Three Stories About Nature: Property, the Environment, and Ecosystem Services

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I. INTRODUCTION

Property is the process of dividing the world into bits that may be subjected to private control. As such, how we understand the world, its characteristics, and its processes is very important. If, for instance, we think of water as an infinite resource that serves growth needs, we might not be concerned with how that resource is acquired, used, or even wasted. On the other hand, if we believe that water is a scarce and essential resource, we may find that an allocation scheme bears the weight of accomplishing many social and economic objectives. Nature matters because our understanding of the world matters to the manner in which we construct rights to property. Of course, at some point, the converse also obtains: how we conceive of property influences what we enjoy, fear, and want in the world. A new understanding of nature may
be resisted precisely because it undermines the persuasiveness of the way we protect possessions as property. Property and nature are codependent, but their connection is an indeterminate one.

When we view both nature and property as social constructions, it becomes apparent that the terms “property,” “environment,” and the more recent description of nature based on “ecosystem services” can often be used interchangeably. At least, it should not be surprising that these terms share some common ground, as they share the same referent(s). Yet advocates from different perspectives certainly do not agree on the meaning of these terms or the values that they invoke, and it is to these divergent perspectives that this Article is addressed. These terms, whether considered synonymous or divergent, reflect on the contingency of an inevitable and ongoing clash of values that results when we allow rights to vest in natural things.

With this in mind, consider a slight modification of the rivalry between the two notorious hunters, Pierson and Post. In this modified story, Pierson and Post remain on the hunt. However, at some point in the pursuit, Post recognizes that his efforts are not bearing fruits. Post shoulders his gun, leashes his hounds of imperial descent, and turns his efforts to more constructive projects (whether he intends to abandon the hunt we will never know). He digs up and destroys the fox’s lair, levels the forest, relocates nearby streams, and forcefully removes all fowl and other creatures relied upon by the fox for food. The fox goes hungry, thirsty, and unprotected from the elements. The fox soon grows close to death. Yet just before the fox dies from these “natural” causes, Pierson spots the fox out in the open, springs, then strikes the fox with a mortal blow and leaves with fox in hand. Post, of course, sues for conversion. As the story goes, the success of Post’s claim depends on whether his


Man is biologically predestined to construct and to inhabit a world with others. This world becomes for him the dominant and definitive reality. Its limits are set by nature, but once constructed, this world acts back upon nature. In the dialectic between nature and the socially constructed world the human organism itself is transformed. In this same dialectic man produces reality and thereby produces himself.


3. See Pierson v. Post, 3 Cai. 175 (N.Y. Sup. Ct. 1805), for a discussion of the original rivalry.
actions were sufficient to reduce the fox to "property" and vest an entitlement.\textsuperscript{4}

The force of Post's claim largely depends on the manner in which law constructs boundaries and apportions the world into units of ownership. The premise for this claim of contingency, of course, is that property always appears to be in a state of flux, which is reflected in its constant process of negotiation with and adaptation to new social needs and systemic challenges.\textsuperscript{5} In this process, the meaning of property is pulled and pushed, not only because property is a legal construct (and law generally struggles under such tensions)\textsuperscript{6} but also because property influences how we understand ourselves both individually and as we relate to others.\textsuperscript{7} The very idea of property is fundamental and foundational, but it is also dependent upon purposes we want it to serve. It is within this context of contingency that this Article offers three different possible resolutions to the modified dialogue between Pierson and Post. These are not just different stories about different laws (which, of course, they are): the three answers—Property, the Environment, and Ecosystem Services—propose different stories about nature and how law treats things in the world, and each illustrates its own legal construction of nature.\textsuperscript{8}

\begin{itemize}
\item \textsuperscript{4} Id. at 177.
\item \textsuperscript{5} See generally Craig Anthony (Tony) Arnold, The Reconstitution of Property: Property as a Web of Interests, 26 HARV. ENVTL. L. REV. 281, 291-95 (2002).
\item \textsuperscript{6} Eric Freyfogle writes,

Private property is an organic, evolving institution, as the historical record makes clear to anyone who reads it fairly. Over the generations, the rights and responsibilities of land ownership have shifted considerably, and legitimately so, given that private property is, at root, chiefly a tool that lawmaking communities use to promote their well being. As values, understandings, and circumstances all change, so too should the mix of rights and responsibilities that landowners possess.


\item \textsuperscript{7} See MARGARET JANE RADIN, REINTERPRETING PROPERTY 191-201 (1993) (linking property to identity and self-actualization); see also Amy Sinden, The Tragedy of the Commons and the Myth of a Private Property Solution, 78 U. COLO. L. REV. 533, 539 (2007) ("What we call things and how we categorize them matters because it influences how we think about them.").

\item \textsuperscript{8} Although it might be obvious, it is probably worth mentioning that the contingencies of property will tend to bleed into these stories as well, suggesting that there may be no single description of the relationship between property and nature. While this point may appear to some to be trivially true, it is important to note that our stories often locate only the starting point for an analysis of how law constructs a reality that may be unintended—a point made in great detail by Margaret Jane Radin in her identification of the personhood incident to property. See RADIN, supra note 7, at 191-201.
\end{itemize}
The thesis of this Article is that ecosystem services—the "wide range of conditions and processes through which natural ecosystems, and the species that are part of them, help sustain and fulfill human life"—will have a dramatic impact on the relationship between property and nature, and this impact may be best understood by examining how the Ecosystem Services story diverges from the legal and rhetorical commitments made in the Property and Environment paradigms. To introduce the Property story, Part II of this Article relies on the rule of capture, which occupies a special place in understanding the things in nature and how they have historically been subordinated to human use. Under the rule of capture, the natural world is divided into property and potential property. The argument made in this Part is that the Property description of nature emphasizes the importance of boundaries to delineate claims to things in the world and ascribe value to them. To introduce the story of the Environment, Part III of this Article considers environmental and natural resource laws as efforts to transition law into valuing nature by reference to something other than its potential utility. The argument made in this Part is that despite the dramatic changes reflected in the Environment, the transition from Property was made easier by retaining the central importance of boundaries in the world and by applying that notion to distinguish Property from the Environment; but as a consequence, nature took on the role of a property defect.

The remainder of this Article concerns the manner in which the trends toward an Ecosystem Services approach converge or conflict with past paradigms of nature. Accordingly, Part IV of this Article introduces Ecosystem Services as a description of the world that is notable for the way it navigates and reinvents the boundedness of the things of nature while reconnecting nature to important characteristics of property. The argument made in this Part is that Ecosystem Services combines the intent of the Environment with the value embedded in the Property scheme but modifies value to cast nature as an economic advantage. Part IV also considers the obstacles to formalizing the Ecosystem Services understanding of nature as an element of property, including the difficulties that courts have demonstrated in understanding the nature of the shift.

10. See generally Pierson, 3 Cai. at 178, 179 (discussing the actions required to acquire a property right to a wild animal).
11. See discussion infra Part II.B.
II. THIS THING CALLED PROPERTY

A. *In the Matter of Pierson v. Post*

It is with a strong sense of regret that we concede that this court is not empowered to award the relief that Mr. Post seeks. Under the long-standing rules governing property acquisition, this court awards a superior interest to the hunter who successfully extends his dominion and control over the wild and wily beast. In other words, you have to kill the thing.

We commend Mr. Post on his efforts, and we do recognize that so great an expense for the public benefit should not go unrewarded. Yet we remain certain that Mr. Post will recognize the ease of judicial administration that accompanies the test we here observe. The rule of capture does not recognize property rights in an "almost," indirect, or otherwise incomplete capture. The rule requires domination so complete as to deprive the thing of its natural liberty—a condition that neatly serves the collateral purpose of notifying others of the successful hunt and competing claims for the prize.

We also take this moment to suggest that in future disputes under similar circumstances, Mr. Post might consider pleading trespass, supported by a claim of title to the land. Mr. Post has undoubtedly added substantial value to the land, which is now in a suitable circumstance for virtually any productive use. Hence, such a claim might be made under the auspices of adverse possession or some other patentable claim under statute. Under such a legitimate claim, this court would have no opportunity but to award Mr. Post the protection of the law.

Signed, The Court

B. *Things in Nature as Property*

Capture is a good starting point for any examination of law's relationship to nature due to its historical significance in resource allocation. As the United States began its westward expansion, the country was faced with the perception of an untamed and dangerous but
The rule of capture encouraged the transformation of resources and the civilization of the West by inviting private claims to exploration; encouraging mining and patent of federal lands under the General Mining Act of 1872; vesting a priority in the use of water for mining and irrigation purposes under the prior appropriation doctrine of Western water law; and awarding the right to harvest forests, graze pastures, and take wildlife and a host of other resources. With its focus on labor—a uniquely common asset among pioneers—the rule of capture provided a needed certainty and stability.

In effect, capture encouraged the domination of an untamed nature and transformation of natural processes in a manner that suited pioneering needs. Under the rules set out to resolve the competing claims of Pierson and Post, an expectation to vest an interest in things in nature as property is legitimized by intent, labor, and sufficient control. Of course, there

12. Peter L. Abeles, Planning and Zoning, in ZONING AND THE AMERICAN DREAM: PROMISES STILL TO KEEP 122, 122 (Charles M. Haar & Jerold S. Kayden eds., 1989). As Peter Abeles notes, Of all the modern industrialized nations, the United States is the only one that began with what originally seemed to be an endless supply of land. In fact, it was this seemingly unlimited supply of land that was one of the main reasons for the continuous immigration that eventually used up so much of the land. One of the important foundations of this country was that everyone was free to do what he wanted, partly because of the abundance of land.


15. See generally Richard A. Epstein, Possession as the Root of Title, 13 GA. L. REV. 1221, 1225-26 (1979) (discussing the difficulties with a labor-based rule of entitlement to property).

16. This domination and transformation included eliminating the presence of Native Americans, who were already occupying the lands and interfered with the first possession idea behind capture. See Daniel M. Friedenberg, Life, Liberty, and the Pursuit of Land 27 (1992).

17. See Pierson, 3 Cal. at 177-79.

That is to say, that actual bodily seizure is not indispensable to acquire right to, or possession of, wild beasts; but that, on the contrary, the mortal wounding of such beasts, by one not abandoning his pursuit, may, with the utmost propriety, be deemed possession of him; since thereby the pursuer manifests an unequivocal intention of appropriating the animal to his individual use, has deprived him of his natural liberty, and brought him within his certain control.

Id. at 178.
are many different things in the world, each having its own characteristics and its own manner in which it might be dominated. Hence, capture may not in every case require the physical possession of an animal carcass or a confirmed killing blow.\textsuperscript{18} Rather, if the pursuer "does all that [it] is possible to do to make the animal his own, that would seem to be sufficient" to vest a right in property.\textsuperscript{19} Hence, the failure to take physical possession of a whale after delivering a mortal wound does not undo the completeness of the act, which still qualifies as capture.\textsuperscript{20} Foxes, it seems, can be most apparently dominated by delivering the mortal blow and surrendering the thing to control.\textsuperscript{21} Post is not awarded the fox as property because he failed to exercise dominion.\textsuperscript{22}

Real property can be dominated in the manner required by the rule of capture.\textsuperscript{23} Additionally, like improvements to land, for many of the things of nature—such as in some jurisdictions, water, minerals, and trees—ownership of the things comes with ownership of the surface land.\textsuperscript{24} Yet the mere presence of \textit{ferae naturae} on real property is not by itself sufficient to vest a right of property against the world, except perhaps in protecting the owner’s real property boundaries against trespass during another’s take.\textsuperscript{25} As has been repeatedly held, the state’s police power obligations—including the duty to protect a wholesome food supply—have justified the state’s possession of all \textit{ferae naturae} until the right has been vested by way of capture.\textsuperscript{26} As a result, "[t]here is no private right in the citizen to take fish or game, except as either expressly given or inferentially suffered by the state."\textsuperscript{27} When the right to take \textit{ferae naturae} is available, the rule of capture requires

\begin{itemize}
  \item 19. Id. at 162.
  \item 20. Id. at 160-61.
  \item 21. \textit{See Pierson, 3 Cai. at 177-78.}
  \item 22. Id. at 178.
  \item 23. For instance, real property can be improved, title can be transferred, title instruments can be recorded, and physical areas can be fenced, to name a few. Depending on the circumstances, the courts have recognized a variety of acts that can be characterized as the type an owner would perform. \textit{See, e.g.}, Van Valkenburgh v. Lutz, 106 N.E.2d 28, 29 (N.Y. 1952) (discussing adverse possession).
  \item 24. \textit{25 C.J.S. Crops} § 5 (1966) ("The ownership of realty carries with it as an incident thereto the prima facie presumption of the ownership of both the natural products of the land, such as grass and trees, and the emblements, or annually sown crops.").
  \item 25. \textit{See, e.g.}, Cawsey v. Brickey, 144 P. 938, 940 (Wash. 1914). \textit{But see} M’Conico v. Singleton, 9 S.C.L. (2 Mill.) 244 (1818) (recognizing a right to hunt on the lands of others).
  \item 27. \textit{Cawsey}, 144 P. at 939.
\end{itemize}
domination and control, even within the boundaries of privately-owned real property. As quoted by the court in Brown v. Eckes, "Bees are wild by nature; and so, if a swarm alight on your tree, it is not to be considered yours, until you have hived it, any more than the birds which build their nests there; and hence, if it be hived by another, it becomes his property." In contrast, vegetation has traditionally become part of real property and remains so even upon the sale of yet uncut timber. For instance, courts have readily held that in the absence of a clear intent to create an enduring right in the land itself, a sale of standing trees may create a mere license to enter lands and remove the timber.

The allocation of nature to control by capture and the associated privatization policies supported by capture might be organized under auspices of the "Property" paradigm. Under the Property paradigm, an award of a right in property may include security in the right to possess and transfer the thing, the right to exclude others from it, and the right to its economic use (in the manner preferred by the owner). Moreover, by extending the paradigm to things in the world and making them capturable through effort, luck, and skill, the Property paradigm had an unmistakable influence in early American legal constructions of nature: nature—including land, vegetation, water, minerals, and virtually all ferae naturae—could be made subject to privatization by taking things out of nature.

For purposes of this Article, two conceptual commitments are particularly salient to Property's legal construction of nature. First, Property is able to distinguish between valuable things and things that are merely potentially valuable by determining whether the thing has been reduced to ownership. This version of nature assumes that the world is largely, if not exclusively, comprised of things that are arranged (if at all) in a rather arbitrary and almost useless fashion. Hence, what is the value of gold, coal, or water that remains in the ground? It is

30. Id. at 491-92 (internal quotation marks omitted).
32. E.g., McCastle v. Scanlon, 59 N.W.2d 114, 118 (Mich. 1953) (quoting Curran v. Gordon, 135 N.W. 264, 264 (Mich. 1912)) ("The timber until it was severed was a part of the realty.").
33. See JOHN LOCKE, THE SECOND TREATISE ON CIVIL GOVERNMENT 27 (Great Books in Philosophy ed., Prometheus Books 1986) (1690) (favoring transformed things to natural ones, stating that "bread is more worth than acorns, wine than water, and cloth or silk than leaves, skins or moss."); see also Eric T. Freyfogle, Ethics, Community, and Private Land, 23 ECOLOGY L.Q. 631, 633-34 (1996) (discussing a Lockean approach to property
probably about the same as that of vacant and unused land. This idea implements the Lockean notion that the things of nature are virtually valueless until transformed by the efforts of humans and civilization. The Lockean scheme provides an attractive backdrop for a transformative property doctrine because Locke's theory rests on the premise that the transformation of nature into useful products is the process of adding value to natural things. Locke states that "of the products of the earth useful to the life of man, nine-tenths are the effects of labour." Locke goes further, stating that "land that is left wholly to nature, that hath no improvement of pasturage, tillage, or planting, is called, as indeed it is, waste; and we shall find the benefit of it amount to little more than nothing." In this understanding, there is no pre-capture or pre-transformative value attaching to nonhuman (and even sometimes human) things. That is, things in a pre-property state—such as the fox during the hunt—are only valued insofar as they have potential to become property. So long as the fox eludes the hunters, Property does not value the fox and shows little regard for its condition, safety, or interests.

Things in nature do not entirely lack value, of course, because a wild thing can become property upon capture. Yet by valuing only the potential to become property, the Property paradigm also shows what is important about natural things and how we value them. In Property's

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34. Although market value is not a necessary and sufficient condition for things to become property, it often seems so. See, e.g., Pa. Coal Co. v. Mahon, 260 U.S. 393, 414 (1922) ("What makes the right to mine coal valuable is that it can be exercised with profit."); Tennessee ex rel. Elvis Presley Int'l Mem'l Found. v. Crowell, 733 S.W.2d 89, 97 (Tenn. Ct. App. 1987) ("In its broadest sense, property includes all rights that have value.").

