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## Muddle or Muddle Through? Taking Jurisprudence Meets the Endangered Species Act

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MUDDLE OR MUDDLE THROUGH?  
TAKINGS JURISPRUDENCE MEETS THE  
ENDANGERED SPECIES ACT

MARK SAGOFF\*

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"When landowners find an endangered animal on their property, Chuck Cushman says, the best solution under current law is to 'shoot, shovel and shut up'."<sup>1</sup> So the *Arizona Republic* newspaper reported the response of one landowner to the decision of the Supreme Court in *Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon*.<sup>2</sup> At issue in *Sweet Home* was section 9 of the Endangered Species Act (ESA), which makes it a crime to "take" an endangered or threatened species.<sup>3</sup> The ESA defines "take" as "to harass, harm, pursue, hunt, shoot, wound,

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1. Martin van der Werf, *Endangered Species Act 'Gotta Be Fixed,' Foe Says*, ARIZ. REPUBLIC, July 1, 1995, at B1.

2. 115 S. Ct. 2407 (1995).

3. See 16 U.S.C. § 1538(a) (1994); *Sweet Home*, 115 S. Ct. at 2407.

kill, trap, capture, or collect.”<sup>4</sup> Interior Department regulations extended the definition of “harm” to include “significant habitat modification or degradation [that] actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering.”<sup>5</sup> In *Sweet Home*, the Supreme Court by a six to three majority upheld this extension of the meaning of “harm” in section 9 of the ESA.<sup>6</sup>

Cushman, executive director of the American Land Rights Association, based in Battle Ground, Washington, identified civil disobedience as a rational response to the Court’s decision. He explained, “[a] private-property owner is thinking to himself, ‘I find a spotted owl on my property, I’m going to lose everything I’ve worked for all my life.’”<sup>7</sup> A property owner may find immediate recourse in shooting and burying the bird before federal agents discover it.<sup>8</sup> A more general political remedy, Cushman observed, must be sought from Congress.<sup>9</sup> “I think you’re going to see an eruption in Congress. It’s obvious to everyone now that the Endangered Species Act is broke [sic] and it’s gotta be fixed.”<sup>10</sup>

Newspaper editorials condemned the *Sweet Home* decision as a confiscation of property rights. “The U.S. Supreme Court in a 6-3 decision yesterday trampled property rights in granting federal regulators broad control of private land to protect endangered species,” declared the *Detroit News*.<sup>11</sup> “No worse environmental decision has come from the high court in two decades. The harm can only be undone by Congress, which must overhaul the Endangered Species Act.”<sup>12</sup>

In a syndicated editorial, James J. Kilpatrick wrote that the small landowners who brought suit in *Sweet Home* rely on logging for their livelihoods, which is the only economically viable

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4. 16 U.S.C. § 1532(19).

5. 50 C.F.R. § 17.3 (1994).

6. See *Sweet Home*, 115 S. Ct. at 2418.

7. van der Werf, *supra* note 1, at B1.

8. See *id.*

9. See *id.*

10. *Id.*

11. Editorial, *Endangered Property Rights*, DETROIT NEWS, June 30, 1995, at A8.

12. *Id.*

way that they can use their land.<sup>13</sup> “Now comes the government saying that timber may not be cut in forests supporting the owl and the woodpecker—not if the cutting involves significant habitat modification that actually kills or injures wildlife . . . .”<sup>14</sup> Even if most Americans wish to prevent the extinction of species like the red cockaded woodpecker or the spotted owl, “that does not establish that the Oregon landowners alone can be compelled to pay for their preservation.”<sup>15</sup> On the contrary, as Kilpatrick reminded his readers, “private property may not be ‘taken’ by the government without payment of just compensation” under the Fifth Amendment.<sup>16</sup>

This Article examines the question of whether the government should compensate landowners when it requires them to maintain their property as a habitat for an endangered species, thus preventing them from developing it profitably. The Article is organized as follows: Part I introduces two contending positions—first, the libertarian position that would require compensation for all regulatory takings not preventing a nuisance or harm cognizable at common law and, second, the position of environmentalists who believe that the loss of species does constitute such a nuisance or harm because it undermines the functioning of ecosystems beneficial to human beings.

The introductory section also states this Article’s thesis, namely, that the Court is correct in sticking to an ad hoc or per se jurisprudence that avoids both of these theoretical extremes. Rather than erect into law either ideology, the courts wisely have deferred to the political process, which provides a suitable arena in which landowners and environmentalists may butt heads until they learn that they may gain more by working with than by fighting against each other.

Part II of this Article reviews the enforcement of the ESA and asks in the wake of *Sweet Home* how much of a federal land-grab one may expect. Landowners worry that the Fish and Wildlife Service (FWS) will bankrupt American farmers, loggers, and

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13. See James J. Kilpatrick, *Takings Clause Takes Beating in This Ruling*, BUFF. NEWS, July 22, 1995, at 3C.

14. *Id.*

15. *Id.*

16. *Id.*

other small landowners to coddle minor varieties of gophers, beetles, and squirrels. This Article argues that these landowners, when politically organized, have little to fear from the government. As far as one can assess the balance of economic and political power, it lies with the landowners and not with the federal agencies.

The Article then inquires in Part III why the penchant to theorize in the area of property rights seems overwhelming in spite of the apparent lack of any relationship between this theorizing and the practice of courts and agencies. Here, the Article compares the spate of theorizing about the doctrine of legal standing with the explosion of theory about takings in view of the irrelevance of both kinds of speculation to the decisions courts in fact make. The Article also notes that Supreme Court decisions affecting property rights, from *Pennsylvania Coal Co. v. Mahon*<sup>17</sup> to *Sweet Home*, act as only one factor among many in determining land use. In fact, these judicial decisions often make little difference in what actually happens, as it were, on the ground.

Part IV of the Article examines a particular theory of environmental regulation that stretches from Aldo Leopold's "Land Ethic"<sup>18</sup> to more contemporary conceptions of the ecological connectedness of the land community.<sup>19</sup> On the basis of this general ecological approach, environmentalists argue that the extinction of species so threatens the stability or integrity of ecosystems that regulations requiring landowners to maintain habitat prevent a nuisance or public harm. The Article then proposes that although this theory confronts insuperable conceptual and empirical difficulties—indeed, it offers hardly more than a secularized version of "Great Chain of Being" cosmology<sup>20</sup>—it

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17. 260 U.S. 393 (1922).

18. See ALDO LEOPOLD, *A SAND COUNTY ALMANAC AND SKETCHES HERE AND THERE* (1949) (entitling one chapter *The Land Ethic*); *infra* notes 235-51 and accompanying text.

19. For a discussion of contemporary "disequilibrium" theories, see William H. Rodgers, Jr., *Adaptation of Environmental Law to the Ecologists' Discovery of Disequilibria*, 69 CHI.-KENT L. REV. 887, 888 (1994) (doubting that any predictive principles exist in ecology that offer "durable answers that are worthy of our reliance").

20. See *infra* text accompanying notes 551-59.

remains enormously popular. In spite of overwhelming evidence otherwise, most Americans believe that nature exemplifies a chain, pyramid, or other intelligible design.<sup>21</sup>

Ecologists in their scientific endeavors largely have abandoned the idea that an order exists in nature—a balance, harmony, homeostasis, integrity, or whatever—in which each species plays a role.<sup>22</sup> Yet the temptation to ascribe a purpose, order, or design to nature remains strong in spite of all the Darwinian objections against doing so.<sup>23</sup> Ecologists themselves are loathe to let go of the notion that Nature has a nature.<sup>24</sup> As ecologists throw teleology out the front door, they smuggle it in by the back.<sup>25</sup>

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21. See WILLETT KEMPTON ET AL., ENVIRONMENTAL VALUES IN AMERICAN CULTURE 49 (1995) (finding, for example, that Americans from all walks of life agree in large majorities with statements such as this: "Nature has complex interdependencies. Any human meddling will cause a chain reaction with unanticipated effects").

22. For a description of this history, see Fred P. Bosselman & A. Dan Tarlock, *The Influence of Ecological Science on American Law: An Introduction*, 69 CHI.-KENT L. REV. 847, 848 (1994) (tracing "the development of Eugene Odum's theory of the ecosystem as a mechanical system tending toward harmony and order, its adoption as the scientific basis for modern environmental law, and its subsequent replacement by a chaos theory driven, non-equilibrium paradigm").

23. See Gregory D. Fullem, Comment, *The Precautionary Principle: Environmental Protection in the Face of Scientific Uncertainty*, 31 WILLAMETTE L. REV. 495, 519 (1995) (referring to "the recent rejection by ecologists of the notion of a 'balance of nature' in favor of the new notion of the nonequilibrium paradigm"); cf. Judy L. Meyer, *The Dance of Nature: New Concepts in Ecology*, 69 CHI.-KENT L. REV. 875, 875-83 (1994) (discussing the ecological concept that ecosystems are not necessarily in equilibrium). For an example and analysis of the ambivalence that ecologists experience in abandoning concepts of equilibrium, see generally STUART L. PIMM, *THE BALANCE OF NATURE?* (1991).

24. The old view, presupposing an equilibrium in nature, considered every species to serve some purpose in maintaining the stability of the overall structure. See Bosselman & Tarlock, *supra* note 22, at 848 (1994) (describing "Eugene Odum's theory of the ecosystem as a mechanical system tending toward harmony and order"). Apparently, the newer views do not forsake this commitment to protecting biodiversity. "Stripped to its essentials, the proposed 'new ecological paradigm' means that biodiversity preservation should be elevated above other considerations in managing natural resources." Robert B. Keiter, *Conservation Biology and the Law: Assessing the Challenges Ahead*, 69 CHI.-KENT L. REV. 911, 912 (1994) (citing Reed F. Noss, *Some Principles of Conservation Biology, As They Apply to Environmental Law*, 69 CHI.-KENT L. REV. 893, 894 (1994)).

25. For an historical analysis of the difficulties ecology has encountered trying to rid itself of the "happy state of order" paradigm, see DONALD WORSTER, *THE WEALTH OF NATURE: ENVIRONMENTAL HISTORY AND THE ECOLOGICAL IMAGINATION*

This Article continues in Part V to describe the relevance of the ecosystem concept to takings jurisprudence in view of the widely accepted "non-equilibrium" approach ecologists now apply to biological communities. This section of the Article questions whether ecology as a theoretical science offers credible grounds for believing that changes human beings make to nature tend to upset ecological structures or functions important to our economy.

The Article concludes in Part VI by acknowledging that Americans are broadly sympathetic both to the importance of property rights and to the claims of an environmental or ecological ethic. The former commitment may be traced to the Enlightenment faith that property rights ground material progress and that greater material prosperity is the portal to social happiness. At the same time, Americans share an ecological commitment to the unity of all things, all creatures great and small, under God. We may owe this view in part to a variety of creation myths, such as the stories of Genesis and Noah, along with strong cultural currents of neoplatonic pantheism and transcendentalism.

Where two such fundamentally different theologies, one anti-nomian, the other pantheistic, confront each other, what is the Court to do? Dither. Mumble. Muddle through. Equivocate. Keep everyone guessing. It should be no surprise, indeed, it should be a relief, that the Court has taken refuge in an ad hoc, per se jurisprudence.

## I. INTRODUCTION

Several academic experts have joined editorial writers in speculating that section 9 of the ESA might trigger the Takings Clause of the Fifth Amendment.<sup>26</sup> They point out that the ESA does not raise the question of whether protecting species is a

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156, 160 (1993).

26. See Robert Meltz, *Where the Wild Things Are: The Endangered Species Act and Private Property*, 24 ENVTL. L. 369 (1994); Susan Shaheen, Comment, *The Endangered Species Act: Inadequate Species Protection in the Wake of the Destruction of Private Property Rights*, 55 OHIO ST. L.J. 453 (1994). The Takings Clause states that "private property [shall not] be taken for public use, without just compensation." U.S. CONST. amend. V.



good idea—of course it is—but rather the question who should pay for protecting them. If the public wishes to preserve the habitat of a warbler, lousewort, or toad, that is well and good, these commentators say, but then the public should purchase the necessary land, acquiring it in the open market or by eminent domain.<sup>27</sup> These critics applaud section 5 of the ESA, which authorizes the government to buy critical habitat.<sup>28</sup> These same critics oppose the idea that the government may require private landowners to dedicate their property gratis to the purpose of maintaining habitat, however laudable, when they would rather develop their land for profitable use.

For their part, environmentalists often reply that by compelling landowners to maintain habitat for endangered species, the ESA prevents a public harm or nuisance.<sup>29</sup> In a recent article, Professor Oliver Houck, for example, argued that endangered species are “indicators of the health of the ecosystems that they inhabit.”<sup>30</sup> Houck believes “that the protection of these species should trump private property rights in the same way that other indicators of pollution do: No one, no matter what one owns, has the right to go too far.”<sup>31</sup>

According to this view, a property owner who causes the extinction of a species by converting its habitat harms his or her neighbor or the public as a whole. Restrictions on habitat conversion imposed under the ESA, like regulations that control pollution,

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27. See Ike C. Sugg, *Caught in the Act: Evaluating the Endangered Species Act, Its Effects on Man and Prospects for Reform*, 24 CUMB. L. REV. 1 (1993-1994); Shaheen, *supra* note 26.

28. See, e.g., Meltz, *supra* note 26, at 401-02; see also 16 U.S.C. § 1534 (1994) (authorizing the government to acquire land in order to protect endangered or threatened species).

29. See, e.g., David B. Hunter, *An Ecological Perspective on Property: A Call for Judicial Protection of the Public's Interest in Environmentally Critical Resources*, 12 HARV. ENVTL. L. REV. 311, 323-24 (1988). The principle behind the nuisance exemption, as Professor Frank Michelman has formulated it “is that compensation is required when the public helps itself to good at private expense, but not when the public simply requires one of its members to stop making a nuisance of himself.” Frank I. Michelman, *Property, Utility, and Fairness: Comments on the Ethical Foundations of “Just Compensation” Law*, 80 HARV. L. REV. 1165, 1196 (1967).

30. Oliver A. Houck, *Why Do We Protect Endangered Species, and What Does That Say About Whether Restrictions on Private Property To Protect Them Constitute “Takings”?*, 80 IOWA L. REV. 297, 302 (1995).

31. *Id.*

therefore, would fall under the nuisance exception to the Takings Clause of the Fifth Amendment. Accordingly, the government need not compensate landowners even when ESA section 9 restrictions deprive them of all economic use of their land.<sup>32</sup>

### A. *Two Sides to a Controversy*

This Article evaluates the arguments made on both sides of this controversy. The Article inquires whether a conception of nuisance or harm may justify the government's refusal to compensate landowners affected by regulations under section 9 of the ESA. As will be shown, the debate over compensation engages two fundamental, and fundamentally opposed, conceptions of property rights. The first conception, which describes property rights as natural rights, has been brilliantly, clearly, and elegantly presented by many authors, among whom Professor Richard Epstein is the most celebrated.<sup>33</sup> In his words, "If the rules are in accordance with the law of nature, then the rights acquired in property are 'bottom up' rights derived from individual acts of acquisition, not 'top down' rights derived from the largesse of the state."<sup>34</sup>

According to Epstein's view, which finds an historical authority in the political theory of John Locke,<sup>35</sup> private action creates private property rights, that is, individuals either produce objects or acquire them from the natural commons.<sup>36</sup> Once property rights are thus defined by private production or acquisition, the role of the state is to protect them, for example, by enforcing conditions under which those rights may be trans-

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32. See *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1029 (1992) (stating that "regulations that prohibit all economically beneficial use of land . . . must inhere . . . in the restrictions that background principles of the State's law of property and nuisance already place upon land ownership").

33. See, e.g., Richard A. Epstein, *Takings: Of Private Property and Common*, AM. ENTERPRISE INST., Mar. 7, 1996, at 1-25 (on file with author).

34. *Id.* at 4.

35. See JOHN LOCKE, *TWO TREATISES OF GOVERNMENT* 129-41 (J.M. Dent & Sons, Ltd. 1924) (1690).

36. See RICHARD A. EPSTEIN, *TAKINGS: PRIVATE PROPERTY AND THE POWER OF EMINENT DOMAIN* 10-11 (1985).

ferred consensually.<sup>37</sup> If the government takes or restricts one person's property rights for any reason other than to protect the rights of another, it must pay just compensation for that taking.<sup>38</sup> In other words, the government is bound by the same rules of acquisition and transfer that bind private landowners, except that the government, by exercising eminent domain, can purchase land that the owner may not wish to sell.

A softened and more flexible version of this insistence on the primacy of property rights in land is found in the tradition of legal analysis that descends from the utilitarian philosopher Jeremy Bentham to the writings and opinions of Justice Scalia.<sup>39</sup> This tradition differs from that of natural law by conceding that private property rights, far from preexisting society, are artificial creations of it.<sup>40</sup> This is not to say that property rights are arbitrary. On the contrary, they are central to the established customs and expectations that allow society to function.<sup>41</sup> From the point of view of a strict utilitarian or felicific

37. See *id.* at 334 ("The strength of a natural law theory is in its insistence that individual rights (and their correlative obligations) exist independent of agreement and prior to the formation of the state.").

38. See *id.* at 332.

39. See, e.g., Antonin Scalia, *Morality, Pragmatism and the Legal Order*, 9 HARV. J.L. & PUB. POL'Y 123, 124 (1986) (dismissing libertarian principles to argue that "practical utility is what we are really discussing here"). Fred Bosselman wrote that:

A student of early Scalia articles would recognize land as one of those "well-defined and fully developed 'existential' categories of legal activity" that are recognized by lawyers and judges, though not always by scholars, as a category of "factually similar precedent" whose "consistency among themselves" is more important than "their reconcilability with the mass of decisions involving the general principle."

Fred Bosselman, *Four Land Ethics: Order, Reform, Responsibility, Opportunity*, 24 ENVTL. L. 1439, 1493 n.238 (1994) (quoting Antonin Scalia, *Sovereign Immunity and Nonstatutory Review of Federal Administrative Action, Some Conclusions from the Public-Lands Cases*, 68 MICH. L. REV. 867, 882, 919, 920 (1970)).

40. See JEREMY BENTHAM, *THEORY OF LEGISLATION* 117-22 (C.K. Ogden ed., Richard Hildreth trans., 1987) ("Property is nothing but a basis of expectation; the expectation of deriving certain advantages from a thing which we are said to possess, in consequence of the relation in which we stand towards it.").

41. Bentham wrote:

The idea of property consists in an established expectation; in the persuasion of being able to draw such or such an advantage from the thing possessed . . . . Now this expectation, . . . can only be the work of law. I cannot count upon the enjoyment of that which I regard as mine, ex-

calculus, for example, theft would not be a problem, because it simply transfers pleasure from one person to another, leaving the societal total unchanged. The reason that Utilitarians such as Bentham condemned theft is that it contravened settled and established expectations and therefore destroyed the security on which the social order and with it human happiness depends.<sup>42</sup>

The opposing philosophical position also invokes natural law or preexisting conditions set by nature, but of a different kind. It appeals to laws or principles supposed to govern the functioning of ecosystems and to constitute land as a living community.<sup>43</sup> According to this approach, the forms, functions, and faculties of nature preexist and support the human economy. Landowners must conduct themselves consistently with these preexisting systems and, if they jeopardize them, then they threaten their neighbors and the public as a whole.<sup>44</sup>

On this view, individuals do not acquire property rights to all uses or aspects of land when they remove certain of them from the commons; on the contrary, those resources that they do not actually use or remove from the commons remain in nature where they were originally.<sup>45</sup> If any of these functions of natural communities or systems becomes imperiled or scarce, then

cept through the promise of the law which guarantees it to me.

. . . . Property and law are born together, and die together.

*Id.* at 68-69.

42. "The disutility caused by theft can only be explained by reference to the expectations of the owner, the expectation to retain possession indefinitely." GERALD J. POSTEMA, *BENTHAM AND THE COMMON LAW TRADITION* 169 (1986). For a summation of utilitarian views, see Leonard G. Ratner, *The Utilitarian Imperative: Autonomy, Reciprocity, and Evolution*, 12 *HOFSTRA L. REV.* 723 (1984).

43. See, e.g., Eric T. Freyfogle, *The Owning and Taking of Sensitive Lands*, 43 *UCLA L. REV.* 77 (1995).

44. See BARRY COMMONER, *THE CLOSING CIRCLE: NATURE, MAN, AND TECHNOLOGY* 34-35 (1971).

[A]ll this results from a simple fact about ecosystems—everything is connected to everything else: the system is stabilized by its dynamic self-compensating properties; that these same properties, if overstressed, can lead to a dramatic collapse; the complexity of the ecological network . . . determine[s] how much it can be stressed . . . without collapsing . . . .

*Id.*

45. See Freyfogle, *supra* note 43, at 102.

the government may declare that not even the owners of that property can acquire or dispose of those remaining natural uses of their land.<sup>46</sup> This limitation on land use may even be consistent with the doctrine of John Locke that one acquires a property right when one removes a resource from the state of nature and mixes one's labor with it "at least where there is enough, and as good left in common for others."<sup>47</sup> Under this view, one can come too late to the commons; even the owner of a wetland, for example, who fails to dredge and fill it may lose the right to do so, if so many others of his neighbors already have filled their wetlands that a scarcity exists of whatever public good wetlands are supposed to provide.

Several commentators have drawn analogies, moreover, among wildlife, air, and water, insofar as all three belong to the public even when they flow over private property.<sup>48</sup> It is an established principle of law that the government, in its sovereign capacity, may regulate the taking of wildlife "for the benefit of all the people," for otherwise wildlife "would be destroyed."<sup>49</sup> The analogy among wildlife, air, and water suggests to some analysts that the public retains an interest in and, in some sense, public ownership of "nature" even with respect to privately owned land. Professor Eric Freyfogle made the point as follows: "To the overflying hawk, human boundaries mean nothing. To the percolating groundwater, they mean no more."<sup>50</sup>

46. Professor Freyfogle has stated this position:

Property law in the United States is slowly beginning to deal with the inexorable issue of carrying capacity—the reality that any type of human land-use, however benign the use and however appropriate the location, can prove harmful when too many acres are devoted to it. At some point, in some manner, society must start drawing lines where the carrying capacity is reached and we can disturb the land no further. . . . Will it mean, in the end, a fundamentally new way, an ecological way, of thinking about owning the land?

*Id.* at 79.

47. LOCKE, *supra* note 35, at 130.

48. *See, e.g.*, Eric T. Freyfogle, *The Construction of Ownership*, 1996 U. ILL. L. REV. 173, 175.

49. *Barrett v. State*, 116 N.E. 99, 100 (N.Y. 1917).

50. Freyfogle, *supra* note 48, at 175. Of course, this view encounters various problems. One problem involves the difference between taking wildlife by shooting, trapping, or otherwise hunting it, and taking wildlife by destroying it as an incidental result of modifying its habitat. *See Babbitt v. Sweet Home Chapter of Communities*

The question that concerns the courts is this: To what extent may the government assert its interest in the natural functioning of land, including the well-being of wildlife, without so treading on the rights of the landowner that it must pay him or her compensation? The two sides in the controversy over this question both appeal to nature, whether to natural rights or to natural communities. In a political context, as one commentator has written, "nature" and its cognates serve as metaphors for moral or religious truth. Saying that something is 'natural' is to assert both that it is desirable and that its virtues have foundation in reality."<sup>51</sup>

Each side also appeals to the interconnectedness of the "nature" it values, whether it is the integrity of person and property or the integrity of ecological systems. For those who agree with Epstein, liberty and property are naturally inseparable. "A nation in which private property is protected contains independent, decentralized sources of power that can be used against the state, reducing thereby the possibility that any group will be able to seize control over the sources of information or the levers of political power."<sup>52</sup> Epstein summarized: "Property is defensive, not exploitive."<sup>53</sup>

In asserting that property rights are inextricably connected to

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for a Greater Or., 115 S. Ct. 2407, 2413 n.10 (1995) (discussing this difference).

Second, although polluting groundwater clearly harms one's neighbors and thus creates a nuisance, it is not as clear that extinguishing a species harms anyone, especially rare species whose existence may be known only to experts. The passenger pigeon was hunted into extinction largely because its existence was perceived as a nuisance. There seems to be no value-neutral or nonideological way to determine whether the extinction of an endangered species constitutes a nuisance or harm except, perhaps, in very special cases. One might plausibly argue, then, that by maintaining habitats for species, landowners benefit the public by providing a good that the public wants. In the face of this kind of controversy and confusion, the *Lucas* decision rightly described the "benefit-harm" distinction as "difficult, if not impossible, to discern on an objective, value-free basis." *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1024 (1992).

51. ALSTON CHASE, IN A DARK WOOD: THE FIGHT OVER FORESTS AND THE RISING TYRANNY OF ECOLOGY 2-3 (1995).

52. EPSTEIN, *supra* note 36, at 138.

53. *Id.*

civil and political liberties, Epstein follows F.A. Hayek's view that "the system of private property is the most important guarantee of freedom, not only for those who own property, but scarcely less for those who do not."<sup>54</sup> From this premise it is supposed to follow as a matter of moral and constitutional principle that when the government, for any purpose other than to prevent a harm that would be considered a nuisance at common law, limits the use of private property, for example, to provide "wildlife habitat or some other 'public good,' compensation should be paid."<sup>55</sup> Certainly, the government has the power of eminent domain to dedicate private land to public uses,<sup>56</sup> such as to maintain a natural commons or a refuge for wildlife. In exercising this power, however, the government must compensate landowners for the economic loss they bear when they lose the right to develop their property in ways permitted at common law.

Those who join Epstein in defending property rights generally hold that the government, if it restricts those rights for any reason other than to prevent a nuisance cognizable at common law, must pay compensation, whether explicit or in kind.<sup>57</sup> In ordinary instances of zoning, property owners receive implicit or in kind compensation for their losses.<sup>58</sup> For example, when a zoning ordinance imposes height limits and setbacks, each property owner arguably gains more from the restrictions imposed on others than he or she sacrifices from having to obey those restrictions him or herself.<sup>59</sup> The nature of the regulation in question, then, "should determine whether or not compensation is due, not the level of devaluation experienced by the landowner."<sup>60</sup>

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54. F.A. HAYEK, *THE ROAD TO SERFDOM* 103-04 (15th ed. 1944).

55. Jonathan H. Adler, *Property Rights, Regulatory Takings, and Environmental Protection*, COMPETITIVE ENTERPRISE INST., Apr. 1996, at 12.

56. See, e.g., *United States v. Jones*, 109 U.S. 513 (1883).

57. See, e.g., EPSTEIN, *supra* note 36, at 182-215.

58. See *id.* at 195.

59. For a discussion of implicit compensation, see *id.* at 195-215. See also Michelman, *supra* note 29, at 1225 (discussing the belief that the benefits and the burdens will even out over the long run).

60. Adler, *supra* note 55, at 12 (citing Richard A. Epstein, *Lucas v. South Carolina Coastal Council: A Tangled Web of Expectations*, 45 STAN. L. REV. 1369 (1993)). Epstein himself wrote: "Whatever land-uses may be forbidden by neighbors under nuisance law without compensation may similarly be forbidden by the state without compensation. But the converse proposition . . . is critical. Whatever uses the neigh-

Opposing this view, some environmentalists propose that because everything in the ecosystem is connected,<sup>61</sup> the destruction of habitat on private land injures the public, and thus regulations protecting habitat may be subsumed under the nuisance exemption to the Takings Clause. Michael Bean, a respected authority on wildlife law, has suggested that "restrictions aimed at protecting endangered wildlife are designed to keep the exercise of one property right (the landowner's) from destroying another property right (the public's)."<sup>62</sup>

The image of a chain often occurs in discussions of ecology. As one commentator has declared: "Devastating chains of events within ecosystems can also be set in motion by seemingly minor causes, such as the elimination of a few insect or plant species. Thus, human-caused extinction of any organism is tantamount to a planetary game of ecological 'Russian Roulette'."<sup>63</sup>

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bors could *not* prohibit without just compensation, the state cannot prohibit without compensation either." Epstein, *supra*, at 1389.

61. Deep ecologists pressed the idea of interconnectedness in nature to the point of declaring the equality of all its denizens. "If everything is dependent on everything else, they reasoned, then all living things are of equal worth, and the health of the whole—the ecosystem—takes precedence over the needs and interests of individuals." CHASE, *supra* note 51, at 7.

62. Michael J. Bean, *Taking Stock: The Endangered Species Act in the Eye of a Growing Storm*, 13 PUB. LAND L. REV. 77, 83 (1992) (noting that "[t]o date, American courts have not embraced the view that the Fifth Amendment protects a private right to destroy a publicly owned resource, nor could they without abandoning long settled principles").

Another commentator has described the legal basis of the assertion of public ownership rights in wildlife. See Houck, *supra* note 30, at 311. Houck has noted that "Supreme Court opinions have characterized state 'ownership' of wildlife as a 'legal fiction' expressing the 'importance to its people that a State have power to preserve and regulate the exploitation of an important resource.'" *Id.* (quoting *Douglas v. Seafood Prods., Inc.*, 431 U.S. 265, 284 (1976) (citing *Toomer v. Witsel*, 334 U.S. 385, 402 (1948))).

63. DANIEL J. ROHLF, *THE ENDANGERED SPECIES ACT: A GUIDE TO ITS PROTECTIONS AND IMPLEMENTATIONS* 16 (1989). This approach, which mixes metaphysics and ecology, regards land "as part of the earth's surface, land as part of the ecological community, . . . created by natural forces" that have priority over private economic interests. Freyfogle, *supra* note 48, at 176. Under this view, land and people form an ecological community the principles of which suggest limits that the government may and should enforce without having to compensate landowners for every penny of profit they otherwise might have wrung out of their land.



When the controversy is presented in this way, it appears that the two sides agree on a general principle but disagree on its application. They appear to agree that absent a harm to the public of a sort enjoined at common law, the government should compensate landowners when it restricts their property rights. The two sides appear to disagree only on whether the extinction of species or the eradication of habitat constitutes a public harm or nuisance in that sense. Environmentalists, however, do not in fact endorse the principle that the government should pay compensation when it restricts property rights for reasons other than to prevent harm to the public. On the contrary, environmentalists are likely to applaud Justice Kennedy's assertion that the "common law of nuisance is too narrow a confine for the exercise of regulatory power in a complex and interdependent society."<sup>64</sup>

One may wonder, then, if environmentalists adopt the best strategy when they contend that the destruction of habitat harms the public. If this contention can be grounded on convincing empirical evidence showing that ecosystem services would falter without the species in question, then it may be persuasive. Otherwise, the strategy may seem to concede Epstein's principled position that landowners would be owed compensation for dedicating their land to use as habitat for endangered species if the extinction of those species did not harm human beings in the sense of harm, injury, or damage known at common law.<sup>65</sup>

### B. *Slippery Slopes*

Both those who defend property rights and those who would use the ESA to restrict severely the use of private land rely on the same form of argument, namely, the "slippery slope."<sup>66</sup> Libertarians assert that all *rights* are interconnected, so that if the courts fail to protect even the smallest property right, they also

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64. *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1035 (1992) (Kennedy, J., concurring in the judgment).

65. See EPSTEIN, *supra* note 36, at 182-215.

66. See, e.g., ELLEN FRANKEL PAUL, *PROPERTY RIGHTS AND EMINENT DOMAIN* 192 (1987) ("The slippery slope is real, and it is alarming. What scintilla of liberty might be left to the citizen if one's decisions where to build a house, a school for one's children, . . . can be acted on only at the sufferance of politicians?").

will undermine fundamental political and civil rights.<sup>67</sup> Environmentalists respond by describing all *nature* as being interconnected, so that if society fails to protect the habitat of the least creature, the entire ecological system may collapse. Barry Commoner, in a popular book that appeared two years before the passage of the ESA, summarized this latter view of ecosystems as follows: "The more complex the ecosystem, the more successfully it can resist a stress. . . . Like a net, in which each knot is connected to others by several strands, such a fabric can resist collapse better than a simple, unbranched circle of threads—which if cut anywhere breaks down as a whole."<sup>68</sup>

Events have not borne out the forebodings of either libertarians or environmentalists. Little evidence exists to demonstrate that the failure of the courts to apply the Takings Clause of the Fifth Amendment strictly to environmental statutes has cost Americans their civil, personal, or political rights.<sup>69</sup> On the contrary, the courts have severed takings jurisprudence from its common law moorings, but this has had no apparent effect on

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67. Cf. EPSTEIN, *supra* note 36, at 134-40 (arguing that the Court has protected some "freedoms" more than others).

68. COMMONER, *supra* note 44, at 38. Interestingly, experimental findings led many ecologists to precisely the opposite conclusion, namely, that systems with few species are the most stable. See Fraser Smith, *Biological Diversity, Ecosystem Stability, and Economic Development*, 16 *ECOLOGICAL ECON.* 191-203 (1996). Smith stated: Coming from studies of food web models, the prevailing view in the 1970s and 1980s was that ecosystems with a high degree of internal connectivity (associations among species) tend to be dynamically unstable: an oscillation in the abundance of one species could lead to perturbations in the populations of many others. By contrast, ecosystems with low internal connectivity tend to be dynamically stable.

*Id.* at 195.

69. Nevertheless, Americans tend to think that the freedom to do as one likes with one's land is basic to other rights. See Richard J. Lazarus, *Debunking Environmental Feudalism: Promoting the Individual Through the Collective Pursuit of Environmental Quality*, 77 *IOWA L. REV.* 1739, 1764 (1992) ("The public continues to associate private property rights in land with personal freedom."); see also Carol M. Rose, *The Guardian of Every Other Right: A Constitutional History of Property Rights*, 10 *CONST. COMMENTARY* 238, 244 (1993) (book review) ("And in a very practical way, perhaps property's symbolic force animates the incredible touchiness that is still set off by the regulation of landed property—particularly physical invasions of land . . .").

the personal or civil liberties enjoyed by Americans. The Supreme Court has experienced little difficulty in distinguishing property rights from fundamental civil and political freedoms<sup>70</sup> and attenuating one while augmenting the other.<sup>71</sup>

The dire predictions of environmentalists, moreover, have not materialized. Americans have thoroughly altered the natural environment for agricultural, commercial, and residential purposes, yet basic ecological services remain intact. Would we have been better off had we adopted a rule that would have kept ecological communities pristine? What would one eat? Where would one shop? Where would one park? How would one live? Californians, reputed nature enthusiasts, spend on average only one and one-half hours per day outside.<sup>72</sup> The Japanese have done Californians one better: they have constructed major beaches and ski areas indoors.<sup>73</sup>

The importance of maintaining land in its "natural" state was

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70. See, e.g., *Eisenstadt v. Baird*, 405 U.S. 438, 453 (1972) (defending rights "fundamentally affecting a person"); see also *Roe v. Wade*, 410 U.S. 113, 152 (1973) (citing "personal rights that can be deemed 'fundamental'").

71. For example, the Court has been attentive to the rights of privacy and "personhood." See, e.g., *Planned Parenthood v. Casey*, 505 U.S. 833, 851 (1992) (describing privacy cases in terms of one's right to "define the attributes of personhood"); see also LAURENCE H. TRIBE, *AMERICAN CONSTITUTIONAL LAW* §§ 15-1 to -3 (2d ed. 1988) (discussing the Court's attentiveness to such rights). At the same time, the Court has been unwilling or unable to articulate more than a per se jurisprudential view concerning the compensation owed to landowners for regulatory takings. See Epstein, *supra* note 60, at 1392.

The last major decision of the Supreme Court on takings issues, *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003 (1992), distinguished between rights in land and in personal property, suggesting that the former are more fundamental. See *id.* at 1027-28 ("[I]n the case of personal property, . . . [an owner] ought to be aware of the possibility that new regulation might even render his property economically worthless . . ."). Various commentators have questioned the point of this distinction. See, e.g., Daniel W. Bromley, *Regulatory Takings: Coherent Concept or Logical Contradiction?*, 17 VT. L. REV. 647, 672, 676-78 (1993); William W. Fisher III, *The Trouble with Lucas*, 45 STAN. L. REV. 1393, 1400-01 (1993); John A. Humbach, *Evolving Thresholds of Nuisance and the Takings Clause*, 18 COLUM. J. ENVTL. L. 1, 2-3 (1993). Fred Bosselman, however, correctly solved the mystery by pointing to the strong Benthamite slant present in Justice Scalia's reasoning, in particular, his view that settled expectations about the use of land underlie other expectations about property on which people rely. See Bosselman, *supra* note 39, at 1486.

72. For this and other relevant statistics see Jesse H. Ausubel, *The Liberation of the Environment*, DAEDALUS, Summer 1996, at 14.

73. See *id.* at 13.

not apparent to the 120 Pilgrims who came to Plymouth in 1620, about half of whom died in their first winter of cold, starvation, and disease.<sup>74</sup> A naked human being without tools is a pitiful spectacle in nature, a creature whose only expectation is that of any wild animal, i.e., a swift and painful death.<sup>75</sup> Humanity has survived historically not by preserving but by altering nature thoroughly and repeatedly, replacing wild with domestic everything, wherever, whenever, and however possible. Which original ecosystems, then, should we now protect? What features of these communities can we preserve except change, because change "is the normal course of events for most ecological systems?"<sup>76</sup>

By the middle of the nineteenth century, little if any of the ecology that greeted the Pilgrims remained, with the result that millions of people could then live where only a few Europeans had managed to survive two centuries earlier.<sup>77</sup> If the original ecology represented the "natural" condition or functioning of the land, its restoration hardly would benefit humanity. Indeed, it

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74. See BENJAMIN W. LABAREE, *COLONIAL MASSACHUSETTS: A HISTORY* 34 (1979).

75. Because animals produce many offspring though populations remain more-or-less level, it follows that most of the young must die before reaching sexual maturity. Actually, nature can be described as a holocaust for virtually all of its inhabitants, handing almost all of them a painful and early death as a result of starvation, predation, parasitism, cold, or disease. Some biologists, in viewing the violence of nature, wonder if we can describe natural processes as amoral or indifferent to pain and suffering. It seems to them that nature actually is malevolent, designed to maximize misery and gratuitous suffering while rewarding and thus encouraging the most horrible kinds of behavior. For a fine essay exploring these areas, see George C. Williams, *Huxley's Evolution and Ethics in Sociobiological Perspective*, 1988 *ZYGON* 383, 383-407.

76. THE REPORT OF THE ECOLOGICAL SOCIETY OF AMERICA COMMITTEE ON THE SCIENTIFIC BASIS FOR ECOSYSTEM MANAGEMENT (1995) (visited Nov. 14, 1996) <<http://www.sdsc.edu/ESA/ecmtext.htm>> [hereinafter ESA REPORT] (citing Joseph H. Connell & Wayne P. Sousa, *On the Evidence Needed To Judge Ecological Stability or Persistence*, 121 *AM. NATURALIST* 789, 789-824 (1983)).

77. See LABAREE, *supra* note 74, at 159-70. For other examples, see generally WILLIAM CRONON, *CHANGES IN THE LAND* (1991) (describing the ecological transformation of New England) and Joseph L. Sax, *Ecosystems and Property Rights in the Greater Yellowstone: The Legal System in Transition*, in *THE GREATER YELLOWSTONE ECOSYSTEM: REDEFINING AMERICA'S WILDERNESS HERITAGE* 77 (Robert B. Keiter & Mark S. Boyce eds., 1991) (providing Western examples).

may be next to impossible to define what "original" means. Californians, during the hour-and-a-half they are outdoors, will see from their car windows few of the plants and animals that greeted the Spanish settlers. California's valley grassland has undergone a series of transformations "with alien (primarily Mediterranean) species accounting for 80-90 per cent of the vegetative cover even where 'undisturbed'."<sup>78</sup>

This Article argues that no plausible scientific argument at present supports the claim that the extinction of species in the United States courts environmental disaster. It is far more plausible that rare and endangered species have become epiphenomena, affected by the environment but having little effect upon it. Moral, aesthetic, and spiritual arguments amply may justify all that we do to protect every species, but an instrumental or economic rationale appears beyond reach. As biologist David Ehrenfeld pointed out:

We do not know how many species [of plants] are needed to keep the planet green and healthy, but it seems very unlikely to be anywhere near the more than quarter of a million we have now. Even a mighty dominant like the American chestnut, extending over half a continent, all but disappeared without bringing the eastern deciduous forest down with it. And if we turn to the invertebrates, the source of nearly all biological diversity, what biologist is willing to find a value—conventional or ecological—for all 600,000-plus species of beetles?<sup>79</sup>

### C. *The Thesis of This Article*

This Article proposes that the Supreme Court, rather than resolving controversies about the fundamental character of property, liberty, nature, ecology, and so on, appropriately limits it-

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78. Neil Roberts & Robin A. Butlin, *Ecological Relations in Historical Times: An Introduction*, in *ECOLOGICAL RELATIONS IN HISTORICAL TIMES: HUMAN IMPACT AND ADAPTATION* 1, 8 (Robin A. Butlin & Neil Roberts eds., 1995).

79. David Ehrenfeld, *Why Put a Value on Biodiversity?*, in *BIODIVERSITY* 212, 215 (E.O. Wilson ed., 1988) [hereinafter Ehrenfeld, *Biodiversity*]; see also David Ehrenfeld, *Thirty Million Cheers for Diversity*, *NEW SCIENTIST*, June 12, 1986, at 38-43.

self to reining in regulation at its own frontier. As long as the Court equally threatens opposing positions with utter and devastating defeat—fanning fears that it may vindicate either the libertarian or the environmentalist extreme—it may succeed in restraining the ambitions of both property owners and regulators, who then may recognize that they have more to lose from confrontation than from compromise and accommodation.

The conviction that the freedom to wring the last speculative penny from one's land is of a piece with one's most fundamental civil, political, and personal liberties seems to be grounded less on argument than on assumption. Likewise, the idea that there are such qualities as the "health" or "integrity" of ecosystems and that species are their indicators seems less a refutable proposition of empirical science than a first principle of a certain ecological faith. Society may adopt one metaphysical faith or another in the way it regulates (or declines to regulate) land use, but this determination should be made politically, not by the courts.<sup>80</sup>

This analysis is consistent with the Supreme Court's holding in *Armstrong v. United States*<sup>81</sup> that the Takings Clause of the Fifth Amendment prevents "the government from forcing some people alone to bear public burdens which, in all fairness and justice, should be borne by the public as a whole."<sup>82</sup> One may infer from this doctrine that if political institutions and processes are open and impartial, *prima facie* grounds exist for thinking that the results will not unfairly disadvantage any politically

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80. This is not to say that the controversy is ever resolved. The political process more often than not is a way by which opposing sides in environmental policy live together without either resolving their conflicts or resorting to violence. For a discussion of this premise, see ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION—LAW, SCIENCE, AND POLICY 72 (1992) ("The diverse philosophies that animate environmental concerns and the immense uncertainties that confront policymakers provide ample opportunity for controversy. When regulatory policy is developed and implemented, tensions submerged in ambiguous statutory language often are resolved in ways that contribute further to the extraordinary complexity of environmental regulation.").

81. 364 U.S. 40 (1980).

82. *Id.* at 49 (Harlan, J., dissenting).

powerful group.<sup>83</sup> By honing in on the fairness of the process and by protecting interests that are politically weak, the courts properly ride herd on legislatures and agencies on a case-by-case basis and keep well-organized groups from taking advantage of more vulnerable ones under the cover of pieties about liberty, equality, or ecology. In applying the Takings Clause the courts act to prevent particular forms of abuse, for example, by ensuring that governments do not regulate property in order to drive its price down before acquiring it through eminent domain.<sup>84</sup>

Within this ad hoc jurisprudence, courts may order compensation when a regulation affects politically powerless groups,<sup>85</sup> physically invades property,<sup>86</sup> defeats investment-backed expect-

83. This analysis is consistent with that put forward by JOHN HART ELY, *DEMOCRACY AND DISTRUST* (1980). Epstein criticizes this idea that property owners can defend their interests in general through the political process. See EPSTEIN, *supra* note 36, at 214-15.

84. See Alan W. Roddy, Note, *Takings—Isn't There a Better Approach to Planned Condemnations?—Joint Ventures, Inc. v. Department of Transportation*, 563 So. 2d 622 (Fla. 1990), 19 FLA. ST. U. L. REV. 1169, 1173 (1992) (noting cases limiting a state's power to aggressively regulate property prior to acquiring it).

85. This view is a standard one in the literature and reflects John Hart Ely's "political process" approach to constitutional law. See ELY, *supra* note 83. Epstein was completely on target when he observed that the "political process" approach "accepts the modern framework of preferred freedoms and fundamental rights, which relegates the takings to the fringes of constitutional interpretation." EPSTEIN, *supra* note 36, at 214-15. Epstein criticizes the "political process" approach by arguing that a "powerful link" exists between "legislative breakdown and insufficient compensation." *Id.* at 215. One may reply to Epstein that this link may hold only, or at least primarily, when a vulnerable minority has been singled out for disadvantage. Otherwise, when powerful groups such as landowners bear burdens, it is hard to show that the political process has broken down. William Fischel has argued for the "political process" view that Epstein so correctly describes only to rebuke. Fischel has written:

I embrace John Hart Ely's "political process" theory of the Constitution, which discourages judges from taking an active role in reviewing the products of properly apportioned, pluralistic legislatures. Judges have a limited capacity to evaluate regulatory regimes and an undemocratic hold on their office. They should normally respect the substitute methods—economic exit and political voice—by which property can be protected by its owners and their allies.

WILLIAM A. FISCHEL, *REGULATORY TAKINGS: LAWS, ECONOMICS, AND POLITICS* 7 (1995).

86. See *Loretto v. Teleprompter Manhattan CATV Corp.*, 458 U.S. 419, 421 (1982) (holding that any permanent physical occupation of property constitutes a taking). The Court in *Loretto* explained how the per se rule concerning physical occupation fits into its larger ad hoc jurisprudence:

tations,<sup>87</sup> or deprives the owners of "all economically feasible use" of their land.<sup>88</sup> To go beyond these per se rules, however, may be to substitute judicial activism, based on one metaphysical theory or another, for the outcome of an open and fair political process.

Landowners hardly constitute an oppressed or insular minority; they can press their interests through political action, for example, by repealing or weakening the ESA, when its enforcement becomes too onerous.<sup>89</sup> Similarly, environmentalists are

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The Court explained that resolving whether public action works a taking is ordinarily an ad hoc inquiry in which several factors are particularly significant—the economic impact of the regulation, the extent to which it interferes with investment-backed expectations, and the character of the government action. . . . The opinion does not repudiate the rule that a permanent physical occupation is a government action of such a unique character that it is a taking without regard to other factors that a court might ordinarily examine.

*Id.* at 432 (citation & footnote omitted) (discussing the holding in *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 124 (1978)); see *TRIBE*, *supra* note 71, §§ 9-4 to -5 (observing that physical invasions of property constitute per se constitutional takings); see also *Nollan v. California Coastal Comm'n*, 483 U.S. 825, 835-36 (1987) (noting that property owners were not required to allow public access to the beach as a condition precedent for obtaining a building permit); *Michelman*, *supra* note 29, at 1184 ("The modern significance of physical occupation is that courts, while they sometimes do hold nontrespassory injuries compensable, never deny compensation for a physical takeover.").

