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Some consume beauty for gain; but all of us must consume it to live.[1]

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1. Yi-Fu Tuan, *Our Treatment of the Environment in Ideal and Actuality*, 58 AM. SCI. 244, 249 (1970).

I. INTRODUCTION

How much is beauty worth in dollars? Some people may recoil at the very phrasing of this question.[2] Yet placing a monetary value on natural resources is not inherently destructive. Custom places a monetary value on artwork. Capitalism even values beautiful natural vistas in the form of land prices. Placing a monetary value on beauty and other features of nature may be essential if one is to protect natural resources fully.

This Article explores the proper monetary valuation under Superfund and other legislation of natural objects,[3] including living animals, aesthetic views, and water purity. The path to achieving valuation is rife with pitfalls, both philosophical and practical. Should the law focus on the monetary value to those people who "consume beauty for gain," as in the free market, or should government also consider beauty's existence and intrinsic value to the rest of society, which may "consume it to live." If the latter, then what dollar value possibly can be used?

Placing an economic value on natural resources is not just an academic exercise. Valuation of resources allows courts to assess damages for environmental harm, deters future pollution, and helps ensure protection for natural ecosystems. When natural resources are publicly held for (almost) free use, citizens have an inexorable incentive to over-

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2. *See* Higgs, *Changing Value Perspectives in Natural Resource Allocation: From Market to Ecosystem*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 525, 527 (1987). To Higgs, an environmental ethicist, "to quantify values is to take away their essential power as edifying expressions of social preference." Higgs asks, "[h]ow could we measure the experiential value of Niagara Falls?" as an example of "certain types of social questions which cannot be fully considered by appeal to economic mechanisms." *Id.*; *see also* Kelman, *Cost-Benefit Analysis: An Ethical Critique*, in REGULATION, Jan.-Feb. 1981, at 33-38. Kelman writes:

> Finally, one may oppose the effort to place prices on a non-market thing and hence in effect incorporate it into the market system out of a fear that the very act of doing so will reduce the thing's perceived value. To place a price on the benefit may, in other words, reduce the value of that benefit. Cost-benefit analysis thus may be like the thermometer that, when placed in a liquid to be measured, itself changes the liquid's temperature.

Id.

3. *See infra* notes 10-51 and accompanying text.

consume these resources. A person who pollutes natural resources may seize the economic benefit of the polluting activity, while avoiding any economic cost to himself from the harms caused by pollution. Economists call this practice externalizing a cost. As a result, public natural resources are destroyed, even when contrary to the interest of society.[4] One solution to this destructive situation forces those who harm the environment to bear the economic costs of this harm. Commonly described in economics as internalizing an external cost, this objective was one of the purposes of the Superfund legislation. According to the Senate Report, the first purpose of Superfund was to assure "that those responsible for any damage, environmental harm, or injury from chemical poisons bear the costs of their actions."[5] Natural resource valuation also may be critical to analyzing the costs and benefits of protecting the environment in government regulation.[6]

Thus economics can form the foundation of environmental protection. While some environmentalists regard environmental resource

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4. *See generally* A. FREEMAN, R. HAVEMAN & A. KNEESE, THE ECONOMICS OF ENVIRONMENTAL POLICY (1973); Ruff, *The Economic Common Sense of Pollution*, in MICROECONOMICS: SELECTED READINGS 498 (E. Mansfield ed. 1975); *see infra* notes 377-81 and accompanying text.

5. S. REP. No. 848, 96th Cong., 2d Sess. 13 (1980). Upon signing the hill into law, President Carter declared that "[m]ost important, it enables the Government to recover from responsible parties the costs of their actions in the disposal of toxic wastes." Comprebensive Environmental Response, Compensation, and Liability Act of 1980: Remarks on Signing H.R. 7020 Into Law, 16 WEEKLY COMP. PRES. DOC. 2797, 2798 (Dec. 11, 1980). Court interpretations of Superfund concur, finding that "Congress intended that those responsible for problems caused by the disposal of chemical poisons bear the costs and responsibility for remedying the barmful conditions they created." United States v. Reilly Tar & Chem. Corp., 546 F. Supp. 1100, 1112 (D. Minn. 1982); *see also* Obio *ex. rel.* Brown v. Georgeoff, 562 F. Supp. 1300, 1312 (N.D. Ohio 1983). To fulfill this intent, the harms created by hazardous wastes must be monetized as damages to be imposed upon those who create the harms.

6. While cost-benefit analysis has numerous critics, the system is increasingly employed in analyzing proposed environmental protection regulations. *See, e.g.*, Andrews, *Economics and Environmental Decisions, Past and Present*, in ENVIRONMENTAL POLICY UNDER REAGAN'S EXECUTIVE ORDER: THE ROLE OF BENEFIT-COST ANALYSIS 43 (K. Smith ed. 1984). *See generally* COMPTROLLER GENERAL, GENERAL ACCOUNTING OFFICE, REPORT TO THE CONGRESS: COST-BENEFIT ANALYSIS CAN BE USEFUL IN ASSESSING ENVIRONMENTAL REGULATIONS, DESPITE LIMITATIONS (1984). The application of cost-benefit analysis has been limited, however, by shortcomings in the valuation of environmental benefits. *See* OFFICE OF POLICY PLANNING & EVALUATION, ENVIRONMENTAL PROTECTION AGENCY, EPA'S USE OF BENEFIT-COST ANALYSIS: 1981-1986, at 4-4 (Aug. 1987) (stating tbat in a majority of EPA cost-benefit analyses, the agency was unable to monetize the benefits of the regulation in question). As long as cost-benefit analyses fail to monetize fully environmental benefits, relatively intangible benefits may be overlooked or understated in tbe cost-benefit balancing. Cost-benefit analysis tends to ignore variables that are not monetized. Tribe, *Seven Deadly Sins of Straining the Constitution through a Pseudo-Scientific Sieve*, 36 HASTINGS L.J. 155, 161 (1984); *see also* J. CAMPEN, BENEFIT, COST, AND BEYOND 63-64 (1986). The answer to this skewing in cost-benefit analysis is not to abolish the analysis, but to incorporate better environmental and other relatively intangible benefits. *Id.* at 99-102. Complete and accurate valuation of natural resources would contribute to the improvement of cost-benefit analysis and the better protection of environmental concerns.

monetization as a Faustian bargain,[7] use of these economic principles can provide an essential weapon for future protection of the environment.[8] Internalizing external environmental costs through the market can deter future ecological destruction, as well as remedy some acts of past destruction.[9] Therefore, accurately determining the value of natural resources is important for preserving nature. To preserve the environment effectively, valuation must be as complete and accurate as possible.

The federal government and some states have taken the first halting steps toward determining how to value natural resources. This Article examines the nascent law of natural resource valuation and proposes an approach more expansive than the approach under Superfund regulations. Part II summarizes the sources of legal authority that allow the government to recover damages for harm done to natural resources from environmental pollution. Part III summarizes the characteristics of natural resources that could be compensable. Part IV discusses the available methods for valuing the loss of natural resources. Finally, Part

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7. *See* D. EHRENFELD, THE ARROGANCE OF HUMANISM 189 (1978). To Ehrenfeld, the effort of placing economic value on nature is at best a subterfuge or "rationalization." *Id.* As such, the effort is inevitably transparent and self-defeating. Ehrenfeld argues that this approach will fail to save endangered species and other components of the ecology and may distract from genuine, effective approaches. *Id.* at 189-92. The very act of referring to nature as a resource may undermine its intrinsic value. *Id.* at 192. The modern "deep ecology" movement also rejects monetization of nature in virtually any form. *See infra* notes 122-24 and accompanying text. Nevertheless, even Ehrenfeld concedes that economic and other "selfish" approaches to conservation can play an important role in protecting nature, in tandem with other approaches. D. EHRENFELD, *supra*, at 210.

8. *See, e.g.*, Plater, *In the Wake of the Snail Darter: An Environmental Law Paradigm and Its Consequences*, 19 U. MICH. J.L. REF. 805 (1986). In his extensive review of the Tellico Dam controversy under the Endangered Species Act, Plater contends that "as so often occurs in environmental cases, to have a realistic chance of prevailing in the long run, [environmentalists] had to base their position on a comprehensive implicit benefit-cost-alternatives accounting." *Id.* at 814-15. Plater further concludes that "[s]ound economic analysis, including analysis of constructive alternatives, is part of any environmental controversy's optimum strategy." *Id.* at 815. Indeed, the ultimate construction of the Tellico Dam may have resulted from the public perception of the snail darter controversy as pitting the environment against economic growth. *Id.* at 849-50. When the issue is framed in this fashion, environmentalists risk the "stigma of elitism," which may undermine their potential successes. *Id.* at 850. If environmentalists can show the compatibility of ecology and economic welfare, then their prospects for prevailing may be enhanced.

9. The ecological philosophy known as deep ecology, propounded by Aldo Leopold and others, *see infra* notes 122-24 and accompanying text, rejects reliance on market mechanisms as technocratic and ultimately doomed to failure, in favor of a public value paradigm that elevates the environment above other concerus. Whatever the merits of such an attitude change, it does not appear on the immediate horizon. One contemporary author, who believes in the need for a noneconomic rationale for environmental protection, fears that "to depend on something like Aldo Leopold's *Land Ethic* is almost certainly to succumb to the economic appetites of human nature." Carpenter, *Ecology in Court, and Other Disappointments of Environmental Science and Environmental Law*, 15 NAT. RESOURCES LAW. 573, 585 (1983). Aldo Leopold himself worried that "our educational and economic system is headed away from, rather than toward, an intense consciousness of land." A. LEOPOLD, THE LAND ETHIC 239 (1948).

V argues that current regulations under Superfund are inadequate, and proposes legal standards for monetizing the value of damages to natural resources. Specifically, restoration cost should provide the presumptive measure of damages, unless restoration is impossible or disproportionately expensive. When restoration is impractical, alternative contingent valuation methods are appropriate. This approach recognizes the uncertainties confounding our efforts to value natural resources and best achieves the objective of preserving natural resources at reasonable cost.

II. Legal Authority for Government Recovery of Natural Resource Damages

Before assessing the tools for natural resource damage valuation, it is critical to review the legal framework that authorizes recovery for these damages. While the most prominent federal authority is Superfund, other statutes permit recovery in defined circumstances. Furthermore, state statutes or state common law may enable a state government to recover for some types of harm done to natural resources within the state. This section surveys these sources of legal authority and their limits.

A. Superfund

Although Superfund[10] is best known for authorizing the government to cleanup hazardous waste disposal sites,[11] the legislation also permits governmental entities to recover money damages when a release of hazardous substances causes an "injury to, destruction of, or loss of natural resources."[12] Superfund defines the term "natural resources" broadly to include "land, fish, wildlife, biota, air, water, ground water, drinking water supplies, and other such resources belonging to, managed by, held in trust by, appertaining to, or otherwise controlled by the United States . . ., any State or local government, or any foreign government."[13] In short, the statute permits recovery for virtually any

10. The official name of Superfund is the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), Pub. L. No. 96-510, 94 Stat. 2767 (1980) (codified at 42 U.S.C. §§ 9601-9657 (1982 & Supp. IV 1986)), *amended by* The Superfund Amendments and Reauthorization Act of 1986, Pub. L. No. 99-499, 100 Stat. 1613 (1986).

11. *See* 42 U.S.C. §§ 9604-9607 (1982). For a general summary of these provisions, see Frank & Atkeson, *Superfund: Litigation and Cleanup*, Env't Rep. (BNA), Special Report (1985); *Developments in the Law—Toxic Waste Litigation*, 99 HARV. L. REV. 1458 (1986) [hereinafter *Developments in the Law*]; and Note, *Superfund: Conscripting Industry Support for Environmental Cleanup*, 9 ECOLOGY L.Q. 524 (1981).

12. 42 U.S.C. § 9607(a)(4)(C) (Supp. IV 1986).

13. 42 U.S.C. § 9601(16) (1982 & Supp. IV 1986).

damages on government lands.[14] The Act, however, does not create a private right of action for the recovery of natural resource damages.[15]

Only state or federal officials designated "to act on behalf of the public as trustees for natural resources" may bring a Superfund action to recover for natural resource damages.[16] Under the statutory plan, these officials first assess the natural resource damages resulting from a release of a hazardous substance[17] and, if warranted, may bring an action against statutorily designated responsible parties.[18] The statutory defenses to these actions are quite limited.[19] If the court finds the de-

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14. Commentators dispute the extent of the government's right to recover for natural resource damage. Some commentators suggest that "CERCLA be construed broadly to reach all resources within the government's jurisdiction," including at least some privately owned resources. *See Developments in the Law*, *supra* note 11, at 1567. Other commentators, however, construe the statutory language to restrict recoverable damages to those natural resources on state-owned lands. *See, e.g.*, Comments of the Chem. Mfrs. Ass'n. on the Dept. of Interior's Proposed Natural Resources Damage Assessment Regulations, at 33 (Mar. 19, 1986) (source on file with Author) [hereinafter Comments of the Chem. Mfrs. Ass'n] (stating that "not only does CERCLA preclude recovery for private uses of resources, but it does not permit recovery for *any* effects to a resource that lacks the appropriate government connection" (emphasis in original)), *responding to* Notice of Proposed Rulemaking, 50 Fed. Reg. 52,126 (1985).

Resolution of this issue "will probably have to await judicial interpretation, further legislative elaboration, or at least regulatory definition." Breen, *CERCLA's Natural Resource Damage Provisions: What Do We Know So Far?*, 14 Envtl. L. Rep. (Envtl. L. Inst.) 10,304, 10,306 (Aug. 1984). The plain language of the statute makes clear Congress's intent to exclude some resources, though, which rules out the broadest interpretations of coverage. *See, e.g.*, Reiter v. Sonotone Corp., 442 U.S. 330, 338 (1979) (stating that the court should give effect to "restrictive significance" of statutory language). Furthermore, because private resource owners almost certainly have a state common-law right of action to recover for these damages, the need for governmental recovery does not seem great and raises the undesirable specter of double recovery. Even if statutory coverage is limited strictly to government lands, its sway will be considerable because the federal government owns roughly one-third of the Nation's land area. *See* Coggins, *The Public Interest in Public Land Law: A Commentary on the Policies of Secretary Watt*, 4 PUB. LAND L. REV. 1 (1983).

15. In most instances, state tort law provides a remedy for damages to privately held natural resources, such as shade trees, under the doctrines of trespass, negligence, nuisance, or strict liability for ultrahazardous substances.

16. 42 U.S.C. § 9607(f)(2)(A) & (B) (Supp. IV 1986). The President has designated certain federal agencies as trustees pursuant to the National Oil and Hazardous Substances Contingency Plan. *See* 40 C.F.R. § 300.72 (1987). Numerous states also have desiguated their trustees for the purposes of Superfund recovery.

17. 42 U.S.C. § 9607(a)(4) (Supp. IV 1986). Damages also may be recovered for harms resulting from a "threatened release" of a hazardous substance, *id.*, though it is unclear how the mere threat would injure natural resources.

18. Liability for natural resource damages parallels that for cleanup costs, and includes current site owners, certain past owners, waste transporters, and generators of waste. *See id.* § 9607(a)(1)-(4).

19. In practice, the most siguificant defense may be Superfund's inapplicability to oil spills. The statutory definition of hazardous substance explicitly excludes petroleum. *Id.* § 9601(14). The value of this defense is mitigated, however, because natural resource damages resulting from oil spills often may be recovered under the authority of the Clean Water Act. *See infra* notes 24-31.

The natural resource damage provisions of Superfund provide specifically that there will be no liability when:

fendants liable for the release, then it must assess damages commensurate to the degree of injury to natural resources. When the state or federal government recovers the damages, it must use the money recovered "to restore, replace, or acquire the equivalent of such natural resources."[20] Superfund's text, however, offers little guidance about how these damages are to be measured.

To simplify the courts' task in valuing natural resource damages, section 301 of Superfund authorizes the President to promulgate valuation regulations, a task since delegated to the Department of the Interior.[21] These regulations create a "Type A" methodology for "simplified assessments requiring minimal field observation," and a more elaborate "Type B" methodology "for conducting assessments in individual cases to determine the type and extent of short- and long-term injury, destruction or loss."[22] These regulations are particularly significant because any determination made under the regulations has "the force and effect of a rebuttable presumption on behalf of the trustee."[23]

Thus Superfund provides a well-defined process for recovering natural resource damages. Theoretically, a state or the federal government can easily identify a release of pollutants, ascertain the extent of damages according to the Department of the Interior regulations, and recover those damages from responsible parties. As demonstrated in Part V section of this Article, however, the current framework cannot yet fulfill the objectives of the Superfund legislation and is subject to considerable criticism.

[T]he party sought to be charged has demonstrated that the damages to natural resources complained of were specifically identified as an irreversible and irretrievable commitment of natural resources in an environmental impact statement, or other comparable environment analysis, and the decision to grant a permit or license authorizes such commitment of natural resources, and the facility or project was otherwise operating within the terms of its permit or license . . . .

42 U.S.C. § 9607(f)(1) (Supp. IV 1986). Still other general statutory defenses preclude recovery for damages resulting from: "federally permitted release[s]," *id.* § 9607(j), damages from the application of registered pesticide products, *id.* § 9607(i), and damages from releases caused by acts of God, war, and third parties unrelated to the defendant, *id.* § 9607(b). These defenses, however, are unlikely to apply to most instances of natural resource damages. Damages are also unavailable "where such damages and the release of a hazardous substance from which such damages resulted have occurred wholly before [the enactment of this Act]." *Id.* § 9607(f). In addition, Superfund places a cap on damages for certain releases from vessels and other forms of transportation. *Id.* § 9607(c).

20. *Id.* § 9607(f)(1) (1982 & Supp. IV 1986).

21. *See id.* § 9651(c)(1).

22. *Id.* § 9651(c)(2).

23. *Id.* § 9607(f)(2)(C). *See generally* Menefee, *Recovery for Natural Resource Damages Under Superfund: The Role of the Rebuttable Presumption*, 12 Envtl. L. Rep. (Envtl. L. Inst.) 15,057 (1982).

B. The Clean Water Act and Other Federal Laws

Prior to Superfund, the Clean Water Act provided for recovery of some natural resource damages.[24] Like Superfund, this legislation authorizes designated state and federal representatives to "act on behalf of the public as trustee of the natural resources."[25] Unlike Superfund, the original text of the Clean Water Act defines specifically the measure of damages as the cost of restoring or replacing the damaged or destroyed natural resources.[26]

Section 311 of the Clean Water Act assigns liability for the discharge of oil or hazardous substances into United States navigable waters or near the coastal shoreline.[27] Parties liable under section 311 include the owners and operators of vessels or onshore and offshore facilities that release oil.[28] As under Superfund, the defenses are quite limited.[29] Its coverage of oil spills makes the Clean Water Act broader than Superfund and uniquely applicable in some major episodes of natural resource damage. Conversely, the Clean Water Act is limited to navigable waterways and contains relatively low limits on liability.[30] In addition, Superfund altered the availability of damages under the Clean Water Act. While section 311 originally provided automatically for restoration or replacement costs, Superfund's damage assessment procedures now apply to natural resource damages under the Clean Water Act as well.[31]

Other federal legislation authorizes natural resource damage

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24. *See* 33 U.S.C. § 1321 (1982).

25. *Id.* § 1321(f)(1).

26. *Id.* § 1321(f)(4).

27. *Id.* § 1321(f)(1) (referring to the coverage of 33 U.S.C. § 1321(b)(3) (1982)).

28. *Id.*

29. *Id.* These defenses include an act of God, an act of war, negligence of the U.S. government, and an act or omission of a third party. *Id.* These exceptions to liability have been construed narrowly.

30. *Id.* Liability is limited to $125 per gross ton of barges, $150 per gross ton of other vessels, or $250,000, whichever is greater. *Id.* For onshore and offshore facilities, total liability is limited to $50,000,000. *Id.* § 1321(f)(2) & (3).

31. *See* 42 U.S.C. § 9651(c)(1) (Supp. IV 1986) (stating that regulations for damage assessment apply "for the purposes of this chapter and section 1321(f)(4) and (5) of title 33 [the Federal Water Pollution Control Act]"); *id.* § 9607(f)(2)(C) (granting rebuttable presumption to "[a]ny determination or assessment of damages to natural resources for the purposes of this chapter and section 1321 of title 33 [the Federal Water Pollution Control Act] made by a Federal or State trustee in accordance with the regulations promulgated under section 9651(c) of this title"). Arguably, the subsequent passage of Superfund amends implicitly the restoration cost methodology of the Clean Water Act. The Department of the Interior, however, explains that as long as the damages collected are ultimately used for restoration, no inconsistency exists. 52 Fed. Reg. 9042, 9050 (1987) (Type A damage assessment regulations). The latter view is questionable because the damages recovered under other Superfund methodologies may be inadequate to accomplish the complete restoration costs that were recoverable under § 311 of the Clean Water Act.

awards in specific circumstances. The Deepwater Port Act of 1974 authorizes recovery for damage resulting from deepwater port oil discharges,[32] including damage to "the natural resources of the marine environment, or the coastal environment of any nation."[33] The Outer Continental Shelf Lands Act also provides recovery for damages, including "injury to, or destruction of, natural resources" and "loss of use of natural resources."[34] Finally, the Trans-Alaska Pipeline Act also authorizes damages in the event of oil discharge.[35] None of these laws, however, specifies how to measure or value damaged natural resources. Although these acts may be important in individual instances of natural resource damage, their limited coverage renders them inapplicable to most injuries to public natural resources.

C. State Statutes and Common Law

Even before the enactment of the federal statutes, state common-law precedent authorized state recovery for damages to publicly held natural resources. In addition, many state legislatures have passed laws explicitly permitting and guiding the recovery of these damages. Because Superfund did not preempt these state laws,[36] the states apparently may choose whether to recover under state or federal law.

Common-law authority for state recovery of natural resource damages derives from the traditional principle that government has a proprietary interest in public natural resources.[37] When these resources are

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32. Deepwater Port Act of 1974, Pub. L. No. 93-627, 88 Stat. 2126 (codified at 33 U.S.C. §§ 1501-1524 (1982)). Damage recovery authorization is found at 33 U.S.C. § 1517(d) & (e) (1982).

33. *See* 33 U.S.C. § 1517(m)(2) (1982). This law provides that the owner and operator of a vessel at a deepwater port shall be liable "for cleanup costs and for damages that result from a discharge of oil." *Id.* § 1517(d).

34. Outer Continental Shelf Lands Act, Pub. L. No. 95-372, § 303(a)(2)(C) & (D), 92 Stat. 629, 674 (1978) (codified at 43 U.S.C. §§ 1301-1356 (1982)).

35. Trans-Alaska Pipeline Act, Pub. L. No. 93-153, 87 Stat. 576 (1973) (codified at 43 U.S.C. §§ 1651-1655 (1982)). Under this legislation, the holder of the pipeline right of way in a region shall be liable "for such damages, and without regard to ownership of any affected lands, structures, fish, wildlife, or biotic or other natural resources relied upon by Alaska Natives, Native organizations, or others for subsistence or economic purposes." 43 U.S.C. § 1653(a)(1) (1982). In addition, vessels are liable under this Act for all damages resulting from a discharge of oil into the environment. *Id.* § 1653(c)(1).

36. 42 U.S.C. § 9614(a) (1982) (providing that "[n]othing in this chapter shall be construed or interpreted as preempting any State from imposing any additional liability or requirements with respect to the release of hazardous substances within such State"). Of course, government plaintiffs may recover only once for any given damage to natural resources. Superfund provides that a "person who receives compensation for removal costs or damages or claims pursuant to any other Federal or State law shall be precluded from receiving compensation for the same removal costs or damages or claims as provided in this chapter." *Id.* § 9614(b).

37. *See, e.g.*, Toomer v. Witsell, 334 U.S. 385, 408 (1948); Geer v. Connecticut, 161 U.S. 519, 534 (1896), *overruled by* Hughes v. Oklahoma, 441 U.S. 322 (1979).

injured, the state may sue under *parens patriae* trustee authority.[38] Early on, the United States Supreme Court recognized that "the state has an interest independent of and behind the titles of its citizens, in all the earth and air within its domain."[39] Several states recognize *parens patriae* authority and, although it is not used frequently, sufficient case law supports recovery under this theory.[40] Some important limitations on *parens patriae* precedents, however, render the theory an incomplete authority for recovering damages for harm done to public resources.[41]

Numerous states have enacted legislation authorizing natural resource damages.[42] The breadth of these state laws varies widely. Some states, including Alaska,[43] California,[44] and Minnesota,[45] have broad

38. *See generally* W. RODGERS, HANDBOOK ON ENVIRONMENTAL LAW 171-82 (1977); Halter & Thomas, *Recovery of Damages by States for Fish and Wildlife Losses Caused by Pollution*, 10 ECOLOGY L.Q. 5, 9-13 (1982); Sax, *The Public Trust Doctrine in Natural Resource Law: Effective Judicial Intervention*, 68 MICH. L. REV. 471 (1970); Note, *State Protection of its Economy and Environment:* Parens Patriae *Suits for Damages*, 6 COLUM. J.L. & SOC. PROBS. 411 (1970); Annotation, *State's Standing to Sue on Behalf of Its Citizens*, 42 A.L.R. FED. 23 (1979).

39. Georgia v. Tennessee Copper Co., 206 U.S. 230, 237 (1907). Thus, a state may bring a claim to protect "the atmosphere, the water and the forests within its territory, irrespective of the assent or dissent of the private owners of the land most immediately concerned." Hudson County Water Co. v. McCarter, 209 U.S. 349, 355 (1908); *see also* Alfred L. Snapp & Son, Inc. v. Puerto Rico *ex rel.* Barez, 458 U.S. 592, 604 (1982).

40. *See, e.g.*, Maine v. M/V Tamano, 357 F. Supp. 1097, 1099 (D. Me. 1973); Department of Natural Resources v. Amerada Hess Corp., 350 F. Supp. 1060, 1067 (D. Md. 1972); Department of Fish & Game v. S.S. Bournemouth, 307 F. Supp. 922, 925 (C.D. Cal. 1969); Department of Envtl. Protection v. Jersey Cent. Power & Light Co., 133 N.J. Super. 375, 388-89, 336 A.2d 750, 759 (App. Div. 1975), *rev'd on other grounds*, 69 N.J. 102, 351 A.2d 337 (1976); State v. Bowling Green, 38 Ohio St. 2d 281, 283, 313 N.E.2d 409, 411 (1974); State Dep't of Fisheries v. Gillette, 27 Wash. App. 815, 819-20, 621 P.2d 764, 766-67 (1980).