35. See LOCKE, supra note 33, at 26-31.
36. Id. at 19-20.
37. Id. at 26.
38. Id. at 27.
40. See id.
41. See Eric T. Freyfogle, Ownership and Ecology, 43 CASE W. RES. L. REV. 1269, 1277 (1993) ("If the land is injured in a way that the market does not value, the injury is irrelevant."). After capture, Property shows even less interest in the needs of the fox (as a fox). Under the Property scheme, a captured fox has become valuable by the hunter's ability to extend his boundaries of ownership in a way that includes the fox, now transformed by the domination of the hunter. After capture, Property values the fox as the hunter's property.
42. See PIERSON, 3 Cai. at 178-79.
description of nature, rights might be acquired in "as much as [man] could use," and as such, property rules can be developed in ignorance of, or at least in the absence of understanding of, natural processes. The market may be disinterested in such things, suggesting that there is no capture-based incentive to investigate and learn more about such pre-capture things except where necessary to capture resources more effectively and efficiently. Yet lack of understanding of nature was not an impediment to allocation of property rights; rules were needed to protect expectations of those people intending to take and those actually taking things in the world. Therefore, wetlands can be made more productive when we understand them as mosquito-infested bogs rather than when we investigate their character, location, or function. Likewise, as Samuel Weil pointed out, law allocated rights to take groundwater in "ignorance or disregard" of the natural processes at work. The mysteries of subsurface water movement were embraced in the allocation of groundwater rights, notwithstanding calls for the convergence of the laws of natural forces and the laws of humans.

Due to the challenges of knowing what occurred underground, it was decided that "an attempt to administer any set of legal rules...to [groundwater] would be involved in hopeless uncertainty, and would be, therefore, practically impossible." Once domination is complete and a property right attaches to the thing, the thing is subjected to the will and fancy of the dominator; the rule of capture "makes the actions of conquest and dispossession proper: property in the captor." The thing that was potentially property and unowned has now become property—a thing to which the claim "this is mine" applies to the exclusion of all others. Hence, it is the Property process that creates value by transforming the chaos and the waste of nature into order. As such, once things in nature are captured and converted to property, the Property paradigm insists that law exert its influence to protect legitimate claims.

43. LOCKE, supra note 33, at 29.
44. See James P. Karp, Aldo Leopold's Land Ethic: Is an Ecological Conscience Evolving in Land Development Law?, 19 ENVTL. L. 737, 742 (1989) ("The main shortcoming of decision making based solely on economics is that many members of the biotic community have no known economic value.").
47. Id.
Property's tool for this project—one that ensures the value in property is enjoyed by the capturer—is found in the idea of boundaries. By enforcing clearly demarcated boundaries, law can identify the limits of the property claim (“this is mine”) and protect property against invasion by another.\(^{49}\) Blackstone’s *Commentaries on the Laws of England* expresses the same sentiment:

> There is nothing which so generally strikes the imagination, and engages the affections of mankind, as the right of property; or that sole and despotic dominion which one man claims and exercises over the external things of the world, in total exclusion of the right of any other individual in the universe.\(^{50}\)

Real property boundaries, whether delineated by a fence, on a plat map, or even by metes and bounds in a deed, enable the owner to exclude others and verify the right to possess. Boundaries further enable markets in things, providing exacting information about the thing’s value in an exchange.

Of course, boundaries also play a role in the retention of property in natural things.\(^{51}\) Assuming that it is in the nature of *ferae naturae* to be wild, the proprietor must also continue to exercise such control over the things left alive so as to prevent the property from escaping and reentering the realm of mere pre-property things.\(^{52}\) Hence, courts have

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49. See Robert W. Adler, *The Law at the Water's Edge: Limits to “Ownership” of Aquatic Ecosystems*, in *Wet Growth: Should Water Law Control Land Use?*, supra note 6, at 201, 206-07 (“Anglo-American property law . . . relies heavily on the notion of fixed boundaries and stability of title, without which landowners could not have the requisite certainty of return necessary to invest labor and capital.”).


51. While the things of nature may become property by capture, all property is subject to loss by abandonment, and with regards to the *ferae naturae*, this rule has special applicability. As noted by Blackstone, “[I]f the pheasants escape from the mew, or the fishes from the trunk, and are seen wandering at large in their proper element, they become *ferae naturae* again, and are free and open to the first occupant that has ability to seize them.” *Blackstone, supra* note 50, at 392.

52.  *Blackstone, supra* note 50, at 391. There has been some conflict in authority on whether an escape actually severs the thing as property when the escaped animals caused damages or trespassed on another’s property. The common law is said to have been imbued with the rule that at least domesticated animals “are required to be restrained by the owner from running at large.” *Evans v. McLain*, 175 S.W. 294, 294 (Mo. Ct. App. 1915). In addition, because “[t]he liability of the owner or keeper of an animal of any description, for an injury committed by such animal, is founded upon negligence,” the owner of a known dangerous “wild beast” is held to a high standard of care. *Scribner v. Kelley*, 38 Barb. 14, 14 (N.Y. App. Div. 1862); see also *Taylor v. City of Cincinnati*, 55 N.E.2d 724, 728 (Ohio 1944). In *Taylor* the court stated that
ruled that enclosures of land to contain *ferae naturae* are sufficient, and often necessary, to establish boundaries and retain the level of control prerequisite to retaining a vested right in the animals. In the case of fish, an Ohio court stated,

> When [the capturer] has confined them within his own private inclosure, where he may subject them to his own use at his pleasure, and maintains reasonable precautions to prevent escape, they are so impressed with his proprietorship that a felonious taking of them from his inclosure, whether trap, care, park, net, or whatever it may be, will be larceny.

The rules for maintaining sufficient control will necessarily vary in accordance with some combined analysis of the nature of the thing and the practical impossibilities associated with preserving the value of title *per industriam*. Therefore, in rejecting an action in trespass against the owner of chickens, a Missouri court declined to follow the common law obligation of the chickens' owners to fence them in, ruling instead that the obligation rested on property owners to fence animals out. In the case of bees, capture requires hiving the swarm; yet because the swarm might escape of their own accord or by enticement of another "by striking upon the brass," the claimant "has the right to reclaim and repossess them so far as he can see them and follow them; otherwise, the swarm belongs to the owner of the land upon which they affix themselves."

Given the operation of the Property value scheme, it should not be surprising that the purpose of boundaries is largely understood to protect the whims of individuals and their preferences concerning the uses to which private property should be put. Under the Property description of nature, environmental quality, species diversity, species themselves, and other environmental elements are relegated to a role that preferences may play. Any other means of valuing property, it

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53. See, e.g., Dieterich v. Fargo, 87 N.E. 518, 520 (N.Y. 1909) (recognizing the property right in deer that had been enclosed and bred in captivity).
55. *Evans*, 175 S.W. at 295-96.
56. *Eckes*, 160 N.Y.S. at 491-92 (internal quotation marks omitted).
57. Garrett Hardin has been the leading proponent of Property as a means of environmental protection. See Garrett Hardin, *The Tragedy of the Commons*, in *GLOBAL POLITICS IN A CHANGING WORLD: A READER* 364 (Richard W. Mansuach & Edward Rhodes
is suggested, is fraught with traps, as “[t]here is something basic—whether its origins are instinctual or cultural—in the notion of ‘mine’ that attaches to physical possessions and that sees the power of others over those possessions as inappropriate interference to be vigorously resisted.”

Based on the central location of boundaries to Property and the manner in which Property vests owners with the discretion over the question of how to value natural things, it should also be no surprise that environmental protection was a difficult concept to integrate into the Property scheme. The idea of nature as transformable, improvable, and capturable supported a drive to dominate as much land as could be used. In *A Sand County Almanac*, Aldo Leopold pointed out that people have found ways to use land when the market supports it: “We abuse land because we regard it as a commodity belonging to us.”

Mining claims and water diversions in the West rested their property claims on the Lockean notion of dessert in property: “[H]e who first connected his labor with the property...in natural justice acquired a better right to its use and enjoyment than others who had not given such labor.” As such, some natural features of land, particularly wetlands and features that presented similar development challenges,

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59. See N. William Hines, *Nor Any Drop to Drink: Public Regulation of Water Quality*, 52 IOWA L. REV. 186, 195-201 (1966) (arguing that the common law was incapable of adequately protecting environmental concerns).
61. Jones v. Adams, 6 P. 442, 446 (Nev. 1885).
have had an understandably troubled history under the Property understanding of nature. A Although land in an unsanitary condition due to natural causes was not necessarily a nuisance at common law, in many cases, wetlands were used for garbage disposal and thus turned into nuisances. Likewise, some large bodies of water served as mere receptacles for solid and hazardous wastes. Even in natural wetlands, the eradication of swamps was recognized as a duty of the state and could be done at the expense of the public, as draining such lands was considered to be for the "common benefit." In other cases, states burdened property owners with the obligation of filling wetlands and marshes that had become stagnant and, as such, a nuisance. As the Supreme Court of the United States stated in its infamous understanding of swamps,

62. See U.S. DEP'T OF THE INTERIOR, THE IMPACT OF FEDERAL PROGRAMS ON WETLANDS, VOL. II, A REPORT TO CONGRESS BY THE SECRETARY OF THE INTERIOR, WASHINGTON, D.C. 33 (Mar. 1994). As reported by the United States Secretary of the Interior, The Fish and Wildlife Service estimates that of the 221 million acres of wetlands which existed in the coterminous United States at the time of the Nation's settlement, only 104 million acres (47%) remained in 1985. Wetlands constitute only about five percent of the surface area of the lower 48 States. Between the mid-1950s and the mid-1970s, annual wetland losses averaged 458,000 acres, an area about half the size of Rhode Island. Between the mid-1970s and the mid-1980s, this loss rate was reduced to about 290,000 acres per year. Id. (footnote omitted).


65. See, e.g., Joe G. Moore Jr., Foreword to FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, U.S. DEP'T OF THE INTERIOR, 905R68003, LAKE ERIE REPORT: A PLAN FOR WATER POLLUTION CONTROL (1968). Joe G. Moore, Commissioner of the Federal Water Pollution Control Administration (FWPCA), once noted, "Man is destroying Lake Erie. Although the accelerating destruction process has been inadvertent, it is as positive as if he had put all his energies into devising and implementing the means. After two generations the process has gained a momentum which now requires a monumental effort to retard." Id. He also noted that although oil spills are common in harbors, in the Lake Erie basin some industrial facilities were "discharging oil intentionally and continuously," a circumstance that was recognized to be "not only disgraceful but also a major health and wildlife hazard. FEDERAL WATER POLLUTION CONTROL ADMINISTRATION, U.S. DEP'T OF THE INTERIOR, 905R68003, LAKE ERIE REPORT: A PLAN FOR WATER POLLUTION CONTROL 58 (1968).


67. See, e.g., Olmstead v. Camp, 33 Conn. 532, 549-50 (1866).

68. See, e.g., Campbell, 21 Haw. at 324.
We think that the trial court might well take judicial notice that the public health is deeply concerned in the reclamation of swamp and overflowed lands. If there is any fact which may be supposed to be known by everybody, and therefore by courts, it is that swamps and stagnant waters are the cause of malarial and malignant fevers, and that the police power is never more legitimately exercised than in removing such nuisances.\footnote{Leovy, 177 U.S. at 636.}

The Court's disposition in \textit{Leovy v. United States} reflects a paradigm under which the natural state is not the valuable state of land, the state of nature can be improved, and nature in some cases is itself noxious. Given the foregoing, the doctrine raising the most significant conceptual challenge for Property's boundary scheme is nuisance. Under the doctrine of public nuisance, public welfare interests can be protected by restricting the rights of private property owners to use their property (or alternatively, of private parties from making particular uses of common lands) in ways that interfere with the public welfare.\footnote{See Lucas v. South Carolina Coastal Council, 505 U.S. 1003, 1051 (1992); Am. Steel & Wire Co. v. Wire Drawers & Die Makers' Unions Nos. 1&3, 90 F. 608, 612, 614 (N.D. Ohio 1898) ("It is just as much a nuisance to block up the street and impair the right by the continual presence of bodies... who obstruct the ingress and egress, as it would be to build barricades and embankments in the street.").} Public nuisances may be less of a concern to the Property paradigm to those who recognize the historic limitations in right to land use as contingent upon systemic needs in a property system.\footnote{For a fuller discussion of this point, see Keith H. Hirokawa, \textit{Property Pieces in Compensation Statutes: Law's Eulogy for Oregon's Measure 37, 38} ENVT. L. 1111, 1138 (2008).} Private nuisance is problematic for the Property approach, however, because it suggests that property boundaries are not physically absolute as between private competitors for space. Although a cause of action in nuisance is premised on an injury felt on the plaintiff's property, the cause and the remedy for nuisance involve an analysis of the reasonableness of activities on another owner's property.\footnote{Morgan v. High Penn Oil Col., 77 S.E.2d 682, 689 (N.C. 1953). In \textit{Morgan} the North Carolina Supreme Court explained that [t]he confusion on this score vanishes in large part, however, when proper heed is paid to the sound propositions that private nuisance is a field of tort liability rather than a single type of tortious conduct; that the feature which gives unity to this field of tort liability is the interest invaded, namely, the interest in the use and enjoyment of land; that any substantial non trespassory invasion of another's interest in the private use and enjoyment of land by any type of liability forming conduct is a private nuisance; that the invasion which subjects a person to liability for private nuisance may be either intentional or unintentional; that a person is...
respect property boundaries. Nuisance allows a party to follow the injury beyond property boundaries to its source, and in this sense vests rights on another's property. Of course, we might not think of nuisance in this way primarily because nuisance operates only on property use and not on possession: where the impact of a land use transcends boundaries and interferes with another's enjoyment of her own property, the intruding land use is not protected by a right in property.\footnote{73}

Even if nuisance law is conceptually difficult to reconcile with property boundaries, it nonetheless follows under the Property scheme that a takings claim under the Fifth Amendment\footnote{74} is questionable when leveled against a regulation of property use. It is perfectly understandable that under the Property approach, a physical invasion by the government for public use is deemed an invasion of constitutionally protected rights. Whether the invasion is intended for physical public use,\footnote{75} causes nuisance-like impacts above private property,\footnote{76} or requires the property owner to allow access,\footnote{77} a taking is founded on a public invasion of private boundaries and the resulting loss of the right to exclude. However, that a mere regulation of property is not considered such a violation\footnote{78} is a circumstance that seems more analytically significant than coincidental under the Property paradigm. Because land owners enjoy a reciprocal advantage offered by police power regulations “applie[d] over a broad cross section,” because property use regulations do not affect the title to property, and because a regulation does not\textit{physically} invade property boundaries, mere regulations of property leave property boundaries intact.\footnote{79} Accordingly, under the

\begin{itemize}
\item subject to liability for an intentional invasion when his conduct is unreasonable under the circumstances of the particular case.
\end{itemize}

\textit{Id.}

\footnote{73. See Keystone Bituminous Coal Ass'n v. DeBenedictis, 480 U.S. 470, 491 n.20 (1987) (“[S]ince no individual has a right to use his property so as to create a nuisance or otherwise harm others, the State has not 'taken' anything when it asserts its power to enjoin the nuisance-like activity.”).}

\footnote{74. U.S. CONST. amend V.}

\footnote{75. \textit{E.g.}, Kaiser Aetna v. United States, 444 U.S. 164 (1979).}

\footnote{76. \textit{E.g.}, United States v. Causby, 328 U.S. 256 (1946).}


\footnote{78. Mugler v. Kansas, 123 U.S. 623, 668-69 (1887); see also Hadacheck v. Sebastian, 239 U.S. 394, 410-11 (1915).}

Property paradigm, the Takings Clause of the Fifth Amendment does not restrain the mere regulation of property use due to the “substantial authority upholding a State’s broad power to impose appropriate restrictions upon an owner’s use of his property.” Hence, in Mugler v. Kansas, the Court rejected a takings theory in a challenge to regulations prohibiting the manufacture of liquor, even when the regulations would clearly diminish the value of the plaintiff’s existing facility. The Court in Mugler noted that a mere limitation on the use of land generally falls short of an unconstitutional intrusion. Instead, such regulations are intended to protect property from being used to a noxious result or impact.

The Property paradigm assumes that natural things are reducible to control by domination, an act that is rewarded in the allocation of a right to property. Property casts natural things as things that must be dominated and transformed to be useful, valuable, and valued. This scheme was protected and enforced by physical boundaries through which law could identify and protect captured property. Yet both the privatization of nature by boundaries and the encouragement of capture by transformation were ultimately vulnerable.

U.S. at 415. Distinguishing between these restrictions may require courts to consider the claims “upon the particular facts” when “[t]he general rule at least is that while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking.” Id. at 413, 415. However, the Court was clear that a regulation has not gone too far by “securing an average reciprocity of advantage” to all interested owners. Id. at 415. “While each of us is burdened somewhat by such restrictions,” reasoned the Court, “we, in turn, benefit greatly from the restrictions that are placed on others.” Keystone Bituminous Coal Ass’n, 480 U.S. at 491.

80. Loretto, 458 U.S. at 441 (emphasis omitted); see also Hadacheck, 239 U.S. at 410-11 (upholding prohibition of brickyard in residential area); Commonwealth v. Alger, 61 Mass. (7 Cush.) 53, 86 (1851) (distinguishing eminent domain from regulatory restrictions on grounds that property use limitations are enforced “not because the public have occasion to make the like use, or to make any use of the property, or to take any benefit or profit to themselves from it; but because it would be a noxious use, contrary to the maxim, sic utere tuo, ut alienum non [laedus]”).

