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MIGRATING BOUNDARIES

Katrina M. Wyman^{*} & *Nicholas R. Williams*[†]

Abstract

The boundaries between land parcels usually are assumed to be static and unchanging. However, not all land borders are stable. An important land boundary that routinely ambulates is the border between what is publicly and privately owned along U.S. coastal shores. This coastal boundary recently has been the subject of renewed attention from the courts, scholars, and even the popular press in the wake of Hurricane Sandy. This Article offers an economic analysis of why the boundary generally ambulates, rather than remaining perpetually fixed as land borders usually are assumed to do. It also considers whether the legal border generally should continue to migrate in an era of sea level rise due to climate change.

INTRODUCTION	1957
I. BACKGROUND	1962
II. RATIONALES FOR AN AMBULATORY COASTAL BOUNDARY	1971
A. <i>Existing Rationales</i>	1971
B. <i>The Efficiency of Migratory Coastal Boundaries</i>	1980
III. MAINTAINING AN AMBULATORY BOUNDARY	1985
CONCLUSION.....	1992

INTRODUCTION

We usually conceive of land borders as static and unchanging, and sometimes literally fixed in stone.¹ Indeed, stability might seem to be a

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1. Think of Robert Frost's famous poem *Mending Wall*, in which the two neighbors preserve the boundary between them by meeting each year to fix the fence of stones that separates them. ROBERT FROST, *Mending Wall*, in THE POETRY OF ROBERT FROST 33–34

prerequisite for borders given that they are intended “to provide certainty and permanence.”² The idea that land borders are fixed also is embedded in contemporary theoretical work on property. A prominent example is Professor Henry Smith’s characterization of land boundaries as “rough” “on/off” “signals” that tell us to keep off others’ property.³ If land boundaries routinely fluctuated, it would be hard for them to act as clear signals.⁴

Not all land borders, however, are stable and well suited to serve as on/off signals. One dramatically unstable land border is the boundary between what is privately and publicly owned along U.S. ocean shores.⁵ This boundary is usually defined as the “ordinary high water mark,”⁶ which in many coastal states is further specified as the “mean high-water line.”⁷ Areas landward of the mean high water line are often private property, while state governments often own the lands seaward of the mean high water line subject to the public trust doctrine.⁸ Many Americans have the right to walk on coastal shores because state

(Edward Connery Lathem ed., 1969).

2. Donna R. Christie, *Of Beaches, Boundaries and SOBs*, 25 J. LAND USE & ENVTL. L. 19, 26 n.41 (2009).

3. Henry E. Smith, *Property and Property Rules*, 79 N.Y.U. L. REV. 1719, 1753 (2004) [hereinafter Smith, *Property and Property Rules*]; see also Henry E. Smith, *Property as the Law of Things*, 125 HARV. L. REV. 1691, 1713–14 (2012) [hereinafter Smith, *Property as the Law of Things*]; Thomas W. Merrill & Henry E. Smith, *The Morality of Property*, 48 WM. & MARY L. REV. 1849, 1890 (2007) (“Exclusion by its nature protects a wide variety of uses, and the signal for violation is a simple on/off signal easily perceived by all—a boundary crossing in the case of land.”); Larissa Katz, *Exclusion and Exclusivity in Property Law*, 58 U. TORONTO L.J. 275, 280 n.17 (2008) (“[T]he on/off function of boundaries is fundamental to Smith’s understanding of the standard case of property.”).

4. Though Smith’s work does not explicitly discuss the idea that land borders are stable, the idea is implicit in his work. See, e.g., Smith, *Property as the Law of Things*, *supra* note 3, at 1713–14; Smith, *Property and Property Rules*, *supra* note 3, at 1765.

Recent work by economists further bolsters the case for stable land borders, suggesting that they promote investment and facilitate the exchange of land rights. See Gary D. Libecap & Dean Lueck, *Land Demarcation Systems*, in RESEARCH HANDBOOK ON THE ECONOMICS OF PROPERTY LAW 257, 257 (Kenneth Ayotte & Henry E. Smith eds., 2011).

5. See, e.g., JOSH EAGLE, COASTAL LAW 89 (2011); Lora A. Lucero, *A Line in the Sand*, PLAN. & ENVTL. L., Jan. 2010, at 12.

6. BRUCE S. FLUSHMAN, WATER BOUNDARIES: DEMYSTIFYING LAND BOUNDARIES ADJACENT TO TIDAL OR NAVIGABLE WATERS 73 (2002).

7. *Id.* at 119–21.

8. See, e.g., *Martin v. Lessee of Waddell*, 41 U.S. (16 Pet.) 367, 410–11 (1842); *Pollard’s Lessee v. Hagan*, 44 U.S. (3 How.) 212, 230 (1845). The public trust often encompasses the wet beach underwater during high tide (also called the foreshore), and submerged lands underlying tidal and navigable waters. There are useful diagrams of the areas along the beach in EAGLE, *supra* note 5, at 90 (referring to “Wet sand or Foreshore”), and James G. Titus, *Rising Seas, Coastal Erosion, and the Takings Clause: How to Save Wetlands and Beaches Without Hurting Property Owners*, 57 MD. L. REV. 1279, 1291 fig.2 (1998). For a discussion of the scope of the public trust, see, for example, *id.* at 1291, 1292–94, 1365–68.

governments own the wet beach under the public trust.⁹

There has been a recent resurgence of interest in the boundary between private and public trust property along the coasts. The coastal boundary was a central issue in a widely discussed 2010 decision from the U.S. Supreme Court,¹⁰ and several scholars recently turned their attention to doctrines related to the boundary.¹¹ In the wake of Hurricane Sandy, which ravaged coastal shorelines in New Jersey, New York, and Connecticut in October 2012, the legal rules determining the coastal boundary have been discussed beyond the courts and academia and in the popular press.¹²

This Article analyzes why the legal boundary between private and public trust property along the ocean coastline generally ambulates, rather than remaining fixed at a defined point as land borders usually are assumed to do. We might be tempted to attribute the generally ambulatory character of the boundary to natural forces.¹³ The geographic location of the mean high water line shifts because of physical changes altering the shore, such as the addition or the loss of sand on the beach.¹⁴ But nature does not explain, by itself, why the legal boundary should also move, and legal decision makers can opt not to allow the boundary to follow the changes along the beach.¹⁵ The common law offers a choice between freezing the boundary at the old mean high water line by deploying the doctrine of avulsion, and shifting the boundary in accordance with the changes wrought by nature by using the doctrines of accretion and erosion (referred to collectively as

9. See Carol Rose, *The Comedy of the Commons: Custom, Commerce, and Inherently Public Property*, 53 U. CHI. L. REV. 711, 713–14 (1986); Robert Thompson, *Beach Access, Trespass, and the Social Enactment of Property*, 17 ROGER WILLIAMS U. L. REV. 351, 352 (2012).

10. *Stop the Beach Renourishment, Inc. v. Fla. Dep't of Env'tl. Prot.*, 130 S. Ct. 2592 (2010).

11. See generally J. Peter Byrne, *The Cathedral Engulfed: Sea-Level Rise, Property Rights, and Time*, 73 LA. L. REV. 69 (2012); Richard A. Epstein, *Littoral Rights Under the Takings Doctrine: The Clash Between the Ius Naturale and Stop the Beach Renourishment*, 6 DUKE J. CONST. L. & PUB. POL'Y 37 (2011); Thomas W. Merrill, *Accession and Original Ownership*, 1 J. LEGAL ANALYSIS 459, 465 (2009); Joseph L. Sax, *The Accretion/Avulsion Puzzle: Its Past Revealed, Its Future Proposed*, 23 TUL. ENVTL. L.J. 305 (2010).

12. See, e.g., Andrew W. Karhl, *The People's Beach*, N.Y. TIMES, Dec. 4, 2012, at A31, available at <http://www.nytimes.com/2012/12/05/opinion/beaches-belong-to-the-public.html>.

13. See *City of Long Branch v. Jui Yung Liu*, 4 A.3d 542, 549–51 (N.J. 2010); *Severance v. Patterson*, 370 S.W.3d 705, 718 (Tex. 2012); Christie, *supra* note 2, at 26.

14. EAGLE, *supra* note 5, at 308.

15. In Florida, for example, a state statute provides that before state-funded beach renourishment projects, the state fixes the legal boundary in relation to the “pre-existing mean high-water line.” *Stop the Beach Renourishment*, 130 S. Ct. at 2599. This fixed line “replaces the fluctuating mean high-water line as the boundary between privately owned littoral property and state property.” *Id.* Note, though, that there may be legal obstacles to fixing the boundary. See *infra* note 61 and accompanying text.

“accretion,” unless otherwise noted).¹⁶ It is because of the “contemporary strong presumption in favor of accretion” in the law that the legal boundary between private and public trust property generally shifts to follow the current mean high water line.¹⁷

This Article offers an economic rationale for the generally ambulatory legal boundary between private and public trust property along coastal shores. It argues that the tendency to shift the legal boundary between private and public trust property to accord with physical changes on the beach is likely efficient. The current presumption in favor of a migratory boundary is a reasonably clear rule that puts private and public landowners on notice that the boundaries of their coastal holdings are subject to change along with physical alterations of the shore and encourages landowners to plan accordingly. Routinely fixing boundaries at a historic point also would be a reasonably clear rule, but a presumption in favor of fixed boundaries would lack two advantages of a migratory boundary. First, and most importantly, a migratory boundary maximizes the value of both private and public trust property along the shore by preserving the water adjacency of both types of property.¹⁸ Second, an ambulatory boundary has administrative advantages for the courts and private and public landowners because it avoids the need to recreate a historic boundary.¹⁹

16. In using the term “accretion” broadly to refer to accretion as well as erosion, we follow Sax, *supra* note 11, at 306 n.2; see also Byrne, *supra* note 11, at 80 & n.49. Professor Sax’s use of “accretion” to refer to accretion as well as erosion may be a bit unconventional. For narrower uses of accretion to refer to the gradual addition of land to the shore, but not erosion, see, for example, EAGLE, *supra* note 5, at 308; FLUSHMAN, *supra* note 6, at 92; Merrill, *supra* note 11, at 465.

17. Sax, *supra* note 11, at 346; see also *infra* note 66 (citing other sources referring to the presumption in favor of accretion).

18. As mentioned below, commentators seem to agree that the principal rationale given by the courts for an ambulatory boundary is the preservation of the water adjacency of private landowners. The benefit of preserving public access to the wet beach and tidal and navigable waters seems less well recognized. See *infra* notes 108–09 and accompanying text.

19. A brief word is in order about other scholarship that refers to the efficiency of accretion. In a recent article critiquing the Supreme Court’s decision in *Stop the Beach Renourishment*, Professor Richard Epstein suggests that there is an economic logic to the Roman law doctrine of alluvion due to its “low administrative costs” and preservation of “[a]ccess to the ocean.” Epstein, *supra* note 11, at 52. Accretion narrowly construed as the addition of land is the modern descendant of the doctrine of alluvion. Alluvion is better understood today to refer to “the material deposited” through the physical addition of land to the shore. Sax, *supra* note 11, at 306 n.2. We are grateful to Epstein for drawing our attention to his recent article. Our argument that a migratory boundary is generally efficient is based largely on English and American sources rather than the Roman law sources that Epstein discusses.

In addition, Professor Thomas Merrill recently offered an efficiency rationale for accretion (narrowly construed), which he views as an example of the principle of accession. Merrill, *supra* note 11, at 465–66. See *infra* note 79 for our critical analysis of Merrill’s treatment of accretion as an instance of accession.

After underscoring the “efficiency properties”²⁰ of the current preference for shifting the boundary, this Article examines whether the legal boundary generally should continue to migrate with changes due to natural forces in an era of climate change. In the aftermath of Hurricane Sandy, many observers have underscored the need to prepare coastal regions to adapt to climate change.²¹ The question of whether the boundary should continue to migrate arises because sea level rise due to climate change is expected to gradually shift the mean high water line landward. If the common law doctrine of erosion is allowed to play out as usual, public trust property will expand at the expense of private property, as the mean high water line moves landward.²² Under existing law, the private landowners who lose property rights due to sea level rise are not entitled to compensation.²³ The “unidirectional”²⁴ nature of the expected changes has prompted at least one commentator to raise a question about the justice of applying the existing rule going forward and to mention the option of compensating private property owners who lose land to the public trust due to sea level rise.²⁵ This Article argues against revising the preference for a migratory boundary because such a preference will likely prove efficient in the future as well.

The coastal boundary is important in practice due to the public’s interests in the coast and the value of private coastal property.²⁶ The coastal boundary is of theoretical interest because of the centrality of borders in exclusion-based understandings of property, such as

20. The phrase “efficiency properties” is borrowed from Merrill, who uses it in analyzing the principle of accession. Merrill, *supra* note 11, at 501.

21. Matthew L. Wald & Danny Hakim, *Storm Panel Recommends Major Changes in New York*, N.Y. TIMES, Jan. 6, 2013, at A14, available at <http://www.nytimes.com/2013/01/07/nyregion/new-york-state-storm-panel-recommends-major-changes.html>.

22. See *infra* note 135.

23. See *infra* note 76 and accompanying text.

24. Margaret E. Peloso & Margaret R. Caldwell, *Dynamic Property Rights: The Public Trust Doctrine and Takings in a Changing Climate*, 30 STAN. ENVTL. L.J. 51, 88 (2011) (“Sea level rise is a unidirectional change that will result in the continuous encroachment of the sea on to littoral property.”); Joseph L. Sax, *Some Unorthodox Thoughts About Rising Sea Levels, Beach Erosion, and Property Rights*, 11 VT. J. ENVTL. L. 641, 645 (2010) (noting that the “migratory boundary” is “unidirectional . . . with modern sea level rise”).

