

WATER RIGHTS, MARKETS, AND CHANGING ECOLOGICAL CONDITIONS

BY

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Conventional environmentalist thought is suspicious of private markets and property rights. The prospect of global climate change, and consequent ecological disruptions, has fueled the call for additional limitations on private markets and property rights. This Essay presents an alternative view. Specifically, this Essay briefly explains why environmental problems generally, and the prospect of changing environmental conditions such as those brought about by climate change in particular, do not counsel further restrictions on private property rights and markets. To the contrary, the prospect of significant environmental changes strengthens the case for greater reliance on property rights and market institutions to address environmental problems, such as the management of fresh water resources.

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I. INTRODUCTION

Conventional environmentalist thought is deeply suspicious of private markets and property rights. Mainstream environmentalist thinkers believe the segmentation and commodification of land and natural resources place

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ecological values in peril.¹ As environmental law pioneer Eric T. Freyfogle counseled, individual parcels of land are, by definition, “a tiny piece of an entirety that is, in nature’s terms, interconnected and indivisible.”² From this perspective, property rights and markets must be curtailed and restrained if ecological values are to be preserved.³ Property rights may be useful, but only if carefully limited; constitutional protection of property rights, on the other hand, would present a mortal ecological threat.⁴ Markets may need to be tolerated for economic purposes, but only if subject to extensive regulation. Indeed, the organizing principle of much environmental regulation is that government intervention is necessary precisely because market institutions are incapable of safeguarding ecological values to any meaningful extent.⁵

¹ See, e.g., Rory O’Brien, *Law, Property, and the Environment: An Introduction*, in THINKING ABOUT THE ENVIRONMENT: READINGS ON POLITICS, PROPERTY, AND THE PHYSICAL WORLD 57, 57 (Matthew Alan Cahn & Rory O’Brien eds., 1996) (“Defining property as something that is privately held immediately impacts the environment.”); Eric T. Freyfogle, Symposium Essay, *Goodbye to the Public-Private Divide*, 36 ENVTL. L. 7, 8 (2006) (“A major cause of [environmental] trouble is the institution of private property rights in land.”); Eric T. Freyfogle, Lecture, *The Tragedy of Fragmentation*, 36 VAL. U. L. REV. 307, 313–14 (2002) (arguing that private landownership does not actually promote ecological stewardship); Lynda L. Butler, *The Pathology of Property Norms: Living Within Nature’s Boundaries*, 73 S. CAL. L. REV. 927, 931 (2000) (noting “the pervasive and pathological influence of property norms on ecosystem health”).

² Eric T. Freyfogle, *Ownership and Ecology*, 43 CASE W. RES. L. REV. 1269, 1269 (1993); see also Joseph L. Sax, *Takings, Private Property and Public Rights*, 81 YALE L.J. 149, 150 (1971) (noting “interconnectedness between various uses of seemingly unrelated pieces of property”).

³ See, e.g., THE USE OF LAND: A CITIZENS’ POLICY GUIDE TO URBAN GROWTH 23 (William K. Reilly ed., 1973) (noting that “tough restrictions will have to be placed on the use of privately owned land” in order to protect critical environmental resources).

⁴ See, e.g., FRED BOSSELMAN ET AL., THE TAKING ISSUE: A STUDY OF THE CONSTITUTIONAL LIMITS OF GOVERNMENTAL AUTHORITY TO REGULATE THE USE OF PRIVATELY-OWNED LAND WITHOUT PAYING COMPENSATION TO THE OWNERS iv (1973) (warning a constitutional compensation requirement could be the “weak link” in environmental protection efforts); see also THE USE OF LAND: A CITIZENS’ POLICY GUIDE TO URBAN GROWTH, *supra* note 3, at 24–25; John D. Echeverria, *The Takings Issue*, in LET THE PEOPLE JUDGE: WISE USE AND THE PRIVATE PROPERTY RIGHTS MOVEMENT 143, 148 (John D. Echeverria & Raymond Booth Eby eds., 1995) (“There can be little doubt that an expanded reading of the takings clause would in fact increase the cost of existing environmental programs and reduce the level of environmental protection Americans currently enjoy.”).

⁵ In the dominant formulation, government intervention is necessary to correct for “externalities” generated by economic activity. Yet if, as Barry Commoner counseled, “[E]verything . . . is connected to everything else,” BARRY COMMONER, THE CLOSING CIRCLE: NATURE, MAN, AND TECHNOLOGY 23 (1972), then externalities are everywhere and the justification for government intervention is never-ending. It is for this reason that Nobel Laureate Ronald Coase argued that “the mere existence of ‘externalities’ does not, of itself, provide any reason for governmental intervention.” R. H. COASE, THE FIRM, THE MARKET, AND THE LAW 26 (1988).

Professor James Huffman is among those who have challenged this “orthodox” environmental view.⁶ Through his scholarship and other activities over the past few decades,⁷ Professor Huffman has argued that property rights and market institutions are not only “critical to the efficient allocation of scarce resources,”⁸ but are essential for environmental protection as well.⁹ As Professor Huffman would have it, greater protection for property rights and respect for markets can lay the foundation for more effective environmental conservation and ensure that environmental goals are achieved in a more equitable fashion. If more conservation is what people want, markets will provide conservation more efficiently than government administration or regulation. As a consequence, much of Professor Huffman’s scholarship has sought to defend the ecological value of markets and buttress the case for constitutional protection of private property rights.¹⁰ Professor Janet Neuman, although not endorsing Professor Huffman’s brand of “free market environmentalism,” has also helped demonstrate the conservation value of property rights in natural resources, particularly in the case of water, through both her scholarship and her work as President of the Oregon Water Trust.¹¹ Reflecting on their work provides an opportunity to reconsider the role of property rights and markets in environmental protection.

The perspective that private property rights and market institutions provide an effective foundation for environmental conservation remains a

⁶ See James L. Huffman, *Protecting the Environment from Orthodox Environmentalism*, 15 HARV. J.L. & PUB. POL’Y 349, 351 (1992) (“My goal in this paper is to unravel (or is the accepted term now deconstruct?) environmental orthodoxy.” (footnote omitted)).

⁷ Among other things, Professor Huffman has served on the boards of the Foundation for Research on Economics and the Environment and the Rocky Mountain Mineral Law Foundation, and he is the former Chair of the Executive Committee of the Environment and Property Rights Practice Group of the Federalist Society. Lewis & Clark Law School, *James Huffman: Dean Emeritus*, http://law.lclark.edu/faculty/james_huffman/ (last visited Feb. 18, 2012).

⁸ James L. Huffman, *The Public Interest in Private Property Rights*, 50 OKLA. L. REV. 377, 379 (1997).

⁹ See, e.g., Huffman, *supra* note 6, at 353 (“Free market environmentalists contend that left to choose, individuals will allocate significant resources to environmental protection. Indeed, they contend that we will get more environmental protection from the market than from command-and-control regulation.”); James L. Huffman, *Markets, Regulation, and Environmental Protection*, 55 MONT. L. REV. 425, 434 (1994) (“Neither markets nor command and control regulation will solve all of our environmental problems, but the environment will clearly suffer if we do not give markets a chance.”) [hereinafter Huffman, *Markets, Regulation, & Environmental Protection*]; James L. Huffman, *Environmental Perspectives: Moving Toward a Market-Oriented Middle Ground*, 28 HARV. J.L. & PUB. POL’Y 61, 67 (2004) (“The most decentralized approach is the market. It is not a panacea for environmental policy, but it warrants more attention than it has received over the recent decades of modern environmental politics.”).