81. 123 U.S. 623 (1887).

82. Id. at 664.

83. Id. at 668-69.

84. Id. at 669.

The exercise of the police power by the destruction of property which is itself a public nuisance, or the prohibition of its use in a particular way, whereby its value becomes depreciated, is very different from taking property for public use, or from depriving a person of his property without due process of law. In the one case, a nuisance only is abated; in the other, unoffending property is taken away from an innocent owner.
III. THE ENVIRONMENT AS BOUNDED NATURE: VALUING NONHUMAN THINGS, ONE THING AT A TIME

A. In the Matter of Pierson v. Post

At this point in time, our insistence that public laws serve the public welfare has converged with our understanding of the importance in protecting the natural environment. In response to a history of mistreatment and misunderstanding of the environment, the legislature has enacted a host of regulatory schemes to curtail pollution of the air, water, and land; to preserve areas of special natural interest; and to save endangered species that lie on the brink of extinction. This shift in policy is based in part on human health needs and in part on the values inhering in nature, and by all accounts it is changing the way that business is done in our state. Nevertheless, and in all honesty, we stand amazed and a touch appalled at how many laws may have been violated in this case, not as much because of Pierson's and Post's lack of responsibility or fidelity to law (which is undoubtedly troubling) but because of the manner in which Mr. Post's actions are regulated. The law now contains separate volumes on each of many aspects of nature, including water use and water quality; drinking water quality; air emissions; toxic substances; releases of hazardous materials; the generation, transportation, and disposal of hazardous wastes; wildlife regulations (some of them on a species-by-species basis); timber and grazing practices; mining practices; roadless areas; wetlands (freshwater and coastal); and power generation, to name only a few. Law has even accommodated the regulation of rainwater.

Pierson and Post long for the days when fox hunting remained a raucous and effete affair, and both reminisce by asserting that this fox is rather ordinary, neither threatened nor endangered, and is generally considered to be something of a pest. They each contend—on the relative merits of their own claim, of course—that they have benefitted the public by removing such a mischievous creature. As to these arguments, we find it difficult to object because there seems to be nothing special about this menace, save that it remains a menace and that the legislature has not seen fit to imbue it with any special
Yet the court is also reminded of a favorite children's novel: in the opening pages, Zuckerman intended to put the axe to the runt of the litter because, as he put it, he knew best what to do with such things; his daughter cried, "It's unfair." The pig lived (at least before the pig met the spider) because we have passed the time when the things of nature are always subject to what is most convenient for us (such as in killing the runt to save the cost of raising a less valuable pig).

That said, we note that nobody—government, nonprofit, or individual—has been able to identify the inherent value of this fox or has been willing to speak on its behalf. On this issue, we find it significant that nobody seemed aware of this fox's existence, and certainly nobody had captured it by photograph or otherwise celebrated its natural liberty. Thus, nobody that we can think of has standing to object to the taking of this fox, except perhaps the parties themselves. In any event, any yet unvoiced preferences in favor of the fox have effectively been waived.

Of course, while this waiver may end the dispute for Pierson, Post has murkier waters to navigate before clearing the tide. The array of laws violated is, as noted, impressive. The federal government has adopted laws and regulations that protect, among other things, the forests of this region from clearcutting, the fish and people from degradation of the nation's surface waters, and various animals and insects from extermination. The state legislature has likewise adopted laws that require consideration of environmental values before denying the public of its preference for nature and natural areas. Even the local government has adopted laws that require Mr. Post to submit his plans to scientific and engineering review when his plans dramatically transform these natural things.

The foregoing should be a sufficient basis to reject Post's argument that Pierson and Post should share equally in any potential liability for violations of the applicable environmental laws. According to Post, because the parties shared the intent to take the fox, they should

be equally liable for the adverse impacts caused by the
taking. The problem with Post's argument is that the laws
dealing with nature are compartmentalized. Each environ-
mental amenity has its own regulatory scheme, and there
is very little crossover between the various schemes. For
example, Pierson's blow to the fox does not, but Post's
relocation of the stream does, trigger the "dredge and fill"
regulations of the Clean Water Act (CWA).

Had Post applied for and been granted permits for
these activities (a scenario about which we are highly
skeptical), Post's action might only have been annoying
and contrary to the stated public preferences for leaving
clean water, clean air, clean land, and beautiful scenery
intact. Mr. Post's claim fails not only because he failed to
comply with the regulatory requirements governing his
actions but also because his actions ultimately deprived
the public of the value of lands in their natural state, a
value for unused land that the legislature has found to be
within the scope of the public's interests.

Signed, The Court

B. Finding Value in Pre-Property Things

In 1972 the Supreme Court rejected the Sierra Club's claim that it had
standing to challenge the federal approval of a proposed ski resort and
recreation area in a "quasi-wilderness area largely uncluttered by the
products of civilization." The Court refused to alter the requirement
that a petitioner, even if suing on behalf of nature, meet the basic
elements of standing. The Court did not modify the rule that even a
sincere care for the interests and needs of others (especially nonhuman
others) could not by itself be sufficient to seek redress in courts.

87. Id. at 739-40.
88. Id. However, nonhuman things can neither speak for their interests nor possess
cognizable interests under Article III of the United States Constitution. See U.S. Const.
art. III. The argument in favor of a broad reading of standing at the time was delivered
in Justice Douglas's dissent, in which he argued that the standing inquiry
would be simplified and also put neatly in focus if we fashioned a federal rule that
allowed environmental issues to be litigated before federal agencies or federal
courts in the name of the inanimate object about to be despoiled, defaced, or
invaded by roads and bulldozers and where injury is the subject of public outrage.
Sierra Club, 405 U.S. at 741 (Douglas, J., dissenting). This approach was also reflected in
Christopher Stone's answer to the question of whether trees should have standing to sue
on their own behalf. See Christopher D. Stone, Should Trees Have Standing? Toward
Moreover, consistent with the notion of boundaries that underlies the Property paradigm, the Court ruled that claims to have visited similar places are inadequate, and similarly, the Court rejected "almost" and "maybe" future uses of threatened natural places under the standing inquiry's requirement that the party demonstrate an actual injury.\(^9\)

Nevertheless, in *Sierra Club v. Morton*, the Court diverged from the Property paradigm by determining that the Court's authority could be invoked to resolve a controversy over threats to a nonhuman, environmental value: a party interested in protecting nature could declare a specific use of the specific natural thing *(that Environment over there)* in a manner that qualifies her interests in judicial controversies.\(^9\) The Court recognized that natural things themselves had value and construed such value in a way that is referred to here as the "Environment."\(^9\)

The shift represented in *Sierra Club* was dramatic.\(^9\) Statutes facilitating the domination of nature and development of the West, referred to by Charles Wilkinson as "the lords of yesterday," adopted capture-type schemes, and the vast natural resources of the West were subordinated to the civilization of the wild.\(^9\) As historian John Steele Gordon states,

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*Legal Rights for Natural Objects*, 45 S. Cal. L. Rev. 450, 464-73 (1972). The Court's response to Stone's request was a variation of what is often referred to as the sameness argument: the system was set up to service humans and human interests, so only those entities that share those interests and can communicate them as such (in other words, only entities that have sameness with the human interests protected under law) can seek redress. *See Sierra Club*, 405 U.S. at 736-40. It is the sameness argument that keeps trees out of court, and in all likelihood, it is the sameness approach to value in nature that keeps this understanding of nature from offering a legal construction of nature that protects nonuse values. This understanding is subject to and occasionally dependent upon the boundaries of property to have legal existence.

90. *Sierra Club*, 405 U.S. at 739-40.
91. *See id.* at 734-35.
92. *Hence, the Pennsylvania Supreme Court recently noted that* *while the owner of land might once have been permitted to mine his land without regard to the effect that it had on public streams, as evidenced by the spoilage of "11,000 miles of streams" in this country, that expectation is, and has been for some time, no longer reasonable.*

93. *See generally CHARLES F. WILKINSON, CROSSING THE NEXT MERIDIAN xiii, 17 (1992).*
So rapid an alteration of the landscape could only have a severe impact on the ecosystem as a whole. The loss of so much forest caused runoff to increase sharply, eroding the land and burdening the waters with silt, destroying more wetlands. Many animals' habitats disappeared. And because the ancient biblical notion that humans had dominion over the earth still held, others vanished entirely.  

In the meantime, rivers burned, forests disappeared, and animals and insects that were once believed to be disposable disappeared on a scale that had been inconceivable. 

As the West became less wild from early pioneering efforts, and as humans began to realize the gravity of irreversible impacts on nature, the privatization model of resource allocation began to lose its luster. By encouraging domination over lands and resources, the rule of capture arguably allowed too much privatization, too much individualism, and too much transformation. Although they may have been unwilling to revoke capture as legal doctrine, state and federal governments were willing to exercise their authority in rethinking the character of those things subject to privatization through capture. Governmental entities began to withdraw public property from the commons and restrict the privatization of such lands. 


95. Jonathon H. Adler, Fables of the Cuyahoga: Reconstructing a History of Environmental Protection, 14 FORDHAM ENVTL. L.J. 89, 95 (2002). The 1969 fire on the Cuyahoga River is frequently attributed as the birthplace of modern environmental law. Id. at 94.

96. See Gordon, supra note 94, at 36, 40, 44.

97. See, e.g., United States v. Midwest Oil Co., 236 U.S. 459, 466-67 (1915) (discussing the Secretary of Interior's approval of a recommendation to suspend private claims to oil lands in California).

98. See id. In Midwest Oil Co., the Court was called upon to resolve a challenge to the executive branch's authority to withdraw public lands from "all forms of location, settlement, selection, filing, entry, or disposal under the mineral or nonmineral public-land laws." Id. at 467. This act, made by presidential proclamation, was challenged by private parties that had successfully explored public lands for oil deposits and begun extracting oil from public lands. Id. at 467-69. The challenge, in effect, sounded in takings. See id. at 468. The Court rejected the challenge, concluding that the resource had never been capturable and, therefore, no private injury could have resulted:

But when it appeared that the public interest would be served by withdrawing or reserving parts of the public domain, nothing was more natural than to retain what the government already owned. And in making such orders, which were thus useful to the public, no private interest was injured. For, prior to the initiation of some right given by law, the citizen had no enforceable interest in the public statute, and no private right in land which was the property of the people.

Id. at 471. Where the liberty and individual interests embodied in the rule of capture need to give way to public needs, government serves the public by effectively withdrawing the
accommodated preconditions to capture in the form of permitting programs. This was not, of course, the first time that the state regulated capture, but the idea that restrictions on capture could be based on an analysis of environmental impacts was a bit novel.\footnote{100}

While some commentators have argued that environmental law evolved through a gradual and incremental shift in political consciousness,\footnote{101} most have focused on how immediately and dramatically environmental law diverged from the Property paradigm.\footnote{101} For purposes of this Article, the difference is merely one of degree. Whether modern environmental law appeared in a flash or a growing rumble, the focus here is on the transition away from nature as things effected dramatic shifts in the way that law understood and treated the environment. Where wild or natural areas were identified, they were severed (both physically and conceptually) from the transformative urges of privatization in favor of a trend toward preserving aesthetic, scientific,

The authority of governmental agencies to refine and modify the capture of natural resources has been repeatedly upheld by the courts. See, e.g., Texaco v. Short, 454 U.S. 516 (1982). In Texaco the Court reviewed the constitutionality of Indiana's Dormant Mineral Interests Act, 1971, Ind. Acts 1970, § 1, repealed by 2002 Ind. Acts 187, § 8 (codified at Ind. Code § 32-23-10-2 (2002)), which automatically reverted severed mineral interests that went unused for a period of twenty years or more. Texaco, 454 U.S. at 516. Although such mineral interests had not previously been subject to durational requirements, the Court upheld the act, stating that "just as a State may create a property interest that is entitled to constitutional protection, the State has the power to condition the permanent retention of that property right on the performance of reasonable conditions that indicate a present intention to retain the interest." Id. at 526. Soon after, in United States v. Locke, 471 U.S. 84 (1985), the Court approved the forfeiture provisions of the Federal Land Policy and Management Act (FLPMA) of 1976, 43 U.S.C. §§ 1701-1785 (2006), which triggered the forfeiture of unpatented mining claims for failure to comply with annual filing requirements. Locke, 471 U.S. at 88-89. The Court in Locke refined the rule, noting that "[e]ven with respect to vested property rights, a legislature generally has the power to impose new regulatory constraints on the way in which those rights are used, or to condition their continued retention on performance of certain affirmative duties." Id. at 104.

\footnote{99} Although the analysis here suggests a chronology for the alternative paradigms addressed in the Article, it is not the intention to argue that any particular date or law affected a revolutionary shift.

\footnote{100} See generally KARL BOYD BROOKS, BEFORE EARTH DAY: THE ORIGINS OF AMERICAN ENVIRONMENTAL LAW, 1945–1970 (2009) (arguing that the modern environmental law regime is the product of incremental changes).

and ecological values, as well as something of the sublime.\textsuperscript{102} Water bodies and wetlands were assessed for uses other than waste disposal.\textsuperscript{103} Forest-harvesting practices attempted to reconcile the ideas of consumption and regrowth.\textsuperscript{104} Liability schemes led to large-scale remediation of hazardous waste sites.\textsuperscript{105} Laws even identified species on the brink of extinction and restrained acts that would result in the decline of endangered and threatened species.\textsuperscript{106} These laws illustrate serious consideration for the notion that the dangers of resource depletion and human exposure to toxins should play a significant role in identifying how nature should be treated.\textsuperscript{107}

Notably, in the shift to understanding nature as the Environment, the legal construction of nature incorporated, instead of abdicated, the reliance on a physical presence to confirm values of nature in land. In particular, courts have imposed on the Environment an ascertainability element, requiring agencies to identify as clearly as possible a particular


\textsuperscript{104} \textit{Cf.} LEOPOLD, supra note 60. Leopold observed that humans have invented constructive tools or at least have invented constructive uses for some tools. \textit{Id.} at 67-68. However, “when the axe was invented, [man] became a taker: he could chop [trees] down. Whoever owns land has thus assumed, whether he knows it or not, the divine functions of creating and destroying plants.” \textit{Id.} at 67.


\textsuperscript{107} The laws of the Environment embraced a different understanding of the things in nature: these laws were intended to protect values in land that are foreign to the fundamentals of the Property paradigm. Given the extent of this transition in the way that we understood nature—arguably, a veritable paradigm shift in our private and personal understandings of the world—it could seem surprising that law was able to adapt. Indeed, in contrast to the primacy of personal preferences protected in the Property scheme, the Environment imposed nonproperty and nontransformative values on land and other objects of property. Law found a way to make the shift, evidenced by the volumes of laborious literature by legal scholars intent to identify unifying threads or common grounds that run through each of the statutes that tie our legal treatment of nature to the values that we express in nature. The transition from Property has been no small feat, and it in large part consisted of overlaying property boundaries with notions of nature as valuable pre-property things.
aspect of nature that is subject to regulation. For instance, the decision in *Sierra Club* showed that parties can only acquire standing in such cases if they are able to demonstrate a convergence of their physical selves with a particular place or thing by ultimately penetrating the boundaries of the Environment.\(^{108}\) Similarly, in *United States v. Riverside Bayview Homes, Inc.*,\(^{109}\) although "the Corps' ecological judgment about the relationship between waters and their adjacent wetlands" is not appropriate for searching judicial scrutiny, the Court insisted that "the Corps must necessarily choose some point at which water ends and land begins."\(^{110}\) Later, in *Rapanos v. United States*,\(^{111}\) Justice Scalia's plurality opinion concluded that wetland jurisdiction would extend only to a wetland that is adjacent to, and continuously connected through surface water to, "a relatively permanent body of water connected to . . . navigable waters."\(^{112}\) Justice Scalia's opinion, which largely relies on commonplace definitions of the jurisdictional term "waters,"\(^{113}\) emphasizes the manner in which the Environment was identified by associating the values of the Environment with a physical, structural presence.

Law in this approach has tended to operate with three primary results, each illustrating a different aspect of the boundedness of the Environment. First, because the emerging paradigm required treatment of the environment as a thing independent of (and perhaps irrelevant to) property ownership, the Environment could be withdrawn from the realm of capturable things and segregated from Property's conception of

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108. See 405 U.S. at 735 ("Nowhere in the pleadings or affidavits did the Club state that its members use Mineral King for any purpose, much less that they use it in any way that would be significantly affected by the proposed actions of the respondents."). Justice Kennedy explained in *Lujan v. Defenders of Wildlife*, 504 U.S. 555 (1992), that "[w]hile it does not matter how many persons have been injured by the challenged action, the party bringing suit must show that the action injures him in a concrete and personal way. This requirement is not just an empty formality. It preserves the vitality of the adversarial process by assuring both that the parties before the court have an actual, as opposed to professed, stake in the outcome, and that the legal questions presented . . . will be resolved, not in the rarified atmosphere of a debating society, but in a concrete factual context conducive to a realistic appreciation of the consequences of judicial action."


