THE UNIFYING ROLE OF HARM IN ENVIRONMENTAL LAW

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INTRODUCTION

Environmental law concerns itself largely with the prevention or correction of harm.[1] Under one view—the view advocated by proponents of the harm principle—harm is a necessary condition for government intervention, whether through criminal prohibition, administrative regulation, or creation of a tort action.[2] Indeed, as the following examples suggest, environmental law has developed as a series of responses to demonstrations of harm.

For instance, we generally apply a "presumption of innocence" to chemicals in that we allow their manufacture and use until we learn they are harmful.[3] But when chemicals are shown to have harmful effects, we ban them (for example, DDT),[4] attempt to ban them (for example, asbestos),[5] or regulate them.[6]

Historically, landowners were free to use their property as they wished.[7] But as land-use conflicts arose, we curbed that freedom: first

1. ROBERT V. PERCIVAL ET AL., ENVIRONMENTAL REGULATION LAW, SCIENCE, AND POLICY 346 (4th ed. 2003).

2. *See* JOHN STUART MILL, ON LIBERTY 139 (David Bromwich & George Kateb eds., 2003) (1859).

3. *See* PERCIVAL ET AL., *supra* note 1, at 346 ("Historical experience—as opposed to regulatory theory—indicates that until recently we have still waited for 'dead bodies' before implementing strict regulation."). Pharmaceuticals, which are regulated by the Food and Drug Administration pursuant to the Food, Drug, and Cosmetic Act, 21 U.S.C. §§ 301-397 (2000), and pesticides, which are regulated by the Environmental Protection Agency (EPA) pursuant to the Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. §§ 136-136y (2000), are apparent exceptions to the "innocent until proven guilty" approach. These substances are more closely regulated because they are intended to have some sort of toxic effect on organisms, although applications for pesticide registrations can be denied (and existing registrations cancelled) only upon EPA findings of unreasonable adverse effects on the environment. 7 U.S.C. §§ 136a(c)(5), 136d(b).

4. *See* Consolidated DDT Hearings, 37 Fed. Reg. 13,369, 13,369-76 (July 7, 1972) (reaffirming an EPA order canceling the use of DDT on crops by December 31, 1972).

5. *See* Asbestos; Manufacture, Importation, Processing, and Distribution in Commerce Prohibitions, 54 Fed. Reg. 29,460 (July 12, 1989) (issuing a rule prohibiting the manufacture, importation, processing, and distribution in commerce of most asbestos-containing products). The U.S. Court of Appeals for the Fifth Circuit later invalidated most of the EPA's prohibition on asbestos. *See* Corrosion Proof Fittings v. EPA, 947 F.2d 1201, 1215 (5th Cir. 1991).

6. *See, e.g.*, PERCIVAL ET AL., *supra* note 1, at 346.

7. James Metzenbaum, *The History of Zoning—"A Thumbnail Sketch,"* 9 W. RES. L. REV. 36, 38-39 (1957) (recounting the history of the development of zoning laws in America).

through nuisance actions and express contractual agreements, and then through more comprehensive measures such as zoning.[8]

Waste disposal has a similar history. We used to dump human wastes and wastewater directly into the ground or into open gutters in the streets.[9] When that gave us typhoid fever, cholera, and other serious health problems, we restricted disposal practices and turned to sewer systems, sewage treatment plants, and ultimately, a detailed system of regulation for handling waste.[10] In these examples, the harm was obvious, as was the need for a policy response. The law responded by seeking to eliminate, mitigate, or compensate for the harm.

The concept of harm pervades environmental law today. Nuisance actions, the precursors to modern environmental law, require a showing of harm to interests in the use and enjoyment of land.[11] Environmental toxic tort actions, whether sounding in strict liability or negligence, require a showing of harm as a result of exposure to a toxic substance.[12] And the statutes and regulatory schemes that now dominate environmental law aim to prevent or reduce harm to human health or the environment.[13]

But what exactly is environmental harm? One might expect the concept to be well-defined, given its centrality to environmental law. Indeed, the appeal of the harm principle derives largely from its

8. *See* ROBERT C. ELLICKSON & A. DAN TARLOCK, LAND-USE CONTROLS 39 (1981). *See generally* Metzenbaum, *supra* note 7 (recounting the history of the development of zoning in America).

9. *See* Joel A. Tarr et al., *Water and Wastes: A Retrospective Assessment of Wastewater Technology in the United States, 1800-1932*, 25 TECH. & CULTURE 226, 228-29 (1984) (describing the cesspool-privy vault system); *see also* DANIEL DEFOE, A JOURNAL OF THE PLAGUE YEAR 44 (Louis Landa ed., 1969) (1722) (providing a primarily fictional account of the 1665 plague outbreak and the orders of the mayor of London, "[t]hat the Sweeping and Filth of Houses be daily carry'd away by the Rakers," and that "the Laystalls be removed as far as may be out of the City, and common Passages, and that no Nightman or other be suffered to empty a Vault into any Garden near about the City").

10. *See* Tarr et al., *supra* note 9, at 230-46.

11. *See* DAN B. DOBBS, THE LAW OF TORTS § 463, at 1321-22 (2000) (defining private nuisance); *id.* § 467, at 1334-35 (defining public nuisance); PERCIVAL ET AL., *supra* note 1, at 60-61; *see, e.g.*, CAL. CIV. CODE § 3479 (West 1997) (defining nuisance).

12. *See* Albert C. Lin, *Beyond Tort: Compensating Victims of Environmental Toxic Injury*, 78 S. CAL. L. REV. 1439, 1446 (2005). *See generally* Richard A. Epstein, *The Harm Principle—And How It Grew*, 45 U. TORONTO L.J. 369, 369 (1995) ("Much of the common law torts edifice rests on the powerful distinction between those actions that cause harm to another individual and those actions that do not.").

13. *See infra* Part I.C.

apparent simplicity and objectiveness.[14] Surely, environmental harm must include death and illness, and perhaps dark clouds of pollution billowing from a smokestack. Yet the concept of harm in environmental law has received relatively little theoretical attention. As a closer examination reveals, harm can be surprisingly ambiguous and contested.[15] Harm means different things to different people, and the harm principle often disguises inevitable choices about values.[16]

The different understandings of harm may not be immediately obvious. Death caused by an explosion at a chemical plant is an easy case of harm. So is lung cancer resulting from asbestos exposure. The world in which we live today, however, also presents more difficult cases that call into question traditional notions of harm.[17] For one, the world seems more complex than ever before. We have unprecedented amounts of information about chains of causation that generate indirect and cumulative harms. We also have unprecedented access to that information, which could serve as the basis for vast expansion of the scope of the harm principle. Furthermore, the world is in fact becoming more complex. Thanks to globalization and technological advances, we are more interconnected with others, and change is occurring at a frenetic and accelerating pace. These developments both reveal and generate effects that challenge our casual notions of harm. For example, scientists' growing ability to detect potential precursors of toxic illness raises the question of whether the law should view such precursors as harm. Rapid technological advances in new fields of research, such as nanotechnology, generate uncertain consequences that are not yet—but may one day be—harmful. Furthermore, the increasing breadth and volume of human activity threaten to affect the environment around us in unprecedented ways.

These developments raise questions not only about the meaning of "harm," but also about the adequacy of the harm principle. If harm is present or anticipated, the harm principle provides a well-established justification for a legal response. If harm is absent, one implication might be that the situation in question is beyond the proper reach of the law. Another implication, however, might be that there exist—or should exist—justifications for government action other than the harm principle. A coherent articulation of the concept of harm thus can

14. *See* discussion *infra* Part II.A.

15. *See* discussion *infra* Part II.

16. *See infra* notes 249-53 and accompanying text.