41. *See* Note, *Defining the Appropriate Scope of Superfund Natural Resource Damage Claims: How Great an Expansion of Liability?*, 5 VA. J. NAT. RESOURCES L. 197, 201-02 (1985) (authored by Thomas Newlon). Newlon notes that these damages may be limited to navigable waters or wildlife. *Id.* at 202. In addition, some courts have denied money damages, limiting *parens patriae* to injunctive relief. As a consequence of these and other restrictions, litigants rarely invoke the *parens patriae* doctrine. *Id.* at 201-02 n.39.

42. *See* [State Laws—Master Index] Env't Rep. (BNA) 211:0115 (1988). The *Environment Reporter* cites 28 states that provide statutorily for damages for environmental damage. *Id.* Review of these statutes indicates that 25 states provide for recovery of natural resource damages. These states include Alaska, California, Connecticut, Colorado, Delaware, Florida, Kansas, Louisiana, Maine, Massachusetts, Minnesota, Mississippi, Missouri, Nebraska, New Jersey, New York, Oklahoma, Oregon, Rhode Island, Tennessee, Virginia, Washington, West Virginia, Wisconsin, and Wyoming. *Id.* The list does not include those states that provide liquidated civil penalties for environmental violations. A somewhat older survey of state attorneys general found 25 states that provided for state recovery of "compensatory damages for the destruction of fish and wildlife." Halter & Thomas, *supra* note 38, at 9 n.25. The list of these 25 states is not congruent with the list compiled from the *Environment Reporter*.

43. *See* ALASKA STAT. § 46.03.758(d) (1987). Alaska's law provides for civil penalties, not damages, but these penalties are related to the extent of natural resource damage. For oil pollution, the penalty shall vary according to the "toxicity, degradability and dispersal characteristics of the oil" as well as the "sensitivity and productivity of the receiving environment." *Id.* These penal-

and apparently effective authority to recover for damage to natural resources. Other states have more limited authority, applying only to oil spills[46] or to criminal violations.[47] When applicable, state laws typically permit recovery of the costs of restoring fish and wildlife. Some states simplify this process hy relying on the value tables of the American Fisheries Society[48] or by establishing their own tables for valuing the loss of individual members of varying species.[49]

In some cases, state law provides a framework for recovery of the full measure of natural resource damages. New York's Assistant Attorney General has observed that a "state's own statutes and authorities may well provide a more comprehensive remedy than [an action under

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ties may not exceed $10 per gallon of oil spilled in an environment with "significant aquatic resources" and $1 per gallon of oil in an "environment without significant aquatic resources." *Id.* § 46.03.758(b)(1).

44. *See* CAL. HARB. & NAV. CODE § 293 (West Supp. 1989). California law establishes liability for "any damage or injury to the natural resources of the state, including, but not limited to, marine and wildlife resources, caused by the discharge or leakage of petroleum, fuel oil, or hazardous substances." *Id.*

45. *See* MINN. STAT. ANN. § 115B.04 (1)(c) (West 1985). The Minnesota Environmental Response and Liability Act makes persons who release hazardous substances liable for "[a]ll damages for any injury to, destruction of, or loss of natural resources."

46. *See, e.g.*, Maine Oil Discharge Prevention and Pollution Control Act, ME. REV. STAT. ANN. tit. 38, § 551 (1978); Massachusetts Rules for the Prevention and Control of Oil Pollution in the Waters of tlie Commonwealth § 9.02 (1973), *reprinted in* [State Water Laws] Env't Rep. (BNA) 806:0553 to 0554 (1988).

47. *See* N.Y. ENVTL. CONSERV. LAW § 71-2723 (McKinney 1981) (providing criminal penalties including the cost of "restoring to its original state the area where a substance was unlawfully released").

48. *See* Comments of the Am. Petroleum Inst. on Dep't of Interior Request for Additional Comments on Dev. of Regulations on Natural Resource Damage Assessment, at 6 (May 31, 1985) (source on file with Author) (stating that "most states use the fish tables developed by the American Fisheries Society"), *responding to* Request for Additional Information, 50 Fed. Reg. 1550 (1985). *See* AMERICAN FISHERIES SOCIETY, Pub. No. 13, MONETARY VALUES OF FRESHWATER FISH AND FISH-KILL COUNTING GUIDELINES (1982) (most recent publication of the Society). The values contained in this document are based primarily on "hatchery production costs" for replacement. *Id.* at 3. The American Fisheries Society also published *Monetary Values of Fish* in 1970 and *Reimbursement Values for Fish* in 1978. This table is used, for example, by Florida (FLA. STAT. § 403.141(3) (1972)) and Virginia (*see* NOAA REPORT, *infra* note 80, at 94-95). Reliance on these tables is representative of presumptive values for damaged resources. *See* State Dep't of Pollution Control v. International Paper Co., 329 So. 2d 5, 8 (Fla. 1976) (holding that due process requires an opportunity to rebut use of the tables in individual cases).

49. The State of Oregon specified these values in the statute. Under this law the destruction of an elk costs $750, of a gray squirrel costs $10, and of a salmon or steelhead trout costs $125. OR. REV. STAT. § 466.890 (1987). Following the Santa Barbara oil spill, California placed specific values on hundreds of species, including sponges and anemones. The values ranged from roughly one-tenth of one cent per Northern Anchovy to $21,000 for each gray whale. *Hazardous and Toxic Waste Disposal Field Hearings: Joint Hearings Before the Subcomms. on Environmental Pollution and Resource Protection of the Senate Comm. on Environment and Public Works*, 96th Cong., 1st Sess. 316-53 (1979) (statement of Edwin J. Dubiel, California Deputy Attorney General) [hereinafter *Hazardous and Toxic Waste Disposal Hearings*].

Superfund or the Clean Water Act] in some circumstances."[50] The inconsistent and incomplete coverage of state liability statutes, however, makes Superfund a superior source of recovery for most natural resource damage.[51] Consequently, Superfund and the attendant Department of the Interior regulations probably will assume paramount importance in determining the scope of future natural resource damages.

III. VALUES ATTRIBUTABLE TO NATURAL RESOURCES

The first difficulty in valuation is determining the meaning of value itself and then determining which value characteristics of natural resources should be compensable. This axiological process is a precursor to an assessment of valuation methods. Congress has offered little guidance in evaluating the types of value that are compensable. In the Fish and Wildlife Conservation Act of 1980, Congress declared only that "[f]ish and wildlife are of ecological, educational, aesthetic, cultural, recreational, economic, and scientific value to the Nation."[52] Yet this listing of value types obscures the most crucial questions. Surely wildlife has ecological value, but what does that mean? Does Congress intend to protect wildlife's ecological value to human beings, to other wildlife, or to the ecosystem as a whole? What does economic value mean? In a sense, all these values are economic, because valuation and assessment of damages necessitate that the value be monetized. Thus, these classifications offer little assistance in identifying types of potentially compensable value.

A more useful approach recognizes at least three analytically distinct types of natural resource value that could be compensable: use

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50. Johnson, *Natural Resource Damage Assessments Under CERCLA: Flawed Regulations May Limit Recoveries*, 2 NAT'L ENVTL. ENFORCEMENT J., July 1987, at 3, 3. In addition to better procedures for recovery, the state authority sometimes may permit government claims for damage to resources on purely private land, unlike Superfund. *See supra* note 14.

51. *See, e.g.*, Note, *supra* note 41, at 201 (observing that "[t]he broad sweep of these [Superfund] provisions is especially striking when compared with previous common law doctrines and statutes"). Thus, Colorado's Attorney General emphasized that "Congress created this [Superfund] claim in recognition of the inadequacies of tort law in dealing with environmental damage cases brought by the states on behalf of present and future generations of their citizens." Plaintiff's Reply Brief on the Issue of the State's Role as Public Trustee at 4, State v. Cotter Corp., Civ. No. 83-C-2389 (May 22, 1986).

52. 16 U.S.C. § 2901(a)(1) (1982). An environmental ethicist adds to this list "life support value," "genetic diversity value," "cultural symbolization value," "historic value," "character-building value," "therapeutic value," and "religious value." H. ROLSTON, PHILOSOPHY GONE WILD: ESSAYS IN ENVIRONMENTAL ETHICS 184-87 (1986). There is considerable merit in some of Rolston's analysis of these values, but one may doubt whether Congress intended these values to be compensable under Superfund and whether tools exist for even rough quantification of these values.

value, existence value, and intrinsic value.[53] Use value recognizes that natural resources only have value to humans when the resources are used for practical human ends, such as for fishing or hunting. Use value seeks to measure the monetary importance of the loss of these human uses. Existence value acknowledges that the presence of natural resources, even unused, may have value to humans. For example, some people may want to preserve the availability of resources for future generations. Intrinsic value recognizes that natural resources may have value independent of humans, based on their status as natural creatures or objects. This section examines these three types of value and evaluates their legitimacy as approaches to valuing natural resource damages.

A. Use Value

Use value is simply the worth of natural resources to the people who use them. When a family goes fishing, it uses natural resources in a consumptive fashion. The continued presence of the fish has some obvious economic value for this family, which expended resources such as license fees and travel costs in order to go fishing. A 1975 United States Department of Agriculture (USDA) study found that some twenty million Americans participated in "sport hunting," spending nearly six billion dollars in the process.[54] When the same family goes bird watching, they still use and value the resources, but in a nonconsumptive way. The magnitude of nonconsumptive use of natural resources considerably exceeds even consumptive uses.[55] The use value of natural resources is one logical tool for monetizing the loss of those resources. The language of Superfund refers to use value as a factor to be considered in resource valuation.[56]

Commentators advance several reasons for employing use value when assessing the worth of natural resources. Use value for public resources approximates market value for private resources, which is the standard measure of damages in our capitalist system. Sometimes even publicly held natural resources have an established value in the private market. For example, a forest may be used as lumber, or fish may be used as food. In these cases the law often uses market value when as-

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53. The literature in this field has yet to agree on a standardized set of terms for these value types. Existence value, for example, is used in several different ways. The definitions of these terms for the purpose of this Article are set forth in the text, but the reader should be aware that the terms may have a different meaning in other articles.

54. *See* Shaw, *Problems in Wildlife Valuation in Natural Resource Management*, in VALUATION OF WILDLAND RESOURCE BENEFITS 221, 225 (G. Peterson & A. Randall eds. 1984).

55. *See id.* Studies have shown that Americans spent 478 million days engaged in sport hunting in 1975, but 1.6 billion days participating in wildlife observation. *Id.*

56. 42 U.S.C. § 9651(c)(2) (1982).

sessing damage to resources.[57] On other occasions, courts use reduction in land value to measure the damages from natural resource destruction on a given site.[58] The market usually measures the use value of resources to purchasers. Thus, even if land and market values are not available for state-owned natural resources, common-law authority finds the use value of these resources through other tools.[59] The significance of common-law precedent is indicated by Senator Alan Simpson's floor discussion of Superfund, in which he called for the use of "traditional legal rules for calculating damages" to natural resources.[60]

The early cases upholding the regulation of public resources by the states also relied on use value. For example, one case noted bluntly that "the source of the police power as to game birds . . . flows from the duty of the State to preserve for its people a valuable food supply."[61] Much of the early nature conservation movement was a scientific movement geared toward using resources effectively in order "to guarantee sustained economic well-being."[62] Focusing on the use value of natural resources is consistent with a long tradition of United States law.

Historical reliance on use value is not without justification. Use value is more precise and less speculative than other types of resource value because it isolates the extent to which people "put their money where their mouth is." Use value measures actual behavior, rather than attitudes, and therefore is a more certain means of ascertaining damages.

Courts in other contexts also have recognized the importance of behavioral evidence of value, such as that provided by use value. The Su-

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57. *See, e.g.*, Chevron Oil Co. v. Snellgrove, 253 Miss. 356, 367, 175 So. 2d 471, 474 (1965) (using market value for timber); Nash & Windfohr v. Edens, 109 S.W.2d 496, 500 (Tex. Ct. App. 1937) (using market value for damaged strawberry plants); State Dep't of Fisheries v. Gillette, 27 Wash. App. 815, 824, 621 P.2d 764, 768 (1980) (using market value of fish in hatchery).

58. *See, e.g.*, Farny v. Bestfield Builders, Inc., 391 A.2d 212, 214 (Del. 1978) (discussing loss of land value from harm to shade trees); Fiske v. Moczik, 329 So. 2d 35, 37 (Fla. Dist. Ct. App. 1976) (discussing loss of land value from death of ornamental trees); Phillips Petroleum Co. v. Mangan, 189 Okla. 166, 168, 114 P.2d 454, 456 (1941) (discussing loss of land value from damage to soil and shade trees); Atlas Chem. Indus., Inc. v. Anderson, 524 S.W.2d 681, 687 (Tex. 1975) (discussing loss of land value from polluted creek).

59. The concept that statutes customarily should be interpreted in a manner consonant with pre-existing common law is a long standing maxim of statutory construction. *See* MODEL STATUTORY CONSTRUCTION ACT § 15(4) (1965), *reprinted in* C. NUTTING & R. DICKERSON, CASES AND MATERIALS ON LEGISLATION 437 (5th ed. 1978). In this instance, the statutory terms "injury," "loss," and "destruction" parallel roughly the harms compensable under common-law damages. *See, e.g.*, Wood v. Security Mut. Life Ins. Co., 112 Neb. 66, 198 N.W. 573 (1924) (defining damages as "loss, injury or deterioration" of a legally protected interest). While pre-existing common law should not control the interpretation of Superfund, it is certainly relevant.

60. 126 CONG. REC. S15,008 (daily ed. Nov. 24, 1980).

61. Geer v. Connecticut, 161 U.S. 519, 534 (1895).

62. Hart, *The Environmental Movement: Fulfillment of the Renaissance Prophecy?*, 20 NAT. RESOURCES J. 501, 517 (1980).

preme Court denied standing to an environmental group because the "alleged injury will be felt directly only by those who use" the national park.[63] In determining whether environmental groups may sue to protect a given nature area, the Second Circuit granted standing only to "those who by their activities and conduct have exhibited a special interest" in "the aesthetic, conservational, and recreational aspects of power development."[64] Economics largely relies on behavioral evidence and rejects the relative untrustworthiness of purely hypothetical opinions. The concept of public use value also underlies the *parens patriae* authority of the state to recover for damaged natural resources.[65]

Although the argument for use value rests largely on precedent and economics, and therefore may seem callow and selfish when juxtaposed against other ways of valuing nature, the advocate of use value need not yield the moral and philosophical high ground. The market reflects a degree of human freedom of choice, a point Ronald Dworkin emphasized in *A Matter of Principle.* Government may reasonably protect parkland because of market imperfections, but if it protects parkland for paternalistic reasons or contrary to popular will, it is undemocratic. Dworkin criticizes, for example, a hypothesized government intervention for parkland based on "a superior conception of what a truly worthwhile life is."[66] Such government intervention is not "liberal" and,

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63. Sierra Club v. Morton, 405 U.S. 727, 735 (1972). The Court further held that "a mere 'interest in a problem,' no matter how longstanding the interest and no matter how qualified the organization is in evaluating the problem, is not sufficient by itself to render the organization 'adversely affected' or 'aggrieved.'" *Id.* at 739. In United States v. Students Challenging Regulatory Agency Procedures (SCRAP), 412 U.S. 669, 685 (1972), the Court upheld standing because of plaintiff's "allegations that their members used the forests, streams, mountains and other resources in the Washington metropolitan area for camping, hiking, fishing, and sightseeing." *Id.* at 685. This concept even carries over to Justice Douglas's famous dissent in *Sierra Club v. Morton,* 405 U.S. at 741 (Douglas, J., dissenting). While Douglas put forth the controversial proposition that natural features receive judicial standing in their own right, he suggested that their rights should be vindicated in court by "those people who have so frequented the place as to know its values and wonders." *Id.* at 752.

64. Scenic Hudson Preservation Conference v. Federal Power Comm'n, 354 F.2d 608, 616 (2d Cir. 1965).

65. *See* Odom v. Deltona Corp., 341 So. 2d 977, 981 (Fla. 1976). The court stated:

> The basis of the title status of sovereignty lands rests initially on the common law of England under which the Crown held the title to the beds of navigable and tide waters, in trust for the people of the realm who had rights of navigation, commerce, bathing, and fishing and other recognized easements.

Id.

66. *See* R. DWORKIN, A MATTER OF PRINCIPLE 202 (1985). Dworkin thus rejects government policy based on deference to the intrinsic value that may be found in nature. Dworkin does not hesitate to approve government intervention in the economy when necessary to promote human equality. *See also* Fedkiw, *Coming Back to Market Value and Valuation for the Great Lakes Fisheries,* 116 TRANSACTIONS AM. FISHERIES SOC'Y. 346, 346 (1987) (stating that the marketplace is "the commonplace and commonsense approach to valuation in a democratic society").

presumably, is totalitarian in impulse.[67] Charles Meyer similarly criticizes the "absolutist" impulse of some environmentalists and concludes that the "economists' model . . . seems to me more in keeping with democratic theory in a pluralistic society."[68] Indeed, "ecoauthoritarianism" has been proposed as a response to environmental degradation.[69]

Use value is a plausible, intellectually respectable measure for determining the worth of natural resources. Complete reliance on use value has some shortcomings, however. Contrary to the implications of use value, greater public use of recreation sites actually may diminish the recognized public value of those facilities.[70] Most significantly, use value ignores the reality that natural resources may have worth beyond their use by humans.[71] Even unused resources may have some value to society. Surely a fish is worth something, even if a fisherman never catches it. Some state courts have affirmed this view. For example, a New York state court in upholding the New York Endangered Species Act held: "The police power is not to be limited to guarding merely the physical or material interest of the citizen. His moral, intellectual and spiritual needs may also be considered. The eagle is preserved, not for its use but for its beauty."[72] The following section explores the significance of nonuse values.

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67. R. DWORKIN, *supra* note 66; *see also* Farber, *From Plastic Trees to Arrow's Theorem*, 1986 U. ILL. L. REV. 337, 351 (stating that "[a]s the example of religion shows, even when some individuals agree with certitude about the fundamental attributes of the universe, they are not justified in imposing their views on others, or in using the machinery of the state to further their views"). Significantly, Farber shows how the marketplace also falls short of a justifiable allocation of resources. *Id.* at 352-54.

68. Meyer, *An Introduction to Environmental Thought: Some Sources and Some Criticisms*, 50 IND. L.J. 426, 452-53 (1975); *see also* Sagoff, *Where Ickes Went Right or Reason and Rationality in Environmental Law*, 14 ECOLOGY L.Q. 265, 288 (1987) (stating that "[t]he prospect of intervening with the freedom of individuals to educate their judgment or to improve their preferences, of course, strikes us as dangerous because it seems to invite tyranny").

69. *See generally* W. OPHULS, ECOLOGY AND THE POLITICS OF SCARCITY (1977). Ophuls suggests that man "may simply not be intelligent enough to grasp the issues" attendant to ecological scarcity. *Id.* at 160. The better future society in Ophuls's view must be "more authoritarian and less democratic than the industrial societies of today." *Id.* at 163.

70. *See, e.g.*, Cicchetti & Smith, *Congestion, Quality Deterioration and Optimal Use: Wilderness Recreation in the Spanish Peaks Primitive Area*, 2 SOC. SCI. RES. 15 (1973); McConnell & Sutinen, *An Analysis of Congested Recreation Facilities*, in 3 ADVANCES IN APPLIED MICRO-ECONOMICS 9 (K. Smith & A. Witte eds. 1984) [hereinafter APPLIED MICRO-ECONOMICS]; Menz & Mullen, *Expected Encounters and Willingness to Pay for Outdoor Recreation*, 57 LAND ECON. 33 (1981).

71. For this reason, commentators have argued that "relying on direct use values alone would significantly understate the total benefits of water quality improvements." Fisher & Raucher, *Intrinsic Benefits of Improved Water Quality: Conceptual and Empirical Perspectives*, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 38.

72. A.E. Nettleton Co. v. Diamond, 27 N.Y.2d 182, 192, 264 N.E.2d 118, 123, 315 N.Y.S.2d 625, 632 (1970) (quoting Barret v. New York, 220 N.Y. 423, 428, 116 N.E. 99, 101 (1917)).

B. Existence Value

Emphasis on market value for natural resources, or even a broader conception of use value, strikes many people as exalting economics above other socially held values. In the context of natural resources, unthinking reliance on economic principles would recommend selling the Grand Canyon to the highest bidder for commercial development, if that sale would yield the most profit. Not long ago, Milton Friedman proposed closing the national parks in which the commercial value of lumber or minerals exceeded the value of recreational use.[73] The democratic process has rejected this result unequivocally. The Wilderness Act of 1964, for example, prohibits human use of wilderness areas when the use is incompatible with preserving the land in its natural condition.[74] The Alaskan National Interests Lands Conservation Act of 1980 similarly preserves certain lands and waters for "the benefit, use, education, and inspiration of present and future generations."[75] This exemplary statute demonstrates the presence of a benefit beyond use value. The Supreme Court has acknowledged expressly "the public interest in preserving reaches of wild rivers and wilderness areas."[76]

The worth of natural resources beyond their use value is labeled existence value.[77] Existence value has three distinct subparts. First, humans may place their own "option value" on the preservation of natural resources. While I have never visited Yosemite National Park, I might want to do so someday and, therefore, I value its preservation. Retaining the option of future use intuitively has an economic importance. Second, humans may obtain "vicarious value" from natural resources. Even if I never intend to visit Yosemite National Park, I may still value its preservation. The knowledge that a given natural environ-

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73. *See generally* M. FRIEDMAN, CAPITALISM AND FREEDOM (1962).

74. *See* Wilderness Act of 1964, 16 U.S.C. § 1131(c) (1982). The National Wilderness Preservation System permits undeveloped federal land "where the earth and its community of life are untrammeled by man." *Id.* The Act also provides "roadless" areas to be preserved in their "primitive" state. *Id.* §§ 1132(b), (c). *See generally* McCloskey & Desautels, *A Primer on Wilderness Law and Policy*, 13 Envtl L. Rep. (Envtl. L. Inst.) 10,278 (Sept. 1983). A primary purpose of this legislation was to guarantee that these lands would be preserved in their original, natural state. *See* Sierra Club v. Block, 622 F. Supp. 842 (D. Colo. 1985).

75. 16 U.S.C. § 3101(a) (1982) (emphasis added).

76. Udall v. Federal Power Comm'n, 387 U.S. 428, 450 (1967).

77. One of the more entertaining expressions of existence value is in Johnson, *Recreation, Fish, Wildlife and the Public Land Law Review Commission*, 6 LAND & WATER L. REV. 283, 289 n.18 (1970):

> Motorbikes are a particular bane in the wilderness. But, it is said, many people like to ride motorbikes on mountain trails. This led me to invite a number of friends to fill in the blank in the following sentence: Because people like to ride motorbikes on mountain trails they should be allowed to do so, is like saying that because they like to _____ on mountain trails they should be allowed to do so. Unfortunately none of the entries were printable.

Id.

ment is protected is valuable to some Americans, and vicarious appreciation of nature, therefore, has a demonstrable economic value. Third, preservation of natural resources may have "intertemporal value." Even if I have no interest in visiting Yosemite National Park, I may want my offspring or their descendents to have the chance to see the park. The ability to bequeath natural resources to future generations also may have measurable monetary value.

Natural resource damages can capture these nonuse existence values. The strongest argument for including existence values is that they indubitably exist.[78] Option value is logically the simplest form of existence value. In several well-established private markets, such as the market for agricultural commodities, traders are accustomed to paying a substantial sum for a future option or right to use a product. Analytically, option value applies to environmental resources as well.[79] It is not uncommon for a person to desire to see the Grand Canyon at least once in his lifetime, nor is it unusual to postpone this visit until later in life. Presumably, people ascribing to this view would pay something to preserve their ability to see the Grand Canyon at a later date. The magnitude of option value is still uncertain, however.[80] An analogous concept is referred to as quasi-option value. Quasi-option value represents unknown latent benefits from natural resources. This value is used often for endangered species for which the full range of future benefits is unknown.[81] For example, an endangered plant species may possess undis-

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78. *See, e.g.*, C. COOPER, ECONOMIC EVALUATION AND THE ENVIRONMENT 68 (1981); Fisher & Raucher, *supra* note 71, at 60; Randall & Peterson, *Valuation of Wildland Benefits: An Overview*, in VALUATION OF WILDLAND RESOURCE BENEFITS 38 (G. Peterson & A. Randall eds. 1984).

79. The first and leading exposition of option value as applied to environmental resources is Weisbrod, *Collective-Consumption Services of Individual-Consumption Goods*, 78 Q.J. ECON. 471 (1964). Weisbrod argued that the true value of national parks significantly exceeds their use value. For a rigorous explication of the economics of option value, see Bishop, *Resource Valuation Under Uncertainty: Theoretical Principles for Empirical Research*, in 4 APPLIED MICRO-ECONOMICS, *supra* note 70, at 133-52 (K. Smith ed. 1986).

80. *See, e.g.*, NATIONAL OCEANIC & ATMOSPHERIC ADMIN., THE USE OF ECONOMIC ANALYSIS IN VALUING NATURAL RESOURCE DAMAGES: AN OVERVIEW 32-33 (E. Yang, R. Dower, M. Menessee eds. 1984) [hereinafter NOAA REPORT] (discussing studies, including some which showed a negative option value). Some of the uncertainty about the existence of positive option value are discussed in Fisher & Raucher, *supra* note 71, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 40-42. The uncertainty relates primarily to the unpredictability of future supply of or demand for the commodity in question. In the situation "that seems most relevant for water-quality-related analyses," the authors conclude that option value is probably both positive and significant.

81. This concept may have been best expressed by Justice Douglas, who wrote:

> A teaspoon of living earth contains 5 million bacteria, 20 million fungi, one million protozoa, and 200,000 algae. No living human can predict what vital miracles may be locked in this dab of life, this stupendous reservoir of genetic materials that have evolved continuously since the dawn of the earth. For example, molds have existed on earth for about 2 billion years. But only in this century did we unlock the secret of the penicillins, tetracyclines, and other antibiotics from the lowly molds, and thus fashion the most powerful and effective medicines ever

covered medical properties capable of curing human disease.

A second form of existence value, called vicarious value, also may be significant for natural resources.[82] Established concern for endangered species partly illustrates this point. Thus, people who will never use whale products or even see a whale still may be willing to pay something to prevent the extinction of whales.[83] A similar concern for wolves and other species exists.[84] One study found that eighty-nine percent of Americans were willing to pay increased energy costs for protection of bald eagles, even though most of these people will never share the thrill of observing these eagles.[85] The significance of vicarious value also may

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discovered by man. Medical scientists still wince at the thought that we might have inadvertently wiped out the rhesus monkey, medically, the most important research animal on earth. Sierra Club v. Morton, 405 U.S. 727, 750-51 n.8 (Douglas, J., dissenting). Explicit concern for loss of future benefits through extinction underlies the Endangered Species Act, 16 U.S.C. § 1540 (1982). *See, e.g.*, Plater, *supra* note 8, at 823. The House Report on the Act stated that the "value of this genetic heritage is, quite literally, incalculable." H.R. REP. No. 412, 93d Cong., 2d Sess. 4 (1973).

82. *See* McConnell, *Existence and Bequest Value*, in MANAGING AIR QUALITY AND SCENIC RESOURCES AT NATIONAL PARKS AND WILDERNESS AREAS 255 (R. Rowe & L. Chestnut eds. 1983) [hereinafter MANAGING AIR QUALITY]. McConnell has hypothesized that "existence value may be relatively more significant than option value." *Id.*; *see also* Greenley, Walsh & Young, *Option Value: Empirical Evidence from a Case Study of Recreation and Water Quality*, 97 Q.J. ECON. 657 (1981) (finding option value of the South Platte River Basin to be $23 per person per year and existence or vicarious value to be $42 per person per year). Several other studies suggest that existence and option values may be large and may exceed significantly the use value for resources such as Western wildlife habitat and Grand Canyon air quality. Randall & Stoll, *Existence Value in a Total Valuation Framework*, in MANAGING AIR QUALITY, *supra*, at 270-71. A summary of the available economic studies concluded that existence benefits "may account for a sizable portion of society's valuation of improved water quality." Fisher & Raucher, *supra* note 71, at 37; *see id.* at 47-49 (discussing the specific studies and concluding that existence value was at least half of use value, if not substantially more).

83. Anderson & Bishop, *The Valuation Problem*, in NATURAL RESOURCE ECONOMICS 125 (D. Bromley ed. 1985).

84. Glass & Muth, *Pitfalls and Limitations in the Use of Fishery Valuation Techniques*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 381, 387 (1987):

> The relationship between a large segment of society and the timber wolf provides a good example of existence values. Many people place a high value on the preservation of this species even though they are extremely unlikely to ever encounter a wolf. Although it is difficult and costly to measure existence values in monetary terms, the reality of such values is amply manifested through political action and often demonstrated by donations to resource-related causes in which the grantors do not use the resource.

Id.

85. *See* Shaw, *supra* note 54, at 226. Similarly "both 'saving' Lake Erie from 'dying' and protecting visibility at the Grand Canyon appear to be widely supported by people who have no intention of using either." Talhelm, *Unrevealed Extramarket Values: Values Outside the Normal Range of Consumer Choices*, in MANAGING AIR QUALITY, *supra* note 82, at 275. A detailed study of the South Platte River Basin in Colorado found:

> About 20 percent of the households interviewed who do not use the River Basin for recreation activities reported they were willing to pay an average of $25 annually for knowledge of the existence of the natural aquatic ecosystem and $17 annually to bequeath clean water to future generations, for a total non-user value of $42 annually.

be inferred from the broad membership of organizations such as the Sierra Club, the Audubon Society, the National Wildlife Federation, and others.[86] Nor is vicarious value a concept that is unique to environmental preservation. Even those people who never anticipate being arrested may value the constitutional rights provided to criminal defendants.[87]

Finally, natural resources may possess intertemporal value. If society values these resources today, future generations almost certainly will value the preservation of these resources.[88] This generation may regret the extinction of the passenger pigeon because of the actions of past generations and should consider the consequences that our acts may have for people living in the future. Intertemporal value is reflected in federal legislation such as the Wild and Scenic Rivers Act, which directs that "environments shall be protected for the benefit and enjoyment of present and future generations."[89]

These forms of existence value are not only present, but also quite significant. An elaborate EPA-sponsored study of water quality in Pennsylvania's Monangahela Valley surveyed the applicable literature and concluded that "all these studies have found option and existence values to be substantial—greater than half of the total benefits of envi-

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Greenley, Walsh & Young, *supra* note 82, at 667.

86. *See, e.g.*, Krutilla, *Conservation Reconsidered*, 57 AM. ECON. REV. 777, 781 (1967). Krutilla observed: "Subscriptions to the World Wildlife Fund are of the same character. The funds are employed predominantly in an effort to save exotic species in remote areas of the world which few subscribers to the Fund ever hope to see." *Id.* Similarly, "[c]ontributions in time, money and aid to the sea birds damaged in an oil spill is a measure of psychic damage value." *Hazardous and Toxic Waste Disposal Hearings*, *supra* note 49, at 370 (statement of Fred Walgenbach, Senior Resources Economist, California Dept. of Fish and Game); *see also* Comments of the State of Colorado In the Matter of the Proposed Rule for Natural Resource Damage Assessments, at 7 (1986) (source on file with Author) ("non-use values exist for many resources . . . as evidenced by contributions and the efforts of special interest groups (for example, the non-game wildlife tax checkoff in Colorado raises millions of dollars annually)"), *responding to* 53 Fed. Reg. 52,126 to 52,174 (1985).

87. Existence value also may exist for "historical buildings, historical districts, speech dialects . . . and many of the other characteristics that make up the quality of life." McConnell, *supra* note 82, in MANAGING AIR QUALITY, *supra* note 82, at 262. Another author indicates that existence value is central to "goods" such as "the 1957 Chevrolet, various coins, the Mona Lisa, national defense, the Empire State Building, and Beethoven's Fifth Symphony." Talhelm, *supra* note 85, in MANAGING AIR QUALITY, *supra* note 82, at 278. Still others have suggested that "[o]pera buffs may place genuine value on knowing that grand opera is performed live in medium-sized cities like Des Moines." Randall & Stoll, *supra* note 82, in MANAGING AIR QUALITY, *supra* note 82, at 268.

88. Some commentators have argued for a moral imperative to consider the benefits to future generations. Whether or not such a moral duty exists, many individuals now voluntarily recognize the interest of future generations. *See, e.g.*, Heal, *The Intertemporal Problem*, in NATURAL RESOURCE ECONOMICS, *supra* note 83, at 8-11 (discussing the philosophies of Sidgwick and Rawls justifying intertemporal concerns on predominantly utilitarian grounds).

89. 16 U.S.C. § 1271 (1982).

ronmental improvements."[90] Other studies suggest that the existence value of parks may be several times greater than the use value.[91] These findings are consistent with broader-based social science research.[92]

Although research has suggested that existence value may play a significant role in assessing the importance of natural resources, some people remain skeptical. There is no good behavioral test for existence value.[93] Because the concept is demonstrated attitudinally, and not behaviorally, an economist may question how strongly the value is truly held.[94] People who claim that they value educational television often fail to watch or contribute to their local station. For skeptics, the absence of a behavioral test of existence value renders the concept impossible to measure accurately.[95]

In addition to measurement difficulties, some people question the importance of existence value in the context of hazardous substance releases. Most releases do not obliterate a significant, well-known natural resource, but instead cause marginal harms to possibly unrecognized resources, such as water quality or an obscure plant species. While it is understandable how some people value the existence of a given national park, it is less clear how these people value the existence of a relatively small number of plants in a corner of that park.[96] There is evidence,

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90. W. DESVOUSGES, V. SMITH & M. MCGIVNEY, A COMPARISON OF ALTERNATIVE APPROACHES FOR ESTIMATING RECREATION AND RELATED BENEFITS OF WATER QUALITY IMPROVEMENTS 1-11 (Environmental Protection Agency Working Paper No. 230-05-83-001, March 1983).

91. *See* Shaw, *supra* note 54, at 199. Shaw noted: "Total 'preservation value' was found to be many times greater than on-site use value for visibility in the Southwestern park lands, and several times larger than on-site user values for increments to a regional park system in Australia." *Id.* (citations omitted).

92. *See* Gregory, *Nonmonetary Measures of Nonmarket Fishery Resource Benefits*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 374, 377-78 (1987) (stating that "recent social science research emphasizes both the richness and complexity of people's values and the importance of certain intrinsic demands that are associated with desires to maintain future options despite uncertainty (option demands) or simply to preserve valued amenities (existence values)").

93. *See* Talhelm & Libby, *In Search of a Total Value Assessment Framework: SAFR Symposium Overview and Synthesis*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 293, 296 (1987) (stating that "[o]nly through collective action in the public sector, or through voluntary philanthropic activities, do people act in response to existence value, so the value cannot be easily inferred from observable human activities").

94. *See* W. DESVOUSGES & V. SKAHEN, TYPE B TECHNICAL INFORMATION DOCUMENT TECHNIQUES TO MEASURE DAMAGES TO NATURAL RESOURCES 1-7 (Department of Interior CERCLA 301 Project, Sept. 1985) (stating that "economists' understanding of indirect use or existence values is less developed than their understanding of direct use values").

95. *See* Bishop, Boyle & Welsh, *Toward Total Economic Valuation of Great Lakes Fishery Resources*, 116 TRANSACTIONS AM. FISHERIES SOC'Y. 339, 339 (1987) (stating that "doubts remain about whether [existence] values can be measured with sufficient accuracy for policy analysis").

96. *See* Talhelm, *supra* note 85, at 280. Talhelm argues that "in analyzing existence value, the change in quantity . . . is essentially meaningless, since the question at hand is the existence or nonexistence of something." *Id.* Talhelm notes, however, that even small increments of a national park have some uniqueness of their own and therefore may possess independent existence

however, that some degree of existence value applies even to non-unique environments or small increments of environmental quality change.[97]

Existence value has other troublesome aspects. Environmentalists as well as economists may question reliance on existence value for natural resources because under the existence value and use value paradigms, nature's only value is its value to human beings. The human-based, or anthropocentric,[98] valuation can prescribe undue enviroumental destruction.[99] Anthropocentric valuation may lead to "the criminal conceit that nature is to be considered primarily as a source of raw materials and energy for human purposes."[100] One author criticized a benefits analysis of the Delaware River that took into account the benefits accruing to fishermen from an increase in the fish population, and not the benefit accruing to fish, which have no money to sacrifice.[101] This view raises a difficult question. Does wildlife, for example, have no value beyond that to humans, or is wildlife worthwhile—even sacred—on its own terms? The precise source of this value is unclear, but there is a widespread belief that natural things have some value of their own.[102] Increasingly, this view encompasses inanimate elements of na-

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value. *Id.*

97. *See* Randall & Stoll, *supra* note 82, in MANAGING AIR QUALITY, *supra* note 82, at 268-72.

98. *See* Callicott, *Non-Anthropocentric Value Theory and Environmental Ethics*, 21 AM. PHIL. Q. 299, 299 (1984) (stating that "[a]n anthropocentric value theory (or axiology), by common consensus, confers intrinsic value on human heings and regards all other things, including other forms of life, as being only instrumentally valuable, i.e., valuable only to the extent that they are means or instruments which may serve human beings").

99. *See, e.g.*, A. LEOPOLD, A SAND COUNTY ALMANAC at viii (1974) (arguing that "[w]e abuse land because we regard it as a commodity belonging to us"); Weiss, *The Planetary Trust: Conservation and Intergenerational Equity*, 11 ECOLOGY L.Q. 495, 498 n.13 (1984) (noting that human-based valuation has "been criticized as calling in its most extreme form for nature to be maintained only to the extent necessary to support continued human existence"). One commentator calls for a "primary naturalistic" ethic to replace the "secondary, humanistic" concepts implicit in use and existence value. H. ROLSTON, *supra* note 52, at 11.

100. H. ROLSTON, *supra* note 52, at 22. In the perspective of one commentator, it "was presumed that the only interest reflected in the legal system was the human one and that all values were derived from calculations concerning usefulness to humans. It is now time to recognize that wildlife have their own interests . . . ." Favre, *Wildlife Rights: The Ever-Widening Circle*, 9 ENVTL. L. 241, 259 (1979); *see also* Randall, *Total Economic Value as a Basis for Policy*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 325, 326 (1987) (stating that "animals may be seen as 'having a good of their own,' possessing rights, or being the beneficiaries of duties and obligations arising from ethical principles incumbent on humans"). Randall goes on to caution that "it is legitimate to worry that the future of some particular environmental entities may be precarious if they have no claims beyond those that derive directly from human caring." *Id.* at 326 n.4.

101. B. ACKERMAN, S. ROSE-ACKERMAN, J. SAWYER & D. HENDERSON, THE UNCERTAIN SEARCH FOR ENVIRONMENTAL QUALITY 139 (1974).

102. *See, e.g.*, Sagoff, *On Preserving the Natural Environment*, 84 YALE L.J. 205 (1974) (arguing that the American cultural heritage and our basic ideals provide a basis for valuing nature); Tribe, *From Environmental Foundations to Constitutional Structures: Learning from Nature's*

ture, such as rocks, as well as animals.[103] If this view is accurate, then it fundamentally undermines an exclusive reliance on the existence value and use value paradigms.

Making nature's value entirely dependent on human wants and desires creates additional problems. Under existence value, the worth of nature can be manipulated by keeping the public ignorant of ecological damage.[104] For example, anyone familiar with environmental law is aware of the great importance that was placed on the preservation of the endangered snail darter, primarily due to its existence value. Suppose that an endangered cousin of the snail darter lived in other streams, but we were wholly unaware of its existence.[105] Our lack of awareness translates into a lack of existence value for this species.[106] Existence value thus creates a perverse incentive to keep the public ignorant of the characteristics and attributes of the natural world.[107] Moreover, under the existence value paradigm the economically optimal remedy would be to inform the public that a site will be restored and then fail to do so. Fooling the public would capture much of the existence value without expending the costs of actual restoration. While this approach does little to preserve natural resources, it is the most cost-effective alternative.

The occasional practice of "planting" plastic artificial trees in place of real trees provides an even more telling example.[108] Humanity might

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Future, 84 YALE L.J. 545 (1975) (criticizing Sagoff and arguing for a process-oriented recognition of nature's value). Other commentators have offered religious reasons for independently valuing nature. *See* Callicott, *supra* note 98, at 302; Yi-Fu Tuan, *supra* note 1, at 244. No consensus view is apparent. *See generally* Callicott, *supra* note 98 (analyzing the theories for ascribing intrinsic value to nature); Farber, *supra* note 67 (observing the varying approaches and preferring a universal intuitivist emotion that living things possess some value); Higgs, *supra* note 2, at 429 (noting that "[m]any philosophical arguments have pointed to the need for greater concern for nature and for moral systems that stress the moral rights of certain species").

103. *See, e.g.*, Stone, *Should Trees Have Standing?—Toward Legal Rights for Natural Objects*, 45 S. CAL. L. REV. 450, 456 n.26 (1972); *see also* Seed, *Anthropocentrism?*, in ECOPHILOSOPHY 5, 11 (G. Sessions & B. Devall eds. 1983) (noting that "the distinction between 'life' and 'lifeless' is a human construct").

104. *See* Randall & Stoll, *supra* note 82, in MANAGING AIR QUALITY, *supra* note 82, at 270 ("[e]xistence value is, therefore, quite volatile in the face of new information").

105. This supposition is actually quite realistic, as "[n]ew species of darters are being constantly discovered and classified—at the rate of ahout one per year." Tennessee Valley Auth. v. Hill, 437 U.S. 153, 159 n.7 (1978).

106. *See id.* Until its discovery in 1973, the snail darter's existence demand was zero.

107. Under existence valuation, iguorance is made blissful. Indeed, it is not hard to imagine a case in which the optimal economic result will involve keeping natural resources secret so that they may be destroyed without perceived loss. Yet our law (both environmental and constitutional) is based on a contrary assumption, that greater knowledge will benefit the public interest.

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

some day be persuaded to prefer plastic trees to growing trees.[109] Should this occur, existence value would recognize no harm in replacing all of nature with man-made objects. One commentator observes, "[I]f human caring ceased for some reason, environmental values would evaporate and environmental entities would have no moral claims even for continued existence."[110] Intuitively, this result seems wrong.[111] Nature surely must have some value even when humans fail to recognize it.[112] And even if mankind never chooses plastic trees, existence value may overemphasize the big, "glamorous" mammal species at the expense of important smaller creatures and plants.[113]

The above criticisms, however, do not support a contention that existence value is absent or wrong or should be ignored entirely. Rather, they suggest that existence value is an incomplete measure of the total value found in natural resources. As a component of resource value, existence value remains well supported.

C. *Intrinsic Value*

Existence value ignores the inherent worth possessed by natural objects and places no weight on the needs or wants of nature.[114] Some

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109. The obvious popularity of artificial Christmas trees indoors may presage the increased acceptance of "artificial nature." Professor Tribe provides several examples of hotels and other organizations providing simulated natural settings for the pleasure of their visitors. *Id.* at 1316. Perhaps even animals will become unnecessary as technology enhances the quality of dioramas. *See also* Emond, *Co-operation in Nature: A New Foundation for Environmental Law*, 22 OSGOODE HALL L.J. 323, 332 (1984) (stating that "[m]any people do not question the integrity of a society with plastic trees, swimming pools, shopping malls and Disney Worlds").

110. Randall, *supra* note 100, at 326. While this occurrence may seem far fetched, one author has emphasized that

> conscious public choice can manipulate this learning so that the environments which people learn to use and want reflect environments that are likely to be available at low cost. . . . Much more can be done with plastic trees and the like to give people the feeling that they are experiencing nature.

Krieger, *What's Wrong with Plastic Trees?*, 179 SCIENCE 446, 451-53 (1973).

111. Tribe perceives "a growing sense in contemporary industrialized societies that there is in fact something sacred in the natural." Tribe, *supra* note 108, at 1337.

112. *See* Callicott, *supra* note 98, at 300.

113. *See, e.g.*, D. EHRENFELD, *supra* note 7, at 180. The article states:

> It is no coincidence, for example, that among the Australian mammals, the large showy, beautiful, diurnal ones, those like the big kangaroos that might be seen on safari, are zealously protected by conservationists, and most are doing fairly well. Yet the small, inconspicuous, nocturnal marsupials, such as the long-nosed bandicoot and the narrow-footed marsupial mouse, include a distressingly large number of seriously endangered or recently exterminated species.

Id. Obviously, members of the insect kingdom generally will receive little existence value and may, in a case such as mosquitoes, possess negative existence value to many humans.

114. The reader may question whether natural objects have wants. For animate objects, however, the presence of wants is obvious. Animals eat, need affection, and need room to roam. Plants can communicate effectively their wants by turning brown or drooping.

ecologists contend that man must recognize his fiduciary obligation to other species of life.[115] According to modern "deep ecologists," all living things "have inherent value and have moral significance independent of their use by human beings, or even of human existence."[116] Perhaps only recognition of intrinsic value can protect mankind from a future of forests comprised of plastic trees.[117]

It is not necessarily radical to acknowledge some intrinsic value in natural resources. Even the great utilitarian Jeremy Bentham argued that only tyranny denies rights to other animal species.[118] And St. Francis of Assisi reportedly preached to the sparrows and ministered to the wolves.[119] Contemporary philosophical thought, eloquently expressed by George Santayana, suggests that focus on purely human concerns "is inspired by the conceited notion that man, or human reason, or the human distinction between good and evil, is the center and the pivot of the universe. That is what the mountains and the woods should make you ashamed to assert."[120] The thought that nature might possess its own inherent value is both recurrent and powerful, and is reflected in environmental regulation, such as the Endangered Species Act.[121]

Yet those who ascribe to the intrinsic value of nature may themselves oppose the monetary measurement of that value. Some deep ecologists, for example, are uncomfortable with the capitalist system's

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115. Weiss, *supra* note 99, at 498 n.14.

116. Elder, *Legal Rights for Nature—The Wrong Answer to the Right(s) Question*, 22 OSGOODE HALL L.J. 285, 286 (1984). Norwegian philosopher Arne Naess has advocated an awareness of "the equal right [of all things] to live and blossom" into their own unique forms of self-realization. Naess, *The Shallow and the Deep, Long-Range Ecology Movement: A Summary*, 16 INQUIRY 95, 96 (1973) (emphasis omitted). The principles and theories of the deep ecology movement are well summarized in Pollack, *Reimagining NEPA: Choices for Environmentalists*, 9 HARV. ENVTL. L. REV. 359, 401-13 (1985). Central to the paradigm is a rejection of "anthropocentrism, a philosophy holding that things are valuable only insofar as they further human interests." *Id.* at 405. Alternatively, this movement is sometimes referred to as deconstructionist ecology. Luke, *Notes for a Deconstructionist Ecology*, 11 NEW POL. SCI. 21 (1983).

117. Rolston doubts whether we can distinguish between the worth of nature to us and nature's intrinsic worth. Rolston argues that the interests of humans and those of nature are so congruent that they merge. H. ROLSTON, *supra* note 52, at 23. Indeed, he suggests confusingly that "[m]an can manipulate nature to his best interests only if he first loves her for her own sake." *Id.* at 22.

118. J. BENTHAM, AN INTRODUCTION TO THE PRINCIPLES OF MORALS AND LEGISLATION § 1, at 381 (1945).

119. According to legend, the saint asked the birds to be quiet while he delivered a sermon to them and shamed a wolf into repentance. For the tales of Saint Francis of Assisi among the animals, see THE FRANCIS BOOK (R. Gasnick ed. 1980).

120. *See* Sessions, *Ecological Consciousness and Paradigm Change*, in DEEP ECOLOGY 39 (M. Tobias ed. 1985) (quoting Santayana speech at the University of California-Berkeley in 1911).

121. 16 U.S.C. § 1540 (1982); *see* Plater, *supra* note 8, at 824-25 (observing that this "philosophical principle was the most difficult articulated amidst congressional hearings or agency proceedings but reflected an important thread that runs through the endangered species cases").

focus on private property.[122] For these ecologists, relying on economics is "technocratic" and the root of environmental degradation; monetary natural resource damages contribute to the problem rather than the solution.[123] These people refuse to place a monetary value on nature, finding that the very effort demeans the underlying worth of nature.[124] Their refusal leaves the law only two options: Economically valuing natural resources at zero or at infinity. The former alternative inevitably creates an incentive to destroy the resources that the naturalist seeks to protect.[125] The latter is transparently unworkable, as it suggests that the death of a single fly provides grounds for bankrupting the largest corporations.[126] While it is indisputably difficult to assess the monetary value of natural objects, the effort should be made. Otherwise, "treating the problem as an *inherent* incapacity of analysis to incorporate the intangible can only retard the needed development of these important abilities."[127] No persuasive methodologies, however, objectively and reliably ascertain the intrinsic worth of natural resources.

Arguments for granting intrinsic value to natural objects may suffer from more fundamental shortcomings. The intrinsic worth of natural objects is not recognized universally. Aristotle contended that "plants are created for the sake of animals, and the animals for the sake of

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122. *See* Pollack, *supra* note 116, at 406-07.

123. An economist has acknowledged that an "economic approach to valuing natural and environmental resources is explicitly instrumentalist, utilitarian, and homocentric." Randall, *supra* note 100, at 326. To deep ecologists, economics plays at most a "minor role" that is "subordinate to ecological-ethical criteria." Devall, *The Deep Ecology Movement*, 20 NAT. RESOURCES J. 299, 312 (1980). Another leading author counterposes "the desire for monetary reward" in our present technocratic view with "the joy of natural experiences" in his future ecological view. T. O'RIORDAN, ENVIRONMENTALISM 300 (1976).

124. *See, e.g.*, Hedgpeth, *Seven Ways to Obliteration: Factors of Estuarine Degradiation*, in 2 OFFICE OF WATER PLANNING & STANDARDS, U.S. ENVIRONMENTAL PROTECTION AGENCY, ESTUARINE POLLUTION CONTROL AND ASSESSMENT 723, 725 (1975), *quoted in* Halter & Thomas, *supra* note 38, at 8 n.22. The article states:

> An economist who suggests that we set a money value to the fish or amenity that may be destroyed by a power plant, and submit the cost-benefit ratio to a public vote, is proposing an evil and senseless procedure. . . . The idea of assigning a dollars and cents value to life—any life—can lead to the end of life on earth . . . .

Id.

125. *See* Yang, *Valuing Natural Resource Damages: Economics for CERCLA Lawyers*, 14 Envtl. L. Rep. (Envtl. L. Inst.) 10,311, 10,312 (Aug. 1984).

126. Valuing natural resources at infinity also reflects a lack of understanding of nature. As Darwin proved, destruction of some elements of nature is itself natural. When a snake eats a mouse, it is fulfilling nature, not destroying it. Humans themselves are part of nature and should not be hesitant to destroy some other parts of nature when necessary. The desire to protect nature may be best understood as an effort to prevent unnecessary damage.

127. Tribe, *supra* note 108, at 1322 (emphasis in original). True deep ecologists, however, will remain unpersuaded. To them, no incentive system will suffice, as a revolutionary change in people's attitudes is the only answer to environmental degradation.

man."[128] The Book of Genesis plainly sets forth man's "dominion" over the beasts of nature.[129] This view has persisted through Roman law,[130] and the writings of St. Augustine, St. Thomas Aquinas, Kant, and Sir Francis Bacon.[131] John Passmore, a recent philosopher of nature, suggests that if plants, animals, and landscapes were treated like persons and thus part of a moral community, humanity could not civilize the world or even continue to live.[132] The obvious violence and selfishness of the principle of survival of the fittest suggest an inherent immorality of nature itself.[133] A river cannot have moral qualms about drowning a person, so why should a person have doubts about polluting a river?[134] On the other hand, man's greater moral capabilities may impose a correspondingly higher moral duty.[135]

Perhaps the argument over the intrinsic worth of natural resources is largely pointless. Political realists contend that concern for inherent animal welfare lacks public credibility. Whatever the metaphysical basis for nature's intrinsic value, the advocates of this position risk being considered impractical and fuzzy-headed, if not outright crackpots. Their arguments are treated with more ridicule than respect.[136] Perhaps these critics are partly correct. As long as government is making the legal rules and as long as only humans vote, the concerns of nature never will be reflected directly in our nation's governmental policy. Most environmental laws enacted to date focus on protecting people's

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128. 1 ARISTOTLE, POLITICS 1256 (W. Ellis trans. 1962).

