GOVERNING WATER: THE SEMICOMMONS OF FLUID PROPERTY RIGHTS

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This Article applies an information-cost theory of property to water law. Because of its fluidity, exclusion is difficult in the case of water and gives way to rule of proper use, i.e., governance regimes. Looking at water through this lens reveals that prior appropriation employs more governance and riparianism rests more on a foundation of exclusion than is commonly thought. The development of increasing amounts of exclusion and governance are both compatible with a broadly Demsetzian account that is sensitive to the nature of the resource. Moreover, hybrids between prior appropriation and riparianism are not anomalous. Exclusion strategies based on boundaries and quantification allow for rights to be formal and modular, but this approach is particularly challenging in the case of water and other fugitive resources. The challenges of exclusion that water and other fugitive resources present often lead to a semicommons in which elements of private and common property both coexist and interact.

INTRODUCTION

Water is a fugitive resource that is expected to fulfill many human needs, including drinking and household uses, raising farm animals, irrigation, mining, power, manufacturing, sewage, navigation, wildlife, recreation, aesthetic, and environmental values. Some of these uses require withdrawals of water, some involve discharges into water, and others presuppose some quantity of water left in place. To serve all these ends, many parties require access to water, and at the same time water itself moves easily and replenishes partially (and not completely predictably) as part of the hydrologic cycle. Given the heterogeneity of uses, the costliness of measuring and monitoring them, and the difficulties in predicting flows of water from year to year, water is among the most challenging of resources from the point of view of property law. And, as we might expect, the nature of

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water law itself has proved elusive. The fluid nature of the resource and the multiplicity of possible uses have led to water regimes that differ by region and diverge in important ways from the law of real and personal property. Water law is seemingly so special that many commentators have seen reflected in it their preferred paradigms for property law more generally and have drawn very different lessons from it for the problems facing water users today.

In this Article, I apply an information-cost theory of property to water law. This model distinguishes two poles of a spectrum of strategies for delineating and enforcing property rights.[1] On the one end is the *exclusion* strategy which employs very rough proxies of access to things in order to delegate decisions over whole reservoirs of unspecified uses to owners.[2] By employing boundaries (and, if necessary, fences, etc.), the owner of Blackacre has the right to keep others out of Blackacre. Using this device, he can protect his interests in a wide range of uses, from growing crops, to maintaining a residence, to preserving habitat. The roughness and indirectness between the mechanism—the exclusion right—and the uses that are the owner's main interests make the exclusion strategy simple and easy for third parties to understand, but its crudeness also leaves many problems unaddressed. When use by multiple parties becomes important enough, in a positive or negative sense, it becomes worthwhile to move toward the opposite pole of the spectrum of strategies and expend more delineation effort on a *governance* strategy, which prescribes proper use. Governance rules can range from contractual (e.g., covenants) to off-the-rack common law (nuisance) to statutes and regulations (e.g., zoning and pollution control).

In the following Article, I will focus on information costs. Broadly speaking, these include the cost of measuring stocks or flows of a resource, and of delineating, monitoring, and enforcing property rights to them. Crucially, information costs follow from the need to select and meter various proxies.[3] Thus, crossing a boundary onto land is a very rough proxy for use of or harm to land, whereas measurement of a volume of pollution can involve increasingly precise proxies for the harm to humans (amount discharged, location, dissipation patterns, etc.). If information costs are as important as I hypothesize them to be, a partial model emphasizing information costs should shed some light on the direction of evolution of rights to water. Moreover, important aspects of water rights, such as the need for groups of users to organize politically, are related to information costs. Groups that advocate uses that are easier to measure can more readily organize in the political process and push through their proposals.[4] Broadly

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1. Henry E. Smith, *Exclusion Versus Governance: Two Strategies for Delineating Property Rights*, 31 J. LEGAL STUD. S453 (2002).

2. *Id.* at S454–56, S467–78.

3. *See, e.g.*, Yoram Barzel, *Measurement Cost and the Organization of Markets*, 25 J.L. & ECON. 27 (1982).

4. For example, copyright interests have organized to shape copyright law throughout its modern history. Jessica D. Litman, *Copyright, Compromise, and Legislative History*, 72 CORNELL L. REV. 857, 870–79 (1987) (detailing the role of interest groups in the legislative history of the 1976 Copyright Act). This may be because the uses that political groups coalesce around are easily identified and more easily measured than uses in other

speaking, transaction costs are institution costs, which include the costs of the information required to establish, maintain, and use them. That is, information costs play a role in most aspects of the demand for and supply of institutions.[5] Nevertheless, in its focus on information costs, the model here is deliberately only a partial one.

Water stocks are inherently uncertain and the multiple interacting uses of water form a complex system. Water law employs a variety of strategies to deal with this complexity. The two main systems in the common law of water are riparianism characteristic of Eastern states, in which owners of land abutting watercourses have a right to reasonable use of the water, and prior appropriation, characteristic of some Western states, in which priority rights to use water are established by diversion for beneficial use.[6] As in the rest of property law, some complexity can be managed by cabining off parts of the system into modules, within which interaction is intense but between which interaction is sparse and stereotyped.[7] Thus, who the owner of a parked car is or what his attributes are becomes irrelevant to the duty not to steal or damage the car.[8] What a landowner is doing on Blackacre is less relevant to outside tortfeasors than one might think.[9] The exclusion strategy allows such modularization, and in the case of land much (but not nearly all) of what an owner does and who she is can be hidden behind the boundary of a modular property right. Only when conflicts become high in stakes is it worth enriching the interface, as in covenants, nuisance, and zoning. In the

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branches of intellectual property, such as patent law. Henry E. Smith, *Intellectual Property as Property: Delineating Entitlements in Information*, 116 YALE L.J. 1742, 1813–14 (2007).

5. *See, e.g.*, Douglas W. Allen, *What Are Transaction Costs?*, 14 RES. L. & ECON. 1 (1991) (arguing that transaction costs are better defined as the costs of establishing and maintaining property rights, in the economist's sense of a de facto ability to derive utility from an action, rather than narrowly as the costs of exchange); Steven N.S. Cheung, *The Transaction Costs Paradigm*, 36 ECON. INQUIRY 514, 515 (1998) ("'Transaction costs' must be defined to be all the costs which do not exist in a Robinson Crusoe economy.").

6. *See infra* Part III.

7. Smith, *supra* note 4, at 1748, 1765; Henry E. Smith, *Modularity in Contracts: Boilerplate and Information Flow*, 104 MICH. L. REV. 1175, 1176 (2006).

8. J.E. PENNER, THE IDEA OF PROPERTY IN LAW 75–76 (1997).

9. *See* LeRoy Fibre Co. v. Chi., Milwaukee & St. Paul Ry., 232 U.S. 340, 350–52 (1914) (holding that landowner need not take precaution in anticipation of tort of another). Wood's classic formulation makes rights into modules with a simple interface:

> It is the duty of every person or public body to prevent a nuisance, and the fact that the person injured could, but does not, prevent damages to his property therefrom is no defense either to an action at law or in equity. A party is not bound to expend a dollar, or to do any act to secure for himself the exercise or enjoyment of a legal right of which he is deprived by reason of the wrongful acts of another.

1 H.G. WOOD, A PRACTICAL TREATISE ON THE LAW OF NUISANCES IN THEIR VARIOUS FORMS: INCLUDING REMEDIES THEREFOR AT LAW AND IN EQUITY § 435 (3d ed. 1893) (citation omitted). Torts scholars have found this aspect of land ownership puzzling. *See, e.g.*, Susan Rose-Ackerman, *Dikes, Dams, and Vicious Hogs: Entitlement and Efficiency in Tort Law*, 18 J. LEGAL STUD. 25, 35–38 (1989); *see also* Mark F. Grady, *Common Law Control of Strategic Behavior: Railroad Sparks and the Farmer*, 17 J. LEGAL STUD. 15 (1988).

case of water, as we will see, basic water law seeks to manage uncertainty and complexity through basic modules (priority in prior appropriation, appurtenancy to land in riparianism), but because of its fugitive nature, modularization through the exclusion strategy needs to give way quickly to richer interfaces through the governance strategy. Delineation of rights in terms of use and regulation of activities with respect to water have always played, and promise to continue to play, a large role in all the common law water systems, prior appropriation, riparian, and hybrid alike.

Because water is fugitive, it is generally recognized that exclusion in the sense of land or chattels is somehow difficult.[10] Indeed, Blackstone, in a somewhat exaggerated fashion, thought that by definition property in water had to be usufructory.[11] The information-cost theory allows a more refined and accurate version of this proposition and several others that can be derived and tested. With most resources, the marginal costs of exclusion rise as more precision is called for: think of trying to use fences, or even conditional exclusion rules alone, in trying to prevent hired hands from pilfering from a farm.[12] In the case of water—like other fugitive resources—the marginal cost of employing the exclusion strategy rises especially quickly; demarcating a specific instance of moving water is problematic, and water is valued for hard-to-measure attributes, like timing and

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10. *See, e.g.*, Rance L. Craft, *Of Reservoir Hogs and Pelt Fiction: Defending the* Ferae Naturae *Analogy Between Petroleum and Wildlife*, 44 EMORY L.J. 697, 722–23, 727–28 (1995) (arguing that fugitive resources are characterized by difficulties in establishing rights of access to stocks); Dean Lueck, *The Rule of First Possession and the Design of the Law*, 38 J.L. & ECON. 393, 425 (1995) (exploring similar difficulties in establishing full ownership over fugitive resources such as wildlife, oil, and gas, and the analogous legal treatment they receive); Lior Jacob Strahilevitz, *Information Asymmetries and the Rights to Exclude*, 104 MICH. L. REV. 1835, 1843 (2006) (noting "certain fugitive resources, such as air, that do not lend themselves to exclusion-oriented strategies," which are the alternative to use-oriented governance strategies). A leading case on the application of the rule of capture to oil and gas diagnoses the common problem:

> Water and oil, and still more strongly gas, may be classed by themselves, if the analogy be not too fanciful, as minerals feræ naturæ. In common with animals, and unlike other minerals, they have the power and the tendency to escape without the volition of the owner. Their "fugitive and wandering existence within the limits of a particular tract was uncertain," . . . .

Westmoreland & Cambria Natural Gas Co. v. DeWitt, 18 A. 724, 725 (Pa. 1889) (quoting Brown v. Vandegrift, 80 Pa. 142, 148 (1875)). On traditional criticisms of the rule of capture, see Craft, *supra*, at 707–10.

11. A usufructory right is a right to use as opposed to a right to exclude, and Blackstone believed that in the case of water the difficulties with the latter make the former the most that can be claimed:

> For water is a movable, wandering thing, and must of necessity continue common by the law of nature; so that I can only have a temporary, transient, usufructuary property therein: wherefore, if a body of water runs out of my pond into another man's, I have no right to reclaim it.

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12. Dogs can be trained to guard boundaries but not to monitor activities by those with authorized access. Robert C. Ellickson, *Property in Land*, 102 YALE L.J. 1315, 1329 (1993).

properties of flow, none of which are amenable to a simple fencing strategy analogous to the one used in land.[13] Measuring quantities of flowing water, much less possessing an entire watercourse, is a nontrivial exercise. This makes a focus on use relatively more attractive. A shift to governance strategies that deal with particular classes of uses will occur more readily in the case of water than in the case of other comparably valuable resources.