¹⁰ See, e.g., James L. Huffman, *Lucas: A Small Step in the Right Direction*, 23 ENVTL. L. 901, 902, 905 (1993); James L. Huffman, *Judge Plager’s “Sea Change” in Regulatory Takings Law*, 6 FORDHAM ENVTL. L.J. 597, 611, 613–14 (1995).

¹¹ See, e.g., Janet C. Neuman, *The Good, the Bad, and the Ugly: The First Ten Years of the Oregon Water Trust*, 83 NEB. L. REV. 432, 433 (2004); Lewis & Clark Law School, *Law Faculty: Janet Neuman: Professor of Law, Retired*, http://law.lclark.edu/faculty/janet_neuman/ (last visited Feb. 18, 2012).

minority view.¹² Despite the success of property-based conservation strategies and the prevalence of market-driven ecological advances, most environmental thinkers continue to view property and markets with suspicion. Property rights legislation and judicial decisions insulating private property rights from governmental regulation are derided as “anti-environmental,”¹³ and there is a never-ending stream of proposals for additional layers of regulation to constrain markets for the benefit of ecological resources.¹⁴

The conventional environmental view has drawn strength from the emergence of larger and ever more challenging environmental problems, many of which are the consequence of industrial development and other human activities. Chief among these is global warming, a “super wicked” environmental problem, if ever there was one.¹⁵ It is now widely accepted that human activity has contributed to an increase in the concentration of greenhouse gases in the atmosphere and this will produce some degree of atmospheric warming.¹⁶ The prospect of global climate change, and

¹² To some, the very notion of “free market environmentalism” is an “oxymoron.” See James E. Krier, *The Tragedy of the Commons, Part Two*, 15 HARV. J.L. & PUB. POL’Y 325, 332 (1992) (“[F]ree market environmentalism is, if not a moronic idea, at least an oxymoron.”).

¹³ See, e.g., Ira Michael Heyman, Address, *Property Rights and the Endangered Species Act: A Renascent Assault on Land Use Regulation*, 25 PAC. L.J. 157, 158 (1994); Douglas T. Kendall & Charles P. Lord, *The Takings Project: A Critical Analysis and Assessment of the Progress So Far*, 25 B.C. ENVTL. AFF. L. REV. 509, 587 (1997); Joseph L. Sax, *Using Property Rights to Attack Environmental Protection*, 14 PACE ENVTL. L. REV. 1, 2–3 (1996); Glenn P. Sugameli, *Takings Bills Threaten Private Property, People, and the Environment*, 8 FORDHAM ENVTL. L.J. 521, 522–23 (1997).

¹⁴ The fact that government intervention in the marketplace is, as often as not, at least partly to blame for the environmental problems to which these regulatory proposals respond is often ignored. See Jonathan H. Adler, *Free & Green: A New Approach to Environmental Protection*, 24 HARV. J.L. & PUB. POL’Y 653, 677–81 (2001) (explaining that federal development, tax incentives, and regulatory policies induce environmental damage and increase risks to human health and safety); see generally GOVERNMENT VS. ENVIRONMENT (Donald R. Leal & Roger E. Meiners eds., 2002) (detailing how government policies can encourage environmental degradation).

¹⁵ See Richard J. Lazarus, *Super Wicked Problems and Climate Change: Restraining the Present to Liberate the Future*, 94 CORNELL L. REV. 1153, 1159–60 (2009) (describing climate change as a “super wicked problem” because it exacerbates problems exponentially and any future technology would have to achieve exponentially greater reductions to make up for lost time).

¹⁶ See William Collins et al., *The Physical Science Behind Climate Change*, SCI. AM., Aug. 2007, at 64, 68 (noting that the 2007 Intergovernmental Panel on Climate Change (IPCC) report concluded it was “very likely” that human activity was responsible for most of late 20th century warming, whereas the 2001 IPCC report concluded that human responsibility was only “likely”); *id.* at 65 (“Over the past 20 years, evidence that humans are affecting the climate has accumulated inexorably, and with it has come ever greater certainty across the scientific community in the reality of recent climate change and the potential for much greater change in the future.”); see also Gabriele C. Hergerl et al., *Understanding and Attributing Climate Change*, in CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS: CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 663, 665 (Susan Solomon et al. eds., 2007) (“Greenhouse gas forcing has very likely caused most of the observed global warming over the last 50 years.”); BD. ON ATMOSPHERIC SCIS. & CLIMATE, NAT’L RESEARCH COUNCIL, ADVANCING THE SCIENCE OF CLIMATE CHANGE 3 (2010) (“Climate

consequent ecological disruptions, has fueled the call for additional limitations on private property rights and constraints on markets, and not merely to the extent that market activities have themselves contributed to the accumulation of greenhouse gases in the atmosphere.

This Essay suggests that the conventional view of property rights and environmental protection is misguided. Specifically, this Essay briefly explains why environmental problems generally, and the prospect of changing environmental conditions such as those brought about by climate change in particular, do not counsel further restrictions on private property rights and markets. To the contrary, the prospect of significant environmental changes strengthens the case for greater reliance on property rights and market institutions.¹⁷

Water is a particularly pressing environmental concern, in the United States and around the world. The need for water institutions capable of adapting to inevitable climatic changes requires greater reliance upon markets, not less.¹⁸ Change is constant, and those institutions best able to accommodate and adapt to such changes are those most necessary to help address the threats posed by climate change. Above all else, this Essay posits that if we take environmental concerns seriously, and if we are concerned about the consequences of global climate change, we have to be

change is occurring, is caused largely by human activities, and poses significant risks for—and in many cases is already affecting—a broad range of human and natural systems.”). Despite widespread agreement on the existence of climate change, there remains significant debate over the likely magnitude and effect of such change; most so-called “skeptics” within the scientific community focus their criticisms regarding the alleged scientific climate change “consensus” on these latter issues. See, e.g., PATRICK J. MICHAELS & ROBERT C. BALLING, JR., CLIMATE OF EXTREMES: GLOBAL WARMING SCIENCE THEY DON’T WANT YOU TO KNOW 12, 14, 19–20 (2009) (noting that Earth has experienced warming cycles in its history and that some industrial emissions can actually counteract the warming effect of greenhouse gases); see also ROY W. SPENCER, CLIMATE CONFUSION: HOW GLOBAL WARMING HYSTERIA LEADS TO BAD SCIENCE, PANDERING POLITICIANS, AND MISGUIDED POLICIES THAT HURT THE POOR 80–84 (2008) (asserting that the Earth has natural temperature variability and that human activity is only one explanation for the current warming trends); John R. Christy, *The Global Warming Fiasco, in* GLOBAL WARMING AND OTHER ECO-MYTHS: HOW THE ENVIRONMENTAL MOVEMENT USES FALSE SCIENCE TO SCARE US TO DEATH 27 (Ronald Bailey ed., 2002) (arguing that global temperature changes will be within an adaptable range for human beings and that we are capable of finding and using alternative energy sources); PATRICK J. MICHAELS & ROBERT C. BALLING, JR., THE SATANIC GASES: CLEARING THE AIR ABOUT GLOBAL WARMING 210 (2000) (noting that no one knows the rate of carbon dioxide increase nor the potential availability of future environmental technologies that would displace fossil fuels).

¹⁷ At the same time, a principled commitment to property rights requires taking climate change seriously as a potentially significant environmental threat. See generally Jonathan H. Adler, *Taking Property Rights Seriously: The Case of Climate Change*, 26 SOC. PHIL. & POLY, Summer 2009, at 296, 296–316 (discussing a free market environmentalism approach to environmental policy in recognition that “human-induced climate change is likely to contribute to environmental changes that violate private property rights”).

¹⁸ In this regard, this Essay draws upon Jonathan H. Adler, *Water Marketing as an Adaptive Response to the Threat of Climate Change*, 31 HAMLINE L. REV. 729 (2008).

more open to private rights and private markets than the conventional environmental perspective has been to date.¹⁹

II. PROPERTY RIGHTS, MARKETS, AND ENVIRONMENTAL PROTECTION

It is somewhat curious that private property rights are held in such low regard by many environmental thinkers. The early American conservation movement relied heavily on private conservation efforts undertaken on private land.²⁰ Some early conservation successes were dependent upon the security private rights could provide for threatened environmental resources.²¹ Throughout American history, property rights and markets have been a source of sustainability, whereas government interventions—often at the behest of powerful economic interests—have subsidized or otherwise encouraged unsustainable practices.²²

Well-defined and defended property rights encourage greater resources stewardship and sustainable utilization. This was a point made by ecologist Garrett Hardin in his seminal article on “The Tragedy of the Commons”—albeit a point that has been too often overlooked.²³ The problem, Hardin noted, was not property rights, but the difficulty in extending such rights to the full range of threatened resources.²⁴ Property rights, where enforced, discipline resource use and encourage sustainability.²⁵ A robust system of property rights can also mitigate the consequences of political indifference or broader cultural ignorance about the negative ecological effects of productive activity.²⁶ It does not take a majority vote of the legislature or the successful navigation of the administrative process to protect private land.

¹⁹ For more on this general approach to environmental protection, see generally Huffman, *supra* note 8; TERRY L. ANDERSON & DONALD R. LEAL, *FREE MARKET ENVIRONMENTALISM* (rev. ed. 2001); Adler, *supra* note 14; *ECOLOGY, LIBERTY & PROPERTY: A FREE MARKET ENVIRONMENTAL READER* (Jonathan H. Adler ed., 2000); Fred L. Smith, Jr., *Markets and the Environment: A Critical Reappraisal*, 13 *CONTEMP. ECON. POL'Y*, January 1995, at 62; Huffman, *Markets, Regulation, & Environmental Protection*, *supra* note 9; Fred L. Smith, Jr., *A Free-Market Environmental Program*, 11 *CATO J.* 457 (1992); Huffman, *supra* note 6; Richard L. Stroup, *Controlling Earth's Resources: Markets or Socialism?*, 12 *POPULATION & ENV'T* 265 (1991).

²⁰ See *infra* notes 36–38 and accompanying text.

²¹ See, e.g., Ike C. Sugg, *Where the Buffalo Roam, and Why*, *EXOTIC WILDLIFE*, Jan.–Feb. 1999, at 14 (“[P]rivate conservationists saved the American bison from extinction.”).

²² See discussion and sources cited *supra* note 14; see also *POLITICAL ENVIRONMENTALISM: GOING BEHIND THE GREEN CURTAIN* (Terry L. Anderson ed., 2000) (documenting the manipulation of environmental policies for the benefit of economic interests); Todd J. Zywicki, *Environmental Externalities and Political Externalities: The Political Economy of Environmental Regulation and Reform*, 73 *TUL. L. REV.* 845 (1999) (same); *ENVIRONMENTAL POLITICS: PUBLIC COSTS, PRIVATE REWARDS* (Michael S. Greve & Fred L. Smith, Jr. eds., 1992) (same).

²³ Garrett Hardin, *The Tragedy of the Commons*, 162 *SCIENCE* 1243, 1245, 1247 (1968).

²⁴ *Id.* at 1245 (“The tragedy of the commons as a food basket is averted by private property, or something formally like it. But the air and waters surrounding us cannot readily be fenced, and so the tragedy of the commons as a cesspool must be prevented by different means . . .”).

²⁵ See Fred Smith, *Epilogue: Reappraising Humanity's Challenges, Humanity's Opportunities*, in *THE TRUE STATE OF THE PLANET* 379, 384 (Ronald Bailey ed., 1995).

²⁶ See *id.* at 385.

At the same time, the failure to protect and safeguard property rights tends to undermine resource stewardship and shorten time horizons. Where property rights are insecure, relatively little conservation takes place.

These are not theoretical claims. As a general proposition, private rights in nature have tended to do more good than harm. As one looks at ecological resources around the world, one observes a general pattern. Those resources that are more fully integrated into property institutions tend to be managed more sustainably than their unowned or politically managed counterparts. This is not an invariable tendency—there are exceptions to be sure—but there is a discernible pattern supporting Hardin’s thesis.

Fisheries provide a useful case study. Marine fisheries are, in many respects, the archetypal open-access commons. In the 1950s, fishery economists noted the commons problem that plagued all too many marine fisheries, and suggested property rights as a solution.²⁷ Since then, extensive empirical research has shown that property-based fishery management is more successful than traditional regulatory approaches at averting the tragedy of the marine commons.²⁸ As a recent review in *Science* showed, the implementation of property-based systems tends to halt, and often reverse, trends toward fishery collapse.²⁹ Traditional government regulation has been ineffective and other forms of government intervention, including subsidies for favored interests, have been disastrous.

The experience of marine fisheries is not an isolated example. Similar patterns can be seen with mineral resources,³⁰ forests,³¹ terrestrial species,³²

²⁷ Anthony Scott, *The Fishery: The Objectives of Sole Ownership*, 63 J. POL. ECON. 116, 116 (1955); H. Scott Gordon, *The Economic Theory of a Common-Property Resource: The Fishery*, 62 J. POL. ECON. 124, 124 (1954).

²⁸ See, e.g., Robert Repetto, *A Natural Experiment in Fisheries Management*, 25 MARINE POL’Y 251, 252 (2001) (comparing an Atlantic scallop fishery in United States, which was regulated using fishing limits, with a rights-based Canadian scallop fishery); R. Quentin Grafton et al., *Private Property and Economic Efficiency: A Study of a Common-Pool Resource*, 43 J.L. & ECON. 679, 709 (2000) (documenting efficiency gains from the “privatization” of the British Columbia halibut fishery); MICHAEL DE ALESSI, FISHING FOR SOLUTIONS 11–12 (1998) (using the framework of property rights to analyze fisheries around the world); Richard J. Agnello & Lawrence P. Donnelley, *Prices and Property Rights in the Fisheries*, 42 S. ECON. J. 253, 253 (1975) (concluding that treating fisheries as a “common property resource” results in less efficient management); Richard J. Agnello & Lawrence P. Donnelley, *Property Rights and Efficiency in the Oyster Industry*, 18 J.L. & ECON. 521, 522 (1975) (concluding that communal property rights, as compared to private rights, reduce labor productivity in the United States oyster industry).

²⁹ See Christopher Costello et al., *Can Catch Shares Prevent Fisheries Collapse?*, 321 SCIENCE 1678, 1680 (2008).

³⁰ See, e.g., Jerry Taylor & Peter VanDoren, *Soft Energy Versus Hard Facts: Powering the Twenty-first Century*, in EARTH REPORT 2000: REVISITING THE TRUE STATE OF THE PLANET 118, 120–25 (Ronald Bailey ed., 2000); Stephen Moore, *The Coming Age of Abundance*, in THE TRUE STATE OF THE PLANET 109, 137 (Ronald Bailey ed., 1995).

