

GLOBAL CLIMATE DISRUPTION AND WATER LAW REFORM

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INTRODUCTION

While some holdouts still dispute the point,¹ we live today on a planet undergoing disruptive climate change.² Undercutting the skeptical view are revelations that the federal government, over the past eight years, systematically interfered with scientific work in order to obscure evidence both of climate change and of human agency in causing that change.³ Regardless of cause, a great deal of climate change now seems unavoidable—with potentially disastrous consequences.⁴ Farmers in the Northern Hemisphere are

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1. See NATURE, NOT HUMAN ACTIVITY, RULES THE CLIMATE: SUMMARY FOR POLICYMAKERS OF THE REPORT OF THE NONGOVERNMENTAL INTERNATIONAL PANEL ON CLIMATE CHANGE (S. Fred Singer ed., 2008), available at http://www.heartland.org/custom/semmod_policybot/pdf/22835.pdf. See also Juliet Eilperin, *Global Warming Skeptics Insist Humans Not at Fault*, WASH. POST, Mar. 4, 2008, at A16; Andrew C. Revkin, *Cool View of Science at Meeting on Warming*, N.Y. TIMES, Mar. 4, 2008, at A20; Andrew C. Revkin, *Skeptics on Human Climate Impact Seize on Cold Spell*, N.Y. TIMES, Mar. 2, 2008, at A18; John Tierney, *In 2008, a 100 Percent Chance of Alarm*, N.Y. TIMES, Jan. 1, 2008, at F1.

2. IPCC/TEAP SPECIAL REPORT, WORKING GROUP I, FOURTH ASSESSMENT REPORT: THE PHYSICAL SCIENCE BASIS OF CLIMATE CHANGE (2007) [hereinafter IPCC/TEAP SPECIAL REPORT I], available at <http://ipcc-wg1.ucar.edu/wg1/wg1-report.html>. See generally *Climate Change: Hearings Before the Committee on Energy and Natural Resources*, 109th Cong. (2005); *Climate Change: Understanding the Degree of the Problem: Hearing Before the Committee on Government Reform*, 109th Cong. (2006); WILLIAM R. COTTON & ROGER A. PIELKE SR., HUMAN IMPACTS ON WEATHER AND CLIMATE (2d ed. 2007); ELIZABETH KOLBERT, FIELD NOTES FROM A CATASTROPHE: MAN, NATURE, AND CLIMATE CHANGE (2006); JAMES LOVELOCK, THE REVENGE OF GAIA: EARTH'S CLIMATE IN CRISIS AND THE FATE OF HUMANITY (2006). A British court, in a dispute about teaching materials in British schools, carefully reviewed the evidence and found that it substantially supports the claims of human-caused climate change. *Dimmock v. Sec'y of State for Educ.*, [2007] EWHC (Admin) 2288, (QB), available at <http://www.bailii.org/ew/cases/EWHC/Admin/2007/2288.html>.

3. See *Allegations of Political Interference with Government Climate Change Science: Hearing Before the Committee on Oversight and Government Reform*, 110th Cong. (2007); Juliet Eilperin, *Climate Findings Were Distorted, Probe Finds; Appointees in NASA Press Office Blamed*, WASH. POST, June 3, 2008, at A2; Andrew C. Revkin, *NASA Office is Criticized on Climate Reports*, N.Y. TIMES, June 3, 2008, at A16.

4. NAT'L SCI. & TECH. COUNCIL, SCIENTIFIC ASSESSMENT OF THE EFFECTS OF GLOBAL CHANGE ON THE UNITED STATES (2008); Timothy Egan, *Heat Invades Cool Heights Over Arizona Desert*, N.Y. TIMES, Mar. 27, 2007, at A1; Juliet Eilperin, *Warming Predicted to Take Severe Toll on U.S.*, WASH. POST, Apr. 17, 2007, at A12; Marc Kaufman, *Antarctic Glaciers' Sloughing of Ice Has Scientists at a Loss*, WASH. POST, Mar. 16, 2007, at A2; Mark Landler, *Global Warming Poses Threat to Ski Resorts in the Alps*, N.Y. TIMES, Dec. 16, 2006, at A3; Rick Lyman, *Rising Ocean Temperatures Threaten Florida's Coral Reef*, N.Y. TIMES, May 22, 2006, at A14; Andrew C. Revkin, *Maldives Considers Buying Dry Land if Seas Rise*, N.Y. TIMES, Nov. 10, 2008, at A10; Doug Struck,

experiencing measurably longer growing seasons.⁵ Climate disruption brings more extreme events—droughts and floods—at more frequent intervals.⁶ Even more importantly, global climate disruption also will change the timing and nature of precipitation throughout much of the planet.⁷ These changes will make water more available in some areas and less available in others.⁸ Unfortunately, a precise prediction of how these changes will play out remains

Warming Thins Herd for Canada's Seal Hunt; Pups Drown in Melting Ice; Government Reduces Quotas, WASH. POST, Apr. 4, 2007, at A8.

5. Pam Belluck, *Warm Winters Upset Rhythms of Maple Sugar*, N.Y. TIMES, Mar. 3, 2007, at A1; William K. Stevens, *March May Soon Be Coming in Like a Lamb*, N.Y. TIMES, Mar. 2, 1999, at F3.

6. See IPCC/TEAP SPECIAL REPORT I, *supra* note 2, at 617-29, 783; IPCC/TEAP SPECIAL REPORT, WORKING GROUP II, FOURTH ASSESSMENT REPORT: IMPACTS, ADAPTATION, AND VULNERABILITY 177-78, 186-87, 193 (2007) [hereinafter IPCC SPECIAL REPORT II], available at <http://ipcc-wg1.ucar.edu/wg1/wg2-report.html>. See also MICHAEL COLLIER & ROBERT H. WEBB, FLOODS, DROUGHTS, AND CLIMATE CHANGE (2002); JONATHAN NOTT, EXTREME EVENTS: A PHYSICAL RECONSTRUCTION AND RISK ASSESSMENT (2006); M. Monirul Qader Mirza, R.A. Warrick & N.J. Ericksen, *The Implications of Climate Change on Floods of the Ganges, Brahmaputra and Meghna Rivers in Bangladesh*, 57 CLIMATIC CHANGE 287, 315 (2003); Evelyn L. Wright & Jon D. Erickson, *Incorporating Catastrophes Into Integrated Assessment: Science, Impacts, and Adaptation*, 57 CLIMATIC CHANGE 265, 280 (2003); Symposium, *Prospects of Living with Flood in the 21st Century*, 30 WATER INT'L 1-122 (2005); Charles M. Blow, Op-Ed., *Farewell, Fair Weather*, N.Y. TIMES, May 31, 2008, at A17; Diane Mastrull, *New York to Release Water from Reservoirs*, PHILA. INQUIRER, Apr. 17, 2008, at B1 (reporting a change in reservoir management practices in response to the anticipation of more frequent floods).

7. IPCC SPECIAL REPORT II, *supra* note 6, at 177, 183, 187, 190, 192-93.

8. See, e.g., Lara C. Whitely Binder, *Climate Change and Watershed Planning in Washington State*, 42 J. AM. WATER RESOURCES ASS'N 915 (2006); Catherine Denault, Robert G. Millar & Barbara J. Lence, *Assessment of Possible Impacts of Climate Change in an Urban Catchment*, 42 J. AM. WATER RESOURCES ASS'N 685 (2006); Randall T. Hanson & Michael D. Dettinger, *Ground Water/Surface Water Responses to Global Climate Simulations, Santa Clara-Calleguas Basin, Ventura, California*, 41 J. AM. WATER RESOURCES ASS'N 517 (2005); Glenn A. Hodgkins, Robert W. Dudley & Thomas G. Huntington, *Summer Low Flows in New England During the 20th Century*, 41 J. AM. WATER RESOURCES ASS'N (SPECIAL ISSUE) 403 (2005); Brian H. Hurd et al., *Climatic Change and U.S. Water Resources: From Modeled Watershed Impacts to National Estimates*, 40 J. AM. WATER RESOURCES ASS'N 129 (2004); Katharine L. Jacobs, Gregg M. Garfin & Barbara J. Morehouse, *Climate Science and Drought Planning: The Arizona Experience*, 41 J. AM. WATER RESOURCES ASS'N (SPECIAL ISSUE) 437 (2005); Manoj Jha et al., *Climate Change Sensitivity Assessment on Upper Mississippi River Basin Streamflows Using SWAT*, 42 J. AM. WATER RESOURCES ASS'N 997 (2006); Jonathan Lautze et al., *Water Allocation, Climate Change, and Sustainable Peace: The Israeli Proposal*, 30 WATER INT'L 197, 204 (2005); Hugo A. Loáiciga, *Drought, Tree Rings, and Reservoir Design*, 41 J. AM. WATER RESOURCES ASS'N (SPECIAL ISSUE) 949 (2005); Sarah Newman & Sherman Swanson, *Assessment of Changes in Stream and Riparian Conditions of the Marys River Basin, Nevada*, 44 J. AM. WATER RESOURCES ASS'N 1 (2008); James F. Saunders III et al., *The Influence of Climate Variation on the Estimation of Low Flows Used to Protect Water Quality: A Nationwide Assessment*, 40 J. AM. WATER RESOURCES ASS'N 1339 (2004); Cornelia Dean, *That 'Drought' in Southwest May Be Normal, Report Says*, N.Y. TIMES, Feb. 22, 2007, at A16; Gregg Garfin & Melanie Lenart, *Climate Change Effects on Southwest Water Resources*, SW. HYDROLOGY, Jan./Feb. 2007, at 16; Martin Hoerling & Jon Eischeid, *Past Peak Water in the Southwest*, SW. HYDROLOGY, Jan./Feb. 2007, at 18; Jeanine Jones, *Emerging State Policies on Climate Change*, SW. HYDROLOGY, Jan./Feb. 2007, at 20; Joel B. Smith et al., *Expanding the Tool Kit for Water Management in an Uncertain Climate*, SW. HYDROLOGY, Jan./Feb. 2007, at 24; Betsy Woodhouse, *Climate Change Through the Eyes of Water Managers*, SW. HYDROLOGY, Jan./Feb. 2007, at 22; *Spring Arriving Earlier in Western Streams*, SW. HYDROLOGY, Jan./Feb. 2007, at 26; but see Paul H. Kirshen et al., *Lack of Influence of Climate on Present Cost of Water Supply in the U.S.A*, 6 WATER POL'Y 269 (2004).

impossible and might remain unclear for decades.⁹ We can predict that, over the coming century, hotter temperatures and drier air will cause higher rates of evapo-transpiration, leading to drier soils that are less supportive of plant life without irrigation.¹⁰ Arid regions will become wider,¹¹ and the melting of glaciers and mountain snowpack will reduce or destroy the storage capacity of these immense reservoirs of fresh water that sustain rivers during the dry months of the year.¹² Global climate disruption will also lead to a rise in sea levels, which in some parts of the world (California, for example) will lead to salt water intrusion into fresh waters that today are widely consumed for human uses.¹³ Temperatures, the amount of precipitation, and the depth of snow packs will naturally vary from year-to-year,¹⁴ yet the long-term trends are clear: in many areas with large populations, the availability of water will decrease substantially.¹⁵ A corollary to this change is that the human-built infrastructure for managing water will become obsolete.¹⁶

9. See, e.g., E.Z. Stakhiv, *Policy Implications of Climate Change Impacts on Water Resources Management*, 1 WATER POL'Y 159, 161, 169-73 (1998) (surveying studies of several river systems and demonstrating how the predicted changes for each river system are dramatically widespread). See also Brian E. Gray, *Global Climate Change: Water Supply Risks and Water Management Opportunities*, 14 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 1453, 1454-55 (2008) (surveying predictions of precipitation changes for California, ranging from a "slight increase" to a 20% decline). See generally IPCC SPECIAL REPORT II, *supra* note 6, at 180-86.

10. IPCC SPECIAL REPORT II, *supra* note 6, at 176-77, 180, 184-87, 189-90, 192-93.

11. *Id.* at 223, 225-26, 249, 435, 439, 447-49, 451, 472, 477-78, 583-585, 590, 596, 606-07.

12. IPCC/TEAP SPECIAL REPORT I, *supra* note 2, at 175-77, 179, 184, 187, 194, 337-83, 814-22; UN Env't. Programme, *Meltdown in the Mountains* (Press Release, Mar. 16, 2008), available at <http://unep.org/Documents.Multilingual/Default.asp?DocumentID=530&ArticleID=5760&l=en>. See also Gray, *supra* note 9, at 1455 (predicting a 70 to 90% decrease in the snowpack in California's mountains, producing a decline in late spring stream flows up to 30%); Landler, *supra* note 4; Norman L. Miller, Kathy E. Bashford & Eric Strem, *Potential Impacts of Climate Change on California Hydrology*, 39 J. AM. WATER RESOURCES ASS'N 771, 783-84 (2003); Stephen Chen, *Glaciers Shrinking Fast, Warns Scientist, Ice Melting at Double the Speed, Survey Finds*, S. CHINA MORNING POST, Dec. 26, 2007, at 4; Jon Christensen, Op-Ed., *Who Moved My Glacier?*, N.Y. TIMES, Dec. 23, 2007, at 9; Charles J. Hanley, *On Africa's Great Peaks, Glaciers are in Retreat; Recent Report Blames Loss of Equatorial Ice on Post-70s Warming*, WASH. POST, Dec. 31, 2006, at A18; Mark Kaufman, *Decline in Snowpack is Blamed on Warming; Water Supplies in West Affected*, WASH. POST, Feb. 1, 2008, at A1; Somini Sengupta, *Glaciers in Retreat*, N.Y. TIMES, July 17, 2007, at F1.

13. Gray, *supra* note 9, at 1455. On sea level rise generally, see 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, 534, 536-37, 578 (2007); Christine A. Klein, *The New Nuisance: An Antidote to Wetland Loss, Sprawl, and Global Warming*, 48 B.C. L. REV. 1155 (2007); Robert L. Reid, *U.S. Ports Among Those Deemed Most Vulnerable to Rising Sea Levels*, CIV. ENGINEERING, June 2008, at 13.

14. See, e.g., Warren Cornwall, *Snowpack Makes Water Supply Look Solid*, SEATTLE TIMES, Feb. 12, 2008, at B1.

15. See, e.g., Felicity Barringer, *Lake Mead Could Be Within a Few Years of Going Dry, Study Finds*, N.Y. TIMES, Feb. 13, 2008, at A18 (reporting on a study that found that Lake Mead—the largest reservoir and major source of water in the southwestern states—has a fifty percent chance of becoming unusable by 2021). See generally IPCC SPECIAL REPORT II, *supra* note 6, at 183-84; Dean, *supra* note 8; Jacobs, Garfin & Morehouse, *supra* note 8; Marc Kaufman, *Southwest May Get Even Hotter, Drier; Report on Warming Warns of Droughts*, WASH. POST, Apr. 6, 2007, at A3; Robert Kunzig, *Drying of the West*, NAT'L GEOGRAPHIC, Feb. 2008, at 90; Miller, Bashford & Strem, *supra* note 12.

16. IPCC SPECIAL REPORT II, *supra* note 6, at 175, 178-79, 185, 193-95.

The foregoing points allow us to predict, even without precise foreknowledge, that climate disruption will cause more stress for already stressed water management regimes.¹⁷ These changes render obsolete the existing arrangements for water management, even in regions where water has historically been plentiful. Pressure for water law reform at the national and international levels was felt in many parts of the world long before the impact of climate disruption because of the growth in water demand fueled by population growth and changing patterns of use.¹⁸ Designing the correct legal reforms, however, will not be easy. Too much legal response can produce as much social turmoil as inadequate legal response. Suggestions for responses to the need for water law reform, whether arising from climate disruption, population growth, or other problems, range from muddling through, by doing what we are already doing,¹⁹ to radical reforms such as the introduction of markets as the best response to the massive uncertainty in water management.²⁰ I have written elsewhere in some detail about the problems of relying on markets for coping with these changes.²¹ I have also written at some

17. See Joseph W. Dellapenna, *Adapting the Law of Water Management to Global Climate Change and Other Hydropolitical Stresses*, 35 J. AM. WATER RESOURCES ASS'N 1301, 1303 (1999); Itay Fischhendler, *Legal and Institutional Adaptation to Climate Uncertainty: A Study of International Rivers*, 6 WATER POL'Y 281, 293 (2004); Gregory J. Hobbs, Jr., *The Role of Climate in Shaping Western Water Institutions*, 7 U. DENV. WATER L. REV. 1 (2003); Gregory Sergienko, *Property Law and Climate Change*, NAT. RESOURCES & ENV'T., Winter 2008, at 25.

18. Joseph W. Dellapenna, *Population and Water in the Middle East: The Challenge and Opportunity for Law*, 7 INT'L J. ENV'T. & POLLUTION 72 (1997). See generally IPCC SPECIAL REPORT II, *supra* note 6, at 181-82, 191-95; MAUDE BARLOW & TONY CLARKE, BLUE GOLD: THE FIGHT TO STOP THE CORPORATE THEFT OF THE WORLD'S WATER 3-76 (2002); SANDRA POSTEL, PILLAR OF SAND: CAN THE IRRIGATION MIRACLE LAST? (1999); Otto J. Helweg, *Water for a Growing Population: Water Supply and Groundwater Issues in Developing Countries*, 25 WATER INT'L 33 (2000).

19. See, e.g., Harry F. Lins & Eugene Z. Stakhiv, *Managing the Nation's Water in a Changing Climate*, 34 J. AM. WATER RESOURCES ASS'N 1255, 1255 (1998).