129. *Genesis* 1:26. By contrast, however, the well-known biblical story of Noah may be seen as "a symbol of the sanctity and uniqueness of every living species." S. YAFFEE, PROHIBITIVE POLICY: IMPLEMENTING THE FEDERAL ENDANGERED SPECIES ACT 28 (1982).

130. *See* Favre, *supra* note 100, at 243-45 (summarizing this history).

131. *See* J. PASSMORE, MAN'S RESPONSIBILITY FOR NATURE 3-27 (1974) (summarizing this philosophical tradition).

132. *Id.* at 126.

133. *See* Callicott, *supra* note 98, at 301 (noting that "[n]ature notoriously appears indifferent to individual life and/or individual suffering"); Sagoff, *Animal Liberation and Environmental Ethics: Bad Marriage, Quick Divorce*, 22 OSGOODE HALL L.J. 297, 299 (1984) (stating that "[n]ature ruthlessly limits animal populations by doing violence to virtually every individual before it reaches maturity"). John Stuart Mill observed:

> Nature impales men, breaks them as if on the wheel, casts them to be devoured by wild beasts, burns them to death, crushes them with stones like the first Christian martyr, starves them with hunger, freezes them with cold, poisons them by the quick or slow venom of her exhalations and has hundreds of hideous deaths in reserve, such as the ingenious cruelty of a Nabis or a Domitian never surpassed.

J. MILL, NATURE (1950), *quoted in* H. ROLSTON, *supra* note 52, at 39.

134. Humans may have an obvious self-interest in preventing undue water pollution. When human interest is absent, however, concern for the river itself is arguably contrary to the natural state of things. Other natural entities, such as animals, unhesitatingly pollute the river with excrement or other debris.

135. *See* Weiss, *supra* note 99, at 499 n.14.

136. *See* Stone, *supra* note 103, at 455 (noting that "each time there is a movement to confer rights onto some new 'entity,' the proposal is bound to sound odd or frightening or laughable").

interest in the natural environment.[137] Nature's influence on people may be felt in a myriad of ways, but legislation is not among them. Inasmuch as the question is phrased in public policy terms, the answer must come from humans alone.[138]

Indeed, the terminology from a discussion of natural resources seems antithetical to intrinsic valuation. The term "resource" implies usefulness to man.[139] Similarly, "value" may require a human subject to express a preference regarding the natural object.[140] Remove the human subject, and the concept of value loses meaning.[141] The legal valuation of natural resources is a human undertaking that is limited inescapably to human understanding and choice.

Of course, one may be persuaded that nature has intrinsic value for which government should account. Enlightened human preference thus may capture at least a portion of intrinsic value, but the preference is predicated necessarily on an informed human understanding of intrinsic value, not on the value itself.[142] This recognition also helps defeat the antidemocratic and elitist features potentially existing in concepts of intrinsic value.[143]

Therefore, one must rely on Rabelais's description of man as "an animate being born for pacific domination over all the beasts."[144] Man's domination is a positive fact, yet society should acknowledge a normative duty to be pacific and not to be needlessly destructive toward nature. This conclusion may obscure the difference between intrinsic and existence value, but perhaps this result is unavoidable.[145] Moreover, for the purpose of monetizing natural resource damages, drawing precise

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137. The National Environmental Policy Act, 42 U.S.C. § 4331(a) (1982), for example, includes many phrases relating to human needs, such as "the overall welfare and development of man." *Id.*; Tribe, *supra* note 108, at 1341 n.122.

138. *See* Callicott, *supra* note 98, at 305 (stating that "intrinsic value ultimately depends upon human valuers").

139. *See, e.g.*, D. EHRENFELD, *supra* note 7, at 178.

140. *See* Brown, *The Concept of Value in Resource Allocation*, 60 LAND ECON. 231 (1984); Callicot, *supra* note 98, at 305.

141. Brown, *supra* note 140, at 233.

142. *See* Elder, *supra* note 116, at 285 n.4 (1984). Elder observes that "[w]hether or not nonhumans have rights, only humans can be actors in the legal system and it must follow that only human concerns could ever be addressed by it." *Id.* at 291. Rolston goes even further. He suggests that by their nature values are "mental and ideal" and found "only in people." H. ROLSTON, *supra* note 52, at 74. Consequently, natural things may be "carriers of value" identified by humans but are not values in and of themselves. *Id.* at 75.

143. *See supra* notes 66-69 and accompanying text.

144. F. RABELAIS, THE HISTORIES OF GARGANTUA AND PANTAGRUEL 308 (J. Cohen trans. 1986).

145. The concept of value may imply human preference. *See* Vanderpool, *Social Action, Total Economic Value, and Environmental Policy: The Problem of Rationality*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 336, 336 (1987) (suggesting that "individual preferences are the fundamental source of value").

lines between value types is less important than capturing the full import of those values.

D. Achieving a True Valuation of Natural Resources

The above categorization of values illuminates the breadth and complexity of nature's worth. Natural resources may possess all of the values above, each of which has some merit as a measure of the worth of a given resource. None of these value conceptions is without shortcomings, however. Fortunately, the three value types are not exclusive. Use value, existence value, and intrinsic value are analytically complementary. Insofar as the measurement of each value type can be isolated effectively, the resulting damage figures contain no duplication. Perhaps the true value of a given object is the additive total of its use, existence, and intrinsic values.[146]

Serious problems prevent the achievement of this true valuation. There is no consensus over the legitimacy of considering intrinsic, or even existence, value in measuring natural resource damages. Moreover, while the Author is inclined to acknowledge some existence and intrinsic values in nature, merely recognizing a value type is useless for the purposes of valuation absent a method for quantifying its magnitude in dollars. The following section describes established methods of quantification.

IV. Methods for Monetizing Damage to Natural Resources

Economists have developed several divergent methods for monetizing injuries to natural resources. Although no procedure is accepted universally as a perfect methodology, all of these methods have some merit and promise for measuring the monetary value of natural resources.[147] The four leading procedures for valuing natural resource damages are: (a) restoration and replacement costs, (b) market valuation, (c) behavioral use valuation, and (d) contingent valuation. This section summarizes the various methodologies, reviews the capabilities

146. Even the Department of the Interior, which rejects use of existence and intrinsic values in its natural resource damage assessment regulations, "agrees that, in principle, option and existence values may exist for natural resources and that these would he additive to use values." 52 Fed. Reg. 9042, 9083 (1987) (Type A damage assessment procedures); *see also* 51 Fed. Reg. 27,719 (1986) (stating that "[o]rdinarily, option and existence values would he added to use values") (Type B damage assessment rule).

147. All the valuation techniques discussed here should improve with further study. At the present time, "valuation of environmental amenities" is a "major preoccupation of environmental economists," in part because of renewed emphasis on cost-benefit analysis. Smith, *Introduction to Part I*, in 3 Applied Micro-Economics, *supra* note 70, at 3. Increased need for valuation under Superfund and other damage recovery authorities should create an even greater incentive to study and enhance valuation methodologies.

and deficiencies of the primary methods proposed, and considers their use in practice.

A. *Restoration and Replacement Cost*

When natural resources are damaged, one obvious policy option is to restore or replace them. When possible, restoration can be done on the site where the resources were harmed. When on-site restoration is impossible, the state may choose to acquire and protect comparable land elsewhere, where natural resource values are roughly comparable to those on the damaged site. When restoration is effective, the remedy at least partially can cure the injuries to use value (by providing repaired resources for recreational use), existence value (by restoring the existence of any destroyed resources), and intrinsic value (by reproducing intrinsically valuable natural resources). If a state were to select this option, then the correct measure of natural resource damages would be the cost of their restoration or replacement.

Strictly speaking, restoration and replacement are not means of valuing natural resources. Restoration or replacement occurs regardless of the value of the resources. Some people argue that certain resources may not be worth the cost of their restoration. Automatic use of restoration cost values resources at infinity by ignoring this cost-benefit equation.[148] Restoration cost, therefore, circumvents the question of resource valuation. Nevertheless, restoration cost is widely regarded as one appropriate measure of natural resource damages and was the presumptive measure of damages under the original Clean Water Act. Furthermore, restoration cost often is easily determinable because biological supply firms already provide price information for many flora and fauna natural resources.[149]

While restoration cost seems simple to apply, several practical questions about the procedure remain unanswered. The baseline to which resources are to be restored must be settled. The state might require the polluter to restore nature to the conditions prevailing immediately before the damage causing release, or to a rough approximation of

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148. *See* NOAA REPORT, *supra* note 80, at 48 (arguing that "the problem of using replacement cost as a measure of the lost welfare is that it reflects only the supply side of natural resource uses. Since the value of any commodity is determined by the interaction of demand and supply, the replacement cost method is deficient by definition"); W. DESVOUSGES & V. SKAHAN, *supra* note 94, at 2-43 (stating that a "basic objection to replacement cost is that it is an arbitrary valuation of natural resources that may bear little relationship to true social values"); Yang, *supra* note 125, at 10,314 (discussing the distinction between cost and value).

149. W. DESVOUSGES & V. SKAHEN, *supra* note 94, at 2-43. While actually restoring a site often may be quite expensive, the determination of damages is relatively simple and inexpensive under the restoration cost procedure. *See* NOAA REPORT, *supra* note 80, at 38.

a priori conditions.[150] The state also might require that restoration go beyond the original, possibly polluted, conditions to create as natural an environment as possible.[151] The procedures for restoration also are debatable. Can trees be restored by planting seeds or should the government find and replant grown trees? To what degree should restoration plans account for the environment's own natural tendency to restore itself over time?

Even if one can answer these questions in theory, ecologists dispute the practicality of restoration. Because wildlife systematics and ecology is a complex science, government may be unable to reproduce preexisting environmental conditions. Destruction of an ecosystem may be "equivalent to removing the results of an ecological succession that represents in many cases centuries of natural processes."[152] When prospects are promising, it may take several generations for the ecosystem to resemble superficially its original condition, while in other circumstances complete restoration may be altogether impossible.[153] Serious environmental damage may be irreversible; restoration would be a futile remedy that might exacerbate the environmental damage that it is intended to correct.[154] Restoration ecology is still a relatively new sci-

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150. *See* Comments of the Chem. Mfrs. Ass'n, *supra* note 14, at 13. The Chemical Manufacturers Association has argued that the restoration baseline should be the use value of the preexisting land—government should not require restoration of resources that provided little or no public use. *Id.*

151. *See* Note, *Theories of State Recovery Under CERCLA for Injuries to the Environment*, 24 NAT. RESOURCES J. 1101, 1108 (1984). This article states: "A related problem with the restoration standard is the difficulty of pinpointing the 'health' of the pre-pollution environment. The affected area may already have been degraded by previous pollution . . . ." *Id.*

152. J. KRUTILLA & A. FISHER, THE ECONOMICS OF NATURAL ENVIRONMENTS 43-44 (1975).

153. *Id.* at 44. At present, "[a]ctual cases of totally rebuilt ecosystems are still rare and will remain so." D. EHRENFELD, *supra* note 7, at 187; *see also* Wood, *Requiring Polluters to Pay for Aquatic Natural Resources Destroyed by Oil Pollution*, 8 NAT. RESOURCES LAW. 545, 598 (1976). Wood states:

> The technology available to remove oil and to restock plant and animal communities is very limited at present, and development of such a technology would be a long-range undertaking . . . . In most instances, the recovery of an ecosystem after an oil spill would occur, if at all, only through the slow processes of natural regeneration.

Id. Between 1983 and 1985 the Kesterson National Wildlife Refuge in California was contaminated severely by agricultural run-off, resulting in many bird casualties. Notwithstanding the Interior Department's cleanup and restoration efforts, a recent study expressed concern that "the Kesterson pond area may never be suitable for wildlife." GOVERNMENT ACCOUNTING OFFICE, WILDLIFE MANAGEMENT: NATIONAL REFUGE CONTAMINATION IS DIFFICULT TO CONFIRM AND CLEAN UP 28 (July 1987). Even after two centuries of recovery, nature still may show the effects of man's traumatizing action. *See* Sierra Club v. Morton, 405 U.S. 727, 751 n.8 (1972) (Douglas, J., dissenting) (quoting ecologist Aldo Leopold on the effects of farming on nature's balance).

154. *See* Rorslett, *Some Ecological Implications of Freshwater Systems Restoration*, in THE BREAKDOWN AND RESTORATION OF ECOSYSTEMS 347 (M. Holdgate & M. Woodman eds. 1978) [hereinafter RESTORATION OF ECOSYSTEMS] (finding that attempts to restore a Scandinavian lake damaged by water pollution actually "make the conditions in the lake worse" because "the restoration

ence,[155] however, and in many circumstances at least proximate restoration is practicable.[156]

Even to the extent that restoration is possible, some environmentalists question its value. Restoration of a destroyed environment is like a reproduction of a destroyed Monet painting—the new product may be beautiful and similar to the original, but it is still inauthentic and inadequate as a replacement.[157] To some naturalists, the concept of restoring natural environments is a close cousin to planting plastic trees.[158] Current philosophies of restoration ecology, however, disclaim a desire to replicate precisely prior ecosystems and find worth in re-establishing a new, self-sustaining ecosystem, regardless of its similarity to the original.[159]

The greatest objection to restoration is probably the enormous cost that the process sometimes entails. The cost of attempting restoration can vastly exceed the true value of the resources being restored.[160] The First Circuit Court of Appeals confronted this problem in *Puerto Rico v. S.S. Zoe Colocotroni*,[161] in which a Puerto Rico statute authorized natural resource damages resulting from an oil spill.[162] The district

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plans are working against the ecosystem instead of with it").

155. *See* Aber & Jordan, *Restoration Ecology: An Environmental Middle Ground*, 35 BIOSCIENCE 399 (1985). Aber and Jordan believe that this science can contribute to humankind's knowledge of ecosystems and argue that a "holistic approach to restoration" can give human activity "a positive effect on the landscape." *Id.*

156. *See generally* 1 & 2 ECOLOGY AND RECLAMATION OF DEVASTATED LAND (R. Hutnik & G. Davis eds. 1969) (published papers on the effect of restoration experiments); RESTORATION OF ECOSYSTEMS, *supra* note 154. Indeed, restored land may be "better" than the original in the sense of improved habitat for a variety of species. *See* Bradshaw, Humphries, Johnson & Roberts, *The Restoration of Vegetation on Derelict Land Produced by Industrial Activity*, in RESTORATION OF ECOSYSTEMS, *supra* note 154, at 273.

157. *See* J. KRUTILLA & A. FISHER, *supra* note 152, at 45. The two writers argue that "[e]ven the most painstaking application of modern scientific-technological resources would provide replicas of the original that would satisfy the recreational interests of only the less discriminating clientele." *Id.*

158. *See id.* at 46. Studies have shown various "submarkets" of wilderness consumers, among which are "purists" who object to any human efforts to restore natural environments. *Id.*

159. *See, e.g.*, Johnson & Bradshaw, *Ecological Principles for the Restoration of Disturbed and Degraded Land*, in 4 APPLIED BIOLOGY 149 (T. Coaker ed. 1979) (stating that the objective is not "complete reinstatement of the original environment as it was before disturbance" but "restoration of a properly functioning soil/plant ecosystem"). These authors further note that effective restoration of functioning ecosystems "is a considerable challenge, but the success of so many schemes in so many different areas of the world indicates that it is a challenge that can be met . . . ." *Id.* at 194.

160. NOAA REPORT, *supra* note 80, at 47; Yang, *supra* note 125, at 10,315.

161. 628 F.2d 652 (1st Cir. 1980). The *Zoe Colocotroni* was carrying oil in the Caribbean and grounded on a reef outside Puerto Rico. To free the tanker the ship's captain ordered the release of 1.5 million gallons of oil into the sea. This oil floated onto a beach, destroying mangrove forests and indigenous wildlife, such as fish, shrimp, snails, crabs, and tiny invertebrate organisms. *See id.* at 657-61.

162. *See* P.R. LAWS ANN. tit. 12, § 1131 (29) (1978) (authorizing the Commonwealth's recov-

court granted over six million dollars in damages, using restoration cost as the measure of damages.[163] While affirming the use of restoration costs in many instances, the circuit court limited restoration to instances in which a "reasonable and prudent sovereign or agency" would authorize it.[164] The circuit court concluded that the six million dollar restoration was "disproportionately expensive" and inappropriate for use in valuing damages.[165] One might expect a similar conclusion from a suit brought by the State of Colorado, in which the State has alleged 1.8 billion dollars in restoration cost damages from soil and groundwater contamination.[166] There is widespread recognition, even among environmentalists, that restoration is sometimes too expensive or ineffective to serve as a remedy for harms done to natural resources.

Given these problems with the restoration remedy, the concept of site replacement has obvious appeal. Rather than restore the damaged site, a government simply may purchase a comparable site and transform it into a state park or wildlife preserve. This alternative was suggested by the court in *Zoe Colocotroni*,[167] and adopted by the court in *United States v. Board of Trustees of Florida Keys Community College*.[168] Confronted with evidence that restoration of the damaged site had limited feasibility, the court ordered that a comparable environmental area be created from property already owned by the defendant college.[169] Although the polluter did not purchase a new site in this case, the result embodies the concept of replacement as a remedy for lost natural resources. In some circumstances, replacement may best fulfill the objectives of Superfund.[170]

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ery of "damages caused to the environment and/or natural resources").

163. Puerto Rico v. S.S. Zoe Colocotroni, 456 F. Supp. 1327 (D.P.R. 1978). The court reached this figure by obtaining estimates for the costs of replanting damaged mangrove trees and purchasing replacement animals for those destroyed. The latter damages included six cents for each of the thousands of small invertebrate organisms killed by the oil spill. *Id.* at 1344-45.

164. *Zoe Colocotroni*, 628 F.2d at 675.

165. *Id.* at 675-77.

166. *See* Note, *supra* note 41, at 222 (noting that "[i]t is highly unlikely that the plaintiffs will he able to demonstrate over a billion dollars worth of value in the soil and groundwater of the Rocky Mountain Arsenal"). The district court hearing the case, however, denied a motion to strike the alleged damages. United States v. Shell Oil Co., 605 F. Supp. 1064, 1085 (D. Colo. 1985).

167. *Zoe Colocotroni*, 628 F.2d at 676 (stating that "[a]lternatives might include acquisition of comparable lands for public parks or, as suggested by defendants below, reforestation of a similar proximate site").

168. 531 F. Supp. 267 (S.D. Fla. 1981). In this case the college had constructed an erosion barrier of rocks that necessitated filling a natural slough. This process destroyed a small (one-half acre) habitat for bottom vegetation used by developing fish and wildlife. *Id.* at 269-72. The court found this very small area to be "important to the Florida Keys as a whole." *Id.* at 272.

169. *Id.* at 275.

170. *See* Note, *supra* note 151, at 1115 (stating that "[s]tate citizens may well derive greater benefit from a newly-created public park than from a lengthy process of restoration of an area that provided dubious benefit in the first place").

Replacement has appeal as an easily measured and effective remedy, but the concept has serious limitations that may prevent its widespread application. When a polluter destroys unique resources, replacement is an incomplete solution. Even when resources can be replaced perfectly, the concept of replacement disregards the possibility that both the destroyed resources and the newly acquired replacement resources should be protected and preserved. Because the two sets of resources are not exclusive, the replacement remedy seemingly licenses the destruction of natural resources as long as comparable resources exist elsewhere. As a consequence, the replacement remedy may restore lost use value (by providing persons with a comparable recreational outlet), but fails to remedy the lost existence and intrinsic value of destroyed natural resources.

Thus, the available methods of restoration and site replacement have shortcomings as methods for valuating natural resources. Nevertheless, these remedial options do have attractive features, and many analysts regard them as the optimal response to natural resource damages under Superfund. The basis for this view is discussed in detail in the subsection B of Part V.

B. Market Valuation

A readily available and appealing approach to valuing natural resources uses existing free market value as the measure of damages. In an economic sense, value and market price are virtually congruent.[171] Market transactions demonstrate human value preferences through revealed behavior. For at least some natural resources, a court can determine value by consulting a price list. For example, commercial hatcheries provide an established price for certain species of fish. Even if no market exists for a resource, a court can measure damages by the reduction in land value from the loss of the resource. Courts commonly use this approach for measuring damages on privately held real estate.[172] Diminution in property value following the destruction of natural resources yields the free market's evaluation of the economic harm caused by a hazardous substance release. When such a release harms the production of goods or services, lost profits are a market value measure of damages. Industry argues strongly for the use of market value in monetizing damages to natural resources.

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171. *See, e.g.*, Brown, *supra* note 140, at 239 (noting that "neoclassical economists equate value with competitive market price").

172. *See* W. DESVOUSGES & V. SKAHEN, *supra* note 94, at 2-8. The Interagency Land Acquisition Conference has developed procedures for valuing public lands that could be used under Superfund. *Id.*

Market valuation is easy to measure and promotes economic efficiency.[173] In part for these reasons, loss of property value is customarily the common-law measurement for damages to private natural resources.[174] For injuries to animals, damages have been set historically at the animal's market value.[175] Common-law decisions addressing damage to productive trees customarily use diminution in land value as the measure of damages.[176] Market value was used recently when the State of Washington sought recovery under *parens patriae* for damages to a public salmon fishery.[177]

Market valuation also carries special indicia of reliability. Unlike other approaches in which survey takers ask individuals for their hypothetical valuation of natural resources, the market considers only those who put their money where their mouth is.[178] The market measures changes in the availability of natural resources and the corresponding changes in the actions of individuals. The resulting economic effects are directly observable and measurable. In addition, subsequent marketplace transactions constantly test and validate given values. The ability to verify valuations, a behavioral attribute, makes the market especially reliable.[179]

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173. *See, e.g.*, Fedkiw, *supra* note 66, at 347 (noting that "[m]arket values constitute the single largest and most widely used information resource or data hase in our society"); *id.* at 350 (stating that "[m]arket valuation will produce an abundant data base that will permit more useful economic analysis"). *But see* Glass & Muth, *supra* note 84, at 384 (declaring that "price information is available for only a few kinds of fishery-related activities, such as commercial fishing and, even in these cases, data are often inadequate").

174. *See* RESTATEMENT (SECOND) OF TORTS § 929(1)(a) (1977) (traditional rule uses diminution of property value as measure of damages). An exception exists when restoring the property would cost less than the lost property value, in which case restoration cost is the measure of damages. *See, e.g.*, Big Rock Mountain Corp. v. Stearns-Roger Corp., 388 F.2d 165, 168-69 (8th Cir. 1968).

175. *See, e.g.*, Arkansas Valley Land & Cattle Co. v. Mann, 130 U.S. 69, 79 (1889). *See generally* C. MCCORMICK, HANDBOOK ON THE LAW OF DAMAGES 165 (1935).

176. *See generally* Annotation, *Measure of Damages for Destruction of or Injury to Fruit, Nut, or Other Productive Trees*, 90 A.L.R.3d 800 (1979).

177. *See* State Dep't of Fisheries v. Gillette, 27 Wash. App. 815, 823, 621 P.2d 764, 768 (1980) (upholding the measure of damages based partly on "the market value of the fish" adjusted for other public benefits).

178. *See, e.g.*, Fedkiw, *supra* note 66, at 350.

179. *See* Brown, *supra* note 140, at 239. Other virtues of market price based valuation are reviewed by Brown:

> Competitive market price has four useful features from the standpoint of public decision-making. First, prices exist for many goods, putting those goods on an approximately comparable basis. Second, price is a social phenomenon, resulting from exchanges involving many individuals. Third, it incorporates scarcity into the expression of value; that is, it results from individual supply and demand that are expressed by actions (not mere words), which in turn are constrained by real-world scarcity. Fourth, it gives the relative value of a small change in total supply.

Id.

Reliance on market valuation also contributes to economic efficiency. Efficiency is valuable because it should increase the welfare of all members of society.[180] Market price values equally both public resources and private resources. If private resources are valued by a market price, but comparable public resources receive a different valuation, then economic activities may be distorted. For example, if public trees were valued more highly than privately owned trees, the result would be to realign private behavior to increase the destruction of private natural resources, rather than those held by the public trust. An efficient market avoids this unintended incidental result. Similarly, the free market values industries more accurately by taking into account all externalities. For example, if the external social costs of a business or activity are all included in damages through some "market value" plus methodology, but the external social benefits of the activity are ignored, then the economic and social cost-benefit equation will be skewed unfairly against the business or activity.[181] Consistent reliance on free markets avoids such an outcome. Thus, one commentator contends that "market valuation under free market conditions contributes to both the national efficiency and to individual, and, in a limited way, to social equity objectives of our democratic society."[182]

Market valuation has obvious appeal for appraising the worth of natural resources. The market value procedure has been demonstrated to be practical, and maintains consistency between the valuation of pri-

180. *See* Fedkiw, *supra* note 66, at 348 (stating that "[u]nder competitive conditions, market valuation leads to maximizing net national welfare"). This concept typically goes hy the name of "*Pareto* optimality." In a *Pareto* optimal economic equilibrium, it is impossible to improve the conditions of one person without consequently injuring the conditions of another person. Because this equilibrium is not and may never be present, the concept is used typically as a test for policy changes. If the overall benefits of a policy exceed its overall costs, that policy offers "potential *Pareto* improvement." Economists often consider reliance on private markets and economic efficiency to offer potential *Pareto* improvement, moving our economy in the direction of optimality and thereby improving the welfare of society as a whole. The use of economic efficiency in natural resource valuation under Superfund is supported in *Developments in the Law, supra* note 11, at 1569-73. Other economists, however, criticize reliance on *Pareto* optimality or efficiency in public policy decisionmaking. *See, e.g.*, C. COOPER, *supra* note 78, at 46 (observing that imperfect information may cause efficiency concerns to produce "environmentally dangerous policies"); Randall, *Valuation in a Policy Context*, in NATURAL RESOURCE ECONOMICS, *supra* note 83, at 170-75 (noting that efficiency takes no account of ethical considerations). For these economists, reliance on potential *Pareto* improvement is even more questionable. *See, e.g.*, Randall, *supra* note 100, at 331 (noting that, unlike the market, the concept of potential *Pareto* improvement does not allow for voluntary exchange or actual compensation of those injured by a policy change).