³¹ See, e.g., Jonathan H. Adler, *Poplar Front: The Rebirth of America’s Forests*, in ECOLOGY, LIBERTY & PROPERTY: A FREE MARKET ENVIRONMENTAL READER, *supra* note 19, at 65, 65–77; see also Roger Sedjo, *Forests: Conflicting Signals*, in THE TRUE STATE OF THE PLANET, *supra* note 30, at 177, 177–210.

and even water.³³ As one review of environmental and economic performance across countries observed, “environmental quality and economic growth rates are greater in regimes where property rights are well defined than in regimes where property rights are poorly defined.”³⁴ Property-based systems and market institutions, for all their imperfections, tend to encourage more sustainable and efficient resource use and protection than the available alternatives. Where such institutions can be implemented, they tend to represent an environmentally superior—or, at the very least, a less environmentally inferior—management approach.³⁵

It is important to recognize that reference to private property rights does not necessarily entail individuated ownership by profit-seeking individuals. Property rights may be held and controlled in many forms. Lands owned by the Nature Conservancy or a local land trust are just as much private property as those owned by Ted Turner, Charles Koch, International Paper, or ExxonMobil. Many regimes characterized as “common property” are really forms of collective private ownership, a less-formal variant of a cooperative or condominium. Private ownership comes in many forms, but it is distinct from a lack of ownership and either *de jure* or *de facto* ownership by the state.

Private property rights also empower individuals and groups to pursue ends other than profit, as well as to protect idiosyncratic or unpopular values. The institution of private ownership empowered the Audubon Society to protect birds against market hunting at the turn of the last century and empowered Rosalie Edge to protect raptors at Hawk Mountain.³⁶ The institution of private property also helped rescue the American bison (*Bison bison*) from the brink of oblivion brought about by their wanton

³² See, e.g., IKE SUGG & URS KREUTER, ELEPHANTS AND IVORY: LESSONS FROM THE TRADE BAN 16, 51–53 (1994) (discussing gains in elephant populations and habitat resulting from quasi-property-based management and commercial utilization); Randy T. Simmons & Urs P. Kreuter, *Herd Mentality: Banning Ivory Sales Is No Way to Save the Elephant*, 50 POL’Y REV., Fall 1989, at 46, 46.

³³ See, e.g., Andrew P. Morriss, *Real People, Real Resources, and Real Choices: The Case for Market Valuation of Water*, 38 TEX. TECH L. REV. 973, 974–75, 1008–10 (2006).

³⁴ Seth W. Norton, *Property Rights, the Environment, and Economic Well-Being*, in WHO OWNS THE ENVIRONMENT? 37, 51 (Peter J. Hill & Roger E. Meiners eds., 1998); see also Don Coursey & Christopher Hartwell, *Environmental and Public Health Outcomes: An International and Historical Comparison* (Harris Sch. of Pub. Policy Studies, Univ. of Chicago, Working Paper No. 00.10, 2000) (examining what factors impact the quality of life and environmental conditions across the world, particularly focusing on the relationship between economic freedom and environmental quality).

³⁵ As Andrew Morriss notes, “Markets are far from perfect, of course. But, critiques of markets in general, and critiques of water markets in particular, often conflate dissatisfactions with human nature or other features of society with problems in the market.” Morriss, *supra* note 33, at 975.

³⁶ See FRANK GRAHAM, JR., THE AUDUBON ARK: A HISTORY OF THE NATIONAL AUDUBON SOCIETY 9–10, 44 (1990); see also Jonathan H. Adler, *Back to the Future of Conservation: Changing Perceptions of Property Rights & Environmental Protection*, 1 N.Y.U. J.L. & LIBERTY 987, 1020–21 (2005) (detailing how significant a tool private property was for species conservation historically).

slaughter³⁷—often subsidized and encouraged by those in political power—just as it now enables water conservancies to protect instream flows and, in some cases, help counteract the damage done by decades of subsidized water use and wasteful water infrastructure.³⁸ Property rights are valuable to those who seek profit, but they are no less valuable to those who seek other ends, such as ecological conservation.

Private property rights are not without their flaws. Protection of property rights can, among other things, reinforce pre-existing economic and social inequities.³⁹ All human institutions are imperfect, however, so the question is not whether one set of institutions or another works perfectly. Rather, the question is whether property-based institutions, and the markets they facilitate, are preferable to the available political alternatives, ecologically and otherwise, and whether greater reliance upon such institutions can complement pre-existing conservation strategies to ensure greater resource stewardship and protection than we would otherwise see.

III. WATER RIGHTS AND WATER MARKETS

Markets are not perfect. Nevertheless, markets are the most effective means yet discovered for ensuring efficient resource allocation. Markets facilitate the aggregation of individual choices and preferences so as to encourage the deployment of resources to their greatest and highest valued uses. If people value environmental amenities, markets serve as a comparatively efficient mechanism to ensure such amenities are valued and protected. As Professor Huffman has observed, despite the inevitability and persistence of so-called market failures, “it is abundantly clear that no social institution yet conceived will yield greater net social welfare from a scarce resource than a well-functioning market.”⁴⁰ Professor Robert Glennon, author of *Unquenchable*,⁴¹ explains:

The ability to transfer ownership creates an incentive to shepherd the resource wisely, to use property more productively . . . This is the core idea of markets. Owners of property assess its value to themselves and part with it if they will realize a profit. Buyers seek to change the use of property and capture

³⁷ See Sugg, *supra* note 21, at 14 (“Bison were saved initially by six individuals who either saw business opportunities in the existence of bison or simply wanted to save a vanishing species.” (quoting VALERIUS GEIST, *BUFALO NATION: HISTORY AND LEGEND OF THE NORTH AMERICAN BISON* 102 (1996))).

³⁸ See, e.g., Adler, *supra* note 36, at 1017–18.

³⁹ See, e.g., Robert Glennon, *Water Scarcity, Marketing, and Privatization*, 83 TEX. L. REV. 1873, 1890 (2005) (noting the controversy and conflict that can result from water privatization efforts).

⁴⁰ James L. Huffman, *Water Marketing in Western Prior Appropriation States: A Model for the East*, 21 GA. ST. U. L. REV. 429, 432 (2004).

⁴¹ ROBERT GLENNON, *UNQUENCHABLE: AMERICA’S WATER CRISIS AND WHAT TO DO ABOUT IT* (2009).

the value added by the new use. In this process, both sellers and buyers make profits, and society benefits from increased efficiency.⁴²

This is no less true for water than for other resources.⁴³ Insofar as water rights are currently allocated to comparatively inefficient uses, water markets can help reallocate water to where there is greater need. As Glennon notes, “Water markets would facilitate the movement of water from low-value activities to higher-value ones, thus resulting in a more efficient deployment of the resource.”⁴⁴

Property rights provide the foundation for markets. In a market, it is property rights (however defined) that are bought, sold, rented, or otherwise transferred, temporarily or in perpetuity.⁴⁵ Thus, it is the recognition and gradual expansion of rights in water that have facilitated the development of markets in water.⁴⁶ Without rights in water, water markets could not exist.⁴⁷ But rights in water are not sufficient. The rights must be well-defined, defended, and subject to transfer, and the relevant transaction costs must be sufficiently low.

Under the prior appropriation doctrine, private rights in water were established, but they were also limited by doctrines that constrained the allocation of water to those uses most valued by individual owners. Prior appropriation may have been an effective means of encouraging development and diversion, and even of identifying initial property endowments, but it did not encourage efficient water allocation and use.⁴⁸ Doctrines imposing narrow conceptions of what constitutes a “beneficial use” and threatening the forfeiture of water rights as a “reward” for increased efficiency or conservation have further undermined the development of more complete markets in water, as did appurtenance requirements and limitations on transfers.⁴⁹ As demands for more efficient water use and instream flows increased in the second half of the twentieth

⁴² *Id.* at 307–08.