Although prior appropriation is more exclusion-based than riparianism, both of the major common law water systems, in comparison to nonfugitive property regimes, mix small amounts of exclusion with large and increasing amounts of governance. In the case of the riparianism that is common in Eastern states, the emphasis on reasonable use makes the system look like one of governance. But I will argue that the riparian system, like other property systems, employs exclusion as a first cut at the problem of water overuse, and relies on exclusion to an extent greater than is usually recognized.[14] Perhaps more surprisingly, the prior appropriation system characteristic of the arid Western states, which is conventionally thought of as a parcelized system of private exclusion rights, in fact relies heavily on the governance strategy.[15] The information-cost theory suggests reasons for the heavy focus on uses in prior appropriation, in addition to the basic exclusion-like priority scheme. Some otherwise puzzling aspects of prior appropriation that look wasteful from the point of view of conventional private property make sense in terms of reducing the costs of delineating and enforcing water rights under the governance aspect of an appropriation regime.

The special combination of minimal exclusion and elaborate governance in both riparianism and prior appropriation (and not only in hybrid regimes) leads to a semicommons.[16] A semicommons exists where private and common property overlap and potentially interact.[17] A semicommons is particularly likely in the case of water because basic exclusion is difficult. This difficulty of exclusion starts with one of water's aspects as a public good: preventing access to the resource is costly. First, it is costly to monitor access by multiple potential appropriators. Second, preventing access by all but one user is undesirable in that one user often cannot make full use of the watercourse. This is particularly true where many types of uses can co-exist in theory but strategic behavior is a danger. As a result, the private claims of various users overlap, and are overlaid with group and public rights. The semicommons theory also raises the possibility that mixtures of elements of riparianism and first-appropriation can be cost-effective. By contrast, commentary has favored nonhybrid systems and tended to regard riparianism and prior appropriation as pure systems and other combinations and compromises as inherently deviant and unstable.[18] Combining systems does lead to challenges of

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13. For an application of the present framework to another elusive resource—information—see Smith, *supra* note 4.

14. *See infra* Part III.B.

15. *See infra* Part III.A.

16. Henry E. Smith, *Semicommon Property Rights and Scattering in the Open Fields*, 29 J. LEGAL STUD. 131 (2000).

17. *Id.* at 132–33, 138–44.

18. *See infra* note 72 and accompanying text.

conflict and strategic behavior at their intersection, but if multiple use is valuable enough, it makes sense to tolerate some such behavior or to deal with it through governance regimes often employed in a semicommons. The uneasy compromises in water law are at least theoretically a second-best solution to the problem of a fugitive resource that lends itself to multiple types of valuable uses.

The Article begins in Part I with an overview of water law through the lens of prior accounts. It shows that these views tend to emphasize important aspects of water law that lead either to exclusion on the one hand or governance on the other, but largely ignore the other type of strategy. Part II will present a simple information-cost theory of property rights, which derives propositions about how exclusion and governance will be deployed, based on their marginal costs and benefits and changes to these quantities over time. Part III shows how riparianism and prior appropriation both combine small amounts of exclusion and (increasingly) elaborate governance, as compared to regular property in nonfugitive resources. In Part IV, I argue that water law tends to be a semicommons, as in the case of fugitive resources more generally.

I. THE NATURE OF WATER LAW

Existing economically oriented accounts of water law appear to contradict each other. In terms of the model offered here, each of the existing theories emphasizes only part of the story, exclusion or governance.

The most familiar account of water law is Demsetzian. In his landmark 1967 article, Harold Demsetz argued that property rights emerge when the benefits of internalizing externalities exceed the costs of internalization.[19] Rising resource values or decreases in the cost of definition and enforcement should lead us to expect the emergence of property rights, although Demsetz largely left out of the model any specifics about the process by which this would happen on the supply side.[20] The Demsetz model, as I have argued elsewhere, is compatible with the rise of common property out of open access and the adoption of increasingly stringent governance rules once common property has been established.[21] But many,

19. Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347, 350 (1967) (Papers & Proc.).

20. For neoinstitutional accounts of the development of property rights that pay more attention to the supply side, see for example THRÁINN EGGERTSSON, ECONOMIC BEHAVIOR AND INSTITUTIONS (1990); GARY D. LIBECAP, CONTRACTING FOR PROPERTY RIGHTS (1989). For contrasting views of the supply of property rights and its implications for the Demsetz thesis, see Saul Levmore, *Two Stories about the Evolution of Property Rights*, 31 J. LEGAL STUD. S421 (2002) (arguing that virtually any transition to or from private-property regime can by explained by either an optimistic transaction-cost-lowering story or a competing suspicion-inducing interest-group story); *see also* Stuart Banner, *Transitions Between Property Regimes*, 31 J. LEGAL STUD. S359, S369–71 (2002) (arguing that oligarchs are in position to overcome obstacles in the way of transitions between property regimes, and raising the question why this would or would not tend toward efficiency); Katrina Miriam Wyman, *From Fur to Fish: Reconsidering the Evolution of Private Property*, 80 N.Y.U. L. REV. 117 (2005) (arguing for need to pay greater attention to political process in the evolution of property rights).

21. Smith, *supra* note 1, at S474–84.

including Demsetz himself, expected parcelization and private property to be the universal tendency for valuable resources.[22] Late in his article, Demsetz makes the additional assumption that internalization in communal property is prohibitively costly.[23] Indeed, Demsetz seems to equate common property with open access when he says "[c]ommunal property rights allow anyone to use the land."[24] As many have pointed out, especially in connection with Hardin's *Tragedy of the Commons*,[25] common property—as opposed to open access—involves excluding all but a group (sometimes called the commoners) from access to the common resource, and can involve rules and norms governing the behavior of those with access.[26] Indeed, the historical example of the grazing commons was not tragic for precisely this reason.[27] Whether or not any given commons is optimal is a difficult question, but the combination of exclusion and governance in common property allowed common grazing areas to avoid tragedy for centuries.[28] Some such areas survive even today.[29]

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22. Demsetz, *supra* note 19, at 355–57.

23. *Id.* at 355.

24. *Id.* at 356.

25. Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243, 1244 (1968). Hardin provided a catchy label and an arresting (but incorrect) example for an analysis that had been performed earlier in H. Scott Gordon, *The Economic Theory of a Common-Property Resource: The Fishery*, 62 J. POL. ECON. 124 (1954); *see also* Steven N.S. Cheung, *The Structure of a Contract and the Theory of a Non-Exclusive Resource*, 13 J.L. & ECON. 49, 64 (1970). Years earlier Jens Warming proposed something similar to Gordon's solution, writing in Danish. *See* Jens Warming, *Om "Grundrente" af Fiskegrunde*, 49 NATIONALÖKONOMISK TIDSSKRIFT 495 (1911), *translated in* Peder Anderson, *"On Rent of Fishing Grounds": A Translation of Jens Warming's 1911 Article, with an Introduction*, 15 HIST. POL. ECON. 391 (1983); Jens Warming, *Aalgaardsretten*, 69 NATIONALÖKONOMISK TIDSSKRIFT 151 (1931). And the basic intuition of the tragedy of the commons can be found in Aristotle, who wrote: "[W]hat is common to the greatest number has the least care bestowed upon it. Everyone thinks chiefly of his own, hardly at all of the common interest." ARISTOTLE, THE POLITICS AND THE CONSTITUTION OF ATHENS 33 (Stephen Everson ed., Benjamin Jowett trans., 1996).

26. *See, e.g.*, ELINOR OSTROM, GOVERNING THE COMMONS: THE EVOLUTION OF INSTITUTIONS FOR COLLECTIVE ACTION 2–28 (1990); James M. Acheson, *Management of Common-Property Resources*, *in* ECONOMIC ANTHROPOLOGY 351, 359 (Stuart Plattner ed., 1989); Thráinn Eggertsson, *Open Access Versus Common Property*, *in* PROPERTY RIGHTS: COOPERATION, CONFLICT, AND LAW 74–82, 84–85 (Terry L. Anderson & Fred S. McChesney eds., 2003); Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711 (1986); *see also* Alison Rieser, *Prescriptions for the Commons: Environmental Scholarship and the Fishing Quotas Debate*, 23 HARV. ENVTL. L. REV. 393, 399–400 (1999).

27. *See* sources cited *supra* notes 25–26.

28. For a detailed study of a governance regime in a grazing commons, see Karen J. Friedmann, *Fencing, Herding, and Tethering in Denmark, from Open-Field Agriculture to Enclosure*, 58 AGRIC. HIST. 584, 593–94 (1984).

29. *See, e.g.*, ROBERT MCC. NETTING, BALANCING ON AN ALP: ECOLOGICAL CHANGE AND CONTINUITY IN A SWISS MOUNTAIN COMMUNITY 58–61 (1981); GLENN G. STEVENSON, COMMON PROPERTY ECONOMICS: A GENERAL THEORY AND LAND USE APPLICATIONS 214–15 (1991); *see also* Thráinn Eggertsson, *Analyzing Institutional Successes and Failures: A Millennium of Common Mountain Pastures in Iceland*, *in* THE

This Demsetzian ambiguity about common property and open access extends to water. As an example of the difficulties with "communal property," Demsetz offers the problem of negotiations between a farmer who wants a stream as it is and someone else who wants to dam it: in private property this involves the negotiation between two parties (adjacent landowners), but in "communal property" it would involve everyone.[30] Distinguishing only private property and open access ignores the possibility that water might be (limited access) common property, which belongs to a group but not the world at large.[31]

At first blush, Western water law looks like Exhibit A for the Demsetzian theory.[32] Although prior appropriation rights arose first in mining camps on federal lands, and the federal government did not make clear its acceptance of prior appropriation until the Mining Act of 1866,[33] Eastern riparianism (or the older natural flow theory) was the received common law approach and became the baseline for later developments in U.S. water law.[34] Riparianism was a common property regime characterized by rules of reasonableness, with a requirement of injury.[35] For example, if an upper riparian dams a river, a riparian farmer needing the water for irrigation would normally have a claim. Water has been relatively plentiful in the East—especially at the time the riparian doctrine formed in the nineteenth century—and conflicts over water, while not unknown, were not as intense as in the West. In the more arid West, water is scarcer, giving rise to more important externalities, and as expected private exclusive property rights (on this view of prior appropriation) emerge to internalize them. An earlier appropriator of water for a beneficial use, even on land in another watershed, has a right to the amount of water necessary for this use, as against any later appropriator. Language in Western judicial opinions, most notably in *Coffin v. Left Hand Ditch Co.*, only serves to reinforce the role of scarcity in the "parcelization" of Western water.[36]

POLITICAL ECONOMY OF CUSTOMS AND CULTURE: INFORMAL SOLUTIONS TO THE COMMONS PROBLEM 109, 110 (Terry L. Anderson & Randy T. Simmons eds., 1993).

30. Demsetz, *supra* note 19, at 357.

31. *See, e.g.*, Lueck, *supra* note 10, at 427–28; Carol M. Rose, *Energy and Efficiency in the Realignment of Common-Law Water Rights*, 19 J. LEGAL STUD. 261, 262, 293–95 (1990).

32. *See, e.g.*, Terry L. Anderson & P. J. Hill, *The Evolution of Property Rights: A Study of the American West*, 18 J.L. & ECON. 163, 176–78 (1975); *see also* RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW § 3.2, at 40–42 (5th ed. 1998).

33. Ch. 262, § 9, 14 Stat. 251, 253 (codified as amended at 43 U.S.C. § 661 (2006)).

34. *See, e.g.*, M. CATHERINE MILLER, FLOODING THE COURTROOMS: LAW AND WATER IN THE FAR WEST 10–66 (1993).

35. Tyler v. Wilkinson, 24 F. Cas. 472, 474 (C.C.D.R.I. 1827) (Story, J.); Rose, *supra* note 31, at 264.

36. 6 Colo. 443, 446 (1882). The court stated:

> The climate is dry, and the soil, when moistened only by the usual rainfall, is arid and unproductive; except in a few favored sections, artificial irrigation for agriculture is an absolute necessity. Water in the various streams thus acquires a value unknown in moister climates. Instead of being a mere incident to the soil, it rises, when appropriated, to the dignity of a distinct usufructuary estate, or right of property.

Commentators in this tradition point to the priority system as the basis for exclusive rights.[37] Also, water decrees are formulated in terms of quantity, as are opinions in cases involving change of use and transfer. As we will see, these uses of quantity measures are a little misleading, but they do give the impression of exclusion-based rights.[38] Later, we will see that the idea that "more property" in the Western regime need not mean parcelization. Rather, the greater property rights effort expected on Demsetz's framework can take the form of increasingly articulated governance regimes.

Many in the Demsetzian tradition recognize that scarcity has not led to monotonic increases in the clear definition, exclusivity, and transferability of rights, as one would expect from prior appropriation on the narrow version of the Demsetz thesis.[39] Consider some features of prior appropriation law that fit uneasily into the simple Demsetzian "parcelization" story. On the narrow Demsetzian point of view, on which rising resource values give rise to parcelization—more private property and rights to exclude in particular—several features of Western water law appear anomalous and wasteful. The use-it-or-lose-it quality of Western water law makes little sense because it encourages needless use simply in order to maintain rights.[40] Likewise, the traditional conserved water doctrine, under which saved water (for example, from improving the lining of irrigation ditches) is forfeited, seems particularly perverse in that it provides little incentive to conserve.[41]

The traditional difficulty of, and hostility to, transfers of water rights also makes little sense on the Demsetzian view.[42] Part of the difficulty is that the

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Id. Notice, though, that the right is described as usufructory, as it must be, because ultimate ownership of water in Colorado resides in the state under the Colorado Constitution. COLO. CONST. art. 16, § 5 ("The water of every natural stream, not heretofore appropriated, within the state of Colorado, is hereby declared to be the property of the public, and the same is dedicated to the use of the people of the state, subject to appropriation as hereinafter provided."); Wheeler v. N. Colo. Irrigation Co., 17 P. 487, 489–90 (Colo. 1888).

37. *See, e.g.*, TERRY L. ANDERSON & PETER J. HILL, THE NOT SO WILD, WILD WEST: PROPERTY RIGHTS ON THE FRONTIER 178–80 (2004); Anderson & Hill, *supra* note 32, at 177–78; *see also, e.g.*, Lueck, *supra* note 10, at 427–30 (associating priority with exclusivity but noting limits to exclusivity under prior appropriation through delineation in terms of diversion and protection of downstream appropriation of return flows).

38. Nicole L. Johnson, *Property Without Possession*, 24 YALE J. ON REG. 205, 218–19 (2007).

39. *See, e.g.*, Jedidiah Brewer, Robert Glennon, Alan Ker & Gary Libecap, *Transferring Water in the American West: 1987–2005*, 40 U. MICH. J.L. REFORM 1021, 1025 (2007).

40. *See, e.g.*, Stephen F. Williams, *The Requirement of Beneficial Use as a Cause of Waste in Water Resource Development*, 23 NAT. RESOURCES J. 7 (1983).

41. *See, e.g.*, Salt River Valley Water Users' Ass'n v. Kovacovich, 411 P.2d 201, 204 (Ariz. Ct. App. 1966); Se. Colo. Water Conservancy Dist. v. Shelton Farms, Inc., 529 P.2d 1321 (Colo. 1974). More recently with a greater emphasis on conservation, statutes have been passed to allow appropriators to keep certain types of water (e.g., recycled, desalinated or polluted water that would not have been useful to downstream appropriators anyway) they have conserved. *See, e.g.*, CAL. WATER CODE §§ 1010(b), 1011(b) (West 2006); OR. REV. STAT. §§ 537.455 to .500 (2006).

42. *See, e.g.*, POSNER, *supra* note 32; Anderson & Hill, *supra* note 32.

Western system protects return flows without measuring them. If A appropriates enough water to irrigate 100 acres, and this leads to a return flow, B who is downstream can appropriate any and all of the return flow. If A wants to change the point of diversion or the nature of the use, then B has a right to the return flow the same as it was beforehand if required for her appropriative use. In other words, any change proposed by A cannot diminish later appropriative rights to return flow. Because this no-injury rule makes rights hard to transfer independently of land and makes a transfer to a new use particularly difficult, private property theorists tend to recommend that Western water law become more parcelized by defining rights in terms of consumption.[43] As we will see, others have pointed out that third-party effects remain.[44] Indeed for Demsetzians and others who see Western water law as a private property system trying to come out of its shell, the answer is to more rigorously apply the exclusion paradigm and so (on this view) to push the Demsetzian evolution further along.[45]

Finally, historical developments have not wholly accorded with the exclusive-rights version of the Demsetz thesis. As Carol Rose points out, at earlier stages of Eastern water law, a prior appropriation theory was available and could have been used more extensively in developing Eastern water law.[46] Even if it somehow was not worth the trouble to parcelize at that stage, water in the East is scarcer today. But instead of moving toward prior appropriation, water law in the East is moving toward a regulated riparianism under which the basic riparian system is overlaid with regulation and official permits.[47] Such systems vary but tend to at least require a permit for large new consumptive uses of water and allow for greater regulatory decision-making authority in the case of water conflicts. If these permits become tradable, the evolution seems far from the narrow Demsetzian progression from "communal" to "private," but is consistent with the broader version of the Demsetz thesis.

Others take the opposite approach, emphasizing the governance aspect of both riparianism and prior appropriation and holding it up as an ideal for property law more generally.[48] Riparianism can be fruitfully regarded as a common property regime, and like other common property regimes, it relies heavily on ex post standards to contain the tragic tendencies of common property regimes.[49] The rule of reasonable use limits the activities of those with access and largely prevents

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43. *See, e.g.*, Lueck, *supra* note 10, at 429; *see also* CHARLES J. MEYERS & RICHARD A. POSNER, MARKET TRANSFERS OF WATER RIGHTS: TOWARD AN IMPROVED MARKET IN WATER RESOURCES 290 (National Water Commission, Legal Study No. 4, NTIS No. NWC-L-71-009, July 1971) (proposing property rights to return flows).

44. *See* Ronald N. Johnson, Micha Gisser & Michael Werner, *The Definition of a Surface Water Right and Transferability*, 24 J.L. & ECON. 273 (1981).

45. *See supra* note 43 and accompanying text; *see also, e.g.*, TERRY L. ANDERSON, WATER CRISIS: ENDING THE POLICY DROUGHT (1983) (arguing for further development of markets for private rights in water).

46. Rose, *supra* note 31, at 274–82.

47. *See* Joseph W. Dellapenna, *Regulated Riparianism*, *in* 1 WATERS AND WATER RIGHTS, ch. 9 (Robert E. Beck ed., 1991 ed., repl. vol. 2001).

48. *See, e.g.*, Eric T. Freyfogle, *Context and Accommodation in Modern Property Law*, 41 STAN. L. REV. 1529 (1989).

49. Rose, *supra* note 31, at 290–94.

major consumptive diversions.[50] Eric Freyfogle argues that prior appropriation has moved away from what I would call exclusion towards a governance regime in which "[a]utonomous, secure property rights have largely given way to use entitlements that are interconnected and relative."[51] Freyfogle's focus is on California's hybrid of prior appropriation and riparian water law, and he points to restrictions on riparian rights that use must be reasonable and to doctrines like the public trust that impose a layer of public rights on top of private rights in water.[52] But he also interestingly points out the governance elements in prior appropriation itself. Most obviously, like riparianism in many states, prior appropriation has acquired a regulatory overlay, in which permits are required and authorities are increasingly empowered to take third-party and even the public interest into account when considering requests for changes in use or transfers of water rights.[53] But Freyfogle argues that water rights are not just undergoing regulation but also redefinition in a more complex, context-sensitive, and correspondingly less exclusionary direction.[54] To Freyfogle, a landmark case is *In re Water of Hallett Creek Stream System*,[55] in which the California Supreme Court decided that the federal government impliedly reserved riparian water rights on land designated for particular federal purposes.[56] But even fairly traditional aspects of the prior appropriation system—like the no-injury rule, in which changes in use and transfers must preserve return flows being used by downstream appropriators—make prior appropriation more use-based (and more governance-like in our terms) than appears in most of the commentary.[57] Most fundamentally, Freyfogle emphasizes that water rights are inherently use rights, giving rise to a nonexclusive, use-based, interconnected system of rights that takes many contextual factors and diverse interests into account.[58] According to Freyfogle, this element of governance has increased in recent years. The new, even more contextual rights regime takes responsibilities more seriously and puts more government effort into choosing the combination of uses that will prevail.[59] Overall, the system of water rights is a "complex web of mutual dependencies,"[60] such that the "water-using clan" is "[n]ow structured by connectedness rather than by hierarchy."[61]

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50. Rose's account emphasizes the public good nature of the uses to which water is typically put under riparian regimes. *See infra* notes 66–71and accompanying text.

51. Freyfogle, *supra* note 48, at 1530.

52. Nat'l Audubon Soc'y v. Super. Ct. (Mono Lake), 658 P.2d 709 (Cal. 1983); Freyfogle, *supra* note 48, at 1536–37.

53. *See, e.g.*, Robert Glennon, *Water Scarcity, Marketing, and Privatization*, 83 TEX. L. REV. 1873, 1893–94 (2005) (discussing role of public utility commissions).

54. Freyfogle, *supra* note 48, at 1538–40.

55. 749 P.2d 324 (Cal. 1988).

56. Freyfogle, *supra* note 48, at 1529–35.

57. *Id.* at 1539.

58. *Id.* Interestingly, the fluid nature of water and the consequent necessity of water rights to be usufructory led Blackstone to emphasize (or exaggerate) appropriation as a basis for water rights.

59. *Id.* at 1540.

60. *Id.* at 1545.

61. *Id.* at 1547.

To Freyfogle, the interconnected use-based nature of water rights under both riparianism and prior appropriation (and especially the hybrid Californian system upon which he spends the most attention) is the wave of the future.[62] In his view, Californian water rights bear little resemblance to traditional concepts of property—by which he means rights to exclude—and he believes that the rest of property law can learn from this trend in water law.[63] Freyfogle taps into a strong skepticism about traditional exclusive property rights and concepts that is characteristic of Legal Realism and its successor movements.[64] In our terms, the claim is that as the interactivity and importance of third-party effects become more important we will not only get more delineation effort but that it will take the form of more governance, even to the partial exclusion of the exclusion strategy.

One question that remains on Freyfogle's account of the Legal Realist perspective more generally is what role if any exclusion still plays. Descriptively it does play a role, and I will argue that the nature of water, and certain other resources like intellectual property and broadcast spectrum, call for exclusion that is more limited but still importantly forms a platform for further governance. Because exclusion is very costly and the marginal cost of exclusion rises very rapidly in the case of these fugitive resources, the shift to governance happens quickly. Also, because exclusion is limited by the nature of the resource, the mixture of exclusion and governance tends in the direction of a semicommons. It is interesting in this regard to note that Freyfogle takes as his main example California, the most hybrid of the Western water regimes. Exclusion is not Freyfogle's focus, and we still need a theory of how much and what types of exclusion different conditions in water law require.

One major step toward answering this question is, as Carol Rose has argued, to derive some consequences for entitlement delineation from the nature of the resource and its potential uses.[65] Rose argues that Eastern and Western water law developed along different tracks because of the different nature of the uses to which water is put in the two areas.[66] In the East during the formative period of riparian water law, water was used mainly for water power in addition to minor consumptive household uses, etc. The watercourse was thus more valuable as a whole and could be used by riparians in turn.[67] Uses were nonconsumptive, making the water approximate a public good. Also, in the case of a long river with many water-powered mills, the number of riparians is large (but not as large as it

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62. *Id.* at 1530.

63. *Id.* at 1552–53.

64. *See, e.g.*, Arthur Linton Corbin, *Taxation of Seats on the Stock Exchange*, 31 YALE L.J. 429, 429 (1922) ("Our concept of property has shifted . . . . '[P]roperty' has ceased to describe any *res*, or object of sense, at all, and has become merely a bundle of legal relations—rights, powers, privileges, immunities."); Thomas C. Grey, *The Disintegration of Property*, *in* NOMOS XXII: PROPERTY 69 (J. Roland Pennock & John W. Chapman eds., 1980); *see generally* Thomas W. Merrill & Henry E. Smith, *What Happened to Property in Law and Economics?*, 111 YALE L.J. 357 (2001).

65. Rose, *supra* note 31.

66. *Id.* at 290–94.

67. *Id.* at 291–92.

would be if nonriparians had access), so that some judicial off-the-rack rules along the lines of nuisance make some sense.[68]

By contrast, in the West, water was and is used for a variety of consumptive purposes, ranging from mining to irrigation and, these days, municipal consumption. Accordingly, prior appropriation developed to deal with these irreconcilable potential uses of the water; for example, in times of drought, two irrigators could not use the same water.[69] Greater parcelization makes sense and is consistent even with the narrow version of the Demsetz thesis. What seems to contradict Demsetz is the rejection of early examples of appropriation in the law of some Eastern states like Massachusetts in favor of the less parcelized riparian system.[70] According to Rose's account, Western water law is not necessarily a higher, more developed stage than Eastern riparianism.[71] Instead, depending on the nature of the resource—or more accurately the set of uses to which a resource is to be put—common property can be the more viable regime.

Basing the explanation of the riparian versus prior appropriation split on the nature of water use (public versus private/consumptive) might lead us to expect systems to gravitate to either riparianism or prior appropriation. Consistent with Rose's theory, California's climate is intermediate between those of the riparian and pure prior appropriation states. Other states that recognize some historical riparian rights are also intermediate. It may be that the closer mix of consumptive and nonconsumptive uses make these hybrids worthwhile, but the literature usually assumes that hybrids are wasteful.[72] Interestingly, Mark Kanazawa in a study of the California doctrine provides evidence that the hybrid system is consistent with efficiency.[73] Claiming that doctrine rather than efficiency drove results, Joshua Getzler notes that at least the English riparian system had elements of appropriation in it and that this split within riparianism did not track the distinction between flooding cases (on Rose's theory amenable to a prior appropriation

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68. *Id.* at 284–85. Rose notes the parallel to nuisance and argues that as in Merrill's explanation of nuisance law, high transaction costs call for more judicial effort and judgment rules in order to solve the problem parties cannot be expected to solve for themselves. *See id*. (citing Thomas W. Merrill, *Trespass, Nuisance, and the Costs of Determining Property Rights*, 14 J. LEGAL STUD. 13, 19 (1985)).

69. *Id.* at 290–94.

70. Rose, *supra* note 31, at 277–82.

71. *Id.* at 288–90.

72. *See* Mark T. Kanazawa, *Efficiency in Western Water Law: The Development of the California Water Doctrine, 1850–1911*, 27 J. LEGAL STUD. 159, 172 (1998) (documenting contemporary and modern criticism of California hybrid regime). Even Eric Freyfogle, who is sympathetic to the governance elements in California water law, earlier characterized the rulings of the California Supreme Court that simultaneously recognized riparian and prior appropriation rights as "the 'very reverse' of perfect human reason" and "fundamentally ill-suited to the needs of California." Eric T. Freyfogle, Lux v. Haggin *and the Common Law Burdens of Modern Water Law*, 57 U. COLO. L. REV. 485, 524 (1986).

73. Kanazawa, *supra* note 72, at 176–79.

approach) and withdrawal cases (in which high transaction costs would be expected to lead riparianism to hold sway).[74]

Furthering the recognition implicit in these discussions, I will argue that hybrids are to be expected on an information-cost theory of water law in which exclusion gives way quickly to governance. More generally, this Article questions whether either system, prior appropriation or riparianism, has as unitary a character as these accounts often suggest. I will argue that prior appropriation and riparianism both mix elements of exclusion and governance, with heavy reliance on the latter, making both systems a type of semicommons.

II. A FRAMEWORK FOR WATER LAW

Both prior appropriation and riparianism combine elements of exclusion and governance. Existing accounts of prior appropriation overemphasize exclusion and overlook governance, and the conventional view of riparianism tends conversely to regard it as a pure governance regime, with scant attention to exclusion. Although prior appropriation is more exclusion-based than riparianism, both systems shift toward governance regimes more readily than in the case of nonfugitive property, as the following discussion illustrates.

Water is a special type of property, and this Part will apply a framework developed to derive propositions about the contours of property rights in general to the water resource in particular. Generally, strategies for delineating property rights can be arrayed along a spectrum running from exclusion to governance. These poles are defined by the nature of the informational variables used to define the right (or, to use the term from neoinstitutional economics, proxy measurement).[75] For exclusion in land law, we use simple on/off signals like boundary crossings (trespass, some nuisance) or more tailored variables involving the evaluation of conflicting uses (other nuisance law). These informational variables come with their own characteristic cost structures: the supply of exclusion and governance (and stages in between) involves increasing marginal costs—but increasing at different rates.

Because it relies on rough proxies, the *exclusion* strategy delegates decisions about resource use to an owner who, as gatekeeper, takes responsibility for deciding on uses and monitoring compliance with her plan. Exclusion-style informational variables (or proxies) are simple and crude, like boundaries and the *ad coelum* rule.[76] Presence outside or inside the boundary is effective—but

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74. JOSHUA GETZLER, A HISTORY OF WATER RIGHTS AT COMMON LAW 339–42 (2004).

75. Smith, *supra* note 1, at 467.

76. The full statement of the maxim is *cujus est solum, ejus est usque ad coelum et ad inferos* (he who owns the soil owns also to the sky and to the depths). The maxim is routinely followed in resolving issues about ownership of air rights, building encroachments, overhanging tree limbs, mineral rights, and so forth, and is subject to certain limited exceptions for airplane overflights, for example. *See* Brown v. United States, 73 F.3d 1100, 1103 (Fed. Cir. 1996); Merrill, *supra* note 68, at 26–35; Henry E. Smith, *Exclusion and Property Rules in the Law of Nuisance*, 90 VA. L. REV. 965, 992–96 (2004).

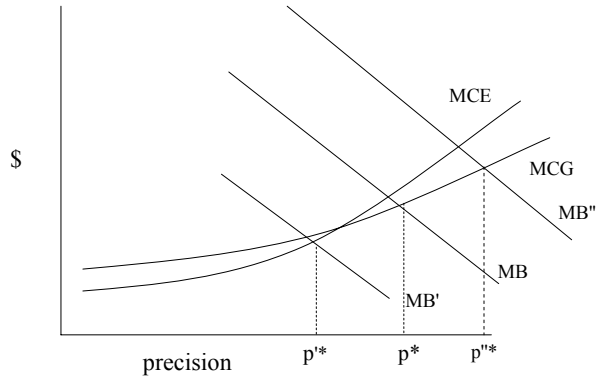
overinclusive—when it comes to preventing misuse such as pilfering of crops.[77] Exclusion also does little by itself to facilitate use by multiple parties—often important in water law—for which governance rules will often be needed. As we will see, the very fact that these proxies make irrelevant a lot of internal information about assets and their owners contributes to the modularity of property. The right to exclude from a thing indirectly protects the owner in a wide range of potential and actual uses, without the law ever having to delineate these use-privileges separately. Dutyholders have the simple job of keeping off, unless they have permission.

Because of its indirectness and simplicity, exclusion is not good at dealing with specific high-stakes use conflicts, and it is here that the governance strategy comes to the fore. Governance rules require the specification of proper activities; examples include rules about timing and amounts of grazing by herders with access to a common grazing area.[78] Governance rules can be supplied by contract, common law, statute, regulation, as well as social norms.

Some rough assumptions about the marginal costs of these strategies (and those in between) lead to a simple partial information-cost model of property rights delineation. The marginal benefit of precision in delineation strategies comes from the additional internalization of spillovers from particular uses and the facilitation of multiple use; this marginal benefit is represented by a (downward-sloping) demand curve. The various delineation (and enforcement) strategies have characteristically shaped supply curves. Without deciding whether the process of forming property rights itself exhibits net positive or negative externalities, one can see that the supply curve for property rights is made up of the envelope of the supply curves for the various strategies, as in Figure 1, with wealth ($) depicted on the *y*-axis and precision depicted on the *x*-axis:[79]

77. Ellickson, *supra* note 12, at 1327–28.
78. *See* Smith, *supra* note 1, at S455, S468, S471–74.
79. For a discussion of how to operationalize precision, see *id.* at S467–79.

Figure 1.—Exclusion and governance for a resource



The supply curve for property rights is made up of the lowest part of the cost curves for the various strategies (the envelope of those curves); I take two representative curves to depict polar solutions of exclusion and governance, out of the many curves that could contribute to the supply side.[80] Costs include, for example, the cost of marking a boundary and building a fence, and distinguishing presence inside a boundary (which would be exclusion-like) or levels of uses or their values (which would be governance-like). Because the marginal cost of exclusion ("*MCE*") starts out low at low levels of precision and increases rapidly it is typically the first approach to defining a resource and preventing the most basic types of theft and use conflict. And, as we will see, *MCE* can be expected to rise even more rapidly in the case of water because of its fugitive nature and the importance of multiple types of use, all requiring access to the entire watercourse.

Governance starts out with high marginal costs ("*MCG*")—think of trying to solve all use conflicts use-by-use or defining property stick-by-stick, with no recourse to exclusion rights. But by hypothesis, governance costs rise less quickly and at some point become least cost (part of the envelope). The marginal cost curve for governance, *MCG*, is the lower of the two strategy-specific marginal cost curves only to the right of the intersection with *MCE*. Again, because exclusion is especially difficult at more than minimal levels of precision in the case of water, we should expect a heavy role for governance in water law. And this we find in all water law systems—riparian, prior appropriation, and hybrid alike.

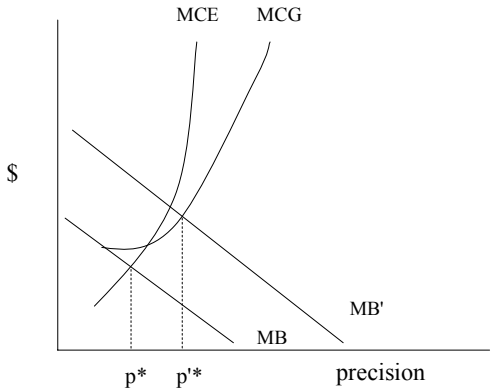
As marginal costs and benefits shift, we can derive predicted trends in the delineation of property rights. The optimal degree of precision occurs where the

80. *See id.* at S476–77.

curve for marginal benefit ("*MB*") of precision in delineation—in terms of incentives to invest, internalization, and gains from specialization and multiple use—intersects with the supply curve of delineation. As the *MB* curve shifts out—say because of an increase in the value of a resource or the more intense use conflict—we expect an increase in the precision of property rights: in Figure 1 a shift from *MB* to *MB*" leads to an increase in precision from *p** to *p*"*. So to the extent that the model picks up on the relevant costs of property rights, broadly taken to include institution costs, then the predicted level of precision will approximate to *p**. Perhaps more importantly, because easier to test empirically, as the marginal costs and benefits shift, we can derive implications for *trends* in levels of property rights precision.

In the case of water, as mentioned above, exclusion is more difficult than in the case of land. It is difficult to fence off water, especially if the watercourse is best used by multiple parties. In terms of the present model, this means that *MCE* rises more steeply than in the case of land. As a result, for similar levels of marginal benefit we would expect a more rapid shift over to the governance strategy as in Figure 2, which, as we will see in the next Part, is in fact what we find.

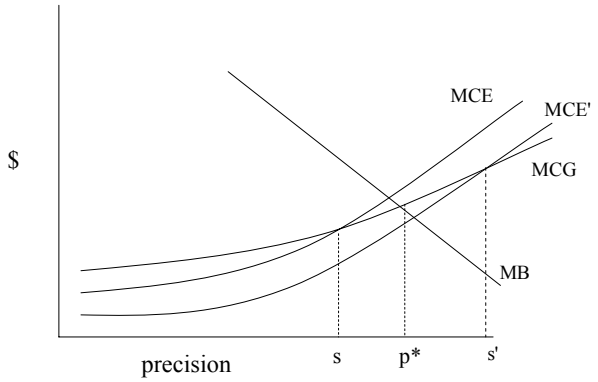
Figure 2.—Exclusion and governance for water



More dynamically, the shape of this envelope—the supply curve for property rights—will change if individual components—the *MCE* and *MCG* curves do *not* move in tandem. The contrast of land and water can be traced to the rapid rise in *MCE*. But this model also implies that if information technology improved a given type of strategy (exclusion or governance) more than the other, we would expect an internal shift in the shape of the curve (i.e., not necessarily on the overall margin). So, for example, as measurement of quantities of water

becomes cheaper and more effective with more meters, better models, and satellite monitoring—the *MCE* curve might shift down by itself and, all else equal, we would expect a tendency toward greater relative reliance on exclusion, as in Figure 3, even if the benefits of entitlement delineation do not change:

Figure 3.—Relative decrease in marginal cost of exclusion

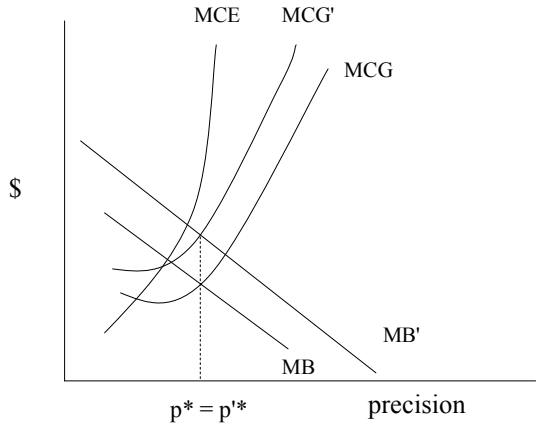


Because the individual informational variables' cost curves have shifted—here the marginal cost of exclusion has shifted downward—we can expect changes in the "switch point," at which a new strategy becomes least-cost, from *s* to *s*'. That is, as exclusion becomes relatively less costly, exclusion remains least cost over a larger range. Here, a switch from exclusion to governance is expected to occur later, as long as conditions under which actors decide to delineate property rights give us some reason to believe that the system has some tendency to move in the direction of efficiency.[81]

The quantities in this model are in principle measurable. Nevertheless, when shifts happen on both the cost and benefit sides, the interpretation of data can be tricky. If, as is particularly relevant to water law, the marginal benefit of delineation increases, but the marginal cost of governance likewise increases, we might get no increase in precision at the margin but a greater relative reliance on exclusion (because the switch point from exclusion to governance would move rightward):

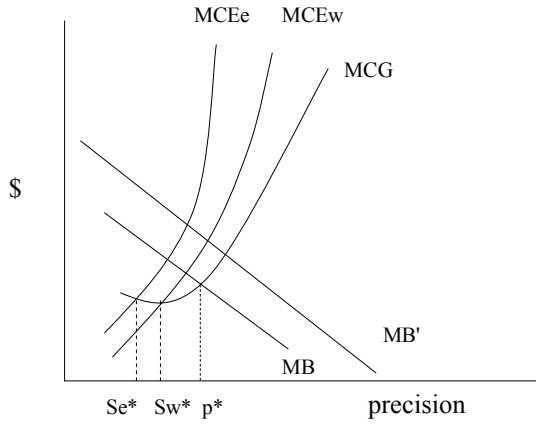
81. *See, e.g.*, LIBECAP, *supra* note 20, at 29–34, 36–37.

Figure 4.—Equal shift in marginal governance cost and benefit



I will not argue that riparian and prior appropriation law are equal in their levels of precision: not only is it hard to tell at this point whether in each case the shift in marginal benefit equals the shift in the marginal cost of governance, but the two systems are hard to compare in terms of precision (although, again, this should in principle be possible). Rather, the possibility illustrated in Figure 4 is a warning that shifts can occur on the cost and on the benefit side, and if so the overall level of precision is to be treated with care. Because governance costs may have risen in the West, we may not get the level of precision at the margin we might otherwise expect. Finally, we can hypothesize that in the case of public good use of water (as tends to be more true in the East), the marginal cost of exclusion rises more rapidly (*MCEe*) than in the West (*MCEw*), as in Figure 5:

Figure 5.—Greater marginal exclusion costs for public goods



If so, we might find relatively more reliance on exclusion in the West even in the absence of greater marginal benefit of governance (and of precision overall), which might nevertheless also be present.

As we will see in the next Part, broadly speaking Western water law shows: (i) a somewhat greater reliance on exclusion than riparianism; (ii) possibly greater but not vastly greater efforts at governance; and (iii) a greater overall effort at delineation than in riparianism. Phenomena (i) and (iii) follow from the model in conjunction with basic assumptions about total and marginal cost, and (ii) is consistent with the model. This picture of the Western prior appropriation system is consistent in its outlines with the broader version of the Demsetz thesis.

Because governance is typically active at the margin of precision, when high stakes call for a high degree of precision, at some point it becomes worth policing governance-style signals or tolerating some deterioration (or both). That is, where high measurement cost is worthwhile, this can take the form of delineating uses and users in a fine-grained way, policing of the rights delineated, and tolerating residual losses from manipulation and deterioration of the signals used. Increasing precision can take the form of exceptions to exclusion, as in the doctrine of necessity in which the owner's right to exclude is suspended, or reduced to liability rule protection. Likewise, under an uncontroversial exception to the rough and ready *ad coelum* rule, owners cannot exclude high-altitude

airplane overflights.[82] Governance can also take the familiar form of rules of proper use, especially those that balance individual uses against each other, as sometimes occurs in the law of nuisance and riparian water law.

Exclusion and governance together determine how modular the property system will be. Modularity is a method for dealing with complexity in systems. A complex system is one characterized by numerous interactions or interdependencies, making it difficult to infer the properties of the whole system from the parts and their modes of interaction.[83] Sometimes systems can be decomposed into components within which dependencies are numerous and free but between which interactions conform to a much lower level. These components are called modules, which have the effect of hiding much information so that the encapsulated components interconnect only in certain ways. This encapsulation allows work to go on in parallel and facilitates certain kinds of innovation and evolution because adjustment can happen within modules without causing major ripple effects. The concept of a modular system was of key importance to Herbert Simon, a founder of behavioral economics, and has played a role in cognitive science and cognitive economics more generally.[84]

As I have argued elsewhere, the exclusion strategy in property lends the system of entitlements a modular character because much information about owners and their uses is irrelevant to dutyholders who simply have to keep off.[85] Part of the low marginal cost at low levels of precision for exclusion strategies (like that illustrated in Figure 1) stems from the effective management of complexity through modular rights based on rough proxies like land boundaries. Governance rules make the system less modular or can be thought of as relatively complex interface conditions. To do so requires incurring ever-increasing marginal costs, as illustrated for the governance strategy in the figures, in order to attain greater precision of proxies at these interfaces. For example, elaborate balancing rules of nuisance constitute a complex interface between the property rights of adjacent landowners. At the limit, resolving all use conflicts case-by-case, use-by-use, would be fully nonmodular.

Because exclusion is costly in water law, water law exhibits a powerful tendency toward governance and nonmodularity, as we will see. Even under prior appropriation, rights have a tendency to interlock in the sense of one right depending on another for its content, which is dramatically true of the no-injury rule. Strong interdependencies between rights lessen the degree of modularity and its resemblance to classic property. This tendency toward nonmodularity in water law captures Blackstone's intuition that water law is inherently usufructory. The

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82. *See, e.g.*, United States v. Causby, 328 U.S. 256, 266 (1946); *see also* THOMAS W. MERRILL & HENRY E. SMITH, PROPERTY: PRINCIPLES AND POLICIES 9–15, 28–29, 313–14 (2007).

83. HERBERT A. SIMON, THE SCIENCES OF THE ARTIFICIAL 195 (2d ed. 1981).

84. *Id.*; *see also* 1 CARLISS Y. BALDWIN & KIM B. CLARK, DESIGN RULES: THE POWER OF MODULARITY 6–11, 169–94 (2000); MANAGING IN THE MODULAR AGE: ARCHITECTURES, NETWORKS AND ORGANIZATIONS (Raghu Garud, Arun Kumaraswamy & Richard N. Langlois eds., 2003); Richard N. Langlois, *Modularity in Technology and Organization*, 49 J. ECON. BEHAV. & ORG. 19 (2002).

85. Smith, *supra* note 4, at 1746–47; Smith, *supra* note 7, at 1185.

interaction between rights in water law will turn out to be intense enough to make it worthwhile to analyze water law as a type of semicommons.

III. EXCLUSION AND GOVERNANCE IN THE COMMON LAW OF WATER

Water law tends to be viewed as either private property on the one hand or as a pure tort-like commons or a regulatory regime on the other. In terms of the information-cost theory, existing water law commentary tends to depict prior appropriation as an exclusion regime and riparianism as one of governance of use. In this Part, I argue that both regimes mix substantial elements of both strategies, exclusion and governance. Because water is both fugitive and subject to many types of very different uses, the shift from exclusion to governance happens more readily than in the case of non-fugitive property. Prior appropriation is to a large extent a governance regime, rather than being as parcelized as it is often portrayed. Conversely, riparianism, though indeed a regime based on governance-type balancing of uses, rests on a larger foundation of exclusion than is usually thought.

It is important also to keep in mind that the common law of water, while the main focus here, is not the only institution used to mediate water conflicts. Instead, many other institutions, ranging from personal contracts among appropriators to mutuals, water districts, and public regulators, can supply the exclusion and, especially, the governance rules needed to increase the usefulness of water.[86] Some of the shifts in water governance reflect the substitution of one institution of governance for another. For example, the rise of riparianism may have substituted off-the-rack judicial (and jury) governance for private agreements.[87] And permit systems are in the process of replacing some of riparianism and prior appropriation's governance aspects with public regulation—much as zoning and land use regulations have partially displaced nuisance law in the case of land. But like nuisance, the two main common-law water systems combine elements of exclusion and governance, to which I now turn.

A. Governance in prior appropriation

In many accounts, prior appropriation is presented as a private property regime of exclusive transferable rights, in aspiration if not in fact. On such accounts, certain features of the system, past and present, are regarded as puzzlingly inconsistent with prior appropriation's status as a classic private property regime and only serve as unnecessary obstacles to the full realization of the efficiency made possible by a system of exclusive private property rights. In this Section, I argue that prior appropriation is in fact more of a governance regime, based on rules of proper use, than the conventional picture recognizes. Overall, prior appropriation employs temporal priority to achieve modularity but quickly shifts to rules of proper use.

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86. *See, e.g.*, Barton H. Thompson, Jr., *Institutional Perspectives on Water Policy and Markets*, 81 CAL. L. REV. 671, 680–81 (1993).

87. Rose, *supra* note 31, at 269–70.

The most familiar aspect of prior appropriation is, as its name suggests, the first-in-time method of allocating priority of rights. Prior appropriation gives priority based on the date of issuance of a water certificate but the right must be used within a reasonable length of time in order to vest.[88] Prior appropriation employs priority to prevent the class of appropriators from becoming too large; by contrast, in riparianism, land ownership (and sometimes use of water on the land or at least the watershed) is used to set up basic exclusion. If riparianism's restriction to riparians is lifted to widen the class of potential users, which as David Schorr argues was its main purpose, then the danger would be that additional appropriators might come along and reduce the size of each water right to an unusably small quantity.[89] If a stream is being used by ten appropriators who have a pro rata right (1/10), each pro rata right will become smaller as the number of users grows ($1/n$ shrinks as n increases). By giving priority of right to earlier appropriators, later appropriators do not cause uses to become inefficiently small; the newcomers are just less likely to get any water.[90] A new junior appropriator would have to divert water in order to have any rights at all: no diversion, no right. And if there are many senior rights making divertable water a rarity, the right will become correspondingly hard to invoke.[91]

What if earlier uses are not as valuable as later ones? We will return to the question of transfers later, but consider for now another benefit of the priority scheme—its modularity. Senior appropriators are highly likely to have their needs satisfied, whereas junior appropriators are much less likely to get water in times of scarcity. Some uses depend on a certain flow (and more particularly a certain flow at certain times), and others do not (they are less sensitive or can depend on alternative supply or storage). For example, some crops need water at certain times

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88. The partial reliance on filing date allows a clear winner to emerge early with less effort, Lueck, *supra* note 10, at 428, but unlike in riparianism unused paper rights are forfeited and vested rights that are unused for long enough will be deemed abandoned.

89. David B. Schorr, *Appropriation as Agrarianism: Distributive Justice in the Creation of Property Rights*, 32 ECOLOGY L.Q. 3, 29 (2005); *see also* BENJAMIN N. CARDOZO, THE GROWTH OF THE LAW 117–18 (1924). Schorr states:

> Sooner or later, if the demands of social utility are sufficiently urgent, if the operation of an existing rule is sufficiently productive of hardship or inconvenience, utility will tend to triumph . . . . Division of the water "into small quantities among the various water users and on the general principle of equality of right" would be a division "so minute as not to be of advantage to anybody." "It is better . . . that some have enough and others go without, than that the division should be so minute as to be of no real economic value."

Id. (citations omitted).

90. *See, e.g.*, Johnson, *supra* note 38, at 219–20; Schorr, *supra* note 89, at 11–22. In a sense the Demsetzian "scarcity" story is a more stringent version of this problem, in which the number of riparians becomes too large in arid climates such that a pro-rata split of the watercourse in times of scarcity might not afford any riparian enough water to keep his crops alive.

91. Some streams are "appropriated" many times on paper, because water decrees can declare rights that have never vested through diversion for an actual beneficial use. New paper rights, while theoretically available, would under such circumstances be virtually vacuous and worthless.

only, and crops that are not so thirsty can receive an amount of water that can be stored from a relatively wet time of year. Priority allows users with these characteristics to satisfy their needs without the need to measure the overall stream. Those with high priority need not know much about lower priority uses and risks. Those with lower priority know with relative ease which risks and what activities will and will not impact them. The scheme unfolds like asset partitioning in organizational law: by segregating pools of assets, those involved in organizations need only know about what they are best at monitoring and can largely disregard the creditors of owners or other related businesses with little risk.[92] To take another analogy, dividing up risk pools in securitization can make the risk cheaper to measure overall and to monitor than if risks were not so partitioned.[93] In all of these areas, modularity provides its familiar benefits of making complexity manageable and allowing for greater specialization of information.

In water law, specialization of information through modularity is achieved through the priority scheme. Most basically, the priority scheme makes a lot of personal information about the other users irrelevant and makes the set of appropriators senior to any given appropriator fixed and easily ascertainable. Putting these two aspects together, if a senior appropriator sold rights along with land so that the use would not change, no new information would need to be acquired. (Changes of use or transfers to someone elsewhere on the watercourse require more than this information, and here the system becomes more articulated.) Such priority rights are not contextually rich.

Beyond this limiting principle of first-in-time, however, prior appropriation abounds in contextually richer governance rules. First of all, governance regimes focus on use, the concept on which prior appropriation is based. Only a diversion of water for a beneficial use establishes rights, and only continued use can maintain the right (systems vary in how long a pause is allowed).[94] Under specified conditions, cessation of use leads to loss of right. Contrary to the image sometimes conjured up, prior appropriation does not directly give a right to a quantity of water.

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92. *See* Henry Hansmann & Reinier Kraakman, *The Essential Role of Organizational Law*, 110 YALE L.J. 387, 402 (2000).

93. Claire A. Hill, *Securitization: A Low-Cost Sweetener for Lemons*, 74 WASH. U. L.Q. 1061, 1090–94 (1996); Kenneth Ayotte & Patrick Bolton, Optimal Property Rights in Financial Contracting (July 2007) (unpublished manuscript), *available at* http://ssrn.com/abstract=989225.

94. In some prior appropriation states water rights are lost through abandonment, which requires nonuse plus an (objectively determined) intent to relinquish the right, and in other states forfeiture can happen through simple non-use for a given length of time (without enumerated extenuating circumstances). *See* John C. Peck & Constance Crittenden Owen, *Loss of Kansas Water Rights for Non-Use*, 43 U. KAN. L. REV. 801, 820–21 (1995).

Water rights under prior appropriation are defined in terms of use.[95] Historically and to a large extent today, there are not enough water meters to measure quantity directly.[96] Rather, a quantity is implicitly defined by observing the use of the water. For example, by diverting water to irrigate 200 acres at given times, one has established a right to perform this activity using the water. One does not have a right to a quantity of water except implicitly.[97] First, what purpose water is used for to some extent determines the quantity consumed: water-wheel power generation consumes little water, whereas irrigation consumes some water but may allow some to return (if the irrigation is in the same watershed).[98]

Second, where the water is used will determine how much is consumed, how much returns to the water course, and where the rejoining of the water will take place.[99] This is very important because prior appropriation, through the no-injury rule, protects junior appropriators along the watercourse in their appropriations of the return flow from upstream senior appropriators. The no-injury rule makes water rights under prior appropriation very unique and hard to evaluate. But difficulty of measurement is the reason for defining rights to return flows implicitly; quantifying rights to return flows would entail far greater delineation cost.[100]

Third, the timing of water use can affect the quantity consumed as well as the impact on others: some periods correspond to constrictions at certain points on the watercourse.[101] The end result is that an appropriator is limited to the particulars of his original use to the extent that he does not want to lose water in the process of obtaining approval for a transfer or change of use. This result certainly makes transfer more difficult but not without reason: from a static point of view, nonmodular rights increase utilization of the watercourse by making the uses interlock more tightly.[102] For example, the no-injury rule makes water unused by senior appropriators more reliably available to junior appropriators. Even the much criticized use-it-or-lose-it aspect of prior appropriation makes water available to potential appropriators next in line, thereby causing water rights to mesh more closely.[103] And, given the state of measurement technology until recently, this automatic transfer may have been a cheaper method of transfer than defining market-alienable rights to unused water.

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95. *See, e.g.*, Freyfogle, *supra* note 48, at 1530; Johnson, *supra* note 38, at 217–18; Smith, *supra* note 76, at 1024–25 & n.184 ("Interestingly, in terms of the exclusion-versus-governance framework, prior appropriation is further towards the governance end of the spectrum than is usually thought (although not as governance-like as riparianism).").

96. *See, e.g.*, LEONARD RICE & MICHAEL D. WHITE, ENGINEERING ASPECTS OF WATER LAW (1987); George A. Gould, *Water Rights Transfers and Third-Party Effects*, 23 LAND & WATER L. REV. 1 (1988).

97. Gould, *supra* note 96, at 8.

98. Johnson, Gisser & Werner, *supra* note 44, at 279–83.

99. *Id.*

100. *Id.* at 280.

101. *Id.* at 279–83.

102. Gould, *supra* note 96, at 21.

103. *Id.*

Unlike the classic exclusion regime, the right here delegates only limited discretion over the nature of the use: the water right for irrigation allows one to vary the crop and timing within limits but approval from a water board (or as in Colorado, a water court) would be required to shift from a use like irrigation to one like power generation. Indeed, the need to quantify rights in shifting from one use to another (particularly to a more consumptive use) is similar to the quantification that occurs as part of the approval process for transfers of water rights from one party to another. Transfers of water rights apart from the land they are used on inherently require quantification. When water rights are defined in terms of specific uses, the use by the new user will almost by definition differ qualitatively (at the very least in terms of location).

Quantity-based measurement mainly happens when an owner proposes a major change in use or a transfer to another user that involves a change in the point of diversion and the nature of the use. The abundance of quantification in reported cases and orders governing these occurrences lends prior appropriation the appearance of a quantity-based regime.[104] After highlighting the use-based nature of prior appropriation, Nicole Johnson labels it a "hybrid" regime that uneasily combines use-based and quantity-based methods for measuring rights, making transfers more costly and instream rights more difficult to define.[105] In a sense, prior appropriation combines two regimes: a small base of exclusion and much governance most of the time and a more exclusion-based quantity-measuring regime when it comes to transfers.

Because of this approach to delineating water rights under prior appropriation, if the holder of a water right saves water through an upgrade to his irrigation equipment (for example, through better lining of irrigation channels), he does not have the right to the conserved water.[106] This feature of prior appropriation law has been heavily criticized and has been modified in some states to afford appropriators rights to conserved water, but such modification requires additional specification of the right (and typically protects third parties' rights to return flows in accord with the no injury rule).[107] More generally, such statutes require additional measurement effort.

Prior appropriation also shows itself as a use regime in the many uses reserved for the public. Public trust uses like navigation override prior appropriation rights. While all property may be limited by public rights, water rights give way to a wide range of robust rights more quickly than do other property rights. Further, under prior appropriation the corpus of the water, as opposed to the use of the flow, is publicly owned.[108] The Colorado Constitution, in

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104. *See* Johnson, *supra* note 38, at 218–19.

105. *Id.* at 219–30.

106. *See supra* note 41 and accompanying text.

107. *See supra* note 41 and accompanying text.

108. *See, e.g.*, CAL. WATER CODE § 102 (West 2006) ("All water within the State is the property of the people of the State, but the right to the use of water may be acquired by appropriation in the manner provided by law."); OR. REV. STAT. § 537.110 (2006) ("All water within the state from all sources of water supply belongs to the public.").

a leading prior appropriation state, declares that all water is owned by the State.[109] This provision stemmed from the fact that delegating broad authority to owners raised fears of monopoly in the formative years of prior appropriation law, and to some extent, these fears persist.[110]

For those who normatively would like to see prior appropriation become more of a private property regime and who especially would like to facilitate transfers, the proposal often surfaces to re-measure prior appropriation rights in terms of consumption. This action would bring prior appropriation closer to the exclusion model and would simplify the interface between rights, although at the cost of a lot of upfront measurement.

But the interface between rights would still be fairly complex and governance-like wherever there are points of constricted flow.[111] Even if rights are defined based on consumption, a transfer upstream can cause flow at any point in between to deprive another appropriator of water he would have received if the diversion had occurred at the original point.[112] In other words, the interconnectedness of uses makes modularization of the water rights very difficult. And the low level of modularization of rights makes them less easily transferable.

Modern prior appropriation regimes have additional overlays of governance by regulation. Prior appropriation rights are administered by water boards. Any change in use or transfer requires a permit from the board. The trend is for these regulatory authorities to have additional authority and discretion to consider the impact of such proposals (and even of existing uses) on third parties and the public interest.[113] In addition, in many Western states, notably California, boards must take into account public trust rights and federal reserved water rights.[114] In some states, water boards can even force senior appropriators to accept substitute sources of water if this substitution will improve the flow for a junior appropriation.[115] This "physical solution" to the problem of maximizing use of water presents yet another move in the direction of a governance regime in the

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109. COLO. CONST. art. 16, § 5; *see also* Johnson, *supra* note 38, at 218; Schorr, *supra* note 89, at 10.

110. *See* David B. Schorr, *The First Water-Privatization Debate: Colorado Water Corporations in the Gilded Age*, 33 ECOLOGY L.Q. 313 (2006).

111. *See* Johnson, Gisser & Werner, *supra* note 44, at 279–83.

112. The water may be used before it gets to the relevant spot where a flow constraint is binding. *See id.* at 278–80.

113. *See, e.g.*, 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, 95 (2002); Douglas L. Grant, *Public Interest Review of Water Right Allocation and Transfer in the West: Recognition of Public Values*, 19 ARIZ. ST. L.J. 681, 689–90, 695–703 (1987).

114. *See* Nat'l Audubon Soc'y v. Super. Ct. (Mono Lake), 658 P.2d 709 (Cal. 1983) (holding in Mono Lake case that public trust requires lake level to be maintained to protect public trust interests at the expense of appropriative water rights); Freyfogle, *supra* note 48, at 1536–37, 1540–44.

115. *See, e.g.*, Harrison C. Dunning, *The "Physical Solution" in Western Water Law*, 57 U. COLO. L. REV. 445, 460 (1986); Lawrence J. MacDonnell, *Out-of-Priority Water Use: Adding Flexibility to the Water Appropriation System*, 83 NEB. L. REV. 485, 504–05 (2004).

presence of multiple interacting uses. The addition of this layer of regulation has its echoes in regulated riparianism, as well as in land use law in which zoning and other regulation have supplemented nuisance law.

An additional layer of governance can be achieved by organizations that either own water rights themselves or regulate members' water use.[116] Mutuals and water districts both implement governance regimes, prescribing terms of use. Mutuals can also be regarded as a form of entity property.[117] Entity property makes possible a simple message to the outside world but a tailored governance regime within the entity. As Thompson demonstrates, water entities, especially mutuals, have made intra-entity transfers of water much smoother than they are between unrelated external third parties pursuing transfers under the state water statutes.[118]

Overall, Western water law is much more of a governance regime than usually thought, and prior appropriation exhibits its greatest orientation toward the exclusion strategy at the time of transfers and other changes of use. Partly, the emphasis on governance even in the West is a function of the high costs of measurement of a fluid resource being put to partly consumptive uses, and we should expect increasing emphasis on quantity-based rights with the rise of better water-flow models and monitoring methods. But to a large extent the emphasis on governance is likely to persist because of the continuing high cost of measurement.

B. Exclusion in riparianism

Eastern riparianism is often thought of as a commons with heavy reliance on rules of reasonable use. Riparianism, often analogized to nuisance, historically has its origins in the law of nuisance.[119] Nuisance is often thought of as all about balancing uses, an approach reflected in the Restatement (Second) of Torts.[120] Elsewhere I have argued that nuisance is itself a complex mixture of exclusion and governance, although the exclusionary elements of nuisance typically receive far less attention than the use-balancing elements.[121] These more exclusionary aspects of nuisance include nuisance per se and the central role that physical invasion still plays in this law. Analogously, I argue in this Section that riparianism mixes of exclusion and governance, and as in the case of nuisance, the exclusionary aspect of riparianism has proved easy to overlook. Exclusion plays some cost-minimizing

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116. *See* Thompson, *supra* note 86, at 680–81, 687–89.

117. On "entity property," see MERRILL & SMITH, *supra* note 82, at 684–829. Hansmann and Kraakman have argued that asset partitioning is the essential contribution of organization law over a pure regime of contract. Hansmann & Kraakman, *supra* note 92, at 390, 402.

118. Thompson, *supra* note 86, at 718–20.

119. *See, e.g.*, GETZLER, *supra* note 74, at 189–91, 276–79; Robert G. Bone, *Normative Theory and Legal Doctrine in American Nuisance Law: 1850 to 1920*, 59 S. CAL. L. REV. 1101, 1224 (1986).

120. RESTATEMENT (SECOND) OF TORTS §§ 826–28 (1979); *see also* WILLIAM L. PROSSER, HANDBOOK OF THE LAW OF TORTS §§ 87, 89 (4th ed. 1971).

121. Smith, *supra* note 76, at 976. Although both nuisance and riparianism are usually considered to be an uneasy interplay of inconsistent theories, *see, e.g.*, Bone, *supra* note 119, at 1111, 1224, they can be interpreted as combining exclusion and governance for functional reasons.

role even in nuisance and riparianism, despite the need in such areas to shift readily to governance strategies.

Riparianism balances uses and makes reasonableness the standard. In times of drought, one use will be evaluated against another and ultimately which should prevail is a matter for the jury. A use is not unreasonable except as compared with another more valuable use, where the uses conflict. Furthermore, in some limited situations of no injury to downstream riparians, additional governance-style refinement can be achieved through contracts that will run as covenants with the land.[122]

Nonetheless riparianism's use-balancing rests on a foundation of exclusion. First, only riparians have riparian rights; they are appurtenant to riparian land. Thus, riparianism piggybacks on the basic exclusionary regime over land. Further, limiting water rights to riparianism is a rough proxy for quantity.[123] Use of rough proxies forms the hallmark of the exclusion strategy.[124] Second, under many versions of riparianism water may only be used on riparian land (exceptions can be made for rights by grant or prescription). Here, too, a rough proxy based on physical location serves very indirectly to measure use. Third, some versions of riparianism provide for per se rules. For example, a riparian can use as much as she needs for natural wants, which are drinking, household uses, and cattle; these take priority over artificial wants, which in a non-arid climate would include irrigation and power.[125] This scheme makes context and balancing largely irrelevant. In a humid climate, it is unlikely that use for natural purposes will leave another with too little water for his natural uses, all of which makes the per se approach good enough.[126] As scarcity increases, we might expect a shift towards more detailed use rules or to a different regime, like prior appropriation.

The overlay of governance on a foundation of exclusion also characterizes the historical development of riparianism. Prior to riparianism, the common law generally held to a simpler system, natural flow.[127] This simple system was easy to administer and may well have served as a baseline from which

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122. *See, e.g.*, JOSEPH KINICUTT ANGELL, A TREATISE ON THE LAW OF WATERCOURSES §§ 255–72, at 425–37 (J.C. Perkins ed., 7th ed. 1877).

123. Olivia S. Choe, *Appurtenancy Reconceptualized: Managing Water in an Era of Scarcity*, 113 YALE L.J. 1909, 1914 (2004).

124. Choe takes appurtenancy as a governance rule. *Id.* at 1927, 1934–35. There is a spectrum running from exclusion to governance. Appurtenancy in its use of a rough proxy for use, as Choe recognizes, *see id.* at 1924, and in terms of the information-post theory, puts it further toward the pole of exclusion than rules balancing uses (in contrast to Choe's treatment of the two types of rules as pure governance rules). Similarly in nuisance law, per se rules are combined with more balancing-oriented approaches. Smith, *supra* note 76, at 997–98; *see also* Keith N. Hylton, *A Missing Markets Theory of Tort Law*, 90 NW. U. L. REV. 977, 989–93 (1996) (arguing that tort law adopts strict liability where external cots clearly outweigh benefits and transaction costs are high).

125. Evans v. Merriweather, 4 Ill. 492 (1842).

126. Again, nuisance law, too, employs the exclusion strategy to some extent, through rules identifying nuisance per se.

127. *See, e.g.*, Choe, *supra* note 123, at 1930–32; Rose, *supra* note 31, at 264, 266, 286–87.

parties could contract in situations in which transaction costs were not prohibitive. It establishes a flat rule that each landowner must leave the drainage in its natural state, thus giving each landowner a servitude over the other for natural flow.[128] Like the exclusion strategy, it delimits the number of those with access privileges to the riparian landowners (a feature shared by riparianism) and also like exclusion employs a noncontextual rough proxy to regulate use: no diminishment of the flow. But as use became more intense, the system did too little to accommodate even minimally consumptive uses.[129] The historical shift to governance follows from the information-cost model and the basic assumptions about the shape of the marginal cost curves for the various property rights strategies. It is consistent with the broad version of the Demsetz thesis, under which "more property" can involve additional governance,[130] but it presents an apparent counterexample to the narrow Demsetzian expectation of ever increasing exclusion.[131] And it accords with a pattern we find in many other historical examples of the commons.[132]

As scarcity of water in the East has further increased, we have seen a shift in about half the riparian states from pure common-law riparianism to regulated riparianism.[133] Under regulated riparianism, certain major uses require a permit.[134] To obtain a permit, the applicant must show the value of the use and its impact on others.[135]

Like prior appropriation, Eastern riparianism employs the exclusion strategy, albeit to a lesser extent. In riparianism, this element of exclusion is easy to overlook because it largely piggybacks on the exclusion regime for (riparian) land. Aspects of exclusion in riparian systems include per se rules based on categories, appurtenancy, and limits to use on riparian land. Also like prior appropriation, riparianism has, in the face of greater scarcity, added further elements of governance over time.

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128. 2 WATERS AND WATER RIGHTS, *supra* note 47, § 10.03(b)(2); 5 WATERS AND WATER RIGHTS § 59.02(b)(3) (Robert E. Beck ed., 1991 ed., repl. vol. 1998); Stanley V. Kinyon & Robert C. McClure, *Interferences with Surface Waters*, 24 MINN. L. REV. 891, 893–97 (1940).

129. *See, e.g.*, Rose, *supra* note 31, at 287.

130. *See, e.g.*, Smith, *supra* note 1, at S486.

131. Morton Horwitz argued that the move from natural flow to the riparian reasonableness standard was an example of courts providing new industrial users with a "subsidy." MORTON J. HORWITZ, THE TRANSFORMATION OF AMERICAN LAW, 1780–1860, at 101–02 (1977). Carol Rose pointed out that, although the subsidy thesis has been criticized in general, the move from natural flow to reasonableness does seem to contradict the expectation of greater private property with a rise in resource values (and an increase in externalities). Rose, *supra* note 31, at 264. This assumes the narrow version Demsetz thesis.

132. *See, e.g.*, NETTING, *supra* note 2929, at 58–61 (1981) (describing process of intensification, expansion, and regulation in medieval Törbel and other Swiss villages in which boundaries were fixed and regulation was instituted in late medieval period when exclusion was not enough); *see also* Carol M. Rose, *Rethinking Environmental Controls: Management Strategies for Common Resources*, 1991 DUKE L.J. 1, 9–36.

133. *See* Dellapenna, *supra* note 47, § 9.06(c)(2).

134. *Id.* § 9.01.

135. Joseph W. Dellapenna, *Introduction to Riparian Rights*, *in* 1 WATERS AND WATER RIGHTS, *supra* note 47, § 6.01(b)(1).

IV. THE WATER SEMICOMMONS AND FLUID PROPERTY

In combining exclusion with governance, as in both of the regimes discussed above, water law is typical of the rest of property law, but the fugitive nature of water causes water law to tend in the direction of a semicommons. The high and quickly rising cost of the exclusion strategy as applied to water, combined with its manifold uses, limits the usefulness of simple exclusion. Many users need simultaneous access to the resource, and their uses potentially interact. Consequently, the governance systems implemented in prior appropriation, riparian water law, and their hybrids necessarily involve detailed specification of use.

I have argued elsewhere that the exclusion strategy helps keep property modular.[136] A modular system is one in which interactions are intense within modules but less intense between modules. Interface conditions and information hiding limit the dependencies between modules, and allow the system to manage complexity more easily than one in which the interdependency between any two elements of the system is in principle possible.

Because of the interlocking nature of water uses and the difficulty of exclusion, water law cannot be as modular as regular property. Instead, many actors with different uses have access to the same resource. Interestingly, water uses are more consumptive and heterogeneous in the West, and it is here, where interdependencies become very difficult, that we see arguably a greater emphasis on exclusion than in riparian water law—although, as I have argued in the Article, not to the extent that is usually thought. Nevertheless, it is worthwhile to consider water law's tendency toward allowing access by parties who under other conditions might be regulated by very different property regimes. One solution to such a problem combines systems in a semicommons.

Semicommon property rights exist where a resource is covered by both common and private property and the two systems potentially interact. For example, in the open-field system of medieval and early modern Europe, this interaction occurred over time.[137] Peasants would own long thin strips in private property for purposes of grain growing. In fallow periods and after harvests the peasants would be required to throw open their strips to common grazing. This allowed small-scale private ownership with intensive incentives for crop growing but operation on a larger scale for grazing, which involved greater economies of scale. The resulting commons was not open access: only those with strips had a right to graze and a right to the manure from the grazing animals. Internally however, exclusion was quite limited: spillovers could occur along the many extensive boundaries between long, narrow strips (e.g., poor weeding, encroachments), and in the commons periods peasants might selectively trash the parts of the commons that belonged to others (e.g., by excessive trampling) or favor their own parts (with manure from commonly grazed animals).[138] Elsewhere,

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136. *See* Smith, *supra* note 4, at 1813–14; Smith, *supra* note 7, at 1198.
137. *See* Smith, *supra* note 16, at 132, and sources cited there.
138. *Id.* at 146–54.

I have argued that the configuration of strips minimized the ability of peasants to engage in the latter forms of strategic behavior.[139]

The general challenge of a semicommons is that a pattern of valuable uses requires extensive access by multiple parties. If the uses individually call for different scales or different levels of exclusion, reconciling the multiple use can be difficult. The nature of the resource and its uses make modularization difficult: multiple interlocking uses are valuable but hard to police. A semicommons converts the problem of interacting uses into a problem of interacting property systems. Sometimes these problems are easier to solve or tolerate. When this is so is an empirical question to be determined on a case-by-case basis.

A semicommons like the open field system is easy to misinterpret as needlessly complicated, and hybrid water law systems likewise have usually been assumed to be inherently unstable and undesirable. The present theory suggests that hybrid water systems may not be anomalous or purely the product of path dependence. Mark Kanazawa's argument that the hybrid system is efficient in California is consistent with this view.[140] In particular his empirical study suggests that the California Supreme Court when faced with riparian objections to appropriations employed an exclusion-like strategy of injunctions regardless of injury when the number of affected parties was small and arguably transaction costs were low,[141] and moved to a rule of reason, a governance strategy, in the presence of many riparians and high transaction costs.[142] Further, Kanazawa shows that over time, the likelihood of applying the rule of reason increased regardless of riparian numbers.[143] This evidence suggests that the hybrid regime tends to apply governance precisely where the information-cost theory predicts: where stakes are high and high transaction costs prevent private supply of governance solutions.[144] Also, in the riparian systems, the tendency to allow for prescriptive rights, the passage of Mill Acts, and other pockets of appropriation law, bring riparianism closer to a semicommons. Given the nature of fluid property, the possibility remains open that such mixtures make sense, given the high cost of measurement of water and the high value of multiple types of use.

The rapid shift to governance and other moves away from simple exclusion, characteristic of a semicommons, trace back to the nature of fugitive resources. Almost by definition, a fugitive resource is difficult to subject to exclusion rights, and this problem impacts the shape of rights to water, wild

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139. *Id.*

140. *See* Kanazawa, *supra* note 72, at 172–79.

141. Bilateral monopoly remains a possibility in interactions between an appropriator and small numbers of riparians.

142. Kanazawa, *supra* note 72, at 175–79.

143. *Id.* at 179.

144. *See* Smith, *supra* note 76, at 996 ("On the information-cost approach, the presence of high stakes ensures that some precision (towards the governance end of the spectrum) will be worthwhile. If, at the same time, the transaction costs of private contracting or the formation of informal norms are high, then judicial governance can be worthwhile." (citing Smith, *supra* note 1, at S471–78)); *see also supra* Part II.

animals, oil and gas, and the broadcast spectrum.[145] This difficulty of exclusion also underlies the much misunderstood *ferae naturae* analogies.[146] In some of these resources, multiple use will require either tolerating interference or the use of hybrid systems whose components themselves need to be reconciled. In the medieval open fields the reconciling device was the scattered pattern of strips, which made strategic differentiation of parcels in the common-property use more difficult. More usually, semicommons require extensive governance rules to make up for what they lack in the ability to manage conflict through exclusion.[147] Thus, in a variety of areas in addition to water law, including broadcast spectrum and intellectual property, we should expect a semicommons, and an emerging literature suggests that semicommons are characteristic of these areas.[148] Even the ultra-familiar example of fugitive resources, wild animals, employ governance regimes to the extent that first possession itself can be regarded as a system regulating the acquisitive competitive process itself. That is, if possession law itself is about "things," the thing is, as in unfair competition law, an "opportunity."[149] But like water, an opportunity is an ethereal resource. And to the extent this is so, we tend to find tort-like rules of governance over these abstract resources.

Water law does point to lessons for property law more generally, but I suggest that water law exemplifies the combination of minimal exclusion and extensive governance with a corresponding tendency toward a semicommons that are characteristic of property regimes over fugitive resources. Using the framework outlined here it should be possible to develop a theory of "fluid property," a task I leave for further work.

CONCLUSION

Like other property law, the law of water mixes exclusion and governance. Exclusion is familiar and more central in the case of prior appropriation than in riparianism, but both common-law water regimes shift to

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145. *See, e.g.*, Thomas W. Hazlett, *Spectrum Tragedies*, 22 YALE J. ON REG. 242 (2005) (analyzing role of exclusion and governance in spectrum); 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, 160–61 (2006) (analogizing spectrum regulation to water law).

146. Difficulties in exclusion are expressed as an analogy to wild animals which are notoriously hard to contain. Craft, *supra* note 10, at 708–09; *see also supra* note 10 and accompanying text.

147. *See, e.g.*, Henry E. Smith, *Governing the Tele-Semicommons*, 22 YALE J. ON REG. 289, 294–96 (2005).

148. *See, e.g.*, Ellen P. Goodman, *Spectrum Rights in the Telecosm to Come*, 41 SAN DIEGO L. REV. 269, 379–403 (2004); Robert A. Heverly, *The Information Semicommons*, 18 BERKELEY TECH. L.J. 1127, 1127 (2003); Lydia Pallas Loren, *Building a Reliable Semicommons of Creative Works: Enforcement of Creative Commons Licenses and Limited Abandonment of Copyright*, 14 GEO. MASON L. REV. 271, 274–75 (2007); Henry E. Smith, *supra* note 147, at 291–96; Peter K. Yu, *Intellectual Property and the Information Ecosystem*, 2005 MICH. ST. L. REV. 1, 11–12.

149. Benjamin L. Fine, *An Analysis of the Formation of Property Rights Underlying Tortious Interference with Contracts and Other Economic Relations*, 50 U. CHI. L. REV. 1116, 1121 (1983).

governance quite quickly, especially as compared to more familiar real and personal property law. This shift to governance helps explain some features of prior appropriation law that are puzzling as long as it is thought to be an exclusive parcelized regime. In this Article, I have provided an information-cost framework for analyzing property rights in general and water rights in particular. This framework shows how a Demsetzian shift to more property can lead to increases in the use of the exclusion or the governance strategy and when we might expect which combinations. As in the case of other fugitive resources, the nature of the water resource makes the marginal cost of exclusion rise very rapidly, causing a quick resort to governance and the emergence of various types of semicommons.