110. *Id.* at 132-34.


112. *Id.* at 742.

113. *Id.* at 739.
value. Withdrawal of land from the public domain for protection of nature generated some competition with notions of pre-property things and the not-yet-properties. This competition became more complex where the Environment was found on private lands. Identification of environmental values in a way that conflicts with the private values of land ownership effectively severed the construct of Property from the values of nature.

The systemic advantage of this approach was that it allowed the values of the Environment to be recognized outside of the commons and even on previously captured private property. Take, for instance, the Endangered Species Act (ESA),\(^\text{114}\) which illustrates a far-reaching example of valuing natural things for nonproperty value.\(^\text{115}\) Indeed, the ESA recognizes the value of a species's continued existence, and taken as a whole, the ESA reflects a formal policy of recognizing the importance of biodiversity.\(^\text{116}\) The value of identifying biodiversity as a nonuse value is not intended to imply that biodiversity is not useful to humans; to the contrary, as Joseph Sax notes, “Most species have no economic value to those who own the lands that are their habitat, though they may be of extraordinary value for research that ultimately generates important scientific and technological advances.”\(^\text{117}\) Moreover, the goals of species biodiversity—including the value added by the very existence of endangered or threatened species—simply do not follow property boundaries and are “not dependent on whether its habitat straddles a state line.”\(^\text{118}\) Therefore, the ESA serves as the measure...
of the distance that environmental law has come from the simple domination basis of rights. When the ESA applies, the federal government withdraws particular species of *ferae naturae* from the realm of capturable things and even protects such species from harm. The majority in *Babbitt v. Sweet Home Chapter of Communities for a Great Oregon* punctuated the point that the protection of biodiversity does not suffer a capture relationship to property.

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120. See id. § 1533(b)(2), (d) (allowing for the Secretary of the Interior to designate critical habitats and take other measures to protect endangered and threatened species). One of the more dramatic divergences of the ESA from the capture description of property comes in the manner that the ESA conceives of “injury” and “harm” to nonhuman entities. Pursuant to 16 U.S.C. § 1532(19), a “take” of a listed species includes “to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in such conduct.” The Fish and Wildlife Service defines the term “harm” to mean “an act which actually kills or injures wildlife. Such act may include significant habitat modification or degradation [that] actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding or sheltering.” 50 C.F.R. § 17.3 (2009).


122. See id. at 704. In *Babbitt* the dissent advocated a restrictive definition of a “take” of a listed species as a concept of property acquisition tied to notions of physical domination over the *ferae naturae*. *Id.* at 717 (Scalia, J., dissenting). The majority of the Court affirmed an understanding of species protection that reflects on keeping endangered species alive, defining the term “harm” to include habitat modification and other actions that injure a species’ ability to find shelter and breed. *Id.* at 707-08 (majority opinion). The majority specifically rejected the capture approach and the notion that wildlife is akin to “some creature” despite the contention that capture provided an “established meaning” of ‘take’ in the sense of a ‘wildlife take,’ a meaning respondents argue extends only to ‘the effort to exercise dominion over some creature.” *Id.* at 697 n.10. This characterization, which becomes important in the following section on ecosystem services, illustrates how problematic it might be to identify any particular point in time at which any one paradigm might be said to dominate this field of law.

In large part, this problem has resulted from the way in which we have engaged nature in the Environment as a haphazard collection of independent things. Take, for example, the array of relatively clearly delineated categories of water and resulting independent regulatory schemes, including the following: surface stormwater, percolating stormwater, navigable surface waters, nonnavigable waters, isolated wetlands, connected wetlands, groundwater, subsurface streams, drinking water, aquatic habitat, return flows, saved water, and the various water quality classifications under the CWA’s water quality scheme. See generally 33 U.S.C. §§ 1251-1376. For the most part, these classifications deal with how the particular water sources or flows affect property values, influence capture rules, or threaten human health. The categories do not relate so sharply to ecosystem functionality in the sense that they are not intended to identify the role such source or flow plays in ecosystem health or the production of ecosystem goods and services. Moreover, as illustrated in the role of critical habitat mapping in implementing environmental values, the battles over classifying the species unit subject to protection under the ESA, the rejection of using habitat triggers to indicate species decline, and the emphasis on
The second result of the shift toward the Environment’s understanding of nature relates to the role of boundaries in identifying the Environment. Treating things in nature as valuable in themselves (without transformation) may have been a significant blow to the economic potential attributed to natural things, particularly as that sense of value is manifested in law. However, incorporation of boundaries allowed Property and the Environment to coexist in the scheme. Not all natural things qualified as part of the Environment, of course, so bounding the Environment allowed law to identify environmental priorities while helping to identify what was not property (and thus not captured or subject to capture).

As an example, consider the manner in which nature is identified for protection under the Wilderness Act of 1964. Through the Wilderness Act, Congress intended to assure that the ever-increasing human population and expanding ecological footprint would “not occupy and modify all areas within the United States and its possessions, leaving no lands designated for preservation and protection in their natural condition.” The Wilderness Act was specifically aimed at curtailing the private capture and domination of “wild areas” as a means of preventing the permanent transformation of an otherwise unrenewable resource. The Wilderness Act was not novel for the reason that federal authority was exercised to curtail the privatization of common resources. Rather, what was novel about the Wilderness Act was that its premise for protecting wilderness was the value of wilderness producing a dead member of the listed species as the ultimate trigger for enforcement, all maintain a distinctiveness from property within the boundaries of the Environment. See, e.g., Miccosukee Tribe of Indians of Florida v. United States, 566 F.3d 1257, 1274 (11th Cir. 2009) (ruling that the Fish and Wildlife Service may not use habitat markers as an alternative to population counts as triggers for an incidental take or reconsultation). The divergence that is suggested here relates to the relationship between laws that identify atomistic units of nature—such as “fox” and “salmon”—and laws that focus on ecosystem functionality and ecosystem services—such as the performance or functionality of a wetland to resolve and filter pollutant levels in watersheds. The ESA is placed in this section, instead of the section discussing ecosystem services, because its celebration of biodiversity does not result in the direct protection of biodiversity but rather in the protection of particular animals that might contribute to biodiversity. See 16 U.S.C. §§ 1531, 1533.

125. See id.
126. See, e.g., Camfield v. United States, 167 U.S. 518, 524-26 (1897) (upholding the federal authority to regulate activities on private land that effectively enclose public lands from access).
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without the influence of humans. The Wilderness Act identifies wilderness "in contrast with those areas where man and his own works dominate the landscape" and defines the term to signify "an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain." Not all lands or landscapes garner the protection afforded to untrammeled lands, so the values of particular environments (such as those under the Wilderness Act) do not extend generally to nature. Indicative of this result is that wilderness areas can be identified by reference to a map, partitioned from capturable property, and the relevant values can be protected from intrusions.

By linking this understanding of nature as the Environment to the notion of boundaries underlying Property, law was able to implement new values by keeping them distinct from the privatization tendency of capture. Bounding the Environment allowed law to identify nature because it also allowed law to identify the places and things that were recognized as exhibiting the values of the Environment. In the meantime, boundaries allowed law to identify which persons had a sufficient interest to sue on behalf of nature (those persons who effectively pierced the boundaries of nature). Finally, bounding nature allowed environmental protection to coexist with property, but it did so in a curious manner: on private property the presence of Environment was competitive with Property. Under Property, the value of natural things was in their transformation and use; under the Environment, the value of natural things was in their nonuse and

127. See, e.g., Wilderness Soc'y v. U.S. Fish & Wildlife Serv., 353 F.3d 1051, 1062, 1064-65 (9th Cir. 2003) (en banc) (holding that the Act allows human use of such natural areas, but not commercial use, even to the extent of prohibiting a sockeye salmon enhancement project when the primary benefit is realized in economic terms).
129. Important, then, is the insight provided by William Cronon's constructivism critique of the "natural" idea of wilderness. Cronon states, "The time has come to rethink wilderness." William Cronon, The Trouble with Wilderness; or, Getting Back to the Wrong Nature, in UNCOMMON GROUND: RETHINKING THE HUMAN PLACE IN NATURE 69 (William Cronon ed., 1996). He has argued that by identifying wilderness and "natural" in a particular place or a particular thing, we were actually identifying natural as "that place over there" or "that thing." See id. at 85-86. By partitioning, or even quarantining, wilderness from humans, what we get is a nature that we cannot touch—not for lack of physical access but for the rhetorical relationship that we have constructed. See id.
Cronon's point is a good one: laws creating the Environment have arguably constructed a nature that humans do not live in, that does not surround us, but that we can capture and (for lack of a better word) quarantine. See id.
130. See Lujan, 505 U.S. at 565-67.
nontransformation. Finding the Environment on one's property was a
detracttion, or perhaps more accurately, a property defect.

Because of the divide between values of the Environment and those of
Property, the onset of the Environment reinvigorated the challenge to
Mugler v. Kansas through the argument that property could be
invaded by regulation for purposes of the Takings Clause of the Fifth
Amendment. Indeed, when in conflict with captured property, the
Environment could be understood as a mappable area that exhibits
particular nonhuman uses—not to the exclusion of human benefits but as
an addition to human benefits. As a thing with boundaries, the
Environment might intrude into or overlap with an owner's property
boundaries, in which case the law could question the extent of the
overlap. From here, a mere physical presence of the Environment made
analysis of a takings claim conceptually simple: where there was
overlap, property could be considered encumbered. If, as in Lucas v.
South Carolina Coastal Council, the overlap went too far or was
even complete—meaning that the boundaries of property were entirely
contained within the Environment—a categorical taking had oc-
curred. On the other hand, if the overlap was neither coextensive
with the Environment nor completely subsumed, as in Palazzolo v.
Rhode Island or Penn Central Transportation Co. v. City of New
York, the court would consider and balance the remaining valuable
property with the Environment. Either way, it is because the
Environment is described in relation to its values, but identified by
reference to its boundaries, that we can compare and balance the values
of the land.

The third consequence of the Environment's boundedness is fragmen-
tation in the way nature is regulated. Property's legacy of observing
different rules of capture for different things in nature—whales, foxes,
bees, land, and so forth—corresponded to an enormous body of laws
intended to individually regulate each component of nature with little
collaboration between them. As Tony Arnold notes, "Each regime has a
different 'expert culture'—different professional and organizational norms,

131. 123 U.S. 623 (1887).
132. U.S. Const. amend V.
134. See id. at 1014.
different ways of looking at the world, and different ways of conceptualizing problems and solutions.”

The ecological limitation of this approach has been most evident in conceptualizing both the challenge of and responsibility for climate change. Of course, the Environment approach encouraged an information-gathering exercise that was missing from the Property approach, resulting in a richer and deeper understanding of nature and its processes. In addition, the Environment provided a platform from which the impacts of climate change could be considered significantly adverse. Yet the Environment has arguably been unable to provide effective tools for responding to impacts that accumulate throughout a natural system, and more specifically, it did not provide the conceptual means to inculcate anthropogenic contributions to natural processes. Essentially, the question of cause and effect in climate change has caused too much confusion in identifying either the Property or Environment boundaries at issue.

The Environment reconceived the values attributed to things in nature by asserting that natural, nonhuman entities and processes contained some level of pre-capture (or pre-property) value. In the regulation of land uses, this new understanding of nature encouraged the identification of nature as a collection of different objects—air, water, insect, fox, and so on—that were valuable independent of their use. Nature under the Environment approach possessed pre-property value, and emboldened by a more scientifically sophisticated assessment of environmental attributes, law strived to protect those attributes against the impacts of land-use choices. What was protected was, of course, the thing in the Environment. Wetlands were mapped based on an assessment of the soil's ability to demonstrate wetland characteristics. Point-source discharges of pollutants were controlled because they would invade the values of particular surface water bodies by causing severe impacts on segments of the Environment, such as navigable waters (and the particular living things that inhabited or visited such waters, including

139. See Sierra Club, 405 U.S. at 734-35.
140. U.S. ARMY CORPS OF ENG'RS, WESTLANDS RESEARCH PROGRAM TECHNICAL REPORT Y-87-1, WETLANDS DELINEATION MANUAL (1987). The manual defines “wetlands” as “[t]hose areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.” Id. at A14. The manual details wetland soil characteristics. Id. at 20-28.
fish or humans). Water quality was premised on the impacts of particular actions on water quality segments, ensuring that the Environment could be subject to a rather exacting calculus for its relationship to property and economic worth. The Environment did not shed the boundaries so central to Property but applied the idea of boundaries to things that were not property.

IV. ECOSYSTEM SERVICES, THINGS THAT ARE CONNECTED TO OTHER THINGS, AND PROPERTY WITHOUT BOUNDARIES

A. In the Matter of Pierson v. Post

Mr. Post is not entitled to possession of the fox carcass. That said, the court is happy to make a finding that Mr. Post in fact killed the fox (and most of the other living things in the affected forest), but this is not to imply that the law awards Mr. Post with a vested interest in the fox. Nature's feat—producing this fox—cannot now be repeated due to the actions of Mr. Post, and we will not reward Mr. Post for so depriving the public of this natural capital.

We make one point that has obviously occurred to Mr. Post: human actions in nature may have effects throughout an ecosystem, and when human actions impair those ecosystem services that benefit human health and property, we do not treat such acts as private or independent of the public interest. Or more accurately, Mr. Post has intruded upon the ecosystem in a manner that will deny existing beneficiaries of the services they rely upon from natural ecosystems. We liken this act to a theft of natural and economic advantage on such a broad scope that Mr. Post should avail himself of a better lawyer than the one who pled this action for conversion. If it turns out that those denied of services are unable to benefit from statutory codifications of these interests, we feel confident that the doctrines of nuisance, private or public, will operate to their advantage.

To the extent that Mr. Post has taken the art of hunting to a new level, we are certainly impressed. However, he failed to consider—or did consider but ulti-

142. See, e.g., id. § 1251(a).
mately ignored—the ecosystem effects of his actions. Only a few need be mentioned here. Mr. Post’s relocation of the stream will deprive the ecosystem dependents of much needed flood control, water purification, and climate regulation. The clearing activities, at the least, have reduced the region’s natural capacity for carbon sequestration, habitat provision, erosion control, nutrient and soil retention, biomass production, and recreational opportunities (including fox hunting). Mr. Post’s soil disruption has likely impaired the ecosystem’s ability to monitor, utilize, and supply the system with sufficient and timely water to satisfy ecosystem and domestic needs. The eradication of critters in this area has thwarted the biodiversity services on which we all depend.

Obviously, there are some ecosystem services and redundancies in such services that are not intended to be excluded from this brief analysis. There are always unintended omissions of insight, particularly in matters of emerging science. Yet we are sadly reminded of a recent interview that drives home both the point of ecosystem services and Mr. Post’s ignorance of ecosystem health:

A large flying fox eats a fruit ingesting its seeds. Flying over the tropical forests it eventually deposits the seeds at the base of another tree far from the first. One of these seeds takes root, sprouts, and in thirty years time a new tree waits for another flying fox to spread its [seed].

In the Southeast Asian tropics an astounding 80 percent of seeds are spread not by wind, but by animals: birds, bats, rodents, even elephants. But in a region where animals of all shapes and sizes are being wiped out by uncontrolled hunting and poaching—what will the forests of the future look like?\textsuperscript{143}

Of course, in the case at hand, we know what the forest will look like in the future—it is gone today, and it will be gone tomorrow, along with the fruits, foxes, birds, bats, and insects.

In a separate action that has been joined with the underlying cause for conversion, the Friends of the Fox ask for injunctive relief and an order that Mr. Post restore the

Mr. Post objects vehemently, suggesting that the Friends' complaint should be dismissed for want of standing. Indeed, the Friends did not allege that a single one of its members had visited the site, swam in this stretch of the creek, shared space with the fox, or otherwise has an interest in the specific property that Mr. Post has transformed. Mr. Post contends that the remoteness of the alleged injuries tolls against the Friends' standing. That, however, is no longer the test for standing. The Friends alleged that some of its members live in the watershed of this no-named creek, and the relocation of this creek has caused turbidity and sedimentation in the stream. Other members draw drinking water from wells and have alleged that the stream relocation has altered the rate and quality of aquifer recharge. Still other members allege injury from the removal of habitat by Mr. Post, an action that has exposed wildlife in the forest to edge effects and predators, displaced wildlife populations, removed food supplies, and driven wildlife away from the properties owned by members of the Friends. In holding the Friends' allegations sufficient to plead standing, we recognize that the injury element of standing can be met by what might have previously been considered too remote an injury. Under current science, however, we hold that in the same manner that leveling the forest may have killed the fox, the destruction of ecosystem services may well have a substantial economic and health-based impact on the members of the plaintiff's group.