⁴³ Terry L. Anderson & Peter J. Hill, *Introduction: Taking the Plunge, in WATER MARKETING—THE NEXT GENERATION: THE POLITICAL ECONOMY FORUM* xi, xi (Terry L. Anderson & Peter J. Hill eds., 1997) (“[T]he efficacy of markets for averting resource shortages is no better demonstrated than with water.”).

⁴⁴ Glennon, *supra* note 39, at 1884.

⁴⁵ See *Securing Property Rights: The Foundation of Markets*, *ECON. REFORM TODAY*, no. 1, 1996, at 2, 2, available at http://cipe.org/publications/ert/e19/E19_02.pdf.

⁴⁶ See Andrew P. Morriss, *Lessons from the Development of Western Water Law for Emerging Water Markets: Common Law vs. Central Planning*, 80 *OR. L. REV.* 861, 938–40 (2001).

⁴⁷ See James L. Huffman, *Institutional Constraints on Transboundary Water Marketing, in WATER MARKETING—THE NEXT GENERATION: THE POLITICAL ECONOMY FORUM*, *supra* note 43, at 31, 32 (“An effective market in water requires well-defined property rights”); Glennon, *supra* note 39, at 1888 (“If water markets are to flourish, there must be a system of quantified water rights that are transferable Without a property right that is quantified and transferable, there will be no voluntary reallocation of water use.”).

⁴⁸ Christopher L. Len, *Synthesis—A Brand New Water Law*, 8 *U. DENV. WATER L. REV.* 55, 64 (2004) (“Prior appropriation has led to waste and poor choices about who receives water for what purpose.”).

⁴⁹ See Huffman, *supra* note 40, at 438.

century, state laws began to change—albeit quite slowly—gradually facilitating the voluntary transfer of water rights both among users and for varying uses, to generally positive economic and environmental effect.⁵⁰

The relaxation of artificial limitations on how water rights were defined and could be used had environmental benefits. Such changes encouraged more efficient water use and allocation. The gradual recognition of instream flows as a beneficial use empowered conservation organizations to enter into the water marketplace and purchase or lease water rights for the benefit of threatened fish populations.⁵¹ The broadening of water rights facilitated the replacement of lobbying and political maneuvering with voluntary, cooperative transactions to reallocate water. The recognition of property rights in water gives farmers a potentially marketable asset, and the demand for instream rights from conservationists, recreationists, and others creates a financial incentive to “use” water in ways that benefit species and local ecosystems.⁵² Rather than seek the imposition of additional regulatory controls, which may trigger conflict and litigation, water conservancies can negotiate with farmers and ranchers to purchase, lease, or otherwise transfer water rights.⁵³ Additional legal changes enabling water rights owners to keep gains from increased efficiency in water use has further added to the potential gains from trade.⁵⁴

This development has been slow, however, largely due to legal and physical limitations on water rights. Nonetheless, the volume of water trades, leases, and purchases has been increasing.⁵⁵ This is not surprising, as economic analyses have concluded that the potential efficiency and welfare gains from the transfer of water rights are quite significant.⁵⁶ By some estimates, the net welfare gains from market-driven water transfers could be greater than the value of the water rights themselves.⁵⁷

Insofar as excessive amounts of water are devoted to agriculture, the best solution is to facilitate the voluntary transfer of such water to other uses, whether urban water consumption, environmental conservation, or

⁵⁰ Janet Neuman, Anne Squier & Gail Achterman, *Sometimes a Great Notion: Oregon's Instream Flow Experiments*, 36 ENVTL. L. 1125, 1130–31 (2006).

⁵¹ See TERRY L. ANDERSON & PAMELA SNYDER, WATER MARKETS: PRIMING THE INVISIBLE PUMP 120 (1997) (discussing how by leasing water rights on Buck Hollow Creek from a rancher, the Oregon Water Trust has kept the water in the stream of a steelhead (*Oncorhynchus mykiss*) spawning tributary).

⁵² See, e.g., TERRY L. ANDERSON & DONALD R. LEAL, ENVIRO-CAPITALISTS: DOING GOOD WHILE DOING WELL 94–95 (1997) (describing how funds from the Northwest Area Foundation provided a rancher with the financial incentive to use water in a manner that would encourage a recovery of the local steelhead population).

⁵³ See *id.* at 94–98 (describing the efforts of “enviro-capitalists” to avoid litigation by acquiring various property rights).

⁵⁴ See, e.g., Neuman, Squier & Achterman, *supra* note 50, at 1150.

⁵⁵ Jedidiah Brewer et al., *Transferring Water in the American West: 1987–2005*, 40 U. MICH. J.L. REFORM 1021, 1042 & fig.2 (2007).

⁵⁶ Marian L. Weber, *Markets for Water Rights Under Environmental Constraints*, 42 J. ENVTL. ECON. & MGMT. 53, 53 (2001).

⁵⁷ See Morriss, *supra* note 33, at 982.

something else. Such transfers enhance welfare by allocating resources to higher valued uses, as well as by providing additional incentives for sustainable resource management and innovation. The possibility of a market transfer induces rights owners to consider whether it is better to maintain existing uses or sell their rights to another. This, in turn, creates incentives to use the resource in question more efficiently and economically.

If a farmer can sell unused water rights to a municipality or conservation group, that farmer has a greater incentive to improve the efficiency of his operations—or perhaps even to accept payment and cease farming altogether. A failure to make cost-effective changes forfeits economic opportunities. At the same time, if a municipal water system can generate surplus water rights by increasing conservation or enhancing efficiency, it can create a valuable asset. In all cases, the potential transferability of the rights induces rights holders to recognize the value their rights could provide to others and to take such values into account when making use and management decisions. As a consequence, the price of water rights will reflect the value of potential alternative uses.⁵⁸ The more robust water markets become, the more powerful these incentives will be—and the more pressure there will be for more efficient water use.

However compelling the case for greater reliance upon water markets, implementing water markets can be a challenge. The physical nature of water, the natural landscape, and the costs of transporting and monitoring flows,⁵⁹ all complicate the move to markets. The transaction costs associated with creating and sustaining water markets can be significant, but so too are the potential welfare gains from making water markets a greater reality. Authorizing trades does not guarantee that markets will emerge, but if trades are allowed, there is an incentive for entrepreneurs to discover ways to make welfare-enhancing trades possible. Transaction costs may be an obstacle to trades, but they are also evidence of an entrepreneurial opportunity. Expanding water markets and making them more robust will take substantial effort, legal and otherwise, but it is an effort worth undertaking.

IV. CHANGING ECOLOGICAL CONDITIONS

Whatever the economic benefits of private property rights and markets—whether for water or anything else—some worry that they conflict with environmental protection efforts. The gradual evolution of our

⁵⁸ See Paul Holden & Mateen Thobani, *Tradable Water Rights: A Property Rights Approach to Resolving Water Shortages and Promoting Investment* 11 (World Bank, Policy Research Working Paper No. 1627, 1996), available at http://www-wds.worldbank.org/external/default/WDSContentServer/WDSP/IB/1996/07/01/000009265_3961214131318/Rendered/PDF/multi_page.pdf.

⁵⁹ See Brewer et al., *supra* note 55, at 1025 (pointing out complications impeding the development of a water market); see also Morriss, *supra* note 33, at 986–87 (discussing problems related to monitoring water use and the ways in which the unique attributes of water affect users differently); Barton H. Thompson, Jr., *Water Markets and the Problem of Shifting Paradigms*, in WATER MARKETING—THE NEXT GENERATION: THE POLITICAL ECONOMY FORUM, *supra* note 43, at 1, 17 (discussing challenges related to transporting water).

environmental understanding and changes in ecological conditions are identified as among the reasons to restrain markets and curtail property rights.⁶⁰ From this perspective, the recognition that “everything in the environment is connected to everything else,” and the reality of persistent ecological changes, some of which are due to human interventions, are reasons to be wary of protecting property rights and allowing markets to influence the allocation of environmental resources.⁶¹ What markets value today may not be so important tomorrow.