25. J. Peter Byrne, *Rising Seas and Common Law Baselines: A Comment on Regulatory Takings Discourse Concerning Climate Change*, 11 VT. J. ENVTL. L. 625, 633, 639 (2010); Byrne, *supra* note 11, at 80, 96. Other sources more obliquely raise the prospect of changing the rules of the game due to sea level rise. CHRISTINE A. KLEIN ET AL., NATURAL RESOURCES LAW: A PLACE-BASED BOOK OF PROBLEMS AND CASES 674 (2d. ed. 2009) (asking whether “the public/private boundary [should] migrate in accordance with changes in sea level”); Sax, *supra* note 11, at 355–56; Michael A. Hiatt, Note, *Come Hell or High Water: Reexamining the Takings Clause in A Climate Changed Future*, 18 DUKE ENVTL. L. & POL’Y F. 371, 383 (2008) (“Large-scale sea level rise due to climate change should be considered beyond the scope of the common law doctrine of erosion and accretion.”).

26. See, e.g., Christie, *supra* note 2, at 21–24, 29.

Professor Smith's, that currently dominate scholarly thinking about property.²⁷ Nevertheless, scholars have paid relatively little attention to the legal rules that govern boundary determination along the ocean shores—or inland.²⁸

This Article proceeds as follows. Part I provides background on the legal rules that govern the boundary between private and public trust property on U.S. shores. Part II demonstrates that a concern with efficiency undergirds the existing preference for a migratory boundary. It begins by arguing that five rationales offered in case law and by commentators for an ambulatory boundary can be understood as reflecting a concern with efficiency. We then offer our own explanation for why an ambulatory boundary likely is efficient, drawing on themes that emerge from the existing rationales. Part III emphasizes the desirability of preserving the preference for an ambulatory boundary in an era of sea level rise. We briefly conclude.

I. BACKGROUND

As the immense damage inflicted in the Northeast by Hurricane Sandy recently underscored, many Americans live on land near the oceans.²⁹ Immediately adjoining the private—and sometimes public³⁰—lands on which Americans live along the shore are vast areas often owned by the states that are covered by the public trust doctrine. This Article is about the boundary between the lands that lie upward of the dividing line, which we call private property (although some may be

27. Hanoch Dagan, *Pluralism and Perfectionism in Private Law*, 112 COLUM. L. REV. 1409, 1413 (2012) (indicating that “several leading property scholars are again considering the right to exclude as the most defining feature of property”); Henry E. Smith, *Commentary* to Richard A. Epstein, *Playing by Different Rules? Property Rights in Land and Water*, in PROPERTY IN LAND AND OTHER RESOURCES 356, 357 n.3 (Daniel H. Cole & Elinor Ostrom eds., 2013) (referring to “exclusion theorists”).

28. Libecap & Lueck, *supra* note 4, at 258 (“While the demarcation of land is fundamental to a system of property law it is largely unexplored by property law scholars and instead simply, or implicitly, taken for granted.”). The way that people communicate their claims to property is a related issue that has received attention from property scholars. See, e.g., Robert C. Ellickson, *The Inevitable Trend Toward Universal Recognizable Signals of Property Claims: An Essay for Carol Rose*, 19 WM. & MARY BILL RTS. J. 1015, 1022–32 (2011) (discussing Professor Carol Rose’s great interest in the communication of property claims and his own thoughts on the matter).

29. The press coverage of rebuilding in communities affected by Hurricane Sandy points to the human presence along the coasts. David M. Halbfinger et al., *On Ravaged Coastline, It’s Rebuild Deliberately vs. Rebuild Now*, N.Y. TIMES, Dec. 21, 2012, at A1, available at <http://www.nytimes.com/2012/12/22/nyregion/on-ravaged-coastline-its-rebuild-deliberately-vs-rebuild-now.html>.

30. Jonathan Mahler, *How the Coastline Became a Place to Put the Poor*, N.Y. TIMES, Dec. 3, 2012, at A29, available at <http://www.nytimes.com/2012/12/04/nyregion/how-new-york-citys-coastline-became-home-to-the-poor.html>.

publicly owned), and the lands seaward of the dividing line, which we refer to as public trust property. Public trust property is often state owned, but can be privately owned “subject to the public trust.”³¹

Rooted in Roman and English law, the public trust doctrine dictates that coastal states hold the lands underlying tidal and navigable waters in trust for the public.³² There is a strong economic rationale for keeping these lands under state ownership and open to the public, well explored by scholars such as Professor Carol Rose and Professor Richard Epstein.³³ As a general matter, these lands are distinct from uplands and suitable for different purposes. As the Florida Supreme Court once explained:

The beaches of Florida are of such a character as to use and potential development as to require separate consideration from other lands with respect to the elements and consequences of title. The sandy portion of the beaches are of no use for farming, grazing, timber production, or residency—the traditional uses of land—but has served as a thoroughfare and haven for fishermen and bathers, as well as a place of recreation for the public.³⁴

Public ownership likely is the highest and best use of public trust lands because it facilitates public use of these lands for the purposes for which they are suited, namely the triad of navigation, commerce, and fisheries traditionally protected by the public trust doctrine, and other purposes more recently protected by the public trust, such as recreation.³⁵ Rose argues that public use of the trust lands has “scale

31. 11 POWELL ON REAL PROPERTY § 79A.01[6] (Michael Allan Wolf ed., 1999).

32. *Nat’l Audubon Soc’y v. Superior Court*, 658 P.2d 709, 718 (Cal. 1983) (noting the public trust doctrine’s origins).

33. See generally Richard A. Epstein, *The Public Trust Doctrine*, 7 CATO J. 411 (1987); Rose, *supra* note 9; J.B. Ruhl & James Salzman, *Ecosystem Services and the Public Trust Doctrine: Working Change from Within*, 15 SOUTHEASTERN ENVTL. L.J. 223, 224–29 (2006). See Barton H. Thompson, Jr., *The Public Trust Doctrine: A Conservative Reconstruction & Defense*, 15 SOUTHEASTERN ENVTL. L.J. 47, 62–64 (2006); see Titus, *supra* note 8, at 1364; see also Joseph D. Kearny & Thomas W. Merrill, *The Origins of the American Public Trust Doctrine: What Really Happened in Illinois Central*, 71 U. CHI. L. REV. 799, 929 (2004) (“A resource such as submerged land under navigable waters requires a kind of blend of open access and exclusion rights.” (citing Epstein, *supra*, at 417)).

34. *City of Daytona Beach v. Tona-Rama, Inc.*, 294 So. 2d 73, 77 (Fla. 1974); see also FLUSHMAN, *supra* note 6, at 75–76; Christie, *supra* note 2, at 21 (quoting *Daytona Beach*, 294 So. 2d at 77). Notably, beaches are generally located only partly on public trust lands. The public trust encompasses the wet beach, but does not usually provide public access to the dry beach. For exceptions, see Gregory S. Alexander, *The Social-Obligation Norm in American Property Law*, 94 CORNELL L. REV. 745, 802–03 (2009) and Titus, *supra* note 8, at 1293, 1366–68.

35. On the evolution of the public trust doctrine, see, for example, *Cinque Bambini P’ship*

returns”: commerce generates ever-increasing wealth, for example, while unrestricted public recreation (as well as commerce) may be “socializing practice[s]” whose benefits are enhanced by the participation of larger numbers of people.³⁶ Epstein focuses on the risk that private control of property covered by the public trust would result in holdout behavior—a particularly acute risk along navigable waterways.³⁷ The public trust doctrine acts as a check on government alienation of trust lands and waters, and preserves public access to them.³⁸ In Judge Guido Calabresi and A. Douglas Melamed’s terms,³⁹ the public has an entitlement to the lands seaward of the mean high water line that is protected by the public trust doctrine’s restrictions on alienability.⁴⁰

The boundary between private and public trust property is usually defined as the ordinary high water mark.⁴¹ Since the early twentieth

v. *State*, 491 So. 2d 508, 512 (Miss. 1986); Alexandra B. Klass, *Modern Public Trust Principles: Recognizing Rights and Integrating Standards*, 82 NOTRE DAME L. REV. 699, 699, 707–14 (2006); and Rose, *supra* note 9, at 713–14, 727–30.

There also may be valuable resources in submerged lands, such as oil. *Phillips Petroleum Co. v. Mississippi*, 484 U.S. 469, 472 (1988); *Cinque Bambini*, 491 So. 2d at 511, *aff’d*, *Phillips Petroleum Co.*, 484 U.S. 469; Robert E. Beck, *The Wandering Missouri: A Study in Accretion Law*, 43 N.D. L. REV. 429, 437 (1967).

36. Rose, *supra* note 9, at 777; *see generally id.* at 766–70, 775–81. In noneconomic terms, we might say that holding certain types of property and use of that property open for the public is fundamentally important to the well-being of society. *See* Robin Kundis Craig, *Adapting to Climate Change: The Potential Role of State Common-Law Public Trust Doctrines*, 34 VT. L. REV. 781, 798 (2010).

37. Epstein, *supra* note 33, at 415; *see also* PPL Mont., LLC v. Montana, 132 S. Ct. 1215, 1230 (2012); Rose, *supra* note 9, at 750, 753–60.

Rose observes that “even if the holdout danger was *necessary* for a presumption of ‘publicness,’ that danger cannot have been *sufficient*. Surely, there should also be some reason to suppose that a property will be more valuable if open to public access than it would be under exclusive control.” Rose, *supra* note 9, at 761. She maintains “that the ‘scale returns’ of socialization, taken together with the possibility of private holdout, will underlie any arguments for the inherent publicness of property.” *Id.* at 781.

38. *See generally* Klass, *supra* note 35, at 699 (“To some, the doctrine is a vehicle for public access to water, beaches, or fishing in a world otherwise dominated by private ownership. To others it is a check on government attempts to give away or sell such resources for short-term economic gain.”); Joseph L. Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471, 478–85, 556–65 (1970) (analyzing ideas underpinning the public trust and the public trust doctrine).

39. Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1092–93, 1111–15 (1972) (distinguishing inalienability rules from both property rules and liability rules, and discussing inalienability rules in detail).

40. Kearney & Merrill, *supra* note 33, at 802 (“*Illinois Central* . . . was the first prominent decision squarely to hold that lands submerged under navigable waters are subject to a rule of inalienability.” (citing Calabresi & Melamed, *supra* note 39)).

41. EAGLE, *supra* note 5, at 89 (“Most states set the legal coastline at the high-water mark.”); FLUSHMAN, *supra* note 6, at 73; David J. Bederman, *The Curious Resurrection of*

century, the ordinary high water mark has been more precisely defined in many states as the “mean high-water line,”⁴² consistent with a 1935 Supreme Court decision defining the boundary as the “mean high-tide line” when federal patents are involved.⁴³ In some states the boundary

Custom: Beach Access and Judicial Takings, 96 COLUM. L. REV. 1375, 1376 n.6 (1996); David C. Slade et al., *Lands, Waters and Living Resources Subject to the Public Trust Doctrine*, in PUTTING THE PUBLIC TRUST DOCTRINE TO WORK 13, 44 n.58 (1990) (listing cases defining the landward boundary of the public trust in each coastal state); Titus, *supra* note 8, at 1365–66.

This Article is concerned with the boundary between private and public trust property along the ocean coasts. The boundary between private and public trust property also may be defined as the “ordinary high water mark” for other bodies of water. Bruce S. Flushman states that “[t]he property boundary of lands adjacent to navigable lakes, the beds of which are owned by the states, is, in most cases, the ordinary high water mark.” FLUSHMAN, *supra* note 6, at 295 (footnote omitted). In *Glass v. Goeckel*, the majority of the Michigan Supreme Court held that the boundary for the application of the public trust doctrine on the Great Lakes is the “ordinary high water mark” and that this is defined (following Wisconsin precedent) as “the point on the bank or shore up to which the presence and action of water is so continuous as to leave a distinct mark either by erosion, destruction of terrestrial vegetation, or other easily recognized characteristic.” 703 N.W.2d 58, 72 (Mich. 2005) (quoting *Diana Shooting Club v. Husting*, 145 N.W. 816, 820 (Wis. 1914)). The dissenting opinions in the case, which would have defined the boundary as the “water’s edge,” emphasized that the ordinary high water mark is a hard boundary to apply to nontidal waters like the Great Lakes, a point the majority partly acknowledged. *Id.* at 79 (Young, J., concurring in part and dissenting in part); *Id.* at 83, 85, 93, 96–102 (Markman, J., concurring in part and dissenting in part); *Id.* at 71. In *State ex rel. Merrill v. Ohio Department of Natural Resources*, the Supreme Court of Ohio refused to define the boundary for the public trust along Lake Erie as “the ordinary high-water mark,” and insisted that the boundary is the “natural shoreline,” which is the line at which the water usually stands when free from disturbing causes.” 955 N.E.2d 935, 939 (Ohio 2011); *see also id.* at 947 (refusing to define the boundary as the ordinary high-water mark based on precedent). We thank Professor Joseph Sax for emphasizing the relevance of *Glass* and *Merrill*.

42. FLUSHMAN, *supra* note 6, at 121; *see also* EAGLE, *supra* note 5, at 182; Christie, *supra* note 2, at 32; Slade et al., *supra* note 41, at 44 n.58; Peloso & Caldwell, *supra* note 24, at 57. On the timing of the move toward greater precision in defining the boundary between private and public trust property, *see* FLUSHMAN, *supra* note 6, at 104–10, 119–21.

43. *Borax Consol., Ltd. v. Los Angeles*, 296 U.S. 10, 14–15 (1935). State law defines the boundary between public trust and private property, except “with respect to uplands claimed under federal patent,” when federal law applies. EAGLE, *supra* note 5, at 98.

The move to more precisely define the ordinary high water mark is likely related to the growth in the value of coastal property and the “heightened awareness of the value of the public’s shore lands” which probably increased the benefits of greater precision in coastal boundary determinations. FLUSHMAN, *supra* note 6, at 105–06; Frank E. Maloney & Richard C. Ausness, *The Use and Legal Significance of the Mean High Water Line in Coastal Boundary Mapping*, 53 N.C. L. REV. 185, 245–46 (1974); *see also In re Ashford*, 440 P.2d 76, 91 (Haw. 1968) (Marumoto, J., dissenting) (excerpting testimony indicating that it only “bec[a]me important” to determine “the precise location” of the seaward boundary after “the value of oceanside properties went up”).

The costs of defining a more precise boundary also may have declined over time. Originally to assist with navigation, the federal government began to collect tidal observations in the 1850s and developed “maps” of coastlines. FLUSHMAN, *supra* note 6, at 118; *see also In re Ashford*, 440 P.2d at 82 (Marumoto, J., dissenting). The availability of this information facilitated more

between private and public trust property is more favorable to private landowners, extending to the low water mark.⁴⁴ There are also a few states where the boundary between private and public trust property is not defined by reference to data about the tides, but rather is defined as the “vegetation line.”⁴⁵ From the public’s perspective, the vegetation line is an expansive boundary because it lies upland of the mean high water line (and necessarily the low water mark), and state ownership up to the vegetation line means the state owns the dry as well as the wet beach.⁴⁶ The vegetation line is more easily discerned when walking on the beach than the mean high water line,⁴⁷ but the vegetation line is not as precise.⁴⁸

The mean high water line is a precise boundary determined by a survey and tidal data, but the boundary shifts regularly due to changes in the landform along the shore.⁴⁹ There are “vertical” and “horizontal”

accurate boundary determination using tidal data. FLUSHMAN, *supra* note 6, at 115–16, 118–19; Charles E. Corker, *Where Does the Beach Begin, and to What Extent Is This a Federal Question?*, 42 WASH. L. REV. 33, 63, 65 (1966).

44. Eagle indicates that “[s]even states—Delaware, Maine, Massachusetts, New Hampshire, Pennsylvania, Virginia and Wisconsin—extend the area capable of ordinary private ownership to the low-water mark.” EAGLE, *supra* note 5, at 89. James G. Titus indicates that the boundary is the low water mark in five states (Maine, Massachusetts, Pennsylvania, Delaware, and Virginia). Titus, *supra* note 8, at 1293 n.41. However, Titus emphasizes that:

Ownership . . . is only part of the picture. In the five states where the tidelands are privately owned, the public still has an easement along the tidelands for at least some purposes—for example, hunting, fishing, and navigation. In several states, the public has access along the dry beach for recreational use as well.

Titus, *supra* note 8, at 1293.

45. FLUSHMAN, *supra* note 6, at 107; Titus, *supra* note 8, at 1366 n.360. States that use the vegetation line may consider it a specification of the “high-water mark” or “high-water line,” and the vegetation line may serve as a proxy for the upper reach of the tides. *Dolphin Lane Assocs. Ltd. v. Town of Southampton*, 333 N.E.2d 358, 359–60 (N.Y. 1975).

In defining the boundary for the public trust along the Great Lakes as the ordinary high water mark, the Supreme Court of Michigan suggested that a mark left by the “destruction of terrestrial vegetation” might signal the ordinary high water mark. *Glass*, 703 N.W.2d at 62 (quoting *State v. Trudeau*, 408 N.W.2d 337, 342 (Wis. 1987)). Concurring in part and dissenting in part, Justice Young asked, “[I]n what sense would the line of vegetation be an ordinary high water mark in the sense suggested by the majority’s definition?” *Id.* at 81 (Young, J., concurring in part and dissenting in part).

46. Titus, *supra* note 8, at 1290–92, 1366 n.360.

47. Christie, *supra* note 2, at 31.

48. See *Ashford*, 440 P.2d at 80 (Marumoto, J., dissenting).

49. See *In re 1 AARON L. SHALOWITZ, SHORE AND SEA BOUNDARIES* 89–90 (1962); Joseph J. Kalo, *North Carolina Oceanfront Property and Public Waters and Beaches: The Rights of Littoral Owners in the Twenty-First Century*, 83 N.C. L. REV. 1427, 1444 (2005) (noting that “natural forces [may] change the contours of the beach itself” and therefore shift the “mean high tide line”).

components of the boundary.⁵⁰ The vertical component is based “on the height reached by the tide during its vertical rise and fall” over a roughly nineteen-year period.⁵¹ The “mean high water” level is “[t]he average height of *all the high-waters* at a location for a period of 19 years.”⁵² Tidal observations from the National Oceanic and Atmospheric Administration’s National Ocean Service or predecessor agencies may be used to calculate the vertical component, perhaps supplemented by tidal observations from other sources.⁵³ While the vertical component of the boundary

is basically stable, being based on observations over nineteen years[, t]he horizontal element of the boundary determination on a sandy beach is anything but stable. The intersection of the horizontal plane of mean high water changes with erosion and accretion, seasonal variations in the beach, wind, waves, storms and man-made changes to the beach—anything that changes the profile of the beach. . . . It follows that even the most accurate determination of the [mean high water line] for a dynamic sandy beach is no more than a snapshot of the boundary at that particular time and place.⁵⁴

Due to the constantly changing nature of the mean high water line boundary, the boundary does not provide a clear on/off signal. Thus there are difficulties enforcing laws against trespassing in coastal states that use the mean high water line as the boundary.⁵⁵ For example, in *State v. Ibbison*,⁵⁶ six defendants cleaning up a beach in Rhode Island were charged with criminal trespass on the basis that they had ventured onto private oceanfront property.⁵⁷ After holding that the boundary

50. 1 SHALOWITZ, *supra* note 49, at 89; *see also* FLUSHMAN, *supra* note 6, at 78 (“[T]here are two physical components of any water boundary determination: the landform’s elevation, slope, and composition and the relative elevation of the water level that impresses itself against the landform.”).

51. 1 SHALOWITZ, *supra* note 49, at 89; *see also* Luttet v. State, 324 S.W.2d 167, 174, 181 (Tex. 1958) (describing processes for determining the mean high water); GEORGE M. COLE, WATER BOUNDARIES 15–17 (1997); FLUSHMAN, *supra* note 6, at 117–18.

52. FLUSHMAN, *supra* note 6, at 117, 118 n.83.

53. Christie, *supra* note 2, at 33–34; *see also* COLE, *supra* note 51, at 45.

54. Christie, *supra* note 2, at 34 (footnote omitted); *see also* COLE, *supra* note 51, at 42, 45; FLUSHMAN, *supra* note 6, at 90, 126; 1 SHALOWITZ, *supra* note 49, at 89–90.

55. Although the boundary between public and private property on ocean shores may be especially difficult to ascertain, there are other boundaries that also are unclear and costly to specify. Inland boundaries may be unclear and costly to ascertain, and identifying boundaries in intellectual property may entail search costs. Stewart E. Sterk, *Property Rules, Liability Rules and Uncertainty About Property Rights*, 106 MICH. L. REV. 1285, 1296–99 (2008).

56. 448 A.2d 728 (R.I. 1982).

57. *Id.* at 729.

between private and public property is the mean high tide line, the Rhode Island Supreme Court affirmed the dismissal of the trespass charges.⁵⁸ The court held that the boundary “is not readily identifiable by the casual observer”⁵⁹ and that “due process provides that no man shall be held criminally responsible for conduct that he could not reasonably understand to be proscribed.”⁶⁰

Despite the current preference for an ambulatory legal boundary, the idea of fixing the boundary along the shores is not unknown.⁶¹ Reminiscent of Roman law, the common law provides two main options to address changes along ocean shores that affect the boundary.⁶² Under the doctrine of avulsion, after any changes to the shoreline deemed to be avulsive, the legal boundary remains the preexisting mean high water line.⁶³ Second, under the doctrine of accretion,⁶⁴ any changes deemed to be accretive cause the legal boundary to shift to the new mean high water line.⁶⁵ Courts today exhibit a strong presumption for applying

58. *Id.* at 732–33.

59. *Id.* at 732.

60. *Id.* at 733. For a fascinating discussion of *State v. Ibbison* and its implications for the beach, see Thompson, *supra* note 9; *cf.* Christie, *supra* note 2, at 35–36 (discussing the confusion even courts have with ambulatory seashore boundaries). Enforcement of trespass laws on the beach also has given rise to controversy in Florida. See Christie, *supra* note 2, at 34–36, and *Crystal Dunes Owners Ass’n Inc. v. City of Destin, Florida*, 476 F. App’x 180, 182 (11th Cir. 2012) (dismissing beachfront property owners’ procedural due process and equal protection challenges to a city policy refusing to enforce “trespass laws within twenty feet of the wet sand’s edge”). For background on the use of criminal trespass statutes, see THOMAS W. MERRILL & HENRY E. SMITH, *PROPERTY: PRINCIPLES AND POLICIES* 369–71 (2d ed. 2012). We thank Donna Christie for referring us to the *Crystal Dunes Owners* case.

61. However, there could be legal obstacles to generically fixing the boundary between private and public trust property. Fixing the boundary might constitute a taking if, for example, fixing the boundary deprived landowners of the right to accretions. Christie, *supra* note 2, at 36–37 (referring to the Justice Stewart’s dissent in *Hughes v. Washington*, 389 U.S. 290 (1967)). Also, state lawmakers could not fix the boundary that applied to federal grants of land. *Id.* at 36 (drawing on *Hughes v. Washington*).

62. On the Roman law principles, see G. INST. 2.70, 2.71; and J. INST. 2.1.20, 2.1.21, 2.1.23, 2.1.24. Epstein helpfully discusses the Roman law of alluvion and avulsion. Epstein, *supra* note 11, at 49–55; Richard A. Epstein, *Playing by Different Rules? Property Rights in Land and Water*, in *PROPERTY IN LAND AND OTHER RESOURCES* 317, 319, 321, 342 (Daniel H. Cole & Elinor Ostrom eds., 2012).

63. *Stop the Beach Renourishment, Inc. v. Fla. Dep’t of Env’tl. Prot.*, 130 S. Ct. 2592, 2599 (2010) (noting that following “an avulsive event[,] . . . the boundary between littoral property and sovereign land does not change; it remains (ordinarily) what was the mean high-water line before the event”).

64. As noted above, we use the term “accretion” to encompass both accretion and erosion. See *supra* note 16 and accompanying text.

65. *Stop the Beach Renourishment*, 130 S. Ct. at 2598 (“In Florida, as at common law, the littoral owner automatically takes title to dry land added to his property by accretion . . .”); FLUSHMAN, *supra* note 6, at 96. Apart from situations deemed avulsion, there are other exceptions where accretive changes may not lead to a change in the boundary. See *id.* at 96–97,

accretion and preserving an ambulatory boundary.⁶⁶ A leading treatise on water boundaries goes so far as to suggest that “there is some question as to whether” “the doctrine of avulsion applies to open coast lands,” indicating that “[i]n California there are no reported cases, and one court in Texas has expressed the view that the rule of avulsion may not apply to the tidal coastline.”⁶⁷ Florida applies the doctrine of avulsion to the coasts,⁶⁸ but even Florida seems to presume a migratory boundary.⁶⁹

Even if avulsion applies to coastal shores in a state, the distinction between it and accretion is not always clear, which leaves the courts scope to characterize changes as accretion and thus maintain a migratory boundary. Doctrinally, accretion and erosion encompass “gradual and imperceptible” changes to the land.⁷⁰ Accretion refers to

129–34.

66. There are many references to the contemporary presumption in favor of accretion and erosion and the resulting migratory boundary, as compared with avulsion and the fixed boundary that it brings. *E.g.*, FLUSHMAN, *supra* note 6, at 100, 134–35; Christie, *supra* note 2, at 27; Sax, *supra* note 11, at 346, 354; *cf.* Kalo, *supra* note 49, at 1440–44 (concluding that North Carolina, by statute, abandoned the avulsion rule and consequently that the legal boundary between private and public trust property ambulates in accordance with the mean high tide line regardless of the reason for the shift).

67. FLUSHMAN, *supra* note 6, at 134 (footnote omitted). A 2012 decision of the Texas Supreme Court provides further evidence of the strong legal preference for a migrating boundary between private and public trust property. *Severance v. Patterson*, 370 S.W.3d 705 (Tex. 2012). The issue in the case was whether, after a hurricane, a public beachfront access easement on a privately owned portion of the dry beach rolled landward onto another parcel of private property that was never burdened by an easement. *Id.* at 708. The majority held that the public beachfront access easement did not roll landward onto the other parcel because the change to the shore was avulsion. *Id.* at 724–25. In the course of holding that the easement did not roll, the majority indicated that “[t]he division between public and private ownership remains at the mean high tide line in the wake of naturally occurring changes, and even when boundaries seem to change suddenly.” *Id.* at 725. It also indicated that “[w]e have never applied the avulsion doctrine to upset the mean high tide line boundary.” *Id.* at 722. However in a footnote, the majority suggested that it was not definitively deciding that avulsion would never freeze the boundary between private and public trust property. After it indicated that “[s]ome states apply avulsion to determine that the mean high tide line as it existed before the avulsive event remains the boundary between public and private ownership of beach property after the avulsive event,” the majority stated that “[w]e have not accepted such an expansive view of the doctrine, but we need not make that determination in this case.” *Id.* at 722 n.20.

68. FLUSHMAN, *supra* note 6, at 134; Christie, *supra* note 13, at 27; *see also* *Siesta Props., Inc. v. Hart*, 122 So. 2d 218, 223–24 (Fla. Dist. Ct. App. 1960) (applying avulsion to islands); *Cinque Bambini P’ship v. State*, 491 So. 2d 508, 520 (Miss. 1986) (applying avulsion to artificially induced changes); *City of Long Branch v. Jui Yung Liu*, 4 A.3d 542, 552–54 (N.J. 2010) (applying avulsion to beach renourishment).