Signed, The Court

B. Ecosystem Services: Things Without Boundaries

By all accounts, ecosystem services are vital to the production of ecosystem goods and the maintenance of a livable environment.144 As

144. As noted above, one accepted definition of the term "ecosystem services" is "a wide range of conditions and processes through which natural ecosystems, and the species that are part of them, help sustain and fulfill human life." Daily et al., supra note 9, at 2. Other definitions vary but retain the central importance of ecosystem functionality and its importance to human well-being. In their watershed article, Robert Costanza and his colleagues define the term as follows: "Ecosystem functions refer variously to the habitat, biological or system properties or processes of ecosystems. Ecosystem goods (such as food) and services (such as waste assimilation) represent the benefits human populations derive, directly or indirectly, from ecosystem functions." Robert Costanza et al., The Value of the World's Ecosystem Services and Natural Capital, NATURE, May 15, 1997, at 253, 253.
such, the relevance of ecosystem services to human needs and the manner in which ecosystem services add value (at least by producing things that we value as property) are far reaching: ecosystems provide products that directly benefit humans from their consumption, use, and trade, such as food, fuel, fresh water, clean air, and building materials; ecosystems regulate natural conditions and hazards by recharging aquifers, filtering water and air, reducing floods, controlling temperature, and sequestering carbon; ecosystems support the productivity of ecosystems through soil and oxygen production, nutrient cycling, organic decomposition, and habitat provision; and ecosystems offer other meaningful but less tangible services, such as providing recreational, spiritual, and educational opportunities. As James Salzman notes, ecosystem services have typically and historically been taken for granted or assumed to be valueless. Perhaps the problem is in how we identify what nature has to offer: “Our unthinking reliance on ecosystem services is due in part, no doubt, to society’s dissociation between the milk carton and medicines in our home, on the one hand, and the services of nutrient cycling and biodiversity, on the other, that made these possible.” From the “Ecosystem Services” perspective, engaging ecology serves the purpose of transitioning the perspective of ecosystems as expendable to functional, “from amenity to living technology.” At present, the Ecosystem Services approach to nature is beginning to overwhelm the stalwarts of the Property scheme, both in its understanding of nature and its approach to law. This section illustrates how the shift to an Ecosystem Services approach will require us to reorganize our legal understanding.

Similarly, the Millennium Ecosystem Assessment, reports define the term as follows:

Ecosystem services are the benefits people obtain from ecosystems. These include provisioning services such as food, water, timber, and fiber; regulating services that affect climate, floods, disease, wastes, and water quality; cultural services that provide recreational, aesthetic, and spiritual benefits; and supporting services such as soil formation, photosynthesis, and nutrient cycling. The human species, while buffered against environmental changes by culture and technology, is fundamentally dependent on the flow of ecosystem services.


145. See supra text accompanying note 144.


147. Id.

of natural things so that boundaries are not prioritized over the natural processes that produce value in property.

1. Ecosystem Services as a Dialogue on Form and Function in Nature. This idea of describing nature in terms of ecological processes is not particularly new. Neither is the notion that natural processes benefit human well-being. However, the concept of Ecosystem Services, the way that this concept conceives of value in nature, and the attempt to explicitly construct ecosystem services as incidents of property value are relatively recent topics.\textsuperscript{149} This approach recognizes that the individual fox derives meaning both as a good from the ecosystem \textit{and} from the services it provides within the ecosystem.

The most obvious contrast between Ecosystem Services and the Property description of things in nature is Ecosystem Services' rejection of Property's insistence that nature becomes valuable only through transformation.\textsuperscript{150} Ecosystem Services attributes value to the functionality of ecosystems, in which the individual components of ecosystems are identified for the services they provide throughout the ecosystem itself and through human benefits.\textsuperscript{151} A recent National Research Council publication explains the features of Ecosystem Services as follows:

\textit{Ecosystem structure} refers to both the composition of the ecosystem (i.e., its various parts) and the physical and biological organization defining how those parts are organized. A leopard frog or a marsh plant such as a cattail, for example, would be considered a component of an aquatic ecosystem and hence part of its structure. \textit{Ecosystem function} describes a process that takes place in an ecosystem as a result of the interactions of the plants, animals, and other organisms in the ecosystem with each other or their environment. Primary production (the process of converting inorganic compounds into organic compounds by plants, algae, and chemoautotrophs) is an example of an ecosystem function. Ecosystem structure and function provide various \textit{ecosystem goods} and \textit{services} of value to humans such as fish for


\textsuperscript{150} See Sax, \textit{supra} note 39, at 1442 (distinguishing between the "transformative economy" and the "economy of nature," which recognizes value in ecosystems).

\textsuperscript{151} See \textit{supra} text accompanying note 144.
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recreational or commercial use, clean water to swim in or drink, and various esthetic qualities (e.g., pristine mountain streams or wilderness areas).\textsuperscript{152}

Ecosystem goods and services provide for the needs of human health, market preferences, and other anthropocentric needs. Ecosystem structure and function determine how and to what extent an ecosystem is capable of providing those goods and services. An impairment of ecosystem structure and function impacts the ability of the ecosystem to deliver goods and services.

Notably, the Ecosystem Services approach also diverges from the Environment in the particular values that are attributed to nature. Under Ecosystem Services, the capacity of an ecosystem to deliver ecosystem goods and services is a coincidence of ecosystem structure and processes—form and function. Hence, the Ecosystem Services approach and the Environment approach do not diverge from the Property approach in the same way: when the Environment replaces Property's focus on transformation with a nonuse or inherent value, Ecosystem Services accepts a use valuation (an economic valuation) for ecosystem goods based on the idea that ecosystems can be valued for the services they provide and for being able to continue to produce the goods in the future.

A recent decision in the United States Court of Appeals for the Fourth Circuit illustrates the limitations in regulating the nature described in the Environment and the challenges the courts have faced in moving towards an Ecosystem Services approach. In \textit{Ohio Valley Environmental Coalition v. Aracoma Coal Co.},\textsuperscript{153} three environmental groups challenged the Army Corps of Engineers' approval of four separate permits allowing the mining applicants to fill West Virginia streams as part of their surface coal mining operations. The operations involved "mountaintop removal" mining, in which underground coal seams are exposed by blasting soils and rocks from mountaintops. The "spoils" of this method, which for the most part cannot be replaced, are dumped into adjacent valleys, inevitably burying streams and impacting the watershed.\textsuperscript{154} Ultimately, this action involved the approval of twenty-

\textsuperscript{152}. \textsc{Committee on Assessing and Valuing the Services of Aquatic and Related Terrestrial Ecosystems, National Research Council, Valuing Ecosystem Services: Toward Better Environmental Decision-Making} 1 n.1 (2005) [hereinafter \textsc{CAVSARTEI}].
\textsuperscript{153}. 556 F.3d 177 (4th Cir. 2009).
\textsuperscript{154}. \textit{Id.} at 185-86. Mountaintop removal mining, which is considered by many to be among the dirtiest mining practices, "leaves a legacy of foul streams, hideous slag heaps and polluted air." \textsc{Harry M. Caudill, Night Comes to the Cumberlands: A Biography of a Depressed Area} x (1962); see also Patrick C. McGinley, \textit{From Pick and Shovel to
three separate fills of valleys and the resulting impacts of over thirteen miles of headwater streams.\textsuperscript{155}

For purposes here, the relevant issues in this case involve the standards governing the approval of a § 404 permit under the Clean Water Act.\textsuperscript{156} The Corps is authorized to permit "the discharge of dredged or fill material into the navigable waters at specified disposal sites,"\textsuperscript{157} which includes the deposit of mining overburden into waters.\textsuperscript{158} In analyzing the significance of the impacts from the proposal, the Corps is required to make particular factual determinations to ensure that the appropriate wetland values and functions have been considered.\textsuperscript{159}

\begin{footnotesize}
\begin{itemize}
\item \textsuperscript{156} \textit{Ohio Valley}, 556 F.3d at 187.
\item \textsuperscript{157} See generally 33 U.S.C. § 1344. The Corps made findings to support a finding of no significant impact (FONSI) for each of the four projects on the basis of the mitigation measures planned for the operations. \textit{Ohio Valley Envtl. Coal. v. U.S. Army Corps of Eng'rs}, 479 F. Supp. 2d 607, 642 (S.D. W. Va. 2007). After the district court vacated the permits and enjoined the Corps and applicants from acting on the permits, the Corps and applicants sought review. \textit{Ohio Valley}, 556 F.3d at 186.
\item \textsuperscript{158} Pursuant to the authority granted to the Environmental Protection Agency (EPA) under CWA § 404, the EPA promulgated the CWA § 404(b)(1) Guidelines in conjunction with the Corps and codified them at 40 C.F.R. pt. 230 (2009). See generally 33 C.F.R. § 320.2(f) (2009) (stating the issuance of § 404 permits "will be in accordance with guidelines developed by the Administrator of EPA in conjunction with the Secretary of the Army"). The Corps is required to assess impacts to both structure and function; thus, they must determine the nature and degree of effect that the proposed discharge will have, both individually and cumulatively, on the structure and function of the aquatic ecosystem and organisms. Consideration shall be given to the effect at the proposed disposal site of potential changes in substrate characteristics and elevation, water or substrate chemistry, nutrients, currents, circulation, fluctuation, and salinity, on the recolonization and existence of indigenous aquatic organisms or communities.
\item \textsuperscript{159} \textit{Ohio Valley}, 556 F.3d at 198. Pursuant to the authority granted to the Environmental Protection Agency (EPA) under CWA § 404, the EPA promulgated the CWA § 404(b)(1) Guidelines in conjunction with the Corps and codified them at 40 C.F.R. pt. 230 (2009). See generally 33 C.F.R. § 320.2(f) (2009) (stating the issuance of § 404 permits "will be in accordance with guidelines developed by the Administrator of EPA in conjunction with the Secretary of the Army"). The Corps is required to assess impacts to both structure and function; thus, they must determine the nature and degree of effect that the proposed discharge will have, both individually and cumulatively, on the structure and function of the aquatic ecosystem and organisms. Consideration shall be given to the effect at the proposed disposal site of potential changes in substrate characteristics and elevation, water or substrate chemistry, nutrients, currents, circulation, fluctuation, and salinity, on the recolonization and existence of indigenous aquatic organisms or communities.
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The proposed impairment of several miles of streams could have triggered a factual inquiry into the functions served by the affected streams. Such an analysis would have allowed for a determination of whether the proposed mitigation would be appropriate and adequate to protect the beneficiaries of the lost aquatic ecosystem functions; however, the analysis was not performed. Rather than investigating the functions of headwater streams or considering the likelihood that the chosen mitigation would protect the local ecology, the Corps calculated the linear feet of lost streams and approved mitigation requirements of a one-to-one replacement to be implemented by enhancement of existing drainage ditches. The Corps' analysis of replacement of stream structure effectively acted as a “surrogate” for analysis of stream function. The majority in the Fourth Circuit upheld the Corps' approach and held that, although the Corps is required to consider “the effect at the proposed disposal site,” whatever the role of headwater streams in overall watershed ecology, the Corps is not required to differentiate between headwater and other stream types in the determination of mitigation measures. A mile of stream, here or there, is the same thing.

energy.” Id. The determination of a proposal’s effects on stream structure and function are thus imperative in the CWA § 404 permitting process. See id. § 230.5(a) (referring to § 230.11 as one of the “principal regulatory provisions of the Guidelines”); id. § 230.10(c) (requiring that “[f]indings of significant degradation related to the proposed discharge shall be based upon appropriate factual determinations, evaluations, and tests” pursuant to various subparts of the Guidelines).

160. Ohio Valley, 556 F.3d at 203-04. The gravamen of this case involves a subsequent regulatory guidance letter stating that the Corps “will determine, on a case-by-case basis, whether to use a functional assessment or acreage surrogates for determining mitigation and for describing authorized impacts.” U.S. ARMY CORPS OF ENGR'S, REGULATORY GUIDANCE LETTER NO. 02-2, GUIDANCE ON COMPENSATORY MITIGATION PROJECTS FOR AQUATIC RESOURCE IMPACTS UNDER THE CORPS REGULATORY PROGRAM PURSUANT TO SECTION 404 OF THE CLEAN WATER ACT AND SECTION 10 OF THE RIVERS AND HARBOURS ACT OF 1899 at 2 (2002). This guidance letter seeks to avoid the requirement for a functional assessment “where functional assessment is not practical” and instead allows the Corps to consider mitigation proposals that “should generally replace linear feet of stream on a one-to-one basis.” Id. at 3. In this case, the Corps did not have available a stream assessment of the functionality of headwater streams. Ohio Valley, 556 F.3d at 222.

161. Ohio Valley, 556 F.3d at 199.

162. 40 C.F.R. § 230.11(e).

163. Ohio Valley, 556 F.3d at 203. Ultimately, the Fourth Circuit deferred to the Corps on grounds that there are several levels of adequacy in mitigation, and mitigation decisions are generally led by a rule of practicality. See id. at 203-04; see also Memorandum of Agreement, 55 Fed. Reg. 9210 (Mar. 12, 1990).

164. Although the history of “no net loss” often includes allusions to loss of functionality, it is less clear that functionality played the most instrumental role in the policy. See, e.g., George Bush, Remarks to Members of Ducks Unlimited, June 8, 1989, THE AMERICAN
From the Ohio Valley controversy it is easy to see that managing the transition to an Ecosystem Services understanding of nature will require a concerted effort to identify for the courts the important distinctions between the bounded Environment and ecosystem functionality. It is noteworthy that from the perspective of the Environment, the one-to-one replacement ratio approved in Ohio Valley must be considered a significant victory for nature: loss of the headwater streams at issue should not have raised a value problem under the Property paradigm, but here the Corps navigated the limits of property and found authority to require replacement of the streams. From the Ecosystem Services perspective, however, a no-net-loss rule measured in linear feet makes as little sense as the conflation of wetland boundaries to indicate the edge of the ecological influences and needs of wetlands. Even a successful replacement of miles of streams will fail on a large ecological scale if the functionality of the watershed as a whole is impaired from the loss of these particular streams. Attention only to the structure of an ecosystem is not sufficient to account for ecosystem functionality.

2. Ecosystem Services and the Economic Value of Nature. The thrust behind Ecosystem Services is that a functionality approach provides a better policy framework for ensuring sustainable and productive ecosystems over the long term. This approach insists that ecology and economics wed to enable both to better provide an accounting of noncommodity services provided by functioning ecosystems; either one alone is unable to accomplish the task. However, when used in unison, such as in the effort to estimate economic values for ecosystem


And I want to ask you today what the generations to follow will say of us 40 years from now. It could be they'll report the loss of many million acres more, the extinction of species, the disappearance of wilderness and wildlife; or they could report something else. They could report that sometime around 1989 things began to change and that we began to hold on to our parks and refuges and that we protected our species and that in that year the seeds of a new policy about our valuable wetlands were sown, a policy summed up in three simple words: "No net loss."

Id. 165. Ohio Valley, 556 F.3d at 204.
166. CAVSARTE, supra note 152, at 153. The consort of the two is the challenge of ecology and the promise of ecosystem services: "efforts to preserve natural areas, acquire new greenspace, initiate plantings, and manage existing greenspace resources are frequently hampered by our inability to fully appraise the environmental services greenspace (i.e. the urban forest) provides.” McPherson, supra note 148, at 41.
services, ecology and economics can provide persuasive reasons for rethinking the manner in which we treat nature.\footnote{Costanza and his colleagues, for instance, estimated that “the annual value of [global ecosystem] services is US$16-54 trillion, with an estimated average of US$33 trillion. The real value is almost certainly much larger, even at the current margin.” Costanza et al., \textit{supra} note 144, at 259.}


Another successful area in which ecosystem knowledge is being translated into economic value is found in the growing body of literature on urban forest services and urban tree canopy. In comparing the benefits of trees in urban areas (for example, climate moderation, stormwater and air quality control, and habitat provision) with the potential liabilities (for example, pollen production and water use), studies have repeatedly concluded that the economic benefits of ecosystem functionality outweigh the costs of maintaining a healthy urban forest.\footnote{See, e.g., \textit{Salzman et al., \textit{supra} note 146, at 314-18. Cf. David J. Nowak \\& Jeffrey T. Walton, \textit{Projected Urban Growth (2000-2050) and its Estimated Impact on the US Forest Resource}, 2005 J. FORESTRY 383, 388 (finding that forests provide economic value under an ecosystems approach).}

The analysis of ecosystem functionality has improved—particularly over the last fifteen years—as more information has been gathered relating to the costs of constructing replacement service facilities (for example, stormwater detention facilities to replace the stormwater filtering and retention services provided by trees) and as needs have increased for

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\item \footnote{\textit{McPherson, \textit{supra} note 148, at 42-50 (stating that “[a]verage annual benefits from the selected environmental services are projected to exceed costs by US$15.48 per tree (2.6 benefit-cost ratio)” before discounting adjustments are made). Jessica Sargent-Michaud of The Trust for Public Land estimated a return on conservation easement investments by the State of Colorado by comparing the investment–state grants for easement acquisition and tax credits—to the value of the services provided by the predominant ecosystem type for each acre subject to a conservation easement under the program. Jessica Sargent-Michaud, \textit{A Return on Investment: The Economic Value of Colorado’s Conservation Easements}, THE TRUST FOR PUBLIC LAND (2009), http://www.tpl.org/content_documents/-Final%20report%20ecosystem%20services.pdf. She estimated that in 2008 Colorado was receiving a return of six times the initial investment. \textit{Id.} at 5.}}
\end{itemize}
these services from urbanization and industrial processes. Hence, the
City of Vancouver, Washington, has noted in its Urban Forestry
Management Plan that "[u]nlike traditional gray infrastructure capital
improvements, such as transportation and water systems, which begin
to depreciate as soon as they are installed, green infrastructure accrues
value and provides greater services as time passes." In order to
comply with the Endangered Species Act (ESA), the Clean Air Act (CAA),
and the Clean Water Act (CWA), Vancouver specifically incorporates urban canopy benefits into its strategies. In addition
to water and air quality benefits, habitat provision, and cooling benefits
of urban canopy, Vancouver relies on the promise of economic advantage
stemming from a healthy and mature canopy cover. Vancouver estimates that its existing canopy provides the same services as an
annualized $12.9 million of avoided cost to taxpayers from installing
stormwater retention structures, saves $78.3 million in air pollutant
removal services, and reduces cooling costs by approximately 4% from
shade. The economic benefits of the canopy include Vancouver’s
sense of self and place:

Improving aesthetics of our community has tangible economic benefits.
Systems of open space and bike trails give a community a reputation
for being a good place to live and visit. Increased recreational and
community activity attracts new businesses and stimulates tourism.
Well-maintained trees improve residential “curb appeal” and increase
potential buyers’ willingness to pay a 3-7% premium for property.
Trees in retail settings increase shoppers’ willingness to pay for goods
and services by 12%. Shoppers also indicate that they are willing to
drive farther and stay longer if a retail district is well-landscaped with
trees.