17. *Cf.* Eric T. Freyfogle, *The Owning and Taking of Sensitive Lands*, 43 UCLA L. REV. 77, 126 (1995) ("In common law days, harms were easier to see and subject to more definite proof. Today, legal rules that ban only known, provable harms will overlook many of the most potent sources of ecosystem destruction.").

strengthen the foundation and clarify the reach of environmental law. It can also promote a necessary dialogue about the justifications for environmental law.

This Article introduces a theoretical framework for understanding harm in environmental law.[18] As the Article explains, harm is neither objective, nor is it subject to a universally applicable definition. Rather, "harm" is a normative concept that reflects underlying social judgments about the good and the bad. To illustrate the framework, the Article applies it to concrete examples that challenge intuitive notions of harm as objective and readily identifiable.

Part I examines environmental law and identifies various contexts in which the concept of harm plays a significant role: environmental torts, environmental statutes, takings law, and the law of constitutional standing. This examination not only demonstrates the centrality of harm in environmental law, but also reveals courts' long-standing struggle with the concept even in core areas of environmental law. Part II explores philosophical approaches to harm to develop an understanding of harm in environmental law. Building on the works of philosophers John Stuart Mill, a leading advocate of the harm principle, and Joel Feinberg, who further analyzed the concept of harm, Part II constructs a theoretical framework of environmental harm. The framework defines harm as a setback to human interests that community norms have deemed to be significant. Part III of this Article describes four cutting-edge issues of harm in environmental law. These issues demonstrate the inadequacy of relying on vague notions of harm and provide concrete factual settings for applying the framework for analyzing harm developed in Part II.

This Article does not contend that society must respond to every harm. Whether damages or injunctive relief is appropriate, or whether government regulation is justified, depends on a host of factors.[19]

18. Harm, of course, is not unique to environmental law. Consideration of all the legal contexts in which harm arises is beyond the scope of this paper. For a broader discussion of the similar concept of pollution, see JOHN NAGLE, POLLUTION (forthcoming 2006).

19. *Cf.* RESTATEMENT (SECOND) OF TORTS § 7 cmt. d (1965). "Harm . . . is not necessarily actionable." *Id.* To give rise to a tort claim, it must "be legally caused by tortious conduct" and must "result[] from the invasion of a legally protected interest." *Id.*; Jules L. Coleman, *Tort Law and the Demands of Corrective Justice*, 67 IND. L.J. 349, 369 (1992) ("It does not follow that someone who is harmed has a claim to repair in justice."); Epstein, *supra* note 12, at 400 (suggesting that the harm principle offers "only a first cut" and that the decision on whether to regulate harm may be based on utilitarian grounds); Andrew Kernohan, *Accumulative Harms and the Interpretation of the Harm Principle*, 19 SOC. THEORY & PRAC. 51, 66 (1993) ("[W]hile the individual harm principle licenses the imposition of duties to prevent harm, it must be supplemented with considerations of justice and efficiency to determine what particular

Relatively minor harms may warrant only limited regulation, whereas more significant harms may warrant a tort remedy or even prohibition. What the harm principle does is "jurisdictional": it is a touchstone for identifying one class of conduct that society has the power to regulate.[20] The role of the harm principle in political philosophy thus is analogous to that of the Commerce Clause in constitutional law: it is a means of delineating the scope of legal authority.[21] In some instances, the harm is obvious, and so is the power to regulate. In other instances, the harm is contested, leaving the power to regulate—at least pursuant to the harm principle—in doubt. As with the Commerce Clause, jurisdiction does not necessarily compel action. Once harm is established, whether regulation is appropriate, and what form that regulation should take, will depend on case-specific facts such as the extent of the harm, uncertainty associated with the harm, and social priorities.

I. HARM AND ENVIRONMENTAL LAW

In the wake of the information revolution and rapid technological change, courts, agencies, and society in general are struggling with the concept of harm.[22] This struggle is not new, however, nor has it been confined to discrete areas of environmental law. Harm is a recurring theme in environmental law, from common law nuisance to toxic tort to environmental regulation. Moreover, the problem of defining harm has plagued the courts in established doctrinal areas, such as takings law and standing doctrine, for decades.

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duties to impose."); Steven D. Smith, *The Hollowness of the Harm Principle* 11 (Univ. San Diego Legal Studies, Research Paper No. 05-07, 2004), *available at* http://ssrn.com/abstract=591327 ("The harm principle does not entail, of course, that government *must* restrict all conduct that causes harm: whether restrictions are appropriate depends on a consideration of relevant factors, such as the costs and benefits of restrictions and the value of liberty to engage even in potentially harmful conduct.").

20. *See* MILL, *supra* note 2, at 139 ("As soon as any part of a person's conduct affects prejudicially the interests of others, society has jurisdiction over it . . . ."); *see also* Smith, *supra* note 19, at 11 (explaining Mill's use of "jurisdiction" to refer to the legitimacy of government regulation).

21. *See* Epstein, *supra* note 12, at 378 (comparing jurisdictional functions of the harm principle and the Commerce Clause); *cf.* Donald A. Dripps, *The Liberal Critique of the Harm Principle*, 17 CRIM. JUST. ETHICS 3, 3-5 (1998) (positing that the harm principle could be incorporated as an internal norm of tolerance or as an external constraint on legislative discretion). The harm principle is only an analogue to the Commerce Clause, as it is not found explicitly in the Constitution.

22. *See infra* Part III.

A. Nuisance Law

Harm is a central concept in tort law; as a legal commentator once put it, "harm is the tort signature."[23] Negligence, strict liability, and intentional torts are all aimed at allocating losses, or harms, arising out of human activities.[24] Traditionally, tort law recognized "only direct and tangible injuries to persons or property."[25] Neither the presence of intangible losses alone nor the threat of future harm was actionable.[26]

The origins of environmental law can be traced to tort law, particularly the law of nuisance.[27] Nuisance protects a plaintiff from nontrespassory, intangible interference with one's use and enjoyment of land.[28] In contrast to much of the rest of tort law, nuisance is not terribly concerned with the degree of fault in a defendant's conduct.[29] The focus of nuisance law, rather, is on whether there is significant

23. Warren A. Seavey, *Principles of Torts*, 56 HARV. L. REV. 72, 73 (1942).

24. *See* W. PAGE KEETON ET AL., PROSSER AND KEETON ON THE LAW OF TORTS 6 (5th ed. 1984); *see also* DOBBS, *supra* note 11, at 1 ("A tort is conduct that amounts to a legal wrong and that causes harm for which courts will impose civil liability."). For a few torts such as trespass, "[t]he harm postulated is a legal fiction designed to provide a unified rationale for legal interference." John Kleinig, *Crime and the Concept of Harm*, 15 AM. PHIL. Q. 27, 27-28 (1978) (noting that trespass may not result in physical damage and that harm from trespass is defined as deprivation of exclusive use and enjoyment); *cf.* John C.P. Goldberg, *Rethinking Injury and Proximate Cause*, 40 SAN DIEGO L. REV. 1315, 1322-23 (2003) (suggesting that harmless trespass nevertheless involves injury in the form of rights violations).

25. Nancy Levit, *Ethereal Torts*, 61 GEO. WASH. L. REV. 136, 140 (1992); *see also* DOBBS, *supra* note 11, at 3-4 (noting that tort law has given the greatest protection to the physical security of persons and property, and has been more reluctant to impose liability for intangible and economic losses); Claire Finkelstein, *Is Risk a Harm?*, 151 U. PA. L. REV. 963, 976 (2003).

26. *See* DOBBS, *supra* note 11, at 4 (stating that courts traditionally imposed liability for intangible harm only if the defendant physically interfered with the plaintiff's person or property); KEETON ET AL., *supra* note 24, § 30, at 165 (stating that the threat of future harm is not actionable).

27. *See* Epstein, *supra* note 12, at 400 ("[C]oncern with environmental harms can be traced back to the venerable tort of nuisance . . . ."); *see also* 1 WILLIAM H. RODGERS, JR., ENVIRONMENTAL LAW: AIR AND WATER § 2.1, at 29 (1986) ("[N]uisance law continues to be the fulcrum of what is called today environmental law.").

28. *See* DOBBS, *supra* note 11, § 462, at 1319. A private nuisance is a nontrespassory interference with a neighbor's possessory interest in the use and enjoyment of land. RESTATEMENT (SECOND) OF TORTS § 821D (1979); DOBBS, *supra* note 11, § 463, at 1321. A public nuisance is a nontrespassory interference with a right held by the general public in the use of public facilities or with the public health, safety, or convenience. RESTATEMENT (SECOND) OF TORTS § 821B (1979); DOBBS, *supra* note 11, § 467, at 1334. *See generally* John Copeland Nagle, *Moral Nuisances*, 50 EMORY L.J. 265, 271-75 (2001) (summarizing nuisance law).

29. *See* RODGERS, *supra* note 27, § 2.4, at 41-43 (noting that nuisance may involve conduct that is intentional, reckless, negligent, or free of fault).

harm—that is, significant interference with one's use and enjoyment of land or significant impairment of public rights.[30]

Because of the wide range of contexts in which it has been applied, the law of nuisance was once described as an "impenetrable jungle."[31] The harms that nuisance may encompass include a great variety of negative impacts, such as tangible property damage, diminution in market value, loss of use, loss of light or view, disturbance of a neighbor, or even disturbance of a neighbor's peace of mind.[32] It is critical to note that although harm is central to nuisance doctrine,[33] the specific harms that nuisance governs are neither fixed nor objective.[34] Rather, what nuisance law treats as a harm is highly contextual and determined by community norms.[35] Whether a nuisance exists involves a balancing of the gravity of the harm, the utility of the conduct, the location and surroundings of the activity, and other factors that ultimately reflect social value judgments.[36]

30. *See* DOBBS, *supra* note 11, § 463, at 1321; *see also* Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1054-55 (1992) (Blackmun, J., dissenting) ("Common-law public and private nuisance law is simply a determination whether a particular use causes harm.").

31. KEETON ET AL., *supra* note 24, § 86, at 616.

32. Examples of private nuisance include flooding, blasting that damages a house, odors or noises that disturb a neighbor, and operation of a bawdy house that disturbs a neighbor's peace of mind. *Id.* § 87, at 619-20. Examples of public nuisance, an even broader term, include obstruction of a highway, keeping of diseased animals, and operation of a house of prostitution. *Id.* § 90, at 643-44. For other unusual examples of nuisances, see RODGERS, *supra* note 27, § 2.1, at 29-30; *see also* DOBBS, *supra* note 11, § 463, at 1321-22.

33. *See* RODGERS, *supra* note 27, § 2.2, at 33 ("Nuisance is a word derived from the French word for harm."); *id.* § 2.4, at 42 ("[L]iability for a nuisance (private and public as well) must be premised upon significant harm.").

34. *See* John A. Humbach, *Evolving Thresholds of Nuisance and the Takings Clause*, 18 COLUM. J. ENVTL. L. 1, 13 (1993) ("The only objective feature that common law nuisance cases seem to share is that somebody did something, not otherwise a tort or crime, whose consequences had negative effects on others.").

35. *Cf.* Nagle, *supra* note 28, at 299 ("A moral objection must be commonly held in the community before the harms that it causes can give rise to a nuisance claim.").

36. *See* KEETON ET AL., *supra* note 24, § 88, at 630 (listing factors considered in deciding whether the plaintiff or defendant should bear a loss); Humbach, *supra* note 34, at 10-13; James E. Krier, *The Regulation Machine*, 1 SUP. CT. ECON. REV. 1, 14 (1982) ("The calculus of nuisance is one of costs and benefits.").

B. Toxic Torts and Harm

Environmental law incorporates not only nuisance from tort law, but also toxic torts based on negligence or strict liability.[37] Environmental toxic torts target personal injuries caused by exposure to toxic substances in the environment.[38] The law in this area is instructive for understanding harm in environmental law because it illustrates how the concept of harm has expanded beyond physical and economic injuries.

Traditional tort law provides compensation for nonphysical and noneconomic harm under limited circumstances.[39] The most obvious example is the tort of assault, which compensates a plaintiff's apprehension of harmful conduct even absent physical harm.[40] Another example is the tort of negligent infliction of emotional distress, which also recognizes nonphysical harm, although a plaintiff, until recently, could only recover for such harm by also showing contemporaneous physical harm.[41]

For environmental toxic tort plaintiffs, the law governing recovery for emotional distress is of particular interest because it encompasses claims for fear of future disease arising from toxic exposure.[42] Intangible harms recognized in emotional distress claims may include fear, anxiety, and diminished enjoyment.[43] Yet as reflected in the history of the tort of negligent infliction of emotional distress, the intangible nature of such harms often generated judicial skepticism.[44] To prevent fraudulent claims and curtail potentially unlimited liability,

37. *See* Troyen A. Brennan, *Environmental Torts*, 46 VAND. L. REV. 1, 1-2 (1993).

38. *See id.*

39. *See generally* Levit, *supra* note 25 (discussing causes of action for "intangible or emotional injuries or deprivations of expectancy or reliance interests," invasion of privacy, "infliction of emotional distress, breach of confidence, breach of good faith, interference with economic expectancies, loss of a chance, [and] loss of choice").

40. DOBBS, *supra* note 11, § 33, at 63-64.

41. *Id.* § 302, at 821-22, § 308, at 836. Unlike negligent infliction of emotional distress, the tort of intentional infliction of emotional distress did not require physical injury. *See, e.g.*, State Rubbish Collectors Ass'n v. Siliznoff, 240 P.2d 282, 286 (Cal. 1952). In the latter instance, courts explained that the genuineness of claims was assured by the requirement that extreme and outrageous conduct be directed at the plaintiff in an intentional or reckless manner. *Id.*

42. *See, e.g.*, Sterling v. Velsicol Chem. Corp., 855 F.2d 1188, 1205-06 (6th Cir. 1988) (holding that under Tennessee law, mental distress from a reasonable fear of cancer is a present and compensable injury).

43. DOBBS, *supra* note 11, § 302, at 821.

44. *See* Mary Donovan, Comment, *Is the Injury Requirement Obsolete in a Claim for Fear of Future Consequences?*, 41 UCLA L. REV. 1337, 1347-48 (1994).

courts also required proof of physical injury—mental disturbance alone could not sustain a negligence claim.[45]

Over time, however, the physical injury requirement receded.[46] Courts found it overly demanding, and advances in detecting and documenting intangible injury undermined the need for artificial limitations on recovery.[47] Courts developed varying approaches as they wrestled with the conceptual problems of the injury requirement. In some cases, the physical injury requirement gave way to a requirement that there be some sort of contemporaneous physical contact.[48] Other jurisdictions adopted the zone-of-danger test, which requires neither a contemporaneous physical injury nor impact.[49] Under the zone-of-danger test, a plaintiff need only prove personal danger of physical impact and the presence of physical symptoms at some point subsequent to the event that caused the emotional distress.[50] Today, a minority of jurisdictions recognize a cause of action for negligent infliction of emotional distress absent physical injury or impact.[51] These courts reason that advances in clinical psychology allow courts to address directly whether a plaintiff truly is experiencing emotional distress.[52]

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45. *Id.*

46. *See* Levit, *supra* note 25, at 140-42.

47. *See id.* at 141-42, 145.

48. *See id.* at 144-45 & n.48 (citing Bosley v. Andrews, 142 A.2d 263, 264 (Pa. 1958)).

49. *See id.* at 145 (citing Resavage v. Davies, 86 A.2d 879, 883 (Md. 1952)).

50. *See id.*; *see, e.g.*, Robb v. Pa. R.R., 210 A.2d 709, 714-15 (Del. 1965); Niederman v. Brodsky, 261 A.2d 84, 90 (Pa. 1970). The zone-of-danger rule was further relaxed to encompass scenarios for which strict application of its requirements resulted in unjust results. Most notably, in *Dillon v. Legg*, the California Supreme Court held that family members outside the zone of danger but present at the scene of an accident could recover if the defendant negligently put a close loved one at risk of physical injury. 441 P.2d 912, 914 (Cal. 1968).

51. *See* Donovan, *supra* note 44, at 1355 & n.72 (citing cases representative of those jurisdictions); *see also* Richard Bourne, *Medical Monitoring Without Physical Injury: The Least Justice Can Do for Those Industry Has Terrorized with Poisonous Products*, 58 SMU L. REV. 251, 265 (2005) (noting only "modest" success by plaintiffs' lawyers in persuading courts to avoid the physical injury requirement in negligent infliction of emotional distress claims).

52. *See, e.g.*, St. Elisabeth Hosp. v. Garrard, 730 S.W.2d 649, 653 (Tex. 1987) (noting that medical research has provided a "more detailed and useful understanding of the interaction between mind and body" as the reason for eliminating the physical manifestation requirement); Paugh v. Hanks, 451 N.E.2d 759, 765 (Ohio 1983) (finding that "a rigid requirement which prevents a plaintiff from recovering from serious emotional harm[,] except where a physical injury manifestation has ensued, completely ignores the advances made in modern medical and psychiatric science"); Rodrigues v. State, 472 P.2d 509, 519 (Haw. 1970) (rejecting the requirement of physical injury and adopting "general standards" to test the genuineness and seriousness of mental distress).

Despite the erosion of barriers to recovery for emotional harms, discomfort with recognizing such injuries persists.[53] Most courts still tie compensability to "physical impacts, physical manifestations of injury, or other proxies for emotional distress";[54] and even the more generous courts restrict emotional distress claims in other ways.[55] Ultimately, claims of emotional injury are viewed with far greater skepticism than claims of physical injury.[56] This is not only because emotional injuries are harder to prove. Rather, courts often do not consider emotional injury to be serious harm.[57] For these courts, "[i]njuries—to be considered 'real'—must be physical, visible, or discernible."[58] As we shall see, this discomfort with nonphysical injuries is also present in statutory environmental law.

C. Environmental Regulation

Nuisance and toxic tort claims play an important but relatively modest role in modern American environmental law. In the paradigmatic tort case, identifying the harm is a relatively simple task.[59] A negligent driver collides with another driver, causing bodily injury and property damage. Or a chemical plant accident releases a cloud of highly toxic gas that causes illness and death in a nearby community. In these examples, there may be individual problems of proof, but the tort system generally can determine whether there has been harm and who caused it.[60] Environmental problems, however, often cause harm

53. *See* Levit, *supra* note 25, at 145-46.

54. *See id.* at 146.

55. *See* Donovan, *supra* note 44, at 1355-56 (discussing the requirements that: (1) the defendant have a duty to refrain from the conduct, (2) there be a guarantee that the emotional distress is genuine, and (3) the emotional distress be serious or severe); Christopher P. Guzelian, *Liability & Fear*, 65 OHIO ST. L.J. 713, 766-804 (2004) (discussing restrictions on liability for emotional harms); *see, e.g.*, Burgess v. Superior Court, 831 P.2d 1197, 1201 (Cal. 1992) (limiting recovery in the absence of physical injury to "direct victims," and defining direct victims as those persons to whom the defendant owed a preexisting duty).

56. Levit, *supra* note 25, at 172.

57. *Id.* (contending that courts treat emotional injuries as "intrinsically less serious" than physical injuries).

58. *Id.* at 174.

59. *Cf.* Glen O. Robinson, *Probabilistic Causation and Compensation for Tortious Risk*, 14 J. LEGAL STUD. 779, 780 (1985) ("One of the illusions fostered by traditional tort doctrine is that events have determinate causes that can be identified by careful investigation.").

60. *Cf.* Note, *Latent Harms and Risk-Based Damages*, 111 HARV. L. REV. 1505, 1506 (1998) ("The current injury requirement [of traditional tort law] was relatively straightforward for much of our history: either the plaintiff was injured or he was not.").

that is latent, less direct, and less obvious.[61] Chronic exposure of a population to common carcinogenic pollutants, for example, will cause cancer in a proportion of exposed individuals; but people who become ill decades after their initial exposure often have difficulty demonstrating that a particular defendant's conduct caused their illness.[62] In such instances, common law tort provides neither sufficient redress for widespread harms nor adequate mechanisms for anticipatory intervention.[63] To address these shortcomings, the legal system turned to public law—legal structures based on statutes and administrative regulations.[64] For nearly the last four decades, direct governmental regulation has been the principal means of addressing environmental harm.

Environmental regulation seeks to correct market failures and to ensure that an adequate supply of public goods, such as clean air and water, is available to the public.[65] Human activity often results in

61. *See* Lin, *supra* note 12, at 1445-52 (describing the characteristics of environmental toxic torts); Note, *supra* note 60, at 1506 (describing the increasing recognition of latent harms "that may not develop into symptomatic diseases for significant periods of time").

62. *See* Lin, *supra* note 12, at 1446-52 (explaining the difficulties faced by environmental toxic tort plaintiffs in demonstrating causation); David Rosenberg, *The Causal Connection in Mass Exposure Cases: A "Public Law" Vision of the Tort System*, 97 HARV. L. REV. 849, 856 (1984) ("Rarely is any particular toxic agent the exclusive source of a given disease. Insidious diseases generally have several sources, each of which may by itself be sufficient to bring about the condition.").

63. *See* ZYGMUNT J.B. PLATER ET AL., ENVIRONMENTAL LAW AND POLICY: NATURE, LAW, AND SOCIETY 283 (3d ed. 2004) (listing the inadequacies of the common law and noting that "many modern environmental problems are so complex and difficult to prove in the courtroom setting that common law cannot be relied upon to serve as society's primary environmental law strategy"); *see also* ROBERT L. GLICKSMAN ET AL., ENVIRONMENTAL PROTECTION: LAW AND POLICY 50-51 (4th ed. 2003) (suggesting that "the perceived failure" of the common law to protect the commons "became the basis for federal command and control regulation"); PERCIVAL ET AL., *supra* note 1, at 85 ("Even in cases of public nuisance, the common law has proved to be a crude mechanism at best for controlling the onslaught of modern-day pollution."); David A. Westbrook, *Liberal Environmental Jurisprudence*, 27 U.C. DAVIS L. REV. 619, 647 (1994) ("Archaic environmental law is radically incomplete.").

64. *See* PERCIVAL ET AL., *supra* note 1, at 85 (noting the predominance of federal and state statutes in environmental law, while recognizing the potential of the common law to "serve as an important tool for addressing regulatory gaps"); PLATER ET AL., *supra* note 63, at 283.

65. *See* J. Peter Byrne, *Property and Environment: Thoughts on an Evolving Relationship*, 28 HARV. J.L. & PUB. POL'Y 679, 681 (2005) ("Environmental law starts from the recognition that: 1) environmental benefits are public goods . . . and 2) legal institutions are needed to make owners take account of the costs that they might impose on others."); Kirsten H. Engel, *The Dormant Commerce Clause Threat to Market-Based Environmental Regulation: The Case of Electricity Deregulation*, 26 ECOLOGY

negative externalities—that is, harms to others. An economically rational actor is likely to disregard these harms unless their costs are internalized through environmental regulation or some other means.[66] Absent regulation, individual firms are likely to shift the health costs and environmental damage associated with pollution to others.[67] Aside from this economic component, environmental regulation of harms has a moral element as well: the principle of corrective justice that polluters should pay for the harms they cause.[68]

What harms, or negative externalities, are the primary objects of environmental regulation? Pollution is perhaps the most obvious example. For instance, the National Ambient Air Quality Standards, which serve as the regulatory foundation of the Clean Air Act, are

L.Q. 243, 349 (1999) (contending that environmental regulation is justifiable on economic grounds); Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243, 1243-45 (1968) (describing overgrazing and pollution as examples of the "tragedy of the commons," in which individually rational behavior affecting commonly held property results in collectively irrational outcomes); Westbrook, *supra* note 63, at 647 (stating that most environmental regulation is justified by a theory of market failure); Tseming Yang, *Melding Civil Rights and Environmentalism: Finding Environmental Justice's Place in Environmental Regulation*, 26 HARV. ENVTL. L. REV. 1, 10 (2002) (contending that Hardin's conception of collective action problems "has driven modern environmental regulation and led to approaches seeking to force polluters to bear the costs of the pollution harms they create"); *cf.* Mark Sagoff, *Economic Theory and Environmental Law*, 79 MICH. L. REV. 1393, 1393-96 (1981) (noting economists' view that "environmental problems are economic problems," but contending that environmental statutes reflect noneconomic goals).

66. *See* David B. Spence, *The Shadow of the Rational Polluter: Rethinking the Role of Rational Actor Models in Environmental Law*, 89 CAL. L. REV. 917, 917 (2001) ("The modern American environmental regulatory system is founded on the assumption that business firms are rational polluters . . . . This traditional view of firms implies that environmental regulators must deter pollution through the imposition of fines and penalties . . . ."). The Coase Theorem predicts that government regulation is unnecessary to achieve an economically efficient outcome, if bargaining is costless and full information is available. R.H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1, 10 (1960) ("With costless market transactions, the decisions of the courts concerning liability for damage would be without effect on the allocation of resources."). The assumptions of no transaction costs and perfect information rarely hold true, as Coase himself recognized. *See* R.H. COASE, THE FIRM, THE MARKET, AND THE LAW 174-75, 185 (1988); *see also* ROGER W. FINDLEY ET AL., CASES AND MATERIALS ON ENVIRONMENTAL LAW 281-82 (6th ed. 2003) ("Coase regarded the zero-transaction-cost assumption as unrealistic."); Westbrook, *supra* note 63, at 651 ("In the real world . . . bargaining is not costless and information is not perfect.").

67. *See* Spence, *supra* note 66, at 919-20.

68. *See* Byrne, *supra* note 65, at 687-88 ("Paying people not to harm the environment obscures a basic issue of morality: polluters ought to pay for the harm they cause or bear the cost of pollution abatement."). The "polluter pays principle" is a principle of international environmental law that calls for the internalization of environmental costs. *See* DAVID HUNTER ET AL., INTERNATIONAL ENVIRONMENTAL LAW AND POLICY 414-15 (2d ed. 2002).

harm-based standards because they are designed to avoid harm and are set according to scientific evidence of harm to human health and welfare.[69] Similarly, the Clean Water Act prohibits the discharge of oil or hazardous substances into navigable waters "in such quantities as may be harmful."[70] Penalties assessed for violating these statutes consider the harm or potential harm to health, property, and the environment caused by each violation.[71]

Some regulatory schemes—particularly those governing toxic substances—address the risk of harm more than the harm itself.[72] As knowledge and public perception of toxic risks have increased, society has adopted regulation aimed directly at risk.[73] Risk-based regulation is

69. *See* 42 U.S.C. § 7409(b) (2000); *see also* PLATER ET AL., *supra* note 63, at 552. *See generally* MARK SAGOFF, PRICE, PRINCIPLE, AND THE ENVIRONMENT 106 (2004) ("Environmental statutes seek to minimize or eliminate the harm pollution causes, particularly to our health.").

70. 33 U.S.C. § 1321(b)(3) (2000). As originally enacted, this provision prohibited discharges of "harmful quantities" of oil. *See* PERCIVAL ET AL., *supra* note 1, at 133. Because of the difficulty of proving actual harm on a case-by-case basis, the Secretary of the Interior interpreted the statute to deem harmful any oil spill that caused a film or sheen on water. *Id.* After this interpretation was successfully challenged, Congress amended the statute to incorporate the less stringent "as may be harmful" standard. *See id.* at 134.

71. *See* ENVTL. PROT. AGENCY, CLEAN AIR ACT STATIONARY SOURCE CIVIL PENALTY POLICY 10 (1991), *available at* http://www.epa.gov/compliance/resources/policies/civil/caa/stationary/penpol.pdf (listing "actual or possible harm" as a factor to be weighed in determining penalties); ENVTL. PROT. AGENCY, CIVIL PENALTY POLICY FOR SECTION 311(b)(3) AND SECTION 311(j) OF THE CLEAN WATER ACT 8 (1998), *available at* http://epa.gov/compliance/resources/policies/civil/cwa/311pen.pdf (considering potential and actual harm in determining penalties for settlement purposes); *see also* CLIFFORD RECHTSCHAFFEN & DAVID L. MARKELL, REINVENTING ENVIRONMENTAL ENFORCEMENT & THE STATE/FEDERAL RELATIONSHIP 65 (2003) (noting that the determination of a penalty for violating environmental statutes typically includes a consideration of potential harm).

72. *See* GLICKSMAN ET AL., *supra* note 63, at 674 ("[O]ne of the major innovations of environmental law has been to substitute the concept of risk as a proxy for injury for the common law's insistence that injury be established by proof that an action in fact caused demonstrable harm."); John S. Applegate, *The Perils of Unreasonable Risk: Information, Regulatory Policy, and Toxic Substances Control*, 91 COLUM. L. REV. 261, 267-71 (1991) (observing that the Federal Insecticide, Fungicide, and Rodenticide Act; Resource Conservation and Recovery Act; Comprehensive Environmental Response, Compensation, and Liability Act; and Toxic Substances Control Act all regulate risk instead of actual harm); Fred P. Bosselman & A. Dan Tarlock, *The Influence of Ecological Science on American Law: An Introduction*, 69 CHI.-KENT L. REV. 847, 868 (1994) (noting that in the 1970s, risk was accepted as a basis for regulating toxic substances, thus enabling regulation without full scientific knowledge).

73. *See* EUGENE BARDACH & ROBERT A. KAGAN, GOING BY THE BOOK: THE PROBLEM OF REGULATORY UNREASONABLENESS 11-13 (2002) (arguing that these factors

also a response to the piecemeal nature of tort remedies and to the difficulties that toxic-tort plaintiffs face.[74] Many of these difficulties arise because tort liability requires proof that an action caused demonstrable harm.[75] Risk-based regulation, in contrast to common law tort, is premised on collective harms and operates to prevent harm before it occurs.[76] Yet even in risk-based regulation, the law has generally required an affirmative showing that harm is likely before intervening.[77] The possibility of harm, or uncertainty about the effects of exposure, generally is not enough to trigger regulation.[78]

Finally, some environmental regulation addresses matters other than harm to humans or their property, or the risk of such harm. Statutes such as the Endangered Species Act are concerned at least in part with harm to the environment, in addition to harm to human interests.[79] Nevertheless, harm, if loosely understood to include these varying interests, might be said to undergird all environmental regulation.

D. Takings and Harm

Takings law, though somewhat removed from the core of environmental law, merits consideration because it has given special attention to the concept of harm and to the nuisance doctrine. The U.S. Supreme Court's struggle with defining harm in this area underscores the need for a more thorough understanding of environmental harm.

The relationship between harm, nuisance, and takings is less straightforward than it may first appear. Clearly, the government may

contributed to the growth of safety and environmental regulation in the 1960s and 1970s).

74. *See* Applegate, *supra* note 72, at 272.

75. GLICKSMAN ET AL., *supra* note 63, at 674; Lin, *supra* note 12, at 1444-52.

76. Applegate, *supra* note 72, at 273; Christopher H. Schroeder, *Lost in the Translation: What Environmental Regulation Does That Tort Cannot Duplicate*, 41 WASHBURN L.J. 583, 589 (2002) ("The goal of much modern environmental regulation is to prevent harm to the environment before it occurs, with an implementation structure that includes prior approvals, permits that embody standards to be met, and the monitoring of compliance, all with that goal in mind.").

77. Alyson C. Flournoy, *Legislating Inaction: Asking the Wrong Questions in Protective Environmental Decisionmaking*, 15 HARV. ENVTL. L. REV. 327, 366 (1991) (observing that statutes generally provide for regulatory inaction, in the absence of a positive finding that a substance causes an unreasonable risk of harm).

78. *See id.*

79. *See infra* Part III.D.

bring an action to enjoin public nuisances,[80] and it may regulate nuisances—public and private—without having to provide compensation.[81] The key question of regulatory takings law, however, is whether the only harms the government may regulate without compensation are the harms comprising common law nuisance.

The Takings Clause of the Fifth Amendment prohibits the governmental taking of private property "for public use, without just compensation."[82] Exactly when the government must pay compensation for regulating use of private property is a question with which the Supreme Court has struggled over the years.[83] Early takings cases broadly affirmed the state's police power. All private property, the Court wrote in 1887, "is held under the implied obligation that the owner's use of it shall not be injurious to the community."[84] Based on this principle, the Court developed the harm-benefit test, which provided that government regulation of private property, if intended to prevent harm to the public, was not a taking.[85] Conversely, a regulation intended to confer a public benefit was generally compensable.[86] Although the test originated in public nuisance

80. *See, e.g.*, Georgia v. Tenn. Copper Co., 206 U.S. 230, 239 (1907) (stating that "there is no alternative to issuing an injunction" if the state successfully proves public nuisance).

81. *See* RICHARD A. EPSTEIN, TAKINGS: PRIVATE PROPERTY AND THE POWER OF EMINENT DOMAIN 112 (1985) ("Supreme Court cases have repeatedly referred to control of nuisances as a proper end of the state . . . .").

82. U.S. CONST. amend. V.

83. The Court itself has recognized this difficulty. *See, e.g.*, Lingle v. Chevron U.S.A. Inc., 125 S. Ct. 2074, 2081 (2005) ("In Justice Holmes' storied but cryptic formulation, 'while property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking.' The rub, of course, has been—and remains—how to discern how far is 'too far.'" (citations omitted)).

84. Mugler v. Kansas, 123 U.S. 623, 665 (1887).

85. *See* Keystone Bituminous Coal Ass'n v. DeBenedictis, 480 U.S. 470, 492 (1987) ("[T]he public interest in preventing activities similar to public nuisances is a substantial one, which in many instances has not required compensation."); Goldblatt v. Town of Hempstead, 369 U.S. 590, 592-96 (1962) (upholding an ordinance that prohibited excavation below the water table, effectively closing a gravel pit operation); Hadacheck v. Sebastian, 239 U.S. 394, 411 (1915) (upholding an ordinance prohibiting the operation of a brickyard based on the "effect upon the health and comfort of the community"); *Mugler*, 123 U.S. at 669 (upholding a state law prohibiting the manufacture or sale of alcohol as "a noxious use" that "inflict[ed] injury upon the community").

86. Lynda J. Oswald, *The Role of the "Harm/Benefit" and "Average Reciprocity of Advantage" Rules in a Comprehensive Takings Analysis*, 50 VAND. L. REV. 1449, 1458-72 (1997) (recounting the development and modern application of the harm-benefit test); *see also* ERNST FREUND, THE POLICE POWER: PUBLIC POLICY AND CONSTITUTIONAL RIGHTS 546-47 (1904) (contending that the police power does not impair property rights because such power is aimed at harmful activities).

doctrine,[87] until recently the Court did not require a showing that the prevented harm constituted a nuisance.[88]

The harm-benefit test was appealing in its apparent simplicity, but it was not always easy to tell if a regulation was intended to prevent harm or to confer a benefit.[89] At times, the Court applied an alternative test focusing on the economic effects of a regulation rather than its purpose.[90] Justice Holmes's declaration in 1922 in *Pennsylvania Coal Co. v. Mahon* reflects this approach: "[W]hile property may be regulated to a certain extent, if regulation goes too far it will be recognized as a taking."[91] Under this economic-impact test, a regulation effected a taking "if it denie[d] an owner economically viable use of his land."[92]

The Court's two tests conflict when a regulation with the purpose of preventing harm also has the effect of denying property owners all economically viable use of their property.[93] This conflict came to the fore in 1992 in *Lucas v. South Carolina Coastal Council*.[94] In his opinion for the majority, Justice Scalia emphasized the difficulty of distinguishing between "harm-preventing" and "benefit-conferring" regulation[95] and purported to reject harm as the decisive criterion for awarding or denying compensation.[96] Justice Scalia declared it "self-

87. *See* Oswald, *supra* note 86, at 1459 ("[H]eavy overtones of nuisance law permeate the cases discussing and developing the harm/benefit test."); *see also* EPSTEIN, *supra* note 81, at 112 (noting the power of the state to control public nuisances under the Takings Clause).

88. *See* Miller v. Schoene, 276 U.S. 272, 280 (1928) (upholding the power of the state to order felling of infested cedar trees without compensating the owner, regardless of "whether the infected cedars constitute[d] a nuisance"); *Goldblatt*, 369 U.S. at 593 ("Nor is it of controlling significance that the . . . use prohibited is arguably not a common-law nuisance." (citation omitted)). In addition, the Court's upholding of a comprehensive zoning ordinance in *Village of Euclid v. Ambler Realty Co.* recognized the power of local governments to regulate land uses without compensation, even if no nuisance was involved. 272 U.S. 365 (1926).

89. Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1024 (1992).

90. *See* Pa. Coal Co. v. Mahon, 260 U.S. 393, 414-15 (1922).

91. *Id.* at 415.

92. Hodel v. Va. Surface Mining & Reclamation Ass'n, 452 U.S. 264, 295-96 (1981) (quoting Agins v. Tiburon, 477 U.S. 255, 260 (1980)).

93. Acknowledging that it had been "unable to develop any 'set formula'" for analyzing takings challenges, the Court in *Penn Central Transportation Co. v. New York City* listed several factors, including the amount of harm and economic impact, that might be relevant in any individual case. 438 U.S. 104, 124-28 (1978).

94. 505 U.S. 1003.

95. *Id.* at 1022-24.

96. *Id.* at 1026.

> [T]he distinction between "harm-preventing" and "benefit-conferring" regulation is often in the eye of the beholder. . . . One could say that

evident that noxious-use logic cannot serve as a touchstone to distinguish regulatory 'takings'—which require compensation—from regulatory deprivations that do not require compensation."[97] Instead, at least in cases involving "permanent physical occupation" or deprivation of all economically beneficial use, the Takings Clause requires compensation unless the regulation in question imposes limitations that are inherent "in the restrictions that background principles of the State's law of property and nuisance already place[d] upon land ownership."[98]

This revised takings test is itself problematic, however, as the dissenters in *Lucas* and numerous commentators have pointed out. To determine whether an activity is a nuisance in light of "background principles," one must consider the harm caused by an activity to others.[99] Justice Scalia's appeal to common law nuisance inevitably requires courts to decide whether an activity constitutes a noxious use—precisely the sort of analysis he had decried as unworkable.[100]

Harm thus continues to play a critical role in regulatory takings law. Although the Takings Clause generally requires compensation when regulation results in a "permanent physical invasion of property"

> imposing a servitude on Lucas's land is necessary in order to prevent his use of it from "harming" South Carolina's ecological resources; or, instead, in order to achieve the "benefits" of an ecological preserve.

Id. at 1024.

97. *Id.* at 1026.

98. *Id.* at 1028-29.

99. *See id.* at 1030-31 (citing RESTATEMENT (SECOND) OF TORTS §§ 826-28, 830-31 (1979)); *see also* Freyfogle, *supra* note 17, at 123 ("As applied, nuisance law is little more than the harm-benefit test."); *supra* Part I.A.

100. *See Lucas*, 505 U.S. at 1054-55 (Blackmun, J., dissenting).

> Even more perplexing, however, is the Court's reliance on common-law principles of nuisance in its quest for a value-free takings jurisprudence. In determining what is a nuisance at common law, state courts make exactly the decision that the Court finds so troubling . . . : They determine whether the use is harmful. Common-law public and private nuisance law is simply a determination whether a particular use causes harm.

Id.; *see, e.g.*, Richard J. Lazarus, *Putting the Correct "Spin" on* Lucas, 45 STAN. L. REV. 1411, 1419 (1993).

> The Court elaborated on the "background principles" exception in terms entirely consistent with the "harm" inquiry proposed by the South Carolina Coastal Council. In fact, the Court's nuisance analysis—one of the "background principles of law" that "inhere in the title"—embraced the very same balancing test that it had discarded in previous paragraphs.

Id.; *see also* Jed Rubenfeld, *Usings*, 102 YALE L.J. 1077, 1093 (1993) (contending that Scalia's "appeal to nuisance law is nothing other than an appeal to the 'noxious-use logic' that the *Lucas* Court began by condemning so effectively").

or deprives an owner of "all economically beneficial use,"[101] it does not require compensation if the government is prohibiting a nuisance.[102] Moreover, where there is no permanent physical invasion or complete deprivation, regulatory takings challenges are governed by the inquiry set out in 1978 in *Penn Central Transportation Co. v. New York City*—an inquiry that also considers harm.[103] Under the *Penn Central* test, a court weighs various factors, including the regulation's economic impact on the claimant, its interference with reasonable investment-backed expectations, and the character of the government action.[104] Part of what is considered in this last factor is whether a restriction serves a "substantial public purpose."[105] As the Court explained in *Penn Central*, a challenged governmental action that interferes with private property use is unlikely to be a taking if the action is merely "adjusting the benefits and burdens of economic life to promote the common good."[106] Harm, it seems, is an inescapable part of takings law.

E. Harm as a Requirement for Standing

Harm is not only a critical substantive element of environmental law, but is also a critical jurisdictional element of constitutional standing doctrine. Constitutional standing requirements apply in all federal cases, not just environmental ones.[107] Many of the leading standing precedents, however, have involved environmental citizen suits, and it is in that context that the doctrine has restricted access to the courts most severely.[108]

The ostensible purpose of constitutional standing doctrine is to ensure the existence of a genuine controversy properly within the jurisdiction of Article III courts.[109] The Supreme Court's oft-recited test for constitutional standing contains three elements: injury-in-fact to the plaintiff, "a causal connection between the injury and the conduct

101. Lingle v. Chevron U.S.A. Inc., 125 S. Ct. 2074, 2081 (2005) (citing *Lucas*, 505 U.S. at 1019; Loretto v. Teleprompter Manhattan CATV Corp., 458 U.S. 419 (1982)). *Lingle* also summarizes the history and development of takings law. *Id.*

102. *Id.* (citing *Lucas*, 505 U.S. at 1026-32).

103. *See* 438 U.S. 104, 124-25 (1978).

104. *Lingle*, 125 S. Ct. at 2081-82 (citing *Penn Central*, 438 U.S. at 124).

105. *See Penn Central*, 438 U.S. at 124, 127.

106. *Id.* at 124.

107. Lujan v. Defenders of Wildlife, 504 U.S. 555, 560-61 (1992).

108. *See id.* at 594 (Blackmun, J., dissenting) ("I have difficulty imagining this Court applying its rigid principles of geographic formalism anywhere outside the context of environmental claims.").

109. *See id.* at 560.

complained of," and likelihood "that the injury will be 'redressed by a favorable decision.'"[110] The first element, injury-in-fact, is what concerns us here.

Injury-in-fact is best understood in light of the doctrine's historical development. Traditionally, litigants had Article III standing if the law granted them a right to bring suit.[111] The critical question, in other words, was simply whether a plaintiff could allege that he had suffered a legal injury.[112] Here, the word "injury" was used in its customary manner to refer to a violation of one's rights.[113]

Beginning in 1970, however, the Court's understanding of injury changed. In *Ass'n of Data Processing Service Organizations v. Camp*, the Court declared that standing existed only for those who could show "injury in fact, economic or otherwise."[114] The existence of injury-in-fact, the Court added, depended primarily, if not wholly, on facts

110. *Id.* at 560-61 (citations omitted); *see also* Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc., 528 U.S. 167, 180-81 (2000); Steel Co. v. Citizens for a Better Env't, 523 U.S. 83, 102-03 (1998); Valley Forge Christian Coll. v. Ams. United for Separation of Church & State, Inc., 454 U.S. 464, 472 (1982); Simon v. E. Ky. Welfare Rights Org., 426 U.S. 26, 38 (1976).

111. Cass R. Sunstein, *What's Standing After* Lujan*? Of Citizen Suits, "Injuries," and Article III*, 91 MICH. L. REV. 163, 177 (1992); *see* William A. Fletcher, *The Structure of Standing*, 98 YALE L.J. 221, 224-28 (1988) (attributing the articulation of modern standing law to the growth of the administrative state and the increase in litigation over public values).

112. *See* Sunstein, *supra* note 111, at 170-71.

113. *See* RESTATEMENT (SECOND) OF TORTS § 7 cmt. a (1965) ("The word 'injury' is used throughout the Restatement . . . to denote the fact that there has been an invasion of a legally protected interest which, if it were the legal consequence of a tortious act, would entitle the person suffering the invasion to maintain an action of tort."); JOEL FEINBERG, HARM TO OTHERS 107 (1984) ("Unlike the word 'harm,' which for many centuries has meant damage, impairment, or loss, 'injury' originally and for many centuries meant a wrong, or a violation of one's rights, or an injustice.").

114. 397 U.S. 150, 152 (1970); *see* Fletcher, *supra* note 111, at 230 ("*Data Processing* was the first case to state that 'injury in fact' was required, and to formulate the issue of plaintiff's standing as a factual (and therefore an ostensibly non-normative) matter."); Sunstein, *supra* note 111, at 185 (describing how *Data Processing* replaced the requirement that the plaintiff show a legal injury with the requirement that the plaintiff show an injury-in-fact). *Data Processing* left open the question of whether injury-in-fact was required by the Constitution or only by the specific statute it was interpreting in that case, the Administrative Procedure Act. *See* 397 U.S. at 151, 153 (stating both that "the question of standing in the federal courts is to be considered in the framework of Article III" and that "the Administrative Procedure Act grants standing to a person 'aggrieved by agency action within the meaning of a relevant statute'"). The Court subsequently made clear, however, that injury-in-fact was constitutionally mandated. *See* Valley Forge Christian Coll. v. Ams. United for Separation of Church & State, Inc., 454 U.S. 464, 472 (1982); Warth v. Seldin, 422 U.S. 490, 498-99 (1975).

rather than law.[115] Such injury could even include harm to one's aesthetic or environmental interests.[116] But as later cases made clear, injury-in-fact does not refer to injury in the traditional sense of legal injury.[117] Rather, injury-in-fact is the same as harm—"the existence of loss or detriment in fact."[118]

The Court's shift in attention from legal injury to factual injury was contemporaneous with the enactment of the major federal environmental statutes, many of which contain citizen suit provisions.[119] These provisions, which authorize "any person" to bring claims for certain statutory violations, were intended to transform individual citizens into "private attorneys general" who would supplement government enforcement.[120] The traditional focus on legal injury placed no constraints on Congress's ability to create such causes of action. By introducing a requirement that there be injury-in-fact—and not just legal injury—the Court moved towards restoring the common law tort paradigm in which only individuals who have suffered harm may sue.

The narrowing effect of the injury-in-fact doctrine can be seen in the Court's 1992 decision in *Lujan v. Defenders of Wildlife*, a case brought by environmental plaintiffs to compel the U.S. government to perform consultations under the Endangered Species Act for actions taken in foreign countries.[121] Writing for the majority, Justice Scalia defined injury-in-fact as "an invasion of a legally protected interest

115. *See Data Processing*, 397 U.S. at 153 ("The 'legal interest' test goes to the merits. The question of standing is different."); Sunstein, *supra* note 111, at 188 (stating that the *Data Processing* Court "seem[ed] to assume that whether there [was] an 'injury' [could] be answered as if it were a purely factual matter—as if the existence of injury depended on some brute fact, not on evaluation, and not on law").

116. *See* Sierra Club v. Morton, 405 U.S. 727, 734 (1972).

117. *See* Sunstein, *supra* note 111, at 171 (explaining that the Article III requirement of case or controversy "had everything to do with whether the legislature or some other source of law had created a cause of action" and "nothing to do with 'injury in fact'").

118. *See* RESTATEMENT (SECOND) OF TORTS § 7 (1965) (defining "harm" as "the existence of loss or detriment in fact of any kind to a person resulting from any cause").

119. *See, e.g.*, Toxic Substances Control Act, 15 U.S.C. § 2619(a) (2000); Endangered Species Act, 16 U.S.C. § 1540(g)(1) (2000); Surface Mining Control and Reclamation Act, 30 U.S.C. § 1270(a) (2000); Clean Water Act, 33 U.S.C. § 1365 (2000); Safe Drinking Water Act, 42 U.S.C. § 300j-8 (2000); Resource Conservation and Recovery Act, 42 U.S.C. § 6972 (2000); Clean Air Act, 42 U.S.C. § 7604 (2000); Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9659(a) (2000).

120. *See* Trevor W. Morrison, *Private Attorneys General and the First Amendment*, 103 MICH. L. REV. 589, 602-03 & n.57 (2005).

121. 504 U.S. 555, 558-59 (1992).

which is (a) concrete and particularized and (b) actual or imminent, not conjectural or hypothetical."[122] Although the potentially protected interests encompass aesthetic as well as more tangible interests,[123] Justice Scalia's opinion narrowed the class of people that might be able to demonstrate injury with the requisite specificity.[124] "Injury in fact," he declared, requires "that the party seeking review be himself among the injured."[125] Such a party essentially must be close enough in time and space to the object—in *Lujan*, the endangered species—physically affected by the action at issue.[126] In the words of one commentator, injury-in-fact to Justice Scalia is "something *real*, which exists, or does not exist, quite independent of legal context or underlying, substantive law."[127] Not all members of the Court agree with this view, however. Justice Kennedy's concurrence in *Lujan*, for instance, described injury-in-fact primarily in terms of legal norms: "Congress has the power to define injuries and articulate chains of causation that will give rise to a case or controversy where none existed before," so long as Congress "identif[ies] the injury it seeks to vindicate and relate[s] the injury to the class of persons entitled to bring suit."[128]

More recent Court pronouncements have further muddled the meaning of injury-in-fact. In *Friends of the Earth, Inc., v. Laidlaw Environmental Services (TOC), Inc.*, decided in 2000, the Court emphasized that harm to plaintiffs, not harm to the environment, is critical.[129] The plaintiffs in *Laidlaw* alleged injury-in-fact with respect to their use of an area affected by discharges from Laidlaw's wastewater treatment plant.[130] Laidlaw allegedly discharged pollutants beyond the limits set out in its permit.[131] Given that the district court

122. *Id.* at 560 (internal quotations and citations omitted).

123. *Id.* at 562-63.

124. *Id.*

125. *Id.* at 563 (quoting Sierra Club v. Morton, 405 U.S. 727, 734-35 (1972)).

126. *Id.* at 564-66 (holding that professions of "some day" intentions to visit the habitat of an endangered species were not sufficiently imminent to establish injury-in-fact and declaring that "a plaintiff claiming injury from environmental damage must use the area affected by the challenged activity and not an area roughly 'in the vicinity' of it" (citing Lujan v. Nat'l Wildlife Fed'n, 497 U.S. 871, 887-89 (1990); *Sierra Club*, 405 U.S. at 735)).

127. Ashutosh Bhagwat, *Injury Without Harm:* Texas v. Lesage *and the Strange World of Article III Injuries*, 28 HASTINGS CONST. L.Q. 445, 447 (2001).

128. *Lujan*, 504 U.S. at 580 (Kennedy, J., concurring). Justice Kennedy did acknowledge that the Constitution establishes some outer limit to Congress's power to confer rights of action. *See id.* at 580-81.

129. Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc., 528 U.S. 167, 181 (2000).

130. *Id.* at 183.

131. *Id.* at 176.

had found "no demonstrated proof of harm to the environment from the excessive discharges,"[132] Laidlaw argued that there was no injury-in-fact.[133] The Court rejected this argument, however, explaining that "[t]he relevant showing . . . is not injury to the environment but injury to the plaintiff."[134]

If injury-in-fact does not require harm to the environment, what was the injury to the plaintiffs? According to the majority, it was the plaintiffs' *perception* that the river was polluted, a perception that caused the plaintiffs to use the river less frequently, if at all.[135] That the perception the river was polluted—and not some more objective injury—could serve as injury-in-fact seems to contravene *Lujan*'s requirement of "concrete" and "actual" injury.[136] The Clean Water Act's purpose is to protect actual water quality, not just perceptions of it.[137] Indeed, Justice Scalia attacked the majority for making "the injury-in-fact requirement a sham."[138] The harm in *Laidlaw*, however, did not consist solely of the plaintiffs' perception that the river was polluted; it also consisted of the loss of use resulting from that perception.[139] For the majority, this loss of use satisfied *Lujan*'s requirement that "'the party seeking review be himself among the injured.'"[140]

Commentators have attacked the injury-in-fact test as conceptually incoherent.[141] As Professor Cass Sunstein has explained: "The basic

132. 956 F. Supp. 588, 602 (D.S.C. 1997) (quoted in *Laidlaw*, 528 U.S. at 181).

133. *Laidlaw*, 528 U.S. at 181.

134. *Id.*

135. *See id.* at 181-83; *cf.* David N. Cassuto, *The Law of Words: Standing, Environment, and Other Contested Terms*, 28 HARV. ENVTL. L. REV. 79, 95 (2004) ("In essence, plaintiffs were injured because they *believed* they had been injured . . . .").

136. *See* Lujan v. Defenders of Wildlife, 504 U.S. 555, 564, 578 (1992).

137. *See, e.g.*, 33 U.S.C. § 1251(a) (2000) (declaring the act's objective as "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters").

138. *Laidlaw*, 528 U.S. at 201 (Scalia, J., dissