Albrecht Dürer's
The Four Horsemen of the Apocalypse

Across the Apocalypse on Horseback: Imperfect Legal Responses to Biodiversity Loss

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> *I looked, and there was a pale green horse. Its rider was named Death, and Hades accompanied him. They were given authority over a quarter of the earth, to kill with sword, famine, and plague, and by means of the beasts of the earth.*[1]

I. HEARING THE HOOVES OF THE ECOLOGICAL APOCALYPSE

Life on earth overcomes mass extinction events on a temporal scale spanning millions of years. By this measure, "the loss of genetic and species diversity" is probably the contemporary crisis "our

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This Article was originally published in book form. *See* THE JURISDYNAMICS OF ENVIRONMENTAL PROTECTION: CHANGE AND THE PRAGMATIC VOICE IN ENVIRONMENTAL LAW 197 (Jim Chen ed., 2003). It is reprinted here with the kind permission of the publisher, the Environmental Law Institute.

1. *Revelation* 6:8 (New American Bible).

descendants [will] most regret" and "are least likely to forgive."[2] Biodiversity loss is the "scientific problem of greate[st] immediate importance for humanity."[3] If indeed biodiversity loss has reached apocalyptic proportions, it is fitting to describe the engines of extinction in equine terms. Jared Diamond characterizes the deadly horsemen of the ecological apocalypse as an "Evil Quartet" consisting of habitat destruction, overkill, introduced species, and secondary extinctions.[4] Edward O. Wilson prefers an acronym derived from the Greek word for horse. HIPPO represents *H*abitat destruction, *I*nvasive species, *P*ollution, *P*opulation, and *O*verharvesting.[5] Although conservation biologists have identified the leading causes of biodiversity loss, legal responses to the crisis do not address distinct sources of human influence on evolutionary change. Not surprisingly, legal scholarship tends to ignore the distinctions among causes of biodiversity loss. This Article takes a modest step toward remedying at least the latter shortcoming.

Such "environmental and land-use ethics" as are codified in law today stem from an "era when the human population, at one-tenth its present size, tamed wilderness with axe and ox."[6] Before the rise of Neolithic agriculture and the spread of sedentary human settlements across much of the globe, Wilson's deadly HIPPO took the reverse sequence: OPPIH. The transmogrification of OPPIH to HIPPO over time frames the human impact on evolution in historical as well as biological terms. In Paleolithic times, the overharvesting of large mammals and flightless birds had a greater ecological impact than what was then "a still proportionately small amount of habitat destruction."[7] In North America, for instance, the sudden

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2. *Toward a Lasting Conservation Ethic: Hearing Before the S. Comm. on Envtl. Pollution*, 97th Cong. 366 (1981) (statement of Edward O. Wilson, Baird Professor of Science, Harvard University).

3. EDWARD O. WILSON, THE DIVERSITY OF LIFE 254 (1992).

4. *See* Jared Diamond, *"Normal" Extinctions of Isolated Populations*, *in* EXTINCTIONS 191 (Matthew H. Nitecki ed., 1984); Jared Diamond, *Overview of Recent Extinctions*, *in* CONSERVATION FOR THE TWENTY-FIRST CENTURY 37, 39–41 (David Western & Mary C. Pearl eds., 1989).

5. *See* EDWARD O. WILSON, THE FUTURE OF LIFE 50–51 (2002).

6. David Tilman, *Causes, Consequences and Ethics of Biodiversity*, 405 NATURE 208, 210 (2000).

7. WILSON, *supra* note 5, at 50.

disappearance of large mammals such as mammoths and ground sloths 11,000 to 12,000 years ago, after the continent's megafauna had survived twenty-two glacial cycles, strongly suggests that this mass extinction was attributable to "blitzkrieg."[8] The settlement of Polynesia, beginning 3,500 to 3,000 years before the present, introduced three domesticated species of Eurasian provenance—pigs, dogs, and chickens—that simultaneously dictated the arc of economic development on each island and spelled doom for many of the islands' endemic species.[9] Today, "the principal cause of biodiversity loss is the fragmentation, degradation, and destruction of ecosystems and habitats through conversion of land to economically productive uses, especially agriculture, forestry, mineral and fossil fuel extraction, and urban development."[10]

Thanks to a pair of prominent controversies over the constitutionality of endangered species protection under federal law,[11] most jurists and legal scholars understand, at a minimum, the utilitarian rationales for protecting biodiversity.[12] The law fails, however, to calibrate its remedies according to the severity of the biological threat. Perversely enough, the legal understanding of

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8. *See* Jared M. Diamond, *Quaternary Megafaunal Extinctions: Variations on a Theme by Paganini*, 16 J. ARCHEOLOGICAL SCI. 167 (1989). *See generally* QUATERNARY EXTINCTIONS (Paul S. Martin & Richard G. Klein eds., 1984). The extent to which human colonization affected the ecology of North America is fiercely debated. *See, e.g.*, TIM FLANNERY, THE ETERNAL FRONTIER (2001); SHEPARD KRECH III, THE ECOLOGICAL INDIAN (1999); TED STEINBERG, DOWN TO EARTH (2002).

9. *See* JARED DIAMOND, GUNS, GERMS, AND STEEL 60 (1997). The enduring prominence of the words for pigs, dogs, and chickens in the Hawaiian language—*pua'a*, *'ilio*, *moa*—pays linguistic homage to the centrality of animal husbandry in Polynesian culture before European contact. For further discussion of the effects of European contact on island culture, see SALLY ENGLE MERRY, COLONIZING HAWAI'I 221–42 (Sherry B. Ortner et al. eds., 2000); PATRICK VINTON KIRCH, ON THE ROAD OF THE WINDS (2000).

10. Bradley C. Karkkainen, *Biodiversity and Land*, 83 CORNELL L. REV. 1, 7 (1997) (internal citations omitted).

11. *See* Gibbs v. Babbitt, 214 F.3d 483 (4th Cir. 2000); Nat'l Ass'n of Home Builders v. Babbitt, 130 F.3d 1041, 1053 (D.C. Cir. 1997). *See generally* Christine A. Klein, *The Environmental Commerce Clause*, 27 HARV. ENVTL. L. REV. 1 (2003); Bradford C. Mank, *Protecting Intrastate Threatened Species: Does the Endangered Species Act Encroach on Traditional State Authority and Exceed the Outer Limits of the Commerce Clause?*, 36 GA. L. REV. 723 (2002); John Copeland Nagle, *The Commerce Clause Meets the Delhi Sands Flower-Loving Fly*, 97 MICH. L. REV. 174 (1998); Omar N. White, *The Endangered Species Act's Precarious Perch: A Constitutional Analysis Under the Commerce Clause and the Treaty Power*, 27 ECOLOGY L.Q. 215 (2000).

12. *See generally* WILSON, *supra* note 3.

extinction mechanisms remains frozen in time, like an insect in amber or, more appropriately, a cave dweller in ice. The legal enterprise of preventing extinctions is likelier to succeed if it addresses the most powerful causes of biodiversity loss today. Habitat destruction and alien invasive species should figure more prominently than overkill in the law of biodiversity protection.

As the balance of this Article will show, however, the few laws that do address biodiversity loss take primary aim at overkill and the marketing of products derived from endangered species. Part II of this Article describes how the law seeks to preserve biodiversity by deterring overkill, habitat destruction, and the introduction of alien invasive species. The law imposes its clearest and harshest sanctions precisely where the drivers of extinction are weakest: when humans take conscious steps to capture or kill other living things. Part III concludes that the lack of congruence with conservation biology impedes legal efforts to preserve biodiversity.

II. HORSE-WHIPPED: LEGAL RESPONSES TO VECTORS OF BIODIVERSITY LOSS

A. Overkill

The Edwardian excess of Joseph Conrad's *Heart of Darkness*[13] retains its firm grip on the conservationist imagination. The 1916 treaty at issue in *Missouri v. Holland*,[14] perhaps one of the first legal enactments in the United States (or anywhere else in the world) to treat biodiversity conservation as "a national interest of very nearly the first magnitude,"[15] focused exclusively on "the killing, capturing or selling . . . of . . . migratory birds."[16] At a certain level, we have never recovered from witnessing the spectacular slaughter of the Carolina parakeet and the passenger pigeon.[17] These birds,

13. JOSEPH CONRAD, HEART OF DARKNESS (1902).
14. 252 U.S. 416 (1920).
15. *Id.* at 435.
16. *Id.* at 431.
17. At least with respect to the passenger pigeon, this is true in a very tangible sense. By eliminating the principal predator of ticks in northern forests, the extermination of the passenger pigeon may be fairly blamed for the recent prominence of Lyme disease. *See* David E. Blockstein, *Lyme Disease and the Passenger Pigeon?*, 229 SCIENCE 1831 (1998); David E. Blockstein,

respectively the only parrot native to North America and what is thought to have been not only the most abundant bird but also the most abundant terrestrial vertebrate, became extinct at the Cincinnati Zoo four years apart. Martha, the last passenger pigeon, died on September 1, 1914; Incas, a male Carolina parakeet and the last of his kind, died on February 21, 1918.[18] The paradigmatic act of converting wildlife to personal property through capture and slaughter[19] remains the central focus of laws designed to protect endangered species. In the United States, section nine of the Endangered Species Act of 1973 (ESA)[20] flatly prohibits the taking of any protected species.[21] "The term 'take' means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct."[22] Section nine so unequivocally condemns the harvesting of protected organisms that few if any litigated ESA cases discuss this aspect of the statute. One of the most prominent reported cases involving an attempt to harvest a member of a protected species actually arose under the Marine Mammal Protection Act of 1972[23] rather than the ESA.[24]

Passenger Pigeons, Lyme Disease, and Us, BIRDING, Aug. 2001, at 302. *See generally* A. W. SCHORGER, THE PASSENGER PIGEON (1955).

18. *See* CHRISTOPHER COKINOS, HOPE IS THE THING WITH FEATHERS (2000); SCOTT WEIDENSAUL, THE BIRDER'S MISCELLANY (1991). *See generally* ERROL FULLER, EXTINCT BIRDS (1987). For a celebrated account of how Incas "died of grief" after the death of his mate, Lady Jane, see George Laycock, *The Last Parakeet*, AUDUBON, Mar. 1969, at 21. That these two extinctions coincided with what was then the most extravagant exercise in human slaughter is perhaps more prophetic than coincidental.

19. *See* Pierson v. Post, 2 Am. Dec. 264, 3 Cai. R. 175 (N.Y. Sup. Ct. 1805); Liesner v. Wanie, 145 N.W. 374, 376 (Wis. 1914) (awarding ownership to the hunter who fires the shot that mortally wounds a hunted animal); Young v. Hichens, 115 Eng. Rep. 228, 230 (Q.B. 1844) (Denman, C.J., dissenting) (proposing to award possession where a fisherman has attained "actual power over the fish"); *cf.* Geer v. Connecticut, 161 U.S. 519, 529–31 (1896) (recognizing the traditional police power of the states over hunting and fishing). *See generally* 2 WILLIAM BLACKSTONE, COMMENTARIES *391 (describing common law precedent before the nineteenth century on the ownership of wild animals); Dhammika Dharmapala, *An Economic Analysis of "Riding to Hounds":* Pierson v. Post *Revisited*, 18 J.L. ECON. & ORG. 39 (2002).

20. Pub. L. No. 93-205 § 9, 87 Stat. 884, 893–95.

21. 16 U.S.C. § 1538 (2000).

22. *Id.* § 1532(19).

23. 16 U.S.C.S. §§ 1361–1421h (2005).

24. *See* United States v. Hayashi, 22 F.3d 859 (9th Cir. 1993). *But see* United States v. McKittrick, 142 F.3d 1170 (9th Cir. 1998) (upholding ESA penalties levied against a rancher who shot and decapitated a gray wolf).

The Endangered Species Act reveals an overt bias, preventing direct takings of large, charismatic fauna over all other threats to biodiversity. The Act excludes certain insects from its protective aegis,[25] even though they are essential to human welfare: if "land-dwelling arthropods . . . were to disappear, humanity probably could not last more than a few months."[26] Moreover, even though "[t]he biological differences between animals and plants . . . offer no scientific reason for lesser protection of plants,"[27] the Act significantly undervalues plants.[28] Threatened and endangered plants are protected only insofar as they appear on federal land or are destroyed in knowing violation of state law.[29] Plants receive far fewer critical habitat designations than do threatened and endangered animals.[30] In so doing, the ESA perpetuates the common law's baneful treatment of plants as private property merely because they dwell on private land.[31]

Traffic in goods derived from endangered species remains the single act of biodiversity destruction on which international law has reached a punitive consensus. The Convention on International Trade in Endangered Species (CITES),[32] now in its fourth decade, would

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25. *See* 16 U.S.C. § 1532(6) (2000) (excluding from "[t]he term 'endangered species' . . . a species of the Class *Insecta* determined . . . to constitute a pest whose protection . . . would present an overwhelming and overriding risk to man").

26. WILSON, *supra* note 3, at 133. *See generally* THE NEW ENCYCLOPEDIA OF INSECTS AND THEIR ALLIES (Christopher O'Toole ed., 2003). On the concept of ecosystem services, see generally NATURE'S SERVICES (Gretchen C. Daily ed., 1997); PEAST PANEL ON BIODIVERSITY & ECOSYSTEMS, TEAMING WITH LIFE (1999); Graciela Chichilnisky & Geoffrey Heal, *Economic Returns from the Biosphere*, 391 NATURE 629 (1998); Janet S. Herman et al., *Groundwater Ecosystems and the Service of Water Purification*, 20 STAN. ENVTL. L.J. 479 (2001); H. A. Mooney et al., *Biodiversity and Ecosystem Functioning*, *in* GLOBAL BIODIVERSITY ASSESSMENT 275, 282 (V.H. Heywood & R.T. Watson eds., 1995); James Salzman, *Valuing Ecosystem Services*, 24 ECOLOGY L.Q. 887 (1997); Barton H. Thompson, Jr., *People or Prairie Chickens*, 51 STAN. L. REV. 1127, 1136–37 (1999).

27. NAT'L RESEARCH COUNCIL, SCIENCE AND THE ENDANGERED SPECIES ACT 90 (1995).

28. *See* Sandra B. Zellmer & Scott A. Johnson, *Biodiversity in and Around McElligot's Pool*, 38 IDAHO L. REV. 473, 481–82 (2002).

29. *See* 16 U.S.C. § 1538(a)(2)(B) (2000).

30. *See* Conservation Council for Hawaii v. Babbitt, 2 F. Supp. 2d 1280, 1281 (D. Haw. 1998) (noting that critical habitat designations covered only twenty-four of approximately seven hundred plant species listed in 1998).

31. *See* Holmes Rolston III, *Property Rights and Endangered Species*, 61 U. COLO. L. REV. 283, 293 (1990).

32. Convention on Int'l Trade in Endangered Species of Wild Fauna & Flora, Mar. 3–Apr. 30, 1973, 20 U.S.T. 1087, 993 U.N.T.S. 243.

represent a major step toward conserving biodiversity as long as one is willing to overlook the fact that it does not work. The extension of CITES during the 1980s to "all aspects of trade and research" in orchids "immediately increased the desire for the plants, raised their market value dramatically, and led to even more collecting of rare orchid species from the wild."[33] Nothing in CITES stops developers and farmers who would "flood [critical] habitat with a hydroelectric dam, log it, level the hillsides of a road, build a golf course on the site, or burn the jungle to the ground for agricultural purposes."[34] Not surprisingly, "no reliable data [show] that CITES and similar efforts ha[ve] reduced smuggling, saved any orchid species from extinction, helped protect orchid habitats, or even salvaged orchid plants facing . . . certain destruction."[35] Controlled harvests for profit outperform direct regulation under CITES in deterring the poaching of elephants.[36] As with the American alligator,[37] the elephant's salvation may lie in commercialization. The focus on politically visible but environmentally secondary acts of overkill and commercial exploitation has rendered CITES tragically impotent.

B. Alien Invasive Species

In an increasingly interconnected world,[38] human ecological mismanagement often takes the form of introducing an invasive species.[39] "[M]ost invasions have a weak impact," but on occasion

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33. ERIC HANSEN, ORCHID FEVER 67 (2000).

34. *Id.* at 17.

35. *Id.* at 262–63.

36. *See* EDWARD BARBIER ET AL., ELEPHANTS, ECONOMICS AND IVORY 132–38 (1990); FRANCES CAIRNCROSS, COSTING THE EARTH 132–41 (1992); Michael J. Glennon, *Has International Law Failed the Elephant?*, 84 AM. J. INT'L L. 1 (1990).

37. *Cf.* Gibbs v. Babbitt, 214 F.3d 483, 495 (4th Cir. 2000) (noting the successful recovery of the American alligator from the United States endangered species list in 1975 to a return to a contemporary market for its hides); Catharine L. Krieps, *Sustainable Use of Endangered Species Under CITES: Is It a Sustainable Alternative?*, 17 U. PA. INT'L ECON. L. 461, 479–80 (1996) (describing the creation of a market in alligator products as a spur for the conservation of alligators and their habitats). *See generally* SARA J. SCHERR ET AL., MAKING MARKETS WORK FOR FOREST COMMUNITIES (2002); *Pulp Friction*, ECONOMIST, Mar. 16, 2002, at 80.

38. *See, e.g.*, Theodore C. Foin et al., *Improving Recovery Planning for Threatened and Endangered Species*, 48 BIOSCIENCE 177, 180–81 (1998); David S. Wilcove et al., *Quantifying Threats to Imperiled Species in the United States*, 48 BIOSCIENCE 607, 608–09 (1998).

39. *See generally* GEORGE W. COX, ALIEN SPECIES IN NORTH AMERICA AND HAWAII

"an invasive species [is] capable of precipitating monumental changes to an ecosystem."[40] For example, introducing the Nile perch into Lake Victoria devastated endemic cichlids.[41] Exotics have suppressed or eliminated native, often endemic, species in the Everglades, the Great Lakes, the Hawaiian Islands, and Guam.[42] Starlings, a scourge to many native birds, entered North America by virtue of a single man's perverse obsession with importing all birds mentioned by Shakespeare.[43] Feral cats, perhaps 100 million strong, constitute "a non-native predator that is creating havoc for certain native [bird] species" in the United States.[44] Barnacles, mollusks, worms, and hydroids leaving warmer seas on a flotilla of wooden fragments and buoyant pumice threaten the integrity of Arctic and Antarctic waters.[45]

(1999); CHARLES S. ELTON, ECOLOGY OF INVASIONS BY ANIMALS AND PLANTS (1958); MARK WILLIAMSON, BIOLOGICAL INVASIONS (1996); Andrew N. Cohen & James T. Carlton, *Accelerating Invasion Rate in a Highly Invaded Estuary*, 279 SCIENCE 555 (1998); David M. Lodge, *Biological Invasions: Lessons for Ecology*, 8 TRENDS ECOLOGY & EVOLUTION 133 (1993); M. Jake Vander Zanden et al., *Stable Isotope Evidence for the Food Web Consequences of Species Invasions in Lakes*, 401 NATURE 464 (1999).

40. Kevin Shear McCann, *The Diversity-Stability Debate*, 405 NATURE 228, 232 (2000). *See generally* Mark Williamson & Alastair Fitter, *The Varying Success of Invaders*, 77 ECOLOGY 1661 (1996).

41. *See* TIJS GOLDSCHMIDT, DARWIN'S DREAMPOND (Sherry Marx-Macdonald trans., 1996); Peter N. Reinthal & George W. Kling, *Exotic Species, Trophic Interactions and Ecosystem Dynamics: A Case Study of Lake Victoria*, *in* THEORY AND APPLICATION IN FISH FEEDING ECOLOGY 296 (Deanna J. Stouder et al. eds., 1994).

42. *See, e.g.*, ROBERT DEVINE, ALIEN INVASION (1998); WILLIAMSON, *supra* note 39, at 77, 142–43, 145–48; Julie A. Savidge, *Extinction of an Island Forest Avifauna by an Introduced Snake*, 68 ECOLOGY 660 (1987); Don C. Schmitz & Daniel Simberhoff, *Biological Invasions*, ISSUES IN SCI. & TECH., Summer 1997, at 33; Eric Biber, Note, *Exploring Regulatory Options for Controlling the Introduction of Non-Indigenous Species to the United States*, 18 VA. ENVTL. L.J. 375, 380 (1999).

43. *See* ANNIE DILLARD, PILGRIM AT TINKER CREEK 37 (1974) (recounting the story of Eugene Schiffelin); *cf.* WILLIAM SHAKESPEARE, THE FIRST PART OF KING HENRY THE FOURTH, act I, sc. 3, ll. 218–24, *in* THE OXFORD SHAKESPEARE 453, 459 (Stanley Wells & Gary Taylor eds., 1988) ("[The king] Forbade my tongue to speak of Mortimer; / But I will find him when he lies asleep, / And in his ear I'll hollo 'Mortimer!' / Nay I'll have a starling shall be taught to speak / Nothing but 'Mortimer,' and give it him / To keep his anger still in motion."). Efforts to reverse the damage by exterminating starlings have failed. *See* DILLARD, *supra*, at 38–39.

44. James Gorman, *Bird Lovers Hope to Keep Cats on a Very Short Leash*, N.Y. TIMES, Mar. 18, 2003, at F3.

45. *See generally* David K. A. Barnes, *Biodiversity: Invasions by Marine Life on Plastic Debris*, 416 NATURE 808 (2002).

As overall biological diversity decreases, the environmental impact of invasive species will probably increase. If "simplified communities are more vulnerable to invasion," then "we should also expect an increase in frequency of successful invaders as well as an increase in their impact."[46] Repeated cycles of extirpation and invasion, whether intentional or inadvertent, "can, and eventually will, invoke major shifts in community structure and dynamics."[47] In this game of ecological roulette, the disturbances with the "greatest ecological impact frequently incur high societal costs."[48]

Existing law offers few, if any, ways to address the problem of invasive species. Laws targeting the animal and plant pests[49] do enable the Department of Agriculture to constrict the movement of organisms known or suspected to have an adverse effect on agriculture.[50] Such laws, however, serve more to regulate the proposed releases of genetically modified crops than to provide broad-based authority to restrain the diffusion of invasive species.[51]

The National Environmental Policy Act of 1970 (NEPA)[52]—a statute whose procedural requirements are analogous to those of the ESA[53]—provides a somewhat broader platform for legal intervention. One federal court of appeals has used NEPA to require a federal agency to address how dam construction could introduce zebra

46. McCann, *supra* note 40, at 233.

47. *Id.*

48. F. Stuart Chapin III et al., *Consequences of Changing Biodiversity*, 405 NATURE 234, 239 (2000). On the economic impact of alien invasive species, see generally UNITED STATES OFFICE OF TECHNOLOGY ASSESSMENT, HARMFUL NON-INDIGENOUS SPECIES IN THE UNITED STATES (1993); David Pimentel et al., *Environmental and Economic Costs of Nonindigenous Species in the United States*, 50 BIOSCIENCE 53 (2000).