69. *Mun. Liquidators, Inc. v. Tench*, 153 So. 2d 728, 731 (Fla. Dist. Ct. App. 1963) (“[T]here is a presumption of accretion or erosion as against avulsion.”); *accord* *Schulz v. City of Dania*, 156 So. 2d 520, 521 (Fla. Dist. Ct. App. 1963); *see also* FLUSHMAN, *supra* note 6, at 99–100; Christie, *supra* note 2, at 28 n.54.

70. FLUSHMAN, *supra* note 6, at 92–93.

gradual and imperceptible “deposition[s]” to the shore,⁷¹ and erosion to “the gradual and imperceptible wearing away or loss of littoral or riparian land by the action of the water.”⁷² Avulsion refers to “the rapid, perceptible, and often violent removal of or addition to land due to the action of water, or the sudden and perceptible change in the physical location of the boundary watercourse.”⁷³ The neat doctrinal distinction between “gradual and imperceptible” and “rapid, perceptible, and often violent” changes is not straightforward in practice.⁷⁴ Indeed, there are some strongly counterintuitive holdings, such as a Texas decision that found changes following hurricanes, which seem sudden and violent, were properly characterized as erosion.⁷⁵

When upland private landowners lose property because the changes are legally treated as accretion, the state acquires the property subject to the public trust. However, the state is not required to compensate private landowners for the loss of their land. To quote Professor Peter Byrne, “[a]ccretionary loss has never been considered a taking, constitutionally requiring public compensation because nature, rather than the state, effects the deprivation. Loss of littoral land through accretion might be

71. FLUSHMAN, *supra* note 6, at 92. Accretion was historically distinguished from “reliction,” which occurs when “lands once covered by water . . . become dry when the water recedes.” *Stop the Beach Renourishment, Inc. v. Fla. Dep’t of Env’t. Prot.*, 130 S. Ct. 2592, 2598 (2010). Reliction and accretion generally receive the same treatment by courts. FLUSHMAN, *supra* note 6, at 97; *see also Stop the Beach Renourishment*, 130 S. Ct. at 2598 (referring “to accretions and relicions collectively as accretions”). Flushman indicates that “[t]he process of reliction is not one associated with lands along the open coast.” FLUSHMAN, *supra* note 6, at 133.

72. FLUSHMAN, *supra* note 6, at 93. “Littoral property abuts the sea or a lake, while riparian property abuts rivers.” Sax, *supra* note 11, at 306 n.3.

73. FLUSHMAN, *supra* note 6, at 94 (footnote omitted); *see also Stop the Beach Renourishment*, 130 S. Ct. at 2598.

74. For discussion of the difficulty of distinguishing between accretive and avulsive changes, see *Southern Center of Theosophy Inc. v. South Australia* [1982] ACLR 706, 721 (Austl.) (“Since there is a logical, and practical, gap or ‘grey area’ between what is imperceptible and what is to be considered as ‘avulsion,’ the issue of imperceptibility or otherwise was always considered to be a jury question”); *Attorney-General v. M’Carthy* [1911] 2 I.R. 260, 296 (Ir.) (“The difficulty is, [w]hat is the unit or measure of time for ‘gradual and imperceptible’? . . . Justinian and Bracton attempt no definition.”); FLUSHMAN, *supra* note 6, at 98–99 (discussing the difficulty); Sax, *supra* note 11, at 343–46 (discussing the Supreme Court’s broadening of “the definition of accretion”); A. Dan Tarlock, *Takings, Water Rights, and Climate Change*, 36 VT. L. REV. 731, 745 (2012) (“The distinction [between ‘accretion/erosion and avulsion’] is often hard to discern.”).

75. *City of Corpus Christi v. Davis*, 622 S.W.2d 640, 646 (Tex. Ct. App. 1981) (“[E]rosion can be both sudden and perceptible, and does not have to be always gradual and imperceptible”). In holding that the changes were not avulsive, the Texas court also emphasized that there were several causes of changes along the shore, not all of which were hurricanes. *Id.*; *see also Christie*, *supra* note 2, at 52 n.229. For a judicial reference to a hurricane as an example of avulsion, see *City of Long Branch v. Jui Yung Liu*, 4 A.3d 542, 551 (N.J. 2010).

understood to be a risk that ‘inheres in the title’ to such land.”⁷⁶

II. RATIONALES FOR AN AMBULATORY COASTAL BOUNDARY

This Part turns to the reasons why an ambulatory coastal boundary is likely efficient. We begin by analyzing five existing rationales for a migratory boundary and arguing that they can be understood in efficiency terms. Then we offer our own explanation for why a migratory boundary likely is efficient, drawing on themes that emerge from considering the existing rationales.

A. Existing Rationales

In a recent article, Professor Joseph Sax helpfully returns to the English and American historical authorities discussing the rules of accretion and avulsion “in an effort to understand something about how and why they developed as they did, with the hope that greater understanding might ultimately generate better outcomes.”⁷⁷ His analysis indicates that various rationales have been offered over the centuries for accretion, and our discussion in this section is indebted to his masterful efforts bringing together the authorities.⁷⁸

Below we show that five rationales for accretion either identified by Sax or present in the materials that he discusses each can be understood in economic terms to reflect a concern with promoting efficiency. This Article does not suggest that the various authorities that deployed these rationales were solely concerned with promoting efficiency or even consciously interested in promoting efficiency. Nor does this Article argue that a shift in the legal boundary to accord with natural changes will result in an efficient outcome in every case. We contend, however, that these five rationales reflect a concern with promoting efficiency, and thus that efficiency is an underlying, if unarticulated, justification

76. Byrne, *supra* note 11, at 80 (quoting *Lucas v. S.C. Coastal Council*, 505 U.S. 1003, 1029 (1992)); *see also id.* at 100; Tarlock, *supra* note 74, at 741; Titus, *supra* note 8, at 1339 (“An invasion by the sea due to natural factors is not a constitutional taking.”) (citing *Cinque Bambini Partnership v. State*, 491 So. 2d 508, 519–20 (Miss. 1986) (en banc)); *id.* at 1286, 1371–84, 1388–91. Titus cautions that “some states may be waiving” their “common law right to require shorefront owners to abandon property as shores erode.” *Id.* at 1376.

For a contrasting perspective, see Hiatt, *supra* note 25, at 372 (suggesting that there might be a taking when, due to sea level rise, governments acquire newly submerged private lands pursuant to the public trust doctrine, but arguing “that it should not be considered a taking when a state takes title or asserts control over private lands submerged due to climate change and large-scale sea level rise”).

77. Sax, *supra* note 11, at 307–08. For a useful discussion of the Roman authorities, see Epstein, *supra* note 11, at 47–57.

78. Other sources provide similar lists of rationales for the doctrine of accretion, generally drawing on modern U.S. law. *See, e.g.*, 9 POWELL ON REAL PROPERTY, *supra* note 31, at § 66.01[3]; Beck, *supra* note 35, at 431–39; Christie, *supra* note 2, at 28–29.

for an ambulatory boundary between private and public trust property.⁷⁹

79. In a recent article, Professor Thomas Merrill offers an efficiency explanation for the principle of accession, for which he believes the doctrine of accretion is an example. Merrill, *supra* note 11, at 465–66. Merrill uses accretion to refer specifically to the doctrine “that a riparian landowner whose land is gradually augmented by alluvial formations owns the newly formed land,” not broadly as we do in this Article to encompass the legal rules of accretion and erosion. *Id.* at 465. Professor Merrill argues that the principle of accession is an alternative to “first possession” “for establishing original ownership” and defines the principle in these terms: “When new resources are discovered or changes in relative values cause previously ignored questions of ownership to become salient, the newly discovered or newly salient resource is awarded to the person who owns as property some other resource prominently connected with the newly discovered or salient thing.” *Id.* at 463.

Our analysis suggests that the doctrine of accretion as applied on the nation’s coastal shores is not best understood as an example of the principle of accession, interpreted “as a principle of acquisition.” MERRILL & SMITH, *supra* note 60, at 170 (indicating that the casebook “explore[s] the principle of accession as a principle of acquisition but” that “[a]ccession can be seen as defining the scope of property claims”); *see also* Merrill, *supra* note 11, at 481 (contrasting the two understandings of accession). Rather than a principle for awarding ownership to a new resource, accretion is one of the legal rules for drawing boundary lines between private and public landholdings in response to continuous physical changes on the coasts, with erosion being another important rule. Our understanding of accretion as a rule of boundary determination suggests that it may be serving the function of “defining the scope of property claims,” to use the language of MERRILL & SMITH, *supra* note 60, at 170.

In a law review article from the 1960s, Professor Robert Beck rejects the idea of analogizing accretion to accession. Beck, *supra* note 35, at 432. Influenced by his work, we believe that there are two difficulties with Professor Merrill’s analysis of accretion as accession.

First, the analysis presumes that when land is added to the shore, there is only a single landowner to whom the land could be assigned because there is only a single landowner who can claim to be “prominently connected” to the new land through an existing resource. Merrill, *supra* note 11, at 463; *see also id.* at 466 (“[T]he new soil always goes to the riparian owner on whose banks the new land is attached, who readily can be said to have the most prominent relationship to it.”); MERRILL & SMITH, *supra* note 60, at 183 (discussing “the logic” behind thinking “of accretion as an example of the principle of accession”). However, when land is added to the coast there will be two potential owners: the private landowner who owns the upland property, and the state that owns the wet beach and submerged lands in trust for the public. There is no reason to think that only the private landowner is prominently connected to the new land. Beck, *supra* note 35, at 432 (“[W]hy should the alluvion belong to the owner of the contiguous land instead of to the owner of the bed? Was it not ‘acceding’ or ‘accreting’ or ‘adding’ just as much to the bed as to the contiguous land?”). Indeed, we might think that the state, as the owner of the submerged lands on behalf of the public, has a greater claim to the accreted land than the private landowner because the newly added sediment might have come from the state-owned submerged lands. *See* Christie, *supra* note 2, at 28 (excerpting JOSEPH K. ANGELL, A TREATISE ON THE RIGHT OF PROPERTY IN TIDE WATERS, AND IN THE SOIL AND SHORES THEREOF 68 (Harrison Gray ed., 1826)). As Beck argues, “[T]here must have been something more than simply the theory of analogy to accession that led to preferring the riparian owner over the owner of the bed.” Beck, *supra* note 35, at 432. For a decision that illustrates the presence of two landowners, *see United States v. Milner*, 583 F.3d 1174 (9th Cir. 2009) (protecting the tideland owner’s right to an ambulatory boundary).

Second, analyzing the doctrine of accretion as an instance of accession overlooks the existence of its companion, the doctrine of erosion, and the legal presumption in favor of accretion and erosion and against avulsion. Accretion, erosion, and this presumption help to ensure that the boundary line between private and public property generally migrates along with

One longstanding rationale for an ambulatory boundary is that gradual and imperceptible changes to the shoreline likely have a “*de minimis* impact.”⁸⁰ This rationale does not easily explain cases where courts apply accretion but shift the ownership of sizeable parcels of land.⁸¹ Nonetheless, the idea that the legal boundary should track *de minimis* changes reflects a concern with efficiency. If the change wrought by nature is genuinely negligible, then the change should not affect the value of either the private or the public trust property. Moreover, because identifying the current ordinary high water mark is simpler than specifying the historic ordinary high water mark, shifting the legal boundary to accord with the current ordinary high water mark also should reduce administrative costs.⁸²

A second longstanding rationale for a shifting boundary is that accretion results in a “lost boundary.”⁸³ The idea “is that where accretion or reliction [and erosion] occurred very slowly over a very long time, there was no longer evidence or knowledge of the location of the original boundary.”⁸⁴ As with the *de minimis* rationale, it may be hard to explain the cases using the lost boundary rationale because courts seem to have shifted the boundary even where the old border was knowable.⁸⁵ Regardless of whether it makes sense of the case law, in

physical changes along the shores. The doctrine of accretion necessarily allocates new land to the upland private owner, but this is incidental to the doctrine’s larger role in implementing a migratory boundary. As we emphasize, the migratory boundary that accretion helps to achieve is likely to be efficient along the coast because of the importance of maintaining private and public water adjacency and the administrative advantages of aligning the legal boundary with the status quo on the beach. Analyzing accretion as a “principle of acquisition” obscures accretion’s role as a rule of boundary determination that fosters a migrating border between private and public landowners on the beach to the benefit of both sides.

80. Sax, *supra* note 11, at 320; *see also* 2 WILLIAM BLACKSTONE, COMMENTARIES *262 (noting the accretion rule applies because “*de minimis non curat lex*”). Professor Joseph Sax notes that the *de minimis* rationale was “cast away” by the court in *The King v. Lord Yarborough*, (1824) 107 Eng. Rep. 668 (K.B.); 3 B. & C. 91. Sax, *supra* note 11, at 332. However, there are later references in case law to the *de minimis* rationale. *S. Ctr. of Theosophy Inc. v. South Australia* [1982] ACLR 706, 721 (Austl.).

81. Notably, Professor Sax offers a way to reconcile the *de minimis* rationale and shifting the ownership of sizeable parcels of land. According to his reading, early English cases found accretion where the land at issue was “*de minimis* in terms of sovereign interest, even if not *de minimis* in monetary value or acreage.” Sax, *supra* note 11, at 329. Indeed, “the amounts of land in controversy were . . . often substantial in size.” *Id.* at 313. For example, in Lord Yarborough’s case, the court found accretion where “alluvion . . . had gradually filled a salt marsh of 453 acres.” *Id.* at 330–31.

82. *See* COLE, *supra* note 51, at 93–104 (discussing how to find historic shoreline boundaries); FLUSHMAN, *supra* note 6, at 135–38 (same).

83. Sax, *supra* note 11, at 313. Professor Sax notes that the lost boundary rationale was “cast away” alongside the *de minimis* rationale in Lord Yarborough’s case. *Id.* at 332.