[hereinafter UFMP], available at http://www.cityofvancouver.us/parks-recreation/parks
_trails/urban_forestry/pdf/UFMP_final-web.pdf.
174. UFMP, supra note 170, at 9.
175. See id.
176. Id. at 1. Vancouver adopts estimates made by American Forests in a 2001 review
of the City’s urban forest ecosystem. Id. at 7 n.4.
177. Id. at 8.
178. Id. at 9 (footnotes omitted).
Based on this review and those upon which Vancouver relies, Vancouver estimates an annual net benefit per tree of $1-8 for small trees, $19-25 for medium-sized trees, and $48-53 for large trees.\footnote{179}

American Forests has noted similar economic advantages in their series on urban ecosystem analysis.\footnote{180} In a recent tree canopy analysis of Mecklenburg County and the City of Charlotte, North Carolina, American Forests noted that in 2008 Charlotte’s tree canopy covered 46% of its jurisdiction and was estimated to provide 662 million cubic feet of stormwater detention services, to remove 7.2 million pounds of air pollutants, to store 3.7 million tons of carbon, and to sequester 28,000 tons of carbon.\footnote{181} Valuation for these services is based on the cost of constructing a means of providing replacement services: $1.3 billion for stormwater detention and $19.2 million per year of air pollutant removal.\footnote{182} American Forests also assessed the costs of losing tree canopy:

Between 1985 and 2008, Mecklenburg County, lost 33% of its tree canopy and 3% of its open space, while gaining 60% of urban area. These changes resulted in the loss of the tree canopy’s ability to naturally manage 252 million cubic feet of stormwater, valued at $504 million using a local engineering cost of $2 per cubic foot. The County’s green infrastructure also lost the ability to remove approximately 3.8 million lbs. of air pollutants annually, valued at $8.8 million per year . . . .\footnote{183}

The economic component of Ecosystem Services has drawn its fair share of critics. The difficulty here is not that functionality is a new topic for ecologists, and it is not that environmental quality is a new topic for economists. The problem is that the services that ecosystems provide (especially the “indirect” benefits from ecosystems)\footnote{184} have
historically remained invisible, and they have done so at least in part because property owners may have no means of directly capturing benefits from ecosystem services provided on their lands, as there are no markets for most of these services.\textsuperscript{185} In addition, it is typically "the case that the value of ecosystem services becomes apparent only after such services are diminished or lost, which occurs once the natural processes supporting the production of these services have been sufficiently degraded."\textsuperscript{186} In this sense, the most persuasive point made by Ecosystem Services advocates is the economic one: preserving functional ecosystems is economically advantageous. In many cases, preserving or protecting ecosystem functionality for purposes of receiving clean water, flood control, biodiversity, and carbon sequestration, among other benefits, will be less expensive than providing replacement goods or services.\textsuperscript{187} Hence, adopting the Ecosystem Services approach is an

\begin{footnotesize}
\begin{enumerate}
\item[\textsuperscript{185}] See Salzman et al., supra note 146, at 312 ("The services themselves have no market value for the simple reason that no markets exist in which they can be exchanged.").
\item[\textsuperscript{186}] CAVSARTE, supra note 152, at 154; see also Daily et al., supra note 9, at 12 ("[P]eople whose activities disrupt ecosystem services often do not pay directly for the cost of those lost services.").
\item[\textsuperscript{187}] The Forest Service reports that there have been five general methods of ecosystem goods and services valuation. U.S. Dep't of Agric., supra note 184, at 10. The first method—market prices, which are dependant on market mechanisms—may produce economic values for some ecosystem goods but may be entirely unhelpful for goods and services for which there is no competitive market. The other four methods—revealed preference, stated preference, production function, and replacement cost methods—help estimate value in the absence of competitive markets. Id. at 10-11. Of these, the Forest Service reports that replacement cost—used to measure the cost of replacing a lost good or service—is often used to provide value of ecosystem services. Id. at 11. An additional method, known as benefits transfer, estimates the value of ecosystem goods and services based on the studies of other ecosystem services or locations. Benefit Transfer Method, ECOSYSTEM VALUATION, http://www.ecosystemvaluation.org/benefit_transfer.htm (last visited Dec. 20, 2010). This methodology is typically used when there is inadequate information to estimate the value of a particular ecosystem service or characteristic. Id. Under this method, economic values of ecosystem benefits in one location or context, when there are published studies or sufficient information, are adapted to provide an estimate of ecosystem benefits at another location or in another context. Id. Although benefits-transfer methodology provides a good starting point for thinking about the economic valuation of ecosystem services, it is only an initial assessment of value. See id. The limitations of this method include that reliable studies for the particular ecosystem feature may be unavailable, either because they have not been accomplished or because they have not been published; existing studies may not provide sufficient data to enable an accurate transfer analysis or otherwise be difficult to verify; and there may be insufficient data on the particular site, location, or other specific characteristics of the subject ecosystem to allow for an accurate extrapolation of which ecosystem features allow for analogical valuation.
\end{enumerate}
\end{footnotesize}
effort to make ecosystems visible by making nature an asset instead of a defect.  

Although the effort to converge ecology with economics allows the Ecosystem Services approach to adopt a familiar vocabulary, the wedding is challenging. The manner in which Ecosystem Services conceives of natural processes—as interdependent and dynamic—raises a host of ambiguous questions and equations. As Janet Neuman notes,

I know that if I take my checkbook to the lumberyard, I can write a check for fifty dollars and take home a certain number of two-by-fours. But how many murrelet nests would that fifty dollars buy, and who would take my money? If I lived in Wheeler, Oregon, and wanted to assure that the Tillamook watershed would provide clean drinking water for my grandchildren, how much would that cost, and who could I pay for it even if I wanted to? Will there be jobs for my grandchil-

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188. One way of thinking about this advantage is based on the simple idea that ecosystem services analysis allows for a more persuasive application because it adopts the vocabulary of economics. That is, assuming that much of our environmental policy-making is led by cost-benefit analysis, ecosystem services replaces the comparison of apples to oranges (for example, the economic value of property versus the value of knowing a pristine environment exists) with an apples to apples comparison. Ecosystem services allow for realization of nature as having a nonuse value. Until our decision-making paradigm changes, ecosystem services will enable environmental protection in ways that were not attainable under previous paradigms. As was pointed out for me in a casual conversation with Marc Poirier, this does not mean that the ecosystem will prevail by way of preservation in every case. “In some cases, perhaps many, a focus on services will not justify conservation of biodiversity or certain natural habitats” or may “be largely irrelevant to environmental protection,” but it probably does lead to protection of ecosystem function on an entirely different scale, typically in efforts to craft appropriation mitigation for lost ecosystem functions. Salzman et al., supra note 146, at 312-13.

189. Marc Poirier notes that “[t]he ecosystems services approach seeks to quantify the long-term value of environmental services in order to make them concrete and recognizable, thus facilitating cost-benefit arguments against their degradation; some also aspire to create markets in ecosystem services.” Marc R. Poirier, Natural Resources, Congestion, and the Feminist Future: Aspects of Frischmann’s Theory of Infrastructure Resources, 35 Ecology L.Q. 179, 197 (2008).

190. The world under Property is comprised of potential commodities that have value in a way that is relevant to the Ecosystem Services scheme. These things—foxes, plants, and minerals, among others—are ecosystem goods that can be valued for how they can be used. However, the Ecosystem Services approach diverges from Property by recognizing that particular, essential ecosystem goods and services might not have an approved market value and by rejecting the notion that any individual object is valued only for its anthropocentric use or market value. Ecosystem Services also incorporates the notion that nature provides services for which there may be no commodity market but which have economic value nonetheless.
dren to keep them in Wheeler? Will they be loggers, fishing guides, owners of a saltwater taffy shop for tourists, or carbon traders? 191

Some ecosystem goods may be susceptible to market valuation, yet the value of ecosystem services is difficult to estimate merely by reference to the behaviors of willing buyers and sellers. In large part, the difficulty lies in the marketplace: property is only beginning to be traded in consideration of the ecosystem services provided and received. Calculating the value of ecosystem services on a case-by-case basis is a complex undertaking that is made more difficult by the mere fact that it requires an adaptation of traditional neoclassical economics to noncommodified goods and services that did not arise from human labor. Difficulties also derive from the dynamic nature of ecosystems, which simultaneously provide multiple services that markets may cast as competing. 192

More problematic, however, is that sufficient information about the benefits of ecosystems is currently available for only a narrow range of relevant ecosystem services, 193 and as such, uncertainty continues to pervade Ecosystem Services valuation. This uncertainty is understandable as the science and economics of Ecosystem Services is evolving, even if at an explosive rate, yet they remain at a nascent stage. The question is what to do about the present shortage of information on ecosystem services. Perhaps, as Gretchen Daily and her colleagues have noted, these circumstances should not gravitate towards avoidance of Ecosystem Services analysis, as “it may be prudent to establish fundamental

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192. The mechanism for this shift in valuation—essentially a shift in valuation methods—is the centralization of the concept of interconnectedness. An Ecosystem Services approach recognizes that a multitude of ecological features contributes to the realization of ecosystem goods and services. Costanza et al., supra note 144, at 253-55. The process of producing these goods requires the participation of both ecosystem structure and function. See id. at 254-55. The loss of any particular component in this production process may impair the production capacity of the entire ecosystem. See id. at 255. Such components, also referred to as “natural capital,” determine the capacity of the ecosystem to be productive. Id. at 254-55. Competition in this regard will inevitably, but not exclusively, arise in controversies over altered ecosystems where restoration of a long-ag altered system may impair ecosystem services that properties and wildlife have come to enjoy (for example, a dike removal for purposes of floodplain and wetland restoration). The Ecosystem Services approach will suffer controversies over competing ecosystem needs, but this is not unique to Ecosystem Services.

193. CAVSARTE, supra note 152, at 193; see also Salzman et al., supra note 146, at 318. Ecosystem services accounting may be difficult to generalize from one ecosystem to another when location plays such an important factor in ecosystem functionality.
ecosystem protections even though uncertainty over economic values remains.\textsuperscript{194}

3. \textbf{Ecosystem Services in Agencies.} Many agencies have responded to these uncertainties by embracing the Ecosystem Services approach.\textsuperscript{195} At the EPA, the Ecosystem Services Research Program has identified priorities for the identification of standards, including indicators, measurement protocols, valuation techniques, and capacity building.\textsuperscript{196} The EPA continues to pursue an Ecosystem Services valuation of natural resources damages under both the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)\textsuperscript{197} and the Oil Pollution Act (OPA).\textsuperscript{198} After the Secretary of Agriculture announced the establishment of the Office of Ecosystem Services and Markets\textsuperscript{199} to help implement section 2709 of the Food, Conservation,

\begin{itemize}
\item \textsuperscript{194} Daily et al., \textit{supra} note 9, at 12.
\item \textsuperscript{195} Environmental law is arguably prepared for the transition to Ecosystem Services. As argued by Robert Fischman, the NEPA environmental analysis is the purest expression of that strand of environmental law that seeks to expand cost-benefit balancing to include indirect and incidental effects. Valuation of ecosystem services is exactly the kind of assessment NEPA envisions, providing a means to inform the public and decision-makers about what we stand to gain or lose in several alternative scenarios. Robert L. Fischman, \textit{The EPA's NEPA Duties and Ecosystem Services}, 20 STAN. ENVT'L. L.J. 497, 500-01 (2001). On the other hand, in \textit{Clinch Coalition v. Damon}, 316 F. Supp. 2d 364 (W.D. Va. 2004), the United States District Court for the Western District of Virginia ruled that in accounting for economic value as required under several applicable natural resource statutes, the Forest Service did not violate any statutory directive by refusing to account for ecosystem services associated with clean water, wildlife, recreation, scenery, and non-timber forest products, among others. \textit{Id.} at 377. As noted by the district court, these relevant statutes require the Forest Service to assess the costs and benefits associated with the proposal, but the statutes do not specify which method should be used to make this value assessment. \textit{Id.} at 377-81.
\item \textsuperscript{196} For information on the EPA's direction in ecosystem services research, see \textit{Environmental Protection Agency, EPA-SAB-09-012, Valuing the Protection of Ecological Systems and Services: A Report of the EPA Science Advisory Board} (2009) (explaining and assessing the state of ecosystem services research), and the EPA's website at http://www.epa.gov/ecology/basic-info.htm.
\item \textsuperscript{198} 33 U.S.C. §§ 2701-2762 (2006); see also 15 C.F.R. §§ 990.10, 990.11, 990.21 (2010); National Ambient Air Quality Standards for Ozone, 75 Fed. Reg. 2938 (Jan. 19, 2010) (considering the impacts of \textsubscript{O}\textsubscript{3} on ecosystem services and functions).
\item \textsuperscript{199} U.S. DEP'T OF AGRIC., OFFICE OF THE SECRETARY, SECRETARY'S MEMORANDUM 1056-001, ESTABLISHMENT OF THE OFFICE OF ECOSYSTEM SERVICES AND MARKETS (2008).
\end{itemize}
and Energy Act of 2008, the Forest Service continued its projected incorporation of Ecosystem Services in asking, “How can the Agency recognize and incorporate provisions in the planning rule for managing lands for the sustainable delivery of ecosystem services?” In 2008 the United States Geological Survey (USGS) published data gathered from over 200 catchments, including “wetland and surrounding uplands contributing runoff to the wetland” in 1997 and 2004 to provide a basis for estimating various ecosystem services.

This trend has launched from federal agencies into state and local governments. For instance, the Oregon legislature has committed resources to an Ecosystem Services approach to nature, establishing a state policy “to support the maintenance, enhancement and restoration of ecosystem services throughout Oregon, focusing on the protection of land, water, air, soil and native flora and fauna.” Oregon law now directs state agencies to incorporate Ecosystem Services values directly into their programs, including ecosystem services markets. At the local level, Clark County, Washington, has adopted a Habitat Conservation Ordinance, which, particularly when read in conjunction with Clark County’s Wetlands Protection Ordinance, provides an ecosystem approach to protecting the functions and values of riparian habitat areas. Under the Clark County habitat program, proposed develop-

205. Id. § 4.
207. Id. § 40.450.
208. See id. §§ 40.440, 40.450. Additionally, the drainage regulations in the Village of Port Jefferson, New York, require the protection of drainage services provided by “[b]rooks, ditches and stream beds” and the replacement of adequate drainage services at the expense of the developer “[w]here existing brooks, water-bearing ditches or dry stream beds giving
ments bear the burden of “demonstrat[ing] that the activity: [s]ubstantially maintains the level of habitat functions and values as characterized and documented using best available science” and “[m]inimizes habitat disruption or alteration beyond the extent required to undertake the proposal.” Clark County also provides a list of possible mitigation measures, all subject to the rule that “[d]isrupted functions and values shall be mitigated on-site as a first priority, and off-site thereafter.”