49. *See* Animal and Plant Health Inspection Act, 7 U.S.C. §§ 150aa–jj (2000); Plant Quarantine Act, *id.* §§ 151–67; *see also* 7 C.F.R. §§ 319.8–.77, 340.0–.9 (2005).

50. *See generally* 7 C.F.R. §§ 340.0–.9 (2005).

51. *See, e.g.*, Availability of Determination of Nonregulated Status for Genetically Engineered Canola Notice, 59 Fed. Reg. 55,250, 55,250–51 (Nov. 4, 1994) (declining to restrict genetically engineered laurate canola varieties containing "sequences . . . derived from the plant pathogens *A. tumefaciens* and cauliflower mosaic virus" once it had been determined that these plants were no likelier than comparable, traditionally bred varieties to become weeds, to confer weedy characteristics on canola's wild relatives, or to harm agriculturally beneficial organisms "such as bees or earthworms").

52. 42 U.S.C. §§ 4321–70d (2000).

53. Thomas v. Peterson, 753 F.2d 754, 764 (9th Cir. 1985).

mussels into previously uninfested waters.[54] More typically, however, NEPA proves impotent to curb invasions. Rejecting arguments that airport expansion could dramatically increase the rate at which commercial flights (especially from Asia) would introduce alien species into Maui, the Ninth Circuit declined to find a NEPA violation.[55] That court took refuge in the vagaries of airport demand projections,[56] the multiplicity of invasion vectors,[57] and the impossibility of determining *ex ante* which species would become established and, among those, which would become "economic pests."[58]

No single country can contain the menace posed by alien invasive species. Within the inherently global project of biodiversity conservation, any hope of addressing the scourge of alien invasive species demands especially vigorous international cooperation.[59] The Convention on Biological Diversity exhorts its contracting parties, "as far as possible and as appropriate," to "[p]revent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species."[60] The United States' persistent refusal to sign the Convention, however, effectively short-circuits international law's potential to spur domestic legal change.[61]

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54. *See* Hughes River Watershed Conservancy v. Glickman, 81 F.3d 437, 445 (4th Cir. 1996). *See generally* PATRICK MCCULLY, SILENCED RIVERS: THE ECOLOGY AND POLITICS OF LARGE DAMS (1996); Christine A. Klein, *Dam Policy: The Emerging Paradigm of Restoration*, 31 ENVTL. L. REP. 10,486 (2001); Christine A. Klein, *On Dams and Democracy*, 78 OR. L. REV. 641 (1999).

55. *See* Nat'l Parks & Conservation Ass'n v. U.S. Dep't of Transp., 222 F.3d 677 (9th Cir. 2000).

56. *Id.* at 680.

57. *See id.* at 680 & n.3.

58. *Id.* at 681.

59. *See* Lyle Glowka, *Bioprospecting, Alien Invasive Species, and Hydrothermal Vents: Three Emerging Legal Issues in the Conservation and Sustainable Use of Biodiversity*, 13 TUL. ENVTL. L.J. 329, 333–49 (2000); *cf.* Steven A. Wade, *Stemming the Tide: A Plea for New Exotic Species Legislation*, 10 J. LAND USE & ENVTL. L. 343 (1995) (urging similar efforts at the domestic level).

60. United Nations Conference on Environment and Development: Convention on Biological Diversity, June 5, 1992, art. 8(h), 31 I.L.M. 818 [hereinafter CBD].

61. *See generally* Robert F. Blomquist, *Ratification Resisted: Understanding America's Response to the Convention on Biological Diversity, 1989–2002*, 32 GOLDEN GATE U. L. REV. 493 (2002).

C. Habitat Destruction

Among the drivers of biodiversity loss, habitat destruction is by far the deadliest.[62] Contracting the physical range of endangered species spurs their extinction.[63] Island biogeography posits that a ninety-percent reduction in the area of a biological island—which may consist of an island in the geographic sense or merely an isolated patch of wildlife habitat—dictates a fifty-percent reduction in biological carrying capacity as measured by the number of distinct species that can be sustained.[64] An area as large and diverse as Centinela, a diverse forest ridge in Ecuador, can fall victim to cacao cultivation.[65] As typified by California's Hetch Hetchy Reservoir,[66] Egypt's Aswan High Dam,[67] and China's Three Gorges Dam,[68] large-scale damming can erase multiple ecological niches. Destroying large

62. *See, e.g.*, Paul R. Ehrlich, *The Loss of Diversity: Causes and Consequences*, *in* BIODIVERSITY 21 (E. O. Wilson ed., 1988); P. A. Matson et al., *Agricultural Intensification and Ecosystem Properties*, 275 SCIENCE 504, 504 (1997) (describing the conversion of land to agricultural use as "one of the most significant human alterations to the global environment"); *cf.* Larry E. Morse et al., *Native Vascular Plants*, *in* OUR LIVING RESOURCES: REPORT TO THE NATION ON THE DISTRIBUTION, ABUNDANCE, AND HEALTH OF U.S. PLANTS, ANIMALS, AND ECOSYSTEMS 205, 208 (Edward T. Lavoe et al. eds., 1995) (describing "[h]abitat alteration and incompatible land use" as larger threats than overcollecting, global climate change, and sea-level rise).

63. *See, e.g.*, Rob Channell & Mark V. Lomolino, *Dynamic Biogeography and Conservation of Endangered Species*, 403 NATURE 84 (2000); John H. Lawton, *Population Dynamics Principles*, *in* EXTINCTION RATES 147 (John H. Lawton & Robert M. May eds., 1995); Bruce A. Wilcox & Dennis D. Murphy, *Conservation Strategy: The Effects of Fragmentation on Extinction*, 125 AM. NATURALIST 879 (1985).

64. *See, e.g.*, ROBERT H. MACARTHUR & EDWARD O. WILSON, THE THEORY OF ISLAND BIOGEOGRAPHY (1967); Daniel Simberloff, *Experimental Zoogeography of Islands: Effects of Island Size*, 57 ECOLOGY 629 (1976); Donald R. Whitehead & Claris E. Jones, *Small Islands and the Equilibrium Theory of Island Biogeography*, 23 EVOLUTION 171 (1969). The most elementary mathematical formula expressing this relationship is $N = k \cdot A^{.27}$, where N represents the number of species, A represents the area, and k represents an empirically determined constant. For a skeptical assessment of island biogeography's strongest claims, see Charles C. Mann, *Extinction: Are Ecologists Crying Wolf?*, 253 SCIENCE 736 (1991).

65. *See* C.H. Dodson & A.H. Gentry, *Biological Extinction in Western Ecuador*, 78 ANNALS MO. BOTANICAL GARDEN 273 (1991); *see also* WILSON, *supra* note 3, at 243 (arguing that the name Centinela "deserves to be synonymous with the silent hemorrhaging of biological diversity").

66. *See, e.g.*, RICHARD WHITE, IT'S YOUR MISFORTUNE AND NONE OF MY OWN 412–15 (1991).

67. *See, e.g.*, TOM LITTLE, HIGH DAM AT ASWAN (1965); Gilbert F. White, *The Environmental Effects of the High Dam at Aswan*, 30:7 ENV'T 5 (1988).

68. *See, e.g.*, VACLAV SMIL, CHINA'S ENVIRONMENTAL CRISIS (1993).

chunks of the earth's physical infrastructure within a temporal frame that by geological standards is effectively instantaneous significantly accelerates the rate of evolutionary change attributable to humans.

1. Private Land

The prohibition against the taking of any species protected by the ESA[69] has been interpreted to extend to the destroying or significantly modifying critical habitat.[70] The Supreme Court's first ESA decision reflected the Justices' understanding of the potential of habitat destruction to disrupt breeding and eliminate indispensable food sources.[71] As the example of orchids illustrates, however, similar sophistication has not migrated from American law to the international sphere. The use of section nine against habitat destruction triggers other provisions of the ESA. Section ten authorizes incidental take permits upon submission and approval of a habitat conservation plan (HCP).[72] In turn, approval of an HCP triggers the federal government's obligation under section seven to "insure [sic] that any action" it undertakes "is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of" critical habitat.[73] This provision has been interpreted as imposing an affirmative obligation to pursue an active species conservation policy.[74]

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69. *See* 16 U.S.C. § 1538 (2000).

