the Ventura Project to that ladder to facilitate fish passage, rather than on limits on the district's right to remove water from the stream.[140] The Court of Claims ruled that the Supreme Court's decision in *Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Agency*, issued after *Tulare Lake*, precluded application of the physical takings framework.[141] The Federal Circuit, over a dissent, disagreed. It held that the categorical physical takings test supplied the appropriate analytical framework because the government had "not merely require[d] some water to remain in the stream, but instead actively caused the physical diversion of water away from [the district's diversion canal] and towards the fish ladder, thus reducing [the district's] water supply."[142]

The Federal Circuit's *Casitas* decision leaves many questions unanswered. First, given the court's focus on the fish ladder, it did not decide the *Tulare Lake* issue—whether a restriction on diversions would be analyzed as a physical taking. The court's justification for the decision, emphasizing the government's physical appropriation of the water by compelling its rerouting, suggests that limits on diversion would not fall in the same category. Second, given the procedural posture of the case, the court did not address the scope of the district's property rights. The United States had sought summary judgment on the question of the appropriate takings standard. For purposes of that motion, it conceded that the district held the rights it claimed to divert water and put it to beneficial use. On remand, however, it remains open to the United States to argue that the public trust doctrine (or other background principles of state law) limits the district's property rights. Finally, it is far from clear that the Supreme Court would agree

136. Melinda Harm Benson, *The Tulare Case: Water Rights, the Endangered Species Act, and the Fifth Amendment*, 32 ENVTL. L. 551, 586 (2002).

137. 76 Fed. Cl. 100 (2007).

138. Casitas Mun. Water Dist. v. United States, 543 F.3d 1276 (Fed. Cir. 2008).

139. *See* Echeverria, *supra* note 135, at 589–90 (describing the shift in emphasis from the trial court to the court of appeals).

140. *Casitas*, 543 F.3d at 1282.

141. *Casitas*, 76 Fed. Cl. at 106.

142. *Casitas*, 543 F.3d at 1291–92.

with the Federal Circuit that the physical takings framework applies. The United States did not seek certiorari following the ruling,[143] but will have another opportunity to do so should it lose on remand.

Like the law of coastal property rights, the law of water rights remains uncertain, in much the same way and for much the same reasons. At the coast and in western waters, public and private rights butt up against one another, sometimes overlap, and more and more often find themselves in tension. Identifying clear boundaries between the two and deciding which prevails in a conflict are tasks which have become more difficult over the last fifty years as notions of the nature of the public interests at stake have expanded to include environmental protection.

IV. CLIMATE ADAPTATION AND PROPERTY RIGHTS ADJUSTMENT

Environmentalists have long argued that property law should be revised to reduce the barriers it poses to environmental protection.[144] They have yet to make much progress, however. Environmental regulation has tinkered with property law at the margins, but has not produced a wholesale readjustment of property rights.

Climate adaptation requires more tinkering with property rights, but not necessarily wholesale rethinking. What is chiefly needed is greater openness to change and greater deference to public, as opposed to private, property rights. Although the required changes are not dramatic, they will not be easy. Federal courts will have to play the primary role, and persuading them to do so in an era when "activist" is the worst epithet that can be attached to a judge will surely be a challenge.

A. Evolution Must Be Rapid

Climate disruption makes changes in property rights more urgent, but not necessarily more likely. Crisis can lower political barriers to legal change; indeed, a substantial proportion of U.S. environmental legislation can be traced to reactions to high-profile crisis events.[145]

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143. Echeverria, *supra* note 135, at 581. The government did seek rehearing and rehearing en banc by the Federal Circuit, unsuccessfully. Casitas Mun. Water Dist. v. United States, 556 F.3d 1329 (Fed. Cir. 2009).

144. *See, e.g.*, ERIC FREYFOGLE, BOUNDED PEOPLE, BOUNDLESS LANDS (1998); ERIC FREYFOGLE, THE LAND WE SHARE (2003); Robert W. Adler, *The Law at the Water's Edge: Limits to "Ownership" of Aquatic Systems*, in WET GROWTH: SHOULD WATER LAW CONTROL LAND USE? 201 (Craig Anthony Arnold ed., 2005); Denise E. Antolini, *Modernizing Public Nuisance: Solving the Paradox of the Special Injury Rule*, 28 ECOLOGY L.Q. 755 (2001); Craig Anthony Arnold, *The Reconstitution of Property: Property as a Web of Interests*, 26 HARV. ENVTL. L. REV. 281 (2002); Myrl L. Duncan, *Reconceiving the Bundle of Sticks: Land as a Community-Based Resource*, 32 ENVTL. L. 773 (2002); Robert J. Goldstein, *Green Wood in the Bundle of Sticks: Fitting Environmental Ethics and Ecology Into Real Property Law*, 25 B.C. ENVTL. AFF. L. REV. 347 (1998); Joseph H. Guth, *Law for the Ecological Age*, 9 VT. J. ENVTL. L. 431 (2008); J.B. Ruhl, *Making Nuisance Ecological*, 58 CASE. W. RES. L. REV. 753 (2008).

145. *See, e.g.*, Jonathan Cannon, *Environmentalism and the Supreme Court: A Cultural Analysis*, 33

There are several reasons, however, not to wait for climate disruption to reach the point of crisis before thinking through, and beginning to make, needed changes to property rules. First, climate change is not the kind of immediate crisis that breaks political logjams; it is more like the gradual heating of the pot that seems easy for people (if not frogs)[146] to ignore.[147] By the time the effects of climate disruption become sufficiently catastrophic to grab political attention, the world will be committed to far worse.[148] Second, climate adaptation is not a rapid endeavor. It may require construction of new infrastructure or even movement of populations away from high-risk areas. Those kinds of steps cannot be taken overnight. Third, climate adaptation will require careful reflection and planning,[149] yet the response to crisis is not always (or even often) rational, carefully considered, or well adapted to future conditions. In particular, a crisis affecting human health, or even human economic well-being, can override any concern

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ECOLOGY L.Q. 363, 409 (2006) ("Urgency, the sense that environmental problems pose threats requiring a strong collective response, has been environmentalism's motive force. This sense animated Congress' enactment of the federal environmental laws of the 1970s and '80s, which restructured institutional arrangements to address a range of perceived environmental crises."); Robert V. Percival, *Regulatory Evolution and the Future of Environmental Policy*, 1997 U. CHI. LEGAL F. 159, 173–74 (1997) ("The history of environmental law seems to suggest that Congress and the EPA respond to perceived crises that demand public attention: for example, CERCLA was enacted in response to Love Canal and other incidents generating widespread public concern over uncontrolled hazardous waste sites; the origins of the Emergency Planning and Community Right-to-Know Act can be traced to the Bhopal tragedy; and the Exxon Valdez oil spill broke more than a decade of legislative gridlock and produced the Oil Pollution Act of 1990."); Michael Allan Wolf, *Environmental Law Slogans for the New Millennium*, 35 U. RICH. L. REV. 91, 99–101 (2001) ("Disasters breed environmental law. One can easily trace the origins of several federal statutory schemes to specific ecological calamities."); Sandra Zellmer, *A Tale of Two Imperiled Rivers: Reflections from a Post-Katrina World*, 59 FLA. L. REV. 599, 624–25 (2007) ("Crisis can open windows of opportunity and spawn long-lasting solutions that transcend immediate pressures and political maneuvering.").

146. Apparently, the frog that placidly allows itself to be cooked as its pot is gradually brought to a boil is a myth. The truth, according to a nineteenth-century report in the prestigious journal *Nature*, is that the gradually heated frog does not go quietly to its death:

> Goltz observed that a frog, when placed in water the temperature of which is slowly raised towards boiling, manifests uneasiness as soon as the temperature reaches 25° C., and becomes more and more agitated as the heat increases, vainly struggling to get out, and finally at 42° C., dies in a state of rigid tetanus.

George Henry Lewes, *Sensation in the Spinal Cord*, 9 NATURE 83, 83–84 (1873). Only if its brain has been removed does the frog react as the popular tale would have it. *Id.* at 84.

147. *See generally* Eric Biber, *Climate Change and Backlash*, 17 N.Y.U. ENVTL. L.J. 1295 (2009); Richard J. Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 CORNELL L. REV. 1153 (2009); Jeffrey J. Rachlinski, *The Psychology of Global Climate Change*, 2000 U. ILL. L. REV. 299; Barton H. Thompson, Jr., *Tragically Difficult: The Obstacles to Governing the Commons*, 30 ENVTL. L. 241 (2000).

148. Susan Solomon et al., *Irreversible Climate Change Due to Carbon Dioxide Emissions*, 106 PROC. NAT'L ACAD. SCI. 1704 (2009).

149. *See, e.g.*, U.S. CLIMATE CHANGE SCI. PROGRAM, *supra* note 61, at 29 ("Responding to sea-level rise requires careful consideration regarding whether and how particular areas will be protected with structures, elevated above the tides, relocated landward, or left alone and potentially given up to the rising sea.").

about the environment.[150] If adaptation is to occur in a way that protects the nonhuman as well as the human world, it cannot wait for the inevitable crises to manifest.

B. Markets Are Not the (Whole) Answer

One might legitimately ask whether changes to property rules are needed to facilitate climate adaptation. To the extent that the problem is one of misallocation of limited resources, the market might seem an attractive mechanism for revisiting that allocation. What role markets should play in climate adaptation is important to a discussion of property rights changes because an emphasis on markets would call for change in a different direction than an emphasis on government regulation or public rights. Markets are better served by strengthening individual rights and reducing uncertainties about the scope of those rights; by contrast, a regulatory strategy is best served by weakening individual rights and strengthening the regulation of public rights or regulatory power.

Markets are, in theory at least, excellent tools for reallocating resources as individual and societal preferences change. They are inherently flexible, and therefore able to respond to the need for continual change and to deal with uncertainties that are gradually reduced. Markets do not demand that a centralized administrator know at all times what society needs and how to provide for those needs. Markets can be remarkably creative, developing tools like options, conditional easements, and land exchanges to facilitate change in the face of uncertainty. They can allocate risk to those best able or most willing to bear it. Provided that they allow outsiders to participate,[151] markets can allow

150. Reactions to western droughts that have limited irrigation deliveries in recent years are illustrative. Water users have blamed California's recent multiyear drought for all the state's economic woes, despite evidence that the housing bust has been a far more important factor. *See* BUS. FORECASTING CTR., EBERHARDT SCH. OF BUS., UNIV. OF THE PACIFIC, UNEMPLOYMENT IN THE SAN JOAQUIN VALLEY IN 2009: FISH OR FORECLOSURE (2009), *available at* http://forecast.pacific.edu/articles/pacificbfc_fish%20or%20foreclosure.pdf (concluding that the economic impact of the construction industry collapse dwarfed that of irrigation restrictions). Politicians reacted with calls to invoke the Endangered Species Act's "god squad," which is empowered to authorize the deliberate extinction of threatened species. *See* Press Release, Dennis Hollingsworth, Republicans Urge Governor to Call for Convention of "God Squad" (Feb. 11, 2009), *available at* http://gadblog.srcar.org/page/24/. Even Senator Dianne Feinstein, usually considered a friend of the environment, proposed overriding the ESA to increase deliveries to San Joaquin Valley farmers. Dianne Feinstein, *Water is Jobs*, S.F. CHRON., Feb. 18, 2010, at A12. Those efforts have not yet borne fruit, no doubt in part because 2010 brought a return of relatively normal rainfall. But Congress did pass a drought-driven appropriations rider in 2003 prohibiting the Bureau of Reclamation from reallocating water from low-value agriculture to protect the Rio Grande silvery minnow. Pub. L. No. 108-37, § 208(a), 117 Stat. 1827, 1849-50 (2003); *see* Doremus & Hanemann, *supra* note 128, at 70–71.

151. Resource markets in the United States have sometimes been limited to historic users. Grazing permits on federal lands provide the most prominent example. *See* Pub. Lands Council v. Babbitt, 167 F.3d 1287, 1307–08 (10th Cir. 1999) (holding that Secretary of Interior lacked statutory authority to issue grazing permits to environmental groups who would remove livestock); David G. Alderson, *Buyouts and Conservation Permits: A Market Approach to Address the Federal Public Land Grazing*

environmental interests to purchase the environmental protection they value from owners who value it less.[152]

Not surprisingly, market-oriented observers see the development of stronger markets as an important response to climate disruption. These arguments have been made most strongly in the context of freshwater resources. Jonathan Adler, for example, argues that "markets provide a superior institutional framework for addressing the water management problems global climate change will create."[153] Even without climate change, economists have long contended that more robust water markets could help address the inefficiencies of the water allocations established in the nineteenth century, which persist today.[154] With the addition of climate change, the need to revisit historic allocations has become even more urgent.