84. *Id.* at 312. For a definition of reliction, see *supra* note 71.

85. Beck, *supra* note 35, at 433 (“[T]here are many cases involving fixed boundaries

economic terms the lost boundary rationale reflects a concern with minimizing administrative costs. Aligning the legal boundary with the natural boundary of the current mean high water line avoids the difficulty of ascertaining an historic borderline, when evidence and knowledge of it have been lost or would be costly to acquire because of the passage of time.⁸⁶ In other words, an ambulatory boundary offers another example of the pervasive influence of information costs in property law emphasized by Professor Henry Smith and Professor Thomas Merrill.⁸⁷

A third rationale for a shifting coastal boundary is what Professor Sax terms the “reciprocity rationale.”⁸⁸ The idea is that the private landowner should receive the benefit of any additions because the landowner also bears the risk of any reduction, and vice versa.⁸⁹ Blackstone includes the reciprocity rationale in his discussion of accretion and avulsion.⁹⁰ The U.S. Supreme Court explained the

which could be identified without great difficulty after a shift in the water line that hold that the accretion doctrine applies.”); see, e.g., *Att’y-Gen. v. M’Carthy* [1911] 2 I.R. 260, 276, 294 (Ir.) (title shifted even though the old boundary may have been knowable); *S. Ctr. of Theosophy Inc. v. South Australia* [1982] A.C. 706, 716 (Austl.) (“The authorities . . . have firmly laid down that where land is granted with a water boundary, the title of the grantee extends to that land as added to or detracted from by accretion, or diluvion, and that this is so whether or not the grant is accompanied by a map showing the boundary, or contains a parcels clause stating the area of the land, and whether or not the original boundary can be identified.”). Professor Sax argues that the decision in *Attorney-General v. M’Carthy* indicates “that by the early twentieth century, the lost-boundary theory had been decisively rejected” in the English courts. Sax, *supra* note 11, at 335.

86. See COLE, *supra* note 51, at 93–104 (discussing the determination of historic boundaries).

87. See, e.g., Thomas W. Merrill & Henry E. Smith, *Making Coasean Property More Coasean*, 54 J. L. & ECON. S77, S90–91, S95, S98–99 (2011). For a definition of information costs, see Smith, *Property and Property Rules*, *supra* note 3, at 1768 (“Information costs include the cost of producing and verifying information about the scope and security of rights.”).

88. Sax, *supra* note 11, at 312, 340. The rationale is also called “the compensation theory” or “equity theory.” *Bonelli Cattle Co. v. Arizona*, 414 U.S. 313, 326 (1973), *overruled on other grounds by Oregon ex rel. State Land Bd. v. Corvallis Sand & Gravel Co.*, 429 U.S. 363 (1977); FLUSHMAN, *supra* note 6, at 253; 9 POWELL ON REAL PROPERTY, *supra* note 31, at § 66.01[3].

89. Sax, *supra* note 11, at 312, 320; Byrne, *supra* note 11, at 95.

90. Specifically, Blackstone says:

And as to lands gained from the sea, either by *alluvion*, by the washing up of sand and earth, so as in time to make *terra firma*; or by *dereliction*, as when the sea shrinks back below the usual watermark; in these cases the law is held to be, that if this gain be by little and little, by small and imperceptible degrees, it shall go to the owner of the land adjoining. For *de minimis non curat lex*: and, besides, these owners being often losers by the breaking in of the sea, or at charges to keep it out, this possible gain is therefore a reciprocal consideration for such possible charge or loss.

2 WILLIAM BLACKSTONE, COMMENTARIES *261–62 (footnote omitted).

rationale in the following terms in the late nineteenth century:

The riparian right to future alluvion is a vested right. . . . The maxim “*qui sentit onus debet sentire commodum*” lies at its foundation. The owner takes the chances of injury and of benefit arising from the situation of the property. If there be a gradual loss, he must bear it; if a gradual gain, it is his.⁹¹

There are several ways of understanding the reciprocity rationale. One might understand it as a justice (or fairness) based rationale, reflecting the idea that a lottery in which there is an equal probability of winning or losing is “fair.”⁹² Although the Court did not explicitly state in the above quoted passage that there is an equal probability of a gain or loss, it seems implicit in doctrinal expositions of the rationale.⁹³

The reciprocity rationale also can be understood in economic terms as promoting efficiency. Property rights help to overcome the “tragedy of the commons” because they internalize onto owners the gains and losses that result from their management decisions.⁹⁴ By assigning

91. *Cnty. of St. Clair v. Lovington*, 90 U.S. (23 Wall.) 46, 68–69 (1874). The Supreme Court also mentioned the reciprocity rationale in an earlier decision. *Mayor of New Orleans v. United States*, 35 U.S. (10 Pet.) 662, 717 (1836).

Professors Powell and Wolf indicate that the rationale “has received only modest judicial support.” 9 POWELL ON REAL PROPERTY, *supra* note 31, at § 66.01[3]. However, the Ninth Circuit Court of Appeals recently invoked the reciprocity rationale to protect the interests of a Native American tribe in tidelands held in trust for it by the United States. *United States v. Milner*, 583 F.3d 1174, 1186–88 (9th Cir. 2009). The court reasoned that, just as upland owners are entitled to gains from accretion because they also run the risk of losing land to erosion, so the tideland owner also “has a vested right in the potential gains that accrue from the movement of the boundary line.” *Id.* at 1187–88.

92. *See, e.g., Milner*, 583 F.3d at 1188 (referring to reciprocity as “the fairness rationale”); *City of Long Branch v. Jui Yung Liu*, 4 A.3d 542, 550 (N.J. 2010) (“The doctrine of accretion and erosion is founded ‘on the principle of natural justice’”); *S. Ctr. of Theosophy Inc. v. South Australia* [1982] A.C. 706, 716 (Austl.) (referring to the idea that a landowner takes subject to “subtractions and additions” as “fair,” “convenient,” and “founded in justice”); Byrne, *supra* note 25, at 633 (“One can understand the intuitive justice, all other things being equal, of allowing party *A* to obtain the benefit of random shifts in property boundaries if party *A* must tolerate losses from the same risk.”).

On the idea of a “fair lottery,” see Lewis A. Kornhauser & Lawrence G. Sager, *Just Lotteries*, 27 SOC. SCI. INFO. 483, 485–92 (1988). Kornhauser and Sager state:

In the very idea of a “fair” coin or die there inheres the element that drives our naive view of what makes a lottery itself fair, *equiprobability*: when and only when a lottery’s payoff condition gives each member of the pool an objectively equal chance to receive the benefit do we think of the lottery as fair.

Id. at 485.

93. *See, e.g., Bonelli Cattle Co.*, 414 U.S. at 326.

94. For discussion of the internalization function of property, see Merrill, *supra* note 11,

territorial gains and losses to owners, a rule that the legal boundary generally moves with natural forces may incentivize owners to make socially optimal investment decisions about their parcels by putting owners on notice that the size of their parcels will vary with changes wrought by nature. How owners respond to the risks of territorial gains or losses will depend on their attitudes toward risk. If there truly is an equal probability of a loss or a gain, risk-neutral owners will make decisions regarding their land unaffected by the risk of losing or gaining property. If the owners are risk averse, however, they will likely focus on the possibility of losing a part of the parcel, and accordingly reduce investment in the property, or invest in protection measures.⁹⁵ Risk-preferring owners might actively invest in coastal property.

A fourth rationale for an ambulatory coastal boundary is that shifting the border may reward a littoral landowner for putting any accreted property to use. The idea that underlies “the use/prescription theory,”⁹⁶ as Professor Sax calls it, is “that when the pace of change is very gradual, the adjacent owner effectively takes over the newly exposed land unperceived and uses it as his own.”⁹⁷ The notion that use of land should be remunerated could be understood in Lockean terms as a reward for labor,⁹⁸ but there is also an efficiency dimension to rewarding use. It may incentivize landowners to put land to productive use, which might encourage economic development and growth. As the House of Lords explained in *Lord Yarborough’s* case, “This custom is beneficial to the public. Much land which would remain for years, perhaps for ever [sic], barren, is in consequence of this custom rendered productive as soon as it is formed.”⁹⁹ Further, the transfer of title will

at 494, and Smith, *Property and Property Rules*, *supra* note 3, at 1755.

95. Professor Steven Shavell explains that “[r]isk aversion is most relevant in situations in which losses would be large in relation to a person’s assets and thus would impinge substantially on his utility. . . . If, however, losses would be modest relative to a person’s assets, he would be likely to display a roughly risk-neutral attitude toward them.” STEVEN SHAVELL, FOUNDATIONS OF ECONOMIC ANALYSIS OF LAW 258 (2004). Experimental findings suggest that many people are risk averse. Charles A. Holt & Susan K. Laury, *Risk Aversion and Incentive Effects*, 92 AM. ECON. REV. 1644, 1653–54 (2002).

96. Sax, *supra* note 11, at 325. Professors Powell and Wolf refer to this as the “productivity or efficiency theory.” 9 POWELL ON REAL PROPERTY, *supra* note 35, at § 66.01[3].

97. Sax, *supra* note 11, at 323 (discussing the conclusion of Robert Callis, one of the earliest English commentators on moving water boundaries).

98. *Gifford v. Lord Yarborough*, (1828) 130 Eng. Reg. 1023 (H.L.) 1024; 5 Bing. 163, 165–66 (U.K.) (quoting philosopher John Locke in support of the idea that a private landowner should be granted title to land added to his property through the deposit of alluvion).

99. *Id.* at 166. Professors Powell and Wolf describe this passage as “[t]he clearest statement of the efficiency argument.” 9 POWELL ON REAL PROPERTY, *supra* note 31, at § 66.01[3] n.32.

Beck discusses a statement of “the ‘productivity’ theory” in *Jefferis v. East Omaha Land Co.*, 134 U.S. 178 (1890). Beck, *supra* note 35, at 434 & n.27. This passage from *Jefferis* states

reward the private landowner without imposing significant costs on the losing party, namely, the state. The state will probably not be making much, if any, use of the land by the time of the transfer if the winning landowner has been using the land.¹⁰⁰ To the extent that the “use/prescription” rationale emphasizes the lack of a loss to the state, it blends with the *de minimis* rationale.¹⁰¹

It is not clear, however, that the use/prescription theory explains the modern preference for an ambulatory boundary.¹⁰² The theory reflects a dated policy in favor of active use. Today society recognizes that nonuse of land, including coastal land, also may be efficient.¹⁰³ In addition, the rationale cannot explain the entire range of circumstances when the boundary migrates. It might explain why the boundary ambulates when an upland parcel is enlarged through the addition of land (accretion in its narrow sense) because in this situation the private owner may have the opportunity to use the new parcel. But the rationale does not explain why the boundary ambulates when the private landowner loses part of his parcel through erosion, because there is no opportunity for private use when land is lost.

A fifth rationale for an ambulatory boundary is that it simultaneously preserves the private landowner’s “proximity [. . .] to the water”¹⁰⁴ and

that “it is the interest of the community that all lands should have an owner, and most convenient that insensible additions to the shore should follow the title to the shore.” *Jefferis*, 134 U.S. at 191. Earlier in *Jefferis*, the almost identical language is used in a quotation from *Banks v. Ogden*, 69 U.S. (2 Wall.) 57, 67 (1865). *Id.* at 189. Professor Sax suggests that the passage from *Banks* might allude to the water adjacency rationale. Sax, *supra* note 11, at 348 & n.241.

100. Professor Sax suggests another reason why awarding the land to the private landowner may not be costly for the state: “The gradualness of the process also diminishes the sense of loss by the loser.” Sax, *supra* note 11, at 324.

The use/prescription theory is interesting in light of the traditional common law “presumption that adverse possession does not apply to the government.” MERRILL & SMITH, *supra* note 60, at 202; *see also id.* (noting that some states have “modified” or “abolished” the presumption against adverse possession of government owned lands).

101. *See Beck*, *supra* note 35, at 434 (suggesting that “the ‘productivity’ theory” and “the *de minimis* theory . . . are in fact one”); Sax, *supra* note 11, at 342 (suggesting that the use/prescription rationale approaches the *de minimis* rationale in stating that “[h]aving happened so insensibly, the change is not perceived as having changed the status quo ante, and is thus effectively *de minimis*.”).

102. *See Christie*, *supra* note 2, at 29 (“The primary value of riparian or littoral land is not that it may produce more land, and the policy for recognizing the right to accreted land is not to encourage the filling of submerged land or creation of more land, but to provide access to the water.” (footnote omitted)).

103. For example, preserving or rebuilding wetlands or dunes may help communities better withstand the effects of climate change. Byrne, *supra* note 11, at 87, 93; *see also* Ruhl & Salzman, *supra* note 33, at 230–37 (arguing for recognition of economic value of the nonuse of coastal land under the public trust doctrine).

104. Sax, *supra* note 11, at 308 n.8 (citing FLUSHMAN, *supra* note 6, at 253).

the public's access to the water.¹⁰⁵ Preservation of the private landowner's adjacency to the water is likely efficient because "water-adjacency is central to the value and use of riparian/littoral property."¹⁰⁶ Protection of the public's access to the water is also likely efficient because of the value of public access to tidal and navigable waters for navigation, recreation, commerce, fishing, and other purposes. Case law refers to the protection of the private owner's water adjacency as a rationale for an ambulatory boundary.¹⁰⁷ Indeed, Professor Sax and other commentators seem to agree that preservation of the private owner's adjacency to the shore underlies the modern preference for an ambulatory boundary.¹⁰⁸ The ability of the ambulatory boundary to simultaneously safeguard the public's access to the water seems less widely recognized.¹⁰⁹

To see how an ambulating boundary protects both private and public

105. Professor Eagle indicates that "the basic proposition of the [public trust] doctrine [is] that the public has the right to access and to use public waterways." EAGLE, *supra* note 5, at 185 (emphasis omitted).