This perspective tends to misunderstand some of the primary virtues of markets and underestimate the potential for markets to adapt to changed conditions, particularly in comparison to the politically driven alternatives. The primary virtue of markets is not the generation of static efficiency, but the constant pressure to allocate resources to their highest valued uses, even as the value of competing uses change over time.⁶² Markets are an immensely powerful means of discovering and aggregating time and place specific information, including subjective value preferences, and markets are constantly adapting as such information, or the conditions upon which it is based, evolve.⁶³

Above all else, the failure of economic central planning is caused by the inability of centralized systems to collect and process a sufficient volume of information to sustain efficient decision making. This is among the key insights of Nobel Laureate economist Friedrich Hayek, who explained: “[T]he knowledge of the circumstances of which we must make use never exists in concentrated or integrated form, but solely as the dispersed bits of incomplete and frequently contradictory knowledge which all the separate individuals possess.”⁶⁴ Markets succeed precisely because the price system is an effective mechanism for discovering and integrating the dispersed and fragmentary knowledge and information that individuals possess.⁶⁵

The ability of markets to respond relatively rapidly and effectively to changes in exogenous conditions makes markets particularly well suited to addressing environmental changes. As the world changes around us, the relative demand for resources will change, as will the relative ease at which various resources may be obtained. Market prices can reflect these changes while at the same time providing incentives for would-be entrepreneurs to find more efficient ways of meeting demands, ecological or otherwise.

A market system, in which participants pay for the resources they use, enables individual water users to weigh the tradeoff between the cost of obtaining additional water, the cost of reducing or conserving water use, and other relevant factors. If markets are sufficiently “thick,” prices can change

⁶⁰ See Freyfogle, *supra* note 2, at 1293–94.

⁶¹ See, e.g., COMMONER, *supra* note 5, at 23; *supra* notes 15–16 and accompanying text.

⁶² Richard C. Feiock & Christopher Stream, *Environmental Protection Versus Economic Development: A False Trade-Off?*, 61 PUB. ADMIN. REV. 313, 314–15 (2001).

⁶³ See ANDERSON & LEAL, *supra* note 19, at 14–21.

⁶⁴ F. A. Hayek, *The Use of Knowledge in Society*, 35 AM. ECON. REV. 519, 519 (1945).

⁶⁵ See *id.* at 524–26.

in response to new information—based on new demands and new environmental realities that affect the relative demand for and supply of relevant resources—far more efficiently and quickly than can a centralized regulatory regime.⁶⁶ It is for this reason that many environmental experts, and even United Nations authorities, have recognized the potential value of using water markets to help address the ecological changes that will be wrought by climate change.⁶⁷ The threat of climate change and “nonstationarity” in water supplies does not undermine this case for rights and markets in water, but strengthens it.

For the same reasons that markets may encourage rampant development of open space during early periods of economic growth, markets also encourage greater conservation and the provision of environmental amenities as environmental preferences blossom in wealthier populations.⁶⁸ In each case, markets powerfully uncover, aggregate, and process information about what resources are valued and for what purposes, and the cost at which such resources are available. Environmental values and preferences change over time, and well-functioning markets help discover and actualize such preferences, often much more effectively than comparable political or command institutions.

V. WATER MARKETS AND CLIMATE CHANGE

Outside of Washington, D.C., and the television studios of various cable news outlets, there is relatively little debate over whether human activity, in the form of increased emissions of greenhouse gases, is contributing to a gradual warming of the atmosphere. Scientists dispute the magnitude of such changes, and the extent to which one may attribute observed conditions or specific events to climate change, but there is fairly wide agreement on the fundamentals.⁶⁹ Human activities have contributed to an increase in atmospheric concentrations of greenhouse gases and, all else equal, a rise in greenhouse gas concentrations will contribute to a gradual climatic warming, which will in turn have various effects on water resources.⁷⁰

⁶⁶ Morriss, *supra* note 33, at 994.

⁶⁷ See, e.g., CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY: CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 491 (Martin Parry et al. eds., 2007).

⁶⁸ See RICHARD L. STROUP, ECO-NOMICS: WHAT EVERYONE SHOULD KNOW ABOUT ECONOMICS AND THE ENVIRONMENT 13–14 (2003); Kenneth E. McConnell, *Income and the Demand for Environmental Quality*, 2 ENV'T & DEV. ECON. 383, 385–86 (reporting empirical evidence on the environmental Kuznets curve); Norton, *supra* note 34, at 45 (noting that, insofar as environmental quality is viewed as a “good,” consumption of environmental quality will increase as wealth increases); BRUCE YANDLE ET AL., ENVIRONMENTAL KUZNETS CURVES: A REVIEW OF FINDINGS, METHODS, AND POLICY IMPLICATIONS 29–30 (2004), available at http://www.perc.org/pdf/rs02_1a.pdf.

⁶⁹ See sources cited *supra* note 16.

⁷⁰ Richard B. Alley et al., *Summary for Policymakers*, in CLIMATE CHANGE 2007: THE PHYSICAL SCIENCE BASIS: CONTRIBUTION OF WORKING GROUP I TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 16, at 1, 1–3; Zbigniew W.

Further, at this point, some degree of climate change is inevitable and unavoidable.⁷¹ Whatever mitigation measures are eventually adopted (if any are), some amount of warming will occur and, as a consequence, some degree of adaptation is necessary. This is particularly so in the case of water.

Climate change will have a dramatic effect on water supplies the world over. While there is substantial uncertainty regarding the details of the impact of climate change on water resources, such uncertainty does not extend to the likelihood of such changes.⁷² As the world warms, rising temperatures and changes in precipitation patterns will impact water resources. “The most dominant climatic drivers for water availability are precipitation, temperature, and evaporative demand,” all of which will be influenced by greenhouse warming.⁷³ According to the 2001 report of the United Nation’s Intergovernmental Panel on Climate Change (IPCC), “Available evidence suggests that global warming may lead to substantial changes in mean annual streamflows, seasonal distributions of flows, and the probabilities of extreme high- or low-flow conditions.”⁷⁴

Historical assessments of water supplies are no longer operable. As the IPCC cautioned in 2007, “It is no longer appropriate to assume that past hydrological conditions will continue into the future (the traditional assumption) and, due to climate change uncertainty, managers can no longer have confidence in single projections of the future.”⁷⁵ As a consequence, “[w]ater managers must now assume that existing hydrologic models are no longer reliable and in many cases lead to an underestimation of available supplies.”⁷⁶

As a general matter, one may be able to say global warming will mean less snowfall, faster snowmelt, and increased evaporation. At the same time, warming is expected to alter generally prevailing precipitation patterns, increasing rain in some areas and decreasing it in others.⁷⁷ Some regions may

Kundzewicz et al., *Freshwater Resources and Their Management*, in CLIMATE CHANGE 2007: IMPACTS, ADAPTATION AND VULNERABILITY: CONTRIBUTION OF WORKING GROUP II TO THE FOURTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 173, 176, 177 tbl.3.1 (Martin Parry et al. eds., 2007).

⁷¹ See Roger Pielke, Jr. et al., *Lifting the Taboo on Adaptation*, 445 NATURE 597, 597 (2007) (noting some degree of climate change is “unavoidable” due to anthropogenic greenhouse gas emissions to date).

⁷² See Kundzewicz et al., *supra* note 70, at 181 (“Uncertainties in climate change impacts on water resources are mainly due to the uncertainty in precipitation inputs and less due to the uncertainties in greenhouse gas emissions, in climate sensitivities, or in hydrological models themselves.” (citations omitted)).

⁷³ *Id.* at 180.

⁷⁴ K. Duncan et al., *North America*, in CLIMATE CHANGE 2001: IMPACTS, ADAPTATION, AND VULNERABILITY: CONTRIBUTION OF WORKING GROUP II TO THE THIRD ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 735, 745 (James J. McCarthy et al. eds., 2001).

⁷⁵ Kundzewicz et al., *supra* note 70, at 199.

⁷⁶ Dan Tarlock, *How Well Can Water Law Adapt to the Potential Stresses of Global Climate Change?*, 14 U. DENV. WATER L. REV. 1, 2 (2010).

⁷⁷ Kundzewicz et al., *supra* note 70, at 177 tbl.3.1; see also E. Elgaali et al., *High Resolution Modeling of the Regional Impacts of Climate Change on Irrigation Water Demand*, 84 CLIMATIC CHANGE 441, 460 (2007) (predicting that climate change will significantly increase irrigation

experience fewer, but more severe, precipitation events that occur earlier or later than such events had occurred in the past, but others may not.⁷⁸ Many analyses focus on the potential for climate change to produce water shortages or droughts, but floods and oversupply in some regions are also possible.⁷⁹ Indeed, “the jury is still out” as to whether climate change and the resulting timing shifts in precipitation will produce floods or low flows in any given place.⁸⁰ Compounding the problem is the fact that direct changes in water supplies brought about by climate change will be augmented by changes in human utilization. Decreases in snowmelt or rainfall in some regions may increase the demand for other sources of water for irrigation and other uses.⁸¹

While we may know that climate change is occurring, scientists are as yet unable to tell us what this will mean for water in any given region, and it is unclear whether they ever will be. The difficulties of making precise temperature projections in given places pale in comparison to the difficulties entailed with making predictions about precipitation.⁸² Similarly, it is much easier to make projections about changes over the course of years than across seasons and months.⁸³ As one reviewer concluded, “In the world of model projections and in the world of statistical analysis, we have the most confidence in statements about the least important aspects of hydrology (the central tendency), and the least confidence in the most important aspects (extreme events).”⁸⁴

Climate change, like environmental change more broadly, requires the adoption of complex adaptive systems.⁸⁵ Specifically, there is a need for systems that can respond relatively rapidly to unforeseen and unpredictable changes; systems that are capable of discovering, dispersing, and accounting for time- and place-specific information about new and emerging demands, needs, and availabilities; and systems that allow for the reallocation of

demands but demonstrating a high degree of uncertainty surrounding future availability of water for irrigation); Kathleen A. Miller et al., *Water Allocation in a Changing Climate: Institutions and Adaptation*, 35 CLIMATIC CHANGE 157, 157 (1997) (“Hydrologic analyses of plausible climate change scenarios indicate possible substantial reductions in streamflows in some areas, increased flood frequencies in other areas, and changes in the seasonal pattern of flows . . .”).

⁷⁸ See Kundzewicz et al., *supra* note 70, at 186–87.

⁷⁹ *Id.*

⁸⁰ Robert M. Hirsch, *A Perspective on Nonstationarity and Water Management*, 47 J. AM. WATER RESOURCES ASS’N 436, 438 (2011); see also Robin Kundis Craig, “Stationarity Is Dead”—*Long Live Transformation: Five Principles for Climate Change Adaptation Law*, 34 HARV. ENVTL. L. REV. 9, 15–16 (2010).

⁸¹ Kundzewicz et al., *supra* note 70, at 191–94.

⁸² Hirsch, *supra* note 80, at 438.

⁸³ *Id.*

⁸⁴ *Id.*

⁸⁵ See J.B. Ruhl, *Thinking of Environmental Law as a Complex Adaptive System: How to Clean Up the Environment by Making a Mess of Environmental Law*, 34 Hous. L. REV. 933, 940–41, 980 (1997) (discussing the reformation of environmental law into a complex adaptive system model).

resources in response to new challenges and opportunities. In short, the sort of system that is required is that provided by a well-functioning market. Top-down, centrally controlled regulatory and administrative systems are not sufficiently adaptive and responsive. Even if such systems could be designed in theory, effective implementation is unlikely, particularly given the procedural obligations the Constitution and administrative law impose on government actors.

Existing centralized water management institutions are scarcely able to keep up with current stresses and demands.⁸⁶ As Professor Robert Glennon notes, “[O]ur current water use practices are unsustainable,”⁸⁷ and that is so even if we do not account for climate change. Existing water management systems cannot handle the additional stresses that will be placed upon them by climate change,⁸⁸ particularly in an era of severe fiscal constraints. While one might conceive of a system with sufficient redundancies and safeguards to manage a wide range of water supply and demand scenarios, the nation cannot afford the costs that creating such a system would entail. A new generation of centrally planned water infrastructure is not an affordable, let alone cost-effective, means of addressing the water management challenges global warming presents.⁸⁹

The dynamic threat posed by climate change strengthens the case for greater reliance on water markets. As Professor Dan Tarlock notes, the “most promising GCC [global climate change] adaptation strategy is to use the market to reallocate water to more GCC-stressed uses.”⁹⁰ Professor Thompson concurs: “As competing demands for our limited water supplies grow, and as the possibility of global warming threatens to increase our water supplies’ year-to-year variability, the need for robust water markets will increase.”⁹¹ I have also argued elsewhere that water markets are an appropriate adaptive response to the threat of climate change.⁹²

The case for greater reliance on water markets may not be universally accepted but has been acknowledged by the IPCC. According to the IPCC, a promising way to manage “the uncertainty associated with estimates of future climate change is to adopt management measures that are robust to uncertainty.”⁹³ In its 2001 report, the IPCC advised that “improving the functioning of water markets could help to create the kind of flexibility

⁸⁶ A 2003 Government Accountability Office report found that a majority of states expected to suffer water shortages within the next 10 years, even in the absence of drought conditions. See U.S. GEN. ACCOUNTING OFFICE, GAO-03-514, FRESHWATER SUPPLY: STATES’ VIEWS OF HOW FEDERAL AGENCIES COULD HELP THEM MEET THE CHALLENGES OF EXPECTED SHORTAGES 8 (2003), available at <http://www.gao.gov/assets/160/157452.pdf>.

⁸⁷ Glennon, *supra* note 39, at 1873.

⁸⁸ *Id.* at 1873–74.

⁸⁹ Kenneth D. Frederick, *Adapting to Climate Impacts on the Supply and Demand for Water*, 37 CLIMATIC CHANGE 141, 142 (1997).

⁹⁰ Tarlock, *supra* note 76, at 20.

⁹¹ Thompson, *supra* note 59, at 24.

⁹² See Adler, *supra* note 18, at 732.

⁹³ Kundzewicz et al., *supra* note 70, at 200.

needed to respond to uncertain changes in future water availability.”⁹⁴The IPCC added:

If water supplies decline in particular locations or seasons, water markets could soften the impacts by moving water from lower to higher valued uses. In the western United States, where irrigation now accounts for more than 80% of consumptive water use, water market activity is likely to continue the current trend of movement of water out of irrigated agriculture to accommodate other water uses.⁹⁵

The IPCC later noted that “short-term transfers can provide flexibility and increased security for highly valued water uses such as urban supply, and in some circumstances may prove more beneficial than constructing additional storage reservoirs.”⁹⁶

Well-functioning water markets could facilitate the reallocation of water to changing conditions, such as changes in population and economic development.⁹⁷ In the same fashion, water markets could facilitate changes in reallocation in response to changing ecological conditions. Relying upon political institutions to properly reallocate water in response to emerging economic and ecological needs is folly. As Glennon cautions, “Allocation decisions made through the political process will invariably result in the water being allocated to the most powerful economic interests.”⁹⁸

Water markets are no panacea—there is no panacea. But the features that make water markets an effective mechanism for allocating water efficiently, accounting for competing uses and evolving preferences, make water markets well suited to address emerging dynamic “nonstationarity” of water supplies. Insofar as the greatest challenge posed by climate change will lie in identifying how and where water supplies and demands are changing in response to climatic changes,⁹⁹ in addition to economic development and other human activities, water markets can play an extremely valuable role.

Water markets today remain quite constrained, however. Imperfectly defined and defended water rights, restraints on transfers, and political limitations hamper the ability of water markets to address changing ecological conditions. Existing obstacles to water markets include regulatory barriers, “inconsistent legal paradigms, opposition by governmental agencies that control much of the water and key transportation facilities, and to a growing extent, concerns about the impact of transfers on exporting

⁹⁴ Duncan et al., *supra* note 74, at 748.

⁹⁵ *Id.*

⁹⁶ Kundzewicz et al., *supra* note 70, at 198.

⁹⁷ Glennon, *supra* note 39, at 1887.

⁹⁸ *Id.* at 1895.

⁹⁹ *Id.* at 1874.

communities.”¹⁰⁰ The primary barriers, in this respect, may be political more than they are legal,¹⁰¹ but they are barriers nonetheless.

In order to facilitate the expansion and further development of water markets several steps can be taken. These steps include 1) defining and recognizing the security and transferability of property rights in water resources, 2) eliminating government subsidies for water use and distribution, 3) moving toward market-based prices for water, and 4) identifying and reducing legal and regulatory barriers to water transfers, particularly interbasin and interstate water transfers.¹⁰² As Professor Thompson observes, “By providing the legal infrastructure for water markets and actively encouraging such markets, the government can help reduce the harm from uncertainty in water rights and deliveries.”¹⁰³ It can also facilitate further innovation in water institutions that can reduce the transaction costs associated with water transfers and encourage more efficient utilization of water resources.

As steps are taken to reduce the transaction costs associated with water markets, steps should also be taken to make water rights more robust. Various water conservancies have been quite successful at obtaining and protecting instream flows for the benefit of fish populations.¹⁰⁴ Yet the instream flows required today may not be those necessary tomorrow. Those rivers or fish populations in greatest need of additional flows one decade may not be those in greatest need in the future. Indeed, due to changes in both the quantity and timing of precipitation events, and consequent changes in irrigation and other water use practices, river systems that experienced extremely low summer or autumn flows in the past may experience higher volumes at those times of year in the future, whereas areas with little need for enhanced instream flows in the past could need them in the future.¹⁰⁵ Such possibilities not only reinforce the need for market systems to facilitate the reallocation of water, but also highlight the need to remove constraints on the marketing of rights.

The reality of nonstationarity in fresh water supplies means that it is a mistake to let the ecological needs of the present dictate the allocation of water supplies in the future. Instream rights acquired in the past to enhance stream flows should be available for sale or transfer in the future. The ability of a conservation organization to protect fish populations and other water-dependent ecological values is maximized insofar as its liquid assets are, in fact, liquid, so that the organization can facilitate the reallocation of

¹⁰⁰ Thompson, *supra* note 59, at 6.

¹⁰¹ See Tarlock, *supra* note 76, at 21.

¹⁰² See CLAY J. LANDRY, STATE-BASED ENVIRONMENTALISM: HOW WATER MARKETS CAN END CONFLICTS: A GUIDE FOR POLICY MAKERS 2–13 (2001) (providing an overview of reforms that would facilitate the development of water markets).

¹⁰³ Barton H. Thompson, Jr., *Uncertainty and Markets in Water Resources*, 36 MCGEORGE L. REV. 117, 125 (2005).

¹⁰⁴ See *supra* notes 51–54 and accompanying text.

¹⁰⁵ Jeffrey T. Payne et al., *Mitigating the Effects of Climate Change on the Water Resources of the Columbia River Basin*, 62 CLIMATIC CHANGE 233, 234–35 (2004).

resources to support the greatest ecological needs. In a dynamic world with constant ecological change, perceptions of today's environmental needs should not result in the imposition of constraints that inhibit appropriate responses to needs that emerge in the future.

Just as water rights need to be defined so as to facilitate transfers, there are environmental reasons to protect such rights from expropriation.¹⁰⁶ The threat of government expropriation can discourage property owners from investing in environmental conservation. Even regulatory measures driven by environmental concerns can discourage environmentally desirable behavior on private lands.¹⁰⁷ The ability of government entities to take property from private owners, whether through eminent domain or regulatory conscription, can undermine ecological conservation and frustrate market development. As Professor Huffman cautions, "If the federal government or state governments are free to take or invalidate vested property or contractual rights in water, water markets will not be successful."¹⁰⁸

Constitutionally required compensation can mitigate such effects, but it alone is not sufficient. Further protecting property rights, including rights in water, by limiting the use of eminent domain for economic development is also wise.¹⁰⁹ If climate change creates or exacerbates water supply problems for politically important constituencies, political institutions will seek to reallocate water accordingly. Ensuring that water rights are real property rights protected by the Takings Clause of the Fifth Amendment can limit this threat, as can state law measures to limit the ability of the government to take water rights or other property save for a true "public use."

VI. CONCLUSION

For too long, markets and property rights have been seen as obstacles, if not enemies, of environmental protection. Yet market institutions and private rights in natural resources will be necessary to overcome the profound ecological challenges faced by humanity today and those that will emerge in the future. Those challenges presented by global climate change loom large today—as well they should—but they are by no means the last ecological challenge humanity will face. At the same time, more mundane

¹⁰⁶ See, e.g., James L. Huffman, *Protecting Species Through the Protection of Water Rights*, in REBUILDING THE ARK: NEW PERSPECTIVES ON ENDANGERED SPECIES ACT REFORM 136, 155–56 (Jonathan H. Adler ed., 2011) (arguing that private conservation measures and positive incentives to conserve—if coupled with the strengthening of water rights against appropriation—would foster an efficient, market-based avenue for conservation that would not require counterproductive environmental lobbying for increased government restrictions on land and water use).

¹⁰⁷ Jonathan H. Adler, *Money or Nothing: The Adverse Environmental Consequences of Uncompensated Land Use Controls*, 49 B.C. L. REV. 301, 303–04 (2008).

¹⁰⁸ Huffman, *supra* note 40, at 443.

¹⁰⁹ Ilya Somin & Jonathan H. Adler, *The Green Costs of Kelo: Economic Development Takings and Environmental Protection*, 84 WASH. U. L. REV. 623, 623 (2006).

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environmental challenges persist all around us. Greater reliance on property rights and markets could help us overcome these challenges, too.

Several years ago, Professor Huffman counseled that it was time to “give markets a chance when dealing with a resource as special as water.”¹¹⁰ Time and the increased understanding of the ecological challenges posed by global warming and other environmental changes have only made this plea more urgent. It is time to give fuller property rights and more robust markets a chance—now more than ever.

¹¹⁰ Huffman, *supra* note 40, at 433.