70. *See* 50 C.F.R. § 17.3 (2005); Babbitt v. Cmtys. for a Great Or., 515 U.S. 687 (1995); *see also* 16 U.S.C. § 1533(a)(3)(A) (2000) (authorizing the designation of "critical habitat" for endangered or threatened species).

71. *See* Tenn. Valley Auth. v. Hill, 437 U.S. 153, 162, 166 n.16 (1978).

72. *See* 16 U.S.C. § 1539(a) (2000).

73. *Id.* § 1536(a)(2); *see also* 50 C.F.R. § 402.01(b) (2005); Friends of Endangered Species, Inc. v. Jantzen, 760 F.2d 976, 984–85 (9th Cir. 1985); Nat'l Wildlife Fed'n v. Babbitt, 128 F. Supp. 2d 1274, 1286 (E.D. Cal. 2000). Section 4(d) of the Act, 16 U.S.C. § 1533(d), may also be used to establish the functional equivalent of HCPs for threatened species. *See* Robert L. Fischman & Jaelith Hall-Rivera, *A Lesson for Conservation from Pollution Control Law: Cooperative Federalism for Recovery Under the Endangered Species Act*, 27 COLUM. J. ENVTL. L. 45, 94–109 (2002).

74. *See* Carson-Truckee Water Conservancy Dist. v. Clark, 741 F.2d 257, 262 (9th Cir. 1984); Fla. Key Deer v. Stickney, 864 F. Supp. 1222, 1237–38 (S.D. Fla. 1994); J.B. Ruhl, *Section 7(a)(1) of the "New" Endangered Species Act*, 25 ENVTL. L. 1107, 1137 (1995).

Before HCPs became a familiar fixture of ESA enforcement, developers and farmers facing potential section nine liability often resorted to the "scorched earth" technique of preemptively clearing wildlife habitat.[75] Clinton-era enforcement transformed the "previously obscure and rarely used permit provision" of section ten into "the centerpiece of . . . endangered species and ecosystem conservation policy."[76] Threatened section nine liability became merely "the opening gambit in a prolonged bargaining process."[77] HCPs today represent "perhaps the most visible example of a consensus-based, multi-stakeholder approach to resource management."[78]

The strategy has its limits. Like the ESA as a whole, HCPs proceed species by species, and only after an individual species has

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75. Michael J. Bean, *Overcoming Unintended Consequences of Endangered Species Regulation*, 38 IDAHO L. REV. 409, 415 (2002) (quoting NAT'L ASS'N OF HOMEBUILDERS, DEVELOPER'S GUIDE TO ENDANGERED SPECIES REGULATION 109 (1996)); *see also* George Cameron Coggins & Anne Fleishel Harris, *The Greening of American Law?: The Recent Evolution of Federal Law for Preserving Floral Diversity*, 27 NAT. RESOURCES J. 247, 297 (1987). Scholars debate just how inflexible section nine is in practice. *Compare* Christopher A. Cole, *Species Conservation in the United States: The Ultimate Failure of the Endangered Species Act and Other Land Use Laws*, 72 B.U. L. REV. 343, 350–54 (1992) (arguing that the Act, at least as enforced without resort to HCPs, is unduly harsh and ineffective), *with* Karin P. Sheldon, *Habitat Conservation Planning: Addressing the Achilles Heel of the Endangered Species Act*, 6 N.Y.U. ENVTL. L.J. 279 (1998) (arguing that landowners historically did not treat their chances of receiving incidental take permits under section ten as sufficiently serious to warrant the making of HCP proposals). For one account of the feared economic consequences of the listing of an endangered species (the northern spotted owl) and the designation of its critical habitat, see Seattle Audubon Soc'y v. Moseley, 80 F.3d 1401, 1403–04 (9th Cir. 1996).

76. Bradley C. Karkkainen, *Adaptive Ecosystem Management and Regulatory Penalty Defaults: Toward a Bounded Pragmatism*, 87 MINN. L. REV. 943, 970 (2003). For details of how section ten arose from efforts to reconcile preservation of the remaining habitat of the endangered Mission Blue butterfly with commercial development on San Bruno Mountain on the San Francisco peninsula, see Friends of Endangered Species, Inc. v. Jantzen, 760 F.2d 976, 982–83 (9th Cir. 1985); S. REP. NO. 97-418, at 10 (1982); H.R. REP. NO. 97-835, at 31–32 (1982), *reprinted in* 1982 U.S.C.C.A.N. 2872–73; MICHAEL J. BEAN ET AL., RECONCILING CONFLICTS UNDER THE ENDANGERED SPECIES ACT: THE HABITAT CONSERVATION PLANNING EXPERIENCE 52–55 (1991); Jamie A. Grodsky, *The Paradox of (Eco) Pragmatism*, 87 MINN. L. REV. 1037 (2003); Albert C. Lin, *Participants' Experiences with Habitat Conservation Plans and Suggestions for Streamlining the Process*, 23 ECOLOGY L.Q. 369, 375–76 (1996).

77. Daniel A. Farber, *Taking Slippage Seriously: Noncompliance and Creative Compliance in Environmental Law*, 23 HARV. ENVTL. L. REV. 297, 317 (1999). For further discussion of environmental law as a process of public-sector negotiation among interested groups, see David A. Dana, *The New "Contractarian" Paradigm in Environmental Regulation*, 2000 U. ILL. L. REV. 35.

78. Jody Freeman, *The Contracting State*, 28 FLA. ST. U.L. REV. 155, 194 (2000).

begun to decline. Despite well-founded doubts about the territorial and institutional suitability of states as participants in ecosystem management,[79] state-law restrictions on land use can enhance the effectiveness of federal HCPs.[80] California law facilitates natural community conservation plans that provide "large-scale, multi-species equivalents of HCPs."[81] That state's active intervention is crucial because it is home to the California floristic province, the hottest of biological "hotspots" in the continental United States.[82] Ultimately, however, the ESA only indirectly addresses habitat loss and altogether ignores "other causes" of biodiversity loss "such as the invasion of exotic species and air and water pollution."[83] The Act as a whole falls far short of "promot[ing] the conservation of ecosystems on the geographic scale necessary to promote biodiversity generally."[84]

2. Public Land

Although "[t]he Endangered Species Act of 1973 was motivated in part by the need to . . . regulat[e] beyond the limited confines of federal land,"[85] a significant degree of habitat conservation takes

79. *See* Bradley C. Karkkainen, *Collaborative Ecosystem Governance: Scale, Complexity, and Dynamism*, 21 VA. ENVTL. L.J. 189, 216 (2002).

80. *See* Marc J. Ebbin, *Is the Southern California Approach to Conservation Succeeding?*, 24 ECOLOGY L.Q. 695, 696–97 & n.7 (1997); 16 U.S.C. § 1535 (2000) (authorizing cooperative species conservation agreements between states and the federal government); *cf.* A. Dan Tarlock, *Biodiversity Federalism*, 54 MD. L. REV. 1315 (1995) (asserting that biodiversity conservation will not succeed absent state-federal cooperation).

81. A. Dan Tarlock, *Biodiversity Conservation in the United States*, 32 ENVTL. L. REP. 10,529, 10,539 (2002) [hereinafter Tarlock, *Biodiversity Conservation*]; *see also* Natural Communities Conservation Act, CAL. FISH & GAME CODE §§ 2800–40 (West 2003). *See generally* John M. Gaffin, *Can We Conserve California's Threatened Fisheries Through Natural Community Planning?*, 27 ENVTL. L. 791 (1997). For further discussion of the role of state tort law in biodiversity conservation, see A. Dan Tarlock, *Local Government Protection of Biodiversity: What Is Its Niche?*, 60 U. CHI. L. REV. 555 (1993).

82. *See* Ryan Carlsbeek et al., *Patterns of Molecular Evolution and Diversification in a Biodiversity Hotspot: The California Floristic Province*, 12 MOLECULAR ECOLOGY 1021 (2003).

83. Tarlock, *Biodiversity Conservation*, *supra* note 81, at 10,537; *see also* Elaine K. Harding et al., *The Scientific Foundations of Habitat Conservation Plans: A Quantitative Assessment*, 15 CONSERVATION BIOLOGY 488 (2000).

84. Tarlock, *Biodiversity Conservation*, *supra* note 81, at 10,540.

85. Gibbs v. Babbitt, 214 F.3d 483, 494 (4th Cir. 2000); *see also* Davina Kari Kaile, Note, *Evolution of Wildlife Legislation in the United States: An Analysis of the Legal Efforts to Protect Endangered Species and the Prospects for the Future*, 5 GEO. INT'L ENVTL. L. REV. 441 (1993);

place under the aegis of public land management. The law of public lands rests on the primary premise of "multiple use," defined as a range of uses "including, but not limited to, recreation, range, timber, minerals, watershed, wildlife and fish, and natural scenic, scientific and historical values."[86] Because "[m]ultiple use posits that all uses from commodity extraction and production to biodiversity are equal," this principle "both supports and hinders biodiversity conservation."[87]

When it first appeared, the concept of "multiple use" represented a substantial improvement in federal land management policy. "[I]ncreased competition for forage" among cattle and sheep ranchers during the nineteenth and early twentieth centuries led to overgrazing, diminished profits, and open hostility among forage competitors."[88] The Federal Land Policy and Management Act of 1976 (FLPMA)[89] explicitly adopted two statutory principles: "multiple use" for recreation, range, timber, mineral extraction, wildlife and fish habitat, and natural, scenic, scientific, and historical uses;[90] and "sustained yield" of renewable resources.[91] At the same time, FLPMA retained "first priority" for existing grazing-permit holders as long as federal land-use planning continued to leave land "available for domestic livestock grazing."[92]

Although a statutory commitment to multiple use may theoretically "provide[] the legal foundation for a management decision to preserve biodiversity,"[93] disputes over federal land management expose a bias favoring commercialization over

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cf. Conservation Council for Haw. v. Babbitt, 2 F. Supp. 2d 1280, 1281 (D. Haw. 1998) (invalidating a decision not to designate critical habitat insofar as that decision was based solely on a claim that some of the species at issue were located on private land, without determining whether a decision not to designate might be appropriate when a species exists solely on private land).

86. 43 U.S.C. § 1702(c) (2000); *see also id.* § 1701(a)(7) (directing that "management [of public land] be on the basis of multiple use and sustained yield unless otherwise specified by law").

87. Tarlock, *Biodiversity Conservation*, *supra* note 81, at 10,540–41.

88. Pub. Lands Council v. Babbitt, 529 U.S. 728, 732 (2000). *See generally* DEBRA L. DONAHUE, THE WESTERN RANGELAND REVISITED: REMOVING LIVESTOCK FROM PUBLIC LANDS TO CONSERVE NATIVE BIODIVERSITY (Gordon Morris Bakhen et al. eds., 1999).

89. Pub. L. No. 94-579, 90 Stat. 2744 (codified as amended at 43 U.S.C. §§ 1701–1785 (2000)).

90. 43 U.S.C. § 1702(c) (2000).

91. *Id.* § 1702(h).

92. *Id.* § 1752(c) (2000).

93. Tarlock, *Biodiversity Conservation*, *supra* note 81, at 10,541.

conservation.[94] When the Interior Department tried in 1995 to "accelerate restoration" of rangelands by making its managerial approach "more compatible with ecosystem management,"[95] incumbent ranchers argued in response that the Department was legally obliged to safeguard livestock interests' reliance on the perpetuation of grazing privileges.[96] This argument ran squarely against an explicit statutory proviso that neither "the creation of a grazing district [n]or the issuance of a permit . . . shall . . . create any right, title, interest, or estate in or to the lands."[97]

Other decisions have demonstrated the willingness of federal land management agencies to favor grazing and other historically privileged land uses. A federal district court was forced to remind federal land managers in 1985 that grazing "[p]ermittees must be kept under a sufficiently real threat of cancellation or modification in order to adequately protect the public lands from overgrazing or other forms of mismanagement."[98] In spite of its statutory mandate to maintain "final control and decisionmaking authority over livestock grazing practices on the public lands," the federal government had all but ceded jurisdiction over grazing permits.[99]

On the whole, federal land management policy concentrates its habitat preservation efforts on tracts designated as "wilderness." "A wilderness, in contrast with those areas where man and his own works dominate the landscape, is . . . an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain."[100] Unlike other public lands, wilderness areas fulfill their function solely by virtue of remaining "in their

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94. *See, e.g.*, United States v. State, 23 P.3d 117, 128 (Idaho 2001) (arguing that reservation of water for a wildlife refuge would unfairly "subordinate" rights to "water intended to be stored and regulated by colossal federal projects for the past 98 years" for the primary purpose of "reclamation").

95. *See* Grazing Administration—Exclusive of Alaska, 60 Fed. Reg. 9894, 9900–06 (Feb. 22, 1995) (codified at 43 C.F.R. pt. 4, 1780, 4100).

96. *See* Public Lands Council v. Babbitt, 529 U.S. 728, 741 (2000).

97. 43 U.S.C. § 315b (2000); *see Public Lands Council*, 529 U.S. at 741–42.

98. Natural Resources Def. Council, Inc. v. Hodel, 618 F. Supp. 848, 871 (E.D. Cal. 1985).

99. *Id*. at 871; *see also* 43 U.S.C. §§ 1901–08 (2000).

100. 16 U.S.C. § 1131(c) (2000); *cf.* Or. Natural Desert Ass'n v. Singleton, 47 F. Supp. 2d 1182, 1192 (D. Or. 1998) holding that "the explicit 'protect and enhance' language of" the Wild and Scenic Rivers Act "requires that watersheds be maintained in a primitive condition and the waters kept unpolluted").

natural condition."[101] Wilderness preservation helps ensure "that an increasing population, accompanied by expanding settlement and growing mechanization, does not occupy and modify" the entire physical surface of the earth.[102]

Cold and high-elevation wilderness areas, however, cannot anchor a comprehensive and effective biodiversity program.[103] Biodiverse "hot spots," rich in species, typically live up to their name: most such locales lie in the tropics.[104] The National Park Service—which is directed to "conserve the scenery and the natural and historic objects and the wild life" in the most spectacular federal lands[105]—was designed to preserve geological wonders, not to serve broader ecological purposes.[106] Wilderness policy, in microcosm, reveals the weakness of the overall legal response to biodiversity loss. Laws designed to prevent biodiversity loss behave like a twisted version of Wee Willie Keeler—aiming environmental law "where they ain't."[107]

III. A MODEST AGENDA FOR FORESTALLING APOCALYPSE NOW

This brief survey shows how the law has failed to keep pace with the scientific understanding of biodiversity loss. Advances in the field of conservation biology have had little or no legal impact. Federal courts routinely decline to treat innovations in conservation biology

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101. 16 U.S.C. § 1131(a) (2000).

102. *Id.*

103. *See* Jonathan S. Adams et al., *Biodiversity: Our Precious Heritage*, *in* PRECIOUS HERITAGE: THE STATUS OF BIODIVERSITY IN THE UNITED STATES 1, 17 (Bruce A. Stein et al. eds., 2000); Tarlock, *Biodiversity Conservation*, *supra* note 81, at 10,542.