106. Sax, *supra* note 11, at 313; *see also* FLUSHMAN, *supra* note 6, at 87; 9 POWELL ON REAL PROPERTY, *supra* note 31, at § 66.01[3]; Christie, *supra* note 2, at 21, 29; Kalo, *supra* note 49, at 1436 n.27.

107. *E.g.*, *Bonelli Cattle Co. v. Arizona*, 414 U.S. 313, 326 (1973), *overruled on other grounds by Oregon ex rel. State Land Bd. v. Corvallis Sand & Gravel Co.*, 429 U.S. 363 (1977); *Hughes v. Washington*, 389 U.S. 290, 293 (1967); *Lamprey v. Metcalf*, 53 N.W. 1139, 1142 (Minn. 1893); *Att'y-Gen. of S. Nigeria v. John Holt & Co. (Liverpool)* [1915] A.C. 599, 612 (P.C.) (appeal taken from S. Nigeria).

108. 9 POWELL ON REAL PROPERTY, *supra* note 31, at § 66.01[3]; Beck, *supra* note 35, at 438; Kalo, *supra* note 49, at 1442–44; Sax, *supra* note 11, at 313, 347–48. Other sources refer to the benefits that an ambulatory boundary has for private landowners. *See* FLUSHMAN, *supra* note 6, at 100; Christie, *supra* note 2, at 29.

Professor Sax indicates that "none of the old cases or old writers" refer to preservation of water adjacency as a rationale to shift the legal boundary. Sax, *supra* note 11, at 326. He speculates that "[p]robably the reason our modern concern with riparian/littoral access to water was not a consideration in earlier times is that in those days, such land was used primarily as forage, rather than for boating or for access related to modern recreational use of the shore." *Id.* at 347 (footnote omitted). Rose suggests that "[b]each recreation" came "into vogue" in the late eighteenth or early nineteenth century in England. *See* Rose, *supra* note 9, at 757.

109. Professor Sax refers to benefits that an ambulatory boundary has for the public as well as private landowners. Sax, *supra* note 11, at 353 (noting that "maintaining water adjacency for riparian/littoral landowners and assuring public use of overlying water (and some part of the foreshore) are the central goals of the law relating to migratory waters"); *see also* Titus, *supra* note 8, at 1370 ("When a shore retreats, the boundaries retreat—regardless of whether the erosion is natural or anthropogenic. Were it otherwise, the public trust rights, such as lateral beach access, would be routinely eliminated . . .").

There also are references in case law to the benefits for the public of maintaining a migratory boundary. *See, e.g.*, *Bonelli Cattle Co.*, 414 U.S. at 318 ("In order for the States to guarantee full public enjoyment of their navigable watercourses, it has been held that their title to the bed of a navigable river mechanically follows the river's gradual changes in course." (footnote omitted)).

trust property, it is helpful to distinguish the effects of an ambulating boundary when land is added to the shore through accretion, and when land leaves the shore through erosion. When land is added to the shore, private landowners risk losing their adjacency to the sea if the new land becomes the property of the state. The new land could separate landowners' property from the ocean.¹¹⁰ Giving landowners title preserves their adjacency to the ocean without interfering with the public's interests in using the water and the wet beach that the public trust historically protects.¹¹¹

When the upland parcel is diminished through erosion, a landward shift of the legal boundary to accord with the new mean high water line diminishes the area under private control. But shifting the legal boundary does not remove the water adjacency that is central to the value of the private property, assuming that the landowner's parcel is not entirely eroded.¹¹² A shift in the legal boundary is probably necessary to preserve the public uses that make public trust property valuable.¹¹³ If the boundary remained the historic mean high water line, parts of the wet beach and tidal and navigable waters could come under private control, which would mean that private landowners could create

110. "The effect of [the application of the avulsion rule to an increase to the beach] would be to destroy the littoral owner's common law littoral rights, including the private littoral right of direct access to the ocean, and to create a ribbon of state-owned, dry sand beach." Kalo, *supra* note 49, at 1442; *see also* *Lamprey*, 53 N.W. at 1142 (describing as "mischief[] . . . if a riparian owner is liable to be cut off from access to the water, and another owner sandwiched in between him and it").

111. For an indication that the interests of the adjoining private and public landowners figure in judicial boundary determinations, *see Bonelli*, 414 U.S. at 328 ("[A]n analysis of the interests of the State and Bonelli [the private landowner,] . . . compels the conclusion that . . . title to the disputed land should be vested in Bonelli The State's acquisition of the exposed land here could only be a windfall, since unnecessary to the State's purpose in holding title to the beds of the navigable streams within its borders.").

As discussed further below, in some circumstances it may be possible to allocate "new land" to the public (using the doctrine of avulsion) without undermining the private landowner's property values. For example, courts have deemed beach renourishment to be avulsion, thereby freezing the boundary at the pre-existing mean high water line and assigning the renourished beach to the public rather than the private owner. Beach renourishment may protect the value of private property because it reduces erosion. Also, renourishment programs may include measures to protect private owners' access to, and views of, the water that reduce the impact on property values. *City of Long Branch v. Jui Yung Liu*, 4 A.3d 542, 553, 555 (N.J. 2010); *Christie*, *supra* note 2, at 42.

112. Natural forces can inflict significant losses on landowners. For example, part of the backdrop to *Severance v. Patterson* was that the "property" of Severance's neighbor was "devastated" by Hurricane Rita. 370 S.W.3d 705, 712 (Tex. 2012). The hurricane "moved the line of vegetation landward" and left "[t]he entirety of the house on Severance's Kennedy Drive property . . . seaward of the vegetation line. The State [of Texas] claimed a portion of her property was located on a public beachfront easement and a portion of her house interfered with the public's use of the dry beach." *Id.*

113. *See, e.g.,* *Rose*, *supra* note 9, at 780.

barriers to the public using these areas for public trust uses such as navigation, commerce, and recreation. An important reason for the public trust over lands underlying tidal and navigable waters is that private owners of these areas might have an incentive to act as holdouts and block access for uses such as navigation and recreation that require consistent public access along long stretches.¹¹⁴

Our discussion so far has focused on five existing rationales for an ambulatory boundary. While not all of these rationales provide satisfactory accounts of the existing case law, each demonstrates a concern with promoting efficiency.

B. *The Efficiency of Migratory Coastal Boundaries*

We now turn to our own explanation of why the current legal preference for a migratory coastal boundary is likely efficient in present circumstances. Our explanation draws on the economic interpretations offered above of the five rationales for a migratory boundary.

Our starting point is that the existing presumption in the law for an ambulatory boundary is efficient because it is sufficiently strong to constitute a reasonably clear rule.¹¹⁵ A clear legal rule provides parties with notice and enables them to adjust their behavior and investments. It should also minimize disputes.¹¹⁶ Of course, freezing the legal boundary at the historic mean high water line under the doctrine of avulsion also

114. PPL Mont., LLC v. Montana, 132 S. Ct. 1215, 1230 (2012) (“A key justification for sovereign ownership of navigable riverbeds is that a contrary rule would allow private riverbed owners to erect improvements on the riverbeds that could interfere with the public’s right to use the waters as a highway for commerce.”); Epstein, *supra* note 33, at 415; Rose, *supra* note 9, at 750. In *Severance v. Patterson*, the majority notes that fixing the boundary using avulsion may “allow[] private property owners to retain ownership of property that becomes submerged under the ocean.” 370 S.W.3d at 722 n.20; *see also* Jefferis v. E. Omaha Land Co., 134 U.S. 178, 189 (1890).

115. Professor Sax alludes to the clarity benefits of the doctrines of accretion and avulsion. Sax, *supra* note 11, at 348 n.241 (“[T]he accretion/avulsion rule is designed to identify a clear owner according to a specified set of rules.”).

We describe the presumption for an ambulatory boundary as “a reasonably clear rule” because there remains the possibility that rather than applying accretion, a court might apply the doctrine of avulsion, which fixes the legal boundary at the historic mean high water line. We do not intend to imply that there are no controversies about whether a physical change along the shore should alter the legal boundary between private and public landowners. *See* Sax, *supra* note 11, at 351 (indicating that “the deeply rooted doctrinal ‘accretion/avulsion’ distinction . . . continues to generate a good deal of wasteful litigation”).

116. *See generally* RICHARD A. EPSTEIN, SIMPLE RULES FOR A COMPLEX WORLD 21–36 (1995); Thomas W. Merrill, *Trespass, Nuisance, and the Costs of Determining Property Rights*, 14 J. LEGAL STUD. 13, 14 (1985) (“[L]ow-cost mechanical entitlement-determination rules play an important role in facilitating the exchange and modification of property rights”); Robert H. Mnookin & Lewis Kornhauser, *Bargaining in the Shadow of the Law: The Case of Divorce*, 88 YALE L.J. 950, 969–71 (1979) (discussing the implications of “vague” legal rules for “private ordering”).

would be a clear rule that would provide notice and presumably reduce disputes. But freezing the legal boundary would sacrifice the benefits of shifting the boundary to accord with natural changes.

Two benefits of an ambulatory boundary are particularly important from an economic point of view. The first is the opportunity that a migratory boundary affords to preserve the water adjacency of private landowners, while simultaneously maintaining public access to the wet beach and tidal and navigable waterways. We have already discussed this advantage and will not repeat the points made above. The second important benefit is the administrative advantages of defining the legal boundary as the contemporary mean high water line rather than a historic mean high water line. We will elaborate on these administrative advantages because, while there are allusions to them in the case law and commentary, we have not come across an extensive treatment of them.¹¹⁷ Nonetheless, simultaneously preserving private water adjacency and public access to the water and the wet beach likely is a more important reason for the preference for a migratory boundary than the administrative advantages of such a boundary. The greater importance of the former is suggested by the judicial willingness to maintain a migratory boundary even when the historical boundary is knowable, and the administrative advantages of aligning the natural and the legal boundaries are less evident.¹¹⁸

To grasp the administrative advantages of an ambulatory boundary, it is useful to keep in mind that while there may be situations where the historical boundary is marked, the historical boundary will most likely be unknown.¹¹⁹ If a dispute arises where a historical boundary is marked, it might be easier to enforce that historical boundary than to undertake a survey to determine a boundary based on the current mean

117. See, e.g., *Siesta Props., Inc. v. Hart*, 122 So. 2d 218, 222–23 (Fla. Dist. Ct. App. 1960) (reversing the trial court, which held that “the law of avulsion insofar as it is attempted to be applied in this case should be rejected as the law of Florida, partly . . . because of the impracticality of applying it intelligently”); *Severance*, 370 S.W.3d at 718 (“[T]he boundary remains fixed (relatively) at the mean high tide line. Any other approach would leave locating that boundary to pure guesswork.” (citation omitted)); *S. Ctr. of Theosophy Inc. v. South Australia* [1982] A.C. 706, 716 (Austl.) (“[I]t is manifestly convenient to continue to regard the boundary between land and water as being where it is from day to day or year to year.”); Byrne, *supra* note 11, at 81; Epstein, *supra* note 11, at 52 (awarding “alluvion” to riparian owners yields “low administrative costs”); Sax, *supra* note 11, at 347 n.234 (discussing *S. Ctr. of Theosophy Inc. v. South Australia*).

118. See *supra* note 85 and accompanying text (discussing judicial willingness to find accretion even where the historic boundary is knowable).

119. See, e.g., 1 SHALOWITZ, *supra* note 49, at 89–90; Thompson, *supra* note 9, at 358 (“[T]o maintain accurate boundary markers on a beach face, the boundary would have to be resurveyed after every winter storm (when a beach can become lower, flatter, and wider as sediment is moved offshore) and even periodically during the calmer summer months (when the beach tends to gain sediment and height).”).

high water line.¹²⁰ However, in the more likely case without a marked historical boundary, it will be less information intensive to determine the contemporary mean high water line boundary than to recreate a boundary based on a historical mean high water line.

The difficulty in recreating a historical boundary is likely to be determining the shape of the landform at the desired point in the past. Historical tidal observations might be available to determine the vertical component of the historical boundary (the height of the mean high tide) because the federal government has monitored tides for over 150 years.¹²¹ But it will be difficult to fix the point along the shore where the mean high water line historically intersected with the shore, because the landform will have changed in the interim. To recreate the shore as it stood in the past likely will require turning to old photographs, maps, surveys, and archival records that may not provide especially “accurate or precise” descriptions of the shore in the past.¹²² Even if a boundary can be determined based on a historical mean water line, there may be less confidence in the accuracy of this boundary than a boundary determined based on a contemporary survey applying data about the mean high water line to the current shore.¹²³ Thus echoing a point made earlier in the discussion of the lost boundary rationale, the legal preference for a migratory boundary seems to be another illustration of the influence of information costs on property law.¹²⁴ It is the difficulty of accessing information about preexisting landforms that complicates the administrative use of a fixed, historic boundary.

We acknowledge that a migratory boundary has costs as well as benefits. One of the disadvantages is the lack of certainty that a migratory boundary provides private landowners and the public about where private ownership begins and public ownership ends when they walk along a beach, especially when the migratory boundary is the mean high water line as opposed to the more visible vegetation line.¹²⁵ As discussed earlier, the mean high water line is not a clear on/off signal. There are problems with policing trespassing by members of the

120. One downside of applying the historical boundary is that it might distance one party from the ocean and result in a loss of water adjacency.

121. Christie, *supra* note 2, at 33.

122. FLUSHMAN, *supra* note 6, at 135–38. For a description of methods surveyors currently use, see COLE, *supra* note 51, at 93–104.

123. The difficulty of determining a historic vegetation line boundary is captured by an article discussing a 1966 Washington State Supreme Court decision that fixed the boundary between private and public trust property as the vegetation line of 1889. The article asks rhetorically, “The unanswered question remains: Can the vegetation line of 1889 in fact be determined? If so, how?” Corker, *supra* note 43, at 91.