20. See, e.g., TERRY L. ANDERSON & PAMELA SNYDER, WATER MARKETS: PRIMING THE INVISIBLE PUMP 76-79 (1997); STEPHEN MERRETT, INTRODUCTION TO THE ECONOMICS OF WATER RESOURCES: AN INTERNATIONAL PERSPECTIVE (1997); RONALD C. GRIFFIN, WATER RESOURCE ECONOMICS: THE ANALYSIS OF SCARCITY, POLICIES, AND PROJECTS 203-40 (2006); CLAY J. LANDRY, SAVING OUR STREAMS THROUGH WATER MARKETS: A PRACTICAL GUIDE (1998); TERENCE RICHARD LEE, WATER MANAGEMENT IN THE 21ST CENTURY: THE ALLOCATION IMPERATIVE 50-87 (1999); Jedidiah Brewer et al., *Transferring Water in the American West: 1987-2005*, 40 U. MICH. J.L. REFORM 1021, 1023, 1025 (2007); Brian Chatterton & Lynne Chatterton, *The Australian Water Market Experiment*, 26 WATER INT'L 62 (2001); Gray, *supra* note 9, at 1453-54; M. Dinesh Kumar & O.P. Singh, *Market Instruments for Demand Management in the Face of Scarcity and Overuse of Water in Gujarat, Western India*, 3 WATER POL'Y 387 (2001); 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, 864 (2001); Janet C. Neuman, *The Good, the Bad, and the Ugly: The First Ten Years of the Oregon Water Trust*, 83 NEB. L. REV. 432, 434-37 (2004-2005); David W. Yoskowitz, *Markets, Mechanisms, Institutions, and the Future of Water*, 31 ENVTL. L. RPTR. 10237 (2001); Michael D. Young & Darla Hatton MacDonald, *An Opportunity to Improve Water Trading in the South East Catchment of South Australia*, 5 WATER POL'Y 127 (2003); Symposium, *A Model Water Transfer Act for California*, 14 HASTINGS W.-NW. J. WEST NORTHWEST J. ENVTL. L. & POL'Y 589, 589-758 (2008).

21. Joseph W. Dellapenna, *Climate Disruption, the Washington Consensus, and Water Law Reform*, 81 TEMP. L. REV. 383 (2008) [hereinafter Dellapenna, *Disruption*].

length about the challenges posed by climate disruption to the international law applicable to water resources.²² I will not repeat those discussions here. Instead, I shall focus on how to reform existing water law regimes in order to create the capacity to respond to the global climate disruption.

I. MODELS OF PROPERTY IN WATER

Water is found nearly everywhere, but, because of its variability in quantity and quality, it is often in the wrong place, available at the wrong time, inadequate in amount, or too impure. Usable water is a scarce and valuable commodity. Adaptations to global climate change will necessarily center on the management of water resources, given its importance to human survival and thriving. As the amount of water available for human use in a particular location undergoes dramatic change, the resulting stresses might overcome the environmental and political concerns that have made it impossible to build new large dams or water conveyance systems that would bring water to areas of increasing aridity from areas of increasing or continuing surplus.²³ If large-scale importation across vast distances remains impossible, water truly will remain a strictly regional resource with a vengeance. Such problems will require serious reconsideration of the laws allocating water among users to enable appropriate adaptation to the changing situation.

Water allocation law is primarily a matter of state law in the United States. The vastly differing experiences of different communities in the United States led to very different approaches to property rights in water.²⁴ As a result, there are three distinct models of water allocation law in the United States, each with its own characteristics that render it more or less capable of providing suitably adaptive responses to the changes induced by global climate disruption. To the east of Kansas City, people considered water to be readily available at little or no cost. Although there might be serious problems with water quality arising from human activities, shortages historically were rare and short-lived. In this setting, a body of law known as riparian rights evolved, predicated on treating the resource as a species of common property.²⁵ To the west of Kansas City,

22. Joseph W. Dellapenna, *International Water Law in a Climate of Disruption*, 17 MICH. ST. J. OF INT'L L. 43 (2008).

23. Gray, *supra* note 9, at 1453, 1456-57. See generally WORLD COMM'N ON DAMS, DAMS AND DEVELOPMENT: A NEW FRAMEWORK FOR DECISION-MAKING (2000), available at <http://www.dams.org>; Adell Louise Amos, *Hydropower Reform and the Impact of the Energy Policy Act of 2005 on the Klamath Basin: Renewed Optimism or Same Old Song?*, 22 J. ENVTL. L. & LITIG. 1 (2007); Brian E. Gray, *Hetch Hetchy and the Paradoxes of Restoration*, 13 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 211 (2007); Nathan Matthews, Essay, *Renwatering the San Joaquin River: A Summary of the Friant Dam Litigation*, 34 ECOLOGY L.Q. 1109 (2007); Daniel McCool, *Rivers of the Homeland: River Restoration on Indian Reservations*, 16 CORNELL J.L. & PUB. POL'Y 539 (2007); Glen Spain, *Dams, Water Reforms, and Endangered Species in the Klamath Basin*, 22 J. ENVTL. L. & LITIG. 49 (2007).

24. See generally DONALD WORSTER, RIVERS OF EMPIRE: WATER, ARIDITY, AND THE GROWTH OF THE AMERICAN WEST (1985); 1 WATERS AND WATER RIGHTS, § 8.01 (Amy K. Kelly ed., 2007) [hereinafter WATERS 1]; Bernhard Grossfeld, *Geography and Law*, 82 MICH. L. REV. 1510 (1983); Hobbs, *supra* note 17.

25. See generally WATERS 1, *supra* note 24, § 6.01(b).

people considered water to be scarce, or at least misplaced. Therefore, the right to use water in the West was treated as a species of private property under a body of law now known as appropriative rights.²⁶ Finally, in the second half of the twentieth century, water users in the eastern United States began to experience recurring and intensifying shortages.²⁷ This led about half of the states that had hitherto applied riparian rights to develop a third model, regulated riparianism, which is predicated on treating water as public property.²⁸ Each model must be separately analyzed to determine whether, in its present form, it allows for appropriate responses to the effects of global climate disruption, and, if not, what reforms might be needed to allow for such appropriate responses.

The California Supreme Court, in the case of *Keys v. Romley*,²⁹ provided an insightful analysis of different types of property relating not to the use of water, but to the drainage of diffused surface water. The analysis, however, helps clarify the foregoing three approaches of the right to use water. The defendant in *Keys* built an ice rink and paved the surrounding land as a parking lot. These and related changes produced an increased erosion of the plaintiff's downhill property.³⁰ Justice Stanley Mosk, writing for a unanimous court, quickly reviewed and dismissed the "common enemy rule" of surface drainage,³¹ focusing instead on choosing between the "natural servitude"³² and the "reasonable use" rules.³³ Mosk described the natural servitude rule as a rule of property, and the reasonable use rule as a rule of tort, apparently in

26. See generally 2 WATERS AND WATER RIGHTS chs. 11-17 (Amy K. Kelley ed., 2007) [hereinafter WATERS 2].

27. See, e.g., *The Global Water Crisis: Evaluating U.S. Strategies to Enhance Access to Safe Water and Sanitation: Briefing and Hearing before Committee on International Relations*, 109th Cong., (2005) (statement of Dan Burton, Representative from Indiana); DIANE RAINES WARD, WATER WARS: DROUGHT, FLOOD, FOLLY, AND THE POLITICS OF THIRST (2002); S.C. DEP'T OF NAT. RES., SOUTH CAROLINA WATER PLAN (2d ed. 2004), available at <http://www.dnr.state.sc.us/>; Lesley-Ann Dupigny-Giroux, *Towards Characterizing and Planning for Drought in Vermont – Part I: A Climatological Perspective*, 37 J. AM. WATER RESOURCES ASS'N 505, 517-18 (2001); Kenneth S. Gould, *An Introduction to Water Rights in the Twenty-First Century: The Challenges Move East*, 25 U. ARK. LITTLE ROCK L. REV. 3, 3 (2002); Stephen Merrett, *Catchment Water Deficits in the 21st Century*, 7 WATER POL'Y 141 (2005); Dustin S. Stephenson, *The Tri-State Compact: Falling Waters and Fading Opportunities*, 16 J. LAND USE & ENVT'L. L. 83, 84-86 (2000); Vail T. Thorne, *Water Scarcity and Its Impact on Water Rights: A Real Concern for Multinational Companies?*, 33 ENVTL. L. RPTR. 10617 (2003); *Second National Water Resources Policy Dialogue*, WATER RESOURCES IMPACT (SPECIAL ISSUE), Jan. 2005; *Water as a Growth Tool*, WATER RESOURCES IMPACT, Nov. 2005; Symposium, *Access to Water*, 5 SUSTAINABLE DEV. L. & POL'Y 1 (2005); Tom Avril & Edward Colimore, *The Drought and How We Got There: Lack of Rain a Factor; So Is Poor Planning*, PHILA. INQUIRER, Apr. 14, 2002, at A1; Douglas Jehl, *Atlanta's Growing Thirst Creates Water War*, N.Y. TIMES, May 27, 2002, at A1.

28. See generally WATERS 1, *supra* note 24, ch. 9.

29. 412 P.2d 529 (Cal. 1966). See generally WATERS 2, *supra* note 26, § 10.03-10.03(c).

30. *Keys*, 412 P.2d at 530-31.

31. Sometimes called the "common law rule." *Id.* at 531-32.

32. Also known as the "natural flow" rule, or the "civil law" rule. *Id.* at 532-33.

33. *Id.* at 533-34.

order to reconcile the two irreconcilable doctrines.³⁴ He declined to choose between the two rules, reaffirming the natural servitude rule while recognizing a duty of landowners not to interfere unreasonably with the property of others.³⁵

Justice Mosk's observations about property and tort were perhaps more insightful than he recognized.³⁶ Mosk apparently had in mind the sort of property concept that we usually associate with the fee simple absolute. A system that attempts to define rights or duties towards water in clear and certain terms, with the law protecting these entitlements from change except through market transactions, would indeed be a private property system of water management.³⁷ The closest we come to such an arrangement in American water law is the system of appropriative rights.

A rule that allows anyone with lawful access to use a common pool resource as long as the use is reasonable is, as Justice Mosk acknowledged, hardly a rule of property at all, at least not in the ordinary sense.³⁸ Such a rule leaves courts to sort out conflicting claims of right to the common resource solely by evaluating the relative reasonableness of the use, a rule that is much more like a tort rule than a property rule.³⁹ It actually is a rule of common property rather than a rule of private property, similar to tenants in common using or disputing the use of the jointly held land.⁴⁰ The law of riparian rights, as it has evolved in the last century, is a prime example of such a legal regime in the United States.

Justice Mosk did not consider the possibility of active public management of surface drainage. That possibility, not at issue in *Keys*, is common in urban areas, including in California. When surface drainage is a public responsibility private parties are required to "hook into" the public system and to conform to the public system's decisions.⁴¹ The newest system of American law applied

34. *Id.* at 535-36.

35. *Id.* at 536-38.

36. *Cf.* Eric T. Freyfogle, *Water Justice*, 1986 U. ILL. L. REV. 481, 499-508 (1986) (describing what he terms "the shift from water rights to water wrongs" in the adjudication of water disputes).

37. *See generally* Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089 (1972).

38. *Keys*, 412 P.2d at 535-36. *See also* State v. Superior Court, 93 Cal. Rptr. 2d 276, 282 (Cal. Ct. App. 2000) (the state's "ownership" of unappropriated groundwater is ownership in a regulatory sense, not in a proprietary sense).

39. Note in this regard the American Law Institute's placement of the law of riparian rights in the *Restatement of Torts* rather than in the *Restatement of Property*. RESTATEMENT (SECOND) OF TORTS §§ 841-864 (1977) [hereinafter RESTATEMENT (SECOND)]; RESTATEMENT OF TORTS §§ 841-864 (1939) [hereinafter RESTATEMENT].

40. *Cf.* England v. Ally Ong Hing, 459 P.2d 498 (Ariz. 1969); McDonnold v. Weinacht, 465 S.W.2d 136 (Tex. 1971).

41. *See, e.g.*, Mehl v. People *ex rel.* Dep't of Pub. Works 532 P.2d 489 (Cal. 1975). *See also* Iowa Nat. Res. Council v. Van Zee, 158 N.W.2d 111 (Iowa 1968); Simon v. Neises, 395 P.2d 308 (Kan. 1964); Reeder v. Bd. of County Comm'rs, 392 P.2d 888 (Kan. 1964); Anntco Corp. v. Shrewsbury Bank & Trust Co., 230 N.E.2d 795 (Mass. 1967); Schmidt v. Eger, 289 N.W.2d 851, 856-57 (Mich. Ct. App. 1980); Borough of Ambler v. Shepherd, 278 A.2d 886 (Pa. 1971). *See generally* WATERS 2, *supra* note 26, § 10.03(b)(5).

to the allocation of surface water, which in this volume is termed “regulated riparianism,” corresponds to a public ownership model.

The correspondence between modern forms of American water law and the several types of property is more than a simple curiosity. In light of the work done in recent decades on the theory of property,⁴² the correspondence of forms of water law to theoretical models enables us to predict with some certainty whether existing forms are adaptable to changing circumstances, or whether an entirely new form must be substituted when water demand or supply changes dramatically.⁴³ Before turning in detail to these models of property in water, we begin by exploring the unusual characteristics of water that make simple application of any model of property problematic. This discussion is followed by analyses of riparian rights, appropriative rights, and regulated riparianism regarding their suitability in a world undergoing climate disruption.

II. WATER’S SPECIAL CHARACTERISTICS

Water’s physical characteristics make recourse to property rules problematic. Tom Robbins captured the peculiar properties of water in a prose poem that opens his best-known novel:

Water—the ace of elements. Water dives from the clouds without parachute, wings or safety net. Water runs over the steepest precipice and blinks not a lash. Water is buried and rises again; water walks on fire and fire gets the blisters. Stylishly composed in any situation—solid, gas or liquid—speaking in penetrating dialects understood by all things—animal, vegetable or mineral—water travels intrepidly through four dimensions, *sustaining* (Kick a lettuce in the field and it will yell “Water!”), *destroying* (The Dutch boy’s finger remembered the view from Ararat) and *creating* (It has even been said that human beings were invented by water as a device for transporting itself from one place to another, but that’s another story). Always in motion, ever-flowing (whether at steam rate or glacier speed), rhythmic, dynamic, ubiquitous, changing and working its changes, a mathematics turned wrong side out, a philosophy in reverse, the ongoing odyssey of water is virtually irresistible.⁴⁴

42. Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347 (1967). See generally JAMES W. ELY, JR., PROPERTY RIGHTS IN AMERICAN HISTORY (1997); CAROL M. ROSE, PROPERTY AND PERSUASION: ESSAYS ON THE HISTORY, THEORY, AND RHETORIC OF OWNERSHIP (1994); STEPHEN R. MUNZER, A THEORY OF PROPERTY (1990); J.W. Harris, *Private and Non-Private Property: What Is the Difference?*, 111 LAW Q. REV. 421 (1995); Alan Randall, *Property Rights and Social Microeconomics*, 15 NAT. RESOURCES J. 729 (1975); Jeanne L. Schroeder, *Chix Nix Bundle-O-Stix: A Feminist Critique of the Disaggregation of Property*, 93 MICH. L. REV. 239 (1994).

43. See Robert H. Abrams, *Charting the Course of Riparianism: An Instrumentalist Theory of Change*, 35 WAYNE L. REV. 1381, 1381-84 (1989).

44. TOM ROBBINS, EVEN COWGIRLS GET THE BLUES 1-2 (1976).

The following discussion of the characteristics of water may strike some as belaboring the obvious, as these characteristics may seem self-evident,⁴⁵ yet they must be discussed expressly because all too often legal regimes applicable to water simply ignore them. Foremost of these characteristics is water's critical importance to human life and thriving. Water is more essential to life itself than anything other than breathable air; a person can go longer without food than without water as many a hunger-striker has demonstrated. To make the point, I often quote a Turkish businessman who commented, with some exaggeration, "Countless millions of people have lived without love, but none without water."⁴⁶ As vital as water is for human needs, it also serves innumerable other purposes, all of which makes denying it for particular uses, at least for survival needs, impossible to sustain under law. This point is made most clearly in Islamic law, which recognizes a right to quench one's thirst—one which must be honored by the owner of land on or under which water is found so long as the owner's own immediate needs have been met.⁴⁷

Nearly as central as water's importance is its ubiquity—water is found nearly everywhere and in nearly everything. Water is a nearly universal solvent, a characteristic that makes it extremely useful, but which also means that water is extraordinarily heterogeneous. Water is not only one of the few substances that appears in all three forms (as a gas, a liquid, and a solid) in nature, but it also is never found in nature without contaminants. That is why water tastes differently in different locations; pure water is a manufactured product. Yet water is stable enough to be used and reused repeatedly, even after many other uses and apparent transformations. Water, moreover, is in constant motion, moving through a continual cycle that eventually returns it to each place and form where it is now found. Thus, water is endlessly renewable, and it is used repeatedly as it moves through its cycle. As long as thirty years ago, water users were withdrawing from the Schuylkill River about seven times as much water as there was water in the river.⁴⁸ These patterns have only become more pronounced with the passage of time. Yet, because at any given moment in any given place water is finite, it can be exhausted or polluted to the point of being rendered unusable.

45. They are discussed at some length, but in a very readable fashion, in FRED POWLEDGE, *WATER: THE NATURE, USES, AND FUTURE OF OUR MOST PRECIOUS AND ABUSED RESOURCE* 12-39 (1982).

46. Amikam Nachmani, *The Politics of Water in the Middle East: The Current Situation, Imaginary and Practical Solutions*, in *WATER AS AN ELEMENT OF COOPERATION AND DEVELOPMENT IN THE MIDDLE EAST* 301, 302 (Ali İhsan Bağis ed., 1994).

47. MUHAMMAD IBN ISMA'IL AL BUKHARI [EL BOKHĀRĪ], 2 *LES TRADITIONS ISLAMIQUES* 104, 108 (O. Oudas & W. Marçais trans. & eds., 1906 ed.). See also YAHYA BEN ADAM, *KITAB AL-KHARAJ* 72 (A. Ben Shemesh ed., 1967); A.M.A. MAKTARI, *WATER RIGHTS AND IRRIGATION PRACTICES IN LAHJ* 17-18, 21-23, 43-44 (1971); Habib Attia, *Water-Sharing Rights in the Jerid Oases of Tunisia*, in *PROPERTY, SOCIAL STRUCTURE AND LAW IN THE MODERN MIDDLE EAST* 85, 85 (Ann Elizabeth Mayer ed., 1985); John C. Wilkinson, *Muslim Land and Water Law*, 1 *J. ISLAMIC STUD.* 54, 60 (1990).

48. R. Timothy Weston & Joseph R. Gray, *Legal Control of Consumptive Water Use in Pennsylvania Power Plants*, 80 *DICK. L. REV.* 353, 356 (1975). The Schuylkill River is located in southeastern Pennsylvania, flowing into the Delaware River within the city of Philadelphia.

Water, in short, is a common pool resource, one that inevitably passes into and out of one's control; in this sense, water cannot be owned. Partly because of water's ambulatory nature, water has also been treated as a free good. Users seldom pay for water when they remove it from a natural source, and even public delivery systems seldom charge for the water as opposed to the services of extracting, purifying, delivering, and carrying away water after its use.⁴⁹ In other words, at least until human population densities become high relative to the water available, water is usually free for the taking. Water, therefore, has long been considered to be the quintessential "public good."⁵⁰ A growing number of economists, however, have argued that it is not a public good,⁵¹ if only because water can be owned in a fairly normal way in small quantities ("This bottle of water is mine."), but also because they can create elaborate market models that at least, in theory, function effectively.⁵² What a public good is and what significance that determination has for water as property thus requires careful consideration.

"Public goods," as distinguished from private goods, share two qualities: indivisibility and publicness.⁵³ Because public goods are indivisible, or "non-excludable," as contemporary economists prefer to term it, one cannot simply divide the goods or buy as much as one wants. Because the goods are public, or subject to "open access," as contemporary economists prefer to term it, one cannot keep others from accessing and enjoying the goods as long as anyone can access and enjoy them. A public good, therefore, is one that all within the relevant public must enjoy more or less equally or no one can enjoy it at all. If water is a public good, then water, like other public goods generally, must be a free good as far as markets are concerned because consumers cannot realistically be excluded from enjoying the good.⁵⁴ What is perhaps an even clearer example of a public good is the blue sky over one's head. How much

49. PETER H. GLEICK ET AL., *THE NEW ECONOMY OF WATER: THE RISKS AND BENEFITS OF GLOBALIZATION AND PRIVATIZATION OF FRESH WATER* 29-39 (2002).

50. See WATERS 1, *supra* note 24, § 6.01(b); John S. Harbison, *Waist Deep in the Big Muddy: Property Rights, Public Values, and Instream Waters*, 26 LAND & WATER L. REV. 535, 546-49 (1991); Douglas R. Williams, *Valuing Natural Environments: Compensation, Market Norms, and the Idea of Public Goods*, 27 CONN. L. REV. 365, 367 (1995). See generally GLOBAL PUBLIC GOODS: INTERNATIONAL COOPERATION IN THE 21ST CENTURY (Inge Kaul, Isabelle Grunberg & Marc A. Stern eds., 1999); MANCUR OLSON, JR., *THE LOGIC OF COLLECTIVE ACTION: PUBLIC GOODS AND THE THEORY OF GROUPS* (1965).

51. See, e.g., ANDERSON & SNYDER, *supra* note 20, at 112-14; Harbison, *supra* note 50, at 546-47.

52. For an example of how complex the creation of such models can be, see RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* § 3.2 (7th ed. 2007).

53. JOHN RAWLS, *A THEORY OF JUSTICE* 265-74 (1971). See also Brigham Daniels, *Emerging Commons and Tragic Institutions*, 37 ENVTL. L. 515, 523-24 (2007) (defining a "commons" as a resource where one person's consumption diminishes the amount of the resource available to others, yet it is difficult to exclude others from access to the resource). See generally ANDERSON & SNYDER, *supra* note 20, at 112-13; GLOBAL PUBLIC GOODS, *supra* note 50; Niva Elkin-Koren & Eli M. Salzberger, *Law and Economics in Cyberspace*, 19 INT'L REV. L. & ECON. 553, 559-61 (1999); Harbison, *supra* note 50, at 547.

54. See generally PUBLIC GOODS AND MARKET FAILURES: A CRITICAL EXAMINATION (Tyler Cowen ed., 1992).

can one charge others for viewing that blue sky? This question suggests an important problem: if you invest in improving the blueness of the sky, others who invest or pay nothing will enjoy the benefits of your investment.⁵⁵ You cannot exclude them from enjoying the good. The result will be “free riders”—those who enjoy the fruits of investment in public goods without sharing the costs. Free riders can seriously inhibit investment unless the government (or some other institution) is able to assure that all (or nearly all) pay for the benefits they receive.⁵⁶ The market simply won’t work; regulation will.

As Nobel Prize-winning economist Ronald Coase demonstrated in *The Problem of Social Cost*⁵⁷ a private-property market system is the most efficient mechanism for allocating resources to particular uses when it works, but the system fails if there are significant barriers to the functioning of a market. Water, in some settings, is a private good. We have all bought bottled water. This does not dispose of the question of whether bulk water—water in its natural condition—is a public good. Few things in this world are strictly indivisible and public. While water is not indivisible and public in the strictest sense (unlike a blue sky), even economists who embrace the extreme of market fundamentalism use water metaphors when discussing what even they concede are public goods: “common pool resource,” “spill-over effects,” and so on.

Some economists prefer to consider water to be a “common good” rather than a “public good.”⁵⁸ Common goods differ from public goods in that, while the goods are shared among a group of common owners, the goods can be exhausted and not everyone in the universe has equal access to the goods. In other words, public goods are “non-rivalrous,” but common goods are “rivalrous.” Because of these features, the consumption of common goods by one person reduces other persons’ ability to consume the same good. Common goods exhibit some measure of subtractability and excludability—qualities that, economists tell us, do not apply to true public goods.⁵⁹ Nevertheless, it is possible for many consumers to benefit jointly from the resource as long as there are means for excluding others from using the resource.

If we take the idea of common goods seriously, there are very few true public goods. Even a lighthouse, often presented as the paradigm of a true public good, is not used by everyone in the world, but only by those on ships

55. See, e.g., Mehmet Bac, *Incomplete Information and Incentives to Free Ride on International Environmental Resources*, 30 J. ENVTL. ECON. & MGMT. 301 (1996); Ramzi Suleiman, *Provision of Step-Level Public Goods Under Uncertainty: A Theoretical Analysis*, 9 RATIONALITY & SOC’Y 163 (1997). See generally Michael A. Heller, *The Boundaries of Private Property*, 108 YALE L.J. 1163 (1999).

56. See Bac, *supra* note 55; Suleiman, *supra* note 55.

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

58. See generally COMMON PROPERTY RESOURCES: ECOLOGY AND COMMUNITY-BASED SUSTAINABLE DEVELOPMENT (Fikret Berkes ed., 1989); ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION (1990); Martin S. Weinstein, *Pieces of the Puzzle: Solutions for Community-Based Fisheries Management from Native Canadians, Japanese Cooperatives, and Common Property Researchers*, 12 GEO. INT’L ENVTL. L. REV. 375 (2000).

59. Richard Moorehead, *Changes Taking Place in Common-Property Resource Management in the Inland Niger Delta of Mali*, in COMMON PROPERTY RESOURCES, *supra* note 58, ch. 15.

coming within range of its light.⁶⁰ Perhaps only the blue sky qualifies as a true public good. In fact, common goods are just public goods for which there is a limited group of co-owners and the level of demand has approached or exceeded the available supply. From a legal point of view, the most central managerial problem regarding public goods is precisely the most central managerial problem for common goods: how can we recover the cost of maintaining or enhancing the good when a significantly large group of people have access to it and the legal right to the use it without direct charge for their use. This leads directly into the “tragedy of the commons.”⁶¹

The peculiar characteristics of water—its critical importance, its ubiquity, its heterogeneity, its renewability, its commonality, and its vulnerability—combine to make markets unworkable for bulk water—water in its natural state. A person (natural or corporate) can own bottles of water, but not a river or an aquifer, nor, given the reality of transaction costs that arise from attempts to market a share of a river or an aquifer, can one readily market a right to use a portion of a river or an aquifer. I have written elsewhere in detail on why markets fail for water and will not reiterate that analysis here.⁶² Here, I will only address the legal forms that govern the allocation of water without regard to the possibility of markets.

What determines whether institutional arrangements (property relations in this case) serve to achieve the optimum use of a resource is how society accords to particular individuals, or to collectivities, the power to determine how a resource is used. This depends not just on the qualities of the goods themselves, but on the social relations created or confirmed by law regarding rights to use the good: is the good subject to individual decisions by everyone with legal access to the goods (common property), or to individual decisions by persons with sole legal access to the goods (private property), or to collective decisions by all interested persons acting through a joint management mechanism (public property)?⁶³ Each form of water has been applied by one or another state of the United States: riparian rights (common property); appropriative rights (private property); and regulated riparianism (public property).

III. RIPARIAN RIGHTS

“Riparian rights” take their name from the Latin word *ripa*, meaning “a river bank.”⁶⁴ Today, the term “riparian rights” also extends to lakes and other

60. R.H. Coase, *The Lighthouse in Economics*, 17 J.L. & ECON. 357, 359 (1974).

61. Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243, 1244 (1968).

62. See Joseph W. Dellapenna, *The Importance of Getting Names Right: The Myth of Markets for Water*, 25 WM. & MARY ENVTL. L. & POLY REV. 317 (2000) [hereinafter Dellapenna, *Myths*]; Dellapenna, *Disruption*, *supra* note 21.

63. See *supra* notes 24-43 and accompanying text.

64. *Johnson v. McCowen*, 348 So. 2d 357, 360 n.3 (Fla. Dist. Ct. App. 1977).

water bodies, although historically rights pertaining to lakes and other large bodies of water were called “littoral rights” (from the Latin word *litus*, meaning “shore”).⁶⁵ Land abutting or underlying a body of water is termed “riparian land.”⁶⁶ The doctrine of riparian rights provides a rule for the allocation of water to particular uses.⁶⁷ As the name suggests, riparian rights are based on the premise that the right to use water is a natural attribute of land, dependent on the natural availability of water to the land.⁶⁸ Today, states applying riparian rights do not rely solely on “pure” riparian rights.⁶⁹ Still, about half of the states east of Kansas continue to apply traditional riparian rights to disputes relating to the allocation of water among users and not any other body of law within the state. What are the characteristics of this body of law and how adaptable is it to the challenges being posed by global climate disruption?

Many scholars assert that at one time the doctrine of riparian rights required the protection of the “natural flow” of a watercourse, under which only domestic uses of water (use of water to meet immediate survival needs) were allowed to alter materially a water source in quantity or quality.⁷⁰ In fact, there is very little evidence that courts ever enforced the “natural flow rule.”⁷¹ Instead, courts early on embraced the “reasonable use rule,” under which a riparian landowner is entitled to make any use the landowner chooses so long as each user does not transgress the equal right of other riparian landowners to use the water.⁷² Thus, although “natural flow” language continues to appear in

65. *Id.* at 360 n.4. See, e.g., *Stefanoni v. Duncan*, 923 A.2d 737, 744-47 (Conn. 2007); *Brannon v. Boldt*, 958 So. 2d 367, 372-74 (Fla. Dist. Ct. App. 2007); *In re Sanders Beach*, 147 P.3d 75, 83-86 (Idaho 2006); *Alderson v. Fatlan*, 867 N.E.2d 1081, 1082 (Ill. App. Ct. 2007); *Glass v. Goeckel*, 703 N.W.2d 58, 61, n.1 (Mich. 2005); *Bayview Land, Ltd. v. State ex rel. Clark*, 950 So. 2d 966, 988 (Miss. 2006); *City of New York v. Mazzella*, 858 N.Y.S.2d 114, 117 (N.Y. App. Div. 2008); *TH Inv., Inc. v. Kirby Inland Marine, L.P.*, 218 S.W.3d 173, 184-86, 196, 199 (Tex. App. 2007).

66. For an analysis of what constitutes riparian land, see WATERS 1, *supra* note 24, § 7.02(a)–7.02(a)(2).

67. See WATERS 1, *supra* note 24.

68. See *Tyler v. Wilkinson*, 24 F. Cas. 472, 474 (C.C.D.R.I. 1827) (No. 14,312) (“The natural stream, existing by the bounty of Providence for the benefit of the land through which it flows, is an incident annexed, by operation of law, to the land itself”). Justice Story’s opinion in *Tyler* is often cited as the first true riparian rights case. For a modern expression of the view that riparian rights are a natural attribute of the land abutting a watercourse, see *Niagara Mohawk Power Corp. v. Cutler*, 492 N.Y.S.2d 137, 139-40 (N.Y. App. Div. 1985), *aff’d mem.*, 492 N.E.2d 398 (N.Y. 1986).

69. WATERS 1, *supra* note 24, §§ 9.01-9.02(d).

70. See, e.g., Bradford Bowman, *Instream Flow Regulation: Plugging the Holes in Maine’s Water Law*, 54 ME. L. REV. 287, 296-97 (2002); D.S. Pensley, *The Legalities of Stream Interventions: Accretive Changes to New York State’s Riparian Doctrine Ahead?*, 25 PACE ENVTL. L. REV. 105, 113-14 (2008); Anthony Scott & Georgina Coustalin, *The Evolution of Water Rights*, 35 NAT. RESOURCES J. 821, 836-50, 860-63 (1995). For domestic uses, see WATERS 1, *supra* note 24, § 7.02(b)(1).

71. WATERS 1, *supra* note 24, § 7.02(c). The few cases in which courts upheld a suit for the violation of the complainant’s riparian rights from the mere decrease of the natural flow without proof of unreasonable injury appear to be as follows: *Hendrick v. Cook*, 4 Ga. 241, 245 (Ga. 1827); *Clinton v. Myers*, 46 N.Y.S. 511, 520 (N.Y. 1871); *Markleton Hotel Co. v. Connellsville & S.L. Ry. Co.*, 89 A. 703, 704 (Pa. 1914); *Pastorius v. Fisher*, 1 Rawle 27, 27 (Pa. 1828).

72. Both points trace back to Justice Story’s opinion in *Tyler*, 24 F. Cas. at 474. That opinion includes several references to the “perfect equality” of the rights of each riparian while mentioning both a right to the natural flow and a right to make a reasonable use.

cases invoking riparian rights today, the courts always end up applying the reasonable use theory, although often in a way that can only be termed confusing.⁷³

The very first case, in either England or the United States, to discuss the allocation of water in terms of modern riparian rights doctrine was *Merritt v. Parker*.⁷⁴ A dispute between the owners of competing water mills, the case explained the law in terms that fairly raise the natural flow theory, the reasonable use theory, prescriptive rights, and appropriative rights:

It is unreasonable, and the doctrine cannot be countenanced, that when one has erected a dam, and at a considerable expense has appropriated water to his own use, another person by cutting a canal shall be permitted to diminish his supply, and avail himself of the labour and work of the original owner, without defraying any portion of the expense that had been incurred, or undertaking to assist in keeping these works in repair. It would be equally unreasonable that one man should have a right to turn more water over the land of his neighbour than would naturally go in that direction; and so far as regards the right, it is altogether immaterial whether it may be productive of benefit or injury. No one has a right to compel another to have his property improved in a particular manner; it is as illegal to force him to receive a benefit as to submit to an injury.⁷⁵

In one of the few modern cases that could be cited for this proposition, *Dimmock v. City of New London*,⁷⁶ the court found a violation of riparian rights from the mere diminution of the level of water in a pond, but the court also denied an injunction on the basis of a balancing of the equities.⁷⁷ The court even suggested that only nominal damages would be recoverable.⁷⁸ Complicating the interpretation of this precedent is the fact that the wrongdoing water user (the city of New London) was not exercising riparian rights because it was exporting the water out of the watershed of origin.⁷⁹ Today, it is clearly established that under riparian rights, apart from a preference for domestic uses, the only real restriction is that a use is not lawful if it “unreasonably harms” another’s riparian use.⁸⁰

73. See, e.g., *Mich. Citizens for Water Conserv. v. Nestlé Waters N. Am., Inc.*, 709 N.W.2d 174, 194-95 (Mich. Ct. App. 2005), *rev'd on other grounds*, 737 N.W.2d 447 (Mich. 2007); *Kinross Copper Corp. v. State*, 981 P.2d 833, 837-38 (Or. Ct. App. 1999), *aff'd on reh'g*, 988 P.2d 400 (Or. Ct. App. 1999).

74. 1 N.J.L. 460 (N.J. 1795).

75. *Id.* at 465-66.

76. 245 A.2d 569 (Conn. 1968).

77. *Id.* at 573-74.

78. *Id.* at 573.

79. *Id.* at 570-72.

80. See WATERS 1, *supra* note 24, §§ 7.02(b)(1), 7.03. For early cases to this effect, see *Cooper v. Hall*, 5 Ohio 320, 323 (Ohio 1832); *Parker v. Griswold*, 17 Conn. 288, 296 (Conn. 1845); *Mason v. Hoyle*, 14 A. 786, 788-89 (Conn. 1888); *Heath v. Williams*, 25 Me. 209 (Me. 1845); *Pratt v. Lamson*, 84 Mass. (2 Allen) 275 (Mass. 1861); *Hayes v. Waldron*, 44 N.H. 580, 582 (N.H. 1863); *Red River Roller Mills v. Wright*, 15 N.W. 167, 168 (Minn. 1883); *Farrell v.*

Thus, the reasonable use rule is a common property system, under which all who own land contiguous to a surface water body are co-owners of the right to use the water.⁸¹ As co-owners, they are left pretty much to their own individual judgment to decide whether, when, and how to use the resource.⁸² A court will intervene in the riparian owners' decisions only when a use by one co-owner interferes directly with a use by another co-owner.⁸³ The case of *Harris v. Brooks*⁸⁴ is illustrative.

Harris involved a dispute that arose between a commercial boat rental service, operated on land leased on the shore of a small lake, and a rice farmer, who drew water for his fields from the same lake, when a severe drought made it impossible to satisfy both needs.⁸⁵ The Arkansas Supreme Court applied the reasonable use theory with the goal of ensuring the equal rights of each riparian "as near as may be" while maximizing the social benefit of the use of the water and minimizing the harm to the others.⁸⁶ This is not simply a question of stopping one water user from interfering with or harming another water user, for in a case like this, each use necessarily interferes with the other, and whichever prevails necessarily destroys the other.⁸⁷ The court adopted the rule of the first *Restatement of Torts*:

The determination in a particular case of the unreasonableness of a particular use . . . should not be an unreasoned, intuitive conclusion on the part of the court or jury. It is . . . an evaluating of the conflicting interests of each . . . contestant[] before the court in accordance with the standards of society, and a weighing of those, one against the other. . . . [I]t is only when one riparian[s] . . . use of the water is unreasonable that another who is harmed by it can complain, even though the harm is intentional. Substantial intentional harm to another cannot be justified as reasonable unless the legal merit or utility of the activity [that] produces it outweighs the legal seriousness or gravity of the harm.⁸⁸

This relational test involves a weighing of the social value of competing uses against each other to determine which is more socially valuable.⁸⁹ In

Richards, 30 N.J. Eq. 511, 515 (N.J. Ch. 1879); *Palmer v. Mulligan*, 3 Cai. 308 (N.Y. Sup. Ct. 1805); *Howell v. McCoy*, 3 Rawle 256, 269 (Pa. 1832); *Richmond Mfg. Co. v. Atl. De Laine Co.*, 10 R.I. 106, 111 (R.I. 1871).

81. See WATERS 1, *supra* note 24, § 7.02-7.02(b).

82. *Id.*, § 7.02(d)-7.02(d)(3).

83. *Id.*, § 7.03-7.03(e).

84. 283 S.W.2d 129 (Ark. 1955).

85. *Id.* at 130-31.

86. *Id.* at 133. See generally RESTATEMENT (SECOND), § 850 cmt. d.

87. See Coase, *supra* note 57, at 3-15 (particularly at 12-13). William Rodgers has sought to make light of Coase's insight by referring to a chicken farmer competing with a nearby fox rancher. See 1 WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW: AIR AND WATER § 1.1B at 6 (1986) ("Causation-neutrality that attributes the spillover damage in equal parts to the hunger of foxes and the tastiness of chickens is a hard sell among people who can tell the difference between aggressor and victim"). In a dispute between a rice farm and a boat livery, there is little of the intuitive sense that one use is in the right that is so appealing in the fox/chicken example; and if one philosophically favors the "natural outcome," does this make one unsympathetic to foxes?

88. *Harris*, 283 S.W.2d at 135 (quoting RESTATEMENT, § 852 cmt. c).

89. See generally WATERS 1, *supra* note 24, § 7.02(d)(2).

Harris, the court enjoined Brooks' (the rice farmer's) pumping whenever the level of the lake fell below 189.67 feet above sea level—the "normal level" of the lake. The court insisted that it chose that level because Brooks' pumping unreasonably interfered with the plaintiff's use of the lake, not because it was "normal."⁹⁰ The court, however, only discussed how to balance uses against each other in vague terms. Such balancing requires a polycentric process that strains the capacity of courts to act according to the traditional model of a disinterested umpire rather than an actively involved manager.⁹¹

In addition to not simply protecting normal levels or natural flows under reasonable use theory, courts also do not necessarily protect the use that began first.⁹² Frank Trelease, the Associate Reporter of the Restatement (Second) of Torts for riparian rights, argued that the court in *Harris* in fact was protecting the use that began first.⁹³ He ignored that the defendant, however, had been irrigating rice for more than twenty years while the year of the suit was the first year that the plaintiff operated the boat livery.⁹⁴ Temporal priority has seldom, if ever, been relevant to the resolution of riparian rights cases.⁹⁵

If the key to cases like *Harris* is the economic value of the competing activities, the court will have to reconsider the result whenever product values change significantly. If the market values of the two products change, or if the rice farmer were to acquire more land and therefore could produce more rice by pumping even more water, the court would have to reevaluate the reasonableness of the competing uses. On the other hand, courts give only minimal, if any, attention to such non-economic questions as the natural characteristics of the stream, general social concerns, or abstract justice.⁹⁶ If these or other variables accounted for the conclusion that the boat livery was a more reasonable use than irrigating rice, then a change in those circumstances would also necessitate reconsideration of the reasonableness of the competing uses. The Arkansas Supreme Court set forth a specific lake level at which the rice farmer was to stop pumping precisely in order to avoid frequent re-

90. *Harris*, 283 S.W.2d at 135-36. On very similar facts, the Arkansas Supreme Court reached the opposite conclusion when the boating and fishing were for personal, rather than for commercial, recreation. *Nilsson v. Latimer*, 664 S.W.2d 447 (Ark. 1984).

91. Lon L. Fuller, Harvard Law School, Address at the Fifty-Fourth Annual Meeting of the American Society of International Law: Adjudication and the Rule of Law (Apr. 28, 1960).

92. WATERS 1, *supra* note 24, § 7.03(d).

93. RESTATEMENT (SECOND), § 850A app. at 31.

94. *Harris*, 283 S.W.2d at 130-31.

95. WATERS 1, *supra* note 24, § 7.03(d). Trelease was uncomfortable with his temporal analysis. In the illustration that he based on *Harris*, he suggested that the court ought to have conditioned the injunction on the plaintiffs reimbursing Brooks for half the value of his lost rice crop. RESTATEMENT (SECOND), § 850A illus. 9. He did not explain why the plaintiffs should pay only half of, instead of all of, the defendant's losses.

96. These principles figure prominently in the *Restatement* even if they do not figure prominently in the cases. RESTATEMENT (SECOND), § 850A. *See generally* WATERS 1, *supra* note 24, § 7.02(d)(3).

litigation of reasonableness.⁹⁷ Nonetheless, the court would have to reconsider its judgment for any truly significant change in the relevant facts.⁹⁸

Courts applying the reasonable use rule sometimes try to avoid such problems by ordering *pro rata* sharing among competing users when there is a shortage.⁹⁹ Sharing cannot be done when a *pro rata* share is too small to be of any use or, as *Harris* demonstrates, for widely differing uses. In *Harris*, the rice farmer would have to stop pumping during a serious drought, forcing the farmer not to plant rice. The farmer did not suffer a loss in the actual case because the trial court ruled in his favor,¹⁰⁰ and it took two years for the case to reach the state's highest court. By then, the drought had ended. In the future, however, the farmer would have to plant a less water-intensive crop or gamble on persuading a trial judge that the circumstances had changed in his favor, followed by another two years of litigation before a final decision by the highest court. If, however, the trial judge ruled against him and enjoined his pumping pending appeal, his crop would be a total loss.

Riparian rights thus have serious problems as a mechanism for addressing water shortages, and thus for addressing the most serious disruptions relating to fresh water that arise because of global climate disruption.¹⁰¹ The problems include the vagueness, instability, and unpredictability of the criteria of decision in any dispute over water,¹⁰² the lack of a process for managing water during extreme shortages or for protecting public values,¹⁰³ and a systematic bias in favor of large users.¹⁰⁴ The analysis of *Harris* illustrates the vagueness, instability, and even unpredictability inherent in the reasonable use theory. The only firm rule under riparian rights is that any use on non-riparian land is *per se* unreasonable.¹⁰⁵ These problems alone were thought sufficient to justify the shift from riparian rights to appropriative rights in western states, and the shift to regulated riparianism in eastern states.¹⁰⁶

There is, moreover, no mechanism for judicially determining and reviewing the rights of all users on a particular watercourse. Even if one could conveniently join all water right holders with claims against a particular water source, courts seem particularly ill-equipped to consider the unrepresented

97. *Harris*, 283 S.W.2d at 136.

98. Forty-five years later, the Arkansas Supreme Court avoided ruling on the need to maintain the "normal level" of Horseshoe Lake. *Taylor v. Zanone Props.*, 30 S.W.3d 74, 82 (Ark. 2000). This might not have been the same lake as in *Harris*.

99. *See, e.g.*, *N. Gualala Water Co. v. State Water Res. Control Bd.*, 43 Cal. Rptr. 3d 821, 833 n.11 (Cal. Ct. App. 2006). *See generally* WATERS 1, *supra* note 24, § 7.03(c)(1).

100. *Harris*, 283 S.W.2d at 130.

101. I leave aside the question of markets under riparian rights. *See* Dellapenna, *Disruption*, *supra* note 21; Dellapenna, *Myths*, *supra* note 62.

102. WATERS 1, *supra* note 24, §§ 7.02(d)(3)-7.03(e); J. Blanding Holman IV, *The Advent of Modern Riparianism in South Carolina*, 16 SE. ENVTL. L.J. 291, 313-15 (2008).

103. WATERS 1, *supra* note 24, § 7.05(a).

104. *Id.*, § 7.02(d)(3); Holman, *supra* note 102, at 314.

105. WATERS 1, *supra* note 24, § 7.02(d)(1).

106. *Coffin v. Left Hand Ditch Co.*, 6 Colo. 443, 446 (Colo. 1882); *Jones v. Adams*, 6 P. 442, 447 (Nev. 1885). *See also* FRANK E. MALONEY, RICHARD C. AUSNESS & J. SCOTT MORRIS, *A MODEL WATER CODE 189-91* (1972). *See generally* WATERS 1, *supra* note 24, §§ 6.01(b), 7.01, 7.01(b), 8.02(b), 9.01; James N. Corbridge, Jr., *Historical Water Use and the Protection of Vested Rights: A Challenge for Colorado Water Law*, 69 U. COLO. L. REV. 503, 529 (1998).

interests of the general public.¹⁰⁷ Even if they can be joined, small users will find themselves at a severe disadvantage because they are less able to afford litigation or to organize collectively for litigation. If small users are able to join the litigation, they will find that the balancing process generally strongly favors large users because the economic value of the water to the large user usually will outweigh the economic loss of the small user. While smaller users can effectively aggregate their claims by receiving their water through a public system, the effectiveness of this approach is limited by legal doctrines limiting the riparianness of public systems.¹⁰⁸ Moreover, aggregation requires submission to yet a different sort of large-scale enterprise.

The foregoing problems derive from the nature of riparian rights as common property. All persons owning riparian land are co-owners of the right to use the water.¹⁰⁹ Each co-owner has equal rights with every other co-owner, and thus none can dictate how the others use the water. Each is free to decide individually when, where, and how to use the water. The result of such a common property system will be what biologist Garrett Hardin famously called the “tragedy of the commons.”¹¹⁰ The tragedy arises because a common property system—a system of open access coupled with individual decision making—can only function successfully when the common pool resource is consistently available in much greater supply than the demand for the resource.

The explanation for this result is straightforward. Each common owner can decide for herself whether to increase the use of the resource regardless of the effect on other common owners (except for direct interference with the uses of the others). Each owner therefore appropriates for herself the whole of each additional increment of use, but the whole group shares equally the cost imposed on the common resource. Hardin used cows grazing on a common pasture to illustrate his point. I obtain the full benefit of each additional cow I add to the herd, but all of the common owners as a group share the burden of the reduced carrying capacity of the pasture.¹¹¹ If we each keep adding cows,

107. See Lynda L. Butler, *Defining a Water Ethic Through Comprehensive Reform: A Suggested Framework for Analysis*, 1986 U. ILL. L. REV. 439, 451-54 (1986); George D. Marlow, *From Black Robes to White Lab Coats: The Ethical Implications of a Judge's Sua Sponte, Ex Parte Acquisition of Social and Other Scientific Evidence During the Decision-Making Process*, 72 ST. JOHN'S L. REV. 291, 295-97 (1998).

108. See, e.g., *Wallace v. City of Winfield*, 149 P. 693, 695 (Kan. 1915); *Fagen v. Mayor of Wharton*, 113 A. 920, 920 (N.J. 1920); *Smith v. City of Brooklyn*, 54 N.E. 787, 788 (N.Y. 1899); *Pernell v. City of Henderson*, 16 S.E.2d 449, 451 (N.C. 1941); *Town of Purcellville v. Potts*, 19 S.E.2d 700, 702-03 (Va. 1942). See generally WATERS 1, *supra* note 24, § 7.05(c).

109. WATERS 1, *supra* note 24, § 7.02-7.02(b).

110. Hardin, *supra* note 61, at 1244.

111. For more contemporary analyses of Hardin's theory, see Ronen Avraham & K.A.D. Camara, *The Tragedy of the Human Commons*, 29 CARDOZO L. REV. 479 (2007); Jerry Brito, *The Spectrum Commons in Theory and Practice*, 2007 STAN. TECH. L. REV. 1, 4-5; James M. Buchanan & Yong J. Yoon, *Symmetric Tragedies: Commons and Anticommons*, 43 J.L. & ECON. 1 (2000); David Collins, *Efficient Allocation of Real Property Rights on the Planet Mars*, 14 B.U. J. SCI. & TECH. L. 201 (2008); Daniels, *supra* note 53; Kirsten H. Engel & Scott R. Saleska, *Subglobal Regulation of the Global Commons: The Case of Climate Change*, 32 ECOLOGY L.Q. 183 (2005); Michael Heller, *The*

which is the rational thing to do if we follow an individual cost-benefit analysis, we will continue to do so until the pasture is exhausted.¹¹²

Economists and others criticize Hardin for over simplifying how “commons” have functioned in earlier times or in remote areas. Commons have functioned successfully over extended periods even when use was close to carrying capacity through informal limits imposed by small communities sharing a commons.¹¹³ These examples are irrelevant for describing how a commons works in a larger society where most persons are strangers to each other, informal sanctions are not effective, and formal law recognizes no real limits on anyone’s exploitation of the commons.¹¹⁴ Under these circumstances, typical of states where riparian rights are applied, the tragedy of the commons will fully play itself out. This is more than a theoretical model. Common pool resources have been destroyed over and over again in the past century when the rule of common property was not displaced by a different rule.¹¹⁵ The tragedy of the commons has played itself out, precisely as Hardin

Rose Theorem?, 18 YALE J.L. & HUMAN. (SPECIAL ISSUE) 29 (2006); J.H. Huebert & Walter Block, *Space Environmentalism, Property Rights, and the Law*, 37 U. MEM. L. REV. 281 (2007); Gary D. Libecap, *Open-Access Losses and Delay in the Assignment of Property Rights*, 50 ARIZ. L. REV. 379 (2008); Thomas B. Nachbar, *The Comedy of the Market*, 30 COLUM. J.L. & ARTS 453, 454 (2006); Francesco Parisi, Norbert Schulz & Ben Depoorter, *Duality in Property: Commons and Anti-Commons*, 25 INT’L REV. L. & ECON. 578 (2005); Amy Sinden, *The Tragedy of the Commons and the Myth of a Private Property Solution*, 78 U. COLO. L. REV. 533 (2007); James M. Walker & Roy Gardner, *Probabilistic Destruction of Common-Pool Resources: Experimental Evidence*, 102 ECON. J. 1149 (1992). See generally GLENN G. STEVENSON, COMMON PROPERTY ECONOMICS: A GENERAL THEORY AND LAND USE APPLICATIONS (1991).

112. For attempts to describe optimal conditions under which a commons might function successfully in more developed economic settings, see Steven Hackett, Edella Schlager & James Walker, *The Role of Communication in Resolving Commons Dilemmas: Experimental Evidence with Heterogeneous Appropriators*, 27 J. ENVTL. ECON. & MGMT. 99 (1994); Ethan Ligon & Urvashi Narain, *Government Management of Village Commons: Comparing Two Forest Policies*, 37 J. ENVTL. ECON. & MGMT. 272 (1999); Charles F. Mason & Owen R. Phillips, *Mitigating the Tragedy of the Commons Through Cooperation: An Experimental Evaluation*, 34 J. ENVTL. ECON. & MGMT. 148 (1997); Charles F. Mason, Todd Sandler & Richard Cornes, *Expectations, the Commons, and Optimal Group Size*, 15 J. ENVTL. ECON. & MGMT. 99 (1988); Carol M. Rose, *Given-ness and Gift: Property and the Quest for Environmental Ethics*, 24 ENVTL. L. 1 (1994).

113. See, e.g., YOCHAI BENKLER, THE WEALTH OF NETWORKS: HOW SOCIAL PRODUCTION TRANSFORMS MARKETS AND FREEDOM (2006); CARL J. DAHLMAN, THE OPEN FIELD SYSTEM AND BEYOND: A PROPERTY RIGHTS ANALYSIS OF AN ECONOMIC INSTITUTION (1980); OSTROM, *supra* note 58; ELINOR OSTROM ET AL., RULES, GAMES, AND COMMON-POOL RESOURCES (1994); THE QUESTION OF THE COMMONS: THE CULTURE AND ECOLOGY OF COMMUNAL RESOURCES (Bonnie J. McCay & James M. Acheson eds., 1987); Kathrine Dixon, *Working with Mixed Commons/Anticommons Property: Mobilizing Customary Land in Papua New Guinea the Melanesian Way*, 31 HARV. ENVTL. L. REV. 219 (2007); Shubha Ghosh, *The Fable of the Commons: Exclusivity and the Construction of Intellectual Property Markets*, 40 U.C. DAVIS L. REV. 855 (2007); Gregg W. Kettles, *Formal Versus Informal Allocation of Land in a Commons: The Case of the MacArthur Park Sidewalk Vendors*, 16 S. CAL. INTERDISC. L.J. 49, 78-85 (2006); Kirsten Westerland, Note, *Nepal’s Community Forestry Program: Another Example of the Tragedy of the Commons or a Realistic Means of Balancing Indigenous Needs with Forestry Conservation?*, 18 COLO. J. INT’L ENVTL. L. & POL’Y 189, 201-02 (2007).

114. Harris, *supra* note 42; Steven W. Lawry, *Tenure Policy Toward Common Property Natural Resources in Sub-Saharan Africa*, 30 NAT. RESOURCES J. 403 (1990). On the transition from informal to formal law generally, see Ronald K.L. Collins & David M. Skover, *Paratexts*, 44 STAN. L. REV. 509 (1992); Joseph W. Dellapenna, *Law in a Shrinking World: The Interaction of Science and Technology with International Law*, 88 KY. L.J. 809, 860-76 (1999-2000).

115. See generally MANAGING THE COMMONS (Garrett Hardin & John Baden eds., 1977); Keith Aoki, *Neocolonialism, Anticommons Property, and Biopiracy in the (Not-So-Brave) New*

predicted, for (to name just a few examples) fish in the sea,¹¹⁶ national park access,¹¹⁷ and even (at times) national treasures.¹¹⁸ I observed just such a tragedy on a visit to Nova Scotia in 1995.

I had long looked forward to visiting Nova Scotia, in part because of my anticipation of some memorable lobster dinners there. One could always get, compared to other parts of the United States, a fairly large lobster for a rather small price when visiting nearby Maine.¹¹⁹ Yet the first restaurant we went to did not even have lobster on the menu. The waitress suggested that we try another restaurant twenty or so miles down the road. That second restaurant did have lobster on the menu—a rather puny one-and-a-quarter-pound lobster, and not cheap either. I ordered it, only to receive two tiny lobsters that together weighed perhaps one-and-a-quarter pounds. I asked the waitress, “Where are the larger lobsters?” She answered, “We ate them all.” I was so struck by her answer that I visited lobster boats and warehouses that deal in lobsters to investigate—it made for a great vacation for the family. The correct answer, it turned out, is that Nova Scotia lobstermen, anticipating government regulations that would sharply curtail their catches, had simply gone out and caught every lobster they could, leaving only lobsters that were too young to reproduce. Evidently, this required a severe curtailment of their lobstering.¹²⁰

World Order of International Intellectual Property Protection, 6 IND. J. GLOBAL LEGAL STUD. 11 (1998); Erin A. Clancy, Note, *The Tragedy of the Global Commons*, 5 IND. J. GLOBAL LEGAL STUD. 601 (1997-1998); Sverre Grepperud, *Population Pressure and Land Degradation: The Case of Ethiopia*, 30 J. ENVTL. ECON. & MGMT. 18 (1996); Robert Wilson, Student Article, *Environmental Regulation of the Human Gene Pool as a Genetic Commons*, 5 N.Y.U. ENVTL. L.J. 833 (1996).

116. See, e.g., Hope M. Babcock, *Grotius, Ocean Fish Ranching, and the Public Trust Doctrine: Ride ‘Em Charlie Tuna*, 26 STAN. ENVTL. L.J. 3 (2007); Jaye Ellis, *Fisheries Conservation in an Anarchical System: A Comparison of Rational Choice and Constructivist Perspectives*, 3:2 J. INT’L L. & INT’L REL. 1 (2007); Shi-Ling Hsu, *What Is a Tragedy of the Commons? Overfishing and the Campaign Spending Problem*, 69 ALB. L. REV. 75 (2005); Libecap, *supra* note 111, at 387-92; Daniel Pauly, *Unsustainable Marine Fisheries*, SUSTAINABLE DEV. L. & POL’Y, Fall 2006, at 10; Alison Rieser, *Oysters, Ecosystems, and Persuasion*, 18 YALE J.L. & HUMAN. (SPECIAL ISSUE) 49 (2006); Katrina M. Wyman, *The Property Rights Challenge in Marine Fisheries*, 50 ARIZ. L. REV. 511 (2008).

117. ALEXANDER GARVIN ET AL., URBAN PARKS AND OPEN SPACES (1997); JOSEPH L. SAX, MOUNTAINS WITHOUT HANDRAILS: REFLECTIONS ON THE NATIONAL PARKS (1980).

118. Rodney D. Fort & John Baden, *The Federal Treasury as a Common Pool Resource and the Development of a Predatory Bureaucracy*, in BUREAUCRACY VS. ENVIRONMENT: THE ENVIRONMENTAL COSTS OF BUREAUCRATIC GOVERNANCE 9 (John Baden & Richard L. Stroup eds., 1981). See also Hsu, *supra* note 116; John A. Vassallo, III, *Agency Inaction and the Regulatory Commons Theory: Lessons from New York State’s Experience with Dry Cleaner Co-Location*, 25 PACE ENVTL. L. REV. 235 (2008); Allen K. Yu, *Enhancing Legal Aid Access Through an Open Source Commons Model*, 20 HARV. J.L. & TECH. 373 (2007).

119. I have told this story before in slightly different language. Joseph W. Dellapenna, *Adapting Riparian Rights to the Twenty-First Century*, 106 W. VA. L. REV. 539, 563-64 (2004); Joseph W. Dellapenna, *Developing a Suitable Water Allocation Law for Pennsylvania*, 17 VILL. ENVTL. L.J. 1, 19-20 (2006).

120. For a study of the related problems in New England, see JAMES M. ACHESON, CAPTURING THE COMMONS: DEVISING INSTITUTIONS TO MANAGE THE MAINE LOBSTER INDUSTRY (2003); Samantha Renée Smith, Note, *The Current Fate of the Lobster Fishery and a Proposal for Change*, 40 NEW ENG. L. REV. 663 (2005-2006).

The problem I had encountered was, in fact, a classic tragedy of the commons. Each lobsterman determined for himself when, where, and how small to catch lobsters until the whole industry was reduced to capturing lobsters too small for reproduction. Suppose I were a Nova Scotia lobsterman who wanted to behave responsibly. I could make a voluntary choice to release any lobster smaller than a certain size—a size that, in my estimation, would provide a reasonable opportunity for the lobster to grow large enough to reproduce before it was caught. As long as the lobster fishery is treated as common property with a free-for-all grab-fest for lobsters, my choice would do little or nothing to benefit the lobsters. Someone else would simply catch the lobsters that I released (or, at least, most of them). I would have reduced my income without conferring much or any benefit on the lobsters. I bear the entire cost, while any resulting benefit is shared by the less responsible lobstermen who capture the released lobsters. On the other hand, if I continue to grab every lobster I can, I maximize my income (I realize the benefit of my increased exploitation of the resource), while the costs are spread over all lobstermen. The only rational economic course would be to grab as many lobsters as I can.¹²¹

Hardin concluded that only a private property system, in which the costs as well as the benefits of resource management decisions are concentrated on a particular owner, could avoid the tragedy of the commons.¹²² According to Hardin, appeals to moderation and moral suasion can only be self-defeating. Like my hypothetical responsible lobsterman, those who respond to such appeals simply leave the field to common owners who continue to increase their exploitation to the point of exhaustion of the resource. Each responsible user soon realizes that heeding the moral appeal reduces their gains with little or no benefit to the common resource. Many who agree with the appeal to morality would join in grabbing whatever they can before it is all gone.

Hardin focused on over-exploitation of the common pool resource. Experience with riparian rights suggests another problem—one that might also be true for the Nova Scotia lobsters. When exploitation of a common pool resource requires significant capital investment, the inability of potential investors to keep others from preempting an investor's uses will bring about under-investment in the resource.¹²³ Fear of such problems, deriving ultimately from the pervasive uncertainty that arises under traditional riparian rights, was invoked to justify rejection of riparian rights in the drier, western third of the United States in favor of the private property system that Hardin

121. Cf. R. Michael McGonigle, *The "Economizing" of Ecology: Why Big, Rare Whales Still Die*, 9 *ECOLOGY L.Q.* 119 (1980) (explaining why a cost-benefit analysis should lead inexorably to the hunting of whales to extinction).

122. Hardin, *supra* note 61, at 1245, 1247. See also LOUIS KAPLOW & STEPHEN SHAVELL, *FAIRNESS VERSUS WELFARE* (2002); Bruce Yandle & Andrew P. Morriss, *The Technologies of Property Rights: Choice Among Alternative Solutions to Tragedies of the Commons*, 28 *ECOLOGY L.Q.* 123 (2001-2002).

123. See, e.g., *In re Waters of Long Valley Creek Stream Sys.*, 599 P.2d 656, 666-67 (Cal. 1979); J.W. Milliman, *Water Law and Private Decision-Making: A Critique*, 2 *J.L. & ECON.* 41, 47-51 (1959); Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 *U. CHI. L. REV.* 711, 715-16 (1986).

argued was necessary for all commons when use approaches supply.¹²⁴ The puzzle is how, given the supposed superiority of private property over common property as a resource management system, the reasonable use rule, a common property system, was substituted for an earlier private property version of riparian rights—the “natural flow” theory of riparian rights.¹²⁵

For purposes of evaluating riparian rights as a system of law to facilitate adaptation to climate disruption, one need not resolve such questions. Instead, one need only consider the strengths and weaknesses of riparian rights in operation. Clearly, that system would not do the job. While the characteristics of the reasonable use version of riparian rights might be seen as a virtue for providing the flexibility necessary to adapt to climate disruption, the slow, laborious process of litigation is ill-suited for adapting water usage to changing supply or demand. Decisions are made by judges who are not versed in hydrology, meteorology, or economics, to name only three of the potentially relevant disciplines. Nor would a reversion to the natural flow theory help — it would only freeze out most consumptive uses at a time when communities will be seeking (sometimes desperately needed) new sources of water for consumptive uses.¹²⁶ The reality of the resulting tragedy of the commons has already led about half of the states that traditionally followed riparian rights to abandon that system in favor of regulated riparianism without fear of climate disruption.¹²⁷ That process will most likely only accelerate as the effects of climate disruption become more widely felt.

IV. APPROPRIATIVE RIGHTS

In the United States, the climate generally becomes drier as one goes from east to west, with truly arid regions between the Rocky Mountains and the mountains along the Pacific Coast, with predictable legal consequences for the law of water allocation.¹²⁸ When settlers of European ancestry reached this region, they needed water for mining, irrigation, and later industrial and municipal uses. They concluded that their needs for water could not be satisfied under riparian rights, particularly in its natural flow version, but also

124. See the authorities collected *supra* note 106.

125. See generally WATERS 1, *supra* note 24, §§ 7.01, 7.02.

126. The few advocates of a revival of the natural flow theory are focused on protecting aesthetic or ecological values rather than on meeting consumptive needs. Lynda L. Butler, *Allocating Consumptive Water Rights in a Riparian Jurisdiction: Defining the Relationship between Public and Private Interests*, 47 U. PITT. L. REV. 95, 156-81 (1985); Peter N. Davis, *The Riparian Right of Streamflow Protection in the Eastern States*, 36 ARK. L. REV. 47, 55-59 (1982-1983). That the natural flow theory is utterly inappropriate for the needs of thriving communities dependent on modern technologies for their survival explains why calls for a revival of the natural flow theory have not found traction with courts or lawmakers.

127. WATERS 1, *supra* note 24, § 9.03.

128. See generally WORSTER, *supra* note 24; Grossfeld, *supra* note 24, at 1514; Hobbs, *supra* note 17, at 5; WATERS 1, *supra* note 24, § 8.01.

in its reasonable use incarnation.¹²⁹ Furthermore, when “Anglo” settlement began, the newcomers generally were trespassers on the public domain, often before any effective government was in place.¹³⁰ The prospectors who suddenly populated California after the discovery of gold at Sutter’s Mill in 1848 did not carefully analyze the legal needs of western states. The Yankee intruders swept away Spanish-Mexican law and law that could have been derived from aboriginal practices,¹³¹ relying instead on the only law with which they were familiar, the common law of the eastern United States.¹³² Yet regarding land and water, the two most important material factors in their lives, the common law was useless.

The land itself was deemed to belong to the federal government (the “public domain”), while under riparian rights, the right to use water belonged to the owner of the land. Because the “forty-niners” would not wait for the establishment of a regular government and the comprehensive land surveys needed to buy the land from the government, the miners simply trespassed on the land and took what water they needed.¹³³ The miners sought to bring order to their lives through “vigilance committees,” giving rise to vigilante law and creating a national mythology that was all too true, involving violent disputes, blood feuds, and sudden death.

Vigilante law was based upon the most elementary notion of justice—first in time, first in right.¹³⁴ If someone were found on another person’s mining claim, the new occupant would hang if he could not justify his presence. Government, when finally organized, could only ratify the customs of the miners.¹³⁵ The mining camps applied the same principles to water as they did to land. Again, organized governments had to follow the customs of the miners.¹³⁶ After 150 years, the miners’ rule has been developed into a complex

129. For a critique of the assumptions western courts made on these issues, see Freyfogle, *supra* note 36. See also WORSTER, *supra* note 24; Gordon Morris Bakken, *The Influence of the West on the Development of Law*, 24 J. WEST 66 (1985); Robert G. Dunbar, *The Adaptability of Water Law to the Aridity of the West*, 24 J. WEST 57 (1985); Donald J. Pisani, *Enterprise and Equity: A Critique of Western Water Law in the Nineteenth Century*, 18 WESTERN HIST. Q. 15 (1987).

130. WATERS 1, *supra* note 24, § 8.01.

131. The early statutes in several states, including California, that preserved the Spanish-Mexican irrigation law, always subordinated such rights to the needs of miners. GORDON MORRIS BAKKEN, *THE DEVELOPMENT OF LAW ON THE ROCKY MOUNTAIN FRONTIER: CIVIL LAW AND SOCIETY, 1850-1912*, 34 (1983); BETTY EAKLE DOBKINS, *THE SPANISH ELEMENT IN TEXAS WATER LAW 136-39* (1959); DONALD J. PISANI, *TO RECLAIM A DIVIDED WEST: WATER, LAW, AND PUBLIC POLICY, 1848-1902*, at 38-44 (1992).

132. See, e.g., JOHN PHILLIP REID, *LAW FOR THE ELEPHANT: PROPERTY AND SOCIAL BEHAVIOR ON THE OVERLAND TRAIL* (1997). See also PISANI, *supra* note 131, at 14; Mark T. Kanazawa, *Efficiency in Western Water Law: The Development of the California Doctrine, 1850-1911*, 27 J. LEGAL STUD. 159, 162-65 (1998).

133. *Moore v. Smaw*, 17 Cal. 199 (Cal. 1861).

134. See generally NORRIS HUNDLEY, JR., *THE GREAT THIRST: CALIFORNIANS AND WATER, 1770S-1990S*, 67-73 (1992); PISANI, *supra* note 131, at 31; Kanazawa, *supra* note 132, at 165-67. Historian Donald Pisani has documented the rather considerable support small miners gave to riparian rights in opposing the increasing concentration of water in the hands of large, capital intensive mining companies. PISANI, *supra* note 131, at 23-26, 35-38.

135. *Jennison v. Kirk*, 98 U.S. 453, 457 (1878) (“[T]he miners . . . were emphatically the law-makers, as respects mining, upon the public lands in the State”).

136. *Irwin v. Phillips*, 5 Cal. 140 (Cal. 1855).

system of water administration found, in various forms, in every appropriation state.¹³⁷

Successive mineral rushes to other western territories brought the California prospectors who had failed to strike it rich in California, and the customs of the California mining camps came with them. In some states, these customs blended with misunderstood principles of Spanish-Mexican law.¹³⁸ Farmers, particularly if they got there first, tended to apply riparian rights. Eventually, nearly everywhere across the West, appropriative rights displaced riparian rights.¹³⁹ In the Plains States and on the Pacific Coast, vestigial riparian rights remain, usually with little actual impact on how water is managed in those states.¹⁴⁰

Appropriative rights are basically a private property approach to water allocation in which water rights are defined as to quantity, time, place, and manner of use,¹⁴¹ and most importantly, according to their priority relative to other uses.¹⁴² Like traditional riparian rights, the appropriative rights doctrine has serious problems, even without reference to global climate disruption.¹⁴³ Appropriative rights exhibit more uncertainty than its governing principle—first in time, first in right—suggests. The earliest priority dates in appropriative rights states predate the modern administrative machinery.¹⁴⁴ Despite statutes and legal proceedings designed to facilitate the recording of these claims, the earliest, and hence most valuable, rights to use water still have not been quantified on some watercourses.¹⁴⁵ Prescriptive, abandoned, or forfeited rights can also create gaps in the official record.¹⁴⁶

137. WATERS 2, *supra* note 26, ch. 15.

138. DOBKINS, *supra* note 131; MICHAEL C. MEYER, WATER IN THE HISPANIC SOUTHWEST: A SOCIAL AND LEGAL HISTORY 1550-1850 (1984); Peter L. Reich, *Mission Revival Jurisprudence: State Courts and Hispanic Water Law Since 1850*, 69 WASH. L. REV. 869, 870 (1994); Peter L. Reich, *The "Hispanic" Roots of Prior Appropriation in Arizona*, 27 ARIZ. ST. L.J. 649, 650 (1995).

139. *See generally* WATERS 1, *supra* note 24, § 8.02.

140. WATERS 1, *supra* note 24, §§ 8.03-8.04(b).

141. *See, e.g.*, *Orr v. Arapahoe Water & Sanitation Dist.*, 753 P.2d 1217, 1219 (Colo. 1988); *Rominiecki v. McIntyre Livestock Corp.*, 633 P.2d 1064, 1065 (Colo. 1981); *Rencken v. Young*, 711 P.2d 954, 960 (Or. 1985).

142. *See, e.g.*, *Coffin v. Left-Hand Ditch Co.*, 6 Colo. 443, 446 (Colo. 1882); *State ex rel. Cary v. Cochran*, 292 N.W. 239, 245 (Neb. 1940).

143. *See generally* Mason Gaffney, *Economic Aspects of Water Resource Policy*, 28 AM. J. ECON. & SOC. 131, 139-41 (1969).

144. The first statute creating a formal administrative system was enacted in 1890 in Wyoming; the most recently enacted was in Alaska in 1966. *See generally* WATERS 1, *supra* note 24, § 8.02(c); WATERS 2, *supra* note 26, chs. 11-17. "Anglo" settlement, with claims of appropriative rights, began in 1849 in California and later in other states, but always long before the creation of the administrative system.

145. *See generally* WATERS 2, *supra* note 26, ch. 16.

146. For several cases recognizing prescriptive rights, see *Gibbons v. Globe Dev., Nev., Inc.*, 553 P.2d 1198 (Ariz. 1976) and *Sears v. Berryman*, 623 P.2d 455 (Idaho 1981). For cases and statutes refusing to recognize prescriptive rights, see ALASKA STAT. § 46.15.040(a) (2008); IDAHO CODE ANN. § 42-607 (2003); KAN. STAT. ANN. § 82a-705 (1997); NEV. REV. STAT. § 533.060(5) (2007); UTAH CODE ANN. § 73-3-1 (1989); *People v. Shirokow*, 605 P.2d 859 (Cal. 1980). For cases that address the issue of abandonment, see *City of Denver v. Snake River*

There is a much more serious problem, however, than gaps in the records of water rights. Rather than preventing wasteful and other bad practices, appropriative rights actually encourage such practices because the “first in time, first in right” principle fosters premature development, as water users seek to capture the rents from unappropriated waters. Thus, appropriative rights reward “jumping the gun” to use water before it is needed, or even if it will never actually be needed.¹⁴⁷ In order to capture rents, appropriators use as much water as they possibly can.¹⁴⁸ Withdrawing water, a cost to society, is a private gain to an appropriator, creating a basis for claiming water in the future, but one must invest real social capital to divert, store, and apply water to lay claim to the water. Capital is switched from socially productive uses to the capturing of sub-marginal resources. As a result, excessive diversion capacity is the rule under appropriative rights,¹⁴⁹ yet for most appropriations of water, there is inadequate investment in the post-diversionary aspects of development, especially those designed to save water.¹⁵⁰ Appropriators thus live in an environment where it is smart to over-irrigate or otherwise to waste water. Much of the water shortage in the west would disappear if appropriators had to start paying a realistic price for water, and the shortage would greatly abate if appropriators simply started thinking in terms of a zero

Water Dist., 788 P.2d 772 (Colo. 1990); *Jenkins v. State Dep't of Water Res.*, 647 P.2d 1256 (Idaho 1982); *Crandall v. Water Res. Dep't*, 626 P.2d 877 (Or. 1981); *Provo River Water Users Ass'n v. Lambert*, 642 P.2d 1219 (Utah 1982); *Okanogan Wilderness League, Inc. v. Town of Twisp*, 947 P.2d 732 (Wash. 1997). For cases that address forfeiture, see *Jenkins*, 647 P.2d at 1260; *Town of Eureka v. State Eng'r of Nev., Div. of Water Res.*, 826 P.2d 948 (Nev. 1992); *In re Cancellation of the Stabio Ditch Water Right on Spearfish Creek*, 417 N.W.2d 391 (S.D. 1987); *Provo River Water Users*, 642 P.2d at 1223; *Sheep Mountain Cattle Co. v. Dep't of Ecology*, 726 P.2d 55 (Wash. Ct. App. 1986); *In re N. Laramie Land Co.*, 605 P.2d 367 (Wyo. 1980). See generally WATERS 2, *supra* note 26, ch. 17.

147. See generally Amy Beatie & James Fosnaught, *The City of Golden's Application for Surface Water Rights: A Kayak Course, Instream Flow, Dilution, or What?*, 2 U. DENV. WATER L. REV. 273 (1999); John D. Leshy, *The Prior Appropriation Doctrine of Water Law in the West: An Emperor with Few Clothes*, 29 J. WEST 5 (1990); Janet C. Neuman, *Beneficial Use, Waste, and Forfeiture: The Inefficient Search for Efficiency in Western Water Use*, 28 ENVTL. L. 919 (1998).

148. Charles W. Howe, Paul K. Alexander & Raphael J. Moses, *The Performance of Appropriative Water Rights Systems in the Western United States During Drought*, 22 NAT. RESOURCES J. 379 (1982). The notion of capturing rents derives from “public choice theory.” See Philip A. Joseph, *The Environment, Property Rights, and Public Choice Theory*, 20 N.Z.U. L. REV. 408 (2003); Jonathan Remy Nash, *Economic Efficiency Versus Public Choice: The Case of Property Rights in Road Traffic Management*, 49 B.C. L. REV. 673, 679-80 (2008); Edward L. Rubin, *Public Choice and Legal Scholarship*, 46 J. LEGAL EDUC. 490, 491 (1996); David A. Skeel, Jr., *Public Choice and the Future of Public-Choice-Influenced Legal Scholarship*, 50 VAND. L. REV. 647, 651-52 (1997) (reviewing MAXWELL L. STEARNS, *PUBLIC CHOICE AND PUBLIC LAW: READINGS AND COMMENTARY* (1997)); Maxwell L. Stearns, *Restoring Positive Law and Economics: Introduction to Public Choice Theme Issue*, 6 GEO. MASON L. REV. 709 (1998).

149. See Neuman, *supra* note 147.

150. See, e.g., *Krieger v. Pac. Gas & Elec. Co.*, 173 Cal. Rptr. 751 (Cal. Ct. App. 1981); *Tulare Irrigation Dist. v. Lindsay-Strathmore Irrigation Dist.*, 45 P.2d 972 (Cal. 1935); *Provo River Water Users*, 642 P.2d at 1219; *Carbon Canal Co. v. Cottonwood-Gooseberry Irrigation Co.*, 427 P.2d 396 (Utah 1967); *Fuss v. Franks*, 610 P.2d 17 (Wyo. 1980). Western courts recently have begun to penalize wasteful practices. See, e.g., *Estate of Steed v. New Escalante Irrigation Co.*, 846 P.2d 1223 (Utah 1992).

price, instead of, as now, regarding the price as negative because of the gain they realize by piling up a "history" of use.¹⁵¹

The introduction of conditional rights made it even easier to "capture" rents by establishing the intent to appropriate water that may take many years before the completion of the works necessary to put the water to use.¹⁵² Even if all appropriators are careful only to appropriate as much water as they actually need, as unlikely as that might be, the legal regime violates two of the most fundamental economizing principles: (1) marginal productivity;¹⁵³ and (2) pooling of risk.¹⁵⁴ Under the rule of "first in time, first in right," appropriators are senior and junior to one another along a scale going from the very first person to begin to use water to the person who began to use the water most recently. When there is not enough water to meet all water rights, a junior appropriator must drop out first and lose everything before the next senior appropriator loses anything.¹⁵⁵ Senior appropriators are protected by exaggerating the risk to junior appropriators. A junior appropriator may lose all access to water, including marginal units of higher productivity than some of the marginal units protected for a senior appropriator. There is no pooling of risk whatsoever. Water rights derive from a larger common supply, but each water right is defined in a way that introduces changes in the aggregate variability of supply beyond the natural variability, and that distributes these risks unequally.

The impact of appropriative rights on efficient use of water does not end with denial of marginal utility. When administered by large irrigation districts, appropriated water may be applied to rationally defined service areas. When claimed by individuals or small districts, however, service areas from any given

151. Neuman, *supra* note 147. See also Robert Benjamin Naeser & Lynne Lewis Bennett, *The Cost of Noncompliance: The Economic Value of Water in the Middle Arkansas River Valley*, 38 NAT. RESOURCES J. 445 (1998). See generally Jürgen G. Backhaus, *The Law and Economics of Environmental Taxation: When Should the Ecotax Kick In?*, 19 INT'L REV. L. & ECON. 117 (1999); Don Fullerton & Gilbert E. Metcalf, *Environmental Taxes and the Double-Dividend Hypothesis: Did You Really Expect Something for Nothing?*, 73 CHI.-KENT L. REV. 221 (1997-1998). Authorities in some states have begun to take steps to eliminate wasteful uses, but this still occurs only rarely. See, e.g., *Imperial Irrigation Dist. v. State Water Res. Control Bd.*, 275 Cal. Rptr. 250 (Cal. Ct. App. 1990). Even George Gould, in a spirited defense of the appropriative rights, conceded that enforcement was intermittent because of a "lack of political will." George A. Gould, *A Westerner Looks at Eastern Water Law: Reconsideration of Prior Appropriation in the East*, 25 U. ARK. LITTLE ROCK L. REV. 89, 96 (2002).

152. See, e.g., *Pub. Serv. Co. of Colo. v. Bd. of Water Works of Pueblo, Colo.*, 831 P.2d 470 (Colo. 1992); *City of Thornton v. City of Fort Collins*, 830 P.2d 915 (Colo. 1992); *In re Water Appropriation*, 280 N.W.2d 75 (Neb. 1979); *In re Application No. 5189-3*, 467 N.W.2d 907 (S.D. 1991); *Green River Dev. Co. v. FMC Corp.*, 660 P.2d 339 (Wyo. 1983). See generally Beatie & Fosnaught, *supra* note 147.

153. See generally ROBIN PAUL MALLOY, *LAW AND ECONOMICS: A COMPARATIVE APPROACH TO THEORY AND PRACTICE* 20-33 (1990); POSNER, *supra* note 52, § 1.1; Gaffney, *supra* note 143, at 140; Herbert Hovenkamp, *Marginal Utility and the Coase Theorem*, 75 CORNELL L. REV. 783 (1990).

154. Gaffney, *supra* note 143, at 140.

155. For one of the most extreme examples of this, see *State ex rel. Cary v. Cochran*, 292 N.W. 239 (Neb. 1940).

source are generally scattered. The farther one is from a source and the more convenient it is to others, the greater the motive to get there first to preclude them. Typically, the first claimants on a source are scattered; soon the supply is fully claimed, and the included dry lands can never get water from this source.¹⁵⁶ They can, however, find other, more remote sources. The results need not be imagined, they may be observed throughout the West: canals (“ditches”) crisscross states, carrying water in opposite directions as appropriators exercise their rights. Recent legal innovations to protect areas of origin have had only limited impact on this problem.¹⁵⁷

Even more than for riparian rights, appropriative rights favor large users. To make an appropriation, it must be used “beneficially.”¹⁵⁸ The amount of water that one can use beneficially is a function of, among other things, the amount of land or the size of the factory that one owns.¹⁵⁹ Appropriative rights thus tend to distribute publicly owned water¹⁶⁰ to those who already own the most. Traditionally, no effort was made to protect the public interest in those publicly owned waters or to distribute the fruits of the use of those waters among the disadvantaged of society.¹⁶¹ Many appropriative rights states have now enacted statutes requiring consideration of the public interest in evaluating applications to make a new appropriation.¹⁶² Such statutes, however, do not preempt existing water rights and thus have little practical effect in the many water basins in which most or all available water has already

156. See *Cochran*, 292 N.W. 239.

157. See, e.g., CAL. WATER CODE ANN. §§ 10505-10505.5 (1992); *El Dorado Irrigation Dist. v. State Water Res. Control Bd.*, 48 Cal. Rptr. 3d 468 (Cal. Ct. App. 2006). See generally NATIONAL RESEARCH COUNCIL, WATER TRANSFERS IN THE WEST: EFFICIENCY, EQUITY, AND THE ENVIRONMENT 78-79, 114-15, 225-32, 243-44, 257-59 (1992); Robert Haskell Abrams, *Interbasin Transfer in a Riparian Jurisdiction*, 24 WM. & MARY L. REV. 591 (1983); Ellen Hanak & Caitlin Dyckman, *Counties Wrestling Control: Local Responses to California's Statewide Water Market*, 6 U. DENV. WATER L. REV. 490 (2003); Ronald A. Kaiser, *Texas Water Marketing in the Next Millennium: A Conceptual and Legal Analysis*, 27 TEX. TECH. L. REV. 181, 215-18, 251-53 (1996); Joseph L. Sax, *Understanding Transfers: Community Rights and the Privatization of Water*, 14 HASTINGS W.-NW. J. ENVTL. L. & POL'Y 33 (2008); Gregory S. Weber, *Twenty Years of Local Groundwater Export Legislation in California: Lessons from a Patchwork Quilt*, 34 NAT. RESOURCES J. 657 (1994).

158. See, e.g., NEB. CONST. art. XV, § 6; *Imperial Irrigation Dist. v. State Water Res. Control Bd.*, 275 Cal. Rptr. 250 (Cal. Ct. App. 1990); *Consol. Home Supply Ditch Co. v. Town of Berthoud*, 896 P.2d 260 (Colo. 1995); *State Dep't of Ecology v. Theodoratus*, 957 P.2d 1241 (Wash. 1998). See generally Rebecca Abeln, *Instream Flows, Recreation as Beneficial Use, and the Public Interest in Colorado Water Law*, 8 U. DENV. WATER L. REV. 517 (2005); Neuman, *supra* note 147.

159. The relation between the amount of land and the amount of water that can be used beneficially is made explicit in laws defining a “duty of water”—the amount of water that the law allows a landowner to use to irrigate acreages of particular crops. See, e.g., *In re Steffens*, 756 P.2d 1002 (Colo. 1988); *McDonald v. State*, 722 P.2d 598 (Mont. 1986); *State Dep't of Ecology v. Grimes*, 852 P.2d 1044 (Wash. 1993).

160. The law in every western state defines the “waters of the state” as belonging to the state or to the public. See, e.g., ALASKA CONST. art. VIII, §§ 3, 5; CAL. CONST. art. X, § 2; COLO. CONST. art. XVI, § 5; NEB. CONST. art. XV, § 5; N.M. CONST. art. XVI, § 3; N.D. CONST. art. XI, § 3; WYO. CONST. art. VIII, § 1.

161. See, e.g., *Aspen Wilderness Workshop, Inc. v. Hines Highlands, L.P.*, 929 P.2d 718, 725 (Colo. 1996). See generally Gaffney, *supra* note 143, at 138.

162. See, e.g., NEB. CONST. art. XV, § 6; *Hardy v. Higginson*, 849 P.2d 946, 949 (Idaho 1993); *Pyramid Lake Paiute Tribe v. Washoe County*, 918 P.2d 697, 698 n.3 (Nev. 1996). See generally Consuelo Bokum, *Implementing the Public Welfare Requirement in New Mexico's Water Code*, 36 NAT. RESOURCES J. 681 (1996); WATERS 2, *supra* note 26, § 15.03(c)(3); Douglas L. Grant, *Instream Flow Protection and Public Interest Review of Appropriations*, 5 RIVERS 294 (1995).

been appropriated.¹⁶³ Whether, in today's economy, distributive equity favors protecting endangered species and providing water for other public values rather than for irrigation, is a hotly debated question that illustrates the difficulty of reaching a proper balance between the public interest and private need.¹⁶⁴

These rather serious problems could perhaps be dealt with fairly easily if markets could be made to work under appropriative rights. But, for reasons that I have addressed at length elsewhere,¹⁶⁵ there has never been a market for appropriative rights to any significant extent.¹⁶⁶ Appropriative rights then, create a rather peculiar form of private property—one that rather than ensuring free transferability and efficient uses of the resource, effectively freezes uses in place¹⁶⁷—unless the state intervenes directly and dramatically to transfer the water to other uses.¹⁶⁸ Small-scale transfers of water rights among users who are making similar uses at more or less the same place are the only ones that regularly occur under appropriative rights without state intervention.¹⁶⁹ Such small-scale, like-kind transactions are precisely the kind that are unlikely to affect third parties.

163. See, e.g., *In re Matter of Permit No. 47-7680*, 759 P.2d 891 (Idaho 1988); *Shokal v. Dunn*, 707 P.2d 441 (Idaho 1985). See generally Norman K. Johnson & Charles T. DuMars, *A Survey of the Evolution of Western Water Law in Response to Changing Economic and Public Interest Demands*, 29 NAT. RESOURCES J. 347 (1989).

164. See, e.g., Robert W. Adler, *Restoring the Environment and Restoring Democracy: Lessons from the Colorado River*, 25 VA. ENVTL. L.J. 55, 64 (2007); Barbara Cosens, *Farmers, Fish, Tribal Power, and Poker: Reallocating Water in the Truckee River Basin, Nevada and California*, 14 HASTINGS W. NW. J. ENVTL. L. & POL'Y 1243 (2008); Paul Ekness & Timothy Randhir, *Effects of Riparian Areas, Stream Order, and Land Use Disturbance on Watershed-Scale Habitat Potential: An Ecohydrologic Approach to Policy*, 43 J. AM. WATER RESOURCES ASS'N 1468, 1478 (2007); Ik-Jae Kim et al., *Riparian Ecosystem Management Model: Sensitivity to Soil, Vegetation, and Weather Input Parameters*, 43 J. AM. WATER RESOURCES ASS'N 1171 (2007); Janet Neuman, Anne Squier & Gail Achterman, *Sometimes a Great Notion: Oregon's Instream Flow Experiments*, 36 ENVTL. L. 1125, 1148 (2006); Richard A. Slaughter & John D. Wiener, *Water, Adaptation, and Property Rights on the Snake and Klamath Rivers*, 43 J. AM. WATER RESOURCES ASS'N 308, 309 (2007); Glen Spain, *Dams, Water Reforms, and Endangered Species in the Klamath Basin*, 22 J. ENVTL. L. & LITIG. 49 (2007); Symposium, *New Mexico's Rio Grande Reservoirs*, 47 NAT. RESOURCES J. 511 (2007); Charles Wilkinson, *The First Half Century of Western Water Reform: Have We Kept Faith with the Rivers of the West?*, 36 ENVTL. L. 1115, 1117 (2006).

165. Dellapenna, *Disruption*, *supra* note 21; Dellapenna, *Myths*, *supra* note 62, at 320. See also Sinden, *supra* note 111.

166. See, e.g., Janis M. Carey & David L. Sunding, *Emerging Markets in Water: A Comparative Institutional Analysis of the Central Valley and Colorado-Big Thompson Projects*, 41 NAT. RESOURCES J. 283, 284 (2001); Gould, *supra* note 151, at 100. See also CARL J. BAUER, SIREN SONG: CHILEAN WATER LAW AS A MODEL FOR INTERNATIONAL REFORM (2004); Chatterton & Chatterton, *supra* note 20.

167. See Thomas J. Graff & David Yardas, *Reforming Western Water Policy: Markets and Regulation*, NAT. RESOURCES & ENV'T., Winter 1998, at 166.

168. See WATERS 1, *supra* note 24, § 6.01(b)(2)-(b)(3).

169. See Joseph W. Dellapenna & Stephen E. Draper, *Straight Talk about Markets for Water* (Aug. 2003) (White Paper for the Georgia Comprehensive State Water Plan Joint Study Committee), available at www.cviog.uga.edu/water/whitepapers/markets.pdf; Thomas M. Fullerton, Jr., *Water Transfers in El Paso County, Texas*, 8 WATER POL'Y 255 (2006); Charles W. Howe & Christopher Goemans, *Water Transfers and Their Impacts: Lessons from Three Colorado Water Markets*, 39 J. AM. WATER RESOURCES ASS'N 1055 (2003). See also Henning Bjornlund, *Irrigators*

The foregoing serious problems make appropriative rights even less capable of responding to the changes induced by global climate disruption. A rigid freezing of water use in wasteful patterns that disregard fundamental principles of marginal utility and pooling of risk is the very opposite of what will be necessary when water use patterns need to be adjusted to the new reality. Thus, sustaining appropriative rights in the regions where it already exists will be difficult or impossible, and major efforts are underway to subvert through a pretense of markets those that are not really markets.¹⁷⁰ Drawing on appropriative rights to replace riparian rights would face additional severe impediments in states with numerous and well-developed water use patterns. To understand why requires some attention to the experience of the Pacific coast states, from Alaska to California, and the high plains states, from North Dakota to Texas, that adopted appropriative rights to replace an earlier system of riparian rights.¹⁷¹

The transition from predominantly riparian rights states to dual systems recognizing both appropriative rights and riparian rights generally occurred through legislation.¹⁷² The legislatures chose to preserve as valid those uses under riparian rights that were in use on the effective date of the state's first appropriative rights statute.¹⁷³ Although most of these transitions happened when existing water uses were relatively few in those states, they produced a dual system that combined the worst features of both bodies of law.¹⁷⁴ Mississippi attempted to do the same in a statute enacted in 1955.¹⁷⁵ The attempt failed, and twenty-nine years later, Mississippi abandoned appropriative rights in favor of regulated riparianism.¹⁷⁶ The reason for the failure of appropriative rights is fairly obvious. Innumerable consumptive uses of water began before 1955, and claiming an appropriative right would only concede priority to an opponent claiming a pre-existing riparian right. Either

and the New Policy Paradigm—An Australian Case Study, 7 WATER POL'Y 581 (2005); Asif M. Zaman, Brian Davidson & Hector M. Malano, *Temporary Water Trading Trends in Northern Victoria, Australia*, 7 WATER POL'Y 429 (2005).

170. See Sinden, *supra* note 111; Dellapenna, *Disruption*, *supra* note 21; Dellapenna, *Myths*, *supra* note 62.

171. See *Lux v. Haggin*, 10 P. 674 (Cal. 1886). See generally WATERS 1, *supra* note 24, ch. 8.

172. See WATERS 1, *supra* note 24, § 8.02(a), (c).

173. See *Cal. Or. Power Co. v. Beaver Portland Cement Co.*, 295 U.S. 142 (1935); *F. Arthur Stone & Sons v. Gibson*, 630 P.2d 1164, 1169 (Kan. 1981); *City of Hesston v. Smrha*, 391 P.2d 93 (Kan. 1964); *Hickman v. Loup River Pub. Power Dist.*, 113 N.W.2d 617, 623 (Neb. 1962); *Baeth v. Hoisveen*, 157 N.W.2d 728, 729 (N.D. 1968); *City of Stillwater v. Okla. Water Res. Bd.*, 524 P.2d 938, 941-43 (Okla. Civ. App. 1974); *In re Hood River*, 227 P. 1065, 1070 (Or. 1924); *Norwood v. E. Or. Land Co.*, 227 P. 1111 (Or. 1924); *Belle Fourche Irrigation Dist. v. Smiley*, 176 N.W.2d 239 (S.D. 1970); *In re Medina River*, 670 S.W.2d 250 (Tex. 1984); *In re Deadman Creek Drainage Basin*, 694 P.2d 1071, 1072 (Wash. 1985); *Brown v. Chase*, 217 P. 23, 25 (Wash. 1923). *But see Franco-Am. Charolaise, Ltd. v. Okla. Water Res. Bd.*, 855 P.2d 568, 571 (Okla. 1990) (finding that the attempt to cut-off unused riparian rights is void as an attempt to take property without compensation).

174. WATERS 1, *supra* note 24, §§ 8.03, 8.04.

175. MISS. CODE ANN. §§ 51-3-3(g), 51-3-5, 51-3-7 (West 1999). See generally William M. Champion, *Prior Appropriation in Mississippi—A Statutory Analysis*, 39 MISS. L.J. 1 (1967).

176. WATERS 1, *supra* note 24, § 8.05-8.05(b).

the riparian right would prevail as the earliest appropriation,¹⁷⁷ or the appropriative right would be a permissive non-riparian use that must fail in competition with a riparian use.¹⁷⁸ The best that an appropriator could hope would be that the appropriative use would be balanced against the complaining riparian's use, which brings us full circle back to the reasonable use version of riparian rights.¹⁷⁹ If an acute general water shortage were to develop, an appropriator, rather than having a more secure title than a riparian, would simply find no water to apply to the appropriation. As a result of such problems, eastern states making a sharp departure from the more or less pure riparian rights tradition uniformly have not gone to appropriative rights, but to regulated riparianism.¹⁸⁰

V. REGULATED RIPARIANISM

Hawaii and about half of the states east of Kansas City have now developed administrative permit systems to replace traditional riparian rights.¹⁸¹ Rather than importing appropriative rights into the east, these states developed a system of water administration based on riparian principles that is best described as a system of public property.¹⁸² The new system is called "regulated riparianism."¹⁸³ The transition from extremely limited regulatory

177. *See id.*, § 8.04(a).

178. *Id.*, § 8.04(b).

179. *See, e.g.*, *Wasserburger v. Coffee*, 141 N.W.2d 738 (Neb. 1966); *Franco-Am. Charolaise, Ltd. v. Okla. Water Res. Bd.*, 855 P.2d 568, 577-78 (Okla. 1990). *See* WATERS 1, *supra* note 24, § 8.04(b).

180. For an argument in favor of importing appropriative rights into eastern states, see Gould, *supra* note 151. Gould does not explain why no eastern state has adopted appropriative rights if it would be so superior to regulated riparianism as he contends. *See* WATERS 1, *supra* note 24, § 8.05(a).

181. *See generally* WATERS 1, *supra* note 24.

182. *See id.* at § 6.01(b)(1).

183. I devised the name "regulated riparianism" some twenty years ago. Joseph W. Dellapenna, *Owning Surface Water in the Eastern United States*, 6 E. MINERAL. L. FOUND. 1-1, 1-33, 1-34 (1985). The name "regulated riparianism" emphasizes both that the administrative permit process proceeds on essentially riparian principles, and that the new system is a regulation of—rather than a taking of—riparian rights. WATERS 1, *supra* note 24, § 9.01. This name has now gained general acceptance. *See, e.g.*, JOSEPH L. SAX ET AL., *LEGAL CONTROL OF WATER RESOURCES, CASES AND MATERIALS* 101-18 (4th ed. 2006); Robert Haskell Abrams, *Broadening Narrow Perspectives and Nuisance Law: Protecting Ecosystem Services in the ACF Basin*, 22 J. LAND USE & ENVTL. L. 243, 257 (2007); Adell Louise Amos, *The Use of State Instream Flow Laws for Federal Lands: Respecting State Control While Meeting Federal Purposes*, 36 ENVTL. L. 1237, 1242 n.15 (2006); Hope M. Babcock, *Reserved Indian Water Rights in Riparian Jurisdictions: Water, Water Everywhere, Perhaps Some Drops for Us*, 91 CORNELL L. REV. 1203, 1206-08, 1217-19, 1234, 1238 (2006); Michael C. Blumm & David H. Becker, *From Martz to the Twenty-First Century: A Half-Century of Natural Resources Law Casebooks and Pedagogy*, 78 U. COLO. L. REV. 647, 692 n.227 (2007); Christine A. Klein, *On Integrity: Some Considerations for Water Law*, 56 ALA. L. REV. 1009, 1047 n.281 (2005); Kirt Mayland, *Navigating the Murky Waters of Connecticut's Water Allocation Scheme*, 24 QUINNIPIAC L. REV. 685, 687, 690, 696, 720 (2006); Evan Mulholland, *Groundwater Quantity Regulation in Vermont: A Path Forward*, 8 VT. J. ENVTL. L. 1, 24 (2006); D.S. Pensley, *The Legalities of Stream Interventions: Accretive Changes to New York State's Riparian Doctrine Ahead?*, 25 PACE ENVTL. L. REV. 105, 111-23, 145 (2008); Scott S. Slater, *State Water Resource Administration in the*

intervention to more or less comprehensive regulation often occurs incrementally, rather than from a conscious design to substitute a new system of water rights for riparian rights. As a result, there is disagreement over when to date the emergence of a true regulated riparian system, and even today it is debatable whether certain states have in fact moved from relying largely on unregulated common law riparian rights to a regulated riparian system. The following indicates the states that I judge to have enacted regulated riparian systems and the approximate date of that adoption:

1. Alabama (1993);¹⁸⁴
2. Arkansas (1957);¹⁸⁵
3. Connecticut (1982);¹⁸⁶
4. Delaware (1959);¹⁸⁷
5. Florida (1972);¹⁸⁸
6. Georgia (1977);¹⁸⁹
7. Hawaii (1987);¹⁹⁰
8. Iowa (1957);¹⁹¹
9. Kentucky (1966);¹⁹²
10. Maryland (1933);¹⁹³
11. Massachusetts (1985);¹⁹⁴
12. Minnesota (1973);¹⁹⁵
13. Mississippi (1985);¹⁹⁶
14. New Jersey (1965);¹⁹⁷
15. North Carolina (1973);¹⁹⁸

Free Trade Agreement Era: As Strong as Ever, 53 WAYNE L. REV. 649, 671 (2007); Henry E. Smith, *Governing Water: The Semicommons of Fluid Property Rights*, 50 ARIZ. L. REV. 445, 454, 472, 474 (2008); Richard F. Ricci, Franklin W. Boenning & Kristina D. Pasko, *Battles over Eastern Water*, NAT. RESOURCES & ENV'T., Summer 2006, at 38, 39; Dale B. Thompson, *Of Rainbows and Rivers: Lessons for Telecommunications Spectrum Policy from Transitions in Property Rights and Commons in Water Law*, 54 BUFF. L. REV. 157, 176, 191-92, 205 (2006). The Supreme Court of Connecticut recently accepted the name "regulated riparianism" as the proper name for Connecticut's water law regime. *City of Waterbury v. Town of Washington*, 800 A.2d 1102, 1155-57 (Conn. 2002). See also *In re Water Use Permit Applications*, 9 P.3d 409, 460 (Haw. 2000) (referring to the *Regulated Riparian Model Water Code* for guidance in interpreting the Hawaii permit statute). The term has even begun to enter into the wider public discourse of general circulation media. See, e.g., Charles A. Nichols, Editorial, *Can W. Va. Conserve Resources Under Its Nose?*, SUNDAY GAZETTE-MAIL (Charleston, W. Va.), Mar. 14, 2004, at 1D; Leah J. Knowlton, *When the Tap Runs Dry, the Dockets May Flow*, DAILY REP. (Fulton County, Ga.), June 16, 2008, at 18.

184. ALA. CODE §§ 9-10B-1 to 9-10B-30 (2001).

185. ARK. CODE ANN. §§ 15-22-201 to 15-22-622 (2003).

186. CONN. GEN. STAT. §§ 22a-365-22a-380 (West 2006).

187. DEL. CODE ANN. tit. 7, §§ 6001-6031 (2001).

188. FLA. STAT. §§ 373.012-.619 (2006).

189. GA. CODE ANN. §§ 12-5-20 to 12-5-31, 12-5-43 to 12-5-53 (2006).

190. HAW. REV. STAT. ANN. § 174C (2008).

191. IOWA CODE ANN. §§ 455B.261- 455B.281 (2004).

192. KY. REV. STAT. ANN. §§ 151.010-151.600, 151.990 (2006).

193. MD. CODE ANN., ENVIRONMENT §§ 5-501-5-514 (2007).

194. MASS. GEN. LAWS ANN. ch. 21G, §§ 1-19 (2002).

195. MINN. STAT. ANN. §§ 103G.001-103G.315 (1997).

196. MISS. CODE ANN. §§ 51-3-1 to 51-3-55 (1999).

197. N.J. STAT. ANN. §§ 58:1A-1 to 58:1A-17 (2006).

16. New York (1979);¹⁹⁹
17. Virginia (1989);²⁰⁰ and
18. Wisconsin (1957).²⁰¹

Four other states apply regulated riparianism to groundwater without applying it to surface waters.²⁰² The Delaware Basin Water Commission and the Susquehanna Basin Water Commission also operate a limited sort of regulated riparianism in parts of Pennsylvania.²⁰³

Little has been written about regulated riparianism, and most of what has been written on the topic describes regulated riparian statutes as minor modifications superimposed on the riparian rights that the authors saw as the remaining core of the law in these states.²⁰⁴ Others have seen regulated riparian statutes as inartfully drafted appropriative rights statutes.²⁰⁵ Few commentators realize that regulated riparianism represents a truly different model of water law. The following summary description of regulated riparianism is based upon the common core of principles, as found in actual regulated riparian statutes and articulated in the *Regulated Riparian Model Water Code* of the American Society of Civil Engineers.²⁰⁶ No state has a system precisely like the one described here or in the Model Code, although several come very close. References here are provided in the text to the *Regulated Riparian Model Water Code* that deal with the points mentioned, and to the relevant chapter of the treatise *Waters and Water Rights*, the most complete analysis of regulated riparianism.²⁰⁷ Together, they are the most convenient sources for understanding the structure and application of regulated riparianism. Both include detailed commentaries explaining the various provisions and exhaustive references to actual regulated riparian statutes.

The most fundamental departure from traditional common law riparian rights under regulated riparianism is that no water is to be withdrawn from a

198. N.Y. ENVTL. CONSERV. LAW §§ 15-1501 to 15-1529 (2006).

199. N.C. GEN. STAT. §§ 143-215.11 to 143-215.22K (2007).

200. VA. CODE ANN. §§ 62.1-242 to 62.1-253 (2006).

201. WIS. STAT. ANN. §§ 30.18, 30.28, 30.292-30.298, 281.35 (2006).

202. ARIZ. REV. STAT. ANN. §§ 45-401 to 45-650 (2003); ILL. COMP. STAT. ANN. 45/1-45/7 (2004); NEB. REV. STAT. ANN. §§ 46-656.01 to 46-656.67, 46-675 to 46-692 (2007); S.C. CODE ANN. §§ 49-5-10 to 49-5-150 (2008). *See generally* 3 WATERS AND WATER RIGHTS ch. 23 (Robert E. Beck ed., 2003).

203. Delaware River Basin Compact, Pub. L. No. 87-328, 75 Stat. 688 (1961); Susquehanna River Basin Compact, Pub. L. No. 91-575, 84 Stat. 1509 (1970). *See* 6 WATERS AND WATER RIGHTS 251 (Robert E. Beck ed., 1991).

204. *See, e.g.*, Richard Ausness, *Water Rights Legislation in the East: A Program for Reform*, 24 WM. & MARY L. REV. 547 (1983); Peter N. Davis, *Eastern Water Diversion Permit Statutes: Precedents for Missouri?*, 47 MO. L. REV. 429 (1982); Holman, *supra* note 102; Scott & Coustalin, *supra* note 70, at 899-901.

205. *See, e.g.*, Frank J. Trelease, *A Water Management Law for Arkansas*, 6 U. ARK. LITTLE ROCK L. REV. 369 (1983); George William Sherk, *Eastern Water Law*, NAT. RESOURCES & ENV'T., Winter 1986, at 7.

206. AM. SOC'Y OF CIVIL ENG'RS, THE REGULATED RIPARIAN MODEL WATER CODE: FINAL REPORT OF THE WATER LAWS COMMITTEE (Joseph W. Dellapenna ed., 1997) [hereinafter MODEL CODE].

207. WATERS 1, *supra* note 24.

water source without a time-limited permit from the state within which the withdrawal occurs.²⁰⁸ The permits determine water rights, not the riparian nature of the use, yet the new system of law remains within the riparian tradition because the criterion by which permit applications are evaluated is whether the proposed use is a “reasonable use” of the water.²⁰⁹ The criterion of “reasonable use” is applied very differently than at common law in that an administering agency decides, before a use begins, whether it is reasonable, both in terms of general social policy and in terms of the effects of the proposed use on other permitted uses.²¹⁰ Water users gain a significant advantage because they know—for the duration of the permit—whether their use is reasonable; they cannot be caught unaware by a judicial decision that wipes out their investment without a penny of compensation.²¹¹ Permits therefore allow potential investors to gauge whether their investments can be profitable, and inform potential investors about the proper scale of the investment.

The administering agency is to subject the permit to conditions designed to protect other lawful users and public values.²¹² The statutes often provide preferences for certain classes of uses.²¹³ Temporal priority has only a strictly limited role in the permit process.²¹⁴ Uses on non-riparian land are no longer unreasonable *per se*; often one of the principle motives for enacting a regulated riparian statute is to authorize the use of water on non-riparian land.²¹⁵ Finally, permits generally are issued only for a period of time (three to twenty years).²¹⁶ Upon expiration of a permit, the continued reasonableness of the use is reexamined, introducing a desirable flexibility into the development, use, and protection of water resources.²¹⁷ The *Regulated Riparian Model Water Code* sets twenty years as the duration of the permits.²¹⁸

208. MODEL CODE, *supra* note 206, § 6R-1-01; WATERS 1, *supra* note 24, § 9.03(a)–9.03(a)(2).

209. MODEL CODE, *supra* note 206, §§ 2R-1-01, 2R-2-20, 6R-3-01, 6R-3-02; WATERS 1, *supra* note 24, § 9.03(b)–9.03(b)(3). Some jurisdictions would substitute the terms “beneficial,” “reasonable-beneficial,” or “equitable” for “reasonable.”

210. MODEL CODE, *supra* note 206, §§ 6R-2-01 to 6R-2-08, 6R-3-02, 6R-3-05; WATERS 1, *supra* note 24, § 9.03(a)(5)(A), 9.03(b)(1)–9.03(b)(3).

211. *Cf. Joslin v. Marin Mun. Water Dist.*, 429 P.2d 889 (Cal. 1967) (denying compensation where the use was unreasonable); *Harris*, 283 S.W.2d 129. *Harris* is discussed in the text *supra* at notes 84–100.

212. MODEL CODE, *supra* note 206, § 7R-1-01; WATERS 1, *supra* note 24, §§ 9.03(a)(5)(A), 9.05–9.05(c).

213. MODEL CODE, *supra* note 206, §§ 6R-1-02, 6R-3-04; WATERS 1, *supra* note 24, §§ 9.03(a)(3), 9.05(c).

214. MODEL CODE, *supra* note 206, §§ 6R-1-03, 6R-3-02; WATERS 1, *supra* note 24, § 9.03(a)(4).

215. MODEL CODE, *supra* note 206, § 2R-1-02; WATERS 1, *supra* note 24, § 9.03(a)(2).

216. MODEL CODE, *supra* note 206, § 7R-1-02; WATERS 1, *supra* note 24, § 9.03(a)(4).

217. *See Freyfogle*, *supra* note 36, at 515.

218. MODEL CODE, *supra* note 206, § 7R-1-02. For an analysis of the merits of possible durations for the permits, see MALONEY, AUSNESS, & MORRIS, *supra* note 106, at 173–77; Ausness, *supra* note 204, at 584–87; WATERS 1, *supra* note 24, § 9.03(a)(4).

Regulated riparian statutes include elaborate judicial enforcement provisions,²¹⁹ provide for hearings within the agency,²²⁰ and judicial review of agency decisions.²²¹ Courts generally have been highly deferential in reviewing agency decisions under regulated riparian statutes.²²² Hawaii's Supreme Court, however, has invoked the public trust doctrine to justify taking a "close look" at agency decisions, at least regarding the protection of ecological values.²²³ The *Regulated Riparian Model Water Code* also supports alternative dispute resolution²²⁴ and the administrative resolution of disputes between permit holders²²⁵—provisions not generally found in actual regulated riparian statutes.²²⁶

While users are sometimes required to pay fees for permits based on the amount of water they use, the fees are not payment for the water itself.²²⁷ Statutes that set a uniform fee regardless of the amount of water used clearly do not charge for the water being used. Even if the fee is variable, however, it is set according to the presumed ability of the user to pay, rather than according to the value of the water or the value that could be created through use of the water.²²⁸ The *Regulated Riparian Model Water Code* breaks new ground in this respect, requiring water use fees that, to some extent at least, reflect the use value of the water.²²⁹ Charging for water use is intended to provide economic incentives for the efficient use of water in a setting where markets are not likely to be effective. Such fees can be varied by class,²³⁰ with the fees going into the general funds of the state.²³¹

219. MODEL CODE, *supra* note 206, §§ 5R-4-01 to 5R-5-03; WATERS 1, *supra* note 24, § 9.03(a)(5)(B).

220. MODEL CODE, *supra* note 206, §§ 5R-1-01 to 5R-1-03.

221. *Id.*, §§ 5R-3-01 to 5R-3-03.

222. *See, e.g.*, City of Fort Smith v. River Valley Reg'l Water Dist., 37 S.W.3d 631, 639 (Ark. 2001); Sw. Fla. Water Mgt. Dist. v. Charlotte County, 774 So. 2d 903, 910 (Fla. Ct. App. 2001); Sw. Fla. Water Mgmt. Dist. v. Save the Manatee Club, Inc., 773 So. 2d 594, 597 (Fla. Ct. App. 2000).

223. *In re Kukui (Molokai), Inc.*, 174 P.3d 320, 329-30 (Haw. 2007); *In re Waiahole Ditch*, 9 P.3d 409, 456 (Haw. 2000).

224. MODEL CODE, *supra* note 206, §§ 5R-2-01, 5R-2-02.

225. MODEL CODE, *supra* note 206, § 5R-2-03; WATERS 1, *supra* note 24, § 9.03(c). *See generally* Ane D. Deister, *Environmental Mediation Strategies for Success: Summaries of Two Consensus-Based Cases—Florida's Growth Management Act Legislation and the Los Angeles River Watershed Task Force*, 32 URB. LAW. 73 (2000); Sarah L. Inderbitzin et al., *The Use of Alternative Dispute Resolution in Natural Resource Damage Assessments*, 20 WM. & MARY ENVTL. L. & POL'Y REV. 1 (1995); Janet C. Neuman, *Run, River, Run: Mediation of a Water-Rights Dispute Keeps Fish and Farmers Happy—For a Time*, 67 U. COLO. L. REV. 259 (1996).

226. A few regulated riparian statutes provide for such remedies. *See* DEL. CODE ANN. tit. 7, § 6005(b)(2) (2006); GA. CODE ANN. § 12-5-42(a) (2006); HAW. REV. STAT. §§ 174C-10, 174C-11 (2008).

227. WATERS 1, *supra* note 24, §9.03(a)(5)(C).

228. *See, e.g.*, MINN. STAT. ANN. § 103G.271(6)(d) (1997); N.J. STAT. ANN. § 58:2-2 (2006).

229. MODEL CODE, *supra* note 206, § 4R-1-08.

230. *Id.*, § 4R-1-08(3).

231. *Id.*, § 4R-1-08(4).

Regulated riparian statutes also include extensive provisions for protecting and implementing the public interest in water resources,²³² including for long-term planning.²³³ The *Regulated Riparian Model Water Code* would establish a particularly comprehensive statewide data system.²³⁴ The administering agency also is usually given broad discretion to plan for and to deal with crises brought on by extreme water shortages, even including suspending permits in whole or in part.²³⁵ The agency can incorporate permit conditions based on its plans or as necessary to protect the public interest.²³⁶

The transition to regulated riparianism is easily justified on the basis of the state's police power to regulate water withdrawal and use in order to protect the public health, safety, and welfare.²³⁷ Still, fear of the political (if not the legal) repercussions of such transformation of traditional water rights has led many state legislatures to exempt from the permit requirement large classes of users (usually agricultural) who were using water when the new statute came into effect, thus introducing a significant temporal element.²³⁸ A more sophisticated solution would be to guarantee existing users an initial permit, but thereafter subject it to renewal on the same terms as any other permit, limiting the temporal preference to a single permit cycle.²³⁹ Existing users who refuse to apply for a permit within a short period of time after the new regulated riparian system comes into effect can then be conclusively presumed to have abandoned their claim of water right.²⁴⁰ There is some evidence, however, that administering agencies prefer to use temporal priority or *pro rata* sharing as the allocation method least likely to provoke litigation or other difficulties for the agency,²⁴¹ thereby sabotaging the whole scheme of regulated riparianism. Thus far, no clear way to prevent such sabotage of the administrative scheme has emerged.

Today, the main threats to the availability of water in eastern states, as to both quantity and quality, are not pollution or withdrawal, but the man-made physical and ecological transformation of water sources and the lands on or in which the sources are found. Global climate disruption is only the most extreme instance of such changes. Regulated riparian statutes address these problems through mandated planning and protections for the public interest,

232. WATERS 1, *supra* note 24, § 9.05(b)-9.05(d).

233. MODEL CODE, *supra* note 206, §§ 4R-2-01 to 4R-2-04; WATERS 1, *supra* note 24, § 9.05(a).

234. MODEL CODE, *supra* note 206, § 4R-2-03.

235. *Id.*, §§ 7R-3-01 to 7R-3-07; WATERS 1, *supra* note 24, § 9.05(d).

236. MODEL CODE, *supra* note 206, § 7R-1-01.

237. *State v. Braun*, 378 A.2d 640, 644 (Del. Super. Ct. 1977); *Vill. of Tequesta v. Jupiter Inlet Corp.*, 371 So. 2d 663, 670-71 (Fla. 1979); *Iowa Nat. Res. Council v. Van Zee*, 158 N.W.2d 111, 117 (Iowa 1968); *Crookston Cattle Co. v. Minn. Dep't of Natural Res.*, 300 N.W.2d 769, 774 (Minn. 1980); *Herschman v. State Dep't of Natural Res.*, 225 N.W.2d 841 (Minn. 1975); *State v. Kuluvar*, 123 N.W.2d 699, 704-05 (Minn. 1963); *Omernik v. State*, 218 N.W.2d 734, 743 (Wis. 1974). *See generally* WATERS 1, *supra* note 24, § 9.04(a).

238. WATERS 1, *supra* note 24, § 9.03(a)(3).

239. MODEL CODE, *supra* note 206, § 6R-1-03; WATERS 1, *supra* note 24, § 9.03(b)(3).

240. *Cf. United States v. Locke*, 471 U.S. 84 (1985) (cutting off mining claims by strictly enforcing filing deadlines); *In re Deadman Creek Drainage Basin*, 694 P.2d 1071 (Wash. 1985) (cutting off riparian rights in favor of appropriative rights).

241. WATERS 1, *supra* note 24, § 9.05(d) n.954.

including requirements for the agency to define and protect some minimum flow, whether an historic average low flow, the amount necessary for the preservation of certain kinds of wildlife, or the amount necessary to protect human health or well-being.²⁴² The *Regulated Riparian Model Water Code* in particular, requires protection of the biological, chemical, and physical integrity of the water source, defined in terms of federal, state, and other relevant legal standards.²⁴³

While regulated riparianism scores might well introduce flexibility into water usage and the protection of public values compared to appropriative rights—both important dimensions of adaptation to global climate disruption—regulated riparianism still has unsolved problems. Regulated riparian statutes usually do not provide for the transfer of water rights or permits between potential users.²⁴⁴ The *Regulated Riparian Model Water Code* charges the administering agency to encourage market transfers of water,²⁴⁵ but there seems to be little reason to think a market would function better under regulated riparianism than under appropriative or riparian rights.²⁴⁶ In practice, the agencies free up far less water through the renewal process than theory suggests because the agencies prefer to tighten conditions on existing uses rather than to deny renewal outright.²⁴⁷ Non-renewal of permits will likely remain an infrequent and cumbersome device unless the state is willing to create a good deal of investment insecurity.

Another problem that could impact the ability to adapt to global climate disruption is that the regulated riparian statute does not provide adequate security for investment in water facilities. If the duration of a permit is too short, leaving too little time to recover the initial cost of a project before the permit expires, private actors will be reluctant to invest in water facilities.²⁴⁸ Additional uncertainty could arise from the administering agency's power to modify permits in light of water emergencies, typically unforeseen water shortages.²⁴⁹ In the actual operation of regulated riparian systems, however, neither investment nor transfer insecurities seem to have caused difficulty.²⁵⁰

242. Lee P. Breckenridge, *Can Fish Own Water?: Envisioning Nonhuman Property in Ecosystems*, 20 J. LAND USE & ENVTL. L. 293, 308, 317-18 (2005); Lee P. Breckenridge, *Maintaining Instream Flow and Protecting Aquatic Habitat: Promise and Perils on the Path to Regulated Riparianism*, 106 W. VA. L. REV. 595, 604-07 (2004); WATERS 1, *supra* note 24, § 9.05(b); Klein, *supra* note 183; Mayland, *supra* note 183.

243. MODEL CODE, *supra* note 206, §§ 3R-2-01 to 3R-2-05.

244. WATERS 1, *supra* note 24, § 9.03(d).

245. MODEL CODE, *supra* note 206, §§ 1R-1-07, 7R-2-01 to 7R-2-04, 7R-3-05, 9R-1-01, 9R-1-02.

246. *See* Gould, *supra* note 151, at 110; Sinden, *supra* note 111; Dellapenna, *Disruption*, *supra* note 21; Dellapenna, *Myths*, *supra* note 62.

247. *See* WATERS 1, *supra* note 24, § 9.03(a)(4) nn.428-32.

248. MALONEY, AUSNESS, & MORRIS, *supra* note 106, at 175-77; Ausness, *supra* note 204, at 584-87; WATERS 1, *supra* note 24, § 9.03(a)(4); Gould, *supra* note 151, at 109-10.

249. Ausness, *supra* note 204, at 581-84; WATERS 1, *supra* note 24, §§ 9.03(d), 9.05(d); Gould, *supra* note 151, at 110, 117-21.

250. WATERS 1, *supra* note 24, § 9.03(a)(4).

Administering agencies have been, if anything, too sensitive to the fears of large institutional investors in water. Administering agencies seldom flatly refuse to renew a permit, although new and more stringent conditions are sometimes attached at the time of renewal.²⁵¹ Instead, authorities in eastern states generally have consulted with major water users in crafting responses to water emergencies and have not made their own expert determinations regarding the matter.²⁵² The cost of imposing an elaborate administrative system might also be substantial,²⁵³ so states might limit their regulated riparian system to certain water basins or other areas of the state where the competition for water is most intense.²⁵⁴

VI. CONCLUSION

Water law can either impede or facilitate the adaptation of societies to global climate disruption. None of the three models of water law found in the United States—riparian rights, appropriative rights, and regulated riparianism—guarantees that societies will strike the perfect balance between the public interest and private need, and between flexibility for society and certainty for the individual, while enabling optimal adaptation. Yet given the increasing failure of traditional riparian rights (a common property system) to cope with the needs of modern societies, the only slightly better performance of appropriative rights (as close to a private property system as we are likely to achieve), and the general failure of markets as a water management tool (as opposed to state water management masquerading as a market), there seems little choice but to move to a regulated riparian system (a public property system). Regulated riparianism is not a perfect system, but it appears to be the best suited for coping with the enormous challenges that the United States will face during the coming century—at least unless some other system is devised.

251. Such evidence suggests that the problem in actual practice is the opposite—agencies fail to exercise their managerial powers sufficiently rather than too aggressively. *See, e.g.*, Alexander Lane, *N.J. Too Generous with Water, Critics Say—State Permits for Big Users Rose Last Year*, STAR LEDGER, Sept. 28, 2003, at 21 (reporting increases in authorized water withdrawals during a major drought).

252. *See, e.g., id.*; Tom Avril, *There Are No Limits on Biggest Water Users: Drought Rules Don't Apply to Industry and Farms. Officials Say Jobs Could Be at Stake*, PHILA. INQUIRER, Mar. 11, 2002, at A1; Avril & Colimore, *supra* note 27; John-Thor Dahlburg, *A Lake Shrinks From Drought and Disarray*, L.A. TIMES, Apr. 18, 2001, at A8; Natalie Garcia, *R.I. Overuses Its Water Supply in Summer, Report Finds*, PROVIDENCE J., Apr. 30, 2008, at B2; Dupigny-Giroux, *supra* note 27.

253. WATERS 1, *supra* note 24, § 9.05(a)(5). *See also* Robert H. Abrams, *Water Allocation by Comprehensive Permit Systems in the East: Considering a Move Away from Orthodoxy*, 9 VA. ENVTL. L.J. 255, 257-70 (1990); Freyfogle, *supra* note 36, at 510-19; Frank J. Trelease, *The Model Water Code, the Wise Administrator and the Goddam Bureaucrat*, 14 NAT. RESOURCES J. 207 (1974); David W. Yoskowitz, *Markets, Mechanisms, Institutions, and the Future of Water*, 31 ENVTL. L. REP. 10237 (2001); Dellapenna, *Myths*, *supra* note 62, at 367-70, 375-77.

254. *See, e.g.*, ALA. CODE §§ 9-10B-1 to 9-10B-30 (2001); ARK. CODE ANN. §§ 15-22-201 to 15-22-622 (2003); FLA. STAT. §§ 373.012 – 373.619 (2006); HAW. REV. STAT. ANN. §§ 174C-1 to 174C-101 (2008); MASS. GEN. LAWS ANN. ch. 21G, §§ 1-19 (2002); VA. CODE ANN. §§ 62.1-242 to 62.1-253 (2006). *See generally* Abrams, *supra* note 253; WATERS 1, *supra* note 24, § 9.03(a)(1).