104. *See* John Charles Kunich, *Preserving the Womb of the Unknown Species with Hotspots Legislation*, 52 HASTINGS L.J. 1149, 1157–58 (2001); Norman Myers, *The Biodiversity Challenge: Expanded Hot-Spots Analysis*, 10 ENVIRONMENTALIST 243 (1990); Norman Myers, *Threatened Biotas: "Hot Spots" in Tropical Forests*, 8 ENVIRONMENTALIST 187 (1988).

105. 16 U.S.C. § 1 (2000) (directing the Service to "provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations"); *see also* Nat'l Park & Conservation Ass'n v. Stanton, 54 F. Supp. 2d 7, 17 (D.D.C. 1999).

106. *See* RICHARD WEST SELLARS, PRESERVING NATURE IN THE NATIONAL PARKS: A HISTORY 2–3 (1997).

107. Wee Willie Keeler amassed a career batting average of .341 from 1892 to 1910 by hitting the ball "where they ain't." *See* Geoffrey C. Ward, *Our Game: Beginnings to 1900*, *in* BASEBALL: AN ILLUSTRATED HISTORY 52 (1994).

as "a necessary element of diversity analysis."[108] In a case assaulting the government's failure to consider "population dynamics, species turnover, patch size, recolonization problems, fragmentation problems, edge effects, and island biogeography,"[109] the Seventh Circuit ultimately held that these concepts of conservation biology were uncertain in application and that the Forest Service could therefore ignore them in managing national forests.[110] Even a valid "general theory," the court held, "does not translate into a management tool unless one can apply it to a concrete situation."[111] A federal district court similarly declined to endorse specific techniques for managing "distinct geographic ecosystems . . . inhabited by grizzly bears."[112] That court seemed to treat complexity as a legal excuse in its own right. The possibility that "science or circumstances" might change, the court reasoned, relieved the agency of any obligation to prepare an "exhaustively detailed recovery plan."[113] As a result, the court rejected a claim that the Endangered Species Act required "linkage zones between ecosystems inhabited by grizzlies."[114]

Cases of this nature suggest that conservation biology, until further notice, will not govern American environmental law until federal land management agencies and the agencies charged with implementing the Endangered Species Act decide that it does. In the meanwhile, federal judges take frequent refuge in the maxim that "a reviewing court must generally be at its most deferential" when an agency "is making predictions, within its area of special expertise, at the frontiers of science."[115] Administrative and judicial passivity bode

108. Sierra Club v. Marita, 46 F.3d 606, 620 (7th Cir. 1995).
109. *Id.* at 618.
110. *Id.* at 622–23.
111. *Id.* at 623.
112. Fund for Animals v. Babbitt, 903 F. Supp. 96, 106 (D.D.C. 1995).
113. *Id.* at 107.
114. *Id.* at 109–10.
115. Baltimore Gas & Elec. Co. v. Natural Res. Def. Council, Inc., 462 U.S. 87, 103 (1983); *see also* Indus. Union Dep't v. Am. Petroleum Inst., 448 U.S. 607, 656 (1980) (plurality opinion); *id.* at 705–06 (Marshall, J., dissenting); Int'l Fabricare Inst. v. EPA, 972 F.2d 384, 389 (D.C. Cir. 1992) (stating that "[t]he rationale for deference is particularly strong when the [agency] is evaluating scientific data within its technical expertise"); Envtl. Def. Fund, Inc. v. Costle, 578 F.2d 337, 339 (D.C. Cir. 1978) ("[I]n an area characterized by scientific and technological uncertainty . . . this court must proceed with particular caution, avoiding all temptation to direct the agency in a

ill for biodiversity conservation. An even more potent driver of ecological ruin and evolutionary change may lurk in global climate change, whose consequences defy description, much less prediction.[116] The failure to coordinate the law with scientific knowledge threatens to consign yet another environmental crisis requiring transnational cooperation to the perdition of zero-sum politics.[117]

In the meanwhile, "[t]hose of us who love nature, and who would like to ensure that nature persists for future generations to love, need to think about saving ordinary places and ordinary things."[118] Without abandoning the admittedly implausible prospect of comprehensively reconfiguring domestic and international environmental law to address habitat destruction and alien invasive species, advocates of biodiversity conservation can pursue a more modest agenda for reform. First, international policymakers should develop a joint framework for the regulation of commercial bioprospecting. International coordination on commercial exploitation of biodiversity can improve the very process of collecting rare specimens. If even casual hiking affects the distribution and population of wildlife,[119]

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choice between rational alternatives."); Alliance for Bio-Integrity v. Shalala, 116 F. Supp. 2d 166, 177 (D.D.C. 2000).

116. *See* Camille Parmesan & Gary Yohe, *A Globally Coherent Fingerprint of Climate Change Impacts Across Natural Systems*, 421 NATURE 37 (2003); Robert L. Peters, *Conservation of Biological Diversity in the Face of Climate Change*, *in* GLOBAL WARMING AND BIOLOGICAL DIVERSITY 15, 21–22 (Robert L. Peters & Thomas E. Lovejoy eds., 1992); Terry L. Root et al., *Fingerprints of Global Warming on Wild Animals and Plants*, 421 NATURE 57 (2003); *cf.* Herman E. Daly, *Ecological Economics*, 254 SCIENCE 358 (1991) (suggesting that global warming can threaten even *homo sapiens* by destabilizing the human food supply). S*ee generally* Osvaldo E. Sala et al., *Global Biodiversity Scenarios for the Year 2100*, 287 SCIENCE 1770 (2000) (describing the potential ecological impact of land use, proliferation of exotic species, climate change, and the continued escalation of CO_2 and N_2 levels). For speculation on the possibility of legal recourse against human agents of climate change, see Myles Allen, *Liability for Climate Change*, 421 NATURE 891 (2003).

117. *See generally* NEIL CARTER, THE POLITICS OF THE ENVIRONMENT 232–44 (2002); MATTHEW PATERSON, GLOBAL WARMING AND GLOBAL POLITICS (1996); Peter Newell, *Who "CoPed" Out in Kyoto? An Assessment of the Third Conference of the Parties to the Framework Convention on Climate Change*, 7 ENVTL. POL. 153 (1998); Peter Newell & Matthew Paterson, *A Climate for Business: Global Warming, the State and Capital*, 5 REV. INT'L POL. ECON. 679 (1998).

118. Holly Doremus, *The Special Importance of Ordinary Places*, 23 ENVIRONS ENVTL. L. & POL'Y J. 3, 4 (2000).

119. *See* Mausolf v. Babbitt, 125 F.3d 661, 669–70 (8th Cir. 1997) (upholding snowmobiling restrictions in Voyageurs National Park on the basis of biological opinions that showed adverse

purposeful bioprospecting leaves a dramatically deeper human footprint. Bioprospectors, anthropologists, or journalists may even engage in deliberate misconduct.[120] Even though the collapse of global fisheries has shaken public confidence in official efforts to achieve "sustainability,"[121] bitter experience teaches that the lack of coordination would be worse. The slash-and-collect approach of Victorian orchid harvesters would probably prevail.[122] Rationalized harvesting would limit instances of "the wonderfully unusual accomplishment of discovering and eradicating in the same instant a new species."[123]

In addition, the international community should facilitate the professionalization of parataxonomy,[124] especially in the developing world. Millions of species await collection and classification by properly trained field biologists. Transnational cooperation can help translate ethnobiological knowledge into terms understood by the global scientific community. Its economic impact is simple and immediate. Scientific research, to put it bluntly, generates jobs.[125] The science of systematics is so labor-intensive that the task of classifying ten million species would require twenty-five thousand

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impacts from snowmobiling on gray wolves). *See generally* David S. May, *Tourism and the Environment*, 14 NAT. RESOURCES & ENV'T 57 (1999). Realizations of this sort have motivated the establishment of the National Wildlife Preservation System within the United States. *See* 16 U.S.C. § 1132 (2000).

120. *See* PATRICK TIERNEY, DARKNESS IN EL DORADO: HOW SCIENTISTS AND JOURNALISTS DEVASTATED THE AMAZON (2000).

121. *See, e.g.*, MICHAEL HARRIS, LAMENT FOR AN OCEAN (1998); CARL SAFINA, SONG FOR A BLUE OCEAN (1998); LISA SPEER ET AL., NAT'L RES. DEF. COUNCIL, HOOK, LINE & SINKING (1997); H. Scott Gordon, *Economics and the Conservation Question*, 1 J.L. & ECON. 110 (1958); H. Scott Gordon, *The Economic Theory of a Common-Property Resource: The Fishery*, 62 J. POL. ECON. 124 (1954); Bob Holmes, *Biologists Sort the Lessons of the Fisheries Collapse*, 264 SCIENCE 1252 (1994); Donald Ludwig et al., *Uncertainty, Resource Exploitation, and Conservation: Lessons from History*, 260 SCIENCE 17 (1993); Alison Rieser, *Property Rights and Ecosystem Management in U.S. Fisheries: Contracting for the Commons?*, 24 ECOLOGY L.Q. 813 (1997); Anthony Scott, *The Fishery: The Objectives of Sole Ownership*, 63 J. POL. ECON. 116 (1955); Barton H. Thompson, Jr., *Tragically Difficult: The Obstacles to Governing the Commons*, 30 ENVTL. L. 241, 247–49 (2000).

122. *See* HAROLD KOOPOWITZ & HILARY KAYE, PLANT EXTINCTION: A GLOBAL CRISIS 199–205 (1983); SUSAN ORLEAN, THE ORCHID THIEF 62–67 (1998).

123. BILL BRYSON, A WALK IN THE WOODS: REDISCOVERING AMERICA ON THE APPALACHIAN TRAIL 92 (1998).

124. *See* CHRISTOPHER JOYCE, EARTHLY GOODS: MEDICINE-HUNTING IN THE RAINFOREST 118–21 (1994).

125. Gibbs v. Babbitt, 214 F.3d 483, 494 (4th Cir. 2000).

professional lifetimes.[126] Whether framed as cooperative bioprospecting or north-to-south technology transfer for the enrichment of parataxonomy, commercially oriented initiatives satisfy the Convention on Biological Diversity's exhortation that the international community should "adopt economically and socially sound measures . . . as incentives" to conserve biodiversity and to contribute to its sustainable development.[127]

Willingness to pursue a more modest agenda, however, does not weaken the need for more aggressive conservation measures. *In situ* preservation remains the only effective way to save biodiversity. The larger the tract of land set aside for conservation, the better.[128] Zoos, gene banks, and other *ex situ* strategies fall far short of the mark.[129] Despite consuming a significant portion of the capital expended on conservation, *ex situ* efforts have protected a trivial amount of biodiversity.[130] *Ex situ* conservation cannot preserve the adaptive and evolutionary value of individual species, let alone entire ecosystems.[131] By introducing criteria designed to suit human tastes and preferences, *ex situ* preservation exerts selective pressure on those species that are targeted for protection.[132] Only *in situ* conservation can effectively preserve the "conditions where genetic resources exist with ecosystems and natural habitats," or at least the surroundings where "domesticated or cultivated species . . . have developed their distinctive properties."[133]

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126. WILSON, *supra* note 3, at 318.

127. CBD, *supra* note 60, art. 11.

128. *See* Karkkainen, *supra* note 10, at 10–12.

129. *See* Holly Doremus, *The Rhetoric and Reality of Nature Protection: Toward a New Discourse*, 57 WASH. & LEE L. REV. 11, 54–57 (2000).

130. *See* Roger A. Sedjo, *Property Rights, Genetic Resources, and Biotechnological Change*, 35 J.L. & ECON. 199, 203 (1992).

131. *See, e.g.*, EDWARD C. WOLF, ON THE BRINK OF EXTINCTION 44 (1987); Matthew B. Hamilton, Ex Situ *Conservation of Wild Plant Species: Time to Reassess the Genetic Assumptions and Implications of Seed Banks*, 8 CONSERVATION BIOLOGY 39 (1994); G. Ledyard Stebbins, *Why Should We Conserve Species and Wildlands?*, *in* CONSERVATION BIOLOGY: THE THEORY AND PRACTICE OF NATURE CONSERVATION, PRESERVATION AND MANAGEMENT 453, 463 (Peggy L. Fiedler & Subodh K. Jain eds., 1992); Mark A. Urbanski, Note, *Chemical Prospecting, Biodiversity Conservation, and the Importance of International Protection of Intellectual Property Rights in Biological Materials*, 2 BUFF. J. INT'L L. 131, 181 (1995).

132. *See* Holly Doremus, Comment, *Patching the Ark: Improving Legal Protection of Biological Diversity*, 18 ECOL. L.Q. 265, 284 (1991).

133. CBD, *supra* note 60, art. 2.

Finally, the academic community bears a singularly immense responsibility to educate the public. A country whose citizens lead the developed world in rejecting the Darwinian account of natural history[134] is hardly well equipped to reorient the primary focus of biodiversity conservation from preventing overkill to preserving habitat and slowing the flux of alien species. Ours, after all, is a legal culture where at least one member of the highest court in the land condemns habitat preservation because it allegedly "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."[135] The same jurist even derives perverse pleasure from mocking "the much beloved secular legend of the Monkey Trial" and thereby delivers rhetorical succor to the enemies of biological enlightenment.[136]

Among creation myths vying to satisfy the human need for a compelling story of origins, especially in an emotionally challenging "age of globalization," "none is more solid and unifying for the species than evolutionary history."[137] No other story of human beginnings boasts a more expansive narrative scope or enjoys greater scientific support.[138] Realigning environmental law with the scientific understanding of biodiversity loss produces its own epiphany, its own spiritually satisfying path toward detecting an "echo of the infinite, a glimpse of its unfathomable process, a hint of the universal law."[139] "[I]ntense spiritual feelings" arise from the "unfathomable complexity and . . . sublime beauty" of the biosphere at its fullest and

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134. *See* Eugenie C. Scott, *Antievolution and Creationism in the United States*, 26 ANN. REV. ANTHRO. 263, 263–64 (1997) (reporting a 1996 survey conducted by the National Science Board that found that forty-four percent of Americans do not believe in an evolutionary explanation of human origins); see Nicholas D. Kristof, *God, Satan and the Media*, N.Y. TIMES, Mar. 4, 2003, at A27 (reporting that "Americans are more than twice as likely to believe in the devil (68 percent) as in evolution (28 percent)").

135. Babbitt v. Cmtys. for a Great Or., 515 U.S. 687, 714 (1995) (Scalia, J., dissenting).

136. Tangipahoa Parish Bd. of Educ. v. Freiler, 530 U.S. 1251 (2000) (Scalia, J., dissenting from denial of cert.).

137. WILSON, *supra* note 5, at 133.

138. *See* David Christian, *The Case for "Big History,"* 2 J. WORLD HIST. 223, 235 (1991) (describing history, at least if studied across the whole of time, "as a form of modern 'creation myth'" that "reflects the best attempts of our society to answer questions about origins").

139. Oliver Wendell Holmes, *The Path of the Law*, 10 HARV. L. REV. 457, 478 (1897), *reprinted in* 110 HARV. L. REV. 994, 1009 (1997).

most diverse.[140] Training the law to harness, perchance to halt, the horses of our ecological apocalypse should help us recapture the "beauty and mystery that seized us at the beginning."[141]

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140. DAVID TAKACS, THE IDEA OF BIODIVERSITY 255 (1996).
141. EDWARD O. WILSON, CONSILIENCE 237 (1998).