124. See *supra* note 87 and accompanying text.

125. See Christie, *supra* note 2, at 72 (describing the “ocean boundaries” of “coastal land” as “indeterminable to laymen—both littoral owners and beach users”).

public onto private property in beach areas due to the uncertainty of the boundary. But the benefits to private landowners—as well as the public—of maintaining water adjacency and reducing the administrative costs of determining the boundary may offset the costs of impinging on the owner’s right to exclude stemming from the migratory mean high water line. These benefits might be especially salient in an era when coastal property is highly valued.¹²⁶

If a migrating boundary is efficient, why do legal decision makers sometimes freeze the boundary at a historic point, through statutes such as the Florida legislation that provides the backdrop to the *Stop the Beach Renourishment* case, or through common law decisions that employ the doctrine of avulsion? One possibility is that individual decisions to fix the boundary might be inefficient and dictated by notions of fairness or perhaps simply politics.¹²⁷ But it is also possible that there may be circumstances where a fixed boundary is efficient even if a migratory boundary generally should be preferred on efficiency grounds.

Consider the choice in Florida to fix the boundary between private and public trust property at the preexisting mean high tide line before undertaking beach renourishment that provided the backdrop for *Stop the Beach Renourishment*.¹²⁸ This choice deprives private landowners of their immediate adjacency to the ocean because the renourished beach is interposed between privately owned land and the ocean, on public trust property seaward of the newly fixed boundary. But fixing the boundary

126. See *supra* note 43 (referring to indications that rising coastal property values prompt greater precision in determining coastal boundaries); see also *Parker v. New Hanover Cnty.*, 619 S.E.2d 868, 871, 880 (N.C. Ct. App. 2005) (upholding an inlet relocation project to protect \$600 million of private coastal property).

127. Professor Byrne states that

the avulsion-accretion distinction . . . seems quite susceptible to judicial interpretation to reach desired results post-hoc, as the degree of perceptibility necessary for finding avulsion cannot be stated with any precision. Indeed, it may be the best rationale for the distinction that its vagaries allow courts to accomplish substantial justice post-hoc.

Byrne, *supra* note 11, at 95. Case law supports the idea that avulsion provides the courts with a means of—as Professor Byrne puts it—“reach[ing] desired results post-hoc.” See *Bonelli Cattle Co. v. Arizona*, 414 U.S. 313, 327 (1973) (“The rationale for the doctrine of avulsion is a need to mitigate the hardship that a shift in title caused by a sudden movement of the river would cause the abutting landowners were the accretion principle to be applied.”), *overruled on other grounds by Oregon ex rel. State Land Bd. v. Corvallis Sand & Gravel Co.*, 429 U.S. 363 (1977); *id.* at 328 (reaching a possibly post-hoc decision by balancing “the interests of the State and [the private landowner]” and finding that “[t]he State’s acquisition of the exposed land here could only be a windfall”).

128. See *Stop the Beach Renourishment, Inc. v. Fla. Dep’t of Env’tl. Prot.*, 130 S. Ct. 2592 (2010).

at the preexisting mean high tide line when undertaking beach renourishment may be efficient.¹²⁹ First, the information problems that in general might make it hard for the courts and private and public landowners to fix the boundary at a historical line are unlikely to plague the fixing of the boundary in the context of beach renourishment. In this context the boundary is determined and fixed before the shape of the shore is physically altered by renourishment. Thus there is no need to go back to old photos, maps, or surveys to recreate the shore and define the point at which the horizontal plane of the mean high water line hypothetically would have intersected with land along the shore, because the shore is available for a survey before renourishment.¹³⁰

Second, fixing the boundary in the context of beach renourishment may protect the value of private and public trust property. Declines in private property values due to the loss of ocean adjacency may be offset by the protection that renourishment provides against declining property values due to erosion.¹³¹ The Florida statute also provides private landowners with protections to safeguard many of their traditional littoral rights that should help to reduce any diminution in their property values.¹³² Freezing the boundary benefits the public by providing it with access to the renourished beach, and as discussed above, public access to the beach has economic value. This public access might be regarded as a reward for investing in beach renourishment, an expensive

129. See Christie, *supra* note 2, at 37 (describing beach renourishment of “critically eroding beaches or beaches that are retreating dramatically” as “one situation . . . where a fixed boundary is the most reasonable policy resolution and, if legislation is designed properly, should avoid constitutional problems”).

130. See *Stop the Beach Renourishment, Inc. v. Fla. Dep’t of Env’tl. Prot.* 130 S. Ct. 2592, 2599 n.2 (2010) (assuming that “the [surveyed] erosion-control line is the pre-existing mean high-water line”); Christie, *supra* note 2, at 40–41 (indicating that the “erosion control line,” that becomes the fixed boundary, is established “[b]efore construction of a beach restoration project” and that the mean high water line “is the primary reference for . . . establish[ing] the erosion control line”).

131. *City of Long Branch v. Jui Yung Liu* refers to the benefits of renourishment for private upland owners. 4 A.3d 542, 545 (N.J. 2010) In this case a coastal landowner argued that the court should treat 225 feet of dry sand added to the beach in front of her property as accretion in its determination of just compensation in an eminent domain action. *Id.* 545. The court, holding that the replenishment constituted avulsion, noted that, by the time the case reached oral argument, the 225 feet of replenished beach already had eroded, and “[o]ne can only surmise what would have been the damage to the Lius’ property without the 225-foot buffer.” *Id.* at 553 n.13; see also Christie, *supra* note 2, at 71 (“As a general proposition, the increase in value of property that was previously endangered by erosion and that would be protected and enhanced by a two-hundred-foot wide beach will offset the value of the right to accretions for property on a critically eroding beach.”).

132. Christie, *supra* note 2, at 42; see also Epstein, *supra* note 11, at 39, 43, 66–67 (arguing that Florida’s statutory scheme for beach renourishment provides in-kind compensation for the taking of littoral rights).

endeavor that may be “cost-effective,” at least in Florida,¹³³ but that might not occur without guaranteeing public access to the renourished beach.¹³⁴

III. MAINTAINING AN AMBULATORY BOUNDARY

If an ambulatory boundary is efficient under current circumstances, should the boundary continue to migrate in a warming world? Sea levels will rise due to climate change; in turn, rising sea levels will push the mean high water line landward. As the line shifts, under the doctrine of erosion, the public trust will burden formerly upland private property and the public trust will expand at the expense of private property.¹³⁵ However, as mentioned above, the private property owners whose lands will be burdened will not be entitled to compensation.

Recent scholarship raises the possibility that the rules of the game should change in a warming world, and that perhaps private owners whose land becomes subject to the public trust should receive compensation.¹³⁶ These suggestions, which we have not seen fully articulated, seem based on the idea that it would be unjust to force landowners to bear the cost of the loss of territory, as they will no longer have the chance to enjoy gains in their holdings, because the likelihood of accretion is much diminished in a warming world where sea levels are rising.¹³⁷ Thus the suggestions draw on a justice-based understanding of the reciprocity rationale for an ambulatory boundary, which justifies awarding any gains in land to private landowners because they face the downside risk of losses in land.¹³⁸ These suggestions seem to reflect a belief that private landowners no longer face a “fair lottery”¹³⁹ in a warming world where the mean high water

133. Christie, *supra* note 2, at 38.

134. Byrne, *supra* note 11, at 94–95 (“States are unlikely to fund beach reconstruction projects if the new beaches are constitutionally required to be privately owned.”).

135. Byrne, *supra* note 25, at 626 (“Under traditional common law rules governing erosion, the migration of the mean high tide line will change ownership of locations from private owners to the public.”); *see also* Byrne, *supra* note 11, at 80, 100.

For background on sea level rise and climate change, see, for example, Byrne, *supra* note 11, at 73–76; Hiatt, *supra* note 25, at 374–77; and Titus, *supra* note 8, at 1298–300. *See also* COLE, *supra* note 51, at 24 (“During the last 100 years, sea-level monitoring has indicated a worldwide trend of continual rise in sea level.”).

136. *See supra* note 25 and accompanying text.

137. *See supra* note 25.

138. *See* Hiatt, *supra* note 25, at 384 (referring to the reciprocity rationale for accretion and erosion and arguing that these doctrines should not apply when boundaries shift due to sea level rise because “the doctrine [will] . . . consistently work to the detriment of private property owners”). However, Hiatt argues that “[i]t should not be considered a taking” when the government acquires control over newly submerged private lands due to sea level rise due to climate change, pursuant to the public trust doctrine. *Id.* at 385.

139. This term is borrowed from Kornhauser & Sager, *supra* note 92, at 492.

line is expected to shift unidirectionally landward. Similarly, it might be argued that tideland owners stand to reap an unfair windfall in a warming world on the basis that the right of tideland owners to gain property through erosion historically has been justified by the equal possibility that tideland owners lose property as dry land accretes to the shore.¹⁴⁰

The suggestions that private landowners receive compensation for the landward movement of the mean high water line raise two questions in Calabresi and Melamed's terms.¹⁴¹ The first is whether the entitlement to the land that becomes seaward of the mean high water line should shift from the state to private landowners. Under current law, this shifting land becomes subject to the public trust. But the idea of compensating private landowners for the inland rolling of the public trust implicitly presumes that private landowners should continue to remain entitled to the shifting land. The entitlement would transfer to the public only after the payment of compensation. The second question concerns the remedy available to private landowners for the loss of their private parcels to rising seas. As explained above, under current law if private landowners lose land to the public trust they are not compensated for the loss of their rights, which means in effect that the loss remains where it falls.¹⁴² Compensating landowners for the loss would spread the loss across taxpayers.¹⁴³

We begin with the first question of whether the entitlement to the shifting land should shift from the state (on behalf of the public) to private landowners. We focus on whether the state or private landowners should be entitled to the land as a general rule. Our discussion presumes that decision makers have the legal authority to grant the shifting land to private landowners. However, the public trust doctrine might prevent lawmakers from allowing private landowners to acquire title to the shifting land because allowing them to do so might be regarded as alienating a portion of the land to which the public should retain access under the doctrine.¹⁴⁴

140. *United States v. Milner*, 583 F.3d 1174, 1189 (9th Cir. 2009) emphasizes the symmetry of the claims of the owners of the uplands and the tidelands. For example, *Milner* states that "both the Lummi and the Homeowners must accept that the ambulatory boundary is 'an inherent and essential attribute of the original property,' and that both the tidelands and the uplands are subject to diminishment and expansion based on the forces of the sea." *Id.* at 1188 (quoting *Cnty. of St. Clair v. Lovington*, 90 U.S. (23 Wall.) 46, 68 (1874)).

141. *See supra* note 39.

142. *Cf.* Calabresi & Melamed, *supra* note 39, at 1091 (referring to "[w]hen a loss is left where it falls in an auto accident").

143. As we mention below, loss-spreading already occurs through flood insurance and disaster relief, which promote risky investments on the coast. *See infra* note 169 and accompanying text.

144. Byrne, *supra* note 11, at 81–82 (discussing the potential that the public trust doctrine

The assignment of the entitlement can be made on efficiency, justice, or other grounds.¹⁴⁵ We analyze the assignment on efficiency grounds, consistent with our view that a concern with efficiency underpins the existing presumption for a migratory coastal boundary. In determining whether to allocate the shifting land to the public trust or to private landowners, the legal decision maker should allocate the entitlement to the actor with the highest use value.¹⁴⁶ To achieve “allocative efficiency,”¹⁴⁷ the decision maker does not need to determine precisely the values that private landowners and the public place on the shifting lands, but only who between them is likely to place a higher value on the shifting land.¹⁴⁸ The decision maker should not count on the parties being able to subsequently reallocate the entitlement through negotiation if the decision maker awards the entitlement to the lower value user because bargaining between the state and private landowners is likely to encounter high transaction costs.¹⁴⁹

It is an empirical question whether the public, acting through the state, or private landowners are likely to be the relatively higher value user of the shifting land. Economically oriented scholarship suggests that the public is likely the higher value user of the shifting lands under current circumstances, and we do not foresee any reason why the calculus might change in an era of sea level rise.¹⁵⁰ While the law

might prevent the abrogation of accretion, because abrogation “would prospectively prevent the public from accessing tidelands or submerged lands”); Hiatt, *supra* note 25, at 382 (“[T]he public trust doctrine likely *requires* a state to take title or assert control on behalf of the public over submerged private lands.”).

145. Calabresi & Melamed, *supra* note 39, at 1093; see Richard R.W. Brooks, *The Relative Burden of Determining Property Rules and Liability Rules: Broken Elevators in the Cathedral*, 97 NW. U. L. REV. 267, 271 (2002).

146. See Brooks, *supra* note 145, at 270 n.11.

147. *Id.* at 283 (“[A]llocationally efficient rules direct entitlements to the parties who value them most.”).

148. *Id.*

149. If the general rule is that private landowners retain title to the shifting land, but these landowners prove to have lower value uses, the state, which represents the public, in theory could buy the land from the private landowners through the exercise of eminent domain. But there are procedural, economic, and political hurdles to the state’s exercise of eminent domain that in practice could thwart state efforts to buy out large numbers of private landowners over an extended period of time. See Smith, *Property and Property Rules*, *supra* note 3, at 1734 (“[T]he main constraints on the use of the eminent domain power are its cumbersomeness and any political opposition aroused by the possibility of its exercise in a given situation.” (citing Thomas W. Merrill, *The Economics of Public Use*, 72 CORNELL L. REV. 61, 77–81 (1986))). If the state is awarded the shifting land as a trustee for the public and the public is the lower value user, then private landowners likely will have difficulty buying the lands back from the state. There are likely to be large numbers of landowners, and many of them might be tempted to free ride. The state also may be a difficult negotiating partner, again, because of procedural and political barriers to decision making.