No doubt water markets can contribute to climate adaptation. Sales of water rights by irrigators to cities can produce a win-win outcome for the parties,[155] increase the efficiency of water rights allocation, and perhaps offer politically necessary transition relief to those who give up their former rights.[156] Even trading strictly among irrigators can reduce the economic losses associated with reduced irrigation deliveries,[157] much as the trading of emission rights can reduce the overall social cost of pollution control.[158] That in turn may dial down the political tensions produced by environmental protection efforts.[159] Markets may also have

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Problem, 12 N.Y.U. ENVTL. L.J. 903, 930–39 (2005) (proposing that Congress adopt a formal conservation permit process allowing environmental interests to compete for grazing permits).

152. *See, e.g.*, Neuman, *supra* note 123 (detailing experience of Oregon Water Trust buying water rights to dedicate to instream flows).

153. Jonathan H. Adler, *Water Marketing as an Adaptive Response to the Threat of Climate Change*, 31 HAMLINE L. REV. 729, 740 (2008).

154. *See, e.g.*, TERRY L. ANDERSON & PAMELA SNYDER, WATER MARKETS 4–7 (1997); CHARLES J. MEYERS & RICHARD A. POSNER, NAT'L WATER COMM'N LEGAL STUDY NO. 4, MARKET TRANSFERS OF WATER RIGHTS: TOWARD AN IMPROVED MARKET IN WATER RESOURCES 47 (1971); NAT'L WATER COMM'N, WATER POLICIES FOR THE FUTURE 260–70 (1973); Andrew P. Morriss, *Real People, Real Resources, and Real Choices: The Case for Market Valuation of Water*, 38 TEX. TECH. L. REV. 973, 1009–10 (2006); Barton H. Thompson, Jr., *Institutional Perspectives on Water Policy and Markets*, 81 CAL. L. REV. 671 (1993). For a far more comprehensive listing of sources advocating expanded use of water markets, see Joseph W. Dellapenna, *The Importance of Getting Names Right: The Myth of Markets for Water*, 25 WM. & MARY ENVTL. L. & POL'Y REV. 317, 319–20 n.7 (2000).

155. Adler, *supra* note 153, at 742–43.

156. On the question of when financial relief for a change in legal rules is necessary or desirable, see generally Bruce R. Huber, *Transition Policy in Environmental Law*, 35 HARV. ENVTL. L. REV. 91 (2011).

157. David Sunding et al., *Water Markets and the Cost of Improving Water Quality in the San Francisco Bay/Delta Estuary*, 14 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 203, 211 (2008).

158. *See, e.g.*, Robert W. Hahn & Robert N. Stavins, *Incentive-Based Regulation: A New Era from an Old Idea?*, 18 ECOLOGY L.Q. 1, 8–9 (1991) (describing marketable permit schemes as minimizing the costs of pollution control).

159. It should be noted, however, that employing a market-based approach does not automatically eliminate political opposition. Water marketing for environmental protection, for example, often faces significant political resistance. *See, e.g.*, Neuman, *supra* note 123, at 475–82

a role to play in the coastal context, where governments might choose to purchase vulnerable lands or rolling easements.[160]

Markets alone, however, cannot be the complete answer to the climate adaptation problem. While markets can produce efficient results between the parties to a bargain, they do not always account well for externalities. Externalities are one of the chief reasons that water markets have been difficult to use; states typically require that water transactions not injure third parties, and that requirement often proves difficult to meet.[161] The nature of water, which is inescapably interconnected, makes the elimination of external effects extraordinarily difficult.[162]

The shortcomings of markets are even more apparent if adaptation is expected to protect environmental quality, which is a classic public good. Because of free rider problems, markets typically underprovide public goods.[163] If adaptation is left entirely to market mechanisms, people with resources and strong individual preferences will be able to realize those preferences, but public goods will suffer.