181. This skewing is a problem with the traditional environmentalist demand for "internalization" of negative externalities associated with a business. While the goal is sensible, it ignores the possibility that a business may create positive externalities (through employment, for example), which are likely to be ignored by law and economics. Internalization of externalities, therefore, does not necessarily yield greater economic efficiency.

182. Fedkiw, *supra* note 66, at 348.

vate and public natural resources. As long as the United States has a capitalist market economy, courts may prefer market valuation. This preference is a presumption at best, however, and market valuation may be inapplicable to public natural resources for a number of reasons.

For some naturalists, particularly those who find some intrinsic value in nature, complete reliance on market valuation is illegitimate or even immoral. A remarkable historic example illustrates this point well. Certain rare butterflies lived only in isolated corners of Africa. Reportedly, unscrupulous collectors would collect a few specimens and then burn the surrounding grassland to destroy as many others of the species as possible, thereby enhancing the uncommonness of their own collections and increasing their value.[183] Thus the free market created a direct incentive to destroy an endangered species. This natural response to market incentives obviously is contrary to the goals of applicable environmental legislation and illustrative of the shortcomings of market valuation.[184] Senator Max Baucus of Montana, a critic of market valuation, has observed that it "is inconceivable that any reasonable person would suggest measuring the [value of the] Grand Canyon or Yellowstone Park on the basis of a land appraisal."[185]

Common-law precedents for private or public damages do not compel valuation based on the market. The common law does not use market value as the exclusive measure of private natural resource damages. In many tort cases, for example, a court is more likely to use the cost of restoration or repair as a measure of damages.[186] In circumstances when property is peculiarly valuable to the owner, the owner may recover costs greater than the loss of market value.[187] For example, the aes-

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183. *See* H. ROLSTON, *supra* note 52, at 21.

184. *See* Yuhnke, *The Importance of Visibility Protection in the National Parks and Wilderness*, in MANAGING AIR QUALITY, *supra* note 82, at 297. Yuhnke described grand vistas as "places where Americans can touch the past and feel a part of the land as God created it and feel communion with the Creator Himself. Such values cannot be measured in the marketplace." *Id.*

185. 132 CONG. REC. S14,931 (daily ed. Oct. 3, 1986) (statement of Sen. Baucus).

186. *See* Board of Educ. v. Kentucky Dept. of Highways, 528 S.W.2d 657, 659 (Ky. 1975). The Supreme Court has cautioned against making a "fetish" of market value, "since that may not be the best measure of value in some cases." United States v. Cors, 337 U.S. 325, 332 (1949) (involving "just compensation" valuation of a ship taken by the government).

187. *See, e.g.*, United States v. Certain Land in Borough of Brooklyn, 346 F.2d 690, 694 (2d Cir. 1965) (stating that the market value test should be abandoned "when the nature of the property or its uses produce a wide discrepancy between the value of the property to the owner and the price at which it could be sold to anyone else"); Maloof v. United States, 242 F. Supp. 175, 184 (D. Md. 1965) (quoting the RESTATEMENT OF TORTS § 929 comment b (1939), "where a building such as a homestead is used for a purpose personal to the owner, the damages ordinarily include an amount for repairs, even though this might be greater than the entire value of the building"); Regal Constr. Co. v. West Lanham Hills Citizen's Ass'n, 256 Md. 302, 305, 260 A.2d 82, 84 (1970) (stating that "the measure of damages is the cost of restoration, even though this may be greater

thetic value of trees may justify an award in excess of lost market value.[188] Analogously, market value may not be an adequate basis for compensation when property is unique or seldom traded.[189] Damage to public natural resources may fall within those categories in which market value is an inappropriate test of value.

Courts have addressed these issues most directly when valuing public property taken by the eminent domain authority of another public entity. Typically, these courts look beyond market value and grant restoration or replacement costs. On some occasions, courts have rejected market value because public facilities generally are not bought and sold on the open market.[190] Courts also reject market value when government has a duty to provide the services found on the land to be taken. In these cases, paying the costs of restoration or replacement may be necessary to preserve government functions. Even if the land has some identifiable market value, damages to public property may be measured by the amount necessary "in order to restore the public agency to its prior state of efficiency in discharging its public functions."[191] When a government may have both a statutory responsibility

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than the entire value of the property"); City of San Antonio v. The Congregation of Sisters of Charity of the Incarnate Word, Inc., 404 S.W.2d 333, 337 (Tex. Ct. App. 1966) (declaring that a plaintiff is not "limited to a recovery under the market value test if the evidence shows that such test will not adequately compensate the owner for special damages suffered").

188. *See, e.g.*, Farny v. Bestfield Builders, 391 A.2d 212, 214 (Del. Super. Ct. 1978); Barker v. Publishers Paper Co., 78 N.H. 571, 574, 103 A. 757, 759 (1918) (stating that "for cutting and carrying away shade trees, the owner is not limited to their value for lumber" but may recover "what their aesthetic value was"); Huber v. Serpico, 71 N.J. Super. 329, 345, 176 A.2d 805, 813 (App. Div. 1962) (declaring that "[s]ound principle and persuasive authority support the allowance to an aggrieved landowner of the fair cost of restoring his land to a reasonable approximation of its former condition, without necessary limitation to the diminution in the market value of the land, where a trespasser has destroyed shade or ornamental trees or shrubbery having peculiar value to the owner").

189. County of Suffolk v. C.J. Van Bourgondien, Inc., 47 N.Y.2d 507, 511, 392 N.E.2d 1236, 1238, 419 N.Y.S.2d 52, 54 (1979).

190. *See, e.g.*, United States v. Certain Property in Borough of Manhattan, 403 F.2d 800, 802-03 (2d Cir. 1968); *see also* County of Cook v. City of Chicago, 84 Ill. App. 2d 301, 306, 228 N.E.2d 183, 186 (1967) (stating that school property in question "has no market value in a legal sense" (citation omitted)); New Jersey State Highway Comm'r v. Board of Educ., 116 N.J. Super. 305, 319, 282 A.2d 71, 78 (Law Div. 1971) (stating that "when school property is condemned it is not possible to determine fair market value because there are no comparable sales"); City of Tulsa v. Mingo School Dist. No. 16, 559 P.2d 487, 493 (Okla. Ct. App. 1976) (concluding that "[b]ecause of its unique nature, such [public] property is rarely sold in the open market"); Pennsylvania Gas & Water Co. v. Pennsylvania Turnpike Comm'n, 428 Pa. 74, 83, 236 A.2d 112, 117 (1967) (declaring that "there simply does not exist a market, in the classic sense, for reservoir property"); Salt Lake City Corp. v. Utah Wool Pulling Co., 566 P.2d 1240, 1242 (Utah 1977) (stating that "there were no sales on the open market of water or water rights in the aquifer basin in which defendant's property was located, and thus no market value in the usual sense of the term").

191. *New Jersey State Highway Comm'r*, 116 N.J. Super. at 319, 282 A.2d at 78; *see also Certain Property in Borough of Manhattan*, 403 F.2d at 804 (use restoration or replacement cost when "the structure is reasonably necessary for the public welfare"); *County of Cook*, 228 N.E.2d

under legislation such as the Wilderness Act and a public welfare concern in preserving natural resources (as recognized in the *parens patriae* cases),[192] restoration or replacement cost may be the appropriate measure of damages at common law.

Market valuation may not reflect the true value of damaged public natural resources. Sometimes, market value may overstate the real level of damage. When substitute renewable resources are readily available, the market price of the destroyed natural resource may be greater than the true societal loss.[193] Market price also includes the cost of hunting or otherwise harvesting resources, which should be deducted from market price before estimating the social loss from resource destruction.[194] More commonly, however, market valuation will understate the true societal loss from damages to natural resources. Only about five percent of some resources, such as plants and animals, possess an established economic value.[195] When a surrogate market does exist, such as commercial fishing, the resultant values may represent incompletely the value of resources to the overall public.[196] For example, the presence of fish may have greater utility to recreational sports anglers than to commercial fishermen operating in the market.[197] In addition, the value of

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at 187 (use replacement cost for public school property); *Mingo School Dist. No. 16*, 559 P.2d at 494-95 (use replacement cost for public school property); Texas v. Waco Indep. School Dist., 364 S.W.2d 263, 266 (Tex. Civ. App. 1963) (noting that "proper measure of damages is what is reasonably necessary to restore the . . . land and facilities to the same or reasonably equal utility for high school purposes").

192. *See supra* notes 38-41 and accompanying text.

193. *See* NOAA REPORT, *supra* note 80, at 27-28. The Report states:

> Economic theory further postulates that, given the existence of opportunity cost, when existing employment disappears, inputs will move toward new employment opportunities. Then, from a national perspective, a redistribution of expenditure cannot be construed as loss since the inputs logically will follow the emergence of the demand elsewhere. For example, when beach A is polluted the tourists may move to beach B in a neighboring state, redistributing their expenditures from businesses near beach A to the ones near beach B. If the now idle inputs at beach A will move to beach B to absorb the rise in demand, there should be no social loss.

Id.

194. *See, e.g.*, Carr v. United States, 136 F. Supp. 527 (E.D. Va. 1955) (stating that the damage of oyster kill to oyster farms must be reduced by the cost of "tonging" and marketing the oysters); *see also Developments in the Law*, *supra* note 11, at 1571-72 (arguing that "[c]ourts should take care to distinguish between the market value of resources in the wild and the market value of the 'harvested' good").

195. *See* A. LEOPOLD, *supra* note 9, at 229. Leopold suggests that the market "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." *Id.*; *see also* Note, *supra* note 151, at 1112 (stating that "[r]elatively few resources are commercially exploited").

196. Randall, *supra* note 100, at 326.

197. For example, long-term contracts or a buyers' market can prevent resource damages from affecting the price of real estate. NOAA REPORT, *supra* note 80, at 41. Alternatively, the price of land already may be discounted in expectation of a future hazardous substance release. *Id.*

fish to commercial fishermen may substantially exceed their return in their business.[198] Land prices may not reflect resource damages because of market imperfections.[199] Insofar as public land has different purposes from privately held land, it may be unrealistic to expect costs or values to be the same.[200] Markets are simply unaccustomed to pricing nonexclusive goods, which theoretically may be "possessed" by all members of a society simultaneously.

More significantly, market valuation fails to account for several types of natural resource value. The market comes closest to approximating use value, but even there market valuation has shortcomings. State ownership of natural resources may distort the free market and the valuations it yields.[201] There is no established market in bird watching, for example, and the market value of given birds may not reflect even the use value of this recreational activity.[202] The social value of the famous Lone Cypress of Monterey Peninsula cannot be reduced to its price as lumber. The lack of a functioning market in publicly held natural resources is a major impediment to reliance on market valuation. Furthermore, even if an effective market existed for the public utilization of natural resources, the market would undervalue the true use value of these resources. Market prices fail to include the consumer surplus from a transaction,[203] which may represent a major component of

198. *See id.* at 44. Intuitively, the effect of a hazardous substance spill on land used by a souvenir seller will be different from its effect on a wildlife preserve.

199. McConnell, *Values of Marine Recreational Fishing: Measurement and Impact of Measurement*, 61 AM. J. AGRIC. ECON. 921, 921 (1979); *see also* Smith, *Satisfaction Bonus from Salmon Fishing: Implications for Economic Evaluation*, 57 LAND ECON. 181, 189 (1981) (stating that "[c]omparisons of commercial and recreational fishing value usually show angling is more valuable").

200. *See* Glass & Muth, *supra* note 84, at 381 (stating that "commercial fishermen capture a return beyond that which is reflected in net revenues because they gain the satisfactions of participation itself"); Smith, *supra* note 199, at 188 (declaring that the "pleasure factor stimulates additional fishing effort despite negative economic returns"); *id.* at 190 (majority of salmon fishermen had "gross returns less than 'out of pocket' costs" yet remain in business).

201. Although some parks charge entrance fees, typically they are not motivated by a desire to maximize profits. *See supra* notes 207-09. As a consequence, private parks may be unable to compete with those run by the government, and a market for recreational use of wildlife has never developed fully.

202. It would be disingenuous to suggest that the market value of eagles, if one even exists, captures the value of those animals to naturalists. Nor can the value of a tree be reduced to its worth as marketable timber. *See* Leepers, Norbury & Kaiser, *Multiple-Use Resource Economics: Theory and Planning Applications*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 367, 367 (1987) (stating that "[f]orest lands provide a wide variety of social benefits such as recreation, aesthetics, and wildlife in addition to the traditional benefits attributed to timber").

203. *See Developments in the Law*, *supra* note 11, at 1571 n.37. In the optimal operation of the free market, prices are set at the level at which the marginal buyer is willing to pay and the marginal seller is willing to sell. As a consequence, some buyers will be able to purchase a good for less than they would be willing to pay. The difference between the sale price and the price that the consumer would have been willing to pay is known as the consumer surplus. This difference repre-

use value.[204] Nor can market value encompass positive externalities of public resources, such as contributions to the local private economy.[205] Market valuation fails almost completely to capture the existence value and intrinsic value of damaged natural resources.[206] Such incompleteness does not yield even the free market goal of fully internalizing an external cost.

C. *Behavioral Use Valuation*

Theoretically, public natural resources could be valued through the market if government established realistic user fees for these resources. Indeed, policy analysts have made strong arguments for greater use of these fees,[207] but this option has been largely rejected in favor of noneconomic values.[208] Nor are our public parks and other resources managed with an eye to market prices or maximizing profit.[209] In short,

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sents a clear benefit to some purchasers that presumably should be considered when valuing resources. *But see* Fedkiw, *supra* note 66, at 348-49 (criticizing use of consumer surplus measures for natural resource damages).

204. *See* W. DESVOUSGES & V. SKAHEN, *supra* note 94, at 2-6 (indicating that consumer surplus may be more significant for typical public goods than for ordinary privately marketed products).

205. *See, e.g.*, Usher, *Ontario Lake of the Woods Fishery: Economic and Social Analysis*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 352, 358 (1987) (stating that Ontario receives millions of dollars of benefit from recreational fishing).

206. This point could be argued. On occasion, conservation organizations have raised funds to purchase land in order to prevent development. When this occurs, the existence value of some individuals becomes reflected in the market for property. *See* 1984 COUNCIL ON ENVIRONMENTAL QUALITY, ANNUAL REPORT: ENVIRONMENTAL QUALITY 363-429 (cataloguing numerous instances of private conservation). It seems unlikely that this procedure succeeds in reflecting the existence value of natural resources for most Americans, however.

207. *See* Bedi, *Pricing of Recreational Fishing Access—A Discussion of Major Issues, with Special Reference to Ontario*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 390, 390 (1987) (stating that "[t]here appears to be wide support within the public policy literature and among the public for shifting the burden of service payments from general taxation onto beneficiaries of these services").

208. As a practical matter, democratic political interest may preclude market pricing of recreational resources, as "existing access fees and charges are very difficult to raise, and new ones are difficult to introduce." *Id.* at 390; *see, e.g.*, Talhelm & Libby, *supra* note 93, at 294 (observing that "[o]ne [Michigan] proposal to eliminate free fishing licenses for spouses of license holders was rejected in order to encourage family fishing; family values were judged more important than additional revenue for better fishery management, although we had no analysis of the impact on family values"). While free spouse licenses ultimately were abolished, the example noted by Talhelm and Libby demonstrates public resistance to using a market for publicly held natural resources. *But see* Fedkiw, *supra* note 66, at 347. Access fees have increased much faster than inflation in this decade, however.

209. *See* Glass & Muth, *supra* note 84, at 381 (declaring that "[l]egislative policy and legal constraints directing fishery management agencies have made it clear that the maximization of net revenues in the short run is not the sole objective of public fisheries management. . . . public agency fishery managers are usually mandated to consider long-run biophysical consequences to the fish populations and socioeconomic distributional questions even if at a sacrifice to present revenues"); Leefers, Norbury & Kaiser, *supra* note 202, at 369. The Leefers, Norbury, and Kaiser

society forgoes economic efficiency in order to make available to a wider range of people access to public natural resources.[210] This political fact itself indicates that market value generally is inappropriate for public natural resources.

Economists seeking to overcome the shortcomings of market valuation of public goods have developed new methods for valuing natural resources based on human behavior, including travel cost studies and hedonic valuation. These procedures primarily measure the use value of natural resources by seeking market surrogates for unpriced natural resources.

Since the 1940s,[211] travel cost valuation has used the travel expenses of visitors to monetize the worth of a given recreational site. This procedure is based on the intuitive assumption that the value of a site to visitors is reflected in the expense they incur to visit the site. Travelers pay a price for recreation in terms of transportation expenses, the opportunity cost of time lost, entrance fees, and other expenses of traveling.[212] This method also measures incremental losses in natural resources—as individual resources are destroyed, the site presumably becomes less attractive to visitors and travel expenditures decline correspondingly. The travel cost methodology is now accepted by most economists[213] and is probably the most common method for estimating demand in a use valuation.[214]

Travel cost valuation has several appealing attributes. The procedure is based largely on verifiable human behavior and therefore seems to be a reliable tool. Although some research is necessary, collection of data on site visitation patterns should not be too onerous.[215] Because economists already have done numerous travel cost studies for recreation sites,[216] this background should help government trustees conduct future appraisals of lost natural resources.

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article stated that "[f]orest managers invest substantially in non-market outputs. Often policies are followed that implicitly place a high value on these non-market outputs." *Id.*

210. Glass & Muth, *supra* note 84, at 383; *see also* Bedi, *supra* note 207, at 392 (arguing that "[g]iven the magnitude of recreational catch and fishing effort in both Canada and the United States, such low license fees represent nearly free access").

211. *See* Brown & Mendelsohn, *The Hedonic Travel Cost Method*, 66 Rev. Econ. & Statistics 427 (1984).

212. *See* W. Desvousges & V. Skahen, *supra* note 94, at 2-11.

213. Note, *supra* note 41, at 214; *see also* NOAA Report, *supra* note 80, at 51.

214. Allen, Stevens & Barrett, *The Effects of Variable Omission in the Travel Cost Technique*, 57 Land Econ. 173, 173 (1981).

215. *See* NOAA Report, *supra* note 80, at 56; *see also* W. Desvousges & V. Skahen, *supra* note 94, at 2-11 (declaring that it is often "possible to use information collected for other purposes").

216. W. Desvousges & V. Skahen, *supra* note 94, at 2-16 to 2-20 (summarizing the procedures and results of 24 travel cost studies conducted since 1970).

Travel cost valuation is subject to several criticisms, however. While theoretically possible, the procedure may not be sensitive enough in practice to measure the impact of relatively small changes on the availability of natural resources.[217] When other site changes coincide with the pollution of natural resources, the procedure does not isolate the effects of the natural resource harms.[218] People may visit the site after destruction of natural resources to enjoy unaffected areas, thus defeating the efforts of travel cost valuation to estimate economic harms.[219] Visitors' lack of information or misperception of site quality also may skew the results of travel cost valuation.[220] Courts may have difficulty obtaining complete and accurate data.[221] Travel cost valuation also ignores incidental use benefits from natural resources.[222] Finally, travel cost methods apply only when travel is a large part of the household expense.[223]

Another methodological difficulty associated with the travel cost model is the problem of valuing travel time. People who forgo wage income during site visits may have considerable opportunity costs. The significance of these opportunity costs, however, depends on the individual's wage rate and his ability to work during travel time.[224] Some

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217. *See id.* at 2-13 (stating that "[e]stablishing linkages between the injured CERCLA resource and the travel cost model is probably the most difficult problem in using the approach for valuing CERCLA resources"). New and creative procedures could help overcome this difficulty. A hybrid of travel cost and contingent valuation has been proposed for the measurement of individual site characteristics. *See* Brown & Mendelsohn, *supra* note 211, at 427.

218. For example, suppose a park created new camping facilities at about the same time that a hazardous substance release caused a fish kill. The full extent of user damage to natural resources would be obscured by the new benefits offered by the site.

219. For example, suppose a certain group of people annually visit Yellowstone National Park to view bison, among other reasons. If the bison die, some of these people may still visit the park to see Old Faithful geyser or other features. These visitors may lose utility from the loss of bison, but the travel cost procedure fails to discern the loss, as long as the individuals visit the same park for other purposes. The travel cost model tests the demand for the site as a whole, not for individual resources.

220. *See* A. FREEMAN, THE BENEFITS OF ENVIRONMENTAL IMPROVEMENT: THEORY AND PRACTICE 219 (1979). If individuals are not informed of the damage to natural resources, then they may revisit the site and be disappointed. Travel cost valuation only considers the fact of the visit, however, not the subsequent loss of utility.

221. *See* Comments of the Edison Elec. Inst., the Util. Air Regulatory Group, the Util. Water Act Group, and the Util. Solid Waste Activities Group on Proposed Rulemaking on Natural Resources Damage Assessment, at 62 (March 21, 1986) (source on file with Author) (noting that it is "often difficult to obtain adequate input data" for travel cost valuation and that "much of the data used to generate travel cost estimates (including the degree of use of a resource) may be imprecise and out-of-date").

222. *See* Randall, *supra* note 100, at 329 (stating that "for example, scenery adds to the enjoyment of travel undertaken for some entirely different purpose").

223. Anderson & Bishop, *supra* note 83, at 128.

224. Still other factors may affect the opportunity cost of travel. If individuals were not traveling to a recreational site, then they might substitute other leisure activities rather than work.

policy analysts have suggested valuing recreational travel time at twenty-five percent to fifty percent of an individual's wage rate as a rough compromise.[225] Other analysts propose to use the full wage rate, at least for persons who can adjust their hours worked.[226] Neither approach enjoys a consensus among economists.[227] Another dispute has arisen over whether the methodology requires individual data on travel cost or if zonal aggregation may be used.[228] Other measurement deficiencies in travel cost valuation also persist.[229] Two authors have suggested that the travel cost method forces researchers "to perform econometric acrobatics, apologize for omitted variables, and specify models that make tenuous assumptions about consumer behavior."[230] Indeed, the results of travel cost valuation may be unduly dependent on certain technical judgments by researchers, which are necessarily arbitrary.[231]

Perhaps more significant than these methodological difficulties are

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Time cost valuation for other family members can also be complex. *See* Bishop & Heberlein, *Measuring Values of Extramarket Goods: Are Indirect Measures Biased?*, 61 AM. J. AGRIC. ECON. 926, 926 (1979).

225. *See, e.g.*, Cesario, *Value of Time in Recreation Benefit Studies*, 52 LAND ECON. 32 (1976).

226. *See* Smith, Desvousges & McGivney, *The Opportunity Cost of Travel Time in Recreation Demand Models*, 59 LAND ECON. 259 (1983).

227. *See* McConnell, *Comment 2*, in NATURAL RESOURCE ECONOMICS, *supra* note 83, at 151, 155, (suggesting that these problems are now irresolvable); *see also* Allen, Stevens & Barrett, *supra* note 214, at 179. The authors state:

> Previous studies have concluded that the travel cost procedure will underestimate recreational values if the effects of either travel time or congestion are omitted from the model. We have demonstrated, however, that the nature and extent of bias due to model misspecification is likely to vary from situation to situation and that the selection of an appropriate specification is indeed a difficult task.

Id.

228. In zonal aggregation, economists survey travel costs from a particular area and average them. See W. DESVOUSGES & V. SKAHEN, *supra* note 94, at 2-13.

229. Travel cost methods survey only current site users and overlook resource benefits to those who have yet to travel to a site but expect to do so in the future. Travel cost valuation underestimates the worth of sites where travel expenditures are minimal (when visitors are located near the site). Alternatively, the method may overvalue sites if the availability of substitutes is not accurately factored in. For a summary of these and other difficulties, see generally W. DESVOUSGES & V. SKAHEN, *supra* note 94, at 2-13 to 2-15.

230. Anderson & Bishop, *supra* note 83, at 128 (stating that the method has improved over time and "is likely to be acceptable to those who are involved in valuation techniques because of its basic validity").

231. *See* Stynes & Donnelly, *Simplifying the Travel Cost Method*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 432, 432 (1987). Stynes and Donnelly note:

> Researchers are finding, increasingly, that estimates of demand and value from travel cost studies can be quite sensitive to a variety of technical decisions, such as aggregation of the data, weighting of data points, functional form of the demand curve, statistical estimation methods, definition of market boundaries, and omitted variables.

Id. (citations omitted).

the inherent deficiencies in travel cost valuation. By its nature, travel cost captures only the use value of natural resources and ignores the possibility of existence or intrinsic values. Moreover, the procedure does not reflect the preferences of poor or working persons, who lack the resources to travel. Travel cost also places low value on true wilderness areas, where human visitation is actually discouraged.

Notwithstanding imperfections in travel cost valuation, the method roughly approximates use value in at least some instances.[232] Travel cost valuation probably is the best available measurement tool for use value.[233] To the extent that existence value or intrinsic value types are important, however, travel cost methods may understate seriously the true worth of natural resources.

Another market-oriented method of valuation is hedonic price valuation. Hedonic valuation measures the extent to which the value of a nonmarketed commodity, such as a pristine environment, is captured directly in the price of marketed commodities, such as land. The best example of hedonic price valuation measures the value of air quality changes by linking high levels of pollution to lowered housing prices or wage rates.[234] In this way, researchers can measure the value of clean air by the willingness of homeowners to pay a premium to live in unpolluted areas. In some instances, such as the effect of air pollution on property values in the Los Angeles area, hedonic price valuation appears to be a reliable measure and may be the "most widely accepted empirical approach" to economic valuation of public goods.[235] Consequently, hedonic price measurement warrants consideration as a method for valuing damage to natural resources.

Unfortunately, hedonic price valuation seldom will be helpful for valuing typical natural resource damage. The best tool for hedonic pricing of environmental amenities is property values, but the lack of a market for public resources limits the utility of this tool. For private land, the environmental value of a site is difficult to isolate from its other attributes, such as convenience to employment, school quality, and innumerable other variables that may affect property values.[236] The

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232. The measure will apply best, for example, where natural resource damages are severe and affect significantly the appeal of the site.