150. See, e.g., Byrne, *supra* note 11, at 82; Rose, *supra* note 9, at 723; see also Hiatt, *supra*

exhibits a general presumption in favor of private property,¹⁵¹ the lands that underlie tidal and navigable waters immediately near the shore are distinctive and, as explained above, are not suitable for many uses made of uplands because either tides affect these lands or they remain completely submerged. Public trust lands are most amenable to uses such as navigation, recreation, fishing, and commerce, and public ownership enables the public to use the lands for these purposes by eliminating the potential for private landowners to put up roadblocks.¹⁵² It is also public use of the public trust lands for these purposes that gives the lands their value.¹⁵³

The second question of whether private landowners should receive compensation arises if, contrary to what we argue, the entitlement over the shifting land shifts to private landowners. As already mentioned, legal decision makers might decide to shift the boundary on justice or fairness grounds, believing that it is no longer fair to burden private landowners with the costs of the loss of territory, because they no longer have the reciprocal prospect of gaining land, due to sea level rise attributable to climate change.

The question of whether private landowners should receive compensation is similar to the more general question of when government should pay compensation for takings.¹⁵⁴ Under existing law there is no governmental taking and compensation is not paid when the public trust encroaches on private land because of changes in the mean high water line. But the public trust encroaching on privately owned lands has a number of structural similarities to a government taking: (1) the private landowner's rights are diminished, and (2) the state becomes the beneficiary of the diminution in private rights because it is the state that safeguards the property as the trustee for the public.¹⁵⁵

note 25, at 382 (“[T]he societal interest in public control of tidal lands and waters will be as applicable in our climate changed future as it has been since Roman times.”).

151. Rose, *supra* note 9, at 717.

152. *See id.* at 757–58 (describing “transportation and commerce” as “[t]he uses of waterways most subject to monopolization or holdout”); *id.* at 753, 757, 760 (explaining why locations for recreation might be susceptible to holdouts, after initially arguing that it is difficult to justify holding areas in trust for the public for recreation using the “anti-holdout rationale”); Epstein, *supra* note 33, at 415–16 (discussing the potential for holdouts if “navigable rivers and lakes” were privately owned). In *Severance v. Patterson*, the majority notes that fixing the boundary using avulsion may “allow[] private property owners to retain ownership of property that becomes submerged under the ocean.” 370 S.W.3d 705, 722 n.20.

153. Rose, *supra* note 9, at 770–71.

154. There is an extensive literature about the justifications for requiring compensation for takings. A classic article is Professor Frank I. Michelman, *Property, Utility, and Fairness: Comments on the Ethical Foundations of “Just Compensation” Law*, 80 HARV. L. REV. 1165 (1967).

155. Thanks to Lewis Kornhauser for his help with framing the situation as similar to a government taking.

Several variables must be considered, assuming again that we are aiming to pay compensation only if it is warranted on efficiency grounds. The implications of not paying compensation for private landowners' investment decisions are one potential justification for paying compensation.¹⁵⁶ Professor Frank Michelman refers to these implications of not paying compensation as “demoralization costs.”¹⁵⁷

Private landowners might respond in two ways to the prospect that rising sea levels will reduce the scope of their holdings. One possibility is that they will reduce investments in at-risk coastal property, an action that could decrease coastal property prices.¹⁵⁸ A decline in investments in at-risk coastal property is economically desirable and not something to forestall through the payment of compensation. There is little point in encouraging investments in land that is at risk of sinking or increased flooding.¹⁵⁹

The other possibility is that landowners will invest in protective measures in an effort to ward off the erosion of their holdings.¹⁶⁰ These might take the form of “hard armoring,” for example building erosion-control structures, such as sea walls. There is also the possibility of “soft armoring,” such as reinforcing dunes and restoring wetlands.¹⁶¹

156. Recall in this light Michelman's statement that “[t]he correct utilitarian statement, then, insofar as *the issue of compensability* is concerned, is that compensation is due whenever demoralization costs exceed settlement costs, and not otherwise.” Michelman, *supra* note 154, at 1215.

157. *Id.* at 1214 (“Demoralization costs’ are defined as the total of (1) the dollar value necessary to offset disutilities which accrue to losers and their sympathizers specifically from the realization that no compensation is offered, and (2) the present capitalized dollar value of lost future production (reflecting either impaired incentives or social unrest) caused by demoralization of uncompensated losers, their sympathizers, and other observers disturbed by the thought that they themselves may be subjected to similar treatment on some other occasion.” (footnote omitted)).

158. Titus argues for “rolling easements” along the ocean coasts, partly on the basis that they will discourage property owners from inefficient investments. Titus, *supra* note 8, at 1325–26.

159. New York Governor Andrew Cuomo's proposal to spend as much as \$400 million to buy out coastal property owners whose homes in flood-prone areas were destroyed by Hurricane Sandy is indicative of a growing recognition that, in view of expected sea level rise, some coastal investment should be discouraged. See Thomas Kaplan, *Cuomo Is Seeking to Curb Building in Flooded Area*, N.Y. TIMES, Feb. 4, 2013, at A1, available at <http://www.nytimes.com/2013/02/04/nyregion/cuomo-seeking-home-buyouts-in-flood-zones.html>.

160. Michelman refers to the potential that a landowner might avoid a governmental taking by “devoting a large proportion of his energies and resources to counter-strategy aimed at fending off the risk” of a government taking. Michelman, *supra* note 154, at 1217. On the likelihood that private owners will resist the incursion of the public trust, see, for example, Byrne, *supra* note 25, at 626; Byrne, *supra* note 11, at 81.

161. Byrne, *supra* note 11, at 87 (defining hard and soft armoring); see also Mireya Navarro & Rachel Nuwer, *Resisted for Blocking the View, Dunes Prove They Blunt Storms*, N.Y. TIMES, Dec. 4, 2012, at A1, available at <http://www.nytimes.com/2012/12/04/science/earth/after-hurricane-sandy-dunes-prove-they-blunt-storms.html> (discussing the protection that dunes offered

The idea that landowners might engage in “armoring” is not idle speculation. When permitted by state law, coastal landowners do already invest in erosion control structures to preserve their parcels against natural changes.¹⁶²

Landowner investments in armoring are a form of self-help. As Professor Smith argues, “[S]elf-help measures . . . are inefficient if they are less cost-effective than government-supplied protection.”¹⁶³ The relative cost-effectiveness of landowners’ and governmental protective measures is an empirical question. However, there is a reasonable basis for thinking that private self-help is likely to be less cost-effective than government-provided protection, especially if the external costs of private armoring are counted. It is well recognized that individual landowners’ hard armoring imposes costs on others, because the construction of a sea wall in one area may exacerbate erosion elsewhere, negatively affecting other private landowners, as well as public access to the shore.¹⁶⁴ Governmental authorities might stand a better chance of devising mechanisms to control erosion that reflect broader social costs and benefits.¹⁶⁵ Thus one argument in favor of compensation is that the absence of compensation encourages private self-help by landowners. However, it may be possible to limit landowner self-help by the regulation of erosion control structures and regulation may be a more cost-effective way of avoiding undesirable self-help than compensation. “A number of” coastal states already regulate the construction of erosion control structures, and there is case law holding that such regulation is not an unconstitutional taking such as to require compensation.¹⁶⁶ In the end neither the possibility that landowners will invest in self-help nor the possibility that landowners

communities from the effects of Hurricane Sandy).

162. Byrne, *supra* note 11, at 101 (noting that “[a] number of states already prohibit armoring on the oceanfront, and so far these have survived takings challenges” but warning that the plurality opinion in *Stop the Beach Renourishment* might provide a basis for challenging prohibitions in some states); Titus, *supra* note 8, at 1281–82 (discussing the construction of sea walls along the coasts, especially along bays); Michael Schwartz, *Dispute in Hamptons Set Off by Effort to Hold Back Ocean*, N.Y. TIMES, Apr. 18, 2013, at A1, available at <http://www.nytimes.com/2013/04/18/nyregion/southampton-homeowners-build-barricades-to-hold-back-sea.html> (reporting that Hamptons homeowners are building “barricades” in light of Hurricane Sandy).

163. Smith, *Property and Property Rules*, *supra* note 3, at 1785.

164. Byrne, *supra* note 11, at 87 (“Hard armoring . . . often increases erosion of neighboring properties by increasing current and wave action laterally against unprotected shorelines.”); see also Christie, *supra* note 2, at 37–38; Sax, *supra* note 24, at 642–43.

165. See Byrne, *supra* note 11, at 87; Epstein, *supra* note 11, at 41.

166. Byrne, *supra* note 11, at 101; see also Titus, *supra* note 8, at 1299, 1301, 1375, 1376 (discussing state measures). However, Professor Byrne suggests that recent Supreme Court jurisprudence might jeopardize the ability of states to “prohibit[] armoring without compensation to owners.” Byrne, *supra* note 11, at 102.

will curtail their investments in coastal property seems sufficiently problematic to justify the payment of compensation.

Thus far we have concluded that compensation is not justified based on how landowners are likely to respond if they do not receive compensation. There are also other factors that weigh against compensation. A traditional factor is the associated administrative costs, which fall under Michelman's rubric of "settlement costs."¹⁶⁷ Compensating private landowners would require establishing a process for determining the amount to pay for the loss of lands attributable to sea level rise due to global warming. The causation issues are formidable if we want to construct a program that pays compensation only for land losses due to climate change. This is because it would be necessary to link losses in particular areas to climate change with a degree of certainty that is likely to be very difficult to attain.

Another factor that weighs against compensation is the potential that compensation would exacerbate an existing moral hazard problem.¹⁶⁸ There already are subsidies for investing in coastal property, including subsidized flood insurance and disaster assistance, that likely encourage overinvestment in light of the risks.¹⁶⁹ Paying compensation might further encourage investments that are socially undesirable given the risks of rising seas and greater numbers of increasingly severe weather events due to climate change.¹⁷⁰

In suggesting that governments should not compensate landowners

167. Michelman, *supra* note 154, at 1214 ("Settlement costs' are measured by the dollar value of the time, effort, and resources which would be required in order to reach compensation settlements adequate to avoid demoralization costs.").

168. There is a general argument that the "payment of full compensation to aggrieved property owners [for governmental takings of their property] can distort the owners' primary behavior by creating moral hazard problems, thereby inducing them to *overinvest* in assets." Abraham Bell & Gideon Parchomovsky, *The Case for Imperfect Enforcement of Property Rights*, 160 U. PA. L. REV. 1927, 1931 (2012). Professors Bell and Parchomovsky helpfully cite the literature analyzing the possibility that takings compensation could prompt moral hazard issues, including the important article by Lawrence Blume et al., *The Taking of Land: When Should Compensation Be Paid?*, 99 Q.J. ECON. 71 (1984). *Id.* at 1931 nn.13–15, 1951–52.

169. RAWLE O. KING, CONG. RESEARCH SERV., R40650, NATIONAL FLOOD INSURANCE PROGRAM: BACKGROUND, CHALLENGES, AND FINANCIAL STATUS 8 (2012) ("The availability of federally-subsidized flood insurance in high-risk areas arguably encouraged too many people to locate in flood-prone areas and to not take appropriate steps to mitigate loss, leaving these financial losses to be either uncompensated or transferred to third-parties, including taxpayers via federal disaster assistance. Economists maintain that the assurance of federal assistance in the event of a repeated disaster creates a 'moral hazard' by lowering the incentives to avoid risk."); *see also* Byrne, *supra* note 11, at 83–85 (urging reform of flood insurance); Tarlock, *supra* note 74, at 757 ("[A] federal flood-insurance program encourages over-building in high risk areas.").

170. For a related argument, see Tarlock, *supra* note 74, at 756–57, where Professor Tarlock argues that climate change suggests that the risk of moral hazard should factor into takings analyses.

for losses caused by erosion due to climate change because it would not be efficient to do so, we do not intend to suggest that public policy should always be based on efficiency considerations. Yet efficiency should play a major role in deciding whether to compensate private property owners along the coast because efficiency is an important, if often unarticulated, underpinning of boundary determination along the coasts. Moreover, the force of the justice- or fairness-based concerns about landowners losing property without compensation would seem to be muted by the likelihood that their losses will be gradual. Provided change proceeds slowly, landowners should be able to gradually adjust their expectations to accord with the new realities along the coasts.¹⁷¹

CONCLUSION

Land borders usually are assumed to be fixed and stable. This Article has highlighted an important border that is generally unstable due to both natural forces and to a legal preference for an ambulatory boundary: the border between private and public trust property on ocean beaches. This Article has argued that this migratory boundary is efficient as a general rule in current circumstances, and that the boundary should be allowed to migrate as usual in an era of climate change. The ambulatory boundary protects the water adjacency of private landowners and the public, while promoting administrative efficiency. In individual circumstances where an ambulatory boundary is problematic, the boundary potentially can be fixed under the doctrine of avulsion, assuming that it applies along the coast in the relevant jurisdiction and that the changes along the shore are “sudden and perceptible.”¹⁷² However in general an ambulatory boundary remains an efficient way of recognizing the distinct combination of private and public interests on the beach.¹⁷³ The modern preference for a migrating boundary reflects a wise balancing of interests that should be preserved going forward as the coastline changes along with the climate.

171. *See id.*; Hiatt, *supra* note 25, at 393–94.

172. FLUSHMAN, *supra* note 8, at 94. As mentioned earlier, there may be legal obstacles to generically fixing the boundary. *Supra* note 61.

173. *See, e.g.*, Sax, *supra* 11, at 356 (“The reality is that there exists on the seashore a zone that is neither wholly public nor wholly private, but in which some accommodation must be made between public and private entitlements.”); *see also* Epstein, *supra* note 11, at 45 (observing that “[t]he boundaries of beachfront property . . . raise profound issues that do not arise with respect to most plots of land”).