Some state and local efforts to implement land-use controls based on Ecosystem Services have received approval from the courts. For instance, the Connecticut Supreme Court has approved of the efforts of local governments to understand nature in a way that avoids restricting environmental regulation to the boundaries of environmental features. In Queach Corp. v. Inland Wetlands Commission of the Town of Branford, the court upheld a town’s regulatory scheme that embodied an ecosystem services approach to wetlands regulation. The town’s ordinance is triggered by “[a]ny activity which substantially diminishes the natural capacity of the inland wetland or watercourse to support fisheries, wildlife, or other biological life, prevent flooding, supply water, assimilate waste, facilitate drainage, provide recreation open space or other functions.” The plaintiffs attacked the ordi-

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209. Id. § 40.440.020(A)(X)(b).
210. Id. § 40.440.020(A)(X)(b).
211. See Queach Corp. v. Inland Wetlands Comm’n of the Town of Branford, 779 A.2d 134, 151 (Conn. 2001).
212. 779 A.2d 134 (Conn. 2001).
213. Id. at 150-51. The Connecticut Inland Wetlands and Watercourses Act (CIWWA), CONN. GEN. STAT. §§ 22a-36 to 22a-45 (2009), authorizes local governments to regulate freshwater wetlands and provides local governments with the express authority to regulate areas that extend beyond designated wetland boundaries. 1996 Conn. Acts 417, 421, 424-25 (Reg. Sess.).
214. Branford, Conn., Inland Wetlands and Watercourses Regulations § 2.1(q)(3)(Sept. 17, 2007). The Branford regulations define regulated “[s]ignificant activity” to mean any activity including, but not limited to, the following activities which may have a substantial effect on the area for which an application has been filed, or any other part of the wetland [or] watercourse system: . . .
3.) Any activity which substantially diminishes the natural capacity of the inland wetland or watercourse to support fisheries, wildlife, or other biological life, prevent flooding, supply water, assimilate waste, facilitate drainage, provide recreation open space or other functions, or . . .
5.) Any activity which causes a substantial diminution of flow of a natural watercourse, or groundwater levels of the regulated area, or . . .
nance on the ground that it attempted to regulate activities occurring outside of wetlands, such as development in buffer areas or removal of groundwater.\textsuperscript{215} In light of the ecological purposes of the state's wetlands regulations,\textsuperscript{216} the court responded that although the regulations indeed required review of a groundwater withdrawal that could affect the services provided by wetlands, the relevant sections of the ordinance "regulate impacts on wetlands and watercourses, not groundwater per se."\textsuperscript{217} The court upheld the approach as a regulatory effort triggered by impacts on wetlands and wetland services and did not limit the agency to regulation of activities occurring only within wetland boundaries.\textsuperscript{218}

7.) Any activity which creates conditions of an inland wetland or watercourse which may adversely affect the health, welfare, and safety of any individual of the community, or
8.) Any activity which destroys unique wetland or watercourse areas having a demonstrable scientific, educational or ecological value.

\textit{Id.} § 2.1(qq)(3), (5), (7)-(8).

215. \textit{Queach}, 779 A.2d at 140.


The inland wetlands and watercourses of the state of Connecticut are an indispensable and irreplaceable but fragile natural resource with which the citizens of the state have been endowed. The wetlands and watercourses are an interrelated web of nature essential to an adequate supply of surface and underground water; to hydrological stability and control of flooding and erosion; to the recharging and purification of groundwater; and to the existence of many forms of animal, aquatic and plant life.

217. \textit{Queach}, 779 A.2d at 150.

218. \textit{Id.} at 151. In some cases, the functionality approach of ecosystem services-based regulations has been more specifically linked to public benefits from ecosystem services. These efforts, too, have been supported in state courts. In the recent case of \textit{New Jersey Shore Builders Ass'n v. Township of Jackson}, 970 A.2d 992 (N.J. 2009), the New Jersey Supreme Court approved a local scheme of preserving tree canopy and biomass production through the township's tree protection ordinance. \textit{Id.} at 995. The challenged ordinance announces that trees are "important cultural, ecological, scenic and economic resource[s]."

\textit{TOWNSHIP OF JACKSON, N.J., CODE} § 100-1(C) (2010). To protect these values, the ordinance prohibits the destruction, removal, and injury to trees, except by permit. \textit{Id.} § 100-3(A). The ordinance further allows removal under certain circumstances, subject to the applicant's preparation of a "tree preservation and removal plan" or payment into a "tree escrow fund" established to facilitate replanting on public property. \textit{Id.} §§ 100-4(A), 100-8(B).

At trial, the Township of Jackson (Township) indicated that the purpose of the ordinance is to recapture the ecosystem services of trees and tree canopy, biomass production, air filtering, and oxygen production. \textit{N.J. Shorebuilders Ass'n}, 970 A.2d at 999-1000. Given that these services were relevant on a Township-wide basis, the Township argued that while on-site replacement would typically be preferable, tree replacement off-site on public properties would provide many of the same services and would be allowed. \textit{Id.} at 1005.
Despite all of the attention being given to Ecosystem function, courts have illustrated the conceptual difficulties of navigating the transition from the Environment to Ecosystem Services. The Ohio Valley controversy may suggest a judicial reluctance to open the field of environmental law to a functionality analysis. Nevertheless, it is noteworthy that the EPA has reacted to the Ohio Valley decision by deepening its commitment to an Ecosystem Services approach. Soon after the Fourth Circuit's decision in Ohio Valley, the EPA issued a broad rejection of the Corps' and the Fourth Circuit's analyses. Specifically, the EPA asserted as follows:

Headwater streams are vital components of the watershed. They provide critical ecological functions necessary for the health and productivity of downstream systems. EPA believes that additional evaluation of the 79 ECP projects is necessary to assess the effectiveness of existing mitigation plans to compensate for anticipated loss of functions associated with the proposed mining-related burial and mine through of headwater streams.

The trial court nonetheless found that a property owner's payment into a fund for off-site tree replacement does not bear a nexus to the evil sought to be avoided in the ordinance, namely, canopy loss, erosion, dust creation and lost property values on the property where trees were removed. See id. at 995. The supreme court reversed, holding that the trial court improperly narrowed the purpose of the payments, and the fund's purposes of tree plantings on public property did bear a nexus to the public's interests in the ecosystem services performed by trees. Id. Preservation and replacement of the ecosystem benefits from trees was, to the Township and supreme court, an ecosystem and community-wide benefit in that the ill effects were shared and felt beyond property boundaries. Id. Such a purpose was found to be squarely within the traditional police powers. Id. at 1002.

219. See, e.g., Hensley v. N.C. Dep't Envtl. & Nat. Res., 685 S.E. 2d 570 (N.C. 2009), rev'd on other grounds, 698 S.E.2d 41 (N.C. 2010). In some cases, courts have shown willingness to defer to agency expertise in fashioning functionality regulations. See, e.g., id. Hence, in Hensley a North Carolina regulation identified and protected the value of particular streams as "[s]uitable for natural trout propagation and maintenance of stocked trout," and the North Carolina Court of Appeals was not inclined to question the certification of the stream segment at issue as a trout water, without regard for the trout population's actual existence in the stream. Id. at 574-76 (alteration in original) (internal quotation marks omitted).

220. See Letter from Peter S. Silva, Assistant Admin., Office of Water, EPA, to Jo-Ellen Darcy, Acting Secretary of the Army (Sept. 30, 2009), available at http://water.epa.gov/lawsregs/guidance/wetlands/upload/wetland_pdf_epa_Letter_to_Army_final_ECP_09-30-09.pdf. On September 11, 2009, the EPA identified a list of pending Appalachian surface mining applications that might require additional review. Id. On September 30, 2009, the EPA delivered a letter to the Army confirming that a list of 79 pending mining applications would be subject to further review to ensure, among other things, that any compensatory mitigation measures justifying permit approval adequately offset lost aquatic functions. Id.

221. Id.
The EPA later issued a proposed determination on the Spruce No. 1 Surface Mine in Logan County, West Virginia, regarding its intention to withdraw or restrict use of certain waters in the mining operations.\textsuperscript{222} The tone in which the EPA framed its response to the Corps’ position suggests the problem as one of competency:

An understanding of the adverse impacts of the proposed project requires an understanding of the nature and importance of headwater streams and their contribution to the overall health of the watershed and to wildlife living in the watershed. Headwater streams play a significant role in the ecology of the Appalachian region. They are sources of clean, abundant water for larger streams and rivers and provide active sites for biogeochemical processes that support both aquatic and terrestrial ecosystems. The benefits of healthy headwaters are cumulative as the critical ecological functions of many small streams flowing into the same river system are necessary to maintain ecological integrity of the larger stream and river systems. Ecosystem functions performed by headwaters are lost when the headwater stream is buried or removed. These functions are lost not only to the headwater stream itself, but also to downstream ecosystems. Some of the functions of Appalachian headwater streams include interfacing with the terrestrial environment and transformation of organic matter from the surrounding landscape (such as leaf litter) into nutrients; storing and retaining nutrients, organic matter, and sediments; exporting water and nutrients downstream; and moderating flow rate and temperature.\textsuperscript{223}

The EPA specifically criticized the manner in which the Army Corps “only accounts for the physical aspects of stream condition and completely ignores the interrelationship of water chemistry and biological resources in stream functioning.”\textsuperscript{224} The EPA suggested that an unassessed compensatory mitigation ratio of one-to-one replacement would be inadequate to replace lost stream functions, an issue that the EPA noted “continue[s] to be effectively ignored.”\textsuperscript{225}

\textsuperscript{222} EPA, \textit{Proposed Determination to Prohibit, Restrict, or Deny the Specification, or the Use for Specification (including Withdrawal of Specification), of an Area as a Disposal Site; Spruce No. 1 Surface Mine, Logan County, West Virginia, ENVTL. PROTECTION AGENCY 1-2} (Mar. 26, 2010), \textit{available at} http://www.epa.gov/region3/mtntop/pdf/sprucepropdeterm.pdf.

\textsuperscript{223} \textit{Id.} at 22-23.

\textsuperscript{224} \textit{Id.} at 37.

\textsuperscript{225} \textit{Id.} at 38. On April 1, 2010, the EPA issued additional detailed guidance for improving EPA review of mining operations. Memorandum from Peter S. Silva, Assistant Admin. for Water, EPA, \textit{Detailed Guidance: Improving EPA Review of Appalachian Surface Coal Mining Operations under the Clean Water Act, National Environmental Policy Act,}
The EPA's insistence on replacement or protection of stream function—contrasted with the Corps' satisfaction to replace lost headwater streams with an exactly measured distance of beds, banks, and flowing water—illustrates the continuing divide between the Environment and Ecosystem Services. The divide exposes the question of form and function—the boundedness or the functionality of nature—in laws governing the treatment of nature. Of course, the disagreement between the EPA and the Corps may be attributed to growing pains: law is constantly adjusting to new circumstances (rights, knowledge, social practices, economic standards, and so on). However, we might also reasonably expect that this shift in our understanding of nature is problematic for property.

4. Thinking About Ecosystem Services as Incidents of Property Without Boundaries. A conflict between Ecosystem Services and Property is inevitable. Under Ecosystem Services, value is dependent on the characteristics of the ecosystem throughout the ecosystem, so it is not limited to a parcel's transformative value. More specifically, the Ecosystem Services approach recognizes that the value added of ecological goods and services may derive from services performed off-site and likewise recognizes that the functionality of ecosystems on-site will impact the value of goods and services benefitting other properties. As such, the Ecosystem Services manner of attributing value to ecosystem functionality serves as an articulation of the idea that property interests may accrue inside another's property boundaries. As abrupt as this idea may seem, the aim of Ecosystem Services is not to redistribute all property value away from the owner. Because the Ecosystem Services analysis values an untransformed and unbounded ecosystem process as an asset, the Ecosystem Services approach merely reworks the relationship between property boundaries and property value. The Ecosystem Services approach recognizes value in nature for its pre-capture characteristics and investigates not the property claims that exist when property boundaries collide but the manner in which natural processes provide something of value to properties on both sides of a boundary.

Property boundaries play a role in this calculus, such as in determining who has geographical control over (or responsibility for) areas of ecosystem contribution and hence the ability to transform ecological...

and the Environmental Justice Executive Order (April 1, 2010), available at http://www.epa.gov/owow/wetlands/guidance/pdf/appalachian_mntop_mining_detailed.pdf. This latter guidance provided for benchmark water quality triggers and indicated the EPA’s intention to further embolden the review of mining impacts and compensatory mitigation to ensure that mitigation replaces lost stream functions and not just stream flow. Id. at 23.
functions (or duty to refrain from doing so). However, modifying the role of boundaries is a necessity due to the Ecosystem Services position that for many ecosystem services, "it is not possible, necessary, or appropriate to delineate clear spatial boundaries between aquatic and related terrestrial systems. Indeed, to the extent that there is an identifiable boundary, it is often dynamic in both space and time." When an owner's interests rely on services performed on a neighboring parcel or farther upstream, the Ecosystem Services approach to property articulates an economic basis for tracing responsibility for the lost services across property boundaries.

An important question concerns the adaptability of property to an Ecosystem Services understanding of nature: does the Ecosystem Services' effort to attribute natural processes as assets translate into nature as a property right? In his extensive writings about the

226. CAVSARTE, supra note 152, at 59 (citation omitted).

227. One objection to the Ecosystem Services approach is that one of its goals, if not its main purpose, is to provide a measure of value for natural processes and goods that is comparable to values assessed in the marketplace. Under the objection, the very act of valuing ecological processes in dollars represents the failure of social norms to recognize non-anthropocentric value in nature. However, it is not clear that such an objection is particularly persuasive against the Ecosystem Services approach to valuation:

The objection may be based partly on the false presumption that quantifying dollar values for natural "assets" automatically implies that they can or should be traded in private markets. However, natural assets are, for the most part, public goods. They are often "non-rival" (one person's use does not preclude other's use) and "non-exclusive" (it is difficult or impossible to exclude people from benefiting from the services). These characteristics are the economist's classic criteria for "public" goods, and most economists would agree that using unfettered private markets to manage these assets will not maximize social welfare. Robert Costanza et al., The Value of New Jersey's Ecosystem Services and Natural Capital 3 (2006), available at http://www.state.nj.us/dep/dsr/naturalcap/nat-cap-2.pdf.

228. Often enough, to suggest that an understanding of nature is "new" is to indicate that it has not been well received or is otherwise problematic because of its divergence from existing concepts of property, law, or nature itself. As noted by J.B. Ruhl and John Nagle, there is a dearth of case law prior to 2000 enforcing a freedom from nuisance right involving ecosystem services. John Copeland Nagle, From Swamp Drainage to Wetlands Regulation to Ecological Nuisances to Environmental Ethics, 58 CASE W. RES. L. REV. 787, 798-99 (2007-2008); J.B. Ruhl, Making Nuisance Ecological, 58 CASE W. RES. L. REV. 753, 756 (2008). However, to say there are few to no cases applying common law causes to produce ecosystem services values is not to say that law has failed to implement the underlying understanding of nature proposed in the ecosystem services approach. Many of the searches for common law expressions of ecosystem services, however, have been troubled. See, e.g., Robert W. Adler, The Law at the Water's Edge: Limits to "Ownership" of Aquatic Ecosystems, in WET GROWTH: SHOULD WATER LAW CONTROL LAND USE?, supra note 6, at 201, 206 (examining the potential of the federal navigation servitude, the public trust doctrine, and "nonownership doctrine" to bridge the gap between property and functionality).
capacity of the common law to account for Ecosystem Services, J.B. Ruhl suggests that common law nuisance can accommodate property rights and remedies because nuisance is flexible enough to account for changing social norms and needs. This approach is consistent with the reflection in this Article on the role of boundaries to property. Nuisance is fluid, a foundation that is especially helpful for Ecosystem Services, which remains an emerging scientific paradigm: nuisance recognizes that property rights hinge on growing and emerging bodies of information that affect our perception of what constitutes harm, what causes harm, and what values should be reflected in remedies to particular harms. In addition, the nuisance approach to a legal construction for Ecosystem Services will take into account location, land-use needs for the area, and the existing and compatible surrounding uses, all of which provide context for the appropriateness of a particular land-use choice. Nuisance, which offers an effective framework for thinking about property without boundaries, allows law to conceptualize the demands that Ecosystem Services makes of property.

Of course, it is completely predictable that few cases to date have expressly addressed the loss of ecosystem services as an impairment of property rights, as property has not historically borne the weight of ecosystem services as a property value. On the other hand, this is not to say that courts have been unwilling to connect ecosystem services with property interests: property and nature are codependent, so even the property regime could not avoid recognizing ecosystem processes. Take, for instance, the Supreme Court’s express finding in the 1900 case of Leovy v. United States that the function of wetlands to the ecosystem and to other property interests required protection against the

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229. See Ruhl, supra note 228, at 753-56. J.B. Ruhl inquires as to whether the common law is suitably equipped to offer plaintiffs a cause of action against another property owner for deprivation of or interference with ecosystem services. Id. at 761. Ruhl argues from a framework of Lucas v. South Carolina Coastal Council, 505 U.S. 1003 (1992), and while he suggests an intent to formulate an ecosystem services analysis into the “background principles” of property, to the extent that such is his project, it certainly seems to be the right direction. See id. at 761-77.

230. See, e.g., Carol M. Rose, Property as the Keystone Right?, 71 NOTRE DAME L. REV. 329, 351 (1996) (suggesting a vision of property that is “more fluid and less fenced-in,” which would illustrate “more of the qualities of flexibility, reasonableness and moderation, attentiveness to others, and cooperative solutions to common problems”).

231. Thus, Ruhl’s hesitancy is admittedly due to a lack of case law awarding nuisance remedies in matters involving impacts to ecosystem services. See Ruhl, supra note 228. He concludes that we may be in need of a new category of nuisance claim—an ecosystem services nuisance. Id. at 762.