87. See *PruneYard Shopping Center v. Robins*, 447 U.S. 74, 83 (1980) (reviewing the economic impact of the challenged statute "and its interference with reasonable investment-backed expectations"). Of course, legal decisions determine which investment-backed expectations are "reasonable," so a circularity exists in this analysis. See *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1034 (1992) (Kennedy, J., concurring in the judgment) ("There is an inherent tendency towards circularity in this synthesis, of course; for if the owner's reasonable expectations are shaped by what courts allow as a proper exercise of governmental authority, property tends to become what courts say it is.").

88. *Lucas*, 505 U.S. at 1016 n.7; see *Pennsylvania Coal Co. v. Mahon*, 260 U.S. 393, 414 (1922); see also *Lucas*, 505 U.S. at 1027-29 (noting that a "taking" may occur not only when the government physically seizes land, but also when the government imposes regulations that strip away property rights and leave the land without viable economic uses); *Keystone Bituminous Coal Ass'n v. DeBenedictis*, 480 U.S. 470, 485 (1987) (inquiring whether property owners retained economically viable uses of their land).

89. For an excellent review of recent legislative initiatives seeking to weaken the ESA by requiring compensation for regulatory takings, see David Coursen, *Property*



adept at cultivating and employing political power.<sup>90</sup> These opposing ideological camps are accustomed to engaging in political battle. They seem to enjoy it, and, when they do not, when political confrontation leads nowhere, environmentalists and landowners may find that cooperation offers better results than conflict. If the courts adopted a general theory that validated one of the ideological visions at the expense of the other they would remove the incentive for bargaining that the current, happy state of uncertainty and confusion creates.<sup>91</sup>

In a series of decisions, culminating in *Lucas v. South Carolina Coastal Council*<sup>92</sup> and *Dolan v. City of Tigard*,<sup>93</sup> the Court has defined per se rules which establish that a regulation that is reasonably related to a valid public purpose will require compensation only under specific conditions, e.g., because it singles out a vulnerable minority,<sup>94</sup> deprives the landowner of all viable use of his or her property,<sup>95</sup> or physically invades or occupies

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*Rights Legislation: A Survey of Federal and State Assessment and Compensation Measures*, 26 *Env'tl. L. Rep. (Env'tl. L. Inst.)* 10,239 (May 1996). For a popular account of the same phenomenon, see for example, Douglas H. Chadwick, *Dead or Alive: The Endangered Species Act*, NAT'L GEOGRAPHIC, Mar. 1995, at 2. See also Stephen M. Meyer, *The Final Act*, NEW REPUBLIC, Aug. 15, 1994, at 24. According to Meyer:

Ranchers, loggers, home builders, members of the grossly misnamed "wise-use" movement and others are moving in, like a pack of wolves, to tear it [the ESA] to shreds. The act, they charge, is a misguided effort to save maladapted, obscure and useless creatures. It shaves percentage points off the gross national product, costs tens of thousands of jobs, tramples private property rights, wastes valuable public resources and clogs the courts with frivolous cases. The act's foes hope to restore "balance" to the legislation with a series of "people first" amendments.

*Id.*

90. See Meyer, *supra* note 89, at 26.

91. The view argued here places takings jurisprudence within the context of the famous footnote in *United States v. Carolene Products Co.*, 304 U.S. 144 (1938), describing ordinary political processes as sufficient to protect ordinary commercial transactions from undesirable governmental interference. See *id.* at 152 n.4. The courts must devote greater scrutiny to governmental actions that restrict access to the political process or that are directed against "discrete and insular minorities." *Id.*

92. 505 U.S. 1003 (1992).

93. 512 U.S. 374 (1994).

94. Cf. *id.* at 385 (stating that a taking will be sustained only if there is a legitimate state interest).

95. See *id.*

the property.<sup>96</sup> Though under pressure from academic theorists, the *Lucas* court rightly refrained from augmenting this per se list with a more general jurisprudence.<sup>97</sup> This Article argues that the Supreme Court correctly constrains land-use policy at the margins while still permitting the political process to determine its overall direction.

The Court's refusal to formulate a general constitutional takings theory may disappoint academic commentators who complain about the uncertainty or unpredictability of the Court's jurisprudence,<sup>98</sup> but it has not produced a great deal of uncertainty or unpredictability among landowners.<sup>99</sup> The Court's ad hoc approach gives prospective litigants a clear idea that plaintiffs will lose absent the special circumstances captured by the per se rules.<sup>100</sup> Despite many predictions to the contrary there has been no rush to the courthouse to file cases in inverse condemnation under section 9 of the ESA.<sup>101</sup>

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96. See *Lucas*, 505 U.S. at 1028.

97. In his concurring opinion, Justice Kennedy signalled how far the Court was from making common law nuisance a bright line test for compensable takings. He wrote: "The common law of nuisance is too narrow a confine for the exercise of regulatory power in a complex and interdependent society. . . . Coastal property may present such unique concerns for a fragile land system that the State can go further . . . than the common law of nuisance might otherwise permit." *Id.* at 1035 (Kennedy, J., concurring in the judgment) (citation omitted). Compare this view with Justice Rehnquist's earlier statement that "[t]he nuisance exception to the taking guarantee is not coterminous with the police power itself." *Penn Cent. Transp. Co. v. City of New York*, 438 U.S. 104, 145 (1978) (Rehnquist, J., dissenting).

98. See, e.g., Fisher, *supra* note 71, at 1410 (describing the "infamous vagueness" of takings doctrine); Gideon Kanner, *Welcome Home Rambo: High-Minded Ethics and Low-Down Tactics in the Courts*, 25 LOY. L.A. L. REV. 81, 103 n.94 (1991) (describing takings jurisprudence as a "swamp").

99. See Meltz, *supra* note 26, at 415-17 (contending that plaintiffs will fail if they challenge the ESA under the Takings Clause of the Fifth Amendment); Paula C. Murray, *Private Takings of Endangered Species As Public Nuisance: Lucas v. South Carolina Coastal Council and the Endangered Species Act*, 12 UCLA J. ENVTL. L. & POLY 119 (1993) (arguing that ESA takings claims should fail).

100. See generally Richard B. Stewart, *The Endangered Species Act: A Case Study in Takings Incentives: A Comment*, AM. ENTERPRISE INST., Mar. 7, 1996 (deploring the many grounds on which takings challenges to the ESA are bound to fail).

101. See James L. Brookshire, Remarks at the Institute of Bill of Rights Law Symposium, *Defining Takings: Private Property and the Future of Government Regula-*

At the same time, property owners have demonstrated their power to protect themselves politically, for example, by confronting environmentalists during the ESA reauthorization process.<sup>102</sup> Civil disobedience also remains a haunting prospect, because it may be nearly impossible to prosecute property owners who have eliminated endangered species before federal agents have discovered them on their land. Abusive regulatory actions may lead to stunning defeats in legislatures as in the courts even if, or especially if, takings jurisprudence remains a theoretical muddle.<sup>103</sup> The kind of uncertainty that characterizes takings jurisprudence thus has a chastening, or at least a moderating, effect by restraining regulation at its borders.

The mere threat that the Court could take a principled position one way or another, moreover, may dissuade both governmental agencies, such as the FWS, and landowners from push-

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tion (Apr. 11, 1996) (noting that until recently no cases had been brought claiming a taking under the ESA); see also Bruce Babbitt, *The Endangered Species Act and "Takings": A Call for Innovation Within the Terms of the Act*, 24 ENVTL. L. 355, 361 (1994) (stating that as of 1994, no property takings claims related to ESA regulations had been filed in the Court of Federal Claims); George W. Miller & Jonathan L. Abram, *A Survey of Recent Takings Cases in the Court of Federal Claims and the Court of Appeals for the Federal Circuit*, 42 CATH. U. L. REV. 863 (1993) (surveying takings claims and finding very few successful takings cases of any kind).

102. Legislative attempts to require compensation for regulatory takings under the ESA include The Omnibus Property Rights Act of 1995, S. 605, 104th Cong. § 404(a)(b)(1) (1995) (forbidding regulations likely to "require an uncompensated taking of private property" and requiring agencies to structure regulations so as to "reduce such takings . . . to the maximum extent possible within existing statutory requirements"), reprinted in 141 CONG. REC. S4500 (daily ed. Mar. 23, 1995), available in 1995 WL 123885.

103. See *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 123-24 (1978), stating that:

While this Court has recognized that the "Fifth Amendment's guarantee . . . [is] designed to bar Government from forcing some people alone to bear public burdens which, in all fairness and justice, should be borne by the public as a whole," . . . this Court, quite simply, has been unable to develop any "set formula" for determining when "justice and fairness" require that economic injuries caused by public action be compensated by the government, rather than remain disproportionately concentrated on a few persons.

*Id.* (alteration in original) (citation omitted); see also FISCHER, *supra* note 85, at 51 ("[T]he Court has always been suspected of basing regulatory takings decisions on ad hoc factors, and *Penn Central* was a signed confession that the justices do not care to do better.").

ing their luck, because a judicial decision could go badly against them. As long as takings jurisprudence remains muddled, adversaries have reason to cooperate rather than to litigate. The Court would be mistaken to move from its present path of ad hoc, case-by-case review to a more principled, coherent, or consistent doctrine.<sup>104</sup> A clear theory of regulatory takings is not needed.<sup>105</sup>

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104. For views opposed to the one advocated in this Article, see, for example, Daniel R. Mandelker & Michael M. Berger, *A Plea To Allow the Federal Courts To Clarify the Law of Regulatory Takings*, 42 LAND-USE L. & ZONING DIG. 3 (1990); Craig A. Peterson, *Land-Use Regulatory "Takings" Revisited: The New Supreme Court Approaches*, 39 HASTINGS L.J. 335, 338 (1988) (stating the need for a clearer understanding of what is a taking of property).

105. To put this thesis in a more general framework: One can base property law either on first metaphysical principles or on the outcome of democratic political processes. To those for whom the true metaphysical principles are obvious, for example fundamentalists among libertarians and environmentalists, democratic political processes are a constant impediment to rational or logical policy-making. Libertarians, property rights advocates, and others who regard environmentalism with a jaundiced eye may point to its political successes, such as the ESA, to show how confiscatory, costly, inefficient, humbling, and ridiculous the results of democratic political processes often are. Environmentalists, in turn, may regard political processes with suspicion because greedy multinational corporations, as they believe, may purchase or otherwise capture legislatures and regulatory agencies. Anyone who has metaphysical truth on his or her side can condemn democracy as prone to unprincipled, corrupt, and costly manipulation by powerful factions. Democracy is a horribly flawed political system, to be sure, and it often produces egregious outcomes. The only thing that can be said for democracy, and it is said often, is that every other system is even worse. See Winston S. Churchill, Speech (Nov. 11, 1947), in MICHAEL C. THOMSETT & JEAN FREESTONE THOMSETT, *POLITICAL QUOTATIONS* 36 (1994).

The argument of this Article is not novel. Justice Stevens, writing in dissent in *Lucas*, argued that the Court should maintain "essentially an ad hoc, factual inquiry," because "fairness and justice" are often disserved by categorical rules." *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1071 (Stevens, J., dissenting). Michael Treanor forcefully has argued a similar position:

[C]ourts should mandate compensation only in those classes of cases in which process failure is particularly likely today—when there has been singling out or in environmental racism cases, where there has been discrimination against discrete and insular minorities. Outside of this realm, the Takings Clause should serve an educative function, but should not lead to court enforcement.

William Michael Treanor, *The Original Understanding of the Takings Clause and the Political Process*, 95 COLUM. L. REV. 782, 784 (1995); see also William Michael Treanor, Note, *The Origins and Original Significance of the Just Compensation*

## II. INTRUSIVE, COUNTERPRODUCTIVE, AND INEQUITABLE

Writing in dissent in *Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon*,<sup>106</sup> Justice Scalia anticipated Mr. Cushman's response to the Court's decision.<sup>107</sup> The majority's opinion, Justice Scalia declared, "imposes unfairness to the point of financial ruin—not just upon the rich, but upon the simplest farmer who finds his land conscripted to national zoological use."<sup>108</sup> Some academic authorities have reached the same conclusion. Professor Richard B. Stewart wrote that *Sweet Home* was decided wrongly, that the Court "should have applied a principle of clear statement, requiring firmer . . . evidence of a congressional determination to impose a sweeping, intrusive, counterproductive and inequitable system of federal land management on private property throughout the country."<sup>109</sup>

### A. A Nation of Zoo-Keepers

How much of a federal land-grab may one expect in the wake of the *Sweet Home* decision? Professor Stewart, Justice Scalia, and Chuck Cushman foresee the ruination of simple farmers, loggers, and other fine Americans the Supreme Court has exposed to the sweeping, inequitable, intrusive, counterproductive, capricious, and confiscatory actions of FWS, among other gov-

*Clause of the Fifth Amendment*, 94 YALE L.J. 694 (1985) (discussing the historical basis of the Takings Clause).

It seems clear that several justices have shared Justice Stevens's conviction noted above that in settling takings cases, ad hoc balancing is better than a consistent jurisprudence based on a set of coherent principles. See, e.g., *Loretto v. Teleprompter Manhattan CATV Corp.*, 458 U.S. 419, 442 (1982) (Blackmun, J., dissenting) (calling on the Court to maintain its traditional, ad hoc balancing approach and to eschew a "rigid *per se* takings rule"); *id.* at 456 (Blackmun, J., dissenting) ("[T]he solution of the problems precipitated by . . . technological advances and new ways of living cannot come about through the application of rigid constitutional restraints formulated and enforced by the courts.") (quoting *United States v. Causby*, 328 U.S. 256, 274 (1946)) (alteration in original). But see David Course, *Lucas v. South Carolina Coastal Council: Indirection in the Evolution of Takings Law*, 22 *Envtl. L. Rep. (Envtl. L. Inst.)* 10,778, 10,782 (Dec. 1992) (describing the Court's "impatience" with its *per se* approach and its "search for a bright-line rule").

106. 115 S. Ct. 2407 (1995).

107. See van der Werf, *supra* note 1, at B1 (providing Mr. Cushman's response).

108. *Sweet Home*, 115 S. Ct. at 2421 (Scalia, J., dissenting).

109. Stewart, *supra* note 100, at 1.

ernmental agencies.<sup>110</sup>

Plainly, if the decision in *Sweet Home* gave federal authorities carte blanche to impose land-use policies on property owners, it would be open to this sort of criticism. The decision could mean little in practice, however, if federal agents are constrained in other ways. To what extent has the decision in *Sweet Home* actually affected property rights? To what extent will aggrieved property owners, such as those who log for a living, appeal to the Fifth Amendment to force the government to pay for the land it conscripts for zoological use?

The fate of the plaintiffs who lost in *Sweet Home* may indicate how other landowners will fare as a result of that Supreme Court decision. What happened to the yeomen loggers and farmers or to their land because they lost the case? The answer is nothing. Because the FWS had neither initiated nor contemplated an enforcement action against any of the plaintiffs in *Sweet Home*, the outcome of the case did not affect them. The timber industry had recruited the plaintiffs to bring a facial challenge to the regulation.<sup>111</sup>

Typical of these plaintiffs, the *Seattle Times* pointed out, was Betty Orem, who inherited a "30-acre tract of forest land overlooking the pastoral valley of Jimmycomelately Creek in the Olympic foothills south of Sequim," abutting a national forest.<sup>112</sup> Orem knew why timber industry lawyers asked her to become a plaintiff: "The reason they chose me is I'm an old widow."<sup>113</sup> The outcome of the case had no effect on Orem's land. "It's been logged," reported the *Seattle Times*.<sup>114</sup> A year before *Sweet Home* had been decided, she received a "state per-

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110. See *Sweet Home*, 115 S. Ct. at 2421 (Scalia, J., dissenting); Stewart, *supra* note 100, at 1; van der Werf, *supra* note 1, at B1.

111. Cf. *Sweet Home*, 115 S. Ct. at 2410 (stating "[r]espondents in this action are small land-owners"); see also *infra* text accompanying note 112 (explaining the background of the case).

112. Eric Pryne, *Private Land vs. Habitat Protection*, SEATTLE TIMES, Apr. 13, 1995, at A1, available in 1995 WL 5017355.

113. *Id.*

114. *Id.*

mit to cut it."<sup>115</sup> Orem, like several other plaintiffs, found that 'tis better to have logged and lost. "The federal owl-habitat guidelines remain in place," observed the *Seattle Times*.<sup>116</sup> The *Times* continued, "Orem is just one of many Washington timberland owners who have ignored them and logged their property anyway."<sup>117</sup>

How will the *Sweet Home* decision affect the nation's small loggers, farmers, and other land owners? It will affect them, it seems, as it did the Widow Orem—that is, not at all. In June 1995, the month the Supreme Court announced its decision in *Sweet Home*, the FWS proposed to exempt nearly all small and residential land holders from its section 9 requirements for protecting the habitat of threatened plants and animals.<sup>118</sup> Secretary of the Interior Bruce Babbitt greeted the Court's decision by announcing that: "[I]t makes it all the more fundamentally important that we work to make this law more flexible and user-friendly for landowners. . . . We will continue to aggressively pursue a variety of reforms to make the [Endangered Species] Act less onerous on private landowners."<sup>119</sup>

Secretary Babbitt committed the FWS to an incentives-based rather than coercive approach in using section 9 to conserve habitat. A "no surprises" policy ensures that once landowners agree to a habitat conservation strategy, they will be subject to no more ESA demands. Landowners who voluntarily enhance wildlife habitat on their lands would be immune from any further land-use restrictions under the ESA. In all, the FWS and the Department of Interior have taken great care to suggest that they will not exploit the Supreme Court decision but will carry on as if *Sweet Home* had been decided against them.<sup>120</sup>

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115. *Id.*

116. *Id.*

117. *Id.*

118. See Endangered and Threatened Wildlife and Plants; Proposed Rule Exempting Certain Small Landowners and Low-Impact Activities from Endangered Species Act Requirements for Threatened Species, 60 Fed. Reg. 37,419 (1995) (to be codified at 50 C.F.R. pt. 17) (proposed July 20, 1995).

119. Office of the Secretary, U.S. Dep't of Interior, *Secretary Babbitt Welcomes 'Common Sense' Action of Supreme Court Species Ruling; Says It Will Not Alter His Flexibility Push*, Press Release, June 29, 1995 (quoting Secretary Babbitt), available in 1995 WL 386054.

120. Landowner-friendly provisions that purportedly govern FWS behavior are listed

Through 1994 not a single case for inverse condemnation under section 9 had been filed in the United States Claims Court.<sup>121</sup>

In the Pacific Northwest, where the spotted owl controversy brought the ESA into the greatest potential conflict with the logging of private lands, the FWS moved not to regulate but to reassure landowners. Although the FWS designated 6.9 million acres of federal land as "critical habitat," it excluded all nonfederal lands from coverage under section 9 guidelines regarding the habitat modification.<sup>122</sup>

The political restraint shown by the FWS in the Pacific Northwest characterizes its general practices. In 1993, A. Dan Tarlock wrote that "[b]iodiversity protection . . . is becoming more decentralized and site-specific,"<sup>123</sup> and that "federal and state land-use managers are extremely deferential to local concerns."<sup>124</sup> J.B. Ruhl observed in 1988 that "the local grip on land planning has remained tight" and that "the federal role . . . has been largely passive."<sup>125</sup> Another commentator observed in 1991 that "the federal government, for the most part, has been reluctant to intrude on state and local land-use decision making authority."<sup>126</sup> Between 1985 and 1993, according to a 1994 U.S. General Accounting Office report, only eight landowners nationwide (about one a year) were convicted of a crime for destroying the habitat of a species.<sup>127</sup> By comparison, about 100 Americans

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and explained in a recent Department of Interior document. See U.S. DEP'T OF INTERIOR, PROTECTING AMERICA'S LIVING HERITAGE: A FAIR, COOPERATIVE AND SCIENTIFICALLY SOUND APPROACH TO IMPROVING THE ENDANGERED SPECIES ACT 6-9 (1995).

121. See Babbitt, *supra* note 101, at 361.

122. See Endangered and Threatened Wildlife and Plants; Determination of Critical Habitat for the Northern Spotted Owl, 57 Fed. Reg. 1796, 1810 (1992) (codified at 50 C.F.R. pt. 17.95(b) (1995)); see also Endangered Species Act of 1973 §§ 3(5)(A), 4(a)(3), 16 U.S.C. §§ 1532(5), 1533(a)(3) (1994) (defining "critical habitat" and indicating that the secretary may designate an area as such).

123. A. Dan Tarlock, *Local Government Protection of Biodiversity: What Is Its Niche?*, 60 U. CHI. L. REV. 555, 557 (1993).

124. *Id.* at 557 n.10.

125. J.B. Ruhl, *Interstate Pollution Control and Resource Development Planning: Outmoded Approaches or Outmoded Politics?*, 28 NAT. RESOURCES J. 293, 309 (1988).

126. Holly Doremus, *Patching the Ark: Improving Legal Protection of Biological Diversity*, 18 ECOLOGY L.Q. 265, 289 (1991).

127. See GENERAL ACCOUNTING OFFICE, REP. NO. RCED-95-16, ENDANGERED SPE-



die each year as a result of being hit by lightning.<sup>128</sup>

### B. *Politics As Usual*

The FWS showed the least political restraint and learned the hardest lessons in its efforts to protect two songbirds and some cave-dwelling invertebrates in central Texas in the late 1980s and early 1990s.<sup>129</sup> In those cases "the coercive nature of FWS's policies," as Ruhl reported, "eventually built pervasive resentment and distrust of FWS and the regional planning process within the regulated community."<sup>130</sup>

The story of FWS's political difficulties in Texas has been told many times, most recently in an informative book by Charles Mann and Mark Plummer,<sup>131</sup> and need not be recounted in detail here. It is sufficient for the purposes of this Article to note that agencies seeking to use ESA authority to protect the habitat of various species on private lands in central Texas in the early 1990s, and, most infamously, the habitat of the golden-cheeked warbler, accomplished little more than to provoke effective local, state, and finally national resentment and resistance to the ESA.<sup>132</sup>

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CIES ACT: INFORMATION ON SPECIES PROTECTION ON NONFEDERAL LANDS 10 (1994) (noting that seven individuals were prosecuted for modification of habitat and one individual was prosecuted for modification coupled with "species mortality").

128. See *Zeus' Mighty Hammer*, NEWS & OBSERVER (Raleigh, N.C.), Aug. 18, 1996, at A32, available in 1996 WL 2893219 (noting that lightning causes approximately 90 deaths and 500 injuries nationwide each year).

129. See Melinda E. Taylor, *Promoting Recovery or Hedging a Bet Against Extinction: Austin, Texas's Risky Approach to Ensuring Endangered Species' Survival in the Texas Hill Country*, 24 ENVTL. L. 581 (1994); Robert D. Thornton, *Searching for Consensus and Predictability: Habitat Conservation Planning Under the Endangered Species Act of 1973*, 21 ENVTL. L. 605, 612 (1991); Kevin D. Batt, Case Comment, *Above All, Do No Harm: Sweet Home and Section Nine of the Endangered Species Act*, 75 B.U. L. REV. 1177, 1198-200 (1995).

130. J.B. Ruhl, *Biodiversity Conservation and the Ever-Expanding Web of Federal Laws Regulating Nonfederal Lands: Time for Something Completely Different?*, 66 U. COLO. L. REV. 555, 636 (1995).

131. See CHARLES C. MANN & MARK L. PLUMMER, *NOAH'S CHOICE: THE FUTURE OF ENDANGERED SPECIES* 190-211 (1995).

132. Landowners who considered themselves possible targets of FWS conservation orders organized to bring political pressure against the agency. See Ruhl, *supra* note 130, at 636-38. Politicians of both parties had no choice but to defend local property rights against "Washington." See *id.* at 638-39. Then-Governor Ann Richards, whose

In Texas, the FWS learned that it was no match for organized local opposition. Even with all the legal authority in the world, FWS officials appear nearly powerless when local groups organize and the political winds blow against federal intervention. Further, if the agency proceeds with less than complete political restraint and sensitivity to the needs of landowners, it will only buttress the case of those working to eviscerate the ESA in Congress. A ham-fisted approach also will encourage the kind of civil disobedience and resistance that Mr. Cushman described at the outset of the Article.<sup>133</sup>

In its Texas debacle, the FWS learned that the legitimacy and effectiveness of regulations are established not so much through judicial review as by judicious application.<sup>134</sup> The actions of the

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bid for reelection would be decided against her a few months later, took every opportunity to express the view all Texas politicians had to espouse:

Our recent experiences with federal agencies and their ham-handed approach causes me serious concern about taking action that increases their authority in local matters. The possibility of greater federal involvement in state or local management or interference with economic development is unacceptable. Frankly, the unilateral actions of federal agencies without consultation with state or local government impedes rather than facilitates progress and I have had enough. Members of Congress agree that their good intentions to protect the environment become an open door for agencies to run amuck.

Letter from Ann Richards, Governor, State of Texas, to John Hall, Chairman, Texas Natural Resources Conservation Commission 1 (July 25, 1994), *quoted in Ruhl, supra* note 130, at 557. Governor Richards similarly wrote to Secretary of Interior Babbitt:

[T]he Fish and Wildlife Service's approach to implementing the [Endangered Species] Act in Texas has become so overreaching that it undermines public support for protecting our wildlife. During the past decade, the agency's efforts to enforce the law and protect wildlife have created enormous problems for landowners. . . . The Department of Interior, with leadership from your office, should initiate a thorough review of the Fish and Wildlife Service's overall approach to implementing the Endangered Species Act in Texas.

Letter from Ann Richards, Governor, State of Texas, to Bruce Babbitt, Secretary, United States Department of Interior (Sept. 12, 1994), *quoted in Ruhl, supra* note 130, at 567-68 (alteration in original). As Texas sued the FWS as *parens patriae* for its citizens, *Texas v. Babbitt*, No. W-94-CA-271 (W.D. Tex. filed Sept. 30, 1994), *cited in Ruhl, supra* note 130, at 639 n.258, and the reauthorization of the ESA came into greater question, Secretary Babbitt restrained the agency.

133. See van der Werf, *supra* note 1, at B1.

134. See *Interior Secretary Scuttles Proposed "Critical Habitat" Plan for Central*

FWS lacked user-friendly flexibility and responsiveness in Texas in the early 1990s.<sup>135</sup> As a result, when the 1994 elections approached, candidates running for election in Texas defended the interests of their own citizens from the orders of the FWS, a federal agency.<sup>136</sup> Candidates of each party competed in excoriating the bureaucracy. "Republicans embraced the issue for their political campaigns," the Bureau of National Affairs reports, "challenging Democratic rivals to choose sides with rural Texans or with Washington."<sup>137</sup> "One by one, the state's top Democratic officeholders—Lt. Gov. Bob Bullock, Attorney General Dan Morales, and Gov. Ann Richards—began lining up against the [FWS-initiated] plan."<sup>138</sup>

In Washington, D.C., Secretary of the Interior Babbitt understood that administration support for FWS actions in Texas could only undermine the already slim chances of Democratic party victories in the 1994 Congressional elections.<sup>139</sup> In a letter to then-Governor of Texas Ann Richards, Babbitt said that he had instructed FWS officials not to designate private lands as "critical habitat" and to work cooperatively rather than coercively to establish conservation plans for endangered species.<sup>140</sup> Aggressive efforts to enforce section 9 requirements proved self-defeating in the field and in Washington.

The Texas example demonstrates that habitat conservation plans will not succeed on private lands without public support, especially support at the local level. Accordingly, the FWS will accomplish its mission more by earning the goodwill of citizens than by winning victories in court. One might argue that just a few horror stories, properly amplified and politicized, such as those associated with FWS policy in Texas, have done more to influence the course of events than has any Supreme Court opinion.

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*Texas*, Daily Env't Rep. (BNA) (Sept. 30, 1994), available in LEXIS, ENVIRN Library, BNAED File [hereinafter *Interior Secretary Scuttles Plan*].

135. See MANN & PLUMMER, *supra* note 131, at 204-08.

136. See *Interior Secretary Scuttles Plan*, *supra* note 134.

137. *Id.*

138. *Id.*

139. See *id.*

140. See *id.*

"There's nothing like a good anecdote," according to Stephen Meyer, a political scientist at MIT who studied FWS's efforts to protect the golden-cheeked warbler in central Texas.<sup>141</sup> "I've never seen a public policy debate so driven by stories."<sup>142</sup> A coercive approach can only undermine public support for the ESA and encourage the "shoot, shovel, and shut up" response that Mr. Cushman described.<sup>143</sup> The *Sweet Home* decision, although welcomed by environmentalists, has made, and is likely to make, little if any difference in the way section 9 is enforced.

For environmentalists, the FWS, and the Clinton Administration, the *Sweet Home* decision may seem like a Pyrrhic victory if the public will not sit still for federal agents' assertions of power over private property that arise as a result of that decision. If these agents use their power without sensitivity and self-restraint, moreover, public opinion may turn against anything more than a pretextual ESA.<sup>144</sup> In urging Congress not to enact Republican-sponsored ESA amendments, Secretary Babbitt promised to make the current ESA "work better for private landowners."<sup>145</sup>

The FWS, for its part, has given up the idea that broad, coercive policies can be anything but self-defeating. It has been careful to acknowledge that a command and control approach would "actually generate disincentives for private landowner support for threatened species conservation."<sup>146</sup> Rather than embolden

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141. Hugh Dellios, *Environmental Act Endangered As Private Landowners Cry Foul*, CHI. TRIB., May 29, 1995, at 1 (quoting Stephen Meyer), available in 1995 WL 6211876.

142. *Id.* (quoting Stephen Meyer).

143. van der Werf, *supra* note 1, at B1.

144. Senator Slade Gorton, for example, introduced into the Senate a bill to revise the ESA thoroughly, restricting the definition of "harm" to include only direct actions taken against protected species. See Amendment to the Department of the Interior and Related Agencies Appropriations Act, S. amend. 2904, 102d Cong. (1992).

145. See U.S. Dep't of Interior, *Statement by Secretary Bruce Babbitt on the "Endangered Species Conservation and Management Act of 1995,"* Sept. 7, 1995, at 2 (on file with author).

146. Endangered and Threatened Wildlife and Plants; Proposed Rule Exempting Certain Small Landowners and Low-Impact Activities from Endangered Species Act Requirements for Threatened Species, 60 Fed. Reg. 37,419 to 37,420 (1995) (to be

the FWS, the *Sweet Home* decision, in fact, may have chastened it, leading it to emphasize voluntary and cooperative efforts to protect threatened species on private property.<sup>147</sup> A great distance, then, separates the cup of regulatory authority from the lip of enforcement. The Clinton Administration's efforts to protect species, as signaled by a Memorandum of Understanding signed on September 27, 1994, increasingly seek to avoid interventions on private property and to concentrate public actions on public lands.<sup>148</sup>

### C. Do Supreme Court Decisions Matter in Environmental Policy?

*Sweet Home* is similar to other landmark Supreme Court decisions which have had underwhelming practical effects. One such decision, *Pennsylvania Coal Co. v. Mahon*,<sup>149</sup> is the "original and most-cited Supreme Court decision on regulatory takings," according to William A. Fischel, who uses the details of this case to open his recent study of the regulatory taking of property rights.<sup>150</sup> At issue was a Pennsylvania law, the Kohler Act, prohibiting coal companies from mining in any way that damaged the surface in developed areas, for example, by causing the subsidence of houses.<sup>151</sup> This law in effect prevented coal mining under cities and towns. The Supreme Court's decision, which required the state to compensate mining companies if it

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codified at 50 C.F.R. pt. 17).

147. For an argument that only a voluntary or incentive-based approach to enforcement will work to protect threatened species on private property, see John Charles Kunich, *The Fallacy of Deathbed Conservation Under the Endangered Species Act*, 24 ENVTL. L. 501, 574-78 (1994).

148. Twelve federal agencies together with the FWS and the National Marine Fisheries Service (NMFS) joined to assert their "common goal of conserving species listed as threatened or endangered under the ESA by protecting and managing their populations and the ecosystems upon which those populations depend." *Memorandum of Understanding Between Federal Agencies on Implementation of the Endangered Species Act Signed Sept. 28, 1994*, [July-Dec.] Daily Env't Rep. (BNA) No. 188, at E-1 (Sept. 30, 1994), available in LEXIS, ENVIRN Library, BNAED File. For a detailed account, analysis, and evaluation of this agreement, see J.B. Ruhl, *Section 7(a)(1) of the "New" Endangered Species Act: Rediscovering and Redefining the Untapped Power of Federal Agencies' Duty To Conserve Species*, 25 ENVTL. L. 1107 (1995).

149. 260 U.S. 393 (1922).

150. FISCHEL, *supra* note 85, at 14-22.

151. See *Pennsylvania Coal*, 260 U.S. at 412-13.

enforced the Kohler Act, thereby seemed to assure the subsistence of houses built upon the coal those companies owned.<sup>152</sup> A lawyer representing the government, indeed, had argued in his brief that the "Kohler Act is our sole protection against a new campaign of ruthless mining . . . ."<sup>153</sup>

Fischel has argued that the Court's decision, in fact, did not change the balance of power between the coal companies and the people of Pennsylvania, nor did it alter the behavior of either contingent.<sup>154</sup> "The mutual economic dependence of the mine owners and surface dwellers, most of whom worked in the coal industry, led to a resolution of the problem that relied little on formal laws."<sup>155</sup> Philip Mattes, the author of the Kohler Act, reflecting many years later, explained why *Pennsylvania Coal* altered little in the lives of citizens:

It might be supposed that the victors would cash in on their expensive victory by mining out their pillar coal in all areas covered by the decision. But the absentee management of the mines had gradually been shifted into local hands who were not insensitive to an aroused public opinion. The statement of Governor Sproul [who signed the Kohler and Fowler Acts], the opinion of Chief Justice Moschzisker [who upheld the acts in the state court], the elections of public officials [the founder of the Surface Protection Association had been elected mayor in 1922], the delegations to Harrisburg, the editorials in the press, all played their part in convincing management that the time had come to forego reaping the last gleanings from the rich fields that had paid them so handsomely in the past.<sup>156</sup>

One might argue, as Professor Fischel has, that the coal companies restrained themselves—in fact, they took great care to

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152. *See id.* at 414.

153. FISCHEL, *supra* note 85, at 26 (quoting Brief of Argument on Behalf of City of Scranton at 25-26, *Pennsylvania Coal* (No. 549)).

154. *See id.* at 37-42.

155. *Id.* at 13.

156. *Id.* at 39 (quoting PHILLIP V. MATTES, *TALES OF SCRANTON* (privately published 1974)).

repair any damage to residences that mining activities caused—because strong ties existed between the companies and the people who lived in mining communities.<sup>157</sup> In an area as small as the region of Scranton, Pennsylvania, where ordinary residents and coal mine executives were likely to meet and know each other, a norm of behavior regarding surface rights was likely to be respected, whatever the law might allow. “Political pressure undoubtedly contributed to the enforcement of this norm,” Fischel concluded, “but, in the end, it seems more likely that concern for reputation on other fronts restrained the coal companies from asserting their legal rights to withdraw surface support.”<sup>158</sup>

A third landmark environmental case, *Sierra Club v. Morton*,<sup>159</sup> similarly illustrates the principle that major cases can have minor effects. In 1969, the Department of the Interior leased the Mineral King valley, located in the middle of Sequoia National Park, to Disney Enterprises to build a mammoth ski resort.<sup>160</sup> The Sierra Club, which sued to stop the development, deliberately refused to establish its standing to sue by failing to assert an interest or injury—refraining, for example, from stating that its members visited the Mineral King Valley and would be harmed by its development.<sup>161</sup> Counsel to the Sierra Club apparently sought a broad ruling to anoint the Club per se as the appropriate general representative of the interests of the environment and to give it standing “to challenge any administrative complicity in environmental degradation.”<sup>162</sup> When the Supreme Court predictably upheld lower court rulings and dismissed the Sierra Club suit for want of standing, Disney might have rushed in the bulldozers to render future litigation moot. In fact, Disney Enterprises, sensitive to public opinion, did not pursue its plans, abandoning the project in the face of public controversy.<sup>163</sup>

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157. See *id.* at 43 (citing the experience of Mr. Nardozzi, whose house did subside but was fully repaired by the Pennsylvania Coal Company).

158. *Id.* at 45.

159. 405 U.S. 727 (1972).

160. See *id.* at 729.

161. See *id.* at 735-36.

162. Richard B. Stewart, *Standing for Solidarity*, 88 YALE L.J. 1559, 1568 n.42 (1979).

163. See John Sinor, *High Sierras Hidden Valley: Enjoying Mineral King Is Worth*

In the area of constitutional rights, Supreme Court decisions make all the difference, as the history of school desegregation,<sup>164</sup> privacy in sexual behavior,<sup>165</sup> and civil rights<sup>166</sup> amply illustrate. The intersection between environmental and constitutional law, however, is slight.<sup>167</sup> Issues of legal standing, federal preemption of state law, and regulatory takings apparently exhaust the constitutional issues in environmental law. Typically, environmental litigation concerns statutory interpretation and implementation; for example, environmental groups often bring actions to compel the Environmental Protection Agency (EPA) to apply more strictly the requirements of statutes such as the Clean Air or Clean Water Acts.<sup>168</sup> In these situations as in most others, however, political realities weigh very heavily, which is the reason that gasoline is still sold in Southern California, for example, even though automobile exhausts contribute to Los Angeles's difficulty in complying with National Ambient Air Quality Standards.<sup>169</sup> Environmental law and policy may take a back seat when things people apparently care more about, such as the freedom to drive, are threatened.

It is easy to understand why political factors weigh heavily in the enforcement of environmental statutes. First, presidents like to be reelected and therefore will try to keep regulatory agencies from imposing burdens that make enemies and cost large numbers of votes. As a result, agencies such as the EPA routinely approve inadequate implementation plans and designate areas

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*the Effort*, SAN DIEGO UNION-TRIB., July 13, 1989, available in 1989 WL 6934407.

164. See, e.g., *Brown v. Board of Educ.*, 347 U.S. 483 (1954).

165. See, e.g., *Griswold v. Connecticut*, 381 U.S. 479 (1965).

166. See, e.g., *Frontiero v. Richardson*, 411 U.S. 677 (1973) (outlawing a military regulation that discriminated based on gender).

167. The weakness of this link has led environmentalists to push for an environmental constitutional amendment. See, e.g., Rodger Schlickeiser, *Protecting Biodiversity for Future Generations: An Argument for a Constitutional Amendment*, 8 TUL. ENVTL. L.J. 181 (1994).

168. See, e.g., *Sierra Club v. EPA*, 992 F.2d 337 (D.C. Cir. 1993).

169. See *L.A. Tops Ozone List, Rates 2nd in Carbon Monoxide*, L.A. TIMES, Aug. 27, 1987, at A1 (noting that even if all cars were taken off the streets the city would still fail the national air standards).



as being in compliance with the law when in fact they are not, allow deadlines to slip, leave violations unmonitored, sign "sweetheart" consent decrees, fail to review various pollutants for safety, and so on, all of which may be the best they can accomplish, given very limited resources and tenuous political backing.<sup>170</sup> Accordingly, article after article appears declaring environmental law precatory, aspirational, and symbolic.<sup>171</sup> Economist George Eads summarized this point: an environmental statute such as the Clean Air Act has become "what I would term a 'policy fiction,' and arguments, intense though they may be, about changing the structure of the act to reflect these accommodations become arguments, at least in part, over the value of maintaining this policy fiction."<sup>172</sup>

Second, members of Congress also like to be reelected. Congress, therefore, tends to postpone, weaken, or make exceptions to laws that become onerous.<sup>173</sup> Indeed, environmental law-making can be compared to an experimental process in which statutes, like hypotheses, are tested after enactment and then revised, either officially by Congress or in practice by the agencies, if they prove unpopular.<sup>174</sup> For this reason, the FWS is likely to continue to soft-pedal habitat conservation on private lands as long as landowners remain a significant political force. What the FWS succeeds in accomplishing will depend less on its legal authority, whether sanctioned by Congress or by the

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170. See, e.g., *Abramowitz v. EPA*, 832 F.2d 1071 (9th Cir. 1987).

171. See, e.g., David Schoenbrod, *Goals Statutes or Rules Statutes: The Case of the Clean Air Act*, 30 UCLA L. REV. 740, 783-803 (1983) (attributing the Clean Air Act's implementation problems to the fact that the Act is a "goals statute").

172. George Eads, *The Confusion of Goals and Instruments: The Explicit Consideration of Cost in Setting National Ambient Air Quality Standards*, in *TO BREATHE FREELY: RISK, CONSENT, AND AIR 229* (Mary Gibson ed., 1985).

173. For example, credible threats by the courts to force the EPA to respond to the Delaney Amendment, which involved the regulation of food additives, Pub. L. No. 85-929, 72 Stat. 1784 (1958), after decades of failure in implementing it, led Congress to repeal it quickly. See Margaret Kriz, *A Peace Treaty over the Delaney Clause*, 28 NAT'L J. 1642 (1996). Its replacement, the Food Quality Protection Act, Pub. L. No. 104-170, 1996 U.S.C.A.N. (110 Stat. 1489), provides a workable political compromise likely to control risks from pesticides far better than the previous aspirational, but nearly useless, statutory contraption.

174. Guido Calabresi has suggested that courts treat all statutes as they treat the common law. See GUIDO CALABRESI, *A COMMON LAW FOR THE AGE OF STATUTES* 82 (1982).

courts, than on how skillfully public officials go about enforcing the ESA.<sup>175</sup>

The enactments of legislatures and the pronouncements of courts are hardly the only, and often they are not the most significant, factors determining environmental outcomes.<sup>176</sup> In the wake of its victory in *Pennsylvania Coal Co. v. Mahon*,<sup>177</sup> as this Article has noted, the coal industry did not undermine cities and towns in Pennsylvania. Similarly, in the wake of *Sierra Club v. Morton*,<sup>178</sup> Disney did not bulldoze Mineral King. Neither Pennsylvania Coal nor Disney Enterprises would risk actions so fraught with public hostility. These instances suggest that even in the absence of a clear theory either of legal standing or of regulatory takings, society can work out reasonable compromises in the context of political bargaining. A principled doctrine of takings, indeed, may be worse than useless because it might undercut a political process capable of accommodating both public and private interests. The Supreme Court should eschew such a principled legal theory to govern takings for fear of skewing—or even destroying—this healthful political give and take.

### III. THE POINTLESSNESS OF THEORY

The litigation over Mineral King came at an important juncture in the scholarly study of administrative law. The doctrine of standing to sue had long been the subject of a meticulous and technical legal scholarship relating to the ability of judges to manage their case loads by determining when litigants, particu-

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175. Charles Mann and Mark Plummer argue persuasively that the political sensitivity of governmental agents, whether they evoke a willingness to cooperate or feelings of hostility, counts as one of the most important factors contributing to the success or failure of the ESA. See MANN & PLUMMER, *supra* note 131, at 212-38.

176. Critics accuse national environmental organizations of being so focused on the political process in Washington, D.C. that they neglect or actually compete against local environmental groups whose grass-roots, result-oriented work is far more influential and effective. For a good and persuasive example of this literature, see generally DONALD SNOW, *INSIDE THE ENVIRONMENTAL MOVEMENT: MEETING THE LEADERSHIP CHALLENGE* (1992).

177. 260 U.S. 393 (1922).

178. 405 U.S. 727 (1972).

larly citizen groups, properly were positioned to represent the issues they sought to argue in court. The traditional scholarship concerning legal standing, of which the late Professor Louis Jaffe's *Standing to Secure Judicial Review: Public Actions* is one of the finest examples, sought to tease out from a long history of cases a series of principles or concepts "deeply rooted in our common law constitutional heritage" that are "inherited from the past and continuously in the process of revision."<sup>179</sup> This scholarship did not intend to set the legal doctrine of standing on philosophical or metaphysical grounds by deriving it from an a priori theory of the "Person" and the "State." On the contrary, this legal scholarship sought to clarify a long practice by which courts controlled their dockets by assuring that those who brought a case were appropriate advocates for the issues involved.<sup>180</sup>

#### A. *The Search for a Theoretical Fix*

The essence of legal scholarship of this traditional kind is to cultivate from the lore of past decisions and legal analysis a vocabulary rich enough to encompass important distinctions and to train one's perceptions to the relevant facts in current controversies. This method of case study and analysis does not deduce relevant principles or decisional rules from higher a priori theories of metaphysics, morality, economics, or justice. Rather, it seeks to show why certain decisions made sense in the circumstances in which they arose, and thus attempts to provide an inductive basis on which courts may respond to relevantly similar circumstances today.

In the early 1970s, following a dissenting remark by Justice Douglas in *Sierra Club v. Morton*,<sup>181</sup> several law professors started to write about the question of standing not in the context

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179. Louis L. Jaffe, *Standing To Secure Judicial Review: Public Actions*, 74 HARV. L. REV. 1265, 1267-68 (1961); see generally Raoul Berger, *Standing To Sue in Public Actions: Is It a Constitutional Requirement?*, 78 YALE L.J. 816 (1969) (discussing common law principles of standing).

180. See Jaffe, *supra* note 179, at 1267.

181. 405 U.S. 727, 741-42 (1972) (Douglas, J., dissenting) ("Contemporary public concern for protecting nature's ecological equilibrium should lead to the conferral of standing upon environmental objects to sue for their own preservation.").

of traditional legal scholarship, but as an occasion to speculate about mankind's relationship to nature.<sup>182</sup> In the law schools during the 1970s, a younger generation of professors who had grown up in the shadow of the great legal scholarship of the 1950s and early 1960s found in philosophy, as they understood it, a way to strike out on their own. The question of whether trees, animals, or rivers, might have legal standing presented an opportunity for law professors to philosophize about the moral significance of animals and other objects of nature.<sup>183</sup> This literature had an immediate cachet and popularity. In resolving long-standing problems by invoking high philosophical concepts and principles, it seemed so much more profound than the kind of legal analysis that preceded it. At the same time, it provided a sharp theoretical sword with which to cut through the tangle of complex legal doctrine associated with the historical accretion of case law.

The sea change from meticulous and patient analysis of cases to instant philosophical revelation that characterized the discussion of legal standing in the 1970s exemplified trends in legal scholarship and education generally. From the 1870s to nearly a century later, legal education committed itself to the historical study of the development of the common law tradition.<sup>184</sup> "Confronted with a mass of judicial decisions extending back in time for over five hundred years," Bruce Ackerman has written, "both law student and law professor were understood to be engaged in the larger enterprise of discovering the fundamental legal order concealed within the welter of judge-made case law."<sup>185</sup> The point of the study of law was to trace the evolution of relevant concepts and principles and to ensure that as they continued to evolve they retained the incremental wisdom of judge-made law.

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182. See, e.g., Laurence H. Tribe, *Ways Not To Think About Plastic Trees: New Foundations for Environmental Law*, 83 YALE L.J. 1315 (1974).

183. See, e.g., Christopher D. Stone, *Should Trees Have Standing?—Toward Legal Rights for Natural Objects*, 45 S. CAL. L. REV. 450 (1972).

184. See BRUCE A. ACKERMAN, *ECONOMIC FOUNDATIONS OF PROPERTY LAW* vii (1975).

185. *Id.*

In the later 1960s, however, law students and professors began to lose patience with this traditional method of legal analysis. The demanding nature of this kind of legal scholarship is not the only reason that the coming of age in the 1970s generation abandoned it. Equally important was the critique, advanced by legal realists such as Jerome Frank and then by the Critical Legal Studies movement, that "deconstructed" property and other bodies of law by redescribing them as outcome-based expressions of power and hegemony.<sup>186</sup> The strident political debates of the 1960s and 1970s, moreover, could not wait for scholars to examine the intricacies of particular cases. The problem was not to understand the legal heritage but to change it.

Albert Hirschman has argued that the rush to theory, like the quest for certainty decried by philosopher John Dewey,<sup>187</sup> characterized the mood of the 1970s.<sup>188</sup> According to Hirschman:

Several factors are responsible for the compulsion to theorize, which is often so strong as to induce mindlessness. In the academy, the prestige of the theorist is towering. Further, extravagant use of language intimates that theorizing can rival sensuous delights: what used to be called an interesting or valuable theoretical point is commonly referred to today as a "stimulating" or even "exciting" theoretical "insight." Moreover, insofar as the social sciences in the United States are concerned, an important role has no doubt been played by the desperate need, on the part of the hegemonic power, for shortcuts to the understanding of multifarious reality that must be coped with and controlled and therefore be understood at once.<sup>189</sup>

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186. See generally JEROME FRANK, *LAW AND THE MODERN MIND* (Peter Smith 1970) (1930) (advocating legal realism); John Blatt, *American Legal Populism: A Jurisprudential and Historical Narrative, Including Reflections on Critical Legal Studies*, 22 N. KY. L. REV. 651, 658 (1995) (discussing how Critical Legal Studies "insists that law floats in a power medium").

187. See generally JOHN DEWEY, *THE QUEST FOR CERTAINTY* (Capricorn Books 1960) (1929) (criticizing man's desire to obtain "absolute certainty").

188. See Albert O. Hirschman, *The Search for Paradigms As a Hindrance to Understanding*, in *INTERPRETIVE SOCIAL SCIENCE* 163-79 (Paul Rabinow & William M. Sullivan eds., 1979).

189. *Id.* at 163-64.

Hirschman noted that those who are adept in what is perceived to be the correct theory have an instant claim to power, because they know what it implies, whether economic, ecological, political, or constitutional theory is in question. Accordingly, it is normal for academics to criticize judges, regulators, and other public officials who are too benighted to draw the appropriate inferences from the appropriate first principles.

Hirschman explained that:

Interestingly enough, revolutionaries experience the same compulsion: while they are fond of quoting Marx to the approximate effect that interpreting the world is not nearly as important as changing it, they are well aware of the enormous strength that is imparted to revolutionary determination by the conviction that one has indeed fully understood social reality and its "laws of change." As a result of these various factors, the quick theoretical fix has taken its place in our culture alongside the quick technical fix.<sup>190</sup>

### *B. Is Law Deducible?*

In legal education by the 1970s, as Bruce Ackerman concluded, courses in property law, like the legal curriculum generally, had become "skeptical of the effort to solve fundamental problems of social conflict by seeking to rework the historical Common Law Tradition in the modest, interstitial ways" tolerated by the analysis of cases.<sup>191</sup> The times seemed to demand a general theory of the law that could justify radical social change and empower academics as policymakers. As a consequence, academic philosophers, lawyers, economists, and others wrote about law in courts from the point of view of extralegal theory rather than from the perspective of the legislative or judicial record.<sup>192</sup> Legislative and judicial decisions were held to be correct or mistaken insofar as they conformed with a theory rather than the other

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190. *Id.*

191. *See* ACKERMAN, *supra* note 184, at ix.

192. *See id.*

way around.

Law professors who wrote about takings jurisprudence in the 1970s similarly divided among those who derived legal doctrine in traditional ways from ordinary moral intuitions and judicial experience, and those who deduced it from higher philosophical or scientific theories about the nature of the law, humanity, or the universe.<sup>193</sup> In a book published in 1977 that retains its relevance, Bruce Ackerman described this divergence between "Ordinary Observers" and "Scientific Policymakers."<sup>194</sup> An "Ordinary Observer" believes that legal concepts, such as "property," "taking," and "harm," have plain meanings in "Ordinary" language and that a judge or legal analyst of this type "is not only devoted to the use of Ordinary language; he is—as an Observer—committed to selecting those rules which ordinary analysis reveals to best support the expectations generated by *dominant* social institutions."<sup>195</sup> These expectations will comprise a list of ad hoc concerns familiar in takings jurisprudence today, for example, questions of whether the government physically occupies the plaintiff's land or deprives it of all economic use.

In the spirit of the "Ordinary Observer," judges may ask whether the regulation at issue prevented a nuisance cognizable at common law. Was a politically powerless group or minority singled out to bear a social burden? Are the conditions imposed on development suitably related to the problems that the development may otherwise cause? These and other familiar questions ground a familiar and predictable, if ad hoc and case-specific, takings jurisprudence. This approach makes no attempt to deduce judicial decisions from higher, deeper, or more general conceptions of property or of justice.

A "Scientific Policymaker," in contrast, "conceives the distinctive constituents of legal discourse to be a set of technical concepts whose meanings are set in relation to each other by clear definitions . . ."<sup>196</sup> According to Ackerman, those who appeal to scientific analysis "understand the legal system to contain, in

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193. See BRUCE A. ACKERMAN, PRIVATE PROPERTY AND THE CONSTITUTION 1-22 (1977).

194. See *id.*

195. *Id.* at 95.

196. *Id.* at 10.

addition to rules, a relatively small number of general principles describing the abstract ideals that the legal system is understood to further.<sup>197</sup> Ackerman called this set of principles, which are presumed to form a consistent logical whole, a "Comprehensive View." The "Scientific Policymaker" assumes that legislative and judicial actions will be justified in relation to this "View" or not at all.<sup>198</sup>

In the legal scholarship surrounding takings jurisprudence, "Comprehensive Views" abound, and legal scholarship is the richer for them.<sup>199</sup> These include the efficiency norm proposed by Richard Posner,<sup>200</sup> the libertarian ideal set forth by Richard Epstein,<sup>201</sup> the natural rights theory advocated by Ellen Frankel Paul,<sup>202</sup> the Benthamite conservatism of Justice Scalia,<sup>203</sup> the "public rights" and "public trust" doctrines described by Professor Joseph Sax and others,<sup>204</sup> a utilitarian or

197. *Id.* at 11.

198. *See id.* at 11-12.

199. For a general review of many of these "Comprehensive Views," see Thomas A. Hippler, *Reexamining 100 Years of Supreme Court Regulatory Taking Doctrine: The Principles of "Noxious Use," "Average Reciprocity of Advantage," and "Bundle of Rights," from Mugler to Keystone Bituminous Coal*, 14 B.C. ENVTL. AFF. L. REV. 653 (1987). *See also* PLANNING WITHOUT PRICES (Bernard H. Siegan ed., 1977) (discussing the economics of the Takings Clause).

200. *See* RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* (4th ed. 1992).

201. *See* EPSTEIN, *supra* note 36. For an appreciation of the implications of Epstein's argument, see Gerald Torres, *Taking and Giving: Police Power, Public Value, and Private Right*, 26 ENVTL. L. 1, 6 (1996) ("He would, in essence, make every governmental action subject to common-law tort analysis and expand governmental liability to include those actions that have traditionally been considered legitimate regulatory exercises of the police power.").

202. *See* PAUL, *supra* note 66, at 266.

[W]e ought to limit eminent domain to a narrow range of strictly public uses: highways, post offices, government buildings, courthouses, and the like. And the police power ought to be confined to essential regulations to protect the public health and safety. If it is used more expansively, injured owners should receive compensation.

*Id.*

203. *See* Antonin Scalia, *The Rule of Law as a Law of Rules*, 56 U. CHI. L. REV. 1175, 1185 (1989).

204. *See* Joseph L. Sax, *Takings, Private Property and Public Rights*, 81 YALE L.J. 149, 150-51 (1971) (proposing that what was "formerly deemed a taking is better seen as an exercise of the police power in vindication of what shall be called 'public



cost-benefit approach endorsed in an early article by Frank Michelman,<sup>205</sup> and various conceptions intended to limit the government's advantage as property holder,<sup>206</sup> extend the concept of "average reciprocity of advantage"<sup>207</sup> over a larger political and ecological landscape,<sup>208</sup> introduce a multifaceted economic balancing test,<sup>209</sup> interpret the Founders' original intent,<sup>210</sup> not to mention various "Comprehensive Views" of deep ecologists<sup>211</sup> and environmentalists concerned with the fate of the earth.<sup>212</sup>

The problem with "Comprehensive Views" associated with "Scientific Policymaking" is that there are so many of them. This problem arises in relation not only to takings jurisprudence but

rights" in view of the interconnectedness of land uses); see also Gary D. Meyers, *Variation on a Theme: Expanding the Public Trust Doctrine to Include Protection of Wildlife*, 19 ENVTL. L. 723, 727 (1989) (arguing for an expansive version of the "public trust" doctrine).

205. See Michelman, *supra* note 29, at 1211-15.

206. See, e.g., William B. Stoebuck, *Police Power, Takings, and Due Process*, 37 WASH. & LEE L. REV. 1057, 1093 (1980) (stating that "[a] police power regulation on land-use is an eminent domain taking only when its effect is specially directed toward benefitting a governmental entity in the use of land in which that entity holds incidents of ownership").

207. *Pennsylvania Coal Co. v. Mahon*, 260 U.S. 393, 415 (1922) (discussing the power of the state to impose borders on property); *Jackman v. Rosenbaum Co.*, 260 U.S. 22, 30 (1922).

208. See Raymond R. Coletta, *Reciprocity of Advantage and Regulatory Taking: Toward a New Theory of Takings Jurisprudence*, 40 AM. U. L. REV. 297, 303 (1990) (arguing that "the term 'average reciprocity of advantage' should be applied expansively rather than narrowly"). The reason that property owners may receive some benefit from environmental laws that limit the ways in which they may use their property is not simply that they have the advantages of living in civil society; it is more specific: environmental regulations under the ESA actually can raise the value of the property landowners might develop. See, e.g., David J. Russ, *How the "Property Rights" Movement Threatens Property Values in Florida*, 10 J. LAND-USE & ENVTL. L. 395, 436 (1994) (contending that environmental regulation has occurred alongside and promoted economic growth in Florida).

209. See generally John J. Costonis, *Presumptive and Per Se Takings: A Decisional Model for the Taking Issue*, 58 N.Y.U. L. REV. 465, 501-23 (1983) (analyzing the strengths and weaknesses of different decisional models for the takings issue).

210. See, e.g., Glenn Harlan Reynolds, *Sex, Lies and Jurisprudence: Robert Bork, Griswold and the Philosophy of Original Understanding*, 24 GA. L. REV. 1045 (1990).

211. See, e.g., Bill Devall, *The Deep Ecology Movement*, 20 NAT. RESOURCES J. 299 (1980); cf. BILL DEVAL & GEORGE SESSIONS, *DEEP ECOLOGY* 67-69 (1985) (arguing for species equality).

212. See Hunter, *supra* note 29.

also in relation to a raft of other legal controversies implicating virtually any area of law. Libertarians, utilitarians, egalitarians, and others propose "foundations" for various areas of the law; they disagree not only with each other but also with those in the realist tradition, economic determinists, and environmental catastrophists. The resulting controversies provide course materials for those who find interesting the philosophical theories, first principles, and "Comprehensive Views" in terms of which academic lawyers and others most impressively second-guess the behavior of judges and legislatures. These alternative foundations for environmental law, property law, liability law, and so on, moreover, may go beyond academic journals to influence political culture and, in that way, the life of the law.

Many theorists who promote "Comprehensive Views" have the judiciary in mind as the principal audience for their arguments. Those holding "Comprehensive Views" should direct their message, at least in their own imaginations if not in fact, equally to legislatures. In a democracy, the choice among competing fundamental doctrines is more often a political choice than a judicial one. The judiciary must see that the political process is open and neutral so that everyone with an ideology, from libertarians and natural rights theorists to deep ecologists, gets a fair hearing. It would be a fearful usurpation of the democratic political processes if the courts showed any favoritism among these fundamental theories or, especially, if they gave a victory to any theory in advance. Intuitively, judicial activism on behalf of any legal theory, whether it be natural law, law and economics, or ecological economics, would be antidemocratic. Once such a "Comprehensive View" received a constitutional blessing by the Court, administration could take the place of both legislation and litigation, with the resulting withering away of the State.

### *C. A Collision of Views, Not a Conflict of Interests*

If there were only one "Comprehensive View," "Scientific Policymakers" easily could replace judges and legislators in making and enforcing regulations, if they could agree among themselves on how to apply their theory. Those who know the

truth—those who understand the nature of justice or the goals of society—could then legitimately claim the power to lead the rest of us. Truth empowers those who possess it to command others until they, too, see the light and in that way attain their own right to share in political power. All that society would need to do, then, is agree on one “Comprehensive” or “Scientific View” of public policy, and then society would not need democracy, judicial review, or the accompanying muddle and mess. Legislators and judges would serve as Plato imagined they should, as Philosopher Kings.<sup>213</sup>

In the United States, no “Comprehensive View” has quite gained the upper hand. Unlike Lenin, Stalin, and other totalitarians, our leaders typically have trouble with the “vision thing.”<sup>214</sup> The problem is not so much that competing economic interests divide Americans. If it were just a matter of those interests, welfare economics, which is one “Comprehensive View,” could provide a way to maximize social well-being. The more fundamental problem, the one that makes democracy for all its shortcomings necessary, lies not in the divergence of our interests but of our opinions. Democracy is the appropriate political system for those who agree to disagree about the normative and conceptual foundations of public policy. That is why the courts should stand ready to upset all the theoretical applecarts brought before them and, as a result, to keep takings law muddled.

Democracy makes sense only in a context of disagreement and inconsistency of opinion; it thrives on the kind of political give and take about policy that can arise only when various “Comprehensive Views” are allowed to compete with each other and perhaps cancel one another out, leaving behind an ad hoc mess or morass. Totalitarian forms of government, in contrast, subsist on consistent theoretical foundations and scientific certainty. Disagreement in a despotic system easily is explained away or prevented, because everyone would agree with the despot but for

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213. See *THE REPUBLIC OF PLATO* (John Llewelyn Davies & David James Vaughan trans., MacMillan & Co. 1950) (suggesting, in Book VI, that the true philosopher is the best guardian of the state).

214. See Godfrey Sperling, *Don't Scrimp on The "Vision Thing,"* CHRISTIAN SCI. MONITOR, Dec. 29, 1992, available in 1992 WL 9873350 (discussing George Bush's comment that he lacked “the vision thing”).

their bourgeois corruption, subordination to hegemonic powers, willful irrationality, contrarian obtuseness to peril, or perverse failure to understand the true nature of the common will. Thus, those who possess the correct "View," whatever it is (and they know who they are), can dismiss dissent as ignorance and insist that the elegant certainty, exigency, or self-evidence of their theory endows them with the right to govern. If the Court would only listen to them, it would end the chaos and conflict inherent in democracy and, derivatively, in the doctrine of takings and other muddled areas of jurisprudence.

It is against the introduction of "Comprehensive Theory" in liberal conceptions of justice that many philosophers, most notably John Rawls, have persuasively argued. Rawls contended that the conception of justice in a constitutional democracy "should be, so far as possible, independent of controversial philosophical and religious doctrines."<sup>215</sup> This principle presumably would free constitutional democracy, at its foundation, from every "Comprehensive View," including natural rights theory, utilitarianism, libertarianism, efficiency maximization, deep ecology, the land ethic, and other principled and consistent approaches that grace the scholarly literature on the takings question, each of which is almost certainly correct.

A conception of justice consistent with democracy, which avoids "scientific" or "comprehensive theories," focuses instead on the structure of social and political processes and institutions, to assure their openness and fairness, so that people of different ideological persuasions can try to convert each other under terms congenial and equitable to all.<sup>216</sup> Liberalism asserts this priority of politics over metaphysics even if the "Comprehensive" or "Scientific Theory" known to the vanguard philosophical party really is correct. A conception of justice, Rawls wrote, far from determining a moral theory (however correct) in advance of political activity, "must allow for a diversity of doctrines and the

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215. John Rawls, *Justice As Fairness: Political Not Metaphysical*, 14 PHIL. & PUB. AFF. 223, 223 (1985).

216. *See id.*

plurality of conflicting, and indeed incommensurable, conceptions of the good affirmed by the members of existing democratic societies."<sup>217</sup>

Those who have theories of judicial takings to offer deplore the "muddled," "ad hoc," or "chaotic" state of takings jurisprudence.<sup>218</sup> If one is to treat the differences among these theorists as of more than mere academic interest, however, one first must understand why a theory of takings is needed at all. Such a theory is not needed to make judicial outcomes predictable: the current per se or laundry-list approach does that tolerably well. One may predict with confidence that if a land-use

217. *Id.* at 225.

218. *See, e.g.*, PAUL, *supra* note 66, at 188.

Virtually everyone admits that this area of the law is in a chaotic state. The time seems right to address the fundamental cause of this unfortunate state of affairs. Perhaps an alternative tradition to ad hoc, utilitarian decision making might hold out some hope for resolving this 'muddle.' The tradition I have in mind is . . . that of natural rights.

*Id.*

Paul correctly stated that virtually everyone regards takings jurisprudence as being in a muddle. Joseph Sax may have been the first to emphasize the point. *See* Joseph L. Sax, *Takings and the Police Power*, 74 YALE L.J. 36, 37 (1964) (noting that takings law is "a welter of confusing and apparently incompatible results"); *see also* ACKERMAN, *supra* note 193, at 8 (describing takings law as "a chaos of confused argument"); Daniel A. Farber, *Public Choice and Just Compensation*, 9 CONST. COMMENTARY 279 (1992); John A. Humbach, *A Unifying Theory for the Just-Compensation Cases: Takings, Regulation and Public Use*, 34 RUTGERS L. REV. 243, 244 (1982) (characterizing takings law as "a farrago of fumbings which have suffered too long from a surfeit of deficient theories"); Saul Levmore, *Just Compensation and Just Politics*, 22 CONN. L. REV. 285, 287 (1990); Carol M. Rose, *Mahon Reconstructed: Why the Takings Issue Is Still a Muddle*, 57 S. CAL. L. REV. 561, 562 (1984) (noting the "confusion in takings analysis"); Arvo Van Alstyne, *Taking or Damaging by Police Power: The Search for Inverse Condemnation Criteria*, 44 S. CAL. L. REV. 1, 2 (1971) ("With some exceptions, the decisional law is largely characterized by confusing and incompatible results, often explained in conclusory terminology, circular reasoning, and empty rhetoric."); Charles R. Wise, *The Changing Doctrine of Regulatory Taking and the Executive Branch: Will Takings Impact Analysis Enhance or Damage the Federal Government's Ability To Regulate?*, 44 ADMIN. L. REV. 403, 410 (1992) ("In doing their balancing act, the courts employ no clear standard in weighing the factors.").

Several commentators have tried to read *Lucas* as an attempt to base takings jurisprudence on a set of consistent philosophical principles. *See, e.g.*, Barry M. Hartman, *Lucas v. South Carolina Coastal Council: The Takings Test Turns a Corner*, 23 *Envtl. L. Rep.* (Envtl. L. Inst.) 10,003, 10,004-05 (Jan. 1993) (arguing that the Court in *Lucas* moved from a "policy-based," ad hoc standard to a more objective, principled approach).

regulation suffers from none of the defects on that well-known list, the plaintiff will lose an action for inverse condemnation. Lawyers advising clients whose land value has been diminished by regulation can give them guidance on the basis of this handful of *per se* rules, telling them, for example, that even in the absence of theory, "our constitutional culture" will require compensation when regulations eliminate all economically valuable use of land.<sup>219</sup>

The mere fact that academic lawyers and other experts disagree about the theoretical foundations of takings law hardly amounts to a crisis of legitimacy in environmental policy and jurisprudence. Indeed, no one questions the legitimacy of legislatures to make laws protecting the natural environment, regulatory agencies to be flexible and sensible in applying those laws, individuals to organize to change those laws if they are too onerous, and judges to decide cases in which the regulatory applications of these laws are challenged. Five hundred years of legal and political tradition and experience sufficiently establish that kind of legitimacy, if anyone ever doubted it.

The need for theory seems to be more an academic crochet than an institutional requirement or a social responsibility. "From the Observer's point of view," as Ackerman has noted, "it seems extraordinary to *begin* analysis by supposing, with the Policymaker, that legal rules ought to satisfy the demands of a Comprehensive View."<sup>220</sup>

#### IV. THE END OF THE ECOSYSTEM

Regardless of whether society needs a theory on which to ground takings jurisprudence, two "Comprehensive" or "Scientific Views" vie for judicial adoption. One of these views, which derives from neoclassical economic theory, proposes that society will prosper to the extent that takings jurisprudence maintains its basis in common law. The expectation that compensation,

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219. See *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1029 (1992).

220. ACKERMAN, *supra* note 193, at 12.

implicit or explicit, will accompany regulatory takings makes it more likely that the benefits of land-use policy to society as a whole will at least equal the costs to private landowners. Without such a constraint, the government will be free to impose costs on landowners far greater than the benefits that accrue to the public, so that society will be worse off as a result.

The opposing "Comprehensive View," which occupies our attention at present, supposes that in regulating land use under section 9 of the ESA, the government does not secure a public benefit but prevents a public harm. According to this "View," the science of ecology has shown that the natural ecosystem or land community possesses both a design and evolutionary direction that supports human life. The structure and function of these biotic communities depend on the diversity of species they contain. Accordingly, by requiring landowners to maintain habitats for these species, the government does not create a compensable taking of property rights. Rather, it protects public rights by preventing the collapse of ecological systems that inevitably would attend the extinction of species.

#### A. *What Is Bad for the Marsh Is Bad for Mankind*

The celebrated case of *Just v. Marinette County*<sup>221</sup> raised the possibility that courts might indeed adopt "Great Chain of Being" ecology as a "Comprehensive View" in applying the Takings Clause of the Fifth Amendment.<sup>222</sup> In *Just*, the Wisconsin Supreme Court offered an unusual rationalization for upholding a local zoning ordinance that prohibited the owners of certain wetlands from using landfill on them unless they obtained a conditional use permit.<sup>223</sup> It is not an unreasonable exercise of the police power, the court wrote, to limit "the use of private property to its natural uses."<sup>224</sup> The Wisconsin court apparently allowed the extension of the nuisance doctrine to rule out all but "natural and indigenous uses" of land absent the required

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221. 201 N.W.2d 761 (Wis. 1972).

222. See *id.* at 767-68; ACKERMAN, *supra* note 193, at 11.

223. See *Just*, 201 N.W.2d at 766.

224. *Id.* at 768.

permit.<sup>225</sup> This finding resembles a slightly later one in New Hampshire, in which the state supreme court, dealing with similar facts, embraced the doctrine that property rights secure only "the normal traditional uses of the marshland including wildlife observation, hunting, haying of marshgrass, clam and shellfish harvesting, and aesthetic purposes."<sup>226</sup> The New Hampshire Supreme Court held that landfill activity was "'bad for the marsh,' and 'for mankind.'"<sup>227</sup>

Many commentators have praised decisions such as *Just, Sibson v. New Hampshire*, and cases with similar outcomes in North Carolina,<sup>228</sup> South Carolina,<sup>229</sup> Florida,<sup>230</sup> and Washington<sup>231</sup> as examples of judicial efforts to "uphold the public's legitimate interest in ecological stability and integri-

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225. *Id.*

226. *Sibson v. New Hampshire*, 336 A.2d 239, 243 (N.H. 1975), *overruled in part by Burrows v. City of Keene*, 432 A.2d 15, 21-22 (N.H. 1981) (holding that if the regulation is not meant to restrain an injurious use of property, then the regulation constitutes an unlawful taking).

227. *Id.* at 240 (quoting N.H. REV. STAT. ANN. § 483-A:1-b (Supp. 1973)). In a more recent case with facts similar to *Sibson*, the New Hampshire Supreme Court reached the same result. See *Rowe v. Town of N. Hampton*, 553 A.2d 1331, 1336 (N.H. 1989). For a discussion of *Rowe* in the context of *Just*, see Freyfogle, *supra* note 43, at 92-94.

228. See *Smithwick v. Alexander*, 17 Env't Rep. Cases (BNA) 2,126 (E.D.N.C. Mar. 20, 1981), *aff'd mem.*, 17 Env't Rep. Cases (BNA) 2,131 (4th Cir. Dec. 15, 1981).

229. See *Carter v. South Carolina Coastal Council*, 314 S.E.2d 327 (S.C. 1984).

230. See *Graham v. Estuary Properties, Inc.*, 399 So. 2d 1374 (Fla. 1981).

231. See *Orion Corp. v. State*, 747 P.2d 1062 (Wash. 1987). In fact, the Washington case may be the most radical. In that case the court held that "[n]o compensable taking can occur as long as regulations substantially serve the legitimate public purpose of prohibiting uses of property injurious to the public interest in health, the environment, or the fiscal integrity of the [state]." *Id.* at 1081. As should be obvious, by making the prohibition of a public nuisance coterminous with protecting the public interest, the Washington Supreme Court eliminated the Fifth Amendment guarantee altogether. A United States Claims Court made this point in another context: "All valid statutes and regulations exist for the public welfare. But the assertion that a proposed activity would be a nuisance merely because Congress chose to restrict, regulate, or prohibit it for the public benefit indicates circular reasoning that would yield the destruction of the fifth amendment." *Florida Rock Indus. v. United States*, 21 Cl. Ct. 161, 168 (1990) (holding that a taking had occurred when the legal requirement that investors have knowledge of restrictions on land had not been met), *vacated*, 18 F.3d 1560 (Fed. Cir. 1994).



ty."<sup>232</sup> Some of these commentators urge an ecological philosophy that opposes the conception of land as property and with it "mankind's moral domination over creation."<sup>233</sup> Others would subsume virtually all property under a "public trust" doctrine by which the public servitude in navigable waterways may "evolve" into an ecological easement on virtually all privately owned land.<sup>234</sup>

Underlying this "Comprehensive View" in takings jurisprudence is the concept of land as a community, an idea attributed to the American conservationist Aldo Leopold early in this century.<sup>235</sup> In a chapter in his book *Sand County Almanac*, entitled "The Land Ethic," Leopold wrote, "[a]ll ethics so far evolved rest upon a single premise: that the individual is a member of a community of interdependent parts."<sup>236</sup> The science of ecology, he then observed, "simply enlarges the boundaries of the community to include soils, waters, plants, and animals, or collectively: the land."<sup>237</sup> Each of these creatures, such as wildflowers and songbirds, Leopold proposed, serves a function in the land community: "these creatures are members of the biotic community, and if (as I believe) its stability depends on its integrity, they are entitled to continuance."<sup>238</sup>

Leopold based his approach on the ecological theory of the time, which borrowed concepts from thermodynamics and regarded nature as a self-regulating complex system adjusting dynamically to change.<sup>239</sup> Leopold did not refer to a balance in

232. Hunter, *supra* note 29, at 311.

233. J. Peter Byrne, *Green Property*, 7 CONST. COMMENTARY 239, 247 (1990); see also Alison Rieser, *Ecological Preservation As a Public Property Right: An Emerging Doctrine in Search of a Theory*, 15 HARV. ENVTL. L. REV. 393 (1991) (surveying various economic theories in an effort to prove why natural resources should be subject to the rights of the public); cf. Carol M. Rose, *Rethinking Environmental Controls: Management Strategies for Common Resources*, 41 DUKE L.J. 1 (1991) (arguing for a broader approach to public property rights).

234. See, e.g., Holmes Rolston III, *Property Rights and Endangered Species*, 61 U. COLO. L. REV. 283 (1990) (developing the concept of "imperfect property rights," involving the landowner as mere "trustee").

235. See LEOPOLD, *supra* note 18, at 203-07.

236. *Id.* at 203.

237. *Id.* at 204.

238. *Id.* at 210.

239. Major texts in this tradition include EUGENE ODUM, *FUNDAMENTALS OF ECOLO-*

nature;<sup>240</sup> rather, he used metaphors suggesting that it formed a dynamic homeostatic mechanism.<sup>241</sup> Even today, many environmentalists, such as those associated with the field of "ecological economics," argue that the principles of thermodynamics, particularly the law of entropy, place inexorable limits on economic growth.<sup>242</sup>

Leopold distinguished between the short-term financial and the long-term ecological uses of land to argue that the latter are most important and must be maintained even when they conflict with the profit motive.<sup>243</sup> "To sum up," he wrote,

a system of conservation based solely on economic self-interest

GY (1st ed. 1953); Raymond L. Lindeman, *The Trophic-Dynamic Aspect of Ecology*, 23 *ECOLOGY* 399 (1942); A.G. Tansley, *The Use and Abuse of Vegetational Concepts and Terms*, 16 *ECOLOGY* 284 (1935).

240. See LEOPOLD, *supra* note 18, at 214. Questioning the then-commonplace notion of the "balance of nature," Leopold wrote that "this figure of speech fails to describe accurately what little we know about the land mechanism." *Id.*

241. See *id.* at 216-18. In fact, Leopold favored metaphors borrowed from electrical engineering to describe the dynamic flows and self-regulating systems he found in nature. See *id.* Evolution, he wrote, "is a long series of self-induced changes, the net result of which has been to elaborate the flow mechanism and to lengthen the circuit." *Id.* at 216-17. For commentary, see J.B. CALLICOTT, IN DEFENSE OF THE LAND ETHIC 65 (1983).

242. See, e.g., Herman E. Daly, *Entropy, Growth, and the Political Economy of Scarcity*, in SCARCITY AND GROWTH RECONSIDERED 69 (V.K. Smith ed., 1979) (arguing that because we are eroding low-entropy energy and matter, particularly, low-entropy terrestrial resources, "nature really does impose an inescapable general scarcity" and it is a "serious delusion to believe otherwise"). Ecological economists use the concept of "entropy" in various senses. As the concept occurs in thermodynamics, it has to do with energy. See RANDOM HOUSE UNABRIDGED DICTIONARY 650 (2d ed. 1987). But Kenneth Boulding, for example, has proposed that "[m]aterial entropy can be taken as a measure of the uniformity of the distribution of elements and, more uncertainly, compounds and other structures on the earth's surface." Kenneth Boulding, *The Economics of the Coming Spaceship Earth*, in VALUING THE EARTH: ECONOMICS, ECOLOGY, ETHICS 297, 301 (Herman E. Daly & Kenneth N. Townsend eds., 1993). Mainstream economists, although agreeing that all systems must import energy, reply that the sun provides a practically inexhaustible external subsidy to the economy. As Kenneth Townsend has said, "the spontaneous flow of energy on earth from low- to high-entropy states may be offset by solar flow." Kenneth N. Townsend, *Is Entropy Relevant to the Economics of Natural Resource Scarcity?*, 23 *J. ENVTL. ECON. & MGMT.* 96, 98 (1992).

243. See LEOPOLD, *supra* note 18, at 210-14.

is hopelessly lopsided. [Such a system] tends to ignore, and thus eventually to eliminate, many elements in the land community that lack commercial value, but that are (as far as we know) essential to its healthy functioning. It assumes, falsely, I think, that the economic parts of the biotic clock will function without the uneconomic parts. It tends to relegate to government many functions eventually too large, too complex, and too widely dispersed to be performed by government.<sup>244</sup>

Citing passages such as this, commentators have criticized current federal takings jurisprudence for rejecting "Leopold's more ecologically coherent view of land and perpetuat[ing] a relationship between people and land defined solely by exploitation."<sup>245</sup> These commentators call for a shift toward a land ethic that "changes the role of homo sapiens from conqueror of the land community to plain member and citizen of it . . . [and] implies respect for his fellow members, and also for the community as such."<sup>246</sup> These analysts favor the outcomes reached in state court decisions such as *Just v. Marinette County*,<sup>247</sup> *Sibson v. State of New Hampshire*,<sup>248</sup> and *Graham v. Estuary Properties, Inc.*,<sup>249</sup> which "emphasize the obligation of stewardship of the land, rather than the rights of ownership."<sup>250</sup> These decisions construe statutes that restrict land to its natural uses as continuous with laws intended to control pollution and to prevent harm to the public. Under this view, statutes like the ESA and section 404 of the Clean Water Act,<sup>251</sup> which protects wetlands, are intended to prevent public harms rather than to provide public goods, and so they qualify for the nuisance exception to the Fifth Amendment's Takings Clause.

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244. *Id.* at 214.

245. Hunter, *supra* note 29, at 334.

246. Gary D. Meyers, *Old-Growth Forests, the Owl, and Yew: Environmental Ethics Versus Traditional Dispute Resolution Under the Endangered Species Act and other Public Lands and Resources Laws*, 18 B.C. ENVTL. AFF. L. REV. 623, 658 (1991) (alteration in original) (quoting LEOPOLD, *supra* note 18, at 204).

247. 201 N.W.2d 761 (Wis. 1972).

248. 336 A.2d 239 (N.H. 1975).

249. 399 So. 2d 1374 (Fla. 1981).

250. Meyers, *supra* note 246, at 658 (citing Hunter, *supra* note 29, at 319).

251. See 33 U.S.C. § 1341 (1994).

### B. Ecology as a "Comprehensive View"

Among commentators favoring the Leopoldian approach, Joseph Sax argued that the Court in *Lucas* should not have restrained "the emerging view of land as a part of an ecosystem, rather than as purely private property . . ." <sup>252</sup> In Sax's view, Justice Scalia, seeing that *Lucas* presented "a new, fundamental issue in property law, . . . had a clear message which he sought to convey: States may not regulate land-use solely by requiring landowners to maintain their property in its natural state as part of a functioning ecosystem . . ." <sup>253</sup> To keep states from turning biology into law at the expense of property rights, the Court in *Lucas*, Sax argued, "repudiate[d] the conclusion of *Just*, and instead effectively reverse[d] the Wisconsin court's conclusion that 'it is not an unreasonable exercise of [police] power to prevent harm to public rights by limiting the use of private property to its natural uses'." <sup>254</sup>

The court in *Lucas*, according to Sax, "correctly perceive[d] that an ecological worldview presents a fundamental challenge to established property rights, but the Court incorrectly reject[ed] that challenge." <sup>255</sup> Sax believes that the Court decided wrongly: it should have grafted the Leopoldian land ethic on takings jurisprudence. <sup>256</sup> The Court, in other words, should

252. Joseph L. Sax, *Property Rights and the Economy of Nature: Understanding Lucas v. South Carolina Coastal Council*, 45 STAN. L. REV. 1433, 1438 (1993).

253. *Id.*

254. *Id.* at 1440 (alteration in original) (quoting *Just v. Marinette County*, 201 N.W.2d 761, 768 (Wis. 1972)); see *id.* at 1446 (adding that *Lucas* represents "the Court's rejection of pleas to engraft the values of the economy of nature onto traditional notions of the rights of land ownership").

255. *Id.* at 1439. In another article, Professor Sax insightfully pointed out that "[t]he ecological truism that everything is connected to everything else may be the most profound challenge ever presented to established notions of property." Joseph L. Sax, *The Constitutional Dimensions of Property: A Debate*, 26 LOY. L.A. L. REV. 23, 32 (1992).

256. See Sax, *supra* note 252, at 1446; see also Meyers, *supra* note 246, at 661 ("Application of an environmental ethic requires greater reliance by decisionmakers on the ecological and biological sciences. We need to decide what level of biodiversity is 'enough' and remove the discretion from federal land and resource management statutes to encroach on that 'minimum' level needed for ecosystems to survive.").

have deemed regulations requiring landowners to maintain the natural characteristics of their land as preventing a public harm rather than as providing a public good.<sup>257</sup> Landowners would not receive compensation, then, even when ecologically based laws, such as the ESA, deny them the entire economic use of their property.

The Court, in *Lucas*, emphatically refused to define "nuisance" in terms of a change in the functioning of an ecosystem; it applied to ecologically inspired regulations the same kinds of *per se* tests that characterize its takings jurisprudence in general.<sup>258</sup> Was the Court wrong to reject this fundamentally new legal basis of land-use regulation? Should it in the future follow *Sax* in allowing a Leopoldian land ethic to become a basis for defining a takings-proof land-use regulatory system?<sup>259</sup>

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257. See, e.g., Eric T. Freyfogle, *Ownership and Ecology*, 43 CASE W. RES. L. REV. 1269 (1993); see also Paul Sarahan, *Wetlands Protection Post-Lucas: Implications of the Public Trust Doctrine on Takings Analysis*, 13 VA. ENVTL. L.J. 537, 543 (1994) (arguing that noncompensable regulation of wetlands, even after *Lucas*, may be justifiable when "premised on the public trust doctrine, and buttressed by scientific data and the state's common law of public nuisance").

258. See *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1015-16 (1992). Many commentators, agreeing with *Sax*, have made the point that in *Lucas* the Supreme Court carefully limited the nuisance exemption to those harms cognizable at common law. See, e.g., Ann T. Kadlecck, Note, *The Effect of Lucas v. South Carolina Coastal Council on the Law of Regulatory Takings*, 68 WASH. L. REV. 415, 430-31 (1993) (arguing that after *Lucas* the nuisance exception will apply only to common law nuisances). Michael Greve also has argued persuasively that in *Lucas* "the Court held that if a regulation deprives an owner of all economically viable use of his land, the state must pay compensation unless the regulation restricts permissible uses no further than the state's common law of nuisance would have permitted when the challenged regulation was enacted." MICHAEL S. GREVE, *THE DEMISE OF ENVIRONMENTALISM IN AMERICAN LAW* 23 (1996).

259. This inquiry poses two questions. The first question asks whether ecology and related sciences provide a reasonable basis by which one may assert that anyone who destroys the habitat of an endangered species thereby threatens economic damage to his neighbors or to the public at large, or threatens them injury of a kind cognizable at common law. The second question asks whether legislatures can determine what qualifies as a "nuisance" as far as takings jurisprudence is concerned, thereby practically assuring that virtually any land-use regulation will prevent a "nuisance" or "harm," as defined by the legislature. Justice Stevens apparently believes that legislatures should have the power to preempt common law, as it were, by defining new conceptions of harm.

The Court's holding today effectively freezes the State's common law, denying the legislature much of its traditional power to revise the law governing the rights and uses of property. . . . Arresting the development

What is disputed, of course, is not the legitimacy of the ESA or of other laws that protect nature. The public has every right to act to protect species for the reasons stated by the ESA, namely, their "esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people."<sup>260</sup> The dispute, like most others involving regulatory takings, centers on who should pay for carrying out the noble purposes of the law the public as a whole, by compensating private landowners, or the landowners themselves.<sup>261</sup> Specifically, the ESA raises the question whether the destruction of habitat, or of any ecological service or good on one's own land, can be considered a "nuisance" to one's neighbors. If so, regulations protecting habitat will not constitute takings under the law.<sup>262</sup>

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of the common law is not only a departure from our prior decisions; it is also profoundly unwise. The human condition is one of constant learning and evolution—both moral and practical. Legislatures implement that new learning; in doing so they must often revise the definition of property and the rights of property owners. Thus, when the Nation came to understand that slavery was morally wrong and mandated the emancipation of all slaves, it, in effect, redefined "property." On a lesser scale, our ongoing self-education produces similar changes in the rights of property owners: New appreciation of the significance of endangered species; the importance of wetlands; and the vulnerability of coastal lands, shapes our evolving understandings of property rights.

*Lucas*, 505 U.S. at 1069-70 (Stevens, J., dissenting) (citations omitted); see also *infra* notes 266-68 and accompanying text (discussing Justice Blackmun's dissent). For discussion, see John A. Humbach, *Evolving Thresholds of Nuisance and the Takings Clause*, 18 COLUM. J. ENVTL. L. 1, 10 (1993) ("The notion that nuisance law can provide a suitable exogenous anchor for takings law is unrealistic. Far from being a likely source of definition or scope, the common law of nuisance is itself an 'impenetrable jungle.'").

260. 16 U.S.C. § 1531(a)(3) (1994).

261. Every reason exists to suppose that the government will achieve greater success by engaging in a voluntary, incentive-based approach to habitat preservation than by trying to coerce landowners to preserve habitats. The issue under discussion here however, concerns the legitimacy, not the effectiveness, of schemes that do not compensate. For discussion of the many advantages gained by using voluntary, incentive-based approaches, see David Farrier, *Conserving Biodiversity on Private Land: Incentives for Management or Compensation for Lost Expectations?*, 19 HARV. ENVTL. L. REV. 303 (1995).

262. One might plausibly propose that not much hangs on this question. After all, even if regulations under the ESA, in light of *Lucas*, will not enjoy the status of

This question goes to the heart of the disagreement that Justice Blackmun presented in his dissent in *Lucas*.<sup>263</sup> Writing for the majority, Justice Scalia sought to limit the reach of the nuisance exception to what can be grasped within "the restrictions that background principles of the State's law of property and nuisance already place upon land ownership."<sup>264</sup> Justice Scalia apparently did not share Aldo Leopold's view of the land as a natural community, any changes to which should be assumed to be detrimental to mankind.<sup>265</sup> Instead, he may have believed that changes to the land, such as the construction of the beautiful avenues in Boston's Back Bay in place of a malarial swamp, or the Jefferson Memorial on a tidal backwater, are not necessarily so bad for mankind that they should be held to constitute a prima facie nuisance.

Justice Blackmun did not disagree with Justice Scalia's dismissal of Leopoldian science. He suggested, however, that legislatures that enact land-use regulation may themselves determine what counts or does not count as a public harm.<sup>266</sup> Justice Blackmun advised that given the absence of an objective, value-free, nonpolitical criterion to define what constitutes a nuisance, the determination has to rest either with the legislature or with the judiciary.<sup>267</sup> Why should the judiciary claim the authority to decide? According to Justice Blackmun, "[i]n determining what is a nuisance at common law, state courts

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preventing nuisances, they still will count as serving a legitimate public purpose. For example, the Court of Appeals for the Sixth Circuit in *Hill v. Tennessee Valley Authority*, 549 F.2d 1064 (6th Cir. 1977), *aff'd*, 437 U.S. 153 (1978), praised the ESA and held that the "public conscience" likely may believe that the protection of endangered species is more important than requiring a company to write off a few million dollars already spent. *See id.* at 1074. Accordingly, regulations restricting the alteration of habitat under section 9 of the ESA would require compensation only if they eliminated all economic use of the land or contravened some other per se provision established by the courts. The political constraints upon FWS actions under the ESA thus appear far more stringent than the legal threat of an action in inverse condemnation. This analysis suggests that judicial determinations will have much less effect on the extent to which species in the United States are protected than will political determinations.

263. *See Lucas*, 505 U.S. at 1036 (Blackmun, J., dissenting).

264. *Id.* at 1029.

265. *See LEOPOLD*, *supra* note 18, at 203-07.

266. *See Lucas*, 505 U.S. at 1047-51 (Blackmun, J., dissenting).

267. *See id.* at 1055 (Blackmun, J., dissenting).

make exactly the decision that the Court finds so troubling when made by the South Carolina General Assembly today: They determine whether the use is harmful."<sup>268</sup>

In contrast to both Justices Scalia and Blackmun, who would base the definition of harm on either common law or on statutory construction, many environmentalists believe that objective criteria can be found in ecological science to show that the destruction of habitat, or wetlands, or other ecologically sensitive environments will harm the public and nature's economy as a whole.<sup>269</sup> "To ecologists," wrote David Hunter, "the need for preserving sensitive resources does not reflect value choices but rather is the necessary result of objective observations of the laws of nature."<sup>270</sup> Another analyst has asserted "that humans depend upon the entire ecosystem; that all human activities affect the ecosystem; and that therefore humankind should be denied the 'right' to destroy the land's ecological capacity."<sup>271</sup>

Citing scientific concepts and principles, commentators have proposed that statutes requiring landowners to maintain the "natural" condition of their property, whether by maintaining habitat or preserving wetlands, should be accepted as preventing harms rather than as providing benefits.<sup>272</sup> James Karp, for example, argued that one can analogize a stewardship ethic to the

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268. *Id.* at 1054 (Blackmun, J., dissenting).

269. See, e.g., Zygmunt J.B. Plater, *From the Beginning, A Fundamental Shift of Paradigms: A Theory and Short History of Environmental Law*, 27 LOY. L.A. L. REV. 981, 1000 (1994) ("Nature has developed a richly diverse and interacting natural equilibrium, communities of communities spread around the planet providing services previously unrecognized, fulfilling important productive functions previously taken for granted, capable of causing broadly destructive systemic consequences when they are jostled out of balance.").

270. Hunter, *supra* note 29, at 315.

271. Meyers, *supra* note 246, at 659. See also Colin Rankin & Michael M'Gonigle, *Legislation for Biological Diversity: A Review and Proposal for British Columbia*, 25 U.B.C. L. REV. 277 (1991). Taking an international perspective, environmentalists argue that global ecosystems are so tightly structured that the protection of the world's species "can be justified primarily as an insurance policy against future catastrophes." Tarlock, *supra* note 123, at 565.

272. See Freyfogle, *supra* note 43; Hunter, *supra* note 29; Rieser, *supra* note 233; Rose, *supra* note 233.



concept of nuisance.<sup>273</sup> According to Karp:

Using land in a fashion that threatens natural systems or community survival rights substantially and unreasonably interferes with the rights of other members of the community. Though not formally ordained by the courts in nuisance cases, the duty of stewardship is an intrinsic and essential part of the prevention of a nuisance; that is, the protection of a landowner's neighbors from substantial and unreasonable interference.<sup>274</sup>

By dressing traditional conceptions of Creation in mathematical concepts and models, the mainstream position in theoretical ecology maintains its deeply satisfying image of nature's orderliness and purposiveness. Relying on this position, Karp, Hunter, Sax, and other commentators then are able to invoke the authority of ecological science to assert that "the duty of stewardship is an intrinsic and essential part of the prevention of a nuisance."<sup>275</sup> As this Article argues, however, the difficulty that theoretical ecologists have experienced in describing the orderliness of nature and their utter failure to develop predictive and falsifiable principles may lead one to question whether "the need for preserving sensitive resources does not reflect value choices but rather is the necessary result of objective observations of the laws of nature."<sup>276</sup> The problem, as we shall see, is twofold. First, theoretical ecology blurs the distinction between science and religion. Second, theoretical ecological science has largely disintegrated into politics by other means.

### C. *The Historization of Nature*

Is "the duty of stewardship," as Karp contended, "an intrinsic and essential part of the prevention of a nuisance"?<sup>277</sup> The stewardship of ecological systems and communities has a con-

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273. See James P. Karp, *A Private Property Duty of Stewardship: Changing Our Land Ethic*, 23 ENVTL. L. 735, 749 (1993).

274. *Id.*

275. *Id.*

276. Hunter, *supra* note 29, at 315.

277. Karp, *supra* note 273, at 749.

nection with the prevention of nuisance only if those ecosystems and communities exist—they have structure or *logos*; and only if they serve human purposes—they have purpose or *telos*. This view of life characterizes the tradition associated with many ecologists including Frederic Clements and Eugene Odum, who discovered in ecosystems “stability” and “equilibrium,” as well as strategies of orderly development.<sup>278</sup> For Clements, as environmental historian Donald Worster has written, “Nature’s course . . . is not an aimless wandering to and from but a steady flow toward stability that can be exactly plotted by the scientist.”<sup>279</sup> Similarly, Paul Sears believed that ecologists should describe “the unbalance which man has produced on this continent” and urge society to restore nature’s original stability and integrity.<sup>280</sup> In this scientific tradition, Leopold constructed his conception of the land community.

In a famous paper published in *Science* in 1969, Eugene Odum completed this tradition by describing a universal “strategy” of ecosystem development replete with homeostasis, feedback mechanisms, and equilibria “directed toward achieving as large and diverse an organic structure as is possible within the limits set by the available energy input and the prevailing physical conditions of existence.”<sup>281</sup> Within this tradition of seeing nature as purposive, as evolving toward greater complexity, diversity, and stability in a web of life, one may reasonably argue that by protecting ecosystems, land-use regulation prevents a public nuisance or harm. Accordingly, the tradition of ecosystem science that regards land as a well-designed, self-regulating biotic community has an important political function in securing the connection between the extinction of species and the collapse of that community.

“For Odum,” Donald Worster has written, “ecology was the

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278. See generally FREDERIC CLEMENTS, *RESEARCH METHODS IN ECOLOGY* (1905); Eugene P. Odum, *The Strategy of Ecosystem Development*, 164 *SCI.* 262 (1969).

279. DONALD WORSTER, *NATURE’S ECONOMY: A HISTORY OF ECOLOGICAL IDEAS* 210 (1977).

280. PAUL SEARS, *DESERTS ON THE MARCH* 142 (3d ed. 1959).

281. Odum, *supra* note 278, at 273.

study of the 'structure and function of nature,' a definition that almost left out of the picture Darwinian evolution and all its turmoils."<sup>282</sup> Odum and other ecologists in the 1950s and 1960s made the ecosystem the organizing concept of ecology, and they packed this concept with "so much stress on natural order that it came close to dehistoricizing nature altogether."<sup>283</sup> This tradition in ecological science, which engages in theoretical research to define a rational and intelligible design in nature, nearly Platonic in its formal coherence, seeks to ground ecology as a mathematical science studying the equilibrium state of natural communities.<sup>284</sup> This ahistorical view of life, if anthropologist Claude Lévi-Strauss is correct, predates even Plato, because it can be traced to prehistoric hunters and gatherers.<sup>285</sup> "The characteristic feature of the savage mind," according to Lévi-Strauss, "is its timelessness; its object is to grasp the world as both a synchronic and a diachronic totality."<sup>286</sup>

The ecosystem concept, with its emphases on balance, order, or equilibrium in nature, however consistent with ancient predictions, has taken a beating lately among academic ecologists.<sup>287</sup> Summing up this change, a *New York Times* article carried the title *New Eye on Nature: The Real Constant Is Eternal Turmoil*.<sup>288</sup> The article quoted Steward Pickett, a plant ecologist, who argued that "the balance-of-nature concept 'makes nice poetry but it's not such great science'."<sup>289</sup> In its traditional

282. Donald Worster, *Nature and the Disorder of History*, in REINVENTING NATURE 65, 70 (Michael Soulé & Gary Lease eds., 1995).

283. *Id.*

284. For this history, see ROBERT P. MCINTOSH, THE BACKGROUND OF ECOLOGY 104-06, 114 (1985); K.S. SHRADER-FRECHETTE & E.D. MCCOY, METHOD IN ECOLOGY: STRATEGIES FOR CONSERVATION 19-24 (1993).

285. See CLAUDE LÉVI-STRAUSS, THE SAVAGE MIND 263 (1966).

286. *Id.*, quoted in Worster, *supra* note 282, at 75.

287. Empirical studies increasingly demonstrate that ecosystems either lack equilibrium qualities or possess them only at particular scales of time or space. See, e.g., William L. Baker, *Effect of Scale and Spatial Heterogeneity on Fire-interval Distributions*, 19 CAN. J. FOREST RES. 700, 703-06 (1989); William H. Romme, *Fire and Landscape Diversity in Subalpine Forests of Yellowstone Park*, 52 ECOLOGICAL MONOGRAPHS 199, 217-18 (1982).

288. William K. Stevens, *New Eye on Nature: The Real Constant Is Eternal Turmoil*, N.Y. TIMES, July 31, 1990, at C1 (reporting on a symposium of the Ecological Society of America held in Snowbird, Utah).

289. *Id.*

formulation, the balance-of-nature theory contends that an ecosystem maintains a dynamic equilibrium to which it returns after being disturbed if it retains the resources for resilience.<sup>290</sup> "We can say that's dead for most people in the scientific community," said Dr. Peter L. Chesson, a theoretical ecologist.<sup>291</sup>

A new generation of ecologists, having observed "only a hodge-podge of organism and environment associations undergoing constant change," has become skeptical of the ecosystem concept.<sup>292</sup> "Certainly the idea that species live in integrated communities is a myth," conservation biologist Michael Soulé has written.<sup>293</sup> "So-called biotic communities, a misleading term, are constantly changing in membership. . . . Moreover, living nature is not equilibrial—at least not on a scale that is relevant to the persistence of species."<sup>294</sup> Soulé perceptively noted that:

[T]he science of ecology has been hoist on its own petard by maintaining, as many did during the middle of this century, that natural communities tend toward equilibrium. Current ecological thinking argues that nature at the level of local biotic assemblages has never been homeostatic. Therefore, any serious attempt to define the original state of a community or ecosystem leads to a logical and scientific maze.<sup>295</sup>

290. The ecological economist Kenneth Boulding emphasized the comparison between equilibrium concepts in ecology and economics. See Kenneth E. Boulding, *Economics and Ecology*, in *FUTURE ENVIRONMENTS OF NORTH AMERICA* 225, 226-27 (F. Fraser Darling & John P. Milton eds., 1966).

291. Stevens, *supra* note 288.

292. See Ned Hettinger & Bill Throop, *Can Ecocentric Ethics Withstand Chaos in Ecology?* (Mar. 17, 1995) (unpublished manuscript on file with author). Recently, a law review symposium addressed this question. In the introduction to the symposium, Fred Bosselman and A. Dan Tarlock wrote: "The new paradigm is the basis for the argument that since nature is in flux, human change is just another flux to be tolerated, although ecologists reject this argument because it undermines the functional, historical and evolutionary limits of nature." Bosselman & Tarlock, *supra* note 22, at 871 (citing Steward T.A. Pickett et al., *The New Paradigm in Ecology: Implications for Conservation Biology Above the Species Level*, in *CONSERVATION BIOLOGY: AN EVOLUTIONARY-ECOLOGICAL PERSPECTIVE* 65 (Michael E. Soulé & Bruce A. Wilcox eds., 1980) [hereinafter *CONSERVATION BIOLOGY*]).

293. Michael E. Soulé, *The Social Siege of Nature*, in *REINVENTING NATURE*, *supra* note 282, at 143.

294. *Id.*

295. *Id.* For a similarly jaundiced view of the community concept in ecology, see

Since the early 1980s, ecologists repeatedly have debunked the view associated with G.E. Hutchinson and Eugene Odum that groups of organisms in nature form "systems" or "communities" defined by feedback loops that strongly promote their self-regulation and persistence.<sup>296</sup> Some ecologists note that the ways in which species interact provide a comparatively poor basis for classifying organisms.<sup>297</sup> Other ecologists contend that no one has shown that competition or any other factor works as a strong term in structuring communities; hence, "null models" of random interaction are as predictive as any.<sup>298</sup> As ecologist E.D. McCoy and philosopher K.S. Shrader-Frechette concluded, "no one had established that whatever community 'structure' may be thought to exist is stable in the way a self-regulating feedback system should be."<sup>299</sup> As a result, these commentators wrote, "ecologists called into question foundational community concepts, particularly in the field of ecosystems ecology."<sup>300</sup>

Among many other ecologists, Francis Gilbert and Jennifer Owen concluded that relationships in ecological communities are largely accidental.<sup>301</sup> What structure had been thought to exist in these communities is merely "a biological epiphenomenon, a statistical abstraction, a descriptive convention without true emergent properties but only collective ones."<sup>302</sup> Other ecologists have argued that nature in its normal or normative state is anything but balanced or settled; disturbance, flux, perturbation, and change, rather than stability, are the only constants.<sup>303</sup>

Margaret Bryan Davis, *Climatic Instability, Time Lags, and Community Disequilibrium*, in *COMMUNITY ECOLOGY* (J. Diamond & Ted J. Case eds., 1984).

296. See, e.g., sources cited *infra* notes 403-05.

297. Cf. JOHN VANDERMEER, *ELEMENTARY MATHEMATICAL ECOLOGY* 273-74 (1981) ("It makes sense to understand community structure not only from the point of view of mathematical distributions or gross properties . . . but also from the more mechanistic view of population interactions.").

298. See Edward F. Conner & Daniel Simberloff, *Species Number and Composition Similarity of the Galapagos Flora and Avifauna*, 48 *ECOLOGICAL MONOGRAPHS* 219, 231-46 (1978).

299. E.D. McCoy & K.S. Shrader-Frechette, *The Community Concept in Community Ecology*, 2 *PERSP. ON SCI.* 455-62 (1994).

300. *Id.*

301. See Francis Gilbert & Jennifer Owen, *Size, Shape, Competition, and Community Structure in Overflies* Dipteraria Syrphidae, 59 *J. ANIMAL ECOLOGY* 21, 32-33 (1990).

302. *Id.* at 33.

303. See S.T.A. Pickett, *Natural Disturbances and Patch Dynamics: An Introduction*,

"Wherever we seek to find constancy, we discover change," Daniel Botkin observed in a book written as an epitaph for equilibria theories.<sup>304</sup> We find "that nature undisturbed is not constant in form, structure, or proportion, but changes at every scale of time and space."<sup>305</sup> This Heraclitean view of nature, putting everything in such flux that one cannot visit the same ecosystem twice, may be the only approach that can be justified without a leap of faith.<sup>306</sup> Donald Worster summarized this viewpoint by stating that "many have begun to believe [that nature] is *fundamentally* erratic, discontinuous, and unpredictable. It is full of seemingly random events that elude our models of how things are supposed to work."<sup>307</sup> Worster concluded that "[n]ature should be regarded as a landscape of patches, big and little, patches of all textures and colors, a patchwork quilt of living things, changing continually through time and space, responding to an unceasing barrage of perturbations. The stitches in that quilt never hold for long."<sup>308</sup>

#### D. *The Problem of Classification*

Ecological systems are the conceptual constructs of a theoretical ecology, the old equilibrium ecology, that is now defunct. Just as the smile of the Cheshire Cat survived his demise, the idea of an ecological system or community has survived the demise of the equilibrium theory of which it was a construct. The concept of the ecosystem haunts the ecological literature as an apparition without substance. Ecosystems are no more than the proverbial Heraclitean flux in which one hardly step over once.<sup>309</sup>

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in 4 THE ECOLOGY OF NATURAL DISTURBANCE AND PATCH DYNAMICS 3, 5 (S.T.A. Pickett & P.S. White eds., 1985).

304. DANIEL B. BOTKIN, *DISCORDANT HARMONIES* 62 (1990).

305. *Id.* at 62.

306. See generally G.S. KIRK & J.E. RAVEN, *THE PRE-SOCRATIC PHILOSOPHERS* 186-87 (1963) (describing the Heraclitean view that everything is in flux).

307. Donald Worster, *The Ecology of Order and Chaos*, *ENVTL. HIST. REV.*, Spring/Summer 1990, at 1, 13.

308. *Id.* at 10.

309. By stepping into an ecosystem, one is likely to change it in some way, howev-

Robert MacArthur, an ecologist writing in the 1950s and 1960s, foresaw the cause of the ambivalence and ambiguity that has since attended the definition of ecosystems or communities. The problem, as he understood it, lay in the absence of a classification system.<sup>310</sup> If the term "ecosystem" or "community" was to be predicated on a collection of objects over time, there must be a way of telling when this collection is the same community or ecosystem and when it has evolved or changed into a different one. After all, ecosystems never die; they just fade into other ecosystems. Accordingly, in order to predicate properties of ecosystems, we must have a classification scheme that allows us to determine when the object of study remains the same ecosystem even though its qualities change, and when an ecosystem of another kind replaces it.

This requirement is an important conceptual condition for doing ecology because otherwise crucial notions, such as resilience or stability, could not have any meaning. If we cannot sort ecosystems and communities into natural kinds, we never will be able to confirm or reject any hypotheses that ascribe any properties to those systems. Consider, for example, the hypothesis that the loss of a dominant species will cause an ecosystem to collapse. The loss of the American chestnut to blight confirms this hypothesis because the disappearance of this dominant species so altered the species composition of southeastern forests that one might say a different forest, and therefore a different ecosystem, emerged. In that event, the original forest lacked resiliency

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er slightly. This change may be sufficient, however, to constitute it as a different ecosystem. There are no criteria for re-identifying ecosystems through change. Hence, the same ecosystems may not exist after any change.

310. MacArthur understood that no one could meaningfully predicate qualities to an ecosystem except under sorting concepts that allowed one to determine whether the same ecosystem persisted through change or disappeared to be replaced by another. He believed that a classifying scheme to sort ecosystems and establish them in natural kinds was on the horizon. MacArthur wrote:

I predict there will be erected a two- or three-way classification of organisms and their geometrical and temporal environments, this classification consuming most of the creative energy of ecologists. The future principles of the ecology of coexistence will then be of the form "for organisms of type A, in environments of structure B, such and such relations will hold."

Robert MacArthur, *The Coexistence of Species*, in CHALLENGING BIOLOGICAL PROBLEMS 253, 257 (John A. Behnke ed., 1972).

and collapsed. Or, you could say that it remained "the same forest" or "the same ecosystem." If it were "the same," however, it would be "resilient," and this would disconfirm the hypothesis.<sup>311</sup>

Consider a well-known experiment on an aquatic ecosystem carried out in 1985 by David Schindler and others.<sup>312</sup> They perturbed a lake ecosystem by putting sulfuric acid into the water.<sup>313</sup> Frank Golley summarized the results:

Schindler and his associates found that ecosystem properties, such as productivity, were relatively robust and did not change under treatment nearly as much as the roles of species in the system. . . . Rare species became common, and formerly common species became rarer. It appears . . . the genuine properties of the lake . . . are more robust and vary much less with an environmental change.<sup>314</sup>

Schindler observed that certain qualities of the lake changed, such as the species ratios, while other qualities stayed the same.<sup>315</sup> How did he or how would anyone know which of these were the "genuine" properties of the lake? How did he know that the same ecosystem persisted rather than segued into a different one? Suppose the experimenters had autoclaved the lake and, having sterilized it, let various creatures migrate into it via a creek. These new species could soon set up shop as an "ecosystem." Have we the "same" ecosystem as before? Have we the

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311. David Ehrenfeld has written, "[e]ven a mighty dominant like the American chestnut, extending over half a continent, all but disappeared without bringing the eastern deciduous forest down with it." Ehrenfeld, *Biodiversity*, *supra* note 79, at 215. Who is he to say? If species composition is an identifying property, the ascomycete that knocked out the mighty chestnut indeed brought down the deciduous forest with it. Now we have a different deciduous forest. If we are interested in something else, trophic complexity, for example, the original forest sprang back handily. Some qualities change; others do not. The rest is interpretation.

312. See D.W. Schindler et al., *Long Term Ecosystem Stress*, 228 *SCI.* 1395 (1985).

313. See *id.*

314. FRANK BENJAMIN GOLLEY, *A HISTORY OF THE ECOSYSTEM CONCEPT IN ECOLOGY 194-95* (1993).

315. See Schindler et al., *supra* note 312, at 1396.



same lake? If the new assemblage of creatures, perhaps identical in species or different from the old, produces as much biomass or transmits as much energy, are the "genuine" properties of the ecosystem intact? Did the ecosystem by remaining *the same ecosystem* show great resilience by returning to equilibrium after sterilization? Would any two theoretical ecologists agree on the way to answer this basic question?

How do we determine which qualities of an ecosystem count as "genuine" or "essential" and which just come and go without affecting the kind of ecosystem it is? How do we know when an ecosystem, despite change, has maintained its "integrity" and when the change has been too much for it to bear? These are conceptual not empirical questions, and experiments are not relevant to answering them. As far as one can tell, theoretical ecologists have not even discussed these basic conceptual matters because they would not know where to begin. Little point exists in trying to measure the "resiliency" or any other property of an ecosystem, however, if one does not have even the slightest basis for telling whether the same ecosystem exists from one moment to the next.<sup>316</sup>

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316. In order to say anything about the emergent properties of an ecosystem over time and change one must distinguish its substantial or essential from its accidental or nominal qualities. These are terms that philosophers from Aristotle to Locke have made familiar. The essential properties, real essences, are those that allow re-identification of an object through time; as long as the object retains these properties, it is the "same" object, even though it may alter in other ways. One could then speak, perhaps, of the integrity, resilience, or health of an ecosystem by studying how well it maintains itself as *the same ecosystem* through perturbations. The essential qualities, which identify the community as a particular kind of ecosystem through time, will remain intact. The nominal or accidental qualities, in contrast, may vary without causing the object itself to cease being.

For example, if one defines a forest ecosystem as a bunch of trees, then one may replace the original trees one at a time with the latest high-tech poplars in neat rows and conclude that the same ecosystem continues to exist and thus has enormous integrity. This conclusion is absurd, of course, but that is where our knowledge stands. No agreed-upon conceptual categories exist by which to discern when an ecosystem has buckled under stress and when, because of its great resilience and resistance, it has maintained its genuine properties, whatever those may be. If one considers the mix of species to be the identifying characteristic of the ecosystem, then the community has vanished after the first species is gone. If one considers some other observable quality such as productivity to be the criterion, then the trees may be cut down one by one, and the forest replaced gradually with an equally productive swamp or savanna, with the same "ecosystem" persisting. These suggestions

"Balance or stability," Stuart Pimm observed, "implies some restoration following disturbance."<sup>317</sup> The obvious question is: restoration of what? The answer: the ecosystem. What qualities define it? Species composition? No; species come and go. If not species composition, what criterion allows us to re-identify the ecosystem through time and change? Nothing remains exactly as it was a moment ago, much less a day or a year ago. If particular species are constitutive, or some food web, energy path, or whatever anybody wants to model as constitutive, then, once again, anyone can tell whether the ecosystem persists, disappears, or goes away temporarily and comes back. All these choices, however, appear arbitrary, if not set against a classification system of ecosystems or communities for which consensus exists among ecologists.<sup>318</sup>

The approach that takes ecosystems as objects of study is doomed. For example, Pimm recognized that ecosystem-level concepts, such as stability, resilience, and equilibrium, have been subject to much criticism among ecologists. These terms have been used with so many different meanings, "no wonder there was little agreement."<sup>319</sup> Pimm has written that "the criticism of the [ecosystem] approach . . . is that the models are terrible and that the data are even worse."<sup>320</sup> Without gainsaying this criticism, which is perfectly true, there is another problem.

are obviously silly, but they illustrate the fact that there is no clear consensus regarding categories by which one can tell when or where one ecosystem ends and another begins.

317. PIMM, *supra* note 23, at 4 (emphasis omitted).

318. One may attribute to communities ecosystem-level predicates such as stability, resilience, health, integrity, or sustainability, only if one can predetermine how to identify and re-identify communities as they undergo changes, both major and minor. One must be able to classify the ecosystem, categorize it, and thus know which of its properties are constitutive and which are accidental. For any perturbation, the same system may show great stability if one set of characteristics is considered constitutive; yet the community will show a lack of stability if another set of characteristics is chosen. In other words, in order for ecosystem science to get off the ground, there must be consensus on the conceptual categories under which ecosystems are sorted and reidentified over time and through change.

319. PIMM, *supra* note 23, at 14.

320. *Id.* at 16.

The models are "terrible" and the data are "even worse" because ecologists use the term "ecosystem" arbitrarily; it can refer to anything at all. An ecologist has no problem in confirming a hypothesis, because he or she alone gets to identify the object of study and determine when it remains or ceases to be "the same ecosystem" through time and change.

The Ecological Society of America has commented on the absence of a classification scheme due to the lack of "natural kinds" in ecology. "Nature has not provided us with a natural system of ecosystem classification or rigid guidelines for boundary demarcation. Ecological systems vary continuously along complex gradients in space and are constantly changing through time."<sup>321</sup> The problem, however, lies not in nature but in ourselves: Ecologists have taken great pains to model ecosystems but have not made any effort to work out classification schemes by which they can identify or re-identify the ecosystems they are so eager to model. Nature never provides a system of classification to any science. Rather, a science succeeds or fails insofar as it can entrench a useful system of classification to test hypotheses.<sup>322</sup>

Allan K. Fitzsimmons made this point pugnaciously:

As a means of partitioning the landscape, Ecosystems represent a classical Frank Sinatra approach—ecosystems are determined 'my way.' There are no theoretical or methodological requirements regarding geographic size, shape, or location of ecosystems. There are no agreed upon standards or protocols to select the variables to be used in defining ecosystems or for combining the distribution of multiple variables into a single pattern of ecosystems.<sup>323</sup>

The Ecological Society of America agrees: Ecologists define ecosystems operationally in terms of the processes that interest them. "Thus, depending on the process of central interest, a

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321. See ESA REPORT, *supra* note 76, at 5.

322. See NELSON GOODMAN, WAYS OF WORLDMAKING 2-5 (1978).

323. Allen K. Fitzsimmons, *Why a Policy of Federal Management and Protection of Ecosystems Is a Bad Idea*, in THE ENVIRONMENTAL PROFESSIONAL (forthcoming 1997) (manuscript at 3-4, on file with author).

dung pile or whale carcass are ecosystems as much as a watershed or a lake."<sup>324</sup>

The creative energy of ecologists, rather than flowing toward the construction of sorting classifications, a taxonomy for ecosystems, which MacArthur knew would be necessary, went instead into the mathematical modeling of indeterminate objects. These models never could be tested because the ecosystem never could be defined. The models became more complex, the mathematics more rarified, but the first step toward a science—sorting the objects of study into natural kinds—was never taken. As a result, each ecologist still decides for him or herself which observable qualities are genuine or constitutive of ecosystems and which are accidental or epiphenomenal. No consensus about classification exists, and no prospect of a consensus exists. As a result, there is a "succession of paradigms" but no real progress in theoretical ecology.<sup>325</sup>

#### *E. The Problem of the Baseline*

Those who argue that the destruction of natural ecosystems constitutes a nuisance must identify in some coherent way which ecosystems are more beneficial in their "natural" state than, for example, if developed for agricultural, industrial, or residential use. If ecosystems as given to us by the hand of nature are normative, if what is bad for the marsh is bad for mankind, then, under this view, any change made in nature may be considered dangerous. Because agriculture is a great destroyer

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324. ESA REPORT, *supra* note 76, at 6. Any parent who has had to spend days picking lice and nits out of a child's hair has a pretty good idea of the sense in which a single species can define an ecosystem. Such a parent also gets an intuitive grasp of the resilience of that ecosystem to stressors, such as pesticidal shampoos. In this example, the definition of the ecosystem, a child's scalp, is determined on non-ecological grounds. Resilience to stressors—and therefore ecosystem stability—can also be found in yeast infections, intestinal afflictions, mildew in the bathroom, termites in the timbers, and other wonders of nature. In these instances, however, one can determine independently what the "ecosystem" is. Absent some concern outside the science, there is no way to identify the object of interest.

325. See Daniel Simberloff, *A Succession of Paradigms in Ecology: Essentialism to Materialism and Probabilism*, 43 SYNTHESE 3 (1980).

of habitat, hunting and gathering food may be the safest course; however, even hunting and gathering alters ecosystems. Should we try to return to the landscape of a prelapsarian past? Which past? How far back? Are we still East of Eden?

Because ecosystems have altered dramatically virtually every place in which human beings are found, what do we use as a baseline? Where in the flux of a biological community do we take a "snapshot" and say "here it is in equilibrium" or "here it has integrity" or "now we have reached the carrying capacity of the land?"<sup>326</sup> Is the ecosystem developing toward a "healthy" condition, is it now "healthy," or is it falling apart? What is the criterion? These questions are unanswerable because we do not know which qualities of ecosystems are the identifying, genuine, or defining ones. The proposition that you never know what may be catastrophic—when the last rivet will pop—tells us to avoid *all* changes in species composition as all are equally risky. The species composition of landscapes, however, constantly changes. At what point in the Heraclitean flux do we say that ecosystems are the mint condition "airplanes," changes to which are likely to be deleterious?

In 1863, George Perkins Marsh observed that humanity had long ago completely altered and interfered with the spontaneous arrangements of the organic and inorganic worlds.<sup>327</sup> More recent authorities agree that, for more than a century, the landmass of the world has been thoroughly altered, usurped, preempted, and co-opted, as these terms are defined by Peter Vitousek and others.<sup>328</sup> Virtually every ecosystem differs greatly from what it would have been had mankind not eaten of the Tree of Knowledge.<sup>329</sup> If the term "natural" or "unco-opted" ad-

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326. The term "carrying capacity," like "equilibrium" and "balance," must be understood as a religious, cultural, or aesthetic concept; it cannot be measured or understood in the context of empirical science. This is not meant in any way to impugn the concept; it is only to say how it is to be understood. For discussion, see Mark Sagoff, *Carrying Capacity and Ecological Economics*, 45 *BIOSCIENCE* 610 (1995). See also Freyfogle, *supra* note 43, at 79.

327. See GEORGE PERKINS MARSH, *MAN AND NATURE* 3 (New York, C. Scribner & Co. 1864).

328. See Peter M. Vitousek et al., *Human Appropriation of the Products of Photosynthesis*, 36 *BIOSCIENCE* 368, 370 (1986).

329. For several relevant studies, see essays collected in *MAN'S ROLE IN CHANGING*

mits of degrees, however, how are these degrees measured? Is the harm to an ecosystem worse if it is caused for short-term economic gain rather than by accident? And if by accident, does it matter if human beings rather than natural forces are responsible? Is the concept of harm to an ecosystem—and therefore ecosystem “integrity” and “health”—a scientific concept or a cultural and aesthetic one?

If one recognizes instead that the ecosystem as an object of scientific inquiry is just a pointless hodgepodge of constantly changing associations of organisms and environments—which seems to be the only tenable position that is not a theological one—then, as far as instrumental value is concerned, one might as well decide, as the Dutch colonists of New Amsterdam and their successors did, which “ecosystems” to preserve and which to alter. To be sure, many kinds of biological ensembles are naturally useful; for example, forests provide wood. Some of these groupings will become more, and some less, useful when they are changed by human beings. Silvicultural plantations provide more wood, for example, than natural forests. If economic rather than ethical or spiritual concerns motivate us, concerns about our welfare rather than about other goals that we may pursue for their own sake, we may find that the way to manage nature efficiently, even for the long run, is to re-engineer it to the extent technology permits. Stephen Schneider has written that no one “really knows scientifically how large the carrying capacity of the earth is now or could be in the twenty-first century” carrying capacity is an elastic notion depending on “social, economic, industrial, and agricultural practices.”<sup>330</sup>

If one who advocates protecting the natural habitat of every species offers moral and spiritual arguments, he or she may be persuasive. The extinction of species may be considered a crime on ethical grounds, like murder or rape, whatever its economic

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THE FACE OF THE EARTH (W.L. Thomas ed., 1956).

330. Stephen H. Schneider, *Climate and Food: Signs of Hope, Despair, and Opportunity*, in THE CASSANDRA CONFERENCE 17, 42 (Paul R. Ehrlich & John P. Holdren eds., 1985).

or instrumental consequences. If causing an extinction is a moral crime (one may think about pornography by analogy) then society surely may regulate it. As with "adult" uses of property, however, it is not easy as a matter of law to prohibit the destruction of habitat entirely on the basis of moral umbrage, however well deserved. Just as restrictions on porn palaces generally are justified on nuisance grounds,<sup>331</sup> it is handy to supplement one's justifiable moral outrage at extinction with claims of injury or damage. Invoking nuisance, however far-fetched on the facts, may be expedient in court.

#### *F. The Redundancy of Species*

Rates of extinction today far exceed "background" historical levels.<sup>332</sup> According to one federal wildlife official, endangered species can be found "in every corner of the United States."<sup>333</sup> In the United States, as elsewhere, the principal cause of expected extinctions is thought to be habitat loss, although pollution, especially pesticides, and hunting have also been important fac-

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331. See, e.g., *Arcara v. Cloud Books, Inc.*, 478 U.S. 697 (1986) (allowing the closing of an adult book store where prostitution occurred under a state statute declaring such a use to be a nuisance). For an article demonstrating that property rights issues can make strange bedfellows, see *Unusual Coalition Battles Property-Rights Act, Supporters Say Dire Predictions are Unfounded*, DALLAS MORNING NEWS, May 15, 1995, at A3 (noting that the Private Property Rights Act has been opposed by both sides of the political spectrum).

332. Scientists offer widely differing estimates of the number of species, though credible suggestions range between a low of 5 million and a high of 100 million. See JEFFREY A. MCNEELY ET AL., INTERNATIONAL UNION FOR CONSERVATION OF NATURE AND NATURAL RESOURCES, *CONSERVING THE WORLD'S BIOLOGICAL DIVERSITY* 17 (1990) (estimating the number of species to be between 5 and 50 million); Norman Meyers, *Tropical Forests and Their Species: Going, Going . . . ?*, in *BIODIVERSITY* *supra* note 79, at 31 (estimating the number of species to be at least 5 million). Professor Wilson estimates that prior to human intervention, extinctions had occurred, at most, at the rate of one species out of one million species per year. See E.O. Wilson, *The Current State of Biological Diversity*, in *BIODIVERSITY*, *supra* note 79, at 13. According to estimates that Professor Wilson has derived from ecological models, the current rate of extinction in tropical forests, where extinctions are concentrated, is vastly greater—as many as 17,500 species become extinct there each year. See *id.* For discussion of the history of extinction in relation to the present situation, see WALTER V. REID & KENTON R. MILLER, *KEEPING OPTIONS ALIVE* 31-35 (1989).

333. Tom Horton, *The Endangered Species Act: Too Tough, Too Weak, or Too Late?*, AUDUBON, Mar.-Apr. 1992, at 68, 70 (quoting an unnamed federal wildlife official).

tors.<sup>334</sup> Somewhat fewer than 1,000 domestic species are listed as endangered, and roughly one third that number or more are considered threatened or in jeopardy.<sup>335</sup> In biodiversity-rich California, the problem is particularly troubling. About one third of the species in jeopardy in the United States reside in California, and of these approximately 125 are listed as endangered.<sup>336</sup>

Although these grim statistics should appall us for ethical reasons, we may wonder if the extinction of hundreds of species in California and thousands nationwide will cause any harm to human welfare. If any of these extinct species had a known economic use, for example, as crops, we would be able to judge the value of the species in terms of its market price. As a rule, creatures that have a direct economic use, such as crops, have habitats created for them (e.g., farms) rather than taken from them. The economic benefits, if any, that flow from endangered species are indirect and not likely to fetch a market price.

To estimate the economic value of such an endangered species we must determine its worth "at the margin," in other words, in relation to the cost of obtaining the least expensive substitute species that performs the same function or service. Suppose, for example, that the American burying beetle, a marvelous but endangered creature,<sup>337</sup> functions in the ecosystem by decomposing the corpses of small animals. We would ask to what expense we must go to find a different kind of beetle or some other animal ready, willing, and able to do the same work of decomposing

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334. See H.R. REP. NO. 95-1625, at 5 (1978) ("The loss of habitat for many species is universally cited as the major cause for the extinction of species worldwide."), reprinted in 1978 U.S.C.A.N. 9453, 9455; 119 CONG. REC. H30,162 (daily ed. Sept. 18, 1973) (statement of Rep. Sullivan, floor manager for the ESA) ("[T]he principal threat to animals [in the United States] stems from the destruction of their habitat.").

335. See U.S. Dep't of the Interior, *Box Score: Listings and Recovery Plans as of August 31, 1996*, ENDANGERED SPECIES BULL., Sept.-Oct. 1996, at 24 (listing 755 endangered species and 209 threatened species endemic to the United States).

336. For discussion of the situation in California, see Douglas P. Wheeler, *Foreword: A Strategy for the Future*, 12 STAN. ENVTL. L.J. ix, xiii (1993).

337. See *Microcosmic Captive Breeding Project Offers New Hope for Beleaguered Beetle*, N.Y. TIMES, Sept. 17, 1996, at C5 (noting that the American burying beetle is an endangered species).



small corpses. Nothing can be assessed economically except at the margin, that is, in relation to the price of substitutes.

"Healthy ecosystems carry out a diverse array of processes that provide both goods and services to humanity," observed the Ecological Society of America in a recent report.<sup>338</sup> Ecosystem services, according to the report, include: "Maintaining hydrological cycles[;] [r]egulating climate; [c]leansing water and air; [m]aintaining the gaseous composition of the atmosphere; [p]ollinating crops and other important plants[;] [g]enerating and maintaining soils[;] [s]toring and cycling essential nutrients; [a]bsorbing and detoxifying pollutants[;] [and] [p]roviding beauty, inspiration, and research[.]"<sup>339</sup> For one reason or another, no extinction of any species in the United States seems thus far to have altered the capacity of the ecosystems to provide these services. The reason may be that for any species that is lost, tens, hundreds, or thousands of others are ready, willing, and able to perform the same functions and services valuable to human beings.

Perhaps twenty species of birds have vanished in the United States since 1492; of those, fifteen have vanished in Hawaii.<sup>340</sup> What specific losses in ecosystem services, such as those listed above, have occurred as a result? Mammals that have become extinct include Goof's pocket gopher, Shaman's pocket gopher, and the Tacoma pocket gopher—all of which disappeared this century. "The loss of a species from a particular area may have little or no net effect on the ability of the ecosystem to perform its ecological processes if competitors take the species' place."<sup>341</sup> Has any ecosystem service diminished owing to the loss of these gophers? Or have other species, including many other kinds of gophers, simply taken their place?

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338. ESA REPORT, *supra* note 76, at 2.

339. *Id.*

340. See The Nature Conservancy, *Where the Wild Things Aren't* (visited Mar. 4, 1997) <<http://www.tnc.org/science/library/pubs/rptcard/where.html>>.

341. David Eugene Bell, *The 1992 Convention on Biological Diversity: The Continuing Significance of U.S. Objections at the Earth Summit*, 26 GEO. WASH. J. INT'L L. & ECON. 479, 486 & n.44 (1993) (recalling that the eastern hemlock (*Tsuga canadensis*) quickly took over the dying American chestnut (*Castanea dentata*) in eastern deciduous forests).

To be sure, if extinctions continue at present rates indefinitely, at some point there may be too few viable species ready, willing, and able to substitute for those that have been lost. How much of a "buffer" exists? How many "extra" rivets are in the wings? Many ecologists follow Paul Ehrlich, Peter Raven, and others in declaring that with every extinction we run the risk of calamitous damage to the environment.<sup>342</sup>

Although one may agree with ecologists such as Ehrlich and Raven that the earth stands on the brink of an episode of massive extinction, it may not follow from this grim fact that human beings will suffer as a result. On the contrary, skeptics such as science writer Colin Tudge have challenged biologists to explain why we need more than a tenth of the 10 to 100 million species that grace the earth. Noting that "cultivated systems often out-produce wild systems by 100-fold or more," Tudge declared that "the argument that humans need the variety of other species is, when you think about it, a theological one."<sup>343</sup> Tudge observed that "the elimination of all but a tiny minority of our fellow creatures does not affect the material well-being of humans one iota."<sup>344</sup> This skeptic challenged ecologists to list more than 10,000 species (other than unthreatened microbes) that are essential to ecosystem productivity or functioning.<sup>345</sup> "The human species could survive just as well if 99.9% of our fellow creatures went extinct, provided only that we retained the appropriate 0.1% that we need."<sup>346</sup>

342. See, e.g., Peter H. Raven, *Our Diminishing Tropical Forests*, in BIODIVERSITY, *supra* note 79, at 121 (describing the effects of biodiversity loss on agriculture).

343. Colin Tudge, *The Rise and Fall of Homo Sapiens*, 325 PHIL. TRANSACTIONS OF THE ROYAL SOC'Y OF LONDON 479, 481 (1989).

344. *Id.* at 482.

345. "The select band of species [contributing to material well being] would be the 10,000 that competent biologists might identify." *Id.* at 485.

346. *Id.* at 486. One may respond that we cannot say for sure which species we may need. In instances in which one of the 600,000 or so kinds of beetles we possess will do the work of another, however, one can say with some plausibility that we do not need both. Anyone who can show that a species performs a function for which no good substitute species exists will demonstrate a reason to protect that plant or animal. The mere possibility that one never knows when something will come in handy, however, is not a reason for preserving everything.

The monumental *Global Biodiversity Assessment* ("the Assessment") identified two positions with respect to redundancy of species. "At one extreme is the idea that each species is unique and important, such that its removal or loss will have demonstrable consequences to the functioning of the community or ecosystem."<sup>347</sup> The authors of the *Assessment*, a panel of eminent ecologists, endorsed this position, saying it is "unlikely that there is much, if any, ecological redundancy in communities over time scales of decades to centuries, the time period over which environmental policy should operate."<sup>348</sup> These eminent ecologists rejected the opposing view, "the notion that species overlap in function to a sufficient degree that removal or loss of a species will be compensated by others, with negligible overall consequences to the community or ecosystem."<sup>349</sup>

Other biologists believe, however, that species are so fabulously redundant in the ecological functions they perform that the life-support systems and processes of the planet and ecological processes in general will function perfectly well with fewer of them, certainly fewer than the millions and millions we can expect to remain even if every threatened organism becomes extinct.<sup>350</sup> Even the kind of sparse and miserable world depicted in the movie *Blade Runner* could provide a "sustainable" context for the human economy as long as people forgot their aesthetic and moral commitment to the glory and beauty of the natural world.<sup>351</sup> The *Assessment* makes this point. "Although any ecosystem contains hundreds to thousands of species interacting among themselves and their physical environment, the emerging consensus is that the system is driven by a small number of . . . biotic variables on whose interactions the balance of species are, in a sense, carried along."<sup>352</sup>

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347. H.A. Mooney et al., *Biodiversity and Ecosystem Functioning: Basic Principles*, in GLOBAL BIODIVERSITY ASSESSMENT 275, 289 (V.H. Heywood et al. eds., 1995).

348. *Id.* at 298.

349. *Id.*

350. Cf. J.H. Lawton & V.K. Brown, *Redundancy in Ecosystems*, in BIODIVERSITY AND ECOSYSTEM FUNCTION 255-70 (Ernst-Detlef Schulze & Harold A. Mooney eds., 1993).

351. The author takes this view and reference to the movie from a talk by Sir Robert May, science advisor to the United Kingdom, presented at the Smithsonian Institute, Oct. 23, 1996.

352. C. Perrings, *The Economic Value of Diversity*, in GLOBAL BIODIVERSITY ASSESS-

To make up your mind on the question of the functional redundancy of species, consider an endangered species of bird, plant, or insect and ask how the ecosystem would fare in its absence. The fact that the creature is endangered suggests an answer: it is already in limbo as far as ecosystem processes are concerned. What crucial ecological services does the black-capped vireo, for example, serve? Are any of the species threatened with extinction necessary to the provision of any ecosystem service on which humans depend? If so, which ones are they?

Ecosystems and the species that compose them have changed, dramatically, continually, and totally in virtually every part of the United States. There is little ecological similarity, for example, between New England today and the land where the Pilgrims died.<sup>353</sup> In view of the constant reconfiguration of the biota, one may wonder why Americans have not suffered more as a result of ecological catastrophes. The cast of species in nearly every environment changes constantly—local extinction is commonplace in nature—but the crops still grow. Somehow, it seems, property values keep going up on Martha's Vineyard in spite of the tragic disappearance of the heath hen.

One might argue that the sheer number and variety of creatures available to any ecosystem buffers that system against stress. Accordingly, we should be concerned if the "library" of creatures ready, willing, and able to colonize ecosystems gets too small. (Advances in genetic engineering may well permit us to *write* a large number of additions to that "library.") In the United States as in many other parts of the world, however, the number of species has been *increasing* dramatically, not *decreasing*, as a result of human activity. This is because the hordes of exotic species coming into ecosystems in the United States far exceed the number of species that are becoming extinct. Indeed, introductions may outnumber extinctions by more than ten to one, so that the United States is becoming more and more species-rich all the time largely as a result of human action.<sup>354</sup>

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MENT, *supra* note 347, at 833-34.

353. See, e.g., CRONON, *supra* note 77 (discussing historical ecological conditions).

354. See Ariel E. Lugo, *Maintaining an Open Mind on Exotic Species*, in GARY K.

Peter Vitousek and colleagues estimate that over 1000 non-native plants grow in California alone; in Hawaii there are 861; in Florida, 1210.<sup>355</sup> In Florida more than 1000 non-native insects, 23 species of mammals, and about 11 exotic birds have established themselves.<sup>356</sup> Anyone who waters a lawn or hoes a garden knows how many weeds desire to grow there, how many birds and bugs visit the yard, and how many fungi, creepy-crawlies, and other odd life forms show forth when it rains. All belong to nature, from wherever they might hail, but not many homeowners would claim that there are too few of them.

Now, not all exotic species provide ecosystem services; indeed, some may be disruptive or have no instrumental value.<sup>357</sup> This also may be true, of course, of native species as well, especially because all exotics are native somewhere. Certain exotic species, however, such as Kentucky blue grass, establish an area's sense of identity and place; others, such as the green crabs showing up around Martha's Vineyard, are nuisances.<sup>358</sup> Consider an anal-

MEFFE & C. RONALD CARROLL, *PRINCIPLES OF CONSERVATION BIOLOGY* 218, 219 (1994) (describing the increase in the number of species in Hawaii as a result of introductions).

355. See Peter M. Vitousek et al., *Biological Invasions as Global Environmental Change*, 84 AM. SCIENTIST 468, 470 (1996) (chart).

356. Florida Dep't of Env'tl. Protection, *Exotics in Florida* (visited Mar. 4, 1997) <<http://www.dep.state.fl.us/rules/exotic.html>> (citing DEP'T OF ENVTL. PROTECTION, TALLAHASSEE, AN ASSESSMENT OF INVASIVE NON-INDIGENOUS SPECIES IN FLORIDA'S PUBLIC LANDS (1994)).

357. See Peter M. Vitousek, *Biological Invasions and Ecosystem Processes: Toward an Integration of Population Biology and Ecosystem Studies*, 57 OIKOS 7 (1990).

358. It is common knowledge that the invasion of nonindigenous organisms can be environmentally harmful. See, e.g., Vitousek et al., *supra* note 355, at 468 ("Unfortunately, the redistribution of the earth's species is proving to be ecologically and economically damaging, and the costs will continue to worsen."). Of course, the redistribution of the earth's species also has been enormously beneficial. The four crops native to the United States are sunflowers, turkeys, Jerusalem artichokes, and cranberries; every other crop grown here is nonindigenous and native to some other country. See Sharon Schmickle, *We Have Columbus To Thank for Global Potluck*, STAR-TRIB. (Minneapolis-St. Paul), Sept. 9, 1991, at 11A, available in 1991 WL 3948612. The most one can say about the situation is a tautology: some introductions have been beneficial (e.g., corn); some deleterious (e.g., the green crab); some mixed (the zebra mussel, which cleaned up Lake Erie while causing headaches to water systems); and some have had no discernible effect. That exhausts the logical possibilities—which is where research on the matter stands. It is sometimes a matter of interpretation whether a non-native species is considered helpful or harmful. "For example, Vitousek and Walker documented nitrogen enrichment in nitrogen-poor lava

ogy with human migration. Everyone knows that after a generation or two, immigrants to this country are hard to distinguish from everyone else. The vast majority of Americans did not evolve here, as it were, from hominids; most of us "came over" at one time or another. This is true of many of our fellow species as well, and they may fit in here just as well as we do.

It is possible to distinguish exotic species from native ones for a period of time, just as we can distinguish immigrants from native-born Americans, but as the centuries roll by, species, like people, fit into the landscape or the society, changing and often enriching it. Shall we have a rule that a species had to come over on the *Mayflower*, as so many did, to count as "truly" American? Plainly not. When, then, is the cutoff date? Insofar as we are concerned with the absolute numbers of "rivets" holding ecosystems together, extinction seems not to pose a general problem because a far greater number of kinds of mammals, insects, fish, plants, and other creatures thrive on land and in water in America today than in prelapsarian times.<sup>359</sup>

The Ecological Society of America has urged managers to maintain biological diversity as a critical component in strengthening ecosystems against disturbance.<sup>360</sup> Yet as Simon Levin observed, "much of the detail about species composition will be irrelevant in terms of influences on ecosystem properties."<sup>361</sup>

flows in Hawaii by the exotic tree *Myrica faya*. The greater availability of soil nitrogen where the exotic occurs favors the entire ecosystem and results in higher productivity." Lugo, *supra* note 354, at 219. For a negative view of the effect of this species on its host ecosystem, see Vitousek et al., *supra* note 355, at 473-74 ("One dramatic example is the invasion of the nitrogen-fixing tree *Myrica faya* into Hawaii Volcanoes National Park. . . . This alters the plants and soil . . . . As it happens the species that do well in these altered habitats are non-native organisms."). The Author wishes to thank Sara Gottlieb for this example.

359. See generally R. Barbault & S. Sastrapradja, *Generation Maintenance and Loss of Biodiversity*, in GLOBAL BIODIVERSITY ASSESSMENT, *supra* note 347, at 232 (discussing species diversity and extinction). It is primarily at the global level that the sheer number and variety of species is diminishing, because at more local levels introductions can easily out-pace any extinctions that they might cause. This observation leads to the question: Is there a global ecosystem, or "airplane," in which all species are "rivets"?

360. See ESA REPORT, *supra* note 76, at 6.

361. Simon A. Levin, *Biodiversity: Interfacing Populations and Ecosystems*, in ECO-

He added: "For net primary productivity, as is likely to be the case for any system property, biodiversity matters only up to a point; above a certain level, increasing biodiversity is likely to make little difference."<sup>362</sup>

What about the use of plants and animals in agriculture? There is no scarcity foreseeable. "Of an estimated 80,000 types of plants [we] know to be edible," a U.S. Department of the Interior document says, "only about 150 are extensively cultivated."<sup>363</sup> About twenty species, not one of which is endangered, provide ninety percent of the food the world takes from plants.<sup>364</sup> Any new food has to take "shelf space" or "market share" from one that is now produced. Corporations also find it difficult to create demand for a new product; for example, people are not inclined to eat paw-paws, even though they are delicious. It is hard enough to get people to eat their broccoli and lima beans. It is harder still to develop consumer demand for new foods. This may be the reason the Kraft Corporation does not prospect in remote places for rare and unusual plants and animals to add to the world's diet.

Of the roughly 235,000 flowering plants and 325,000 nonflowering plants (including mosses, lichens, and seaweeds) available, farmers ignore virtually all of them in favor of a very few that are profitable.<sup>365</sup> To be sure, any of the more than 600,000 species of plants could have an application in agriculture, but would they be preferable to the species that are now dominant? Has anyone found any consumer demand for any of these half-million or more plants to replace rice or wheat in the human diet? There are reasons that farmers cultivate rice, wheat, and corn rather than, say, Furbish's lousewort. There are many kinds of louseworts, so named because these weeds were thought to cause lice in sheep. How many does agriculture really require?

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LOGICAL PERSPECTIVES ON BIODIVERSITY (T. Abe et al. eds., forthcoming) (manuscript at 4, on file with author).

362. *Id.* at 10 (citation omitted).

363. National Park Serv., U.S. Dep't of the Interior, *Biological Diversity: Nature's Harvest* (last modified June 25, 1996) <<http://www.aqd.nps.gov/wv/biodiv.htm#harvest>>.

364. See EDWARD O. WILSON, *THE DIVERSITY OF LIFE* 287 (1992).

365. See DAVID R. GIVEN, *PRINCIPLES AND PRACTICE OF PLANT CONSERVATION* 1 (1994); WILSON, *supra* note 364, at 287-88.

The species on which agriculture relies are domesticated, not naturally occurring; they are developed by artificial not natural selection; they might not be able to survive in the wild.<sup>366</sup>

This argument is not intended to deny the religious, aesthetic, cultural, and moral reasons that command us to respect and protect the natural world. These spiritual and ethical values should evoke action, of course, but we should also recognize that they are spiritual and ethical values. We should recognize that ecosystems and all that dwell therein compel our moral respect, our aesthetic appreciation, and our spiritual veneration; we should clearly seek to achieve the goals of the ESA. There is no reason to assume, however, that these goals have anything to do with human well-being or welfare as economists understand that term. These are ethical goals, in other words, not economic ones. Protecting the marsh may be the right thing to do for moral, cultural, and spiritual reasons. We should do it—but someone will have to pay the costs.

In the narrow sense of promoting human welfare, protecting nature often represents a net “cost,” not a net “benefit.” It is largely for moral, not economic, reasons—ethical, not prudential, reasons—that we care about all our fellow creatures. They are valuable as objects of love not as objects of use. What is good for

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366. The genetic variety of plants used in agriculture has increased vastly as a result of artificial selection. The enormous variability breeders and biotechnologists have created suggests the extent to which human beings will “write” the books in the “library” of biodiversity. Consider rice, arguably the world’s most important crop: we should find it heartening that from about 20 wild rice species in the genus *Oryza*, more than 100,000 cultivars of rice exist in the world today. See R.E. Evenson & D. Gollin, Genetic Resources, International Organizations, and Rice Varietal Improvement (1995) (unpublished manuscript, on file with author). The International Rice Research Institute, located in the Philippines, has itself stored about 85,000 land-acres of wild rice varieties in its long-term *ex situ* facility. Biodiversity in this crucial crop is increasing. Over 1700 useful new varieties of rice have been created by artificial selection (forced evolution) since the early 1960s. See Evenson & Gollin, *supra* (citing many technical reports). As geneticists begin to map and compare the genomes of species, they gain unprecedented abilities to direct evolution to new and better varieties. On top of that, genetic engineering for the first time permits the transfer of genes between virtually any two living things. The prospects for creating biodiversity artificially are stunning, and may be unlimited. For discussion, see JOHN E. SMITH, BIOTECHNOLOGY (3d ed. 1996).



the marsh may be good in itself even if it is not, in the economic sense, good for mankind. The most valuable things are quite useless.

#### V. LOGOS AND TELOS IN THE NATURAL ENVIRONMENT

Senator John Tunney, speaking in favor of the ESA, told Congress in 1973: "To allow the extinction of animal species is ecologically, economically, and ethically unsound. Each species provides a service to its environment; each species is a part of an immensely complicated ecological organization, the stability of which rests on the health of its components."<sup>367</sup> A Senate Committee Report on the ESA concurred, stating that species in their diversity "perform vital biological services to maintain a 'balance of nature' within their environments."<sup>368</sup>

In enacting the ESA, Congress gave political support to the idea that nature is orderly, and that its ecosystems exhibit a balance,<sup>369</sup> health,<sup>370</sup> integrity,<sup>371</sup> and strategy<sup>372</sup> that

367. 119 CONG. REC. S25,668 (daily ed. July 24, 1973) (statement of Sen. Tunney).

At present, we are unsure of the total contribution of each species of fish and wildlife to the health of our ecology. To permit the extinction of any species which contributes to the support of this structure without knowledge of the cost or benefits of such extinction is to carelessly tamper with the health of the structure itself.

*Id.*

368. S. REP. NO. 93-307, at 2 (1973), reprinted in 1973 U.S.C.C.A.N. 2989, 2990.

369. The "balance of nature" to which the Senate Committee Report alludes found support in major writing in ecology at the time. See, e.g., Odum, *supra* note 278, at 262 (advocating the "balance of nature" theory). In 1973, the year in which the ESA was enacted, an excellent survey of biological literature on the "balance of nature" appeared. See Frank N. Egerton, *Changing Concepts of the Balance of Nature*, 48 Q. REV. BIOLOGY 332, 332-50 (1973). Today, however, many ecologists would agree with the statement made by ecologist Charles Elton in 1930:

The balance of nature does not exist, and perhaps has never existed. The numbers of wild animals are constantly varying to a greater or lesser extent, and the variations are usually irregular in period and always irregular in amplitude. Each variation in the numbers of one species causes direct and indirect repercussions on the numbers of the others, and since many of the latter are themselves independently varying in numbers, the resultant confusion is remarkable.

BOTKIN, *supra* note 304, at 15 (quoting CHARLES ELTON, ANIMAL ECOLOGY AND EVOLUTION (1930)).

370. See Robert Costanza, *Toward an Operational Definition of Ecosystem Health*, in ECOSYSTEM HEALTH 239, 239-53 (Robert Costanza et al. eds., 1992).

371. See LAURA WESTRA, AN ENVIRONMENTAL PROPOSAL FOR ETHICS: THE PRINCIPLE

enables them to provide goods and services essential to human life.<sup>373</sup> A congressional committee report on hearings held at the time observed that “[t]he events of the past few years have shown the critical nature of the interrelationships of plants and animals between themselves and with their environment. . . . The hearings proved (if proof is still necessary) that the ecologists’ shorthand phrase ‘everything is connected to everything else’ is nothing more than cold, hard fact.”<sup>374</sup>

### A. *Everything Is Connected to Everything Else*

The ESA reflects the emphasis ecologists and others have placed on current rates of extinction as indicative of the extent humans transgress nature’s limits. Nature does not necessarily abhor extinction; at some rate far lower than that which we now experience, extinction is natural. Current rates of extinction, however, are estimated to be 400 times greater than those found in nature during recent geological times.<sup>375</sup> These extinctions,

OF INTEGRITY (1994); see also James R. Karr, *Protecting Ecological Integrity: An Urgent Societal Goal*, 18 YALE J. INT’L L. 297, 297-306 (1993) (arguing that protecting environmental integrity is essential to the continued sustainability of human society).

372. See generally JOHN MAYNARD SMITH, *EVOLUTION AND THE THEORY OF GAMES* (1982); Jon Reed & Nils C. Stenseth, *On Evolutionarily Stable Strategies*, 108 J. THEORETICAL BIOLOGY 491 (1984); Thomas L. Vincent & Joel S. Brown, *The Evolution of ESS Theory*, 19 ANN. REV. ECOLOGY & SYSTEMATICS 423 (1988).

373. See ESA REPORT, *supra* note 76, at 1 (“Healthy ecosystems carry out a diverse array of processes that provide both goods and services to humanity.”).

374. H.R. REP. NO. 93-412, at 6 (1973), *reprinted in* A LEGISLATIVE HISTORY OF THE ENDANGERED SPECIES ACT OF 1973, AS AMENDED IN 1976, 1977, 1978, AND 1980, at 145 (1982). This “cold, hard” scientific fact has many literary and religious precursors. Robert McIntosh, a leading historian of theoretical ecology, refers to the following representative statement by Richard Bradley in 1721: “All Bodies have some Dependence upon one another; and . . . every distinct Part of Nature’s works is necessary for the Support of the rest; and . . . if any one was wanting all the rest must consequently be out of Order.” MCINTOSH, *supra* note 284, at 70. For a review of the impact of religious and literary models of nature on environmental law, see Charles J. Meyers, *An Introduction to Environmental Thought: Some Sources and Some Criticisms*, 50 IND. L.J. 426 (1975).

375. Professor Edward O. Wilson, a leading authority in conservation biology, has written:

The rate of extinction is now about 400 times that recorded through recent geological time and is accelerating rapidly. If we continue on this

ecologists tell us, upset crucial balances in nature or otherwise threaten the health and integrity of ecological systems.<sup>376</sup> According to this position, the purpose for which ecosystems are designed—the purpose inherent in those systems—is to achieve and maintain the natural balance, stability, integrity, or harmony in the environment, which also benefits human beings.<sup>377</sup> Any change that humans make in the natural functioning of ecosystems, particularly by causing local or global extinctions, may undermine the complex ways nature has organized these communities to benefit humanity and support all life on earth.<sup>378</sup>

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path, the reduction of diversity seems destined to approach that of the great natural catastrophes at the end of the Paleozoic and Mesozoic eras—in other words, the most extreme in 65 million years.

Edward O. Wilson, *The Biological Diversity Crisis: A Challenge to Science*, ISSUES SCI. & TECH., Fall 1985, at 20, 25.

376. See *infra* text accompanying notes 564 and 569 (discussing the “airplane” analogy).

377. See ECOSYSTEM HEALTH, *supra* note 370, at 239-53.

378. The normative or prescriptive aspect of ecological science was particularly pronounced in the foundational work of early theoretical ecologists such as A.G. Tansley and Raymond Lindeman. In Tansley’s work, the term “ecosystem,” which he may have coined, meant something, namely, a dynamic equilibrium among organic elements. “In an ecosystem the organisms and the inorganic factors alike are *components* which are in relatively stable dynamic equilibrium.” Tansley, *supra* note 239, at 306. The concept that made an ecosystem a *system*, namely, dynamic equilibrium, generally has been abandoned with the acceptance of the “non-equilibrium paradigm.” The idea that a jumble of elements still somehow is a system and can be studied as such, however, lingers on unabated. Raymond Lindeman, along with many other ecologists, gave the term “ecosystem” normative content by arguing that the elements in it proceed to a stable, climactic state. “Succession is the process of development in an ecosystem . . . towards a relatively stable condition of equilibrium.” Lindeman, *supra* note 239, at 709.

Theoretical ecologists have tended to see nature as having a valuable order, design, and unity that human beings should preserve or protect, while the physical sciences are “positivistic,” not “normative,” in that they do not ascribe value to the original state of nature. The laws of physics, electromagnetics, or biochemistry do not identify the amount of friction or resistance or ammonia that exist in nature as “healthy;” they would not say that the physical world would have more “integrity” if, for example, we did not extract minerals from the earth. These sciences are neutral with respect to the goals that we choose to pursue; they do not ascribe purposes or final causes in nature. The Newtonian principles, for example, are just as compatible with avalanches as with avionics. The Big Bang just happened and where mountains or minerals fetched up is the result of stochastic processes not design. The order these sciences find in nature in no way resembles a moral one; all of the values come from us. Ecology, however, attributes value to the way nature organizes itself

When Senator Tunney spoke of the stability of "an immensely complicated ecological organization," in which each species performs a service,<sup>379</sup> he drew upon the work of theoretical ecologists.<sup>380</sup> These ecologists have used concepts such as "stability," "equilibrium," and "homeostasis" to describe a balance of nature that human activity may upset.<sup>381</sup> These concepts, often illustrated with flow and circuitry diagrams familiar in other sciences such as cybernetics and thermodynamics,<sup>382</sup> helped to buttress the claim that the extinction of species could undermine the integrity of ecosystems. In this spirit, a distinguished panel of ecologists recently wrote, "[t]he conditions and processes characterizing natural ecosystems supply humanity with an array of

into ecosystems—hence concepts like "succession" and "equilibrium" become important in guiding public policy. Ecology may have given up these concepts, but it retains its commitment to the normativity of ecosystems as organized by nature. But what is the principle of organization?

379. See 119 CONG. REC. S25,668 (daily ed. July 24, 1973) (statement of Sen. Tunney).

380. For an excellent historical study of theoretical ecology in the 1960s and 1970s, see generally MCINTOSH, *supra* note 284.

381. See A. Dan Tarlock, *Biodiversity Federalism*, 54 MD. L. REV. 1315, 1326 (1995) ("The basic idea was that systems, not organisms, evolve; evolution was assumed to move toward homeostasis or balance.") (footnote omitted); see also Leslie A. Carlough, *Integrating Ecology and Environmental Policy*, 23 ENVTL. L. 1375, 1385 n.50 (1993) (describing the "Gaia Hypothesis": "Gaia is the concept that Earth behaves as a super-ecosystem in its capacity to self-regulate and maintain a chemically and physically homeostatic, nurturing environment for the life it contains, and that Earth's biota take the dominant role in maintaining the equilibrium"). The source of the "Gaia Hypothesis" is JAMES E. LOVELOCK, *GAIA: A NEW LOOK AT LIFE ON EARTH* (1979). For a representative application of this hypothesis to environmental policy, see *The Fragile Miracle*, in *GAIA: AN ATLAS OF PLANET MANAGEMENT* 10 (Norman Myers ed., 2d ed. 1993) [hereinafter *The Fragile Miracle*].

382. Ecologists often note that virtually all of their theories borrow from other sciences. Robert Peters, for example, has shown that papers in theoretical ecology refer far more often to papers in other sciences than to those within ecology. See ROBERT HENRY PETERS, *A CRITIQUE FOR ECOLOGY* 6-10 (1991). Lawrence Slobodkin, a theoretical ecologist, asked his colleagues to "stop presenting the platitudes of one field as the intellectual breakthroughs in another." Lawrence B. Slobodkin, *Comments from a Biologist to a Mathematician*, in *ECOSYSTEM ANALYSIS AND PREDICTION* 318, 321 (Simon Levin ed., 1975). "Fitness set diagrams for example, are essentially directly derived from optimality sets in economic oligopoly theory. They have been moved bodily to evolution without either having their operationality determined or their sources stated." *Id.*

free services upon which society depends."<sup>383</sup> They concluded:

destruction of biodiversity at the genetic, population, species or ecosystem level should be permitted only as a last resort, when crucial human needs can be met in no other way. The burden of proof of need must rest on those proposing the destruction, and societies must guard against short-term financial gain at the expense of the majority.<sup>384</sup>

Environmentalists, in viewing the environment as having a kind of theoretical unity, rely upon evidence proffered by ecologists who have developed "increasingly sophisticated models that address the responses to stress of community and ecosystems structure and function, and of patterns of succession, productivity, and nutrient cycling."<sup>385</sup> Ecologists have taken seriously their role in providing the biological theory of the environment on which both their science and public policy might be based.<sup>386</sup> In 1989, Simon Levin, for example, declared: "We

383. H.A. Mooney et al., *supra* note 347, at 282; Noss, *supra* note 24, at 894 ("If we are really interested in maintaining ecological processes and the services they provide to human society, then conservation must be extended to entire landscapes or regional ecosystems. Almost all conservationists agree that some sort of 'ecosystem management' is necessary to maintain biodiversity and ecological integrity in today's world.")

384. H.A. Mooney et al., *supra* note 347, at 284. This statement suggests that any reduction in any area's biodiversity level is prohibited, ruling out any development (i.e., "short-term financial gain"). It is interesting to speculate whether the authors of this passage would have the public at large, which receives so many benefits from biodiversity, compensate individual landowners who would have to provide habitat for species in lieu of engaging in farming, manufacturing, construction of housing, or other such examples of environmental greed.

385. Simon A. Levin, *Challenges to the Development of a Theory of Community and Ecosystem Structure and Function*, in JONATHAN ROUGHGARDEN ET AL., PERSPECTIVES IN ECOLOGICAL THEORY 242, 242-55 (1989).

386. By insisting that ecosystems embody balance, harmony, or integrated complexity of some rarified sort, ecologists claim that ecology is a mathematical science like physics. Joel E. Cohen has observed: "Physics-envy is the curse of biology." Joel E. Cohen, *Mathematics as Metaphor*, 172 SCI. 674, 675 (1971) (book review). For a discussion of physics-envy in ecology see Frank E. Egler, "Physics Envy" in *Ecology*, 67 BULL. ECOL. SOC'Y AM. 233 (1986). According to Egler, "physics envy" is a syndrome "in which the methods, techniques, standards, theories, concepts, and paradigms [of physics] are appropriated and emulated, but have not . . . produc[ed] the equivalent desired robust results." *Id.* at 233. Field biologists who try to find the causes of particular events, such as diseases or deformities in wild animals, find theoretical ecology, systems modeling, and so on, to be not only irrelevant but a drain on resources. The greatest mathematician is likely to have nothing to suggest about what is mak-

must develop a theory for the response patterns of different ecosystems. . . . We must develop standards of comparisons among ecosystems, based on the identification of common, functionally important processes and properties."<sup>387</sup>

Over the past decades, theoretical ecologists, consistent with Simon Levin's advice, have employed "supercomputing ability" to study "the mathematical properties of large-scale dynamical systems" and to engage in "fundamental mathematical analyses of the dynamics of such systems, of their hierarchical relationships, and of the techniques available for simplifying them . . . ." <sup>388</sup> In this way, ecologists have attempted to establish, at least on the theoretical level, a normative basis for environmental policy in the face of the cold, hard fact that everything is connected to everything else.

### *B. Ecology as a Normative Science*

Ecology differs from other natural sciences insofar as it sees itself as a *normative* science, that is, insofar as ecologists ascribe normative properties, such as "health" and "integrity," to biological communities or ecosystems. To the extent it is a normative science, ecology seeks to explain the sense in which "healthy" ecosystems function better ecologically than those that human beings have damaged or compromised.<sup>389</sup> Because "healthy"

ing frogs sick. Geoffrey Fryer has written:

[T]he mania (on the part of some it is nothing less) to express biological events in numerical terms and to support the simplest facts with a statement of their statistical significance has become so widespread as to obscure the fact that a true understanding of many biological phenomena (even in ecology where numbers are so easily generated) often demands qualitative rather than quantitative knowledge . . . . Mathematics may be synonymous with the ordered structure of the physical world: it cannot explain everything in biology.

Geoffrey Fryer, *Quantitative and Qualitative: Numbers and Reality in the Study of Living Organisms*, 17 *FRESHWATER BIOLOGY* 177, 177 (1987).

387. Levin, *supra* note 385, at 243 (quoting K.D. Kimball & Simon A. Levin, *Limitations of Laboratory Bioassays and the Need for Ecosystem Level Testing*, 35 *BIOSCIENCE* 165 (1985)).

388. *Id.* at 243.

389. *See, e.g.*, Noss, *supra* note 24. Reed Noss has stated that "because a healthy

ecosystems support life on earth, they may not only have a good of their own but may also serve a purpose, that is, the well-being of humanity. "Ecosystem function depends on its structure, diversity and integrity," the Ecological Society of America declared.<sup>390</sup> The Society added: "Healthy ecosystems carry out a diverse array of processes that provide both goods and services to humanity."<sup>391</sup> Healthy ecosystems and human well-being exist, in other words, in a preestablished harmony, the maintenance of which is the goal of ecosystem management.<sup>392</sup>

Most natural and physical sciences, in contrast, do not make value claims about objects they study. Avogadro's rule, for example, describes a regularity in the behavior of gas molecules; it does not say that gases have more integrity at certain pressures or temperatures than at others. To be sure, there are "noble" gases, but this title does not refer to their moral character. The point of physics is to say what can and cannot occur in nature, not what should or should not occur there.<sup>393</sup>

Outside of medicine, most natural sciences avoid normative terms such as "health" and "integrity." No physicist would say, for example, that in *healthy* systems objects fall at a gravitational constant, but not in systems that human beings have corrupted for short-term profit. The physical sciences provide the kind of knowledge society can use to manipulate or harness natural

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economy ultimately depends on a healthy ecosystem, human actions that are not compatible with the integrity of the ecosystem should not be permitted." *Id.* at 889.

390. ESA REPORT, *supra* note 76, at 6.

391. *Id.* at 1.

392. "Ecosystem Management does not focus primarily on the 'deliverables' but rather on sustainability of ecosystem structures and processes necessary to deliver goods and services." *Id.* A prominent environmental philosopher has written that ecological theory provides "a social integration of human and non-human nature . . . interlocked in one humming community of cooperations and competitions" requiring each of us "to extend his or her social instincts to all the members of the biotic community." CALLICOTT, *supra* note 241, at 83.

393. Ecology, insofar as it shows that everything connects and that anything can influence or affect anything else, rarely if ever rules out any possibility. Instead, ecologists tend to speak about better or worse rather than possible and impossible. An ecosystem with fewer species can function—but not as well as one having more. For example, Reed Noss has written: "Disruption of the characteristic processes of any ecosystem will likely lead to biotic impoverishment. Although even grossly impoverished ecosystems (for instance, an abandoned strip mine or sewage lagoon) continue to function, they cannot be said to have integrity." Noss, *supra* note 24, at 906.

forces for whatever purposes it wishes to achieve. These sciences would not hypothesize that nature remains in "balance" until upset by human economic activity. On the contrary, making no value judgments about nature, these sciences instruct us how to alter it for our own purposes.

Sometimes a physicist uses normative language, but this is just as a *façon de parler*. When Spinoza wrote that nature abhors a vacuum,<sup>394</sup> for example, he did not mean that vacuums are unnatural states in a pejorative sense. If you operate a vacuum cleaner, you harness a law of nature for a purpose; you do not upset the balance of nature or weaken the ability of nature to provide goods and services over the long run. To mention another example, Aristotle observed that objects, if left alone, tend to descend toward the earth.<sup>395</sup> When Medieval architects constructed the flying buttress, however, they did not transgress nature's integrity by thwarting the natural disposition of walls to fall down. From the perspective of the physical sciences, the exhortation to respect nature or to obey nature, although good advice, is completely unnecessary. Man cannot contravene the laws of the physical world.

With ecology, it is different. Ecologists exhort us to obey nature in the sense that we are to leave it alone.<sup>396</sup> In a recent statement, the Ecological Society of America, for example, observed that: "Extractive or utilitarian management systems such as agriculture, aquaculture or plantation forestry that explicitly reduce complexity and diversity in order to increase productivity of particular ecosystem components may be deficient in key ecosystem processes and, therefore, less stable and less sustainable

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394. See BENEDICT DE SPINOZA, *ETHICS* pt. 1, prop. 15, reprinted in *GREAT BOOKS OF THE WESTERN WORLD* 361 (W.H. White trans., Robert Maynard Hutchins ed., 1952).

395. Cf. JUDY JONES & WILLIAM WILSON, *AN INCOMPLETE EDUCATION* 544 (2d ed. 1995) (discussing this among several of Aristotle's theories).

396. In 1864, George Perkins Marsh established the ideal of permanence in ecology by announcing in *Man and Nature*: "Nature, left undisturbed, so fashions her territory as to give it almost unchanging permanence of form, outline, and proportion." MARSH, *supra* note 327, at 29. He added, "in countries untrodden by man, . . . the geographical conditions may be regarded as constant and immutable." *Id.* at 35.



than intact and diverse natural ecosystems.<sup>397</sup> Presumably, the Ecological Society of America would not require society to give up agriculture, aquaculture, and silviculture altogether. It explained that: "Human generated changes must be constrained because nature has functional, historical, and evolutionary limits. Nature has a range of ways to be, but there is a limit to those ways, and therefore, human changes must be within those limits."<sup>398</sup>

Resource-based industries such as agriculture, silviculture, and aquaculture have followed a different path. They rely on technologies derived from sciences such as biochemistry and genetics that teach us how to alter or transform nature for what is sometimes referred to as short-term financial gain. These industries owe very little, if anything, to the ecological theory of this century. Rather, they depend on natural and physical sciences that benefit human beings by treating nature as either a resource to be exploited or an enemy to be defeated. The conquest of nature rather than respect for its limits, from this perspective, has been the key to survival for human beings.

Ecologists do not as a rule conceive of nature as neutral with respect to human interests, and certainly not as hostile to them. Nor have ecologists made their discipline "value free" like thermodynamics, cybernetics, and information theory, from which they have taken models and concepts. On the contrary, ecologists who hoped to make ecology a predictive science also wished it to remain a normative one. They hoped that the principles they discovered would show that ecosystems and biological communities progress—if undisturbed by human beings—to greater complexity, stability, balance, and so on.<sup>399</sup> The idea implicit in ecological science is that Nature herself has a "health" and "integrity" and that she will attain those appropriate states if we

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397. ESA REPORT, *supra* note 76, at 4.

398. *Id.* at 11 (citation omitted).

399. Dan Goodman referred, for example, to the "coherent and aesthetically pleasing body of theory which predicts that complex trophic systems will be more stable than simple ones, or, in general, that more diverse communities will be more stable than less diverse ones." Daniel Goodman, *The Theory of Diversity-Stability Relationships in Ecology*, 50 Q. REV. BIOLOGY 237, 240 (1975).

leave her alone.<sup>400</sup>

A. Dan Tarlock observed that the idea of the biotic community as a "holistic ecological concept which combined living organisms and the physical environment into a system" was a theory in the grand scientific tradition: it was not based on field observations.<sup>401</sup> Tarlock added that "these ideas drew on the image of a nature in balance which was central to both the Judeo-Christian and Enlightenment world view."<sup>402</sup> As Bosselman and Tarlock pointed out:

The idea that "Nature knows best: leave her alone" fit with the secular-spiritual preservation movement which transformed itself into environmentalism in the 1960s. "Leave her alone" principles derive from classic ecological theories which posited equilibrium as the highest state of natural systems and viewed ecosystems as inherently fragile and thus vulnerable to human degradation. Ecology was an attractive basis for law because it was thought to yield scientific laws which could form the basis for the intense regulation of land and resource use.<sup>403</sup>

### C. *The Non-Equilibrium Paradigm*

At the time Senator Tunney was framing before Congress the hypothesis that each species performs a vital service—or, more generally, that the stability of an ecosystem depends on the biodiversity it contains—ecologists were abandoning that idea partly because the concepts of "stability" and "diversity" beggared definition and measurement,<sup>404</sup> partly because empirical

400. For essays to this effect see, ECOSYSTEM HEALTH, *supra* note 370.

401. Tarlock, *supra* note 381, at 1326 (quoting and citing GOLLEY, *supra* note 314, at 8).

402. *Id.* at 1327 (citing BOTKIN, *supra* note 304, at 32-35).

403. Bosselman & Tarlock, *supra* note 22, at 847-48. There is now nearly universal agreement with "the negative conclusion that ecology as such probably cannot do what is expected of it. It cannot provide a set of ecological 'rules' of the kind needed to manage the environment." William Murdoch & Joseph Connell, *The Ecologist's Role and the Nonsolution of Technology*, in ECOCIDE 47, 57 (Clifton Fadiman & Jean White eds., 1971).

404. See Stuart H. Hulbert, *The Nonconcept of Species Diversity: A Critique and*

evidence piled up against it,<sup>405</sup> and partly because theoretical results showed, if anything, that stability led to diversity, rather than the other way round, or that they were unrelated.<sup>406</sup> In an influential review of the literature in 1975, a widely respected biologist, Daniel Goodman, concluded:

The diversity-stability hypothesis may have caught the lay conservationists' fancy, not for the allure of its scientific embellishments, but for the more basic appeal of its underlying metaphor. It is the sort of thing that people like, and want, to believe. Thus, though better theories supplant it in scientific usage, we may be certain that the "hypothesis" will persist for a while [sic] as an element of folk science. Eventually that remnant, too, may vanish in the light of discordant facts, and the essential imagery of this once-scientific hypothesis will recede to a revered position in the popular environmental ethic, where it doubtless will do much good.<sup>407</sup>

Under pressure from critics like Goodman, many ecologists have abandoned equilibria assumptions and accepted a "new paradigm,"<sup>408</sup> which recognizes that change not permanence, is

*Alternative Parameters*, 52 *ECOLOGY* 577, 577 (1971) ("[S]pecies diversity has become a meaningless concept . . . the term [should] be abandoned . . .").

405. See Robert T. Paine, *A Note on Trophic Complexity and Community Stability*, 103 *AM. NATURALIST* 91, 92 (1969) (showing that the removal of one "keystone" species can greatly alter the species composition of a rich or diverse ecosystem).

406. See generally ROBERT M. MAY, *STABILITY AND COMPLEXITY IN MODEL ECOSYSTEMS* (1973) (arguing that a stable ecosystem in theory presents a basis for accumulating greater diversity). Citing the work of several theoretical ecologists who examined the stability-diversity relationship in the late 1960s and early 1970s, Shrader-Frechette and McCoy concluded, "[t]heir pioneering work and subsequent mathematical analysis failed to demonstrate any causal link between species diversity and stability . . ." SHRADER-FRECHETTE & MCCOY, *supra* note 284, at 38. Similarly Stuart Pimm has written that "[c]omplex communities should be the most sensitive to the loss of species from the top of the food web, because secondary extinctions propagate more widely in complex than in simple ecosystems." PIMM, *supra* note 23, at 356.

407. Goodman, *supra* note 399, at 261. The stability-diversity hypothesis, however, will not go away. Thomas Zaret has commented: "scientists are still very much interested in the relationship, or more appropriately, in the presumed or hoped-for or wished-for relationship, between diversity and stability of biological communities." Thomas Zaret, *Ecology and Epistemology*, 65 *BULL. ECOL. SOC'Y AM.* 4, 4 (1984).

408. Steward T.A. Pickett et al., *The New Paradigm in Ecology: Implications for Conservation Biology Above the Species Level*, in *CONSERVATION BIOLOGY: THE THEORY AND PRACTICE OF NATURE CONSERVATION PRESERVATION AND MANAGEMENT* 65,

the constant in nature. It is remarkable; however, how enthusiastically ecologists give lip service to the new non-equilibrium "paradigm" without acknowledging or even discerning its apparent normative consequence, which is that nature is going nowhere, has no "integrity" or "well-being" of its own, and is utterly devoid of any meaning, order, purpose, or end. If contingency, historical accident, turmoil, disturbance, and path-dependent chaotic randomness comprise the only rules that govern the course that ecosystems follow—or if the terms "eco" and "system," when joined, constitute an oxymoron, as suggested by the "new paradigm"—then it is just one damned thing after another out there.<sup>409</sup> Nature does not know (it has no *logos*) and Nature does not care (it has no *telos*).<sup>410</sup>

Many theoretical ecologists, however, work within the "new paradigm" while keeping faith in the Platonic intelligibility and the Aristotelian purposiveness of the natural world. The place of every species in the design, chain, or harmony of nature remains secure, as far as much current ecosystem theory is concerned, however chaotic, random, or tumultuous ecosystems are. For many ecologists, the "new paradigm" simply means borrowing mathematics from chaos theory rather than from optimization or equilibrium theory; otherwise it is business as usual. For them, contingency is nothing special—just a little randomness mixed in with the determinism. The mathematics become more rarified, but the normative assumptions about the *telos* and *logos* of the ecosystem remain essentially unchanged.

For example, Eugene Odum, the champion of models of orderly development in ecology during the 1960s and 1970s, found it easy to accept non-equilibrium theories in the 1990s.<sup>411</sup> In his

70-74 (Peggy L. Fiedler & Subodh K. Jain eds., 1992).

409. See ERNST MAYR, *THE GROWTH OF BIOLOGICAL THOUGHT: DIVERSITY, EVOLUTION, AND INHERITANCE* 37-38 (1982) (proposing that the only universal law in biology is that "all biological laws have exceptions"). Mayr added: "Each organic system is so rich in feedbacks, homeostatic devices, and potential multiple pathways that a complete description is quite impossible." *Id.* at 59.

410. See SHRADER-FRECHETTE & MCCOY, *supra* note 284, at 149 (making the same point more delicately when they refer to "the apparent uniqueness and randomness of ecological situations").

411. See Tarlock, *supra* note 381, at 1328 n.64 ("We can now more clearly under-

essay *Great Ideas for Ecology for the 1990s*, Odum named as a primary principle the idea that “[a]n ecosystem is a thermodynamically open, far from equilibrium, system.”<sup>412</sup> This “paradigm shift” had so little impact on Odum that he cited his own 1983 text, which classically set forth the “balance-of-nature” theory, as a source of his new-found belief in the non-equilibrium theories!<sup>413</sup> Even if chaotic, contingent, random, radically dependent on the slightest changes in initial conditions, unpredictable, indeterminate, undefinable, and capable of virtually anything, Nature still knows best.

Professor Judy L. Meyer, a colleague of Odum at the Georgia Institute of Ecology, also recognized the paradigm shift that has undermined attempts to define a “natural” state for any ecosystem. She wrote:

Unfortunately, we have not yet developed and popularized an image to replace that of the ‘balance of nature.’ I suggest ‘the dance of nature’ as an image that conveys a sense of change and movement in response to a myriad of influences, just as a modern dancer moves in response to a musical score.<sup>414</sup>

Having embodied in the metaphor of a “dance” following a “score” the concepts of harmony, design, and purpose that were implicit in the old metaphor of “balance,” Meyer drew the orthodox conclusion: “If we follow the non-equilibrium paradigm, . . . we need to preserve the ecosystem . . . and the process that has given rise to that interacting set of species, so that the assemblage can continue to change in response to environmental change.”<sup>415</sup>

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stand that Odum’s theory of ecosystem equilibrium is one of the last gasps of 19th century deterministic science . . .”).

412. Eugene P. Odum, *Great Ideas for Ecology for the 1990s*, 42 *BIOSCIENCE* 542 (1992).

413. *Id.* (citing EUGENE P. ODUM, *BASIC ECOLOGY* (3d ed. 1983)).

414. Meyer, *supra* note 23, at 877.

415. *Id.* at 881. The conceptual confusion should be apparent to the reader. The “new paradigm,” if it means anything, means that we cannot identify ecological systems or communities through time and change because nothing remains stable long enough to serve as a defining criterion of the system. The ecosystem or biological community, in other words, must be understood as a conceptual construct of an ecological theory that has been replaced. In the new paradigm, the concept of ecosystem refers to nothing whatsoever because no stable state, strategy of development, or

“But if communities are not in balance and no ‘natural’ state can be defined,” ecologist Walt Reid asked, “then what should the primary concern of ecological management be?”<sup>416</sup> If we cannot restore nature to some equilibria, stable, or otherwise canonical condition, what should we seek to achieve? Economic development? Wealth maximization? The protection of property rights? If not, why not? If we cannot determine the original or appropriate natural balance—call it a “dance” if you like—what objective has ecological science to suggest? What purposes are ecosystems in their “natural” state supposed to serve? And if the “new paradigm” declares that every state is natural—that constant change is natural—where do we go from there?

#### D. *The Keystone Species*

Not all ecologists, of course, engage in theory building; not all seek to make ecology a “hard” predictive science based on mathematical models and formulas. It is customary, in fact, to divide ecologists into two schools or disciplines: theoretical and field ecologists. The former are most at home indoors with computers and analytical models, the latter are likely to be found *al fresco* running experimental, inductive investigations of particular species and environments.<sup>417</sup> These more empirically-minded ecol-

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equilibrium exist to provide terms by which to define “ecosystem.” Professor Meyer nevertheless blithely assumed that the ecosystem can be re-identified through change, so that one can distinguish between its changing and mere change. Absent concrete notions of balance, equilibrium, design, or structure, the sorts of things provided by the old paradigm, no conceptual categories exist by which to define the object that changes. To use Meyer’s metaphor, one cannot tell the dancer from the dance. *See id.*

416. WALTER V. REID, *Beyond Protected Areas: Changing Perceptions of Ecological Management Objectives*, in *BIODIVERSITY IN MANAGED LANDSCAPES* 442, 448 (Robert C. Szaro & David W. Johnston eds., 1996).

417. George Salt characterized the two schools in ecology as follows:

As the mathematics used became more esoteric, the field biologists found themselves either unwilling or unable to keep abreast while at the same time maintaining their necessary tools in systematics, statistics, physiology, and morphology . . . . The fraternity became splintered into factions with lofty or derogatory titles depending on who applied them. “Empiricists” and “theoreticians” were the most polite.

ogists may take the same approach to the arrangement of the living world that geologists have taken to the physical world.<sup>418</sup> They may discern an historical record in the way things are piled up and tossed around, but they may not seek to discover a universal design or order in the resulting ensembles of plants and animals.<sup>419</sup>

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George Salt, *Roles: Their Limits and Responsibilities in Ecological and Evolutionary Research*, 122 AM. NATURALIST 697, 699 (1983). Salt often has cast a jaundiced eye on the use of mathematical theory in ecology. He has written that mathematical theorizing (in competition theory, for example), although irrelevant to empirical research, has encouraged "more and more extravagantly generalized model systems so that the specter of the rebirth of scholasticism began to appear." *Id.* Simon Levin, a leading mathematical ecologist who now teaches at Princeton University, described the reception that mathematical modelers received from field biologists: "much of mathematical ecology is simply mathematics dressed up as biology, and is dismissed by field biologists as being of no relevance to their interests." Simon Levin, *Mathematics, Ecology, and Ornithology*, 97 AUK 422, 422-23 (1980). Levin might have had in mind such articles as Earl E. Werner & Gary G. Mittelbach, *Optimal Foraging: Field Tests of Diet Choice and Habitat Switching*, 21 AM. ZOOLOGIST 813, 814-15 (1981) (arguing that optimal foraging theory may make sense as mathematics, but not as biology). Lev Ginzburg, a theorist at SUNY Stonybrook, described mathematical ecology in the following manner:

The original idea was to say something meaningful about the dynamics of a real population. Instead, our journals are full of stability conditions, often expressed in terms of the eigenvalues of unknown matrices, diversity and complexity measures having very little to do with reality and a growing number of "theorems" which, I suspect, appear in publications on theoretical biology because they are too trivial for a mathematical journal.

Lev R. Ginzburg, *Ecological Implications of Natural Selection*, in VITO VOLTERRA SYMPOSIUM ON MATHEMATICAL MODELS IN BIOLOGY 171 (Lecture Notes in Biomathematics, Claudio Barigozzi ed., 1980).

418. Stephen Gould described this historical method in evolutionary biology as follows:

[Historical] methods are comparative, not always experimental; they explain, but do not usually try to predict; they recognize the irreducible quirkiness that history entails, and acknowledge the limited power of present circumstances to impose or elicit optimal solutions; the queen among their disciplines is taxonomy, the Cinderella of the sciences. As I wrote in *Hens' Teeth and Horses' Toes*, I watched with almost detached amusement as history slowly emerged in the forefront of my concerns. . . . The flamingo's smile (like the panda's thumb) is its synecdoche—a quirky structure, constrained by a different past, and cobbled together from parts available.

STEPHEN JAY GOULD, *THE FLAMINGO'S SMILE* 18 (1985).

419. One also might compare ecologists in this context with criminologists. Many, if not most, of those involved in helping society deal with crime are detectives. Relying on inductive methods, they work from empirical clues and other evidence in order to

Ecologists who take an empirical or inductive approach in their research often acknowledge the historicity or contingency of the populations or communities they study.<sup>420</sup> "[W]e must always bear in mind the crucial fact that evolution is a history-dependent process," Edward Wilson and George Oster wrote in 1978.<sup>421</sup> They continued: "As systems become more complex, the historical accidents play a more and more central role in determining the evolutionary path they will follow."<sup>422</sup> According to Oster and Wilson, one cannot hope to find automatic processes leading populations to ever higher levels of adaptation: "We will show that not even this relatively modest theme can be translated into mathematically sound arguments."<sup>423</sup>

In spite of acknowledgments of contingency of this kind, empirically minded ecologists, like their more theoretically minded colleagues, often tend to regard nature as normative, as leading to the right or appropriate states as long as it is left alone. These empirically minded biologists, however, are more likely to take metaphors from practical disciplines, such as architecture, than from abstract mathematical fields, such as information theory. In one of the most famous experiments intended to demonstrate the architectural elegance of ecosystems, ecologist Robert

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determine who perpetrated a crime. Such detectives do not suppose that mathematical laws, models, or principles exist from which they can deduce probabilities about who did what. A different group of criminologists study crime in general, asking not who killed whom, but questioning the overall causes of criminal behavior. Of course, theoretical criminology hardly pretends to be a predictive or even mathematical science; it does not use extensive computer modeling of the phenomena. Its pretensions are far more modest than those of mathematical ecology. See generally DONALD R. TAFT & RALPH W. ENGLEND, JR., *CRIMINOLOGY* 11 (4th ed. 1964) (discussing the narrow definition of criminology as the study that attempts to explain crime).

420. For a discussion of historical methods in evolutionary ecology, see William H. Rodgers, Jr., *Where Environmental Law and Biology Meet: Of Pandas' Thumbs, Statutory Sleepers, and Effective Law*, 65 U. COLO. L. REV. 25, 47 (1993) ("The answer is that evolutionary biology is an historical science focusing on the study of complex systems, not unlike investigations of the weather patterns, the movements of the earth, the oceans, and the drift of the galaxies.").

421. GEORGE F. OSTER & E.O. WILSON, *CASTE AND ECOLOGY IN THE SOCIAL INSECTS* 311 (1978).

422. *Id.*

423. *Id.* at 295.



Paine discovered that if he removed a species of starfish from an intertidal area off the coast of Washington state, one kind of barnacle would come to dominate and then displace other kinds, because the starfish would no longer graze down its numbers.<sup>424</sup> On the basis of this and other experiments, Paine and others defined the notion of a "keystone" predator, that is, one that maintains greater diversity in an area by controlling a prey species that would otherwise simplify the system by eliminating its competitors.<sup>425</sup>

The term "keystone" suggests a species whose removal would cause the other parts of the ecosystem to fall apart like stones falling away from an arch.<sup>426</sup> Environmentalists, indeed, often cite "keystone" predators as examples of the way ecosystems organize themselves to achieve a stable order and to maintain various functions.<sup>427</sup> The ecosystem with the "keystone" predator, in this instance, a starfish, is thought to be *better* or have more "integrity" than one that human beings have changed and simplified, say, by removing the starfish.<sup>428</sup> The starfished eco-

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424. See Robert T. Paine, *Food Web Complexity and Species Diversity*, 100 AM. NATURALIST 65, 70-71 (1966).

425. See, e.g., *id.* at 73. For a study of competition exclusion among these species, see Joseph H. Connell, *The Influence of Interspecific Competition and Other Factors on the Distribution of the Barnacle Chthamalus Stellatus*, 42 ECOLOGY 710 (1961).

426. "Analogous to the removal of a keystone from an arch, the removal of a keystone species results in dramatic changes in the functional properties of the ecological system." H.A. Mooney et al., *supra* note 347, at 289. "So-called 'keystone' species provide critical support to wide arrays of other species with which they interact." Fraser Smith, *Biological Diversity, Ecosystem Stability, and Economic Development*, 16 ECOLOGICAL ECON. 195 (1996).

427. Robert Paine drew this conclusion. He spoke of "the integrity of the community and its unaltered persistence through time, that is, stability." Paine, *supra* note 405, at 91. Environmental philosophers, such as Holmes Rolston, also have urged society to "[p]rotect keystone species" because they "play vital roles in the ecosystem." HOLMES ROLSTON III, *CONSERVING NATURAL VALUE* 62 (1994). The assumption, as always, is that there is a system in which species play roles.

428. See generally Paine, *supra* note 405, at 91-92; ROLSTON, *supra* note 427, at 62-63 (discussing the need to afford greater protection to keystone species). But why is this better? So what if one barnacle out-competes another in the absence of the starfish? What difference to the economy could possibly result from the relative population sizes of barnacles among a few rocks? That ecosystems change and will continue to change proves nothing with respect to the instrumental value of biodiversity. One also must show that ecosystem services will collapse or seriously diminish as a result of species change, not merely that one barnacle will come to dominate another.

system, in other words, possesses health, balance, equilibrium, or some such normative property not to be found in an ecosystem from which human beings (perhaps for short-term financial gain) have removed a key building stone.<sup>429</sup>

Pacific sea otters are often cited as important "keystone" predators because they "play a pivotal role in maintaining kelp forests by eating and controlling sea urchins which consume kelp."<sup>430</sup> Not only sea otters, however, but also Japanese consumers like to eat sea urchins, especially their roe, which is a highly-prized delicacy.<sup>431</sup> While the exact relation between urchins and kelp beds remains in doubt—the urchins actually *aid* these forests by spreading kelp spores<sup>432</sup>—there is little question that the fishing industry competes with sea otters for the urchins. Shall we protect the otters, then, so that they can eat the urchins? We should do so if we believe Nature knows best. In this instance, as in the protection of habitat for endangered species, however, there are countervailing economic interests. Diane

429. If Paine had introduced the starfish into the ecosystem and caused the greater diversity of barnacles, then he would have disturbed the original balance. The starfish-inclusive ecosystem then would have less "integrity" than the one without starfish. Attributing "health" and "integrity" to ecosystems depends on the prior determination of which ecosystem is "natural" and which one has been touched by human hands. An interesting experiment would be to give two groups of ecologists the same data about the same ecosystems, except that one group is informed that the ecosystems are pristine and the other group is told that the ecosystems have been constructed artificially by Disney Enterprises as part of a theme park. It would be curious to discover the extent to which the groups would attribute normative properties such as integrity to the ecosystems that were thought to be natural rather than to the same ecosystems identified as confections of capitalistic greed.

430. See H.A. Mooney et al., *Biodiversity and Ecosystem Functioning: Ecosystem Analyses*, in GLOBAL BIODIVERSITY ASSESSMENT, *supra* note 347, at 373, Box 6.1-1; see also James A. Estes & John F. Palmisano, *Sea Otters: Their Role in Structuring Nearshore Communities*, 185 SCI. 1058 (1974) (comparing Western Aleutian Islands with and without sea otter populations).

431. For a discussion of the sea urchin industry, see Hillary Hauser, *Prickly Business in Sea Urchins*, 40 SEA FRONTIERS 33, 33-37 (1994).

432. "In some situations, sea urchins benefit the kelp. Drift kelp laden with spores, for example, is often caught and held in place by the spines of sea urchins." *Id.* at 36. The article continued: "[K]elp is flourishing in California waters and hasn't been harmed by urchins [despite an absence of otters]. Kelco, a kelp harvesting company based in San Diego, has had very high harvests in recent years." *Id.*

Pleschner, a researcher based in Santa Barbara, reported that "[e]ssentially, the divers are doing what the sea otters would have done in the past, controlling the sea urchin population."<sup>433</sup>

Are ecosystems as we humans find them always designed for our needs? Is the ecosystem with starfish and two kinds of barnacles *better* than any alternative humans may produce? Ecologists generally assume that natural *is* better—that ecosystems and biotic communities, if we leave them alone, evolve or have evolved into well organized or integrated units in terms of which it is meaningful to speak of the "role" or "function" of species.<sup>434</sup> The ecosystem is thus compared with a mechanism, chain, pyramid, arch, bridge, circuit, or some other artificial object that possesses an intelligible, purposive design.<sup>435</sup> In the context of analogies of this kind, species are said to be parts in that design, supporting the arch, maintaining the balance, playing a role, or sounding a note without which the ecosystem will change for the worse or cease to be.<sup>436</sup> By disturbing ecosystems, especially by causing extinctions, humanity risks causing these systems to collapse.

If the explanatory factors that structure ecological communities are principally historical accidents, however, it would seem to follow that to alter an ecosystem is simply to add one more change to the others that have arbitrarily determined its random historical course. Changes humans make in nature, for example, by replacing prairie grasses with amber waves of grain or malarial swamps with alabaster cities, may be beneficial or harmful; one must make an argument in terms of the particular example. Unless one assumes beforehand that mankind is essentially sinful—because of Adam's fall, for example—there would be no reason, moreover, to distinguish anthropogenic forces from others that constantly alter the flora and fauna in any environ-

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433. *Id.*

434. *See, e.g.,* Michael E. Soulé, *What is Conservation Biology?*, 35 *BIOSCIENCE* 727, 729-34 (1985) (discussing the interdependency of species).

435. The classic paper of this kind is G. Evelyn Hutchinson, *The Concept of Pattern in Ecology*, 105 *PROC. PHILA. ACAD. NAT. SCI.* 1 (1953) (introducing the "broken stick" model of populations as determined in part by competitive exclusion).

436. *See generally* Soulé, *supra* note 434, at 729 (discussing the interdependency of species).

ment. There would be no *prima facie* reason to believe that changes we humans inflict on nature—by displacing otters, for example—must go badly for us.<sup>437</sup> Indeed, the wholesale changes we have made—for example, by converting the wilderness of the New World to a post-industrial society—have gone well for us. One might discover that the starfish Paine studied sustained a barnacle that fouled boats—in which case, it may be better to get rid of both the starfish and the barnacle of Washington state. Why is it important either for the rocky intertidal community or for mankind that the “keystone” species maintain the “integrity” of that “ecosystem”?

The “new” or “non-equilibrium” paradigm suggests that there are no general truths about ecosystem organization, that anything is possible consistent with the laws of physics in nature.<sup>438</sup> If ecosystems are unstructured, transitory, and acci-

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437. Indeed, if ecological systems and communities are just random, accidental, contingent, and purposeless collections of biological flotsam and jetsam, then there is no general instrumental reason to preserve them. Manipulating them for our purposes may benefit us more than keeping them as they are. Transforming nature, in fact, has been the basis of civilization. Humans are successful in an evolutionary sense largely because they adapt the environment to their needs and interests, not the other way round. Rather than simply taking them as they come, advances in biotechnology invite us to design species to our own specifications, as evidenced by centuries-old agricultural experiments. In this spirit, one ecologist has advised his colleagues:

Ecologists are the people most fit to develop the conceptual directions of biotechnology. We are the ones who should have the best ideas as to what successful plants and animals should look like and how they should behave, both individually and collectively. Armed with such expertise, are we going to continue investing nearly all of our talents in Natural History? . . . Or should we take the forefront in biotechnology, and provide the rationale for choosing species, traits, and processes to be engineered? I suspect this latter approach will be more profitable for the world at large as well as for ourselves.

Frank Forcella, *Ecological Biotechnology*, 65 BULL. ECOL. SOC'Y AM. 434 (1984). Forcella's point may be generalized. If economic security is the issue, it would seem that the greater risk generally may reside with preserving nature rather than with domesticating and developing it. The wholesale alteration of nature, in general, seems to have gone well for human beings. Anyone who lives in a house, uses roads to get places, buys food rather than hunts and gathers, and plugs appliances into a wall socket relies on the alteration of ecosystems. Would our lives be easier if we had left ecosystems alone?

438. Physicists sometimes present “proofs” to suggest that ecological events can defy

dental in nature, it would seem to follow that no general economic or utilitarian grounds exist for protecting them from change. Questions of value would always relate to the particular circumstances. Some species, communities, and ecosystems may benefit mankind as we find them; others we may improve for our uses. There is no general rule to follow about the health, integrity, stability, resilience, or any emergent property of ecosystems.

Historically-ordered systems have to be understood in terms of a narrative. The story of the comings and goings of flora and fauna in the natural environment is not a story of progress, betterment, design, purpose, order, fulfillment, harmony, or any other normative property. How would ecological science, then, provide any general utilitarian reason that society should protect the natural environment? How could that science move beyond particulars—the description of species that benefit and others that harm human beings—to the general pronouncement that Nature knows best?

### *E. Does Nature Know Best?*

Ecologists are quick to concede that the old equilibrium days are over. Conservation biologist Reed Noss observed:

Ecological science has undergone significant changes in recent years. Among the new paradigms in ecology, none is more revolutionary than the idea that nature is not delicately balanced in equilibrium, but rather is dynamic, often unpredictable, and perhaps even chaotic. It follows that classical preservationist approaches to conservation, to the extent that they attempt to hold nature static, do not reflect realities of nature.<sup>439</sup>

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even the laws of physics, for example, that bumble bees, with their big bodies and tiny wings, cannot fly. This conundrum has been resolved only recently. See Kendrick P. Zetie, *The Strange Case of the Bumble Bee Which Flew* (visited Feb. 27, 1997) <<http://www.npl.co.uk/npl/sip/96/bumble.html>> (winning the 1996 Science in Print Award for finally refuting an assertion made by a Swiss aerodynamicist in the 1930s that bumble bees could not fly).

439. Noss, *supra* note 24, at 893 (footnote omitted). One may argue that conservation biology spun off as a new discipline because the discipline of ecology had become mired in its attempt to identify the design in nature that justified preservation

Another ecologist noted that “[c]ommunity ecology has been dominated too long by the assumption that natural systems are at or close to equilibrium.”<sup>440</sup> A commentator added: “There is scant evidence that ecosystems were ever in equilibrium, and instability may be responsible for the continued existence of many species.”<sup>441</sup>

While admitting that the old concepts of structure, e.g., “equilibrium,” “succession,” and “climax,” no longer apply, many ecologists continue in the faith that nature has a *logos*, or design, to which it may return if perturbed, and a *telos*, i.e., a direction or disposition, because of which that design supports human needs.<sup>442</sup> After noting that “the search for simple rules of ecosystem behavior is futile,”<sup>443</sup> and after embracing “catastrophe

efforts. Conservation biology, in contrast, begins by assuming correctly that society wishes to protect ecosystems, for example, animal refuges and parks, and then investigates how to accomplish this. The conservation biologist unlike the traditional ecologist, in other words, is not caught on the petard of having to answer the question: “Why preserve or protect ecosystems?” Instead, the conservation biologist leaves the value question to others and asks: “Assuming that you *want* to preserve or protect the natural environment, what would that mean and how would you do it?” See *id.* at 895 (discussing this underlying assumption). The concept of the ecosystem may be more tractable in conservation biology than it is in ecology for the following reason: Ecological science gives itself the task of defining or identifying the ecosystem that it investigates. In conservation biology, the ecosystem—it may be a national wildlife park, an animal refuge, or a fishery—is defined beforehand, usually politically, and its purpose (e.g., to provide wildlife refuge) also is determined in advance. Conservation biology enters, then, at a stage when the basic classifications already have been sorted out by political means. See *id.* (describing conservation biology as being “mission oriented”).

440. John A. Wiens, *On Understanding a Non-Equilibrium World: Myth and Reality in Community Structure*, in *ECOLOGICAL COMMUNITIES* 439, 451 (Donald R. Strong, Jr. et al. eds., 1984).

441. Farrier, *supra* note 261, at 325.

442. For discussion of resilience in nature, see C.S. Holling, *The Resilience of Terrestrial Ecosystems: Local Surprise and Global Change*, in *SUSTAINABLE DEVELOPMENT OF THE BIOSPHERE* 292, 294 (W.C. Clark & R.E. Munn eds., 1986).

443. James J. Kay & Eric Schneider, *Embracing Complexity: The Challenge of the Ecosystem Approach*, in *PERSPECTIVES ON ECOLOGICAL INTEGRITY* 49 (John Lemons ed., 1995); see also *id.* at 49-59 (discussing futility more generally).

theory<sup>444</sup> and "chaos theory,"<sup>445</sup> two ecologists nevertheless affirm the faith "that ecosystems represent a balance, an optimal point of operation, and this balancing is constantly changing to suit a changing environment."<sup>446</sup>

The new non-equilibrium paradigm, as these ecologists explain, does not mean

that ecosystem behavior and development is chaotic or random or haphazard. On the contrary, ecosystem behavior and development is like a large musical piece like a symphony, which is also dynamic and not predictable and yet includes a sense of flow, of connection between what has been played and what is still to come . . . .<sup>447</sup>

Everything in nature is still assumed to be interconnected in intelligible and enduring ways. "We must always remember that left alone, living systems are self-organizing, that is they will look after themselves. Our responsibility is not to interfere with this self-organizing process . . . ."<sup>448</sup> New paradigm or old, we are reminded that the first rule of tinkering with any engine is to save all the parts.<sup>449</sup> Nature still knows best.

Once one gives up the presupposition that the living world is organized for a purpose, however, then we can no longer think of it as a mechanism (or symphony, etc.) that has parts. After all, even Rube Goldberg machines have some sort of purpose.<sup>450</sup> Music differs from random noise because it appeals to an aesthetic sense. If ecosystems were like symphonies, we should have to understand their value and their principles of organization in aesthetic not in economic terms. (Sometimes the worst music has

444. *Id.* at 51

445. *Id.*

446. *Id.* at 55.

447. *Id.* at 54. "Ecosystem self-organization unfolds like a symphony." *Id.*

448. *Id.* at 55. For additional statements of this position, see the essays collected in *ECOLOGICAL INTEGRITY AND THE MANAGEMENT OF ECOSYSTEMS* (Stephen Woodley et al. eds., 1993).

449. See LEOPOLD, *supra* note 18, at 168-87.

450. See Larry Catá Backer, *The Incarnate Word, That Old Rugged Cross and the State: On the Supreme Court's October 1994 Establishment Clause Cases and the Persistence of Comic Absurdity As Jurisprudence*, 31 *TULSA L.J.* 447, 448 n.4 (1996) (stating that Rube Goldberg machines were created to perform highly trivial tasks).

the best market.) It well may be that all nature is beautiful. This does not show, however, that all nature is useful.<sup>451</sup>

If ecosystems resembled a kind of superorganism—as was once supposed—then one might think of them as having some sort of structure.<sup>452</sup> One could even conceive that ecosystems, like organisms, evolve. “If the organismic theory of communities were still dominant,” writes David Ehrenfeld, former editor of the journal *Conservation Biology*, “if the idea that communities have a normative, equilibrium position, a balance point, were still widely accepted, then the idea of ecological health would pose few problems.”<sup>453</sup> As things have turned out, however, ecologists since the 1920s, but especially over the past two decades, formally have abandoned equilibria assumptions.<sup>454</sup> On the one hand, ecologists reiterate the old equilibrium theory in metaphorical references to symphonies, dances, arches, and so on. Undoubtedly, theoretical ecologists still consider biotic communities to be normative. Yet, as David Ehrenfeld writes: “No longer are communities considered normative.”<sup>455</sup>

On the one hand, ecologists draw analogies between ecosystems and machines, comparing species to “rivets,”<sup>456</sup> and thus support the idea that species composition is essential to ecosystem “equilibrium,” “function,” “structure,” and “integrity.”<sup>457</sup>

451. Kay and Schneider, although comparing ecosystems to symphonies, plainly believe that ecosystems' value lies in their utility and not just, or even primarily, in their beauty. The authors argued that management goals that seek to maintain or maximize or minimize some state or function of the ecosystem “will always lead to disaster at some point.” Kay & Schneider, *supra* note 443, at 55.

452. For a recent attempt to resurrect the concept of ecosystems as superorganisms, see LAWRENCE E. JOHNSON, *A MORALLY DEEP WORLD: AN ESSAY ON MORAL SIGNIFICANCE AND ENVIRONMENTAL ETHICS* (1991). *But see* MEFPE & CARROLL, *supra* note 354, at 28 (stating that the organismic “conception of ecosystems has fallen so far out of fashion in ecology that Johnson can cite no contemporary ecologists to support his claim”).

453. David Ehrenfeld, *Ecosystem Health and Ecosystem Theory*, in *ECOSYSTEM HEALTH*, *supra* note 370, at 135, 137.

454. For discussion, see A. Dan Tarlock, *The Nonequilibrium Paradigm in Ecology and the Partial Unraveling of Environmental Law*, 27 *LOY. L.A. L. REV.* 1121 (1994).

455. Ehrenfeld, *supra* note 453, at 137.

456. *See infra* note 564 and accompanying text (outlining the “airplane analogy”).

457. For a variety of papers supporting this thesis, see *ECOLOGICAL INTEGRITY AND*



Robert Paine himself has spoken of "the integrity of the community and its unaltered persistence through time, that is, stability."<sup>458</sup> On the other hand, the center of mass of thinking has shifted away from equilibrium and toward the Heraclitean character of natural systems.<sup>459</sup> It is not even clear how to define these as "systems." Ecologists such as Frank Bormann and Gene Likens work with the watershed as an ecosystem,<sup>460</sup> while others, such as R.V. O'Neill, loosely note that one way to define an ecosystem is to look at as "the phenomena of interest, the specific measurements taken, and the techniques used to analyze the data."<sup>461</sup>

The Ecological Society of America, in a recent statement, expressed the same ambivalence. It insisted that "ecosystem function depends on its structure, diversity and integrity."<sup>462</sup> It also emptied these terms of meaning, however, by observing that ecosystems exhibit no fixed qualities at all.<sup>463</sup> "Change is the normal course of events for most ecological systems. . . . Empirical studies have increasingly demonstrated either a lack of equilibrium . . . or equilibrium conditions that are observed only at particular scales of time and space."<sup>464</sup>

### *F. Theory in Ecology*

In enacting the ESA, Congress relied upon two assumptions basic to the work of theoretical ecologists in previous centuries. First, these ecologists overwhelmingly embraced the view that everything in nature is interconnected in an orderly or intelligible structure, the principles of which ecologists either had discovered or were about to discover.<sup>465</sup> In the early 1970s, ecolog-

THE MANAGEMENT OF ECOSYSTEMS, *supra* note 448.

458. Paine, *supra* note 405, at 92.

459. See Stevens, *supra* note 288, at C1.

460. See F. HERBERT BORMANN & GENE E. LIKENS, PATTERN AND PROCESS IN A FORESTED ECOSYSTEM 3 (2d corrected prtg. 1981).

461. R.V. O'NEILL ET AL., A HIERARCHICAL CONCEPT OF ECOSYSTEMS 7 (1986).

462. ESA REPORT, *supra* note 76, at 6.

463. See *id.* at 5.

464. *Id.* at 10 (citation omitted).

465. See generally ARTHUR O. LOVEJOY, THE GREAT CHAIN OF BEING 315-33 (1936) (exposing this principle of interconnectedness).

ical science seemed on the brink of describing the mathematical theory that would vindicate its claim to be a *science* as distinct from a branch of natural history. As two ecologists noted: "The basic theory of physics and chemistry was constructed during the first decades in the century. Many signs indicate that a more general theory for ecology and systems ecology is 'just around the corner.'"<sup>466</sup>

Second, ecologists generally assumed that the mathematical principles "around the corner" would explain how ecological systems are organized—and the species in them arranged—in structures beneficial to human beings.<sup>467</sup> For ecology to be a

466. S.E. Jorgensen & H.F. Mejer, *Trends in Ecological Modelling*, in ANALYSIS OF ECOLOGICAL SYSTEMS: STATE-OF-THE-ART IN ECOLOGICAL MODELLING 21 (William K. Laurenroth ed., 1983). Professor Slobodkin, who teaches ecology at SUNY Stonybrook, voiced the same expectation 20 years earlier:

We may reasonably expect to have eventually a complete theory of ecology that will not only provide a guide for the practical solution of land utilization, pest eradication, and exploitation problems but will also permit us to start with an initial set of conditions on the earth's surface (derived from geological data) and construct a model that will incorporate genetics and ecology in such a way as to explain the past and also predict the future of evolution on earth.

LAWRENCE B. SLOBODKIN, GROWTH AND REGULATION OF ANIMAL POPULATIONS 172 (1962). It should be noted that Professor Slobodkin since has modified this view considerably. As a result, Slobodkin and other have taken up the more modest goal of making lists of species rather than mathematical models the key to epistemology in ecology. See L.B. Slobodkin et al., *On the Epistemology of Ecosystem Analysis*, in ESTUARINE PERSPECTIVES 497, 500 (V.S. Kennedy ed., 1980).

We believe that the procedure of attempting to produce rich descriptions is not only useful but that it generates important questions, different from those generated by attempting to fit ecology into the epistemological nexus generated by the physics and engineering of inanimate systems. This is not vitalism but is a refusal to relegate our intellectual problems to strangers.

*Id.* at 506.

467. One could imagine that ecological principles upon which ecosystems are constructed might be indifferent to human welfare. In that event, ecologists could offer no general *prima facie* economic or instrumental reason for society to protect those systems or to preserve species. These principles of ecology might serve, indeed, as a basis for reengineering nature to make it more productive for human purposes, possibly by greatly simplifying ecosystems, as is done in agriculture, for example. Donald Worster has pointed out that not all biologists saw in the prospect of ecosystem science the basis for preserving nature. "Quite to contrary, many found the ecosys-

predictive mathematical science, nature had to be organized according to an intelligible design. For ecology to be a normative science—showing why society should preserve and protect rather than alter ecosystems—that design must, at least in general, serve a purpose, i.e., to support human needs, interests, and welfare.<sup>468</sup>

These two methodological assumptions, ascribing both mathematical design (*logos*) and beneficial purpose (*telos*) to the natural environment, possess a long and impressive ancestry. Plato wrote in the *Timeas* that nothing incomplete is beautiful and that because nature is beautiful, it must be “the perfect image of the whole of which all animals—both individuals and species—are parts.”<sup>469</sup> Because nature exemplifies design—it possesses order that can be expressed in law-like principles—nothing important can be ascribed to chance. Thus Aristotle observed that the “humbler animals” belong as much to Nature’s plan as the greater ones: “in all natural things there is somewhat of the marvellous.”<sup>470</sup> The Roman statesman Cicero did not use the term “ecosystem,” but he described a “world-order” in which “[t]he providence of God has made wise provision for the . . . perpetuation of all kinds of animals and trees and every plant . . .”<sup>471</sup> These authorities asserted—as does the Bible<sup>472</sup>—that creation is designed for the benefit of mankind.<sup>473</sup>

tem idea a wonderful instrument for promoting global technocracy. Experts familiar with the ecosystem and skilled in its manipulation, it was hoped in some quarters, could manage the entire planet for improved efficiency.” WORSTER, *supra* note 25, at 161; see also Peter J. Taylor, *Technocratic Optimism, H.T. Odum and the Partial Transformation of the Ecological Metaphor After World War II*, 21 J. HIST. BIOLOGY 213 (1988) (discussing the Technocracy movement in ecology).

468. Several ecologists saw biotechnology and environmental engineering, rather than conservation biology, as being the rational application of ecological principles. For the argument that ecologists should lead the development of biotechnology, see Frank Forcella’s comments, quoted *supra* note 437, at 434.

469. LOVEJOY, *supra* note 465, at 50 (quoting Plato).

470. ARISTOTLE, PARTS OF ANIMALS 99-101 (A.L. Peck trans., William Heinemann Ltd. 1937).

471. CICERO, THE NATURE OF THE GODS 175 (Horace C.P. McGregor trans., Penguin Books 1972); see also Egerton, *supra* note 369, at 325-30 (discussing the balance of nature as perceived by early philosophers such as Plato and Aristotle).

472. See *Psalms* 104 (describing a natural order in which God has assigned every creature, both great and small, a place).

473. “For whom then shall we say the world was made? Surely, for those living

Although the vocabulary has changed, biologists in more recent times have continued to assert that human beings depend on—and therefore should not tamper with—the order, balance, or intelligible design of the living world.<sup>474</sup> For example, the pre-Darwinian biologist Linnaeus described what we now call “biodiversity” this way: “All these treasures of nature, so artfully contrived, so wonderfully propagated, so providentially supported . . . seem intended by the Creator for the sake of man.”<sup>475</sup> A leading conservation biologist today has described the goal of biodiversity protection as the “restoration and preservation of presettlement type ecosystem structure, function, and integrity.”<sup>476</sup> He added that “this does not mean trying to hold nature steady but rather maintaining natural dynamics and discouraging anthropogenic deterioration.”<sup>477</sup> The difference between

creatures who are endowed with reason. . . . We may therefore well believe that the world and everything in it has been created for the gods and for mankind.” CICERO, *supra* note 471, at 177.

474. George Perkins Marsh in *Man and Nature* stated a view of life that remained influential for at least a century after he expressed it in 1864:

Nature, left undisturbed, so fashions her territory as to give it almost unchanging permanence of form, outline, and proportion, except when shattered by geologic convulsions; and in these comparatively rare cases of derangement, she sets herself at once to repair the superficial damage, and to restore, as nearly as practicable, the former aspect of her dominion.

MARSH, *supra* note 327, at 27. Darwin had little effect on the commitment of ecologists to a notion of the order, stability, or intelligible design of nature. To accommodate Darwin, ecologists earlier in this century introduced competition, especially mathematical models of competition, into their conceptions of nature’s intelligible and ineffable design. Daniel Botkin has quoted limnologist Stephen A. Forbes as writing in 1925 that “no phenomenon of life . . . is more remarkable than the steady balance of organic nature, which holds each species within the limits of a uniform average number” through competition among them. BOTKIN, *supra* note 304, at 33 (quoting Stephen A. Forbes, *The Lake as a Microcosm*, 15 ILL. NAT. HIST. SURV. BULL. 549 (1925)). Because of this competition, biological systems remain in harmony, Forbes proposed, and a lake is “as prosperous as if its state were one of profound and perpetual peace.” *Id.* at 34.

475. WORSTER, *supra* note 25, at 36 (quoting CAROLUS LINNAEUS, *THE OECONOMY OF NATURE* (1751)).

476. Tarlock, *supra* note 123, at 565 (quoting Reed F. Noss, *Protecting Natural Areas in Fragmented Landscapes*, 7 NATURAL AREAS J. 2, 4 (1987)).

477. *Id.*

Linneaus and contemporary theorists is that the latter have dropped references to a Creator but left everything else as it was; they continue to argue that nature exemplifies a purposive design—an equilibrium, homeostasis, or orderly strategy of development—that human beings disrupt at their peril.<sup>478</sup>

In the twentieth century, ecology hoped to become a mathematical science by seeking to determine the timeless principles by which ecosystems and biological communities are organized and from which society may derive policies for protecting and preserving them.<sup>479</sup> Everything that is scientifically interesting in ecology—as in physics or mathematics itself—was supposed to be permanent, to be expressible by laws, principles, or models that are true generally and not simply at a local place or time.<sup>480</sup> In this belief, ecologists applied to biological systems models, metaphors, and formulas borrowed from other mathematical sciences, for example, from thermodynamics,<sup>481</sup> cybernetics,<sup>482</sup> econom-

478. See Bosselman & Tarlock, *supra* note 22, at 870-71 (discussing environmental management utilizing a non-equilibrium paradigm).

479. For a general survey of the search for general theory in ecology through the 1970s, see Robert P. McIntosh, *Ecology Since 1900*, in ISSUES AND IDEAS IN AMERICA 353 (Benjamin J. Taylor & Thurman J. White eds., 1976), and Robert P. McIntosh, *The Background and Some Current Problems of Theoretical Ecology*, 43 SYNTHESE 195 (1980). In his book on the history of theory in ecology, McIntosh described the historical commitment of ecologists to search for universal principles on which to base predictions. See generally ROBERT P. MCINTOSH, *THE BACKGROUND OF ECOLOGY* (1985). McIntosh traced this focus on the hypothetical-deductive (as distinct from the inductive) method to T.C. Chamberlain. See T.C. Chamberlain, *The Method of Multiple Working Hypotheses* (1890), reprinted in 148 SCI. 754 (1965).

480. David Ehrenfeld explained:

What matters here is that since the early days of Watson, Crick, Jacob, and Monod, ecologists have also been looking for a special, simple generality of their own—preferably something more useful and more purely ecological than the theory of evolution, something with which that theory could be supplemented. In 1963 many of my fellow graduate students and I thought we had found it in Ramon Margalef's American Naturalist paper titled "On Certain Unifying Principles in Ecology." But that hope faded in a few years. There was also the idea of diversity and stability, and soon . . . that generality also faded. After that came the generality of competition, but it too was not the grail. Yet the appeal of generality persists; a passion for patterns is part of the twentieth-century mind-set.

David Ehrenfeld, *The Management of Diversity: A Conservation Paradox*, in ECOLOGY, ECONOMICS, ETHICS: THE BROKEN CIRCLE 26, 28 (F. Herbert Bormann et al. eds., 1991).

481. See, e.g., Odum, *supra* note 412 (borrowing from thermodynamics).

482. See RAMÓN MARGALEF, *PERSPECTIVES IN ECOLOGICAL THEORY* 1 (1968).

ics,<sup>483</sup> spectral analysis,<sup>484</sup> mechanics,<sup>485</sup> information theory,<sup>486</sup> and many other disciplines.<sup>487</sup> The result has been to present ecology as an ahistorical, mathematical, theoretical science and to distinguish it from "thick descriptions" and historical narratives about the flora and fauna in particular places.

### G. Theory Against History

As a quantitative, ahistorical, deductively oriented field, ecology resolutely distinguished its method from those of paleontology, geology, natural history, and other historical sciences.<sup>488</sup> These historical sciences, as paleontologist Stephen Gould has written, avoid mathematical pretensions, while "treating immensely complex and nonrepeatable events (and therefore eschewing prediction while seeking explanation for what has hap-

483. See David J. Rapport & James E. Turner, *Economic Models in Ecology*, 195 SCI. 367 (1977).

484. See Trevor Platt & Kenneth L. Denman, *Spectral Analysis in Ecology*, 6 ANN. REV. ECOLOGY & SYSTEMATICS 189 (1975).

485. See Thomas W. Schoener, *Mechanistic Approaches to Community Ecology: A New Reductionism?*, 26 AM. ZOOLOGIST 81 (1986).

486. See, e.g., Robert MacArthur, *Fluctuations of Animal Populations, and a Measure of Community Stability*, 36 ECOLOGY 533 (1955).

487. Ecologists have criticized their colleagues for foisting mathematical models found elsewhere on ecological phenomena and claiming the result to be a new paradigm or theoretical breakthrough. None of these theoretical borrowings has led anywhere. See Simberloff, *supra* note 325, at 3; George M. Woodwell, *A Confusion of Paradigms (Musings of a President-Elect)*, 57 BULL. ECOL. SOC'Y AM. 8 (1976); George M. Woodwell, *Paradigms Lost*, 59 BULL. ECOL. SOC'Y AM. 136 (1978).

488. See Bosselman & Tarlock, *supra* note 22, at 884; Stephen J. Gould, *Balzan Prize to Ernst Mayr*, 223 SCI. 255, 255 (1984). According to Frederic Clements and many ecologists who followed him, ecological communities of plants and animals follow upon each other in orderly succession in any landscape, culminating in a climax community that is stable if left alone by mankind. See, e.g., JOHN E. WEAVER & FREDERIC E. CLEMENTS, *PLANT ECOLOGY* 80 (2d ed. 1938).

While the climax is permanent because of its entire harmony with a stable habitat, the equilibrium is a dynamic one and not static. Superficial adjustments occur with the season, year, or cycle. . . . While change is constantly and universally at work, in the absence of civilized man this is within the fabric of the climax and not destructive of it.

*Id.*

pened) and using the methods of observation and comparison.<sup>489</sup> Evolutionary biologists such as Gould have proposed that nature works by a sort of make-do, catch-as-catch-can tinkering<sup>490</sup> and, accordingly, that its phenomena may be understood only in the context of local, ephemeral, and often random conditions.<sup>491</sup> This view of life relies not on elegant mathematical models but on observation and induction to explain ecological events in the contexts of particularities of time and place.<sup>492</sup>

Theoretical ecologists, in contrast, search for an intelligible design in ecological events.<sup>493</sup> Not content with the rules of thumb, which have plenty of exceptions, these ecologists have presupposed the existence of universal laws or principles that govern the interplay of the phenomena they study.<sup>494</sup> Many ecologists have portrayed evolution as a relentless drive toward optimization or efficiency in relation, for example, to predator-prey models, foraging strategies, and the flow of energy.<sup>495</sup> Theoretical ecologists describe evolution not as a random walk but as a purposive journey in a single direction.<sup>496</sup>

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489. Gould, *supra* note 488, at 255.

490. See Francois Jacob, *Evolution and Tinkering*, 196 SCI. 1161, 1163-66 (1977).

491. See generally Stephen Jay Gould, *Is a New and General Theory of Evolution Emerging?*, 6 PALEO BIOLOGY 119, 125 (1980). The literature is now immense that argues that evolution, far from optimizing anything, must be explained as path-dependent and dependent on random events as much as on anything. See, e.g., R.C. LEWONTIN ET AL., NOT IN OUR GENES: BIOLOGY, IDEOLOGY, AND HUMAN NATURE 262-64 (1984).

492. See CLIFFORD GEERTZ, *THE IMPLICATIONS OF CULTURES* (1973) (discussing "thick descriptions").

493. The oxymorons are apparent in the titles of articles. See, e.g., John R. Krebs & Robin H. McCleery, *Optimization in Behavioural Ecology*, in BEHAVIOURAL ECOLOGY: AN EVOLUTIONARY APPROACH 91 (J.R. Krebs & N.B. Davies eds., 2d ed. 1984). How can evolution, which goes nowhere, has no goals, and tends in no direction "optimize"? All it can do is "satisfy" in the sense of letting those who are relatively more fit in the local situation survive to the next generation.

494. An evolutionary biologist, in contrast, would see that there are no laws, only a path-dependent historical story to be told. See, for example, MAYR, *supra* note 409, at 37-38 ("There is only one universal law in biology: 'All biological laws have exceptions.'").

495. For a review of the development of these models and equations in competition theory, see JONATHAN ROUGHGARDEN, *THEORY OF POPULATION GENETICS AND EVOLUTIONARY ECOLOGY* (rev. ed. 1987).

496. The most influential doctrine of this sort was the theory of ecological succession first presented by Frederic Clements. See Frederic E. Clements, *The Nature and*

Unlike an historical science, theoretical ecology purports to rest on general principles and mathematical models that reveal the underlying and timeless structure of natural events. These generalizations, moreover, are to be predictive, for otherwise they could not be tested. The search for predictive, general, testable, and quantifiable principles in ecology, however, has gone nowhere, or, to put the same point differently, it has produced a continuous outpouring of theoretical breakthroughs, paradigm shifts, and mathematical insights that have convinced very few scientists other than their authors.<sup>497</sup> As observers have noted: "Theoretical ecology is a major growth industry, and the pages of ecological . . . journals are littered with theory."<sup>498</sup> Ecology continues to confront a "constipating accumulation of untested models"<sup>499</sup> after indulging in "a feast of theory [that ecology] isn't quite ready to digest."<sup>500</sup>

The stakes in developing a theoretical ecology are large. Theorists have argued that unless ecologists develop "a strong theoretical core that will bring all parts of [ecology] back together . . . we [ecologists] shall all be washed out to sea in an immense tide of unrelated information."<sup>501</sup> For these ecologists, scientific explanation, to be fully respectable, must come from the top down—from general models and equations to the microstructure of the particular phenomena to be explained. "Top

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*Structure of the Climax*, 24 J. ECOLOGY 252, 255-56 (1936).

497. In 1987, two marine ecologists wrote that "[i]t is time to acknowledge more openly that holistic models in community ecology may not be very useful predictively and that the practice of making broad generalizations from experiments in a small and heavily biased suite of communities is grinding to a halt." Craig Smith & Peter Jumars, *Ecology of Marine Communities*, 237 SCI. 576, 576 (1987) (citations omitted).

498. Simon A. Levin, *The Role of Theoretical Ecology in the Description and Understanding of Populations in Heterogeneous Environments*, 21 AM. ZOOLOGIST 865, 865 (1981).

499. Thomas W. Schoener, *Mathematical Ecology and Its Place Among the Sciences*, 178 SCI. 389, 390 (1972) (book review). For a similar view of the hopeless glut of theoretical ideas in ecology, see Judith May & Robert M. May, *The Ecology of the Ecological Literature*, 259 NATURE 446 (1976).

500. Douglas J. Futuyma, 50 Q. REV. BIOLOGY 217, 217 (1975) (book review).

501. K.E.F. Watt, *Dynamics of Populations: A Synthesis*, in DYNAMICS OF POPULATIONS 568, 569 (P.J. den Boer & G.P. Gradwell eds., 1971).



down' explanation," as Shrader-Frechette and McCoy observed, "appeals to the construction of a coherent world picture and to fitting particular facts into this unified picture."<sup>502</sup> Three respected theoretical ecologists have written that theory "provides an antidote to the helpless feeling engendered by the view that nature is so complicated, and evolutionary processes so contingent on accident and history, that all we can ever hope to achieve is detailed understanding of specific situations . . . rather than any general rules and patterns."<sup>503</sup>

Field biologists, however, do not experience "helplessness" as they go about their inductive work to find particular causes for particular events, from which they build up "thick descriptions" that allow a greater understanding of natural history.<sup>504</sup> What makes these empirical researchers feel helpless is the expectation that they are supposed to make sense of the deluge of untestable mathematical modelling that floods the pages of journals in theoretical ecology.<sup>505</sup> As Simon Levin himself noted, "much of mathematical ecology is simply mathematics dressed up as biology, and is dismissed by field biologists as being of no relevance to their interests."<sup>506</sup> Describing analytical or theo-

502. SHRADER-FRECHETTE & MCCOY, *supra* note 284, at 121.

503. Jonathan Roughgarden et al., *Introduction in ROUGHGARDEN ET AL., supra* note 385, at 8 (citing GEERTZ, *supra* note 492, as a source of the "thick description" view of explanation that provides an alternative to theory).

504. For a discussion of "thick descriptions," see GEERTZ, *supra* note 492.

505. Daniel Botkin puts this point well with respect to the application of Lotka-Volterra equations, which field biologists neither understood nor could apply even if they did. See BOTKIN, *supra* note 304, at 41.

But since physicists and mathematicians had the highest status among scientists, and since what physicists and mathematicians generally said was generally right, field ecologists tended to regard the logistic and the Lotka-Volterra equations as true. Lacking the understanding to analyze and thereby criticize these equations, they accepted them on the basis of authority.

*Id.* At least one practitioner understood Lotka-Volterra models sufficiently to dismiss their relevance to ecological phenomena.

Few ecologists are interested now in these misleading equations, but mathematicians apparently dote on them and are always trying to foist them on us—a classic case of the drunkard who loses his watch in the dark but looks for it under the lamp post because that's where the light is.

Michael Levandowsky, *The Cats in Zanzibar*, 51 Q. REV. BIOLOGY 417, 418 (1976) (book review).

506. Levin, *supra* note 417, at 422-23. Levin added:

retical modeling in ecology, Edward Wilson commented, "one gets the feeling he is receiving secrets of the universe from a space visitor anxious to be on his way."<sup>507</sup>

One obstacle to bringing theoretical ecology to bear in the field is the difficulty of defining or identifying the "ecosystem" or "community" to which the theory may apply. A field ecologist identifies the ecological environment in relation to an organism or a population of interest. "The ecological environment," as philosopher Robert Brandon points out, "reflects those features of the external environment that affect the demographic performance of the organisms of interest."<sup>508</sup> One could even argue that each individual organism at each discrete moment in its life history defines a different ecosystem or ecosystemic path through changing environmental conditions.<sup>509</sup> Logically, in any one place, one could identify as many ecosystems as there are different plants or animals of interest, because each organism may "pick out" an entirely different set of external biotic and abiotic variables as relevant to its reproductive success and other behavior. Accordingly, the idea of "the" ecosystem or of ecosystems in general, to which a general theory may apply,

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Ornithologists and other field biologists, being accustomed to a science based on the solid cornerstones of fact and observation, often look with suspicion upon theory and mathematics and bristle at the invasion of their territory by a new breed of investigator with no formal credentials in the discipline. . . . The pages of ecological journals have experienced a glut of mathematical publications, often neither good mathematics nor good biology; an unfortunate consequence is that these camouflage those few pieces of work that do address questions of interest to biologists and the novel perspectives that may be exposed by a mathematical approach.

*Id.*

507. Edward Wilson, *The New Population Biology*, 163 SCI. 1184, 1185 (1969) (reviewing POPULATION BIOLOGY AND EVOLUTION (Richard C. Lewontin ed., 1968)).

508. ROBERT N. BRANDON, CONCEPTS AND METHODS IN EVOLUTIONARY BIOLOGY 131 (1996). For an application of this argument as interpreted by ecologists, see Robert K. Colwell & Eduardo R. Fuentes, *Experimental Studies of the Niche*, 6 ANN. REV. ECOLOGY & SYSTEMATICS 281 (1975) (arguing that there are as many ways to partition resources in a place as there are possible organisms).

509. See Robert K. Colwell, *What's New? Community Ecology Discovers Biology*, in A NEW ECOLOGY 387 (Peter W. Price et al. eds., 1984) (arguing that not even all vireos are alike so that each individual bird may define the ecosystem differently).

may itself leave field biologists, as it were, in the dust.

Working largely on the basis of mathematical models of abstract systems, theoretical ecologists have used concepts such as "stability," "equilibrium," and "homeostasis" to describe a balance of nature that human activity may upset.<sup>510</sup> General systems theory, however, has not given the field biologist any concepts with which to identify an object of study.<sup>511</sup> No *system* exists; different sets of environmental properties happen to correlate from time to time with the characteristics of different organisms. Field biologists, who are used to observing the endless variety of ecological relations doubt that anything true, general, and nontrivial can be said about competition or any other species interaction.<sup>512</sup> Only particular details about particular interactions in specific contexts are observable.<sup>513</sup>

510. See Tarlock, *supra* note 381, at 1326 ("The basic idea was that systems, not organisms, evolve; evolution was assumed to move toward homeostasis or balance.") (footnote omitted); see also Carlough, *supra* note 381, at 1385 n.50 (describing the "Gaia Hypothesis": "Gaia is the concept that Earth behaves as a super-ecosystem in its capacity to self-regulate and maintain a chemically and physically homeostatic, nurturing environment for the life it contains, and that Earth's biota take the dominant role in maintaining the equilibrium"). The source of the "Gaia Hypothesis" is LOVELOCK, *supra* note 381. For a representative application of this hypothesis to environmental policy, see *The Fragile Miracle*, *supra* note 381, at 10.

511. See Jared Diamond, *Overview: Laboratory Experiments, Field Experiments, and Natural Experiments*, in COMMUNITY ECOLOGY, *supra* note 295, at 3, 5 (arguing that mathematical theory has not succeeded in reaching the "ultimate goal," namely, "a conclusion with at least some generality, rather than one that applies to just one site in one year"). For a general discussion of the gap between theoretical models and field or experimental observation in ecology, see Adam Lomnicki, *The Place of Modelling in Ecology*, 52 OIKOS 139 (1988).

512. Richard Levins published a famous paper in 1966 that makes this criticism of the pretensions of general models or theories in ecology. See Richard Levins, *The Strategy of Model Building in Population Biology*, 54 AM. SCIENTIST 421 (1966). To try to model all the different ecosystems that might be active at any one place (that is, to try to adopt the perspective of all species at once in any locality) is to set up a many-bodied problem of indescribable complexity. See *id.* One can never measure all of the parameters—and they all must be measured, because no *ceteris paribus* provision can work. See *id.* Levins wrote that "there are too many parameters to measure . . . many would require a lifetime each for their measurement." He added that even simplifying equations could be "insoluble analytically and exceed the capacity of even good computers." *Id.* Even when these equations were soluble, the solutions "would have no meaning for us." *Id.* If we were smart enough to model contexts this complex, we would not need the models; we should already understand as much as the gods. See *id.*

513. Peter Price observed that "[i]n fact competition theory lives in a dreamworld

Ecology resembles such disciplines as physics, biochemistry, thermodynamics, electromagnetics, and cybernetics insofar as it is a *theoretical* science, that is, insofar as ecologists presuppose that scientific inquiry can discover fundamental mathematical laws, principles, or models to explain the behavior of the systems and communities they study.<sup>514</sup> Unlike the sciences from which it has borrowed concepts and models, for example, thermodynamics and electrical engineering, ecology has not yet matured into a "hard" predictive science.<sup>515</sup> Many students of ecology would agree with Robert Peters that theories in ecology tend either to be tautological<sup>516</sup> or to rely on concepts so vague that they cannot be made operational.<sup>517</sup> Unlike sciences such as chemistry and electronics, ecologists have not reached consensus—and show no progress toward consensus—on concepts that accurately define the kind of order in nature they propose to study. Nor have ecologists agreed on the universal principles with which they may explain and predict ecological events.<sup>518</sup>

where everything can be explained, but the validity of these explanations has not been adequately established in the real world." Peter W. Price, *Alternative Paradigms in Community Ecology*, in *A NEW ECOLOGY*, *supra* note 509, at 353, 354; see also Werner & Mittelbach, *supra* note 417, at 813-15 (arguing that optimal foraging theory may make sense as mathematics, but not as biology).

514. For a typical statement of this view, popular in the 1960s, see L.B. Slobodkin, *Preliminary Ideas for a Predictive Theory of Ecology*, 95 *AM. NATURALIST* 147 (1961). Ecology needed to be a predictive science, moreover, to be relevant to the Environmental Impact Assessments called for by the National Environmental Policy Act of 1969. Richard Carpenter, for example, wrote that "[t]he essence of an environmental impact statement is prediction. Decision-makers must predict and they ask for assistance in that function." Richard A. Carpenter, *Ecology in Court, and Other Disappointments of Environmental Science and Environmental Law*, 15 *NAT. RESOURCES LAW* 573, 589 (1983).

515. Richard Rorty has distinguished between two kinds of empirical science: "(1) It should contain descriptions of situations which facilitate their prediction and control [; and] (2) [i]t should contain descriptions which help one decide what to do." RICHARD RORTY, *CONSEQUENCES OF PRAGMATISM* 197 (1982). In the past decades, ecology, which is a good science in terms of Rorty's second point, has tried to be a worse science by seeking to meet Rorty's first condition.

516. PETERS, *supra* note 382, at 38-73.

517. *Id.* at 74-104. For an excellent discussion of Peters's critique, see SHRADER-FRECHETTE & MCCOY, *supra* note 284, at 106-19.

518. See Robert P. McIntosh, *Pluralism in Ecology*, 18 *ANN. REV. ECOLOGY &*

### *H. Everything Can Connect With Everything Else*

The problem ecologists face today is not simply that the theoretical principles, concepts, models, and paradigms they offer have run amok while failing to provide a basis for a predictive ecology, although that is certainly true.<sup>519</sup> Nor is the problem simply that unifying concepts, models, and theoretical principles in ecology are so easy to posit that each theoretical ecologist can offer his or her own "just so" paradigm to explain the ecological universe.<sup>520</sup> A deeper difficulty arises because the concepts in relation to which these models or principles are based—e.g., diversity, stability, resilience, ascendancy, hierarchy, scale, adaptation, complexity, and, most recently, chaos—possess so many disparate meanings or are so difficult to measure operationally that they defy the construction of crucial experiments.<sup>521</sup>

SYSTEMATICS 321 (1987).

519. Ecologist Peter Abrams has argued recently that theoretical models of ecosystems inevitably lack the ability to predict. See Peter A. Abrams, *Dynamics and Interactions in Food Webs with Adaptive Foragers*, in *FOOD WEBS: INTEGRATION OF PATTERNS AND DYNAMICS* 113, 113-20 (G.A. Polis & K. Winemiller eds., 1995).

520. For a discussion of optimization theory in contemporary evolutionary biology, see George F. Oster & Edward O. Wilson, *A Critique of Optimization Theory in Evolutionary Biology*, in *CONCEPTUAL ISSUES IN EVOLUTIONARY BIOLOGY* 271 (Elliott Sober ed., 1984); and John Maynard Smith, *Optimization Theory in Evolution*, in *id.* at 289. Theoretical paradigms in ecology may be compared with "just so" stories used by sociobiologists to explain behavior. Edward O. Wilson, one of the progenitors of sociobiology recognized that this science was undermined by the ease with which it could provide theoretical explanations for all phenomena. Wilson wrote:

The greatest snare in sociobiological reasoning is the ease with which it is conducted. Whereas the physical sciences deal with precise results that are usually difficult to explain, sociobiology has imprecise results that can be too easily explained by many different schemes.

EDWARD O. WILSON, *SOCIOBIOLOGY: THE NEW SYNTHESIS* 28 (1975). For further criticisms along these lines, see PHILIP KITCHER, *VAULTING AMBITION: SOCIOBIOLOGY AND THE QUEST FOR HUMAN NATURE* 230-36 (1985) (decrying "adaptionist storytelling"); see also Stephen Jay Gould & Richard C. Lewontin, *The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme*, in *CONCEPTUAL ISSUES IN EVOLUTIONARY BIOLOGY*, *supra*, at 257-58 (referring to "just-so stories").

521. Stuart Pimm has recognized that ecosystem-level concepts, such as stability, resilience, and equilibrium, have received criticism from ecologists. These terms have been used with many different meanings; "no wonder there was little agreement." PIMM, *supra* note 23, at 14. A group of ecologists recently summarized the state of theoretical research as being the relationship among the biodiversity, the productivity, and stability of ecosystems. "Attempts to unveil the relationships between the taxonomic diversity, productivity and stability of ecosystems continue to generate

In other words, it is easy to tell stories or point to events which colorably confirm whatever principles or models one advocates, but it is harder and sometimes impossible to construct experiments that could falsify them and to show how the world would have to differ if they were not true.<sup>522</sup> In nature, one can always find an example of any ecological principle. One can also find an exception.<sup>523</sup> As a result, the findings of much of theoretical research, namely, that one thing *can* affect another—that diversity can affect stability, for example—might just as well be assumed at the start. If no universal patterns or determinate relationships exist among the constructs of ecological theory, then anything physically possible is ecologically possible, and that is that.<sup>524</sup> Every ecosystem, like every species, is a law unto itself.<sup>525</sup>

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inconclusive, contradictory and controversial conclusions.” Kris Johnson et al., *Biodiversity and the Productivity and Stability of Ecosystems*, 11 *TRENDS IN ECOLOGY & EVOLUTION* 371, 372 (1996).

522. Ecological “theories are too frequently vague verbal statements, incapable of rigorous prediction, and, therefore, not subject to rigorous tests.” ROBERT HENRY PETERS, *THE ECOLOGICAL IMPLICATIONS OF BODY SIZE* 8 (1983). Richard Levins noted that “there are too many parameters to measure . . . many would require a lifetime each for their measurement.” Levins, *supra* note 512. George Salt added:

Many of the theoreticians’ generalizations, whether called theories, principles, or whatever, were tested and found, not surprisingly, to be either incorrect or inadequate. . . . However, thanks to the dubious but nonetheless popular cachet of legitimacy provided by mathematics to an idea, a theoretician’s hypotheses were likely to be accepted until demonstrated false. Because empirical tests of hypotheses are time consuming, the empiricists could contemplate the prospect of an ever increasing array of hypotheses . . . . If every mathematically generated hypothesis had to be tested empirically, they would never keep up.

Salt, *supra* note 417, at 699.

523. See MAYR, *supra* note 409, at 38 (“All biological laws have exceptions.”).

524. Johnson et al., *supra* note 521, at 373. Kris Johnson and others have noted “that there may be no pattern or an indeterminate relationship between species diversity and ecosystem function. Results of experiments designed to identify the functional significance of species diversity can be interpreted to support” any of a variety of hypotheses. *Id.*; see also John H. Lawton, *What Do Species Do in Ecosystems*, 71 *OIKOS* 367, 367-74 (1994) (summarizing four competing hypotheses regarding “ecosystem function and species richness”).

525. See H.A. Gleason, *The Individualistic Concept of the Plant Association*, *BULL. TORREY BOTANICAL CLUB* 7, 25 (1926) (describing each species as a law unto itself).

Nowhere in the literature of ecology, moreover, is there any suggestion of the mechanism, force, or cause that could explain the order or design ecologists seek to discover in the natural world. Natural selection, for example, works on organisms that reproduce, not on ecosystems. Even if theoretical ecologists found an intelligible organizing structure in ecosystems, they would be unable to explain how it got there. In earlier centuries, natural philosophers in the tradition of Linnaeus had no compunction about invoking divinity to explain the remarkable *logos* and *telos* they read into natural ecosystems. If future ecologists eventually agree on a theoretical framework with which to describe the orderliness of ecosystems, what would they say is its cause?

Absent any causal explanation of the design they ascribe to biological communities, ecologists are tempted to believe that the hairier the math, the more profound the model. Mathematics has become an end in itself in ecology, as it seems to have become in economics.<sup>526</sup> As we shall see, moreover, the notion of an ecological system or community, to which theoretical concepts and principles are thought to apply, is so amorphous and resistant to definition that testability in ecological theory has become a will of the wisp.

Deluged with a flood of untested models, theories, and unifying concepts in ecology—and unable to frame falsifying experiments to eliminate any of them—several ecologists have given up on the hypothetical-deductive model altogether, deeming it irrelevant to their science.<sup>527</sup> Instead, they liken their method to that of the detective, such as Sherlock Holmes, who discovers inductively the causes of particular events, rather than to that of the mathematical physicist who models systems in quantitative terms and deduces outcomes from the model.<sup>528</sup> An ecologist of such an inductive bent, for example, might examine a population of sick frogs, using the methods of observation and induction to

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526. See Lev Ginzburg's comments on mathematical ecology, quoted *supra* note 417.

527. For discussion, see SHRADER-FRECHETTE & MCCOY, *supra* note 284, at 81 ("[e]cology has no known regularities") (citing L. Van Valen & F. Pitelka, *Intellectual Censorship in Ecology*, 55 *ECOLOGY* 925-26 (1974)).

528. See, e.g., George A. Bartholomew, *The Role of Natural History in Contemporary Biology*, 36 *BIOSCIENCE* 324, 328 (1986).

determine what is making them sick.<sup>529</sup> A theoretical ecologist, in contrast, might try to find a clue in mathematical models that apply universally, not just to those particular frogs.

Several ecologists assert that the careful, empirical study of minute particulars rather than the pursuit of theory-for-theory's sake is likely to make the most sense of a world in which difference and change—rather than order and permanence—seem to dominate.<sup>530</sup> In this spirit, Daniel Willard, in a lecture to a convention of the Ecological Society of America, opined: “We are moving from a rich theoretical phase toward a renewed interest in induction, perhaps because of the requirements of various statutes and regulations. This reexamination shows that many of the previously popular principles do not apply as generally as we thought.”<sup>531</sup>

Still, many ecologists stick to their theoretical lasts and insist that the fundamental mathematical models, concepts, and principles they seek are either in hand or just around the corner. This approach has enormous advantages. First, many ecologists—Robert Peters is an example—believe that the way to judge a science as a science lies in “its ability to predict” on the basis of deduction from general theoretical models and principles.<sup>532</sup> From this and the additional premise that ecologists

529. “To provide an explanation of a particular event is to identify the cause and, in many cases at least, to exhibit the causal relation between this cause and the event-to-be-explained.” WESLEY C. SALMON, *SCIENTIFIC EXPLANATION AND THE CAUSAL STRUCTURE OF THE WORLD* 121-22 (1984). According to Clark Glymour, science that uses inductive methods:

produces explanations, causal explanations; and knowledge, causal knowledge, without producing general laws . . . . In doing as much, social science follows a pattern that is common throughout the sciences. It is a pattern most common in applied sciences, in epidemiology, in biology, and in engineering. It is least common, but scarcely absent, in physics.

Clark Glymour, *Social Science and Social Physics*, 28 *BEHAVIORAL SCI.* 126, 128 (1983).

530. For a review of the “case study” method in ecology, see SHRADER-FRECHETTE & MCCOY, *supra* note 284, at 106-48.

531. Daniel E. Willard, *Ecologists, Environmental Litigation, and Forensic Ecology*, 61 *BULL. ECOL. SOC'Y AM.* 14, 14 (1980).

532. PETERS, *supra* note 382, at 290. For a brilliant debunking of Peters's arguments and beliefs regarding the nature of science, see SHRADER-FRECHETTE & MCCOY, *supra* note 284, at 106-11. For earlier statements of Peters's insistence on the



are scientists, it follows they have or will have or must have theories or models with which to predict ecological events. The mere fact that ecology exists as a theoretical science, in other words, shows that nature must be organized along intelligible, mathematical lines; otherwise ecologists would experience helplessness before nature, rather than bravado.<sup>533</sup> After all, what sense could one make of all the mathematical theorizing in ecology unless nature has a *logos* that ecologists have either discovered (but their theoretical insights have been ignored) or will discover, with appropriate public support?<sup>534</sup>

A commitment to mathematical theorizing, whether or not it leads to testable predictions, offers other advantages. Albert Hirschman has pointed out that "[i]n the academy, the prestige of the theorist is towering."<sup>535</sup> The empiricist, who works in the field rather than at the heights of abstraction, has no such status.<sup>536</sup> This may account for the abundance of theoretical ecologists and the deplorable paucity of taxonomists.<sup>537</sup> Calls for

theoretical and predictive essence of science per se and therefore ecology, see Robert Henry Peters, *From Natural History to Ecology*, 23 PERSP. ON BIOLOGY & MED. 191, 193 (1980) ("The goal of biology, ecology, or any science is prediction."); Robert Henry Peters, *The Role of Prediction in Limnology*, 31 LIMNOLOGY & OCEANOGRAPHY 1143, 1153 (1986).

533. See ROUGHGARDEN ET AL., *supra* note 385, at 8.

534. During the 1960s and 1970s, ecosystem science promised, if not an alternative to Darwinian evolutionary theory, then at least a way of circumventing its more odious conclusions regarding the pointlessness of nature. "When a theory of ecosystem emerges, it will be one of the major synthesizing ideas in science, perhaps rivaled only by the theory of evolution through natural selection." *Joint House-Senate Colloquium to Discuss a National Policy for the Environment: Hearing Before the Senate Comm. on Interior and Insular Affairs, United States Senate, and the Comm. on Science and Astronautics*, 90th Cong. 157 (1968).

535. Hirschman, *supra* note 188, at 163.

536. David Ehrenfeld wrote perceptively:

There is a dichotomy between those who look for general laws and those who seek to add to our knowledge of the specific—the finders of new species, for example. Those who achieve generality, who make and use general discoveries during the course of their scientific research, can win fame and power. Those who do not, those who are unsuccessful in their quest for generality or who never look for it at all, who prefer to stick with the specificities that we associate with such fields as natural history, may achieve happiness but not dominance in the scientific hierarchy.

Ehrenfeld, *supra* note 480, at 27.

537. See Kevin J. Gaston & Robert M. May, *Taxonomy of Taxonomists*, 356 NATURE 281 (1992) (describing the lack of taxonomists).

methodological pluralism in ecology, moreover, allow as many theories as the market will bear, which seems to be an indefinite number, given the apparent impossibility of falsifying and ease of funding so many of them.<sup>538</sup> In addition, by insisting upon mathematical theory, ecology retains its historical roots in the writings of Plato, Aristotle, Cicero, and others who believed that creation exhibits a perfect and intelligible order.<sup>539</sup> The faith that ecosystems exhibit design—that biotic communities are structured according to mathematical principles that satisfy the human mind and sustain the human body—unites theoretical ecologists today with the tradition of “Great Chain of Being cosmology” asserted by natural philosophers from Plato to Linnaeus.<sup>540</sup>

To regard ecology as primarily an historical, empirical, and inductive science, in contrast, is to renounce the delights that charm the theoretical ecologist. Why would anyone represent nature as lacking design and as having no concern about human well-being? To do so is professionally self-defeating and politically incorrect. If all that ecosystems offer is a blooming, buzzing confusion of phenomena with no inherent order or direction, then historical narration and the rules of induction exhaust the theoretical armamentarium of ecological science.<sup>541</sup> Theoretical

538. For discussion, see McIntosh, *supra* note 518. For a typical call to let a thousand flowers blossom (i.e., a thousand paradigms all be funded), see, e.g., H.A. Regier & D.J. Rapport, *Ecological Paradigms, Once Again*, 59 BULL. ECOL. SOC'Y AM. 2, 2 (1978):

We frankly doubt that the current lack of any standard set [of theoretical concepts] is a significant constraint on the further development of ecology. Rather, a clearer recognition of major approaches to ecology already extant might provide a sufficient basis for matching problems (theoretical and practical) to ecological insights already available. Different approaches may well appeal to different interest groups in society—but such is also the case in other disciplines. . . . Ecologists should champion moderate diversity, even within ecology.

539. See *supra* notes 469-73 and accompanying text.

540. See LOVEJOY, *supra* note 465.

541. For discussion of evolution as a “tinkering” path-dependent process, see Jacob, *supra* note 490, at 1163-66. See also Richard C. Lewontin, *Adaptation, in CONCEPTUAL ISSUES IN EVOLUTIONARY BIOLOGY*, *supra* note 520, at 234. For discussion of Darwin's distaste for mathematical theory in natural history, see MAYR, *supra* note

ecology would then describe an abstract world of the theorist's own deriving—a world more orderly and more comforting than the one we have.

### *I. Design in Ecology*

Religious leaders, spiritualists, and theologians, although regarding nature as embodying principles of design, offer a variety of views about such things as the origin of species and the age of the earth. Theosophists, for example, generally follow Madame Blavatsky in describing nature in terms of evolution rather than special Creation.<sup>542</sup> For them, matter is self organizing in more and more complex and ascendant forms—a continuous evolution into higher unities culminating in consciousness.<sup>543</sup> Other spiritually inspired writers, including today's Scientific Creationists, take their views of the age of the earth and the origin of species from scripture. All these faith communities agree, however, that biological communities are organized, designed, and structured in ways analogous to organisms. They ascribe *logos* and *telos* to the "web of life" as well as to the particular constituents of the biological community.

In its publication *Scientific Creationism*, the Institute for Creation Research, for example, argued that biological communities are organized by an intelligent Creator to support human well-being. "Once the creation was finished, these processes of *creation* were replaced by processes of *conservation*, which were designed by the Creator to sustain and maintain the basic systems He had created."<sup>544</sup> According to the Institute, ecosystem processes attain their highest and best state in their original, primordial, or natural condition because that is the way God designed and intended them. These systems then deteriorate, especially when they are injured or damaged by human beings.

The Institute for Creation Research contends that each spe-

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409, at 39.

542. See H.P. Blavatsky, *Is Creation Possible for Man?* (visited Feb. 26, 1997) <<http://www.blavatsky.org/hpb/arts/IsCreationPossibleforMan.htm>> (outlining Theosophist views).

543. See *id.*

544. INSTITUTE FOR CREATION RESEARCH, *SCIENTIFIC CREATIONISM* 12 (Henry M. Morris ed., 1974).

cies plays an important role in supporting the overall structure of ecosystems. The natural environment "was created specifically to serve as man's home"<sup>545</sup> and the "Creator had a purpose for each kind of organism created . . ."<sup>546</sup> We therefore disturb ecosystems at our peril. "In the creationist concept, man is the highest of all creatures, and thus all other created systems must in some way be oriented man-ward, as far as purposes are concerned."<sup>547</sup>

In his critique of Creation Science, evolutionary biologist Douglas Futuyma correctly identified Creation Science's position that the living world had a design or purpose beyond the design of purpose that natural selection imparts to individual organisms. Just as the laws of physics reveal God's wisdom, "the adaptation of plants and animals to their habitats likewise reflected the divine intelligence, which had fitted all creatures perfectly for their roles in the harmonious economy of nature."<sup>548</sup> Futuyma contrasted this view of the harmony of nature's economy with that of Darwin,<sup>549</sup> whose view he characterized as follows: "To the questions, 'What purpose does this species serve? Why did God make tapeworms?' the answer is, 'To no purpose.' Tapeworms are not put here to serve a purpose, nor were planets, nor plants, nor people."<sup>550</sup>

Darwin's great triumph was to explain how efficient causality alone, i.e., natural selection and random mutation, could fashion the amazing design of living creatures. He showed that it is not necessary to invoke divine intelligence to account for the production of the properties of organisms, such as the delicate arrange-

545. *Id.* at 32.

546. *Id.* at 52.

547. *Id.* at 35.

548. DOUGLAS J. FUTUYMA, *SCIENCE ON TRIAL: THE CASE FOR EVOLUTION* 25 (1st ed. 1982).

549. For the followers of Darwin, evolution is a path-dependent series of changes to be explained in terms of contingent local conditions, and "any pathway proceeds through thousands of improbable stages." STEPHEN JAY GOULD, *WONDERFUL LIFE* 51 (1989). Gould added: "Alter any early event, ever so slightly and without apparent importance at the time, and evolution cascades into a radically different channel." *Id.*

550. FUTUYMA, *supra* note 548, at 37.

ment of a bird's wing. Biologists following Darwin have been able to fill in the details of natural selection by describing the genetic mechanisms related to phenotypic changes which succeed or fail when tested against the environment. Of course, evolution operates only on living organisms or on their genomes; more generally, the principle of natural selection makes sense only in relation to creatures that reproduce. It would not apply, say, to artifacts, such as bridges or musical compositions, the design of which must be explained in terms of intelligent agency.

It is important to recognize that theoreticians may accept two tasks when they inquire into nature. First, they may look for order, intelligible structure, or design in the phenomena that they study. Second, they may identify the causes that account for that order. Suppose, for example, someone discovers an orderly succession in the behavior of the tides. He or she would account for that succession by reference to the gravitational force of the moon. Suppose someone observed that sand, pebbles, and stones are arranged on beaches in ways that seem particularly well suited to human use because the smallest grains are the farthest up, where people are likely to walk or lie on the sand, while the less comfortable, larger stones and rocks are distributed gradually deeper in the water. One might point to divine Providence as the reason that beaches are so designed for human convenience, but a scientist would not do this. He or she would attribute this organization to natural forces, namely, the action of waves.

What shall we say, then, about ecosystems? Have they a beneficial organization, design, order, or harmony in which each species plays a role? Theoretical ecologists generally believe they do; otherwise there would be little to theorize about. Critics of theoretical ecology, such as Daniel Simberloff, argue that theorists cannot agree on a way to describe this structure; each ecologist, it seems, reads his or her own theory into the phenomena.<sup>551</sup> No unifying concept, metaphor, or model has succeeded any better than any other in representing the *logos* and *telos* of ecosystems.

Even if ecologists could agree upon a model or metaphor to

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551. See Simberloff, *supra* note 325, at 3.

represent the design or direction of ecosystems, however, they still would have to accomplish a second task. They would have to say how that kind of structure or design got there. Darwin understood that the natural objects he studied—the length of the beak of a finch, for example—have both structure and function. That much everyone could see. His triumph lay in his explanation of this *logos* and *telos* in terms of efficient causality alone. Let us assume that theoretical ecologists succeed in finding order and purpose in ecosystems, as Darwin succeeded in observing these properties in organisms. What kind of causal explanation would theoretical ecologists offer for the wonderful design they believe enables ecosystems so admirably to serve human needs?

Ecosystems could not possibly have acquired that wonderful organization through evolutionary processes. This is because natural selection operates only on creatures that breed true, that is, creatures that enjoy genetic inheritance. Ecosystems do not reproduce, possess genomes, or breed true; heredity is nothing to them. Accordingly, they are not subject to evolution. We should have to account for any order, design, harmony, or structure we impute to ecosystems by appealing to some cause other than evolution. The only other cause is agency, human or Eternal.

Theoretical ecologists want to have it both ways: to write mathematical models that impute design to ecosystems as if they were like organisms and to be Darwinian evolutionists.<sup>552</sup> Darwinian evolution, however, denies that nature has any overall design or any overall direction. Ecologists nevertheless continue to speak of the “trajectory” of natural systems and their ability after disturbance to return to that course.<sup>553</sup> Ecologists acknowledge today that nature is never stable but always dy-

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552. See, e.g., Nils C. Stenseth, *Why Mathematical Models in Evolutionary Ecology?*, in *TRENDS IN ECOLOGICAL RESEARCH FOR THE 1980S* 239, 276 (June H. Cooley & Frank Golley eds., 1984). Stenseth argued: “Ecology cannot develop into a mature science until a better theoretical foundation is developed. . . . I hope we soon will see evolutionary ecology—using both mathematical and empirical techniques—become a unified and mature science.” *Id.*

553. See O’NEILL ET AL., *supra* note 461 (outlining a hierarchical concept of ecosystems).

namic,<sup>554</sup> but this does not bring them into the Darwinian tradition. Darwin did not stop with the acknowledgment that nature is dynamic—that the course of biological communities never did run smooth. Rather, Darwin denied that evolution had any course, purpose, or direction, such as to build ecosystems in ways that support our well-being.<sup>555</sup>

If ecologists believe that ecosystems, like organisms, possess an intelligible or purposive structure or direction, including, for example, self-organizing capabilities, these biologists must tell us what caused ecosystems to have these wonderful properties. Natural selection does not operate on ecosystems, and they do not “evolve” in any sense that is meaningful within the tenets of Darwinian science.<sup>556</sup> Where there is structure or design, there must be a designer. If evolution is not the designer, then who is?

In contrast to Darwinian science, theoretical ecology, whether it invokes musical or architectural metaphors, follows “Great Chain of Being” cosmology in finding order and purpose (*logos* and *telos*) in the natural environment. It must do so for, absent such order or design, what is the theory about? One must ask, then, what efficient cause explains the harmony—discordant or not—ecosystems are said to possess. Theoretical ecologists use the word “evolution,” of course, but the Darwinian tradition of historical explanation has had little influence on them.<sup>557</sup>

554. The Ecological Society of America, in its report, called for:

Recognition of the dynamic character of ecosystems. Sustainability does not imply maintenance of the status quo. Indeed, change and evolution are inherent characteristics of ecosystems, and attempts to ‘freeze’ ecosystems in a particular state or configuration are generally futile in the short term and certainly doomed to failure in the long term.

ESA REPORT, *supra* note 76, at 4.

555. “First, Darwin argues that evolution has no purpose . . . . Second, Darwin maintained that evolution has no direction; it does not lead inevitably to higher things.” STEPHEN JAY GOULD, *EVER SINCE DARWIN* 12-13 (1977).

556. Stephen Jay Gould has written: “Natural selection is a theory of *local* adaptation to changing environments. It proposes no perfecting principles, no guarantee of general improvement; in short, no reason for general approbation in a political climate favoring innate progress in nature.” *Id.* at 45.

557. Gould has explained why ecological science has not grasped:

the essence of history. Its name is contingency—and contingency is a thing unto itself, not the titration of determinism by randomness. Science has been slow to admit the different explanatory world of history into its domain—and our interpretations have been impoverished by this omission.

In order to *theorize* about ecosystems rather than simply *describe* them, ecologists must assume ecosystems are orderly—that they exemplify general principles of mathematical design, structure, and organization not dependent on time and place. Absent such principles of design in ecosystems, there would be no scientific reason to theorize about them. Ecosystems must be purposive, moreover, or there would be no economic reason to care about protecting their “integrity,” “health,” or “natural” condition. Thus theoretical ecologists embrace—and must embrace—Aristotle’s proposition that “in the works of Nature purpose and not accident is predominant.”<sup>558</sup> The alternative would be to concede that ecosystems lack order, purpose, design, or structure and that the ascription of these qualities to them is a kind of anthropomorphism.<sup>559</sup> Theoretical ecology, by rejecting historical explanation and by attempting to model the mathematical design of ecosystems, represents the triumph of “Great Chain of Being” cosmology in our time.

As ecologists during the 1960s and 1970s found more and more order in the systems they studied—orderly succession in forests,<sup>560</sup> for example, and hierarchy and homeostasis in ecological communities generally—Creationists took heart. Although their opponents might invoke Darwinian evolution to

Science has also tended to denigrate history, when forced to a confrontation, by regarding any invocation of contingency as less elegant or less meaningful than explanations based directly on timeless “laws of nature.”

GOULD, *supra* note 549, at 51.

558. ARISTOTLE, *supra* note 470, at 101.

559. See François Chapleau et al., *The Distinction Between Pattern and Process in Evolutionary Biology: The Use and Abuse of the Term “Strategy”*, 53 OIKOS 136 (1988). These authors made the same point as the one argued in this Article. They wrote:

Biologists, in general, seem very eager to give causes, goals or purposes to all the traits of an organism when in fact they might only be transposing their own social philosophy on these organisms. We, as humans, might have goals or purposes that require strategic thinking, but this does not necessarily apply to the rest of nature.

*Id.* at 138. For an excellent study of our tendency to anthropomorphize nature, see RALPH H. LUTTS, *THE NATURE FAKERS* (1990).

560. See Henry Horn, *Forest Succession*, 232 SCI. AM. 90-98 (1975).



explain away the intelligible design (*logos*) and purposiveness (*telos*) of species, they could not account for the design and purposiveness of ecosystems in that way. Because ecosystems do not reproduce, there is no way to distinguish their acquired characteristics from their inherited characteristics, there is no sense in which they “evolve” that is meaningful in Darwinian biology.

According to Kenneth B. Cumming, chairman of the Graduate Biology Department at the Institute for Creation Research, the properties ecologists discovered in ecosystems, “the hierarchical design of living systems especially in organization, cycles, and homeostasis,” show that “living systems are predictable, directional and conservative,” as ecologists in the tradition of Odum had long held.<sup>561</sup> Cumming then observed correctly that these properties of organization and direction “support the creationist perspective and conflict with evolution, which requires randomness, nondirectional progression, and liberal opportunity for change.”<sup>562</sup>

Theoretical ecologists today differ from the Darwinian tradition by failing to describe the cause of the organization they find in the phenomena they study. Ecologists have not yet begun to identify an efficient cause for the structure and function of ecosystems in the same way that Darwin identified an efficient cause for the structure and function of a finch’s beak. They would not even know where to begin. It seems that theoretical ecologists—especially those in the tradition of Tansley, Clements, and Odum who saw the ecosystem as a kind of superorganism—simply assume that if evolutionary forces applied to plants and animals, they must apply to ecosystems as well. For theoretical ecology, whatever God can do, evolution can do better. The term “evolution,” as employed in theoretical ecology, may be understood as a stand-in or proxy for God as the designer of ecosystems. If this is so, then to the extent that ecology attributes *logos* and *telos* to nature, there may be little reason to distinguish it from Creation Science.

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561. Kenneth B. Cumming, *No. 131—Design in Ecology*, IMPACT, May 1984, at i.

562. *Id.*

*J. The "Rivet-Popping" Analogy.*

Many environmentalists support the strict enforcement of the ESA on the grounds that extinctions undermine the biodiversity on which the health, stability, or design of ecosystems depends.<sup>563</sup> In defense of this position, Paul and Anne Ehrlich coined the "airplane" or "rivet-popping" analogy:

Ecosystems, like well-made airplanes, tend to have redundant subsystems and other "design" features that permit them to continue functioning after absorbing a certain amount of abuse. A dozen rivets, or a dozen species, might never be missed. On the other hand, a thirteenth rivet popped from a wing flap, or the extinction of a key species involved in the cycling of nitrogen, could lead to a serious accident.<sup>564</sup>

The Ehrlichs are not alone, of course, in analogizing natural systems to artificial ones; this "argument from design" has a long history in philosophy and theology.<sup>565</sup> The eighteenth century British theologian Bishop Paley asked us to imagine a man

563. See, e.g., PAUL EHRLICH & ANNE EHRLICH, *EXTINCTION* 185-86 (1981) (discussing the ESA and its ability to preserve species).

564. *Id.* at xii-xiii. Five years earlier, Robert B. Craig had written: "The science of ecology has matured dramatically in the last few years. From what was primarily a descriptive science has developed a new, mathematically-based, evolutionary ecology." Robert B. Craig, *Evolutionary Ecology*, 57 *ECOLOGY* 212, 212 (1976). Stenseth and Craig, along with virtually every other theoretical ecologist, agree that a "mathematically-based, evolutionary ecology" is possible; they disagree on whether it is actual. See *id.*; Stenseth, *supra* note 552, at 239. The problem, though, is that the argument is oxymoronic: evolution is an historical process, not a mathematical one. See EHRLICH & EHRLICH, *supra* note 563, at 18-20. This view remains popular. See, e.g., Farrier, *supra* note 261, at 382 n.385.

Conventional economic wisdom advises us, in the absence of a certain date for collapse, to persist in behavior that involves dealing our life-support apparatus ever stronger blows. It is as if people are prying the rivets, one by one, from the wings of an airplane in which we all are riding. They refuse to stop unless we can prove that the removal of any given rivet will cause the wing to fail.

*Id.* (quoting Paul R. Ehrlich, *The Strategy of Conservation 1980-2000*, in *CONSERVATION BIOLOGY*, *supra* note 292, at 341).

565. See generally WORSTER, *supra* note 279, at 38-45 (discussing the use of reason in ecological theories).

walking in a desert who finds a watch.<sup>566</sup> That person would surely infer that a contrivance so well designed, every piece serving the function of the whole, was created by an intelligent agent.<sup>567</sup> The Ehrlichs do not speak in terms of a plane maker as Bishop Paley did his watchmaker, but the theological implications of either analogy are clear.<sup>568</sup>

Airplanes are designed to serve the purpose of transporting passengers great distances at high speeds. The rivets that secure the wings have value in view of that purpose. To complete the analogy to ecology, we must identify the purpose or end for which ecosystems are designed. We may verify then the extent to which species have value because they enable ecosystems to serve that purpose.

What are ecosystems designed to do? The "airplane" analogy implies that ecosystems are designed to support human existence and that each species has a (sometimes redundant) place in that design.<sup>569</sup> Humanity, in this design, crowns creation, and all other species are placed artfully, like rivets in a wing or links in a chain, to support *homo sapiens*.<sup>570</sup> According to this model, nature does nothing in vain; every plant and animal has a reason for being; it has a role to perform as does every rivet in an airplane's wing.<sup>571</sup> This view predates Darwin and has its roots in the neoplatonic and Christian theological tradition that viewed nature as constituting a "Great Chain of Being."<sup>572</sup> Darwin opposed this tradition when he denied that evolution has a *telos*, purpose, or end.<sup>573</sup>

The image of the "Great Chain of Being" epitomizes the moral and religious attention people within the Western tradition have long paid to the diversity of life.<sup>574</sup> From Plato's theory of per-

566. See WILLIAM PALEY, NATURAL THEOLOGY 1-8 (London, R. Faulder, 10th ed. 1805) (outlining this now-famous hypothetical).

567. See *id.*

568. See *id.*; EHRLICH & EHRLICH, *supra* note 563.

569. See EHRLICH & EHRLICH, *supra* note 563, at xi-xiv.

570. See LOVEJOY, *supra* note 465, at 59-64.

571. See *id.*

572. See *id.* at 61-63 (detailing the classic history of this image).

573. See generally *id.* at 59 (discussing the principle of continuity in relationship to the "Great Chain of Being").

574. See *id.*

fect "Forms"<sup>575</sup> to the quest of many recent ecologists to find order and balance in nature, philosophers, poets, painters, and scientists have attempted to describe the living world in ways that answer to religious and moral expectations.<sup>576</sup> Ecologists in this century, like theologians and poets in previous centuries, have argued that the diversity of living things results not from an old chaos of the sun<sup>577</sup> but serves larger purposes, instantiates universal principles and ideas, or expresses an intelligible order or a meaningful plan.<sup>578</sup>

In the twelfth century, the French theologian Abelard, following Plato's *Timaeus*, defined one aspect of this theme, namely that a sufficient reason explains the existence of every kind of organism: "Whatever is generated is generated by some necessary cause, for nothing comes into being except there be some due cause and reason antecedent to it."<sup>579</sup> The principle of sufficient reason itself explains other attributes of the "Great Chain," including plenitude (the idea that every place or "niche," as ecologists now say, is filled) and continuity (that all from the least creature, such as a microbe, to the greatest, such as a lion, are interrelated in a single plan).<sup>580</sup>

These principles have analogies in the ecological theory of recent decades. Plenitude, the principle that the richness and diversity of creation is so great because it expresses the fullness of God's perfection, is found in various versions of the diversity-stability hypothesis, for example, in G.E. Hutchinson's speculation that there are so many species "at least partly because a complex trophic organization of a community is more stable than a simple one."<sup>581</sup> The themes of continuity and gradation likewise

575. See *id.* at 51, 54.

576. See *id.* at 51.

577. The reference here is to *Sunday Morning*, a famous poem by Wallace Stevens celebrating the spontaneity and spirituality of nature. See Wallace Stevens, *Sunday Morning*, in *THE COLLECTED POEMS OF WALLACE STEVENS* 66 (1969).

578. See EHRlich & EHRlich, *supra* note 563, at 6. But see Romme *supra* note 287, at 217-18.

579. LOVEJOY, *supra* note 465, at 71 (quoting Abelard quoting Plato, *Quaestiones* 83).

580. See *id.* at 55-56.

581. G.E. Hutchinson, *Homage to Santa Rosalia or Why Are There So Many Kinds*

echo in hierarchy theory,<sup>582</sup> in theories of trophic levels, food chains, and webs,<sup>583</sup> in the concept of orderly succession,<sup>584</sup> and in organismic concepts that characterized ecology earlier this century.<sup>585</sup>

Fundamental to the idea of the "Chain of Being" was a belief that God creates nothing in vain.<sup>586</sup> Accordingly, we are obliged to care as much for the least creature in nature as for the greatest.<sup>587</sup> This well-known passage in Alexander Pope's *Essay on Man* expresses the same thought as the rivet-popping analogy:

Vast chain of being! which from God began,  
Natures aethereal, human, angel, man,  
Beast, bird, fish, insect, what no eye can see . . .  
Where, one step broken, the great scale's destroy'd;  
From Nature's chain whatever link you strike,  
Tenth, or ten thousandth, breaks the chain alike.<sup>588</sup>

In his classic study, *The Great Chain of Being*, Arthur O. Lovejoy observed that in this tradition, the diversity of nature arises from law-like principles that establish its order.<sup>589</sup> He noted, however, that in the eighteenth century, a controversy arose between philosophers like Spinoza and Leibniz, who believed that the principle of sufficient reason necessitated such an order, and those who agreed with the British philosopher Samuel Clarke that only God's essence necessitated existence and that

of *Animals*, 93 AM. NATURALIST 145, 155 (1959).

582. See Michael Conrad, *Hierarchical Adaptability Theory and Its Cross-Correlation with Dynamical Ecological Models*, in THEORETICAL SYSTEMS ECOLOGY 131, 137-43 (Efraim Halfon ed., 1979); Robert Rosen, *Hierarchical Organization in Automata Theoretic Models of Biological Systems*, in HIERARCHICAL STRUCTURES 179, 179-84 (Lancelot Law Whyte et al. eds., 1969).

583. See, e.g., Paine, *supra* note 424, at 66.

584. See A.G. Tansley, *Succession: The Concept and Its Values*, 1 PROC. INT'L CONG. PLANT SCI. 677 (1929).

585. See, e.g., CLEMENTS, *supra* note 278; cf. Frederic E. Clements, *Experimental Ecology in the Public Service*, 16 ECOLOGY 342 (1935) (explaining that ecology is more properly viewed "as a point of view and a plan of attack").

586. See LOVEJOY, *supra* note 465, at 60.

587. See *id.*

588. *Id.* at 60 (quoting Alexander Pope, *Essay on Man*).

589. See *id.* at 59-63.

contingency pervaded the created world.<sup>590</sup> In 1712, a British poet put Clarke's thesis as follows:

Might not other animals arise  
 Of different figure and of different size?  
 In the wide womb of possibility  
 Lie many things which ne'er may actual be:  
 And more productions of a various kind  
 Will cause no contradiction in the mind . . . .  
 These shifting scenes, these quick rotations show  
 Things from necessity could never flow,  
 But must to mind and choice precarious beings owe.<sup>591</sup>

The debate that exists today between those who regard species as "rivets" in maintaining the "balance of nature" and those who believe that historical accident drives ecosystem composition may not add a great deal to the controversy these two poems encapsulate. The same controversy rages between those who believe that nature must exhibit an "equilibrium" or "order" and those who argue that it is all chaos and contingency.<sup>592</sup> Ecological debates repeat in a secular guise today the same fundamental disagreements about the nature of nature that were framed, perhaps more appropriately, in earlier centuries in cosmological and theological terms.

These two poems also represent succinctly two different approaches to the ESA. The poem by Pope, which found a sufficient reason or place for every species in the "Great Chain of Being," expressed the view shared by Barry Commoner, Paul Ehrlich, and many other ecologists who have resisted the Darwinian revolution. For them, as for the legal commentators cited earlier, we cannot risk popping too many rivets in the wing or losing too many links in the chain. Justice Douglas, in his dissent from *Sierra Club v. Morton*,<sup>593</sup> observed: "When a species is gone, it is gone forever. Nature's genetic chain, billions of

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590. See *id.* at 149-50.

591. *Id.* at 165 (quoting Sir Richard Blackmore, *Creation* (1712)).

592. For a review of this conflict, see Tarlock, *supra* note 454.

593. 405 U.S. 727, 741 (1972).

years in the making, is broken for all time.”<sup>594</sup> As one recent law review article stated: “[L]and itself may demand to be used in a manner that suits its place in the natural ecological chain; no one should have the right to modify or destroy its natural systems.”<sup>595</sup>

The second poem, which referred to species as “precarious beings,” anticipated the Darwinian conception of evolution. From this point of view, it is the unlikelihood, not the perfection, of the living world that amazes us; the improbability of every plant and animal leads us to treasure its existence. Species, even those not yet named, command our moral attention because they have emerged through a billion-year-old toil of evolution. It is morally inconceivable that in our eagerness to satisfy ephemeral consumer wants and demands we should obliterate the results of what must be the greatest miracle we could ever experience, the story of life on earth, and leave future generations instead only the record of our own technology, industry, and trade. This ethic of preservation, which frankly regards creatures as miraculous in their improbability, values every species as intrinsically marvelous and worthy of respect and admiration, but does not pretend that it fits into a larger design or plan. “Every kind of organism has reached this moment in time by threading one needle after another, throwing up brilliant artifices to survive and reproduce against nearly impossible odds.”<sup>596</sup>

This preservationist approach to valuing species properly rests on an ethic of love, affection, and respect for nature, which is the very opposite of the emphasis on utility expressed in the “rivet-popping” analogy. David Ehrenfeld of Rutgers University has written that the value of biodiversity does not depend on “the uses to which particular species may or may not be put, or their alleged role in the balance of global ecosystems.”<sup>597</sup> Ehrenfeld argues, moreover, that owing to the changes in our needs and in

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594. *Id.* at 751 n.8 (Douglas, J., dissenting) (quoting CONSERVE-WATER, LAND, AND LIFE 4 (1971)).

595. Marla E. Mansfield, *When “Private” Rights Meet “Public” Rights: The Problems of Labeling and Regulatory Takings*, 65 U. COLO. L. REV. 193, 205 n.73 (1994) (citations omitted).

596. WILSON, *supra* note 364, at 364.

597. Ehrenfeld, *Biodiversity*, *supra* note 79, at 214.

our technology, instrumental approaches to valuation "are shifting, fluid, and utterly opportunistic in their practical application. This is the opposite of the value system necessary to conserve biological diversity over the course of decades and centuries."<sup>598</sup>

The two poems, both written in the eighteenth century, suggest two different and, in fact, conflicting justifications one might apply to the ESA. The poem by Pope is consistent with the insights of theoretical ecology, insofar as it ascribes a structure and purpose to nature, a design in which every species serves an end, like rivets in the wing of a plane or links in the genetic chain. According to this scientific approach, any change that we make in the natural environment, especially if it causes the extinction of species, may cost us dearly, because it strains the stability, resilience, balance, homeostasis, natural succession, optimal scale, autocatalysis, low entropy, emergy, exergy, negentropy, tensile strength, or other integrative property of the Web, Chain, Neural Network, Circuitry, Hierarchy, Ascendancy, Clockwork, Cycle, or Oscillator<sup>599</sup> that is Nature. One may argue that by destroying habitat, a property owner threatens to harm the "Great Chain", dance, symphony, ascendancy, spiral (or insert your own favorite metaphor) on which all life depends.

According to the Blackmore poem, nature does not have a design but a history. Lacking both *logos* and *telos*, nature could not have been otherwise; changes we make to nature, whether intentional or inadvertent, do not upset a design or plan, because no design or plan exists. No *prima facie*, general, or theoretical reason can be given, then, to suppose that the extinction of species now feared will in any meaningful way harm nature, because nature, having neither design or direction, is not the sort of thing that can suffer harm. Blackmore's view of life, though denying that nature has a design in which species play a part, insists nevertheless that nature has a history in view of which

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598. *Id.*

599. Platt and Denman urge "the nonlinear oscillator representation of living systems" as the new paradigm and foundation for theoretical biology. Platt & Denman, *supra* note 484, at 209.



each species deserves our moral respect and attention. This view makes sense of the contingency of nature; it is the position, then, that abandons "Great Chain of Being" cosmology and acknowledges Darwin.

## VI. THE WARS OF RELIGION

"[P]roperty has its duties as well as its rights," Benjamin Disraeli wrote in *Sybil*.<sup>600</sup> Are the duties of property only those to be found in common law? To what extent may public law—in particular, land-use regulations that diminish the market value of property, impose obligations on landowners without the payment of compensation? On this question, as we have seen, two opposing camps criticize current takings jurisprudence. Advocates of the rights of property, such as Richard Epstein, believe that a free market bounded by common law provides the most promising platform for human betterment and social improvement.<sup>601</sup> Advocates of the duties of property, in contrast, emphasize the interconnectedness of land within a biological community that supports all life.<sup>602</sup> According to this view, "it is not an unreasonable exercise of [police] power to prevent harm to public rights by limiting the use of private property to its natural uses."<sup>603</sup>

This Article has proposed that the second position, which attributes both design and purpose (*logos* and *telos*) to the land community, represents a venerable theological tradition, namely, the pre-Darwinian conception implicit in "Great Chain of Being" cosmology that regarded organisms as interlinked in systems

600. BENJAMIN DISRAELI, *SYBIL OR THE TWO NATIONS* 119 (Alfred A. Knopf 1934) (1845).

601. See, e.g., Richard A. Epstein, *Takings: Descent and Resurrection*, 1987 SUP. CT. REV. 1, 44 ("[T]he [Takings] Clause forces the government officials to put their money where their mouth is when they assert that certain social gains are worth the private costs that they impose."); see also Susan Rose-Ackerman, *Against Ad Hocery: A Comment on Michelman*, 88 COLUM. L. REV. 1697, 1706 (1988) ("The compensation requirement can be understood as a way to force public policymakers to consider the opportunity costs of their proposed actions.").

602. See *supra* text accompanying notes 43-50 and 230-57.

603. Sax, *supra* note 252, at 1440 (quoting *Just v. Marinette County*, 201 N.W.2d 761, 768 (Wis. 1972)). Sax added: "Lucas represents the Court's rejection of pleas to engraft the values of the economy of nature onto traditional notions of the rights of land ownership." *Id.* at 1446.

designed to support human life.<sup>604</sup> Although contemporary ecologists tend to regard ecosystems as structured in this way, they have been unable to agree on the concepts, principles, or models by which to define these systems and to re-identify them through time and change. We have seen that a second difference distinguishes traditional "Great Chain of Being" thinking from contemporary ecological theory. Traditional natural theology refers to God as the designer of the natural environment. Divine authorship might, indeed, provide a powerful reason to preserve biotic communities. Contemporary ecologists who impute order or design to natural ecosystems either say nothing about the author of this design, or they assume that evolution works as well to form biotic communities as to shape the organisms that live in them. How objects that do not reproduce, such as ecosystems, can evolve in a biological sense, however, has not been explained.<sup>605</sup>

It would be unfair not to acknowledge that the first position, which finds the source of human improvement and social betterment in competitive markets bounded only by common law, also represents a theological tradition that has been sanitized of its overt religious language and represented as a contemporary science.<sup>606</sup> Just as theoretical ecology secularizes the "Great Chain of Being," so neoclassical economics secularizes Protestant visions of salvation, which it identifies with material progress and plenty.<sup>607</sup> As theologian Paul Tillich has observed: "The

604. See generally LOVEJOY, *supra* note 465.

605. Eugene P. Odum at least recognizes the problem, while appealing to conceptions of group selection somehow to solve it. He writes in the optative mood: Natural selection may occur at more than one level. . . . Accordingly, coevolution, group selection, and traditional Darwinism are all part of the hierarchical theory of evolution. Not only is the evolution of a species affected by the evolution of interacting species, but a species that benefits its community has survival value greater than a species that does not.

Odum, *supra* note 412, at 543 (citations omitted).

606. See EPSTEIN, *supra* note 36, at 331-33. It should be noted that Epstein carefully identifies the theological sources of the Lockean views upon which he draws. See *id.* at 7-18.

607. For an overview of this position, see Craufurd D. Goodwin, *Doing Good and Spreading the Gospel (Economic)*, in THE SPREAD OF ECONOMIC IDEAS 157-73 (David

idea of providence is secularized in the Enlightenment," and "the first clear expression can be seen in the area of economics."<sup>608</sup>

This Article has focused on the theological content of ecological theory only because the religious basis of the opposing position, neoclassical or welfare economics, is already explored thoroughly in the literature.<sup>609</sup> Economic theory, at bottom, considers market relationships to be as "natural" or as inherent in the created order of things as ecological theory considers biological relationships. Adam Smith stated this axiom of economic theory when he asserted that "the propensity to truck, barter, and exchange one thing for another . . . is common to all men."<sup>610</sup> From this point of view, land and labor must be considered like any other commodity that individuals use or exchange to promote their utility.<sup>611</sup>

The idea that land and labor are fungible goods, like toothpicks and buggy whips, was not, however always obvious to everyone; indeed it is an innovation of modern times. (Governments in modern societies still make taboo the sale of some objects, such as children, sex, and certain drugs, as feudal societies tabooed the sale of land and labor.) "Traditionally," Karl Polanyi has written, "land and labor are not separated; labor forms part of life, land remains part of nature, life and nature form an articulate whole."<sup>612</sup> He adds: "To isolate [land] and form a market out of it was perhaps the weirdest of all undertakings of our ancestors."<sup>613</sup>

C. Colander & A.W. Coats eds., 1989). George L. Stigler, among others, acknowledged that economists form a priesthood advocating economic growth. See GEORGE L. STIGLER, *THE ECONOMIST AS PREACHER AND OTHER ESSAYS* (1982).

608. PAUL TILLICH, *A HISTORY OF CHRISTIAN THOUGHT: FROM ITS JUDAIC AND HELLENISTIC ORIGINS TO EXISTENTIALISM* 334, 338 (1967).

609. Historians have long recognized the theological basis of the idea—common to both capitalism and socialism—that economic or material progress constitutes the path to social redemption or salvation. See, e.g., J.B. BURY, *THE IDEA OF PROGRESS: AN INQUIRY INTO ITS ORIGIN AND GROWTH* 21-22 (1932).

610. ADAM SMITH, *AN INQUIRY INTO THE NATURE AND CAUSES OF THE WEALTH OF NATIONS* 21 (Kathryn Sunderland ed., Oxford Univ. Press 1993) (1776).

611. For discussion, see Frank H. Knight, *Anthropology and Economics, in ECONOMIC ANTHROPOLOGY: THE ECONOMIC LIFE OF PRIMITIVE PEOPLES* 508-23 (Melville J. Herskovits ed., W.W. Norton & Co. 1965) (1940).

612. KARL POLANYI, *THE GREAT TRANSFORMATION* 178 (Beacon Press 1957) (1944).

613. *Id.*

Our ancestors undertook this weird transformation of land from birthright to commodity in the interests of economic growth, which, or so seventeenth- and eighteenth- century economists and philosophers argued, would end scarcity and thus bring Heaven to earth. The deference to the will of the property owner urged by Epstein and others reflects the by-now-established faith that free markets as opposed to feudal arrangements will unleash economic forces that will benefit mankind. Barriers to trade, such as those that environmentalists would impose, would greatly decrease economic benefits. The question then must arise whether competitive markets, by producing more and more consumer goods and services, actually make us better off in any substantive sense. As we shall see, answers to this question turn on faith, not evidence.

This Article argues that the basic debate in takings jurisprudence raises issues that have been familiar for centuries as the essential tension in the Protestant Ethic.<sup>614</sup> At its inception in Calvin, Luther, and Wesley, the Protestant Ethic grounded the idea of property in responsibility, stewardship, and obligation. After the industrial revolution, the justification for private property changed dramatically, however, from an ethic of sustainable production to one of consumption, in response to an enormous glut of new consumer goods. People had to be taught to consume to sustain a market that had come to be seen as sacred in itself.

The courts may side with those environmentalists whose science teaches that the seas will rise up against us if we continue to follow the path of consumption. Alternatively, the courts may side with those economists who believe that the uncompensated constraints on private economic exchange will lead to tyranny and social impoverishment. In choosing between these forebodings in fashioning takings jurisprudence, the Court confronts a fundamental ideological decision akin to the crossroads Woody Allen described. "One path leads to despair and utter hopelessness. The other, to total extinction. Let us pray we have the wis-

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614. For a leading book surveying this literature, see ROBERT H. NELSON, REACHING FOR HEAVEN ON EARTH: THE THEOLOGICAL MEANING OF ECONOMICS (1991).

dom to choose correctly."<sup>615</sup>

The Article concludes by reiterating the thesis that the Supreme Court has done well to embrace neither the position identified with ecological theory nor the position associated with economic theory. Rather than joining either of these faith communities—one believing in the equilibria of ecosystems, the other in the equilibria of markets—the Court wisely has contented itself with reining in regulation at its borders, while still allowing the political process to wander along its own winding way.

### A. *The Gospel of Efficiency*

Max Weber, in his classic study, *The Protestant Ethic and the Rise of Capitalism*, argued that capitalism at its inception offered a system of stewardship of natural resources as well as an ethic of responsibility for the needs of human beings.<sup>616</sup> Capitalism in the seventeenth century, Weber tells us, was not "unscrupulous in the pursuit of selfish interests by the making of money."<sup>617</sup> Weber argued, on the contrary, that capitalism rested on a Protestant calling to frugality and savings.<sup>618</sup> This calling brings each person dignity through productive work in the community here below. And one's success here below manifests one's prospect of salvation in the world to come.

Weber particularly stressed the incompatibility of self-indulgence, even leisure, with the basis of capitalism in a Protestant ethic.<sup>619</sup> Wealth for Weber's capitalist came from fulfilling one's

615. WOODY ALLEN, *SIDE EFFECTS* 57 (1980).

616. See generally MAX WEBER, *THE PROTESTANT ETHIC AND THE SPIRIT OF CAPITALISM* (Talcott Parsons trans., 1958) (analyzing the link between protestantism and the growth of capitalism).

617. *Id.* at 57.

618. See *id.* at 3 (Foreword by R.H. Tawney). In a recent book, Charles Sellers suggested an interesting interpretation of the opposition that exists between the gospel of efficiency and the ecology ethic in terms of the differences that exist between the arminian and antinomian heresies. See generally CHARLES SELLERS, *THE MARKET REVOLUTION: JACKSONIAN AMERICA 1815-1846* (1991). The arminian heresy finds salvation in frugality and hard work, following Calvinist doctrine. See *id.* at 29-30. The opposing antinomian view was expressed more collectivistically than individualistically, asserting "the subsistence world's commitment to communal love against the market's competitive ethic." *Id.* at 30.

619. Weber wrote:

This worldly Protestant asceticism . . . restricted consumption, especially

duty to God, not from engaging in sharp speculation or manipulation of markets.<sup>620</sup> Weber laid particular emphasis on conservation, moreover, and on our responsibilities as God's trustees over the gifts of nature. That we are the stewards of the natural resources that God entrusts to us is an assumption found throughout Weber's theory of capitalism. Within early Protestant theology, ownership entailed obligation and responsibility; a person had a duty to what he owned. Weber summarized: "The idea of man's duty to his possession, to which he subordinates himself as an obedient steward . . . bears with chilling weight on his life."<sup>621</sup>

Weber described the views held by Protestant theologians such as Calvin, who promoted the ideal of stewardship, arguing that for many people, "the knowledge of God [is] sown in their minds out of the wonderful workmanship of nature."<sup>622</sup> In the *Institutes of the Christian Religion*, Calvin worried that humanity contaminated the natural world with its "depravity and corruption."<sup>623</sup> Calvin did not foresee the extent to which technological change would enable human beings, in the course of work, production, and economic advance, to manufacture a deluge of consumer products. Rather, he believed that, if we renounce "prodigious trifles" and superfluous wealth, we may continue to increase production, while being instructed by the "bare and simple testimony which the [natural] creatures render splendidly to the glory of God."<sup>624</sup> If we fail to harmonize our

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of luxuries. On the other hand, it had the psychological effect of freeing the acquisition of goods from the inhibitions of traditionalistic ethics. It broke the bonds of the impulse of acquisition in that it not only legalized it, but . . . looked upon it as directly willed by God.

WEBER, *supra* note 616, at 170-71.

620. Calvin is the principal source of the sanctity of work and wealth derived from productivity. See SELLERS, *supra* note 618, at 29-30 ("Calvinism also became the spiritual medium of capitalist transformation by sanctifying worldly work as religious duty and wealth as fruit of grace.").

621. WEBER, *supra* note 616, at 170.

622. JOHN CALVIN, *INSTITUTES OF THE CHRISTIAN RELIGION*, reprinted in CALVIN'S *INSTITUTES: A NEW COMPEND* 26-27 (Hugh T. Kerr ed., 1989).

623. *Id.* at 17.

624. *Id.* at 26-27. In discussing these passages, Robert Nelson compared them with

lives with the simple teachings of the natural world, however, "wrath, judgment, and terror" await us.<sup>625</sup>

During the seventeenth and eighteenth centuries—and certainly in our own time—capitalism lost touch with stewardship, hard work, and responsibility to the community and merged with the secondary effects Weber also described, such as extremes of wealth and poverty, an infatuation with money, and conspicuous and often competitive consumption of material goods.<sup>626</sup> At the same time, ownership came to be seen as a source of privilege rather than as a responsibility.<sup>627</sup> Weber

statements such as the one made by Dave Foreman, founder of Earth First, that "humans are a disease, a cancer on nature." Robert H. Nelson, *Environmental Calvinism: The Judeo-Christian Roots of Eco-Theology*, in *TAKING THE ENVIRONMENT SERIOUSLY* 233, 235 (Robert E. Meiners & Bruce Yandle eds., 1993) (quoting Dave Foreman, in Douglas S. Looney, *Protection or Provocateur?*, *SPORTS ILLUSTRATED*, May 27, 1991, at 54). Nelson saw very little to distinguish between Calvin's view of humanity and that of Paul Watson, a founder of Greenpeace, who believes that "we, the human species, have become a viral epidemic to the earth." *Id.* (quoting Paul Watson); see generally *id.* at 233-38 (comparing Calvinism and environmentalism).

625. CALVIN, *supra* note 622, at 110. Nelson drew the obvious analogy to contemporary prophecies of environmental destruction. See Nelson, *supra* note 624, at 236-37. Calvin was particularly concerned about the protection of species or what we now call "biodiversity." He wrote that God wills "the preservation of each species until the Last Day." CALVIN, *supra* note 622, at 41.

626. In the 18th century, religious leaders were preoccupied with the tension that still confronts us today. On the one hand, productivity, frugality, savings, and the creation of wealth serve humanity by ending the scarcity and want that would otherwise lead to misery and sin. On the other hand, as people become rich they become arrogant and lose appreciation for the simple virtues. In the 18th century, John Wesley noted that what we call the Protestant Ethic would "necessarily produce both industry and frugality, and these cannot but produce riches. But as riches increase, so will pride, anger, and love of the world in all its branches." On the one hand, Wesley wrote, "we must exhort all Christians to gain all they can, and to save all they can; that is, in effect, to grow rich." On the other hand, "wherever riches have increased, the essence of religion has decreased in the same proportion." For these quotations and relevant discussion, see Rodney Clapp, *Why the Devil Takes Visa: A Christian Response to the Triumph of Consumerism*, *CHRISTIANITY TODAY*, Oct. 7, 1996, at 18, 22, and Kemper Fullerton, *Calvinism and Capitalism: An Explanation of the Weber Thesis*, in *PROTESTANTISM, CAPITALISM, AND SOCIAL SCIENCE: THE WEBER THESIS CONTROVERSY* 6, 19 (Robert W. Green ed., 1965).

627. Michael S. Greve has pointed out that "the common-law construction adopts the perspective of the *owner*. This is not a value decision in favor of economic uses . . . . [W]hatever his intentions, the owner has an interest in predictable rules that . . . preserve his exclusive control, provided only that he do no harm to others." GREVE, *supra* note 258, at 38-39. The question arises, however, why the law should show deference to the property owner. The answer that comes to mind is a value

noted with dismay the extent to which consumption had begun to replace hard work, frugality, and stewardship as the path to spiritual fulfillment. He wrote: "material goods have gained an increasing and finally inexorable power over the lives of men as at no previous time in history."<sup>628</sup> Social and economic élites in Europe and America lost interest in salvation in the world to come. They began to see in the industrial revolution the key to ending material scarcity and, thus, establishing Heaven on earth.<sup>629</sup>

By the eighteenth century, the belief became general that material abundance would bring to earth "the true and only heaven"—to use the phrase the late Christopher Lasch adopted from Hawthorne as the title of a recent book.<sup>630</sup> This faith in material progress dominated much of economic and social philosophy until the twentieth century.<sup>631</sup> As eighteenth-century philosopher David Hume framed the argument, human nature might be perfected if there existed "such profuse *abundance* of all *external* conveniencies, that . . . every individual finds himself fully provided."<sup>632</sup> In that event, selfishness and possessiveness would

decision in favor of economic uses, which is to say, a social preference for consumptive over ecological values. If that preference changes by way of public law, what then would ground the common law deference to the will of the owner? Presumably, Greve would appeal to the same Lockean or Libertarian views as Epstein, but this is itself a view of the soul—the separateness and inviolability of the soul God created—that has its basis in a theological tradition.

628. WEBER, *supra* note 616, at 181.

629. For a discussion, see Ralph Henry Gabriel, *The Gospel of Wealth of the Gilded Age*, in DEMOCRACY AND THE GOSPEL OF WEALTH 55, 58 (Gail Kennedy ed., 1949) (interpreting Andrew Carnegie, *Gospel of Wealth*, in THE GOSPEL OF WEALTH AND OTHER TIMELY ESSAYS 14 (Edward C. Kirkland ed., 1962)).

630. CHRISTOPHER LASCH, THE TRUE AND ONLY HEAVEN: PROGRESS AND ITS CRITICS (1991).

631. Robert Nelson has written:

[T]he history of the modern age (dating from the Enlightenment) reveals a widely held belief that economic progress will solve not only practical but also spiritual problems of mankind. Material scarcity and the resulting competition for limited resources have been widely seen as the fundamental cause of human misbehavior—the real source of human sinfulness. For holders of this conviction, to solve the economic problem would be, therefore, to solve in large part the problem of evil.

NELSON, *supra* note 614, at xxi.

632. DAVID HUME, ENQUIRIES CONCERNING THE HUMAN UNDERSTANDING AND CON-



vanish; without scarcity, justice would be an unnecessary virtue, and "in such a happy state, every other social virtue would flourish, and receive tenfold increase."<sup>633</sup>

Enlightenment philosophy and religion held out the promise that the rise of science would give humanity the means to build the Heavenly City on earth, primarily by conquering nature and thus ensuring limitless material progress, but also by setting economic and social policy on rational principles.<sup>634</sup> The idea that economics might be the science of human well-being—rather than the "dismal" science of scarcity (as Carlyle dubbed it after having read Malthus)—can be traced to eighteenth-century political philosophy, most obviously, for example, to Adam Smith's concept of the workings of the invisible hand of the market.<sup>635</sup> As is well known, the image of the invisible hand brought together the Protestant ideal of individual work and self-improvement with the idea of social well-being. In the eighteenth century, the market was supposed to do what environmentalists believe ecosystems do, that is, secure human welfare. As Smith wrote:

The natural effort of every individual to better his own condition, when suffered to exert itself with freedom and security, is so powerful a principle, that it is alone, and without any assistance, not only capable of carrying on the society to wealth and prosperity, but of surmounting a hundred impertinent obstructions with which the folly of human laws too often incumbers its operations . . . .<sup>636</sup>

The central paradox in the Protestant Ethic—a problem Marx clearly saw as the central flaw of capitalism—lay in the enor-

CERNING THE PRINCIPLES OF MORALS 183 (L.A. Selby-Bigge ed., Oxford Univ. Press 2d ed. 1927) (1777) [hereinafter HUME, *Enquiries*] (this is also cited as marginal section 145, as per the index of the volume). Hume made the same point using different words in *A TREATISE OF HUMAN NATURE* 494-95 (P.H. Niddith ed., Oxford Univ. Press 2d ed. rev. 1978) (1740).

633. HUME, *ENQUIRIES*, *supra* note 632, at 183.

634. For a discussion of the relation between the early effect of rational economic theory on resource management, see SAMUEL P. HAYS, *CONSERVATION AND THE GOSPEL OF EFFICIENCY: THE PROGRESSIVE CONSERVATION MOVEMENT, 1890-1920* (1969).

635. For a discussion see NELSON, *supra* note 614, at 45.

636. See SMITH, *supra* note 610, at 336-37.

mous production of goods and services that the industrial revolution made possible. Those who were taught to produce, to save, to be frugal, to husband resources, and to avoid ostentation could not possibly absorb all the “fripperies” that an efficient industrial engine must create. The problem of capitalism soon became obvious: The production of consumption had to keep up with the consumption of production. Imagine what would happen to the economy if consumers were all like Socrates, who, when looking at the mass of objects for sale, would say to himself, “How many things I can do without!”<sup>637</sup>

How merchandisers in the late nineteenth-century converted shopping into a religious quest and experience—the way Wanamaker along with other founders of the department store “brought Christianity lock, stock, barrel, and Bible into the marketplace and redefined faith in terms of the marketplace”<sup>638</sup>—has been so thoroughly studied that it needs little comment here.<sup>639</sup> Religious sensibilities, when secularized, for example, in the Romantic movement, easily became associated with fashions, novels, movies, cars, and other consumer goods that promised people a kind of “election” akin to religious salvation—in other words, entry into the community of the “saved.” By the 1950s, increases in productivity had become so great that a “consumption ethic”<sup>640</sup> or an “economic gospel of consumption”<sup>641</sup> replaced the old “gospel of efficiency” of which those increases in productivity were a consequence.

The cultural anthropologist Colin Campbell has traced our patterns of increased consumption to the pouring out of religious feelings in the presence of certain secular symbols that substitute for religious icons.<sup>642</sup> Campbell persuasively argued that two cultural traditions or “ethics” developed out of eighteenth-

637. DIOGENES LAERTIUS, *LIVES OF EMINENT PHILOSOPHERS* 155 (R.D. Hicks trans., 1938).

638. Clapp, *supra* note 626, at 23-24.

639. *See, e.g.*, WILLIAM LEACH, *LAND OF DESIRE* (1993).

640. ROLAND MARCHAND, *ADVERTISING THE AMERICAN DREAM* 153-63 (1985).

641. BENJAMIN KLINE HUNNICUTT, *WORK WITHOUT END* 38-66 (1988).

642. *See* COLIN CAMPBELL, *THE ROMANTIC ETHIC AND THE SPIRIT OF MODERN CONSUMERISM* (1987).

century Protestantism and hold sway over our moral imaginations today. The first, which we associate with the Protestant Ethic described by Weber, "stressed rationality, instrumentality, industry, and achievement, and is more suspicious of pleasure than of comfort," which it permits.<sup>643</sup> This tradition is responsible for the massive productivity of industry. The second, which can be traced through revivalism, evangelicalism, and romanticism, "incorporating an 'optimistic,' 'emotionalist' version of the Calvinist doctrine of signs,"<sup>644</sup> developed into sentimentalism and taught people how to release powerful emotions in the presence of symbols. This latter tradition, when massaged by advertising and marketing, is responsible for our ability to want and consume products for which we have no reasonable need. As a result, the way to "election" today is more likely to be sought by the purchase of the proper sneakers, stereo, or yacht than by following the hard path of the Weberian Protestant Ethic.

An unprecedented industrial outpouring of consumer goods transformed economics from the dismal science of scarcity into an optimistic science of creating and satisfying demand. The new demand-side economics became glorified by its association with choice—always a sacred concept for Americans. By underscoring the importance of personal decision and conversion, as one commentator has written,

Charles Finney and other revivalists helped along the sanctification of *choice*, a key component of today's consumer capitalism. Revivalism encouraged rapturous feelings and a malleable self that is open time and again to the changes of conversion and reconversion. This was simply translated into a propensity toward 'conversion' to new products, a variety of brands, and fresh experiences.<sup>645</sup>

When Marx wrote in his *Critique of the Gotha Programme*, "to each according to his needs,"<sup>646</sup> he had an old saw going back to the Bible.<sup>647</sup> Marx recognized the paradox: because techno-

643. *Id.* at 137.

644. *Id.*

645. Clapp, *supra* note 626, at 22.

646. KARL MARX, *CRITIQUE OF THE GOTHA PROGRAMME* 10 (N.Y. Int'l Publishers, rev. ed. 1938) (1875).

647. *See The Acts of the Apostles* 4:35 ("And distribution was made unto every man

logical advance in capitalistic societies causes production continually to expand, "needs" must also grow, to consume all that is produced.<sup>648</sup> He saw in the logic of production and overproduction the same forces that revivalists described in relation to declension and resurrection; for Marx, capitalism led to Armageddon and then to redemption in a classless society. One commentator explains:

[T]he triumph of the proletariat would be accompanied by the elimination of scarcity and thereby restore humans to their true, more innocent and happy nature. Christianity had long taught that government and property were regrettable necessities required by human sinfulness; Marx, in his way, took a similar view.<sup>649</sup>

The faith in material progress—the ever-increasing satisfaction of consumer preferences—as the key to human and societal salvation persists as the foundational principle of welfare economics. Just as the dismal science of Malthus prepared Christians to produce a plethora of goods given scarce resources, so the optimistic science of welfare economics prepares us to consume those goods now produced by technology and, therefore, with theoretically unlimited resources.<sup>650</sup> The basic faith of eco-

according as he had need."). The political economist Louis Blanc had written 30 years earlier than Marx: "Let each produce according to his aptitudes and force, let each consume according to his need." M. LOUIS BLANC, ORGANISATION DU TRAVAIL (5th ed. Paris, Bureau de la Société de l' Industrie Fraternelle 1948), reprinted in 1 THE FRENCH REVOLUTION OF 1848 IN ITS ECONOMIC ASPECT 19 (J.A.R. Marriott ed., 1913).

648. See W. Beckerman, *The Economist as Modern Missionary*, 66 ECON. J. 108, 112 (1956) ("In an economy, such as the United States of America, where leisure is barely moral, the problem of creating sufficient wants . . . to absorb productive capacity may become chronic in the not too distant future. In such a situation the economist begins to lead a furtive existence.").

649. Robert H. Nelson, *The Theological Meaning of Economics*, CHRISTIAN CENTURY, Aug. 18, 1993, at 777, 779.

650. Nature sets no limit on economic growth, according to the standard neo-classical position, because intelligence or ingenuity enables us, as Harold Barnett and Chandler Morse have written, "to choose among an indefinitely large number of alternatives. There is no reason to believe that these alternatives will eventually reduce to one that entails increasing cost—that it must sometime prove impossible

conomic theory, as many commentators have pointed out, lies in a belief in material progress; "the promise of steady improvement with no foreseeable ending at all."<sup>651</sup> Christopher Lasch has noted that economists responded to the prodigiousness of production by no longer condemning "insatiable appetites . . . as a source of social instability and personal unhappiness," but by requiring them to "drive the economic machine."<sup>652</sup>

The belief that material progress and plenty will solve social problems, while continuing to provide a moral basis for welfare economics, lost credibility with the general public after the First World War. Very few people today have faith that the scientific principles of economics—Marxist or capitalist—provide directions for how to bring Heaven to earth. The collapse of socialism in Eastern Europe, two world wars, persistent disparities in levels of income, and environmental destruction, among other disasters, have turned all but the hardiest technological optimists away from the enlightenment faith in material progress as the path to social redemption. Indeed, the collapse of this faith, as documented by Lasch among other authors, is nearly total, so that pessimism, if not despair about the future of humanity, seems to be the more fashionable attitude today.

### *B. Preference Satisfaction as the True and Only Heaven*

In spite of the apparent lack of connection between material improvement and social progress in a meaningful sense, the science of economics continues to insist on the principle that the continuous and unending satisfaction of insatiable consumer

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to escape diminishing quantitative returns." HAROLD J. BARNETT & CHANDLER MORSE, SCARCITY AND GROWTH 11 (1963).

If there is a limiting factor in economic production, neoclassical economists believe that it is knowledge, which, they assume, enables us to "grow" the economy continually by managing, controlling, and manipulating nature. As long as knowledge advances, according to this view, the economy can expand. Where there is effective management, Peter Drucker has written, "that is, the application of knowledge to knowledge, we can always obtain the other resources." PETER DRUCKER, POST CAPITALIST SOCIETY 45 (1993). He added: "The basic resource—the means of production' to use the economist's term—is no longer capital, nor natural resources (the economist's 'land'), nor 'labor.' *It is and will be knowledge.*" *Id.* at 8.

651. LASCH, *supra* note 630, at 47.

652. *Id.* at 52.

preferences leads to advances in human and social welfare.<sup>653</sup> Economists Edith Stokey and Richard Zeckhauser, for example, have declared that “[t]he purpose of public decisions is to promote the welfare of society.”<sup>654</sup>

They add that “[t]he welfare levels of the individual members of society are the building blocks for the welfare of society.”<sup>655</sup> The measure of these “welfare levels” is found in the preferences of the individuals themselves as weighed, for example, by the amounts those individuals are willing to pay to satisfy them. “In the United States we usually take the position that it is the individual’s own preferences that count, that he is the best judge of his own welfare.”<sup>656</sup>

Stokey and Zeckhauser assume that all the moral questions have been settled: the end or purpose of human life is to satisfy one’s preferences, whatever they are; the goal of society is contained in Paretian or microeconomic conceptions of welfare maximization. According to this approach, the political process is not seized with moral questions; rather, the purpose of regulation is simply to act as a prophylactic on markets when these fail to

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653. Normative welfare economics is based on “one fundamental ethical postulate”—that the preferences of individuals are to count in the allocation of resources. “In this framework, preferences are treated as data of the most fundamental kind. Value, in the economic sense, is ultimately derived from individual preferences . . . .” ALAN RANDALL, *RESOURCE ECONOMICS* 39 (1981); see also JAMES QUIRK & RUBIN SAPONSIK, *INTRODUCTION TO GENERAL EQUILIBRIUM THEORY AND WELFARE ECONOMICS* (1968). Welfare economics “focuses on using resources optimally so as to achieve the maximum well-being for the individuals in society.” RICHARD E. JUST ET AL., *APPLIED WELFARE ECONOMICS AND PUBLIC POLICY* 3 (1982).

Preferences form the building blocks of welfare, then, because there is supposed to be some connection between their satisfaction and personal well-being. How strong is this connection? For the neoclassical economist, the connection is a tautological one in that a person is simply postulated to be “better off” insofar as his or her preferences are satisfied. Overwhelming empirical evidence shows, however, that after basic needs are met the satisfaction of consumer desires leads less to contentment than to further dissatisfaction and thus, that there is no substantive relation between preference satisfaction and human or societal happiness. See *infra* notes 658-68 and accompanying text.

654. EDITH STOKEY & RICHARD ZECKHAUSER, *A PRIMER FOR POLICY ANALYSIS* 257 (1978).

655. *Id.*

656. *Id.* at 263.

allocate resources to those who are willing to pay the most for their use. Market equilibria are moral equilibria. These economists summarize:

In this country, the competitive free market is generally regarded as the primary means by which individuals enhance their own welfares. . . . What then, in broad terms, is the appropriate role for government in our free exchange economy? The government should step in only when the private market will not operate satisfactorily.<sup>657</sup>

Welfare economics as a science sanctifies demand insofar as it associates—and must associate—greater and greater consumption or preference-satisfaction with increased human happiness or welfare. The principle that identifies human well-being with the satisfaction of preferences, however, expresses either a trivial tautology or an obvious contradiction depending on how one interprets it. Insofar as neoclassical economics simply defines human and social welfare in terms of preference-satisfaction, then the satisfaction of preference will lead to social welfare only in the most formal and empty sense. In other words, if “preference satisfaction” is simply a stand-in or proxy for “well-being,” then the entire idea behind welfare economics—that one leads to the other—collapses into a mere formalism or tautology.<sup>658</sup>

657. *Id.* at 266.

658. Money does not buy happiness; consumption does not produce contentment. “And this is virtually inevitable because the faster the expectations actually *are* met, the faster they escalate.” NICHOLAS RESCHER, UNPOPULAR ESSAYS ON TECHNOLOGICAL PROGRESS 19 (1980). Commentators have long noted, therefore, the separation of the economic conception of welfare, which is identical to preference-satisfaction, from that of classical utilitarian ethical theory. Miller and Williams have summarized the familiar thesis mentioned here: Utilitarianism cannot provide a plausible or even a coherent account of the goal of preference-satisfaction. First, they have noted that “getting what one wants does not always make one happier or, in any recognizable way, better off.” THE LIMITS OF UTILITARIANISM 166 (Harlan B. Miller & William H. Williams eds., 1982). They have added:

Second, if getting what one desires were of itself to count as one’s being better off, then whatever one were to seek to bring about for others would seem to count as being in one’s interest, even if, paradoxically, it were to constitute what we should all recognize as self-sacrifice. Moreover, the seemingly substantive thesis . . . that one always seeks to advance one’s own interest, would . . . appear to become trivially true.

*Id.*

The principle involves a contradiction, however, insofar as it recognizes that preferences only escalate when they are satisfied—this is the “insatiability” assumption—so that consumption becomes a pointless exercise after basic needs are met.<sup>659</sup> In that event, one cannot satisfy preferences, only change them. John Kenneth Galbraith in *The Affluent Society* argued that after basic needs are met, production “only fills a void that it has itself created.”<sup>660</sup> As Erich Fromm observed: “Contemporary man has an unlimited hunger for more and more consumption.”<sup>661</sup>

Why would anyone want a kind of hunger—like an addiction—that can never be satisfied? What good are goods, after basic needs are met? In terms of substantive happiness or contentment, consumption serves little if any purpose. “When one want is fulfilled, several more usually pop up to take its place.”<sup>662</sup> Colin Campbell commented: “For the endless striving after stimulative pleasure, the gratification of each new want, is no more a rational life-goal than the earning of more and more money.”<sup>663</sup> Weber himself noted that to expect the satisfaction of preference to bring well-being is “absolutely irrational.”<sup>664</sup>

The point of welfare economics as a policy science is to exploit “resources in such a way that ‘value’—human satisfaction as *measured by aggregate consumer willingness to pay* for goods and services—is maximized.”<sup>665</sup> Yet the empirical evidence on the question speaks unequivocally to the fact that after basic needs are met there is no connection between the satisfaction of preferences weighed by willingness to pay and personal or social happiness or contentment.<sup>666</sup> On the contrary, indicators of human

659. For a discussion of the nonsatiety requirement, see ROBERT Y. AWH, *MICROECONOMICS: THEORY AND APPLICATIONS* 42 (1976).

660. JOHN KENNETH GALBRAITH, *THE AFFLUENT SOCIETY* 127 (3d ed. 1976).

661. Erich Fromm, *The Psychological Aspects of the Guaranteed Income*, in *THE GUARANTEED INCOME: NEXT STEP IN SOCIOECONOMIC EVOLUTION?* 183, 187 (Robert Theobald ed., 1967).

662. CAMPBELL, *supra* note 642, at 37 (quoting ROM J. MARKIN, JR., *CONSUMER BEHAVIOUR: A COGNITIVE ORIENTATION* 195 (1974)).

663. *Id.* at 101.

664. WEBER, *supra* note 616, at 53.

665. RICHARD A. POSNER, *ECONOMIC ANALYSIS OF LAW* 10 (2d ed. 1977).

666. The term “satisfaction” is equivocal. To “satisfy” a preference is to meet or



well-being, such as those employed by the United Nations, peak in social groups having quite modest income levels.<sup>667</sup> Per capita income in the United States has doubled in real terms since 1957, but the number of Americans who say they are happy or satisfied has dropped considerably since then.<sup>668</sup>

Social scientists have thoroughly researched the question whether human well-being varies with the satisfaction of consumer wants and preferences. Investigators generally use rising levels of income as a surrogate for preference-satisfaction, on the plausible assumption that the more money a person has, the more preferences he or she can satisfy. People typically report that as their incomes increase and they are able to satisfy more of their wants, they do not become any happier once they have met their basic needs.<sup>669</sup> Studies relating wealth to perceived happiness find that "rising prosperity in the USA since 1957 has been accompanied by a falling level of satisfaction. Studies of satisfaction and changing economic conditions have found overall no stable relationship at all."<sup>670</sup>

Ordinary wisdom suggests what empirical studies confirm: Contentment depends more on the quality of one's desires and on one's ability to overcome them, than on the extent to which they are satisfied. The things that make one happy—achievement, friends, family, health—depend largely on virtue and luck; they

fulfill it; this is the *logical* sense in which equations or conditions are "satisfied." It has no connection, empirical or conceptual, with "satisfaction" in the *psychological* sense in which people are "satisfied" when they are content or happy.

667. Cf. MICHAEL ARGYLE, *THE PSYCHOLOGY OF HAPPINESS* 90-97 (1987); ANGUS CAMPBELL, *THE SENSE OF WELL-BEING IN AMERICA* 56-59 (1981) (noting that more affluent people considered themselves less happy).

668. See Clapp, *supra* note 626, at 20 (citing DAVID MYERS, *SOCIETY IN THE BALANCE* (forthcoming)).

669. See ANGUS CAMPBELL ET AL., *THE QUALITY OF AMERICAN LIFE* (1976); GERALD GURIN ET AL., *AMERICANS VIEW THEIR MENTAL HEALTH* (1960); Hazel Gaudet Erskine, *The Polls: Some Thoughts about Life and People*, 28 *PUBLIC OPINION Q.* 517 (1964).

670. ARGYLE, *supra* note 667, at 144; see also CAMPBELL, *supra* note 667, at 56-69; Ed Diener, *Subjective Well-Being*, 95 *PSYCHOL. BULL.* 542 (1984); R.A. Easterlin, *Does Economic Growth Improve the Human Lot? Some Empirical Evidence*, in *NATIONS AND HOUSEHOLDS IN ECONOMIC GROWTH: ESSAYS IN HONOR OF MOSES ABRAMOVITZ* (Paul A. David & Melvin W. Redor eds., 1974); Daniel Kahneman & Carol Varey, *Notes on the Psychology of Utility*, in *INTERPERSONAL COMPARISONS OF WELL-BEING* 127 (Jon Elster & John E. Roemer eds., 1991).

are not available on a willingness-to-pay basis. People must satisfy their basic needs—but beyond those needs, no empirical relationship or covariance connects well-being with preference-satisfaction. Study after study confirms the folk wisdom that money cannot buy happiness. Accordingly, welfare economics stands out in its faith that money *does* buy happiness—that the satisfaction of consumer preferences brings ever greater well-being—in spite of the obvious implausibility and empirical falsity of any such notion.

### C. *Why Protect Species?*

The implausibility of welfare economics as a guide to public policy is particularly pronounced in relation to the protection of endangered species. Human welfare or well-being is the only ground that the economist *qua* economist can offer for preserving these species. Yet what marginal contribution does an endangered beetle, gopher, or shrub make to human well-being? Ignoring the role these creatures play in the delicate balance of ecosystems, as previously described,<sup>671</sup> the answer is none. This is the reason that theoretical ecology and welfare economics basically need each other and could be expected to join into a new field—ecological economics. Theoretical ecology, in positing order and purpose to ecosystems, identifies species preservation as a “public good” markets fail to price. Economists then have some basis for concluding that species have some economic value even if, at the margin, no one is willing to pay to use them or to obtain an option on their future utility.

To be sure, some plants and animals, such as wheat and cows, matter a great deal to human welfare, but it no more follows from this that the “marginal” endangered species is economically valuable than it follows from the net worth of Bill Gates that a “marginal” unemployed laborer is worth billions. To be sure, one never knows that any of the 600,000 kinds of beetles on earth might prove valuable (or, for that matter, to be a pest). One nev-

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671. See *supra* Part IV.

er knows, for that matter, that the next person born could be another Shakespeare. Uncertainty provides no more reason to protect every creature than to produce every conceivable child or hire every worker or publish every book. There are costs and benefits to be weighed in all these instances.

The reason to protect species, of course, is that we have moral, spiritual, aesthetic, historical, and cultural obligations to do so. It is the right thing to do, and most people know it. It would simply be immoral to destroy the remnants of a billion-year-old evolutionary history in order to produce a few more consumer baubles that add nothing real to human well-being. Economic theory knows how to value the baubles, which it assumes people think might contribute to their well-being or else they would not want them. Economic theory does not know how to value species, however, which people care about for reasons having no bearing on their welfare.<sup>672</sup> Those who believe we ought to protect species are motivated by moral concerns rather than by self-interest; their values, lacking any cognizable connection with well-being, even in the minds of those whose values they are, could not possibly enter the utility calculus on which welfare economists believe environmental policy should be based.

The authors of the *Assessment* recognized this difficulty. They conceded, as they must, that the value individuals impute to the existence of species "involve[s] a moral 'commitment' which is not in any way all self-interested."<sup>673</sup> They added: "Commitment can be defined in terms of a person choosing an act that he or she believes will yield a lower level of personal welfare to him/her

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672. Social scientists who interviewed respondents to contingent valuation surveys in 1992 found many strategies for constructing stated willingness to pay for changes in the level of a resource that had little or nothing to do with the expected utilities of the respondents. See David A. Schkade & John W. Payne, *Where Do the Numbers Come From? How People Respond to Contingent Valuation Questions*, in *CONTINGENT VALUATION* 271-93 (Jerry A. Hausman ed., 1993); see also D.A. Schkade & J.W. Payne, *How People Respond to Contingent Valuation Questions: A Verbal Protocol Analysis of Willingness to Pay for an Environmental Regulation*, 26 *J. ENVTL. ECON. & MGMT.* 88 (1994).

673. C. Perrings et al., *The Economic Value of Biodiversity*, in *GLOBAL BIODIVERSITY ASSESSMENT*, *supra* note 347, at 830 (citation omitted). The authors noted that the "existence" value of species "is almost entirely driven by ethical considerations precisely because it is disinterested value." *Id.*

than an alternative that is also available."<sup>674</sup> If the satisfaction of "existence" values lowers welfare—as this statement recognizes—then on which side of the cost-benefit equation should these preferences be entered? The individual does not want less welfare, per se, but "adherence to one's moral commitments will be as important as personal economic welfare maximization and may conflict with it."<sup>675</sup>

By large majorities, Americans agree in surveys with the statement that destroying species is wrong "because God put them on this earth."<sup>676</sup> This does not suggest that Americans believe that the protection of species will contribute to their own economic or welfare interests. Nor does it entail that most Americans believe in divine creation. Rather, experts conclude, "[i]t seems that divine creation is the closest concept American culture provides to express the sacredness of nature."<sup>677</sup>

The sciences most directly involved in environmental policy, ecology and economics, have replaced the language of the sacred with the language of utility. They then elevated their own conceptual constructs—ecosystems and markets—to the level of the divine. For ecology, each species is useful as a part of the great machinery of the ecosystem, beautifully designed in its fragile complexity to serve human life. Theoretical ecology thus expresses the traditional belief that balanced ecosystems, fresh from the hand of the Creator—oops, Evolution—serve human interests so well that we tamper with them at our peril. What is bad for the marsh is bad for mankind.<sup>678</sup>

For neoclassical economics, each species is useful because it contributes to individual welfare insofar as people are willing to pay for its existence. Markets may fail to value these "public goods" appropriately; accordingly, scientists must "correct" market prices to reflect the "true" worth of plants and animals.<sup>679</sup>

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674. *Id.*

675. *Id.*

676. KEMPTON ET AL., *supra* note 21, at 92.

677. *Id.*

678. *See* *Sibson v. New Hampshire*, 336 A.2d 239, 240 (N.H. 1975).

679. An endangered plant, such as Furbish's lousewort, which grows on one's land

After economic science (perhaps in consultation with ecological science) "corrects" prices, markets will come back into equilibrium, maximizing the satisfaction of consumer demand and with it welfare or well-being. Perfect competition is perfect happiness. What benefits the market benefits mankind.

The ecological and economic sciences have joined together to arrive at the politically and morally correct result: species are valuable and ought to be protected. They have reached this result, however, by transforming a religious tradition that helped us recognize that nature is sacred into a scientism that invests only its own conceptual constructs with divinity. To realize the full utility of the "marginal" endangered plant or animal, we must now rely on ecologists to restore ecosystems to their equilibria or natural state and economists to bring markets to their perfectly competitive or equilibria condition. We need to fund a lot more theoretical research in these sciences to determine exactly where the equilibria lie. Then ecologists and economists may join their equilibria together, as they do in the new discipline of ecological economics, to "get the prices right."<sup>680</sup> Science may then replace politics—expert administrators may do the work of democratic institutions and processes—with the eventual withering away of the state.

Alternatively, we may regard ecological economics—the marriage of theoretical ecology and welfare economics—as an example of the long tradition of faith healing and nature religion in America. Theoretical ecology, for example, in its discovery of "emergy,"<sup>681</sup> and welfare economics, for example, in its measurement of "existence value,"<sup>682</sup> may remind us of earlier attempts to define in scientific terms the moral relation of human beings to the natural world. The quest to restore equilibria that

is no more a public good—or no less "trivial" and "excusable" in its consumption—than the soybeans or petunias that one may raise there.

680. For examples of this sort of exercise, see *ECOLOGICAL ECONOMICS* (Robert Costanza ed., 1991).

681. See generally HOWARD T. ODUM, *ENVIRONMENT, POWER, AND SOCIETY* (1971) (discussing the "emergy" concept); Eugene P. Odum, *Energy Flow in Ecosystems: A Historical Review*, 8 *AM. ZOOLOGIST* 11 (1968).

682. See ROBERT CAMERON MITCHELL & RICHARD T. CARSON, *USING SURVEYS TO VALUE PUBLIC GOODS* 63-67 (1989) (discussing individuals' gain in utility from public goods beyond their expected personal use).

has characterized ecological and economic science in the last two decades has preoccupied scientists for the last two centuries—Swedenborgians, homeopaths, Christian Scientists, Christian physiologists, Grahamites, phrenologists, magnetists, theosophists, and many others.<sup>683</sup> In 1908, advocates of the “Chiropractic Philosophy,” for example, sought to help people restore internal and external balances, claiming their science “ventures into the realm of (so-called) occult phenomena and proves them to be simply action in obedience to easily understood laws.”<sup>684</sup>

Nature religion in America, as historian Catherine Albanese has argued, always seeks the timeless order, the essential balance, that individuals and society must restore as the path to salvation.<sup>685</sup> The vagaries of history for these spiritual sciences are simply illusion; behind the veil of temporal phenomena, true science discerns the eternal equilibria—the rules and principles that *explain* history, natural and economic.<sup>686</sup> Albanese concluded of the spiritual sciences that Americans embrace: “Like the untainted wilderness at the city’s edge in Royall Tyler’s *Contrast*, their heaven on earth signaled a refusal to grow into history. Whether as deists or as Christians, Americans had shown themselves, if anachronism be pardoned, as so many Peter Pans.”<sup>687</sup>

## VII. CONCLUSION

Takings jurisprudence has become the night in which all cows are black.<sup>688</sup> In this area of constitutional adjudication, the common law distinctions on which a substantive legal theory might rest have collapsed or dwindled into desuetude.<sup>689</sup> One

683. See CATHERINE L. ALBANESE, *NATURE RELIGION IN AMERICA* 117-52 (1990).

684. *Id.* at 147 (quoting Joy M. Loben, *The Completeness of Chiropractic Philosophy*, *CHIROPRACTOR*, Aug.-Sept. 1908, at 30-31).

685. See *id.* at 117-52.

686. See *id.*

687. *Id.* at 128.

688. See G.W.F. HEGEL, *THE PHENOMENOLOGY OF MIND* 192 (J.B. Baillie trans., Humanities Press 1977) (1949).

689. As Professor Richard Epstein has forcefully reminded us, property law in the area of takings jurisprudence has become loosed from its moorings in common law.

such distinction can be made between private property, from which unwelcome visitors may be excluded, and common property "open to the public to come and go as they please."<sup>690</sup> Another differentiates between goods traditionally provided by government, such as open space, landmarks, and wildlife habitat, and goods the public provision of which falls to private individuals.<sup>691</sup> The Supreme Court has now brushed aside—at least for purposes of takings decisions—the venerable benefit-harm distinction, for which it is "difficult, if not impossible, to discern on an objective value-free basis."<sup>692</sup> In short, there is hardly a meaningful distinction left. No wonder courts engage in ad hoc, case by case, adjudication.<sup>693</sup>

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As late as 1987, in the wake of *Nollan v. California Coastal Commission*, 483 U.S. 825 (1987), Epstein could still speak of (or hope for) a "resurrection" of common law principles in this area of law. See Epstein, *supra* note 601, at 43-44. Epstein now writes epitaphs. It is a common presumption, he ruefully reported, that private law baselines "do not really matter in the setting of constitutional adjudication, and that correlative concepts of property rights, such as those contained in the law of nuisance, do not have any special role to play in setting out the uses [of] and limitations on government power." Epstein, *supra* note 33, at 2. The established view "tends to treat the topic of takings by government as an issue *sui generis* and not tightly moored to any common law conceptions of property rights." *Id.*

690. *PruneYard Shopping Ctr. v. Robins*, 447 U.S. 74, 87 (1980); see also *Loretto v. Teleprompter Manhattan CATV Corp.*, 458 U.S. 419, 434 (1982) (citing *PruneYard* as upholding a state constitutional right of access to shopping centers for individuals to exercise rights of free speech and petition). There are many examples in which private property has become common property under these rulings. See, e.g., *Southview Assocs. Ltd. v. Bongartz*, 980 F.2d 84, 94-95 (2d Cir. 1992) (noting that the Supreme Court had so narrowed the scope of so-called physical takings (or invasions) that the concept would not apply to the presence of a deer that a would-be developer was forced to endure on his land).

691. See, e.g., *Monongahela Navigation Co. v. United States*, 148 U.S. 312, 325 (1893) (holding that the Takings Clause "prevents the public from loading upon one individual more than his just share of the burdens of government").

692. *Lucas v. South Carolina Coastal Council*, 505 U.S. 1003, 1026 (1992).

693. Plainly, the courts do not wish to overturn the regulatory state by construing "takings" too broadly, nor give it an entirely free hand by construing them too narrowly. As Joseph Sax has argued, the Court "shows no taste for overturning the vast structure of regulatory government, ranging from billboards to bank failures. Its bent is conservative rather than libertarian." Sax, *supra* note 252, at 1437. The Supreme Court seems willing to tolerate a lot of regulatory "takings" on the general grounds (pace Epstein) that the "common law of nuisance is too narrow a confine for the exercise of regulatory power in a complex and interdependent society." *Lucas*, 505 U.S. at 1035 (Kennedy, J., concurring in the judgment). Being deeply conservative, the Court may wish to avoid such a drastic outcome by upholding the general

The Court plainly is unimpressed with calls for a “comprehensive realignment of human values and attitudes toward the land” according to which “owners of sensitive lands could use them only in ways that did not materially disrupt important ecosystem processes.”<sup>694</sup> As Michael Greve has shown in a recent book, administrative case law has moved away from the “ecological paradigm,” which “envisions a world in which everything is connected to everything else and . . . views common-law rights—such as private property and freedom of contract—as a menace to an imperiled planet.”<sup>695</sup>

At the same time, the Court has not moored takings jurisprudence on principles of common law. The common law, as interpreted by Richard Epstein, includes in the “normal bundle of property rights . . . no priority for land in its natural condition; it regards use, including development, as one of the standard incidents of ownership.”<sup>696</sup> Under this view, whenever the state takes development rights from this bundle to provide a benefit to the public—such as open space or aesthetic pleasure—it should pay as any other willing buyer must do. It should pay, so adherents of this position contend, because otherwise public actions will become tyrannical, because they will not be disciplined by any cost constraint.

The Court has not taken up this debate between ecological and economic theory. This is as it should be, because the debate between ecological and economic theory is largely a moral and theological debate and not a legal one. The debate centers on whether ecological systems or market transactions provide the appropri-

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structure of the post-*Lochner* regulatory state, even at the price of being less libertarian than Epstein would like. Nevertheless, the Court has to draw the line *somewhere* for the very reason given by Epstein: It must “appreciate the social function that private property serves as a constraint against centralized power in a system of limited government.” Epstein, *supra* note 601, at 45.

694. Freyfogle, *supra* note 43, at 105-06.

695. GREVE, *supra* note 258, at 1. According to Greve, “[o]ver the past decade, . . . the courts have come to reject the ecological paradigm. They have renounced the doctrines that flow from the paradigm, and they have reasserted harm-based common-law-like doctrines as an organizing principle of American law.” *Id.* at 2.

696. Epstein, *supra* note 601, at 123.



ate natural and normative baseline for judging outcomes as good or right with respect to the use of land. Many environmentalists urge the Court to adjudicate land disputes on the principle, as stated by Aldo Leopold, that "[a] thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."<sup>697</sup> As one commentator wrote, society should adopt the basic principle that "morally acceptable treatment of the environment is that which does not upset the integrity of the ecosystem as it is seen in a diversity of life forms existing in a dynamic and complex but stable interdependency."<sup>698</sup>

Critics of this "ecological" position concede that a profound change in public attitudes toward nature has occurred since the days when the frontier was still open and the Industrial Revolution was new. These commentators, indeed, applaud public efforts to protect wildlife, endangered species, and sensitive lands. The question they raise is simply this: who is to pay for these good works? No constitutional or other objection arises to environmentally inspired regulations as long as the public is willing to pay for the development rights it confiscates—rights that may be otherwise exercised in profitable ways that cause no harm cognizable in the common law of tort. If the public does not pay for those development rights, however, then what constraint is left on the power of government?

The constraint, of course, is the political process itself. The government does not—as some libertarians may suggest—operate from outer space, inflicting its capricious will on small loggers and farmers who have no power over it. On the contrary, property owners have proven their political might over and over again, so that environmentalists are aware that enforcement of the ESA in ways less than respectful of the rights of property are more likely to lead to the evisceration of the Act than to the preservation of habitat.<sup>699</sup> Mr. Cushman, with

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697. LEOPOLD, *supra* note 18, at 224-25.

698. Don E. Marietta, Jr., *The Interrelationship of Ecological Science and Environmental Ethics*, 1 ENVTL. ETHICS 195, 197 (1979).

699. For an important illustrative statement see Michael Bean, *Moratorium Ends, But Wildlife Needs a Better Law* <[http://www.edf.org/pubs/EDF-Letter/1996/Jul-1\\_mbean.html](http://www.edf.org/pubs/EDF-Letter/1996/Jul-1_mbean.html)>. Bean applauded the end of the 15-month congressionally imposed

whom this Article began, knows how to make the political process work for him—or to engage in civil disobedience, if he must.

Someday, the Nation, if swept by an environmental Awakening, may, indeed, come to consider economic development as problematic and, in any case, as lying outside the usual incidents of land ownership. Congress may legislate what critics characterize as a new form of feudalism, in which those who “own” real estate may use it only in particular ways pre-approved by the sovereign.<sup>700</sup> Alternatively, a free market utopianism may engage the public imagination, establishing the principle “that what is mine may be used by me . . . provided only that I not use it in a manner that violates the like right of other owners”<sup>701</sup> as determined by common law tradition. These major decisions, however, are to be made through the political not the judicial process. Until legislatures take a clear position one way or another, takings jurisprudence ought to assure that neither view, as long as it fails clearly to carry the day and the night politically, will succeed through the courts.

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moratorium on the addition of species to the Endangered Species List but noted that “[t]he current Act created perverse incentives that harm species. Some landowners have deliberately eliminated species from their property before those species are listed, or have eliminated suitable, but unoccupied, habitat from their land before endangered species move onto it.” *Id.*

700. See John McClaughry, *Farmers, Freedom, and Feudalism: How To Avoid the Coming Serfdom*, 21 S.D. L. REV. 486 (1976); John McClaughry, *The New Feudalism*, 5 ENVTL. LAW 675 (1975). For a careful and critical assessment of the analogy between current land-use regulation and feudal land tenure regimes, see Lazarus, *supra* note 69, at 1739.

701. PAUL, *supra* note 66, at 138.