Finally, markets will not function properly without sufficient information. But information about the local effects of climate change is both uncertain and subject to biased assimilation.[164] A large fraction of market participants is likely to ignore the potential effects of climate change. Although markets can, in principle, facilitate adaptation to changing conditions,[165] they will not do so unless market players recognize how much change is coming, how fast.[166]

In sum, market transactions can potentially be used to facilitate climate adaptation. But they will not be sufficient. Without changes to the relevant property rules, reallocation will not occur quickly enough, nor will it protect important public values such as environmental quality.

(chronicling political opposition to voluntary water transfers to instream flows in Oregon); *see also* Holly Doremus & A. Dan Tarlock, *Fish, Farms, and the Clash of Cultures in the Klamath Basin*, 30 ECOLOGY L.Q. 279, 333 (2003) (noting that Congress dropped $125 million from aid bill for Klamath Basin farmers because irrigator group opposed provision that would have allowed its use to buy land or water rights from willing sellers).

160. *See, e.g.*, Titus, *supra* note 97, at 1384–87.

161. *See, e.g.*, Bretsen & Hill, *supra* note 128, at 730–37; Dellapenna, *supra* note 154, at 351; George A. Gould, *Water Rights Transfers and Third-Party Effects*, 23 LAND & WATER L. REV. 1 (1988).

162. Smith, *supra* note 128, at 471.

163. MANCUR OLSON, JR., THE LOGIC OF COLLECTIVE ACTION 76 (1965).

164. Jeffrey J. Rachlinski, *The Psychology of Global Climate Change*, 2000 U. ILL. L. REV. 299, 305 (2000).

165. Morriss, *supra* note 154, at 988.

166. Coastal development, for example, has continued to boom even in the face of a series of well-publicized destructive storms. Population growth in coastal counties in the southeast and Gulf coast regions, the areas most at risk from such storms, has far outpaced national growth. NAT'L OCEANIC & ATMOSPHERIC ADMIN., U.S. DEP'T. OF COMMERCE, POPULATION TRENDS ALONG THE COASTAL UNITED STATES 3 (2004), *available at* http://oceanservice.noaa.gov/programs/mb/pdfs/coastal_pop_trends_complete.pdf.

C. Federal Courts Must Play the Primary Role

Legislatures are often the most visible movers in readjusting property rights, toward either greater or lesser exclusivity. That is as it should be; political institutions are generally a more legitimate source than courts of large-scale changes to property rules.[167] Nonetheless, courts, even if they remain in the background, are ultimately the keystone institution because they have the power to block or to facilitate legislative readjustment. More specifically, the locus of power lies in the federal courts, because those courts are the arbiters of the takings doctrine that plays such an important role in limiting the adjustment of property rights.[168]

Justice Scalia, in particular, has shown overt hostility since *Lucas* to changes in property rules that restrict individual rights. His skepticism in *Lucas* of "newly legislated or decreed" restrictions[169] has driven states that see the need to modernize their property law to find (or at least purport to find) the seeds of new rules in ancient doctrines like nuisance and the public trust. Scalia's *Lucas* opinion sought to cabin that practice by declaring that it is not sufficient for a state simply to invoke a general common law maxim such as *sic utere tuo ut alienum non laedas*.[170] In *Stop the Beach Renourishment*, he sought even more openly to freeze property law in its tracks. Justice Scalia pines for a long-ago era when, at least as he recounts history, common law courts denied that they had any power to change the law, even when existing rules no longer served a useful purpose.[171] Apparently, he believes that protecting expectations formed by the eighteenth century is more important than having law keep pace with modern realities.

Justice Scalia's view has yet to gain a majority of the Court, but it is dangerously close to doing so; he had four votes for it in *Stop the Beach Renourishment*. One hopes that he never picks up the decisive fifth vote. That property law should be static is supported neither by history nor by reason. Well

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167. Amnon Lehavi, *The Property Puzzle*, 96 GEO. L.J. 1987, 2022 (2008); Thomas W. Merrill, *Optimal Standardization in the Law of Property: The* Numerus Clausus *Principle*, 110 YALE L.J. 1, 61 (2000).

168. Stop the Beach Renourishment, Inc. v. Fla. Dept. of Envtl. Prot., 130 S. Ct. 2592, 2601 (2010). Indeed, the power Justice Scalia asserts over state court takings is even broader than that which the Court has claimed over legislative decisions. Legislative decisions cannot be invalidated for failing takings review; the Court can only order compensation. Lingle v. Chevron U.S.A., Inc., 544 U.S. 528, 536–37 (2005); *see also* Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1030 n.17 (1992) ("Of course, the State *may elect* to rescind its regulation and thereby avoid having to pay compensation for a permanent deprivation." (emphasis added)). But according to Justice Scalia, the same choice does not apply to a judicial taking; a judicial decision that works a taking is simply subject to reversal. *Stop the Beach Renourishment*, 130 S. Ct. at 2607.

169. *Lucas*, 505 U.S. at 1029.

170. *Id.* at 1031.

171. *See* Stop the Beach Renourishment, 130 S. Ct. at 2606; Rogers v. Tennessee, 532 U.S. 451, 472 (2001) (Scalia, J., dissenting) (criticizing the majority for upholding a state court's "routine exercise of common law decision-making," to bring the law into conformity with reason and common sense, on the grounds that the common law did not allow such decision making at the time the Constitution was adopted).

before they were willing to openly admit to changing the law, the common law courts engaged in some dramatic restructuring of property rights. The most familiar example is perhaps the narrowing of nuisance law, which evolved from providing landowners nearly absolute protection against pollution to allowing factories substantial license to pollute with little acknowledged change in doctrine.[172] According to Joel Brenner, the judges of the industrial revolution era "believed as a bedrock principle that general propositions automatically decide concrete cases," even as they dramatically reshaped the application of those principles.[173] I have no particular desire to defend the reengineering of nuisance law to accommodate factory pollution, only to express skepticism that Justice Scalia would see that change as a judicial taking, even though it did limit preexisting property rights.

The new, utilitarian version of nuisance law developed in the nineteenth century was implicitly justified by the perceived desirability of the economic expansion industrialization made possible. Whether one views that expansion as desirable or not, there is no question that it enjoyed broad support at the time, and that the law changed to accommodate that shift in goals. It is just as legitimate for legislatures and courts to revise property rules today in response to newly recognized impacts on resources, rising marginal costs of resource exploitation with crowding, or evolving societal goals.[174]

Change should not come too fast; the costs of impulsiveness are just as real as those of delay.[175] But as I have argued elsewhere, there is good reason to believe that legal change will come, if anything, too slowly rather than too fast. Institutional and psychological resistance to change combine to anchor the status quo.[176]

Courts do not, therefore, need to see themselves as the last bulwark against ill-considered legislative impulsiveness. Rather, they should be chary of standing in the way when the more politically responsive branches impose new or heightened general restrictions on individual property rights. Such restrictions require strong political support in order to surmount the usual public choice barriers to lawmaking that provides small benefits to the diffuse public while imposing focused costs on the economically powerful few. Only in extraordinary circumstances will they amount to unfair majoritarian exploitation of the propertied minority.

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172. Joel Franklin Brenner, *Nuisance Law and the Industrial Revolution*, 3 J. LEGAL STUD. 403, 431 (1974); *see also* Daniel R. Coquillette, *Mosses from an Old Manse: Another Look at Some Historic Property Cases About the Environment*, 64 CORNELL L. REV. 761, 809 (1979); John P.S. McLaren, *Nuisance Law and the Industrial Revolution: Some Lessons from Social History*, 3 OXFORD J. LEGAL STUD. 155, 157 (1983).

173. Brenner, *supra* note 172, at 433.

174. Doremus, *Takings and Transitions*, *supra* note 7, at 18–21.

175. *Id.* at 14–18.

176. *Id.* at 21–24.

Consider, for example, *Lucas*, which the Court majority regarded as so unfair that it and its ilk categorically require compensation without regard to the importance of the ends served. The South Carolina law applied to all similarly situated properties, that is to all property located seaward of a setback line determined through a public process based on scientific and historical evidence.[177] Surely only a minority of South Carolinians own such property, but that minority is not likely to be politically powerless. Moreover, although Justice Scalia made much of the fact that under prior law others had been allowed to build in the zone now considered off limits, early builders did not get off scot-free. The legislation forbade rebuilding of homes destroyed by storms, and required at least some owners of developed land to nourish the beach to counteract the erosive effects of their structures.[178] It did not single out David Lucas to solve a public problem entirely at his own expense; rather it identified a public problem caused by a class of persons, and required that all of them contribute to the solution.

The point here is that while courts do need to oversee the fairness of property transitions at some level, they do not need to start from the assumption that any restriction on property rights is likely to be unfair. In fact, legislatures are often quite solicitous of the interests of property owners, willing and able to strike a balance between preventing harm to public resources and protecting the interests of landowners faced with unexpected restrictions. The role of the courts should be to demand that legislatures or state courts articulate a legitimate reason for a change in property rules; apply the change to all similarly situated properties; justify any boundaries it draws between classes of property; and justify any variances or special permits it offers, since such relief valves carry the potential for improperly leaving a small group to bear a larger burden.

Specifically in the context of climate change, the federal courts should recognize the realities of the problem and that sufficient political barriers exist to prevent foolish impulsiveness. They should not erect artificial barriers to legal changes, such as new coastal setbacks or restrictions on water diversion for low-value historic uses, that precede certainty that climate change is causing or will cause specified harms. They should be sympathetic to attempts to identify and address in advance the need to adapt. And for the most part they should leave it to state legislative bodies and courts to determine when economic transition relief is necessary or desirable.

At the state level, where property rights are typically defined and redefined, courts and legislatures should continue to work together as they long have done. Courts may need to declare new principles or make old ones explicit, while leaving the details of implementation to the politically responsive legislature or technically expert administrative bodies. The development of California's public trust

177. S.C. CODE ANN. § 48-39-280 (2010).

178. Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1074 (1992) (Stevens, J., dissenting).

doctrine provides a good example of that sort of cooperation. In 1983, in response to litigation challenging the gradual draining of Mono Lake to provide water to Los Angeles, the California Supreme Court issued a blockbuster decision holding that the public trust doctrine gave the state the authority to revise appropriative water rights.[179] But the court did not itself make those revisions. Instead, it remanded to the State Water Resources Control Board to reconsider the appropriations in light of the public trust values at stake.[180] The end result, after protracted litigation and administrative proceedings, was an agreement that reduced but did not halt diversions, established minimum tributary streamflows, and persuaded Los Angeles to implement serious water conservation efforts.[181] The *Mono Lake* process makes good use of the institutional capabilities of courts, legislatures, and agencies.

V. CONCLUSION

Adapting to climate disruption in a way that protects not only human but also environmental interests will require revision of existing property rules. Coastal states will need to be able to discourage, and perhaps even to prohibit, new construction on lands vulnerable to sea level rise or needed for migration of coastal wetlands. Western states will need to be able to reduce water deliveries to low-value agricultural users, and to require that more water remain in streams to meet the needs of aquatic ecosystems. Evolution of property rights in response to climate change will have to occur rapidly, before the changing climate produces a crisis.

That evolutionary process will be a difficult one, because it unsettles established property rights on which people have come to rely. Its details are appropriately left to the states, with federal encouragement and technical assistance. State courts, legislatures, and agencies have long worked cooperatively to design and implement property doctrine; that process should continue. It is crucial, however, that the federal courts not interfere by using takings doctrine to freeze state property law. Rather, the federal courts should recognize that the evolution of property law is a healthy, longstanding process; that evolution can legitimately run in the direction of reduced individual and increased communal or public rights as the other way; and that state institutions can generally be relied on to provide for fair transitions between property regimes, with limited supervision to protect against undue favoritism or singling out. Given the difficulty of the adaptation task, government at all levels needs to be part of the solution, rather than part of the problem.

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179. Nat'l Audubon Soc'y. v. Super. Ct., 658 P.2d 709, 732 (Cal. 1983).

180. *Id.* at 728–29.

181. The aftermath of the Mono Lake litigation is explored in Craig Anthony Arnold & Leigh A. Jewel, *Litigation's Bounded Effectiveness and the Real Public Trust Doctrine: The Aftermath of the* Mono Lake *Case*, 14 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 1177, 1181–82 (2008).