232. 177 U.S. 621 (1900).
owners' actions (or inaction) relative to those ecosystem services. In Leovy the Court established a need to eliminate particular ecosystem characteristics and as such may be cast as an anti-environmental decision, but its relevance here is undeniable: nuisance law has long recognized the relevance of ecosystem services to property, and the public need for such services has correspondingly acted as a limitation on private property rights. Moreover, in the century since Leovy, we have come to a different understanding of wetlands, one that still affects public needs and that illustrates the importance of Ruhl's insistence that nuisance is adaptable to an Ecosystem Services understanding of nature. Robin Kundis Craig has confirmed this transition in her observations about wetlands jurisdiction since Rapanos v. United States, noting in her analysis of United States v. Cundiff that Justice Kennedy's "significant nexus analysis made clear that the Cundiffs' wetlands are performing human waste treatment services, for wastes that are presumably ( . . . the court gives no background) not of the Cundiffs' own making but that could severely impair downstream aquatic ecosystem function."

Having come to this point, it is also worthwhile to mention that nuisance is not the only property doctrine that can accommodate the Ecosystem Services understanding of nature. When we couple nuisance with other property incidents that are specifically designed to navigate and accommodate competing interests in resources, we get a deeper picture of how property can value land, air, and water for the services they provide. Albeit in a piecemeal fashion, property has laid some groundwork principles that support an assertion that when property focuses on ecological function, the legal status of boundaries may be understood as subservient to property expectations grounded in Ecosystem Services.

For instance, riparian rights suggest that law may be able to prioritize water uses that have a lesser impact on ecosystem function. Water allocation in the eastern states was intended to resolve competing opportunities to the use of water abutting riparian lands when use was effectively limited by the rule that no person is entitled to deprive others

233. Id. at 636.
234. See id.
235. See Ruhl, supra note 228, at 762.
of an opportunity to use. Under the "reasonable use" approach to riparian rights allocation, riparian owners are entitled to the full use of the watercourse for beneficial purposes, so long as such use does not unreasonably interfere with the opportunities of others to engage water in beneficial uses on their properties. Under this scheme, reasonableness is a question for adjudication: an actor's use of water is not subject to bare capture, and instead courts balance context, use, and need. More importantly, courts have recognized that the benefits of riparian ownership, and the uses to which riparian rights might be put, may depend upon the character and functions of the particular waterbody. Hence, in *Taylor v. Tampa Coal Co.*, plaintiff riparian owners claimed interference with their use of lake waters "exclusively for recreational purposes—picnicking, bathing, boating and fishing—for its officers and employees and their families." The trial court ordered injunctive relief against a competing user of lake water for irrigation of the user's citrus fields. The court recognized that under the doctrine of riparian rights, "each riparian owner has the right to use the water in the lake for all lawful purposes, so long as his use of the water is not detrimental to the rights of other riparian owners." Furthermore, it is immaterial what use is made of the property, if the use be lawful, for there may be certain special rights peculiar to each shore owner according to the nature of his possession and the character and value

239. See Borough of Westville v. Whitney Home Builders, 122 A.2d 233, 239 (N.J. 1956). In general, riparian rights states are divided into one or the other of two particular adaptations: the "natural flow" theory and the "reasonable use" doctrine. *Id.* at 240. Under the natural flow theory, riparian owners were entitled to receive the natural flow of water in both quantity and quality. *Id.* at 240.

240. *Id.* at 240.

241. Holsman v. Boiling Spring Bleaching Co., 14 N.J. Eq. 335, 342 (1862) ("Every owner of land through which a stream of water flows is entitled to the use and enjoyment of the water, and to have the same flow in its natural and accustomed course, without obstruction, diversion, or corruption. The right extends to the quality as well as to the quantity of the water.").

242. See Armstrong v. Francis Corp., 120 A.2d 4, 10 (N.J. 1956) ("Social progress and the common wellbeing are in actuality better served by a just and right balancing of the competing interests according to the general principles of fairness and common sense . . .").

243. 46 So. 2d 392 (Fla. 1950).

244. *Id.* at 392-93.

245. *Id.* at 393-94.

246. *Id.* at 394; see also Okaw Drainage Dist. of Champaign & Douglas Cnty., Ill. v. Nat'l Distillers & Chem. Corp., 882 F.2d 1241, 1246 (7th Cir. 1989) ("[E]ach riparian owner is entitled to make a reasonable use of the river, with what is 'reasonable' depending on the balance between his own needs and those of the other riparian owners.").
of his improvements. The fact that one riparian owner may choose to use the water in the lake for recreational purposes while another may desire to divert it for an artificial use such as irrigation, will not give the latter a superior right to take water to the detriment of the former, for in this jurisdiction there is no distinction in respect to use between a farm and a summer residence. The use of lands bordering on, and the waters of, such a lake, for the purpose of pleasure, recreation and health constitutes such a use of the lake as to command a remedy for an unlawful interference with its natural condition.  

The injunction was affirmed because under the circumstances, the claimant’s use required instream water, and the instream water uses would be impaired by the diversion. In this case, a riparian rights analysis resulted in a priority for nonconsumptive water uses based on the circumstances and need for the resource: the lake was too small “to allow water to be pumped therefrom for irrigating purposes without consequent damage to other riparian owners.”

A second illustration of accommodation between Ecosystem Services and property relates property rights to natural conditions in geologic support. Legal protection of a property’s lateral support offers an incident of a property right that preserves the ability of owners to maximize property expectations; lateral support protects the owner’s geological expectations and conditions of the land. The rights conferred as lateral support, however, appear to bear an inverse correlation to the boundedness of land exhibited in the Property scheme. In Williams v. Southern Railway Co., the defendant excavated its property alongside the plaintiff’s parcel, ultimately resulting in subsidence and injury to the plaintiff. The Tennessee Court of Appeals found liability on the principle that every owner of land has the right to naturally necessary lateral support from the adjoining soil, and if a landowner removes the soil from his own land so near the land of his neighbor that his neighbor’s soil will crumble away under its own weight, he is liable for damages naturally resulting therefrom, including damage to structures on the subsiding land, without the necessity of showing negligence.

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247. Taylor, 46 So. 2d at 394.
248. Id.
249. Id.
251. 396 S.W.2d 98 (1965).
252. Id. at 99.
253. Id. at 99-100.
Under this rule, any excavation that causes adjoining, unimproved land to collapse will subject the excavator to strict liability, representing the common law view that a property owner is absolutely entitled to lateral support from the adjoining land.\footnote{254} Proof of negligence in the excavation is not required.\footnote{255} Accordingly, the doctrine imposes liability on one's neighbors for transformative improvements; thus, the doctrine favors leaving land in its natural state and vests owners with the right to receive geologic support services.\footnote{256}

A third area of property that provides some insights for an Ecosystem Services-based property scheme relates to property rights in airspace. Rights to airspace, which were historically governed by \textit{ad coelum} and the need to protect owners from permanent airspace intrusions,\footnote{257} were dramatically altered by the invention of human flight. With the commercialization of air travel, courts adopted a pragmatic approach to airspace rights, finding that \textit{ad coelum} did not support exclusive boundaries into the heavens; the doctrine protected property into (and only up to) space that the owner had a reasonable expectation of use and occupancy.\footnote{258} The demise of a strict, boundary-based approach to \textit{ad coelum} opened airspace for an inquiry into other uses for airspace—such as for the passage of light and air. Courts have since recognized that property interests can compete with an underlying owner's interests in neighboring airspace. Hence, in \textit{Echevarrieta v. City of Rancho Palos}

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\item \footnote{254} See \textit{Restatement (Second) of Torts} § 817 cmt. b.
\item \footnote{255} \textit{Id.}
\item \footnote{256} What is interesting about lateral support rights is the manner in which they favor land uses that leave nature to perform its services: overtaxing the land's natural support operates as a waiver of the absolute right. Sime v. Jensen, 7 N.W.2d 325, 327 (Minn. 1942); see also \textit{Restatement (Second) of Torts} § 817 cmt. c (stating that naturally necessary support "does not include the support needed because of the presence of artificial additions to . . . the surrounding land"). Of course, the improving owner is not deprived of all rights. Instead, by making alterations to the natural surface or subsurface of land, the claimant's rights are determined by whether the neighbor's removal of support was done in a reasonable fashion and whether the claimant's own activities were the cause of the lateral weakness. See 8-69 \textit{Thompson on Real Property, Thomas Editions} § 69.04(b)(2)(iii) (West 2010). The emphasis remains on the owner's entitlement to enjoy the benefits of natural geological support.
\item \footnote{257} John G. Sprankling, \textit{Owning the Center of the Earth}, 55 UCLA L. REV. 979, 980-81 (2008) (stating that ownership above and below the land's surface derives from the canon "\textit{cujus est solum, ejus est usque ad coelum et ad inferos, . . . meaning that the rights of the surface owner extend upward to the heavens (\textit{ad coelum}) and downward to the center of the earth (\textit{ad inferos})"."
\item \footnote{258} Swetland v. Curtiss Airports Corp., 55 F.2d 201, 202-03 (6th Cir. 1932); see also Smith v. New England Aircraft Co., 170 N.E. 385, 388-90 (Mass. 1930).
\end{itemize}
Verdes, the City of Rancho Palos Verdes's view-protection ordinance was upheld against constitutional challenges that the ordinance invaded property. The ordinance established foliage height limitations, prohibited property owners from allowing vegetation to impair particular views, and allowed an injured neighbor to apply for a "view restoration permit" to compel the offending owner to trim trees to an extent necessary to protect the view. The court of appeals in Echevarrieta dismissed the takings claim on grounds that the ordinance's protection of viewshe...
ultimately approved, and what has largely led the body of law governing land use control ever since, is the authority to control the character of private land uses to avoid impairing the natural and built infrastructure services so that the benefits of such services could be captured on a broad scale. These principles can be applied through Ecosystem Services: property values may be significantly influenced by the ecosystem’s capacity to accommodate the owner’s intended uses (when such uses might otherwise cause off-site impacts from septic, agricultural, or stormwater discharges) and provide needed services for the intended uses (when particular uses might depend on productive water and soil for food production or geological stability for structure support).

As law becomes more settled in recognizing the rights and injuries to property that account for ecosystem goods and services, we should not be surprised at the resulting irrelevancy of property boundaries to the character of property rights. In evaluating a takings claim (or other compensable loss of property value), for instance, the Ecosystem Services approach will require a more searching analysis of the ground, and not just the market, to determine whether the owner is injured and to what extent the injury might be to a right in property. This adaptation is making an entrance into the courts as well. As J.B. Ruhl noted in his examination of Palazzolo v. Rhode Island, the finding of ecological nuisance has immense and devastating implications for Lucas claimants who propose developments that transform ecosystems. On remand in Palazzolo, the Rhode Island Superior Court disparaged the plaintiff’s judgment of lost property value from the regulation specifically because the plaintiff’s appraiser failed to account for the “diminished amenity value” that would result from filling in the salt marsh. As the superior court noted, “Common sense as well as the evidence adduced at trial necessarily leads to the conclusion that Plaintiff would benefit from an ‘average reciprocity of advantage’ as a result of limited development of the parcel in question.” Regulated property owners will have a

268. Although there are differences between the schemes, it is certainly plausible to think that the Ecosystem Services approach merely implements a more sophisticated understanding of the environment in calculating reciprocity. Under Ecosystem Services, the value-added component of situatedness depends less on distance to public infrastructure—roads, sewer, schools, and so forth—than the property’s location relative to available ecosystem goods and services provided by the functional regional ecosystem.


272. Id. (footnote omitted).
more difficult and complex burden to show the causal relationship between land-use regulations—ones that protect ecosystem services—and lost property values.

Another revealing example has been offered by the New York courts, in which the New York Court of Appeals held that the regulation of ecosystem services will often stay clear of property rights that accrue under this scheme. In Smith v. Town of Mendon,\textsuperscript{273} the Town of Mendon (Town) defended development restrictions arising from regulations implementing certain environmental protection overlay districts (EPODs) in the zoning code.\textsuperscript{274} The overlay districts were intended to control adverse impacts on the environment from development, ensuring resident safety, improving water quality, preventing the loss of natural resources, and preserving wildlife habitats.\textsuperscript{275} Several of the overlays that applied to the plaintiff’s property pertained to the presence of steep slopes, floodplains, wooded areas, and a watercourse. The EPODs regulated construction, vegetation clearing, excavation, grading, and stormwater discharges within the district and subjected the application to performance standards. The plaintiffs were required to show the absence of reasonable alternatives and that the development would not impair the environmental values at issue.\textsuperscript{276}

The Smiths did not intend to build in any of the EPODs, and as such, the Town Planning Board found that the proposed site plan would not impair the sensitive environments on the property so long as the sensitive environment remained undisturbed. Nevertheless, to secure the protection of the sensitive areas, the Town required the Smiths to file a conservation restriction on areas covered by the EPODs.\textsuperscript{277} The court questioned the Smiths’ claimed injury, stating that it was uncertain whether “the conservation restriction would have any effect whatsoever on the market value of the . . . property.”\textsuperscript{278} More importantly, the court rejected the Smiths’ exaction claim, noting that both

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\item[273.] 822 N.E.2d 1214 (N.Y. Ct. App. 2004).
\item[274.] Id. at 1215-16. The Town adopted eleven such districts, including the following: wetlands, steep slope, watercourse, scenic corridors, historic and archeological site, waste disposal site, woodlot, flood damage prevention, soils susceptible to ponding, geological feature, and wildlife corridors and habitat. TOWN OF MENDON, N.Y., CODE §§ 200-21 to 200-32 (2008), available at http://www.ecode360.com/?custId=ME0067.
\item[275.] TOWN OF MENDON, N.Y., CODE § 200-21(A).
\item[276.] Smith, 822 N.E.2d at 1215-16.
\item[277.] Id. The proposed restrictions incorporated the performance standards and use restrictions contained in the zoning code, but they also provided for reasonable Town access to the property, restricted the property in perpetuity, and allowed greater enforcement powers than the Town enjoyed under the zoning code. Id. at 1216.
\item[278.] Id. at 1221.
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Dolan v. City of Tigard\textsuperscript{279} and Nollan v. California Coastal Commission\textsuperscript{280} involved conditions that required the conveyance of the right to exclude others, which is "the most important 'stick' in the proverbial bundle of property rights."\textsuperscript{281} In contrast, the injury alleged by the Smiths merely involved the impacts of foreclosing possible future development in ways that would impair functions of the sensitive environments.\textsuperscript{282} The Smiths retained the rights to possess and exclude others, and as such, the condition exacted from the Smiths "may be among the more modest and fragile twigs in the bundle of property rights, if it is a property right at all."\textsuperscript{283} Here, the court rejected the notion that a conveyance of property interests to preserve ecosystem characteristics could constitute an invasion of property.\textsuperscript{284}

V. CONCLUSION

The relationship between our understanding of nature and how we allocate rights to property is a necessary one. By looking at the ways Ecosystem Services diverges from other descriptions of nature, this Article has explored how property may react and adapt to the values embodied in this emerging story. Ecosystem Services casts the character of nature as ecosystem functionality, the value of nature as economic value of goods and services, and the use of nature's goods and services as a benefit to human well-being. Ecosystem Services, which poses ecosystem functionality as an asset, provides an articulation of property value's dependence on ecosystem influences. As such, challenges to Ecosystem Services will invariably arise where the influence arises on another's property. If the relationship between functionality and economic value proposed in Ecosystem Services is sound, property will conceive of this asset by finding property interests in others' property. This is property without boundaries, in which boundaries become less relevant not just for the process of identifying nature, but also for identifying property interests.

An Ecosystem Services analysis contextualizes the boundedness of nature and largely leaves the property owner with benefits and liabilities that stem from the ground (such as location, ecosystem function, air, water, and grade) but accrue to individual owners (and the public welfare) in an average and reciprocal fashion. Ecosystem Services

\textsuperscript{279} 512 U.S. 374 (1994).
\textsuperscript{280} 483 U.S. 825 (1987).
\textsuperscript{281} Smith, 822 N.E.2d at 1219 (citing Dolan, 512 U.S. 374, and Nollan, 483 U.S. 825).
\textsuperscript{282} See id.
\textsuperscript{283} Id. at 1220.
\textsuperscript{284} See id.
reflects the reasoning behind the average reciprocity justification but
does so by specifying benefits and burdens that hinge upon the
complexity and interrelatedness of the various services at issue. Because
the intent of an Ecosystem Services regulatory scheme is to recognize
these burdens and benefits in conjunction with the whole of the
ecosystem, and not as individual and piecemealed values, an Ecosystem
Services analysis will emphasize that property value is relative to the
ecosystem.

Property has already begun to adapt to the Ecosystem Services scheme
by adjusting to reflect the manner that interests in natural processes
circumvent boundaries. There have been (and will be) challenges, of
course, as law struggles to understand the character of nature to which
property makes a claim. However, the idea that the law must grasp is
that under Ecosystem Services, nature is not placed in competition with
property. Nature is not a property defect; it is a property condition that
is conceptually unseverable from property and incapable of being
ignored.