233. NOAA REPORT, *supra* note 80, at 55.

234. *See, e.g.*, A. FREEMAN, *supra* note 220, at 78; Anderson & Bishop, *supra* note 83, at 105. For a detailed exposition of the economic theory of hedonic price valuation, see *id.* at 106-13.

235. Brookshire, Thayer, Schulze & d'Arge, *Valuing Public Goods: A Comparison of Survey and Hedonic Approaches*, 72 AM. ECON. REV. 165, 165 (1982).

236. One well-regarded hedonic property value study of air quality in Boston included the following variables: The average number of rooms in the house, distance to five employment centers, accessibility to highways, property tax rate, pupil-teacher ratio in local schools, percentage of blacks in local population, percentage of poor in local population, crime rate, size of lots, propor-

hedonic valuation procedure also relies on questionable assumptions.[237] In addition, consumers may have difficulty adjusting their market preferences for marginal injuries to natural resources. Limited options or transaction costs may prevent individuals from adjusting fully to natural resource damage.[238] Hedonic price valuation also may be unable to capture certain injuries, such as those to national parks. While many Americans value national parks, damage to these resources will be reflected at best only in the property values of those few who live in or near the parks. Even assuming that hedonic pricing works well for valuing air quality, the methodology holds little promise for valuing damage to basic environmental goods such as water quality.[239] At present, hedonic pricing holds little promise for evaluating natural resource damages in most contexts. As new and creative methods are developed, however, hedonic pricing and other measures of use value may better capture the significant values of natural resources.[240] Even then, behav-

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tion of nonretail business, and riverside location. *See* M. HUFSCHMIDT, D. JAMES, A. MEISTER, B. BOWER & J. DIXON, ENVIRONMENT, NATURAL SYSTEMS, AND DEVELOPMENT 204 (1983) [hereinafter M. HUFSCHMIDT] (reviewing the Harrison & Rubinfeld study). While this study represents an ambitious effort to isolate air quality from interfering variables, there are other factors in housing price that could obscure the correct results.

237. *See id.* at 207 (listing such assumptions, which include the assumptions that "perfect information on real estate prices exists," that "households continually reevaluate their locational decisions," and that decisions are based on current environmental quality rather than "expectations about future environmental quality"). Another consideration is that the sometimes radical changes in housing cost and shifting interest rates may make moving impractical for many families, even should they value environmental quality highly.

238. For example, how practical is it for a family to move its entire household in response to nearby natural resource damage? Natural resource damage that is less than the cost of moving (which may itself be quite substantial) will largely be ignored by hedonic pricing schemes. *See, e.g.*, McConnell, *supra* note 227, at 158.

239. *See* M. HUFSCHMIDT, *supra* note 236, at 209. The authors state:

> [T]he two reasons for such a dearth of applications in the water pollution field are limited data and the fact that property value studies measure only those benefits that accrue to landowners adjacent to the improved body of water. For major bodies of water, however, this is likely to represent only a relatively small portion of the total benefits . . . .

Id.; *see also* Fisher & Raucher, *supra* note 71, at 45 (stating that "[t]he main disadvantage of this technique is that property values do not reflect benefits to users or non-users who do not own property near the water"); Smith, *supra* note 147, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 6 (stating that "[o]ften indirect market methods, such as the hedonic property value model, are not availahle").

240. One interesting study has used market measures to value wetlands in Massachusetts. Gupta & Foster, *Economic Criteria for Freshwater Wetland Policy in Massachusetts*, 57 AM. J. AGRIC. ECON. 40 (1975). This study measured wildlife values based on wetland acquisition prices paid by the state department of fish and game, visual-cultural values based on land purchases made by town conservation commissions, water supply benefits based on the costs of alternative water supplies, and flood control benefits based on Army Corps of Engineers data. *Id.* at 41-43. The authors concluded that varying wetlands had benefits ranging from $700 per acre to nearly $60,000 per acre. *Id.* at 44. Some obvious shortcomings remain in this study. It involves considerable subjectivity and the first two categories of measurement seem to include double-counting of benefits. It also may be difficult to apply these principles to circumstances other than wetlands.

ioral use valuation methods at best capture only a portion of use value and ignore the other potential values of public natural resources.

D. Contingent Valuation

Contingent valuation simplifies the process of valuing natural resources by asking people directly what monetary value they place on identified resources: "How much are you willing to pay for preserving the remaining grizzlies in Yellowstone National Park?"[241] Although it is impossible to survey every American, this method yields a value for given natural resources through established survey techniques and averaging. Contingent valuation is a convenient, direct measure for assessing any particular type of natural resource damage, and because researchers now have considerable experience using contingent valuation, it is gaining credibility.[242]

Contingent valuation is controversial, however, because it is entirely hypothetical and because it assumes that people respond to the survey as they would to a marketplace transaction.[243] Empirical studies suggest that people's expressed attitudes do not accurately predict their actual behavior.[244] Economists are much more comfortable measuring revealed preferences in genuine market sales.[245] Even an economist, however, should recognize that expressed preferences sometimes may

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Nevertheless, advances such as this in the science of valuation promise to lend additional accuracy to our efforts to monetize natural resource losses.

241. This sample question is unrealistically simple for an effective contingent valuation survey. Accurate assessment requires more detailed questions and a series of follow up questions to enhance the reliability of the results. *See* Smith, Desvousges & McGivney, *supra* note 226, at D-5 to D-13 (presenting a sample questionnaire for valuing changes in water quality of the Monongahela River).

242. *See* Bishop, Boyle & Welsh, *supra* note 95, at 343; W. DESVOUSGES & V. SKAHEN, *supra* note 94, at 2-39 to 2-41 (listing and summarizing 23 contingent valuation studies).

243. Thus, many economists are reluctant to accept contingent valuation, on the theory that "'[a]sk a hypothetical question and you get a hypothetical answer.'" Anderson & Bishop, *supra* note 83, at 125; *see also* Bishop, Boyle & Welsh, *supra* note 95, at 342 (stating that "[b]oth economists and noneconomists have questioned whether survey techniques can be used to ascertain valid values"); Bishop & Heberlein, *supra* note 224, at 927 (declaring that "the hypothetical nature of the transactions may not be at all indicative of how people would behave in an actual market"); Smith, *supra* note 147, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 6 (stating that "contingent valuation methods are viewed with skepticism by many (if not most) economists").

244. *See, e.g.*, Ajzen & Fishbein, *Attitude-Behavior Relations: A Theoretical Analysis and Review of the Empirical Research*, 84 PSYCHOLOGY BULL. 888, 888 (1977) (summarizing the data and noting "the general consensus was that measures of attitude have little value for the prediction of overt behavior"). The authors suggest, however, that the lack of correspondence between attitude and behavior may be attributable largely to flaws in the design of past empirical research on the issue.

245. *See, e.g.*, Smith, Desvousges & Fisher, *A Comparison of Direct and Indirect Methods for Estimating Environmental Benefits*, 68 AM. J. AGRIC. ECON. 280, 280 (1986).

be more accurate than preferences revealed in the market.[246]

Researchers have raised more specific criticisms against contingent valuation as a tool for natural resource appraisal. Most of these criticisms question whether individuals can or will reveal their true value for resources in response to a survey. Researchers fear that respondents might tailor their answers to produce certain public policies, because they would not be required to pay directly for preserving the natural resources in issue.[247] For example, environmentalists might place a very high value on preservation, even higher than their willingness to pay, in order to promote preservationist policies. While concern over this strategic behavior bias is reasonable, the effect of this behavior appears to be insignificant in actual practice. Studies testing for the presence of strategic responses in contingent valuation have discovered that strategic responses are largely absent,[248] at least when questionnaires are well designed.[249]

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246. *See* Brown, *supra* note 140, at 241 (containing persuasive example of this phenomenon). Brown notes, "[a]n individual's held values may incorporate concern about air pollution, but, because the person realizes he or she has little power to effect a change in the use of the common resource, his or her actions do not reflect such concern." *Id.*

247. For a summary of this concern, see A. FREEMAN, *supra* note 220, at 87-96.

248. One study was constructed to create an incentive for consumers to overstate or understate their true values for public goods, but the survey's results found that the incentives had no significant effect. Bohm, *Estimating Demand for Public Goods: An Experiment*, 3 EUR. ECON. REV. 111 (1972). Another study found little difference between environmentalists and nonenvironmentalists in valuing natural resource damage and found few outlying, unusually high responses. Brookshire, Ives & Schulze, *The Valuation of Aesthetic Preferences*, 3 J. ENVTL. ECON. & MGMT. 325 (1976); *see also* Schulze, d'Arge & Brookshire, *Valuing Environmental Commodities: Some Recent Experiments*, 57 LAND ECON. 151 (1981). Even "[a]ttempts to find evidence of strategic behavior in [contingent valuation] studies themselves have failed to find evidence of significant distortions." Bishop, Heberlein & Kealy, *Contingent Valuation of Environmental Assets: Comparisons with a Simulated Market*, 23 NAT. RESOURCES J. 619 (1983). A recent summary of the literature concluded that "there is a body of psychological evidence to the effect that strategic behavior is likely to be encountered only infrequently." Randall, *Theoretical Bases for Non-Market Benefit Estimation*, in VALUATION OF WILDLAND RESOURCE BENEFITS 77, 79 (G. Peterson & A. Randall eds. 1984); *see also* Fisher & Raucher, *supra* note 71, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 46 (concluding that "most writers have found strategic bias to be small"); Hoehn, *Contingent Valuation in Fisheries Management: The Design of Satisfactory Contingent Valuation Formats*, 116 TRANSACTIONS AM. FISHERIES SOC'Y 412, 415 (1987) (reviewing the past studies and noting that "[e]vidence of strategic effects in contingent valuation is unexpectedly weak").

249. Smith, Desvousges & McGivney, *supra* note 226, at 4-5 (suggesting that strategic bias may be present in some instances but that the bias can be overcome by "effectively designed survey questionnaires"); *see also* Freeman, *Approaches to Measuring Public Goods Demands*, 61 AM. J. AGRIC. ECON. 915, 916 (1979) (stating that "[i]t appears to be possible, however, to design survey questions so as to eliminate the incentives for biased response"); Hoehn, *supra* note 248, at 415 (noting that research "shows that it is possible to control the incentives for truth-telling through appropriate design of the decision-making context"); Thayer, *Contingent Valuation Techniques for Assessing Environmental Impacts: Further Evidence*, 8 J. ENVTL. ECON. & MGMT. 27, 27 (1981) (noting that "available evidence indicates that strategic behavior can be neutralized by sound questionnaire design").

Another criticism of contingent valuation challenges whether respondents have sufficient information to make an accurate valuation.[250] Because people have little experience placing monetary value on unpriced natural resources, survey results may be hypothetical and inaccurate. Accuracy here is difficult to test, because resources have no established true value against which contingent valuation may be measured.[251] The results of contingent valuation can be compared with results from other valuation methods, however. The comparison shows that the results of contingent valuation experiments are roughly consistent with the results of travel cost valuation[252] and hedonic property valuation.[253] Even more significantly, studies have found that contingent valuation yields values similar to those in actual marketplace transactions.[254] An elaborate EPA study of several contingent valuation methods and travel cost analysis concluded that "the consistency in these estimates should be interpreted as offering strong support for the feasibility of performing benefit analysis for water quality changes."[255] Perhaps the most compelling favorable evidence is the internal consistency[256] and replicability of contingent valuation survey results.[257]

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250. *See* Bishop, Heberlein & Kealy, *supra* note 248, at 627-28; *see also* Gregory, *supra* note 92, at 378. Gregory asserts that "[a]sking for statements of value that are of a higher level of precision than people readily can articulate will encourage the creation of experimental noise; such measures of value might 'look good' but actually provide lower-quality information and, thus, mislead rather than inform resource managers and policymakers." *Id. But see* Fisher & Raucher, *supra* note 71, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 46 (suggesting that such biases may he overcome by well-conducted surveys).

251. *See* Randall, *supra* note 248, at 84 (noting that "the 'crucial experiment'—that is, one which tests a refutable hypothesis to the effect that estimated values are (are not) equal to the real values—is seldom permitted").

252. *See* Bishop, Boyle & Welsh, *supra* note 95, at 343 (survey noting that "where it was possible to use more than one valuation technique, contingent values have turned out to be roughly similar to alternative measures"); *see also* Bishop & Heberlein, *supra* note 224, at 926; Duffield, *Travel Cost and Contingent Valuation: A Comparative Analysis*, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 67; Knetsch & Davis, *Comparison of Methods for Recreational Evaluation*, in WATER RESEARCH 125 (A. Kneese & S. Smith eds. 1966); Sellar, Stoll & Chavas, *Validation of Empirical Measures of Welfare Change: A Comparison of Nonmarket Techniques*, 61 LAND ECON. 156 (1985). Equally important, logic explains the differences that do exist between the two study procedures. *See* Duffield, *supra*, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 83.

253. *See* Brookshire, Thayer, Schulze & d'Arge, *Valuing Public Goods: A Comparison of Survey and Hedonic Approaches*, 72 AM. ECON. REV. 165 (1982); Randall, Ives & Eastman, *Bidding Games for Valuation of Aesthetic Environmental Improvements*, 1 J. ENVTL. ECON. & MGMT. 132, 147 (1974).

254. *See generally* Bishop, Heberlein & Kealy, *supra* note 248. This study compared a contingent valuation questionnaire asking the value of goose hunting permits with actual sales of such permits. Another study of deer hunting permits also supports the validity of contingent valuation. Bishop, Boyle & Welsh, *supra* note 95, at 343. In addition, "[l]aboratory experiments at the University of Wyoming also compared cash and contingent valuation and found close correspondence for willingness to pay." *Id.* (citation omitted).

255. Smith, Desvousges & McGivney, *supra* note 226, at 8-20.

256. *See* Brookshire, Euhanks & Randall, *Estimating Option Prices and Existence Values*

Notwithstanding the demonstrated reliability of contingent valuation, representatives of industry argue that the procedure remains uncertain and violates the common-law proscription against awarding speculative damages.[258] This contention misunderstands the established legal rule. The rule precludes recovery only when the fact of damage, not the amount of damage, is uncertain.[259] In the context of natural resource damages, the damage is certain, and well-conducted contingent valuation surveys should provide sufficient information to fulfill the reasonability requirement of common law.

Some significant questions remain concerning contingent valuation. Perplexingly, studies have reached substantially different results depending on whether individuals were asked about the price that they would pay for natural resource preservation or the price at which they would sell the natural resource. Willingness to pay for environmental commodities is typically much less than the price at which persons would sell such commodities.[260] The magnitude of the disparity is

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for Wildlife Resources, 59 LAND ECON. 1 (1983). These authors sought to measure option value for certain species of wildlife, such as bighorn sheep and grizzly bears, through contingent valuation methods. After analyzing their results, the authors suggested that there was some evidence of the reliability of the valuation, because "estimated prices were of plausible magnitude, as were the inferred marginal time-preference rates of respondents, and individual willingness to pay exhibited the expected relationships with respondent's income and age, the promised probability of supply and the waiting period until the supply was made available." *Id.* at 14. While the results were not without shortcomings, the authors felt a "guarded optimism about the use of contingent markets to estimate option prices," representing a "conceptually valid measure of uncertain future use values." *Id.*

257. *See* Duffield, *supra* note 252, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 70 (noting that "there is some evidence that results may be replicable across different studies"); *id.* at 84 (noting that "sample means were shown to be relatively stable across sample years, and good internal consistence was found").

258. *See* Comments of the Chem. Mfrs. Ass'n, *supra* note 14, at 14-17.

259. Grantham & Mann, Inc. v. American Safety Prod., Inc., 831 F.2d 596, 601-02 (6th Cir. 1987). Under prevailing precedents, "[o]nce the existence of damages has been shown, all that an award of damages requires is substantial evidence in the record to permit a factfinder to draw reasonable inferences and make a fair and reasonable assessment of the amount of damages." *Id.* at 602; *see* Hoehn, supra note 248, at 412; *see also* Eastman Kodak Co. v. Southern Photo Materials Co., 273 U.S. 359, 379 (1927); Kestenbaum v. Falstaff Brewing Corp., 514 F.2d 690, 698 (5th Cir. 1975).

260. *See* Bockstael & McConnell, *Calculating Equivalent and Compensating Variation for Natural Resource Facilities*, 56 LAND ECON. 56, 61 (1980). The Bockstael and McConnell survey observed that "[i]t is likely that any researcher in this area who has attempted to obtain willingness to sell or willingness to pay responses from users has encountered great differences in them." *Id.* This difference may vary by a factor as high as twenty. *Hazardous and Toxic Waste Disposal Hearings, supra* note 49, at 363 (statement of Fred Walgenbach, Senior Resource Economist, California Dep't of Fish and Game). *See generally* Gordon & Knetsch, *Consumer's Surplus Measures and the Evaluation of Resources*, 55 LAND ECON. 1 (1979); Meyer, *Publicly Vested Values for Fish and Wildlife: Criteria in Economic Welfare and Interface with the Law*, 55 LAND ECON. 223 (1979); Schulze, d'Arge & Brookshire, *supra* note 248, at 166.

It may be possible to overcome some of this disparity, however. *See* Hoehn, *supra* note 248, at

troubling to economists,[261] and raises the additional question whether "willingness to pay" or "willingness to sell" should be used to quantify the value of natural resources. Some economists have expressed fear that individuals' unfamiliarity with the survey questions could undermine the reliability of the results.[262] The results of contingent valuation also may be unduly dependent upon the information provided to respondents and the phrasing of the questionnaire used.[263] Other economists have noted that "[e]ven contingent valuation methods cannot satisfactorily estimate [existence] values because the units of measure (dollars or income) conflict with what is to be measured."[264] The EPA has argued that "estimates using existence and option values using con-

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417 (declaring that "[w]illingness to pay and willingness to accept tend to converge as more time and effort are given to valuation"). Moreover, much of the difference hetween willingness to pay and willingness to accept may disappear once personal income limits are removed. One recent study found that "[w]hile the compensation measure significantly exceeded the willingness-to-pay measure for people managing their own endowments, no significant difference between the measures was found for those advising others about payment and compensation decisions." Brown, *supra* note 140, at 240.

261. *See* Bishop, Heherlein & Kealy, *supra* note 248, at 619-20 (noting that disparity is "in excess of differences that are explainable by income effects or other theoretically acceptable means"); Duffield, *supra* note 252, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 70 (stating that "a result of these direct survey studies that has been consistently at odds with accepted theory . . . is the unexpected divergence of willingness to pay and compensation (or willingness to sell) measures"); Knetsch & Sinden, *Willingness to Pay and Compensation Demanded: Experimental Evidence of an Unexpected Disparity in Measures of Value*, 99 Q.J. ECON. 507, 508 (1984) (noting an "unexpectedly wide variation between the two measures"). The difference between found measures of willingness to pay and willingness to sell may not represent a shortcoming of contingent valuation, however. Instead, the difference may simply reflect realistic human behavioral patterns. *See* Glass & Muth, *supra* note 84, at 386 (stating that "several studies have been conducted in which the actual exchange of money occurred, and disparities between the willingness to buy and willingness to sell were still observed").

262. *See* Bishop, Heherlein & Kealy, *supra* note 248, at 620 (expressing concern that "[m]ost people have not previously attempted to express their values for nonmarket goods in monetary terms, and contingent markets are too artificial to provide a sufficient context for developing accurate values"). *But see* Brookshire, Thayer, Schulze & d'Arge, *supra* note 253, at 176 (noting that "existing studies by Randall et al. and Brookshire, Ives, and Schulze, and Rowe et al. of remote recreation areas certainly suggest that survey approaches provide replicable estimates of consumers' willingness to pay to prevent environmental deterioration, without prior valuation experience").

263. *See* Bishop, Heherlein & Kealy, *supra* note 248, at 620; Samples, Dixon & Gowen, *Information Disclosure and Endangered Species Valuation*, 62 LAND ECON. 306, 306 (1986); Schulze, d'Arge & Brookshire, *supra* note 248, at 156-58. In one study, differences in question format yielded results that varied by a factor of more than six. Smith, Desvousges & Fisher, *supra* note 245, at 287. *But see* Hoehn, *supra* note 248, at 414 (noting that "[c]areful design, pretesting, and analysis can at least detect, if not eliminate, the impact of information bias"); Schulze, d'Arge & Brookshire, *supra* note 248, at 167-68 (finding information bias largely absent in the South Coast Air Basin experiment); Thayer, *Contingent Valuation Techniques for Assessing Environmental Impacts: Further Evidence*, 8 J. ENVTL. ECON. & MGMT. 27 (1981) (testing for information bias, among other possible biases of contingent valuation, and finding no significant effect of same).

264. Talhelm & Libby, *supra* note 93, at 296.

tingent valuation are so unreliable" that they should not be used.[265] The United States Water Resources Council, however, has found contingent valuation sufficiently accurate for government use.[266]

Notwithstanding the apparent and potential problems, contingent valuation offers some great advantages to policymakers. Among economic valuation tools, only contingent valuation measures the existence value of natural resources.[267] Given the potential significance of the existence value attribute,[268] this ability is an important reason for preferring contingent valuation over tools such as travel cost valuation, which measure only a portion of use value.[269] The subjectivity of contingent valuation, moreover, infects other forms of valuation as well.[270] In many instances, contingent valuation provides the best method for assessing the complete economic value that individuals place on natural resource preservation. This conclusion, however, should not obscure the undeniable shortcomings of contingent valuation.

E. Estimating Gross and Net Value of Resources

As the discussion above suggests, there are several means of valuing natural resources, none of which are perfect. A shortcoming that each of these valuation methods shares is the measurement of gross value, rather than net value, a feature that overstates the true worth of resources. Net value is the value of resources reduced by the cost required to sustain them. This cost can be difficult to measure at the present time. Fortunately, most of the cost of producing natural resources is

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265. Comments of the Envtl. Protection Agency on Dep't of the Interior Damage Assessment Regulations, at 8 (March 19, 1986) (source on file with Author), *responding to* Notice of Proposed Rulemaking, 50 Fed. Reg. 52,126 (1985).

266. *See* 44 Fed. Reg. 72,892, 72,950 (1979) (codified at 18 C.F.R. § 713) (establishing regulations for the evaluation of benefits and costs in federal water resource projects and authorizing the use of contingent valuation); *see also* 48 Fed. Reg. 10,250, 10,257 (1983) (codified at 18 C.F.R. §§ 711, 713, 714, 716) (repealing the regulations and replacing them with new Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies that retain the use of contingent valuation).

267. *See, e.g.*, Randall, *supra* note 100, at 329 (declaring that "contingent valuation offers the only means of directly estimating the total value of nonmarketed environmental assets").

268. *See supra* notes 90-92.

269. The *NOAA Report* warns that "the contingent valuation method should be used with caution," but because it is "the only tool available at this time to estimate option and existence values," the Report further observes that "the cost of potential biases [of contingent valuation] is sometimes simply outweighed by its benefits." NOAA REPORT, *supra* note 80, at 62; *see also* Smith, *supra* note 147, in 3 APPLIED MICRO-ECONOMICS, *supra* note 70, at 5-6 (noting that "[t]here has been increasing awareness of the need to use survey based or contingent valuation methods in valuing many types of environmental amenities").

270. *See* Smith, Desvousges & Fisher, *supra* note 245, at 289 (noting that the researcher's judgment is an unavoidable aspect of travel cost and other measures and finding greater variance in the results of their travel cost study than for contingent valuation).

sunk cost in land, and the marginal cost of maintaining the resources is likely to be low or even zero.[271] The difficulty, therefore, may be insignificant, as net value may closely approximate the measured gross value of natural resources.[272]

Even if the disparity between gross value and net value is not a serious problem, other shortcomings plague the available methods of measurement. Anyone developing a method of valuation must grapple with these problems and presumably settle for an imperfect result. The following section discusses the efforts of the Department of the Interior to develop a suitable method and then proposes changes to the current approach.

V. Developing a System of Natural Resource Valuation

Having reviewed the statutory underpinnings of natural resource valuation, the value attributes of those resources, and the available methodologies for monetizing those values, this Article will now develop a system for valuing natural resources under Superfund and other legal authorities. Section A discusses regulations of the Department of the Interior. These rules are not the final word in valuing natural resources, however, and they contain serious shortcomings. Section B proposes modifications to the Department of the Interior regulations that provide a more exhaustive and defensible process for placing monetary value on damaged natural resources.

A. Department of the Interior Regulations—A First Step

After considerable time and litigation, the Department of the Interior promulgated its regulations for assessing natural resource damages, both for Type A[273] and Type B[274] spills. Both of these rules direct the procedure for determining the extent of harm resulting from a hazardous substance discharge.[275] Type B rules are most relevant for economic

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271. This is particularly true for increments of resources. Should an entire national park be destroyed, there will be obvious cost savings from park services. In the more likely case of destruction of a portion of the park's resources, however, such typical costs as upkeep and construction may be unaffected.

272. *See, e.g.*, Rettig, *Bioeconomic Models: Do They Really Help Fishery Managers?*, 116 Transactions Am. Fisheries Soc'y 405, 408 (1987) (stating that for fisheries, one can "set the standard value of the ratio of net to gross economic value at 90%").

273. 43 C.F.R. § 11.40 (1987). At the present time Type A assessment rules are available only for oil spills in aquatic environments, but these discharges constitute nearly two-thirds of all natural resource damages covered by Superfund. *See* 52 Fed. Reg. 9057 (1986).

274. 43 C.F.R. § 11.60 (1987).

275. Because this Article focuses on monetary valuation, it does not go into detail on other aspects of the Department of the Interior rules. Briefly, however, the Type B rules provide for an initial "preassessment screen," during which the federal or state agency responding to a Superfund discharge samples the potentially injured or at-risk natural resources and conducts emergency res-

valuation purposes because they deal with major spills requiring site-specific damage valuation.

The Interior Department regulations rely primarily on "common law and economics" for guidance in valuing natural resources.[276] Based on these sources, the rules focus predominantly on measuring the use value of these resources. The Department converts resources into "services" to humans,[277] including "water for drinking, the use of fish or wildlife for food, and the use of many components of the environment for recreation."[278] Whenever possible, the Department monetizes the loss of use of these services by market value.[279] When market valuation is impossible, the Department allows nonmarket methodologies, including travel cost and hedonic pricing methodologies.[280] The Department only looks to option and existence values when use value cannot be determined.[281] The Type B regulations generally preclude contingent val-

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toration when necessary. 51 Fed. Reg. 27,729-30 (1986) (codified at 43 C.F.R. §§ 11.20-11.25 (1987)). In most instances, this sample is followed by the assessment phase, in which the agency identifies potentially responsible parties, determines the approximate magnitude of resources damaged, and decides whether Type A or Type B assessment is appropriate to this discharge. *Id.* at 27,732-33 (codified at 43 C.F.R. §§ 11.30-11.34 (1987)). If Type B assessment is indicated, the regulations provide detailed procedures for measuring the site-specific extent of injury to natural resources. *Id.* at 27,733-42 (codified at 43 C.F.R. §§ 11.60-11.69 (1987)). This measuring is followed by a quantification of natural resource damage that focuses on reduction in services to the public using the site and the feasibility of cost-effective restoration. *Id.* at 27,742-48 (codified at 43 C.F.R. §§ 11.70-11.73 (1987)). Once quantification is accomplished, monetary damages may then be ascertained. *Id.* at 27,748-51 (codified at 43 C.F.R. §§ 11.80-11.84 (1987)); *see supra* notes 21-23 and accompanying text. The Type B rules culminate with a post-assessment phase for instances when restoration or replacement is used in response to natural resource damage. 51 Fed. Reg. 27,751-53 (1988) (codified at 43 C.F.R. §§ 11.90-11.93 (1987)).

The Type A rules for lesser harms to natural resources are less elaborate. Following the preassessment screen and assessment phase described above, the lead agency may conclude that Type A assessment is indicated. In conducting a Type A assessment, the lead agency supplies certain defined data inputs for a computer model, known as the Natural Resource Damage Assessment Model for Coastal and Marine Environments. This program then projects the likely extent of natural resource damage and the economic value of these losses, based on the valuation principles contained in the Type B regulations. 51 Fed. Reg. 27,751 to 27,752 (1988) (codified at 43 C.F.R. §§ 11.90-11.91 (1987)).

276. 51 Fed. Reg. 27,690 (1986).

277. *See id.* at 27,719 (stating that "[i]n reference to the comments concerning services without clear human use, the Department believes that only when a service has a hnman recipient can it be classified as a use per se").

278. *Id.* at 27,686. This judgment is based on the Department's perception of "traditional economic measures." *Id.*

279. *Id.* at 27,749 (codified at 43 C.F.R. § 11.83(c) (1987)); *see id.* at 27,691 (stating that "[i]f the injured resource is traded in a market, the diminution of the market price should be tbe measure of lost use value" and "[o]nly when the injured resource is not traded in a market or when that market is not reasonably competitive, and no comparable sales are available for use in an appraisal, may the authorized official use any of the nonmarketed resource methodologies").

280. *Id.* at 27,750 (codified at 43 C.F.R. §§ 11.83(d)(3), (4) (1987)).

281. *Id.* at 27,749 (codified at 43 C.F.R. § 11.83(b)(2) (1987)) (stating that "[e]stimation of option and existence values shall be used only if the authorized official determines that no use

uation studies.[282]

The Department of the Interior Type B regulations also address the use of restoration cost for damages. The rules define damages as "the cost to accomplish the cost-effective [restoration] alternative that provides the lost services."[283] Thus, even the restoration authorization in the Interior Department regulations is limited to restoring "services" that have use value and ignores other values of the damaged natural resources. Furthermore, restoration seldom is the damage measurement of choice under these rules. Restoration cost may be used only when it yields a damage estimate that is lower than the estimates of lost use value. In most instances, "[t]he authorized official shall select the lesser of: restoration or replacement costs; or diminution of use values as the measure of damages."[284] One district court has approved this least costly approach to measurement of natural resource damages.[285] The Interior Department did recognize that certain "special resources" may be destroyed forever through its cost-effective approach. For these resources, restoration costs are the proper measure of damages.[286] The Department makes clear, however, that this exception is to be very narrow.[287]

The subsequently promulgated Type A damage assessment rules follow valuation principles that are similar to those in the Type B rules. The simplified Type A damage measurement is accomplished through a computer model, known as the Natural Resource Damage Assessment Model for Coastal and Marine Environments (NRDAM/CME).[288] Like the Type B assessments, this model takes no account of existence or

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values can be determined"). This section is to be used only in "extraordinary circumstances." 51 Fed. Reg. 27,719 (1986).

282. *Id.* at 27,750 (codified at 43 C.F.R. § 11.83(d)(5)(ii) (1987)) (stating that "use of contingent valuation methodology to explicitly estimate option and existence values should be used only if the authorized official determines that no use values can be determined").

283. *Id.* at 27,748 (codified at 43 C.F.R. § 11.81(f)(1) (1987)); *see also id.* at 27,748-49 (codified at 43 C.F.R. § 11.82 (1987)) (describing standards for formulating the restoration methodology plan).

284. *Id.* at 27,733 (codified at 43 C.F.R. § 11.35(b)(2) (1987)). This rule is grounded largely in the Department's finding that "the general common law measure of damages is the lesser of diminution of use value and restoration or replacement costs" and its conclusion that "Congress intended to incorporate traditional notions of damage measurement into the natural resource damage assessment process." *Id.* at 27,705.

285. Idaho v. Bunker Hill Co., 635 F. Supp. 665, 676 (D. Idaho 1986). According to this decision: "Damages to the natural resources may be calculated on a value basis and a cost-of-restoration basis. The calculation which provides the least recovery in terms of dollars is the appropriate measure of damages." *Id.*

286. 51 Fed. Reg. 27,724-25 (1986). At the time of the original rule, the Department concluded that it needed a "closer look" at this concept before formulating final regulations on such "special resources." *Id.* at 27,725.

287. *Id.* at 27,724.

288. For a summary overview of this model, see 52 Fed. Reg. 9045-48 (1987).

intrinsic values of natural resources.[289] The computer program assigns no value to unused resources. Indeed, under the NRDAM/CME, only the destroyed fish that would have been harvested are included in the damages assessment.[290] An obvious consequence of this approach is that "only commercial or recreationally important species have measurable social value."[291] Even some recreational uses of natural resources are valueless under the Department's present approach because it focuses entirely on consumptive uses. Partly for this reason, important marine mammals, such as whales, dolphins, and sea otters, are valued at zero under the NRDAM/CME used in Type A spills.[292]

The now final regulations are an important first step in monetizing key environmental features. The regulations are not, however, the last word. Superfund requires the Department to review and revise the regulations every two years.[293] As described in the following subsection, the current regulations are both incomplete and inadequate, and require modification in order to accomplish the goal of accurately valuing damaged natural resources.

B. The Next Step—More Complete Valuation Procedures

The long awaited promulgation of the Department of the Interior regulations has not quieted the controversy over the proper valuation of natural resources. Environmental organizations filed a direct challenge to the rules in the Court of Appeals for the District of Columbia.[294] Several state governments also challenged the rules as insufficiently protective of natural resource values.[295] Organizations representing industry likewise sued the Interior Department over the natural resource damage regulations.[296] These actions, which the circuit court has consolidated, raise numerous issues beyond the valuation of natural re-

289. *See id.* at 9083 (stating that "there is insufficient information to incorporate the concept of option and existence values into the NRDAM/CME").

290. *Id.* at 9087.

291. Comments of the Chem. Mfrs. Ass'n, *supra* note 14, at 19.

292. *See* Comments of the Nat'l Wildlife Fed'n on Dep't of the Interior Proposed Type A Natural Resource Damage Assessment Regulations, at 14 (August 18, 1986) [hereinafter Comments of the Nat'l Wildlife Fed'n] (source on file with Author), *responding to* Proposal by the United States Dep't of the Interior, 51 Fed. Reg. 16,636 (1986).

293. 42 U.S.C. § 9651(c)(3) (1982).

294. *See* National Wildlife Fed'n, Envt'l Defense Fund v. United States Dep't of the Interior, No. 87-1266 (D.C. Cir. filed June 18, 1987).

295. *See, e.g., id.* (consolidating California v. United States Dep't of the Interior, No. 86-1591 (D.C. Cir.); Colorado v. United States Dep't of the Interior, No. 87-1265 (D.C. Cir.); New Jersey Dep't of Envt'l Protection v. United States Dep't of the Interior, No. 86-1580 (D.C. Cir.)).

296. *See id.* (consolidating Chemical Mfrs. Ass'n v. United States Dep't of the Interior, No. 86-1594 (D.C. Cir.); Puhlic Servs. Elec. & Gas Co. & Dam Corp. v. United States Dep't of the Interior, No. 86-1597 (D.C. Cir.)).

sources.[297] Nevertheless, valuation issues are central to the controversy over the Interior Department regulations. Regardless of the outcome of this litigation, there are sound reasons for modifying the existing regulations.

Many critics contend that the Interior Department's regulations underestimate damage values.[298] Senator Max Baucus, a cosponsor of the Superfund amendments, argued that "the rules to date strongly discourage natural resource damage claims from ever being brought and would severely reduce recoverable damages in those few cases where they were sought."[299] The current regulations may undervalue certain categories of resources; wetlands, for example, fulfill a vital ecological niche that has been recognized expressly by federal executive order,[300] yet wetlands have a relatively low valuation under the Interior Department's methodology because they have little direct use or market value.[301] Many significant marine mammals are valueless under the Type A rules. Damage awards under the current rules seldom will be sufficient to restore the resources destroyed.[302]

Empirical studies bear out these criticisms of the Interior Department regulations. The current regulations understate true natural resource damages because of their exclusive focus on use value and heavy reliance on market valuation. In a test of the Type A regulations, the State of New York used the NRDAM/CME to assess the damages from a hypothetical spill of 2.2 million pounds of PCBs in a narrow estuary similar to the mouth of the Hudson River.[303] The model measured re-

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297. *See, e.g.*, Non-Binding Statement of Issues of the National Wildlife Federation, National Wildlife Fed'n, Envt'l Defense Fund v. United States Dep't of the Interior, No. 87-1266 (filed July 22, 1987). Disputed issues include the proper parties for conducting assessments, the degree of public participation in assessments, standards of proof, and covered resources. *Id.* at 3-4.

298. *See, e.g.*, Dower & Atkeson, *The Unrealized Potential of SARA: Mobilizing Protection for Natural Resources*, 1987 ENVIRONMENT 41.

299. 132 CONG. REC. S14,930 (daily ed. Oct. 3, 1986) (statement of Sen. Baucus).

300. *See* Exec. Order No. 11,990, 42 Fed. Reg. 26,961 (1977).

301. *See* Dower, *Valuing Natural Resources*, 1987 ENVIRONMENT 10, 10. Dower states:

> Wetlands do not often provide much in the way of *direct use value* to an owner (which is why so many are filled in), but are thought to provide a wider range of other use values to the general public including pollutant removal, habitat breeding grounds, aesthetic pleasure (such as bird watching), and flood retention.

Id. (emphasis in original).

302. *See* Comments of the State of California, Dep't of Justice, on Dep't of the Interior Proposed Natural Resource Damage Assessments Regulations, at 5-6 (March 21, 1986) [hereinafter California Comments] (source on file with Author), *responding to* Notice of Proposed Rulemaking, 50 Fed. Reg. 52,126 (1985). The comments assert, "Because the diminution of use value will almost always be less than restoration or replacement costs, under the proposed rule, damage awards will rarely be sufficient to enable state and federal trustees to restore or replace the injured resources." *Id.*

303. *See* Johnson, *supra* note 50, at 9.

source damage to be 571,509 dollars through the year 2034.[304] In a real case, however, the Hudson River was contaminated by a smaller quantity of PCBs[305] and sustained far greater damages than those projected by the Interior Department's computer model. For example, over one million dollars per year have been lost in commercial harvest of striped bass, according to regulatory impact statements.[306] Researchers have calculated additional millions of dollars of damage in recreational fishing through the travel cost method.[307] The results of the New York study are particularly revealing. First, the NRDAM/CME understated the true losses in use value alone, without even considering the additional lost existence value. Second, the model's results were not only low, they were low by orders of magnitude. The current approach vastly underestimates the value of damaged natural resources.[308] Other tests of the Interior Department's model confirm its tendency to understate natural resource damages.[309] While authors of these studies considered only the Type A damage assessment model, the Type B regulations also overlook potentially significant natural resource values.

Finally, the regulations focus on use value almost exclusively, which is directly contrary to the text of Superfund. Section 301 of Superfund, which authorizes the Interior Department regulations, directs that the rules shall take into account "factors including, but not limited to, replacement value, use value, and ability of the ecosystem or resource to recover."[310]

Despite their shortcomings, the present regulations are a considerable advance in the valuation of natural resources. The rules require

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304. *Id.*

305. *Id.* A spill of between 510,000 and 660,000 pounds of PCBs occurred upstream on the Hudson River, although only 167,000 pounds reached the estuary below the federal dam at Troy, New York. The larger spill in the test run of the NRDAM/CME was used to ensure the conservatism and fairness of the New York test comparison results. *Id.*

306. *Id.*

307. *Id.* at 9-10.

308. Indeed, even when Johnson attempted to adjust his assumptions to increase the damages estimated by the model, "the computed damages bore little resemblance to other measurements of economic damage resulting from the PCB-contamination of the Hudson River." *Id.* at 12 n.38.

309. *See* Comments of the Nat'l Wildlife Fed'n, *supra* note 292, at 2. The Federation commented, "The values obtained for spills in Interior's runs of the model (see Type A Background Document) are also stunningly low in many cases—often far less than the value of the material spilled." *Id.* Yet another report suggests that: "After an Oil Spill in Washington State, the Natural Resource Damage Assessment Put a High Value on a Relatively Sterile and Already Polluted Pebble Beach in an Industrialized Area, and A Relatively Low Value on an Ecologically Sensitive Wildlife Sanctuary . . . ." Olson, *Outline of Discussion*, in AMERICAN PETROLEUM INST., NATIONAL RESOURCE DAMAGE ASSESSMENT CONFERENCE PROGRAM, at 4-5 (June 16, 1987) [hereinafter AMERICAN PETROLEUM INST. CONFERENCE].

310. 42 U.S.C. § 9651(c)(2) (1982).

amendments, however, that measure better the full value of damaged resources. Indeed, unless the Interior Department modifies the current regulations, they may become functionally obsolete.[311] The State of California has proposed to the Interior Department the best modifications to the current regulations. Under the California plan, restoration cost would provide the presumptive measure of natural resource damages, unless restoration is infeasible or disproportionately expensive.[312] This Article next explains and justifies the use of the California proposal.

1. Use of Restoration Cost and the Primacy of Preservation

Principles of legal interpretation and sound public policy dictate that environmental protection and preservation be the primary, if not the sole, objective of natural resource damage valuation. Restoring the polluted site is the best method of preserving the environment.[313] In addition to restoration costs, additional damages may be necessary while restoration is proceeding.

An analysis of proper valuation begins with the text and history of Superfund in order to demonstrate that restoration costs are consistent with the statutory scheme. Although the Act does not specify the proper measure of damages, the text of the law suggests Congress's interest in restoration. The law states that "damages shall not be limited by the sums which can be used to restore or replace such resources."[314] This phrasing implies that Congress intended restoration costs to be generally available, at minimum. In addition, the 1986 amendments to Superfund added the requirement that monies recovered by the federal government be used "only to restore, rehabilitate, or acquire the equivalent of such natural resources" as were damaged.[315] This language does not require expressly the use of restoration cost as the measure of damages, but it does suggest that Congress expected damages at least to approximate the cost of restoration or replacement of damaged natural resources.

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311. *See* Kenison, *Issues in the Litigation of Natural Resource Damage Claims*, in AMERICAN PETROLEUM INST. CONFERENCE, *supra* note 309, at 24. Kenison observed: "If the Department of Interior's damage assessment regulations survive challenges . . . states will abandon that metbodology and the rebuttable presumption which compliance with it confers in favor of more innovative, yet reliable damage assessment methodologies." *Id.*

312. *See* California Comments, *supra* note 302, at 6.

313. Replacement cost damages to obtain new sites may sometimes advance the preservationist objectives of Superfimd. Generally, however, restoration is preferable, because it does not irrevocably sacrifice the damaged site. For a discussion of tbe shortcomings of replacement as a response to natural resource damages, see *supra* text accompanying notes 170-71. One review concluded that "CERCLA's overriding purpose [is] to protect and restore tbe environment following the adverse consequences of hazardous waste disposal." Note, *supra* note 151, at 1115.

314. 42 U.S.C. § 9607(f) (1982).

315. *Id.*

The legislative history behind the original Superfund law further supports granting restoration cost damages.[316] The floor comments of legislative sponsor Senator George Mitchell and of Senator Robert Stafford supported the use of restoration cost.[317] The Senate Report on Superfund explained that a purpose of the bill was "to preserve the public trust in the nation's natural resources,"[318] and that the public trustee should "seek restitution for such damages or restoration of such resources."[319] This evidence is admittedly inconclusive, and contrary legislative history also exists.[320]

The legislative history underlying the 1986 Superfund reauthorization and amendments is much clearer in support of restoration costs when natural resources are damaged. While natural resource damages received little congressional attention during the amendment process, the comments that are available criticize the Interior Department's proposed rule.[321] Senator Max Baucus of Montana, a cosponsor of Superfund, contended that "the Interior Department has ignored the intent of Congress and repeatedly erected barriers to the recovery of

316. A legal review of this history concludes that there "is some ambiguity in CERCLA's legislative history, but the better view is that *full cost of restoration is available when a government agency so chooses.*" Breen, *supra* note 14, at 10,307 (emphasis in original). Breen notes that Congress deleted provisions that expressly referred to "economic measures of damages," and retained the language that originally appeared to authorize restoration cost recovery. *Id.*

317. 126 CONG. REC. 30,941 (1980). Senator Mitchell stated that natural resource damages should provide "for the cost of restoring new trees" to a public park. *Id.* Senator Stafford stated that natural resource damages could be obtained after "a restoration plan is developed." *Id.* at 30,986.

318. S. REP. No. 848, 96th Cong., 2d Sess. 84 (1980).

319. *Id.* Intended use of restoration cost is also implied by Senator Stafford's statement that natural resource damages could be obtained after "a restoration plan is developed." 126 CONG. REC. 30,986 (1980).

320. Senator Simpson stated on the floor that natural resource damage recoveries should "achieve[] cost effectiveness by awarding the difference in value before and after the injury, and where the injured interest can be restored to its original condition for less than the difference in value, the cost of restoration is used." 126 CONG. REC. 30,986 (1980). This statement seems expressly to suggest the market value and "lesser cost" portions of the Interior Department's current rules. Senator Simpson, however, was not a leading advocate of Superfund, and his interpretive views should not be given great weight. *See* Breen, *supra* note 14, at 10,308 (noting that Simpson was the only member of the Senate Environment and Public Works Committee who voted against reporting the Superfund bill to the floor of the Senate). The courts have recognized that the views of individual legislators typically "are entitled to little or no weight, particularly when they are unclear or conflict with one another." Murphy v. Empire of Am., 746 F.2d 931, 935 (2d Cir. 1984); Blitz v. Donovan, 740 F.2d 1242, 1247 (D.C. Cir. 1984) (stating that "legislators' remarks during a floor debate, even in the Congress that enacted the legislation, do not control statutory interpretation and generally are not accorded significant weight" (citing Weinberger v. Ross, 456 U.S. 25, 35 n.15 (1982))); *see also* Florida Gulf Coast Bldg. & Constr. Trades v. NLRB, 796 F.2d 1328, 1343 n.16 (11th Cir. 1986) (declining to grant authoritative weight to statements by congressional opponents of legislation); Brock v. Writers Guild of Am., 762 F.2d 1349, 1356 (9th Cir. 1985).

321. The final promulgation of the natural resource damage regulations did not occur until after the passage of the Superfund amendments.

damages to natural resources,"[322] and that market valuation was an inappropriate method for valuing most public resources because it "would result in far less resource restoration, or replacement, than Congress had intended."[323] The Senator feared that the Interior Department's natural resource damage regulations could frustrate a key purpose of Superfund by giving industry an incentive to act carelessly, because industry would not have to internalize the true cost of its activities.[324] Senator Baucus would modify the regulations to "measure damages, based on replacement or restoration, or acquisition of equivalent resources—where restoration or replacement is technically impossible, plus any lost use value or other damages."[325] Senator Stafford, perhaps the leading author and sponsor of Superfund, concurred expressly with Baucus's criticism of the Interior Department rules.[326]

In the House of Representatives, Representative Walter Jones of North Carolina largely echoed the criticisms from the Senate. He supported restoration, observing that the "purpose of the regime, rather, is to make whole the natural resources that suffer injury from releases of hazardous substances."[327] Representative Jones argued specifically for natural resource damage recovery comparable to the California Plan in which restoration would be normative unless technically infeasible or disproportionately expensive.[328] While the 1986 legislative history is not dispositive,[329] its clarity and strength suggest that Congress intended to

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322. 132 CONG. REC. S14,930 (daily ed. Oct. 3, 1986).

323. *Id.* at S14,931.

324. *See id.* at S14,930. Senator Baucus stated:

> These regulations also reduce the incentive on the part of industries to exercise care in order to avoid liability for natural resource damages. By thus failing to force these industries to internalize the true cost of their activities to society, the proposals issued to date are impediments to the restoration and replacement of resources, and incentives to careless, not careful, conduct.

Id.

325. *Id.* at S14,931.

326. *Id.* Senator Stafford stated that Senator Baucus had raised "a number of important points" and that Stafford "concur[red] in those remarks, and agree[d] with the statement he ha[d] just made." *Id.*

327. *Id.* at H9613 (daily ed. Oct. 8, 1986).

328. *Id.* Representative Jones stated,

> The basic measure of damages under CERCLA, as it is under the Clean Water Act, is the costs of restoration, replacement or acquisition of the equivalent of natural resources injured by unlawful releases. Where, of course, restoration is technically impossible or the costs thereof are grossly disproportionate to the value of the resources to society as a whole, then other valuation measures, both market and nonmarket, must be used.

Id.

329. Floor remarks of individual legislators seldom are considered to be controlling in statutory interpretation. *See supra* note 320. The statements of sponsors are more persuasive, however, and should be given more weight. *See* Schwegmann Bros. v. Calvert Distillers Corp., 341 U.S. 384, 394-95 (1951) (noting that "[i]t is the sponsors that we look to when the meaning of the statutory words is in doubt"); Monterrey Coal Co. v. Federal Mine Safety & Health Review Comm'n, 743

measure natural resource damages by the cost of restoration under Superfund.

Although this congressional concern for restoration is manifest, it should not be overemphasized. A blanket mandate for restoration cost recovery would be inappropriate. Congress knew how to mandate recovery of restoration costs, as it did in the Clean Water Act,[330] but chose not to do so under Superfund. Rather, the legislature granted some discretion to the Interior Department to find the optimal measure of natural resource damages. This discretionary authority, however, is not a license to disregard the purposes of Superfund. The present regulations appear to underemphasize the importance of restoration under the Act.

Other federal environmental legislation authorizes broader recovery of restoration costs. The Clean Water Act expressly provides for recovery of restoration cost.[331] Perhaps more helpful is the Deepwater Port Act, which makes certain parties liable for damages to natural resources.[332] The legislative history behind this provision reflects a congressional intent in favor of restoration costs.[333] Even more relevant is the generalized recovery authority of the Outer Continental Shelf Lands Act, because the Superfund language appears to have been taken from the 1978 amendments to that Act.[334] Legislative history behind the provision indicates that federal and state governments may recover restoration or replacement costs.[335] This pattern of federal legislation on natural resource damages, therefore, indicates a clear concern for restoration.[336]

F.2d 589, 596 (7th Cir. 1984) (noting that "sponsor's . . . interpretation is ordinarily accorded substantial weight").

The 1986 legislative history, however, may be discounted on other grounds. Although Congress amended the natural resource damage provisions, the changes were procedural and did not touch the valuation issue. *See, e.g.*, Hayes & Mackerron, *Superfund II: A New Mandate*, [Special Report] Env't Rep. (BNA), 35-36 (1987). Thus the 1986 comments were not contemporaneous with the passage of damage valuation authority and are postenactment legislative history. While courts will not ignore these statements, relatively little credence should be granted to postenactment legislative history. *See* Wald, *Some Observations on the Use of Legislative History in the 1981 Supreme Court Term*, 68 IOWA L. REV. 195, 204-05 (1983). Arguably, however, the 1986 comments on natural resource damage valuation are not truly postenactment, because the entirety of Superfund was reauthorized at this time. Obviously, the significance of these floor statements is muddy. The best approach accords these statements significant weight but does not regard them as dispositive of the proper interpretation of Superfund.

330. *See supra* note 26.

331. *See supra* note 26.

332. *See supra* note 31.

333. S. REP. No. 1217, 93d Cong., 2d Sess. 16 (1975).

334. Breen, *supra* note 14, at 10,309.

335. H.R. REP. No. 590, 95th Cong., 1st Sess. 192 (1977).

336. Congressional interest in conservation of natural resources is found in other federal legislation as well. For example, the National Environmental Policy Act emphasizes "the critical importance of restoring and maintaining environmental quality." 42 U.S.C. § 4331(a) (1982). In

Use of restoration costs also is consistent with the state's role as trustee for resources. As the court held in *Zoe Colocotroni*, "the Commonwealth must have the ability to have the corpus of said public trust reimbursed for the diminution attributable to the wrongdoers."[337] Mere money, however, does not replace the damaged natural resource trust. When the resources of a trust are damaged, the fiduciary must restore or replace them.[338]

These related statutes and decisions, of course, are not dispositive of natural resource damages under Superfund. As the Clean Water Act illustrates, Congress knew how to compel restoration cost as the measure of damages and chose not to do so in Superfund. Hence, it would be a mistake to employ restoration costs as the automatic measure of damages. Evidence of congressional intent for Superfund and related statutes, however, does reflect considerable concern for restoration that should be sufficient to render this measure a presumptive method for resource valuation.

This discussion should provide sufficient legal foundation for the use of restoration costs in measuring natural resource damages. Sound public policy also leads to this conclusion. At first glance, restoration cost appears to be inferior, because it is a cost-based, supply-side measure, rather than a demand-side, value-based measure of natural resource value. For this reason, when natural resource economics advances far enough to provide an adequate demand-side measure, reliance on restoration cost will become inappropriate. At present, however, the economic tools for valuing natural resources are of questionable accuracy. Some methods have inherent deficiencies, such as the failure to consider any existence value of resources. All the current methods have significant methodological shortcomings and yield divergent results.[339] Without a perfect method of valuation, policymak-

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acknowledgement of this national policy, courts have compelled restoration, even under statutes that do not expressly authorize this remedy. *See* United States v. Cumberland Farms of Conn., Inc., 647 F. Supp. 1166 (D. Mass. 1986), *aff'd*, 826 F.2d 1151 (1st Cir. 1987). Recently, when a farming corporation converted a wetland into farmland, without obtaining the required Clean Water Act permit, an Army Corps of Engineers request for compelled private restoration was granted. On appeal, the First Circuit held that "the district court had authority to issue such restorative orders so as to effectuate the stated goals of the Clean Water Act 'to maintain the chemical, physical, and biological integrity of the nation's waters.'" *See, e.g.*, United States v. Republic Steel Corp., 362 U.S. 482 (1960); United States v. Joseph G. Moretti, Inc., 526 F.2d 1306 (5th Cir. 1976); United States v. Robinson, 570 F. Supp. 1157 (M.D. Fla. 1983). Similar restoration orders also have been required under the River and Harbors Act.

337. Puerto Rico v. S. S. Zoe Colocotroni, 456 F. Supp. 1327, 1344 n.42 (D.P.R. 1978).

338. Note, *supra* note 151, at 1105. For an early case adopting this reasoning, see Feather River Lumber Co. v. United States, 30 F.2d 642 (9th Cir. 1929).

339. Two leading natural resource economists have suggested recently that "[w]e know of no social scientists who suggest that a quantitative 'total value framework' can be designed that will

ers should employ restoration cost as the one reasonably accurate and replicable procedure for measuring natural resource damages. This approach acknowledges the current ignorance of economic valuation of resources by adopting a cautious, preservationist approach.[340]

The measurement uncertainty is even more apparent for resources that may possess quasi-option value. By definition, this value is unknown and therefore unmeasurable, at least at present.[341] Yet one can know that quasi-option value ultimately may be quite significant for some resources.[342] Quasi-option value may be particularly significant for idiosyncratic resources that have little apparent value to man.[343] While quasi-option value cannot be measured, use of restoration cost recovery at least offers hope that the value can be restored to the natural environment.

Additional reasons counsel at least for the presumptive use of restoration costs. Economics is not the only inexact science. Mankind's knowledge of the workings and the significance of natural ecology is also deficient. Natural resources may have great undiscovered practical value. More importantly, nature's complex interrelationships are not fully understood.[344] While scientists make advances periodically, "the biotic mechanism is so complex that its workings may never be fully

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yield predictable, consistent, and indisputable total social evaluations." Talhelm & Libby, *supra* note 93, at 294.

340. One ambitious effort to monetize wetlands candidly conceded that "the state of the art in wetlands valuation will lag behind the need to make wetlands management decisions for the foreseeable future." Batie & Shabman, *Estimating the Economic Value of Wetlands: Principles, Methods and Limitations*, 10 COASTAL ZONE MGMT. J. 255, 274 (1982). Given this weakness, the authors conclude that so long as "accurate value estimates may be difficult to attain," the "most feasible valuation tool for natural wetlands is the cost of substitutes." *Id.* When reliable economic information is limited, the best option is to "stress wetlands preservation." *Id.* This analysis applies equally well to most other categories of natural resources, for which there is no precise monetization tool currently available.

341. *See* Randall, *supra* note 100, at 330 (stating that "[t]he literature does not yet include empirical estimates of quasi-option value").

342. *See id.* (noting that study provides "some numerical examples that suggest that quasi-option value may be much larger than ordinary option value when preservation is an alternative to irreversible development").

343. *See* H. ROLSTON, *supra* note 52, at 80, (stating that "[i]t is typically odd, useless, and often rare things that have high scientific values, like the finches on the Galapagos, for the clues they furnish to life's development and survival").

344. *See* D. EHRENFELD, *supra* note 7, at 190-91. As the naturalist Ehrenfeld explains:

> [E]verything in Nature—including nearly all species—is highly interconnected and nearly everything has its own part to play in maintaining the natural order: consequently, nearly all species are significant, have resource value. Remove a species, even a seemingly trivial one from a resource standpoint, and we are more than likely to feel the consequences somehow, somewhere, some day.

Id. While Ehrenfeld rejects the idea that every species or habitat is essential to humankind, he emphasizes that we cannot know or predict in advance the significance of a given species. *Id.* at 192.

understood."[345] Many people know that the dodo bird is extinct, for example, but who could have predicted that its extinction would lead inexorably to the extinction of a species of South Pacific tree.[346]

Humans are arrogant in presuming to be certain of the ultimate value of any natural resource. Humankind's present ignorance, or at least uncertainty, should lead to recognition of the homeostasis of nature. Homeostasis describes nature's complex symbiosis and interdependence, as well as its ability to adapt to outside stress.[347] Ultimately, humans are at the mercy of this planet's nature, and people are far safer relying on nature's unthinking adaptation than on humankind's incomplete knowledge of ecology's workings.

Indeed, this complex homeostasis may be the greatest value of nature. One philosopher has suggested that "[t]he balance of Nature is, in other words, a kind of ultimate value."[348] Self-interest suggests that humankind take a conservative approach toward nature, in the form of a policy that eschews the avoidable elimination of natural resources. Preservation should be at least a presumptive goal of natural resource policy.

Recognition of this preservationist principle carries policy implications for natural resource damages. Whenever someone or something damages a site's resources, steps should be taken to enable natural, homeostatic forces to restore the site to balance. Doing so, however, may require human action in order to cleanse the site of trauma and to initi-

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345. A. LEOPOLD, *supra* note 9, at 220. Leopold further noted:

> The outstanding scientific discovery of the twentieth century is not television, or radio, but rather the complexity of the land organism. Only those who know the most about it can appreciate how little is known about it. The last word in ignorance is the man who says of an animal or plant: "What good is it." If the land mechanism as a whole is good, then every part is good, whether we understand it or not. If the biota, in the course of aeons, has built something we like but do not understand, then who but a fool would discard seemingly useless parts?

Id. at 176-77.

346. The interesting explanation for this result is that the seeds of the *Calvaria major* tree could germinate only after passing through the gizzard of the dodo. Destruction of the dodo eliminated the tree's reproductive ability. *See* D. EHRENFELD, *supra* note 7, at 191.

347. *See, e.g.*, H. ROLSTON, *supra* note 52, at 14. Rolston observes:

> Perhaps the paramount law in ecological theory is that of homeostasis. In material, our planetary ecosystem is essentially closed, and life proceeds by recycling transformations. In energy, the system is open, with balanced solar input and output, the cycling being in energy subsystems of aggradation and degradation. Homeostasis, it should be noted, is at once an achievement and a tendency. Systems recycle, and there is energy balance; yet the systems are not static, but dynamic, as the forces that yield equilibrium are in flux, seeking equilibrium yet veering from it to bring counter forces into play. This perpetual stir, tending to and deviating from equilibrium, drives the evolutionary process.

Id.

348. Colwell, *The Balance of Nature: A Ground for Human Values*, in 26 MAIN CURRENTS IN MODERN THOUGHT, Nov.-Dec. 1969, at 50.

ate natural processes. Restoration cost recovery may be necessary to undertake these actions.

Significantly, the principle of homeostasis also rejects expensive and elaborate restoration projects, which strive to replicate the site's prior condition. This "boutique" restoration supplants ecology's balance with humankind's view of how nature should look. Although all of the restored resources may be organic, the result is as artificial as plastic trees. Once a site has been altered, by humans or otherwise, its natural fate is modified. Only by letting nature take its course can people fulfill the important objective of natural homeostasis. Consequently, a relatively simple, minimalist restoration that cleanses the site of excessive human-made stress is best.[349]

These legal and policy reasons for the general utilization of restoration cost do not support its use in all episodes of natural resource damage. Congress did not intend the unvarying or automatic use of restoration cost. Nor does every incidence of natural resource damage threaten nature's balance and humanity's fate. Nevertheless, restoration is important. Restoration should provide a presumptive methodology to which there are exceptions: restoration may be impossible or too costly. This prospect is discussed in the following section.

2. Cost Considerations and Alternatives to Restoration

Restoration should not be employed in some circumstances. When a site is damaged beyond repair and recovery and restoration is infeasible, alternative measures should be used. Even the most vigorous advocates of restoration cost recovery recognize that restoration cost should not be used when it yields a result that is grossly disproportionate to the actual damages.[350] This view is consistent with congressional intent behind Superfund. While Congress was concerned with preservation of natural resources, it was also concerned with economic efficiency and reasonableness of natural resource damages. All actions under Superfund's national contingency plan are subject to a cost-effectiveness test, which the statute expressly imposes.[351]

This grossly disproportionate test, however, merely begs the critical question. One must establish a measuring stick against which restoration costs are tested before one can conclude that they are grossly disproportionate to true resource value. In some instances, intuition

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349. *See supra* notes 157-59 and accompanying text (discussing the current concepts of restoration ecology that generally support this result).

350. *See, e.g.*, Breen, *supra* note 14, at 10,309-10.

351. 42 U.S.C. § 9605(a)(7) (1982) (standards for national contingency plan); *see* 50 Fed. Reg. 52,128-29 (1985) (indicating the Department of the Interior's view of the role of cost-effectiveness in natural resource damage assessments).

suggests that restoration costs are unreasonably excessive. Intuition, however, is not sufficiently rigorous or reliable to employ in the legal valuation of natural resources. Some methodology is needed to compare with restoration costs in order to determine whether the latter costs are excessive.

The choice of this yardstick methodology is crucial to the ultimate measure of damages. If the reasonableness of restoration costs is tested against a valuation methodology that tends to yield low natural resource values, restoration may often seem unduly costly. Under the Department of the Interior's current regulations, many restoration projects would seemingly require grossly disproportionate costs. Under the Type A methodology, for example, certain marine mammals are valued at zero.[352] Any restoration efforts would be grossly disproportionate to this measure. Because the current regulations substantially undervalue some natural resources, these rules should not be used to test the reasonableness of restoration costs.

The search for a methodology against which to test the reasonableness of restoration costs leads inevitably to contingent valuation. All the other methods ignore the various types of existence value and therefore may substantially understate the true value of natural resources.[353] While contingent valuation is imperfect, the procedure provides at least a rough estimate of natural resource value, which is all that is necessary to test the reasonableness of restoration cost. Absolute reliance on contingent valuation is inappropriate because some episodes of resource damage may lend themselves better to other methodologies. As a general rule, however, contingent valuation offers the most complete approach for monetization of natural resource damages.

Reliance on contingent valuation reopens the question whether willingness to pay or willingness to sell should provide the measure of natural resource value. The choice will be controversial, because willingness to pay yields lower damages.[354] Willingness to pay currently has more empirical support,[355] but several persuasive reasons counsel for re-

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352. *See supra* note 292.

353. *See supra* text accompanying notes 203-06; *supra* notes 232-33 and accompanying text.

354. *See, e.g.*, NOAA REPORT, *supra* note 80, at 61-62 (summarizing various studies finding that willingness to sell may exceed willingness to pay by five- to twenty-fold).

355. *See* 51 Fed. Reg. 27,721 (1986) (noting that "less is known about methods to implement the willingness-to-accept criterion than the willingness-to-pay criterion"). California, for example, has considered the choice and opted to use willingness to pay as a measure of natural resource damages. *Hazardous and Toxic Waste Disposal Hearings, supra* note 49, at 363 (statement of Fred Walgenbach, Senior Resource Economist, California Dep't of Fish and Game). In 1979, the U.S. Water Resources Council chose to use willingness to pay measures, because "reliable empirical methods for estimating willingness to accept compensation for losses have not been developed." 44 Fed. Reg. 72,950 (1979).

liance on willingness to sell estimates. Willingness to sell is more democratic, more consistent with the context of natural resource damages, offers greater promise of complete accuracy and, thus, better fulfills the paramount purpose of Superfund.

The public and democratic nature of natural resource damage valuation favors a willingness to sell standard. Some commentators hypothesize that the disparity of results between the two methods is primarily because of the "income effect." One's current resources constrain one's willingness to pay for any product. Willingness to pay estimates tend to be lower because surveyed individuals lack the income to pay more;[356] willingness to pay estimates reflect the income position of respondents as much as they measure the value of resources. The income effect also influences willingness to sell,[357] but much less so. Should natural resource damage estimates encompass the income effect or not? This Article argues that they should not. Private resources, distributed through the free market, evidence the varying incomes of bidders. The number of "votes" possessed by one person in the marketplace are determined by the number of dollars in his possession. In the public forum, however, each citizen has a vote of equal value, regardless of his wealth. Similarly, government does not price admission to our national parks at free market, profit-maximizing levels, but rather keeps the price low so that even poor Americans can enjoy the parks.[358] Consequently, the chosen measure for valuing publicly held natural resources should avoid an undue income effect.[359]

A second reason for selecting willingness to sell derives from the context of natural resource damages. Government seeks to recover damages to resources that the public already owns. It makes more sense intuitively to view the natural resources as "sold" to the damaging party, rather than to require the public to "pay" for resources that already belong to it. The willingness to pay approach is more relevant to enhancing wildlife opportunities beyond those already extant.[360] The

356. *See, e.g.*, Brown, *supra* note 140, at 240 (providing both theoretical and empirical support for the limiting effect of income on willingness to pay estimates); *see also* Knetsch & Sinden, *supra* note 261, at 508 & n.2 (describing income effect on willingness to pay estimates). *But see id.* at 516 (noting that the magnitude of the disparity between willingness to pay and willingness to sell cannot be entirely explained by the income effect).

357. For example, a person who is desperate for money may be willing to sell resources at a lower price than if that same person had ample resources to support himself.

358. *See, e.g., Hazardous and Toxic Waste Disposal Hearings*, *supra* note 49, at 357 (statement of Fred Walgenbach) (declaring that "wildlife resources, like our highways, schools, national defense and national parks, have been relegated to control by state and federal agencies to insure their availability to all segments of our society and not just to those who would be financially able to compete if these resources were subject to the market mechanism").

359. *See* Tribe, *supra* note 6, at 158-59.

360. *Hazardous and Toxic Waste Disposal Hearings*, *supra* note 49, at 370 (statement of

Department of the Interior adopts this perspective by using willingness to sell estimates under its rarely used contingent valuation.[361]

For a third reason, willingness to sell measures may better represent the true value that people place on natural resources. Because of the disparity of results between willingness to pay and willingness to sell, some commentators assume that the latter measure yields an inaccurately high value.[362] The opposite may be true.[363] Some empirical evidence suggests that willingness to pay studies underestimate value. Contingent valuation of damages must ask respondents to value resources in terms of dollars. One study, however, asked subjects for their values both on a dollar scale and on a more abstract rating scale.[364] This study found that improvements in natural amenities were valued more highly on the abstract rating scale than on the dollar value scale.[365] Individuals thus may possess a sense of nature's value that they cannot express in monetary terms.[366] If this is true, dollar estimates elicited from contingent valuation underestimate the "felt value" that persons place on natural resources. Use of the higher willingness to sell responses minimizes this distortion.

Thus, willingness to pay measures derived from contingent valuation underestimate the true damage to natural resources.[367] Concededly,

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Fred Walgenbach). The National Oceanic and Atmospheric Association affirmed this conclusion, explaining:

> The willingness-to-pay question assumes that the person does not have the right to the resource, while the willingness-to-sell question assumes that the person does have the right since it is his option to sell or enjoy the increased service. When the service of a resource is diminished, asking the user what he should be paid to accept the reduction seems more appropriate. The concept of public good is that the good belongs to no one person but rather the public at large. As the public's representative, the trustee should be considered the rightful owner of the resource and be awarded a compensation equivalent to the willingness to sell on the part of the public.

NOAA REPORT, *supra* note 80, at 31.

361. 51 Fed. Reg. 27,721 (1986) (stating that the "Department continues to maintain that willingness to accept may be the criterion most germane to natural resource damages, since the public has the property right to the injured natural resource").

362. *Id.*

363. *See* Bishop & Heberlein, *supra* note 224, at 929.

364. *See* Brown, *supra* note 140, at 242.

365. *See id.* at 243. The author of the study concluded that "there is a concept of value regarding environmental amenities which is different from real willingness to pay, which surfaces in terms of importance and even in willingness-to-pay terms when dollar responses are not used." *Id.*

366. *See* Bishop, Heberlein & Kealy, *supra* note 248, at 620 (arguing that "[m]ost people have not previously attempted to express their values for noumarket goods in monetary terms, and contingent markets are too artificial to provide a sufficient context for developing accurate values").

367. *See* Walsh, Loomis & Gillman, *Valuing Option, Existence, and Bequest Demands for Wilderness*, 60 LAND ECON. 14, 19 (1984) (finding that "contingent valuation estimates of willingness to pay underestimate the value of environmental amenities by as much as 60%"). Indeed, one

willingness to sell estimates may overestimate the true value of damages. Various studies suggest that the true measure of natural resource value probably lies somewhere between willingness to pay and willingness to sell.[368] Willingness to sell might be best used as an upper limit on true damages.[369] Use of an upper limit is helpful for determining whether restoration costs are grossly disproportionate to actual monetary value of damages.

Use of an upper and not a lower limit is especially critical given the risk of underestimating damages. Uncertainty about nature and its homeostasis provides yet a fourth reason for preferring willingness to sell. While the relatively high estimates yielded by a willingness to sell measure may result in an overestimate of "true" natural resource damages, reliance on willingness to pay measures is more likely to underestimate those damages. Not only is willingness to sell argnably more accurate, it is less risky. We know far less about the operation of the ecosystem than we need to reduce risk. "This tendency to act on the knowns and ignore the unknowns exposes us to extraordinary biological risks."[370] In the face of this uncertainty, it is safest to err in the direction of environmental protection.[371] Better that too many sites be restored than too few. This perspective is also consistent with congressional concern for preservation.

Contingent valuation measures of willingness to sell provide the best test for the reasonableness of restoration cost. Restoration cost should be the standard for natural resource damages unless that cost significantly exceeds a reliable willingness to sell valuation. Given the relatively minimalist restoration proposed by this Article, exceeding the limit should seldom happen. The proposal falls short of a complete pre-

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contingent valuation study obtained lower willingness to pay estimates than for hedonic price estimation. *Id.* This finding is unexpected because the latter measure may not include existence value, and because the study suggests that willingness to pay may underestimate the true value of natural resources.

368. *See* Bishop & Heberlein, *supra* note 224, at 929 (noting that "[o]ur results suggest that both measures are biased, but in opposite directions"); Bishop, Heberlein & Kealy, *supra* note 248, at 620 (declaring that contingent value "mechanisms tend to underestimate willingness-to-pay and overvalue environmental assets when the criterion is willingness-to-accept-compensation"); Brookshire, Randall & Stoll, *Valuing Increments & Decrements and Natural Resource Service Flows*, 62 AM. J. AGR. ECON. 478, 482 (1980) (stating a general rule that willingness to pay will be less than actual consumer surplus, which will be exceeded by willingness to accept).

369. Bishop & Heberlein, *supra* note 224, at 929.

370. S. EDMUNDS & J. LATEY, ENVIRONMENTAL ADMINISTRATION 295 (1973).

371. *See* Walsh, Loomis & Gillman, *supra* note 367, at 19 (stating tbat because "economic analysis is unable to place a dollar value on unknown ecological effects" it is wise to employ "a conservative estimate of the total value to society of protecting these fragile natural environments"); *cf.* Industrial Union Dep't AFL-CIO v. American Petroleum Inst., 448 U.S. 607, 656 (1980) (authorizing OSHA "to use conservative assumptions in interpreting the data with respect to carcinogens, risking error on the side of overprotection rather than underprotection").

scription for natural resource damages, and other serious questions, such as specific methods of contingent valuation and proper discount rate, remain to be answered. The proposal is a significant departure from Department of the Interior regulations, however, and provides the essential framework for comprehensive natural resource damage valuation.

VI. Conclusion—Privatizing the Environment for its Protection

Establishing accurate means for valuing natural resources transcends Superfund itself. The award of natural resource damages can provide an essential, uniquely effective tool for the protection of the natural environment. Broadly used, the right to recover natural resource damages can force the internalization of many pollution costs and thus create a powerful deterrent to future environmental harm.

To date, government ownership, regulation, and prohibition of activities to protect our nation's natural resources has been the source of efforts to protect those resources. While government action has achieved some success, the mechanism has inherent limitations and may always trail behind the creative force of the free market and the harm that it may cause. The job of protecting natural resources relegates to government functions that are too large, complex, or widely dispersed for government to perform.[372] Instilling private marketplace decisions with a concern for harm to nature is a vital and necessary complement to governmental intervention in the market.[373]

This conclusion is consistent with the growing school of economic thought that emphasizes the unavoidable imperfections of government decisionmaking.[374] Because of these imperfections, institutions and the electorate tend to support policies that price public products below marginal cost.[375] To remedy these imperfections, government should

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372. A. Leopold, *supra* note 9, at 230.

373. *See id.* Leopold suggests that the "only visible remedy" is for private owners to recognize an ethical obligation to the land. Given the uncertainty of the development of this ethic, use of economic incentives represents a next best remedy. *Id.*

374. *See* Randall, *Methodology, Ideology, and the Economics of Policy: Why Resource Economists Disagree*, 67 Am. J. Agric. Econ. 1022, 1023 (1985) (describing the growing economic literature of public decisionmaking by "imperfect government institutions" as the "mainstream" of thought); *see also* C. Schultze, The Public Use of the Private Interest 4 (1977). Schultze asserts:

> There is a growing body of objective evidence that government is not performing its new tasks effectively. The counterproductivity of governmental regulation of transportation is well documented. Efforts to improve the environment, while far from a failure, are unnecessarily expensive and increasingly bogged down in Rube Goldberg regulations, legal snarls, and games between regulators and industry as enforcement deadlines draw near.

Id. (footnotes omitted).

375. Mumy & Hanke, *Public Investment Criteria for Underpriced Public Products*, 65 Am.

create institutions that encourage people in the private and public sectors to behave efficiently.[376] Granting recovery for natural resource damages creates just such an incentive for nondamaging behavior.

The present problem of natural resource destruction derives from the status of public lands as a common good in a capitalist system, as recognized in Garrett Hardin's classic article, *The Tragedy of the Commons*.[377] As Hardin observed, "Freedom in a commons brings ruin to all."[378] Hardin further projects that "we must soon cease to treat the parks as commons or they will be of no value to anyone."[379] Nor can the answer be found in a new naturalist ethic.[380] Rather, social arrangements that make individuals and business financially responsible must be established.[381]

Providing a private remedy for natural resource damages is one such social arrangement that creates an economic disincentive to harm resources.[382] This economic disincentive should deter harm to natural resources.[383] Private recovery of cleanup costs under Superfund already has begun to spur voluntary efforts to clean up hazardous waste sites.[384] The threat of recovery may prevent the hazardous releases before resources are harmed. One commentator suggests that Superfund's cause

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ECON. REV. 712, 719 (1975).

376. Randall, *supra* note 374, at 1026.

377. 162 SCIENCE 1243 (1969).

378. *Id.* at 1244. Hardin elaborates:

> The rational man finds that his share of the cost of the wastes he discharges into the commons is less than the cost of purifying his wastes before releasing them. Since this is true for everyone, we are locked into a system of "fouling our own nest," so long as we behave only as independent, rational, free-enterprisers.

Id. at 1245.

379. *Id.*

380. *See id.* at 1246 (arguing that "[i]t is a mistake to think that we can control the breeding of mankind in the long run by an appeal to conscience"). As Hardin notes, even if a majority of members of society subscribe to and abide by this new ethic, the minority will continue to do increasing damage and will actually benefit at the expense of the majority. *Id.*

381. *Id.* at 1247.

382. *See* C. SCHULTZE, *supra* note 374, at 27 (arguing that "the historically demonstrated power of market-like incentives to influence the pace and direction of technological change warrants every effort to install such incentives in our programs of social intervention"); Dower & Atkeson, *supra* note 298, at 43 (declaring that "[e]xperience in other environmental areas has shown that creativity in shaping institutional arrangements, as was the case in the environmental impact statement process, can be just as important as substantive provisions of law in achieving protection of the environment").

383. Commentators frequently assume that new standards of tort liability will deter private behavior. Some empirical evidence confirms this intuitive assumption. *See, e.g.*, W. HIRSCH, LAW AND ECONOMICS 170 (1979) (reporting a study of industrial accident rates and finding that establishment of strict liability reduced worker deaths and that government regulation had little or no impact).

384. *See* Cross, *The Dimensions of a Private Right of Action Under Superfund*, 19 CONN. L. REV. 193, 203-04 (1987).

of action for natural resource damages "created an opportunity for mobilizing unprecedented protection for natural resources across the country."[385]

To be truly effective, however, recovery must capture the full value of the harm done to resources.[386] At present, natural resource valuation under the Department of the Interior guidelines seriously understates the true social harm from damage to natural resources. As long as this is the case, natural resources will be destroyed needlessly and at a level that is economically inefficient. New valuation procedures proposed by this Article can better capture the full range of natural resource value and thereby better protect the environment.[387]

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385. Dower & Atkeson, *supra* note 298, at 43.

386. C. SCHULTZE, *supra* note 374, at 81 (stating that "[t]he trick is to make sure that the costs and gains [private actors] confront also reflect, as far as possible true *social* costs and gains" (emphasis in original)).

387. *See* H. ROLSTON, *supra* note 52, at 193. Rolston observes:

> Some dollar values are better than none at all, for otherwise these intangible values get lost in the middle of pressures for economic use. Especially as the technique [of economic valuation] has been lately refined, the results significantly aid wilderness preservation. Environmentalists can fight fire with fire and prevent the burning of their wildlands on the altar of progress.

Id. Nevertheless, Rolston is leery of reliance on economic valuation for fear that society may become "disinclined . . . to look for truth in likelier directions." *Id.* Yet, as a leading environmental lawyer has pointed out, "It should be possible, in any event, to use market incentives to achieve environmental goals without compromising these goals or denying their ethical, cultural, and political bases." Sagoff, *supra* note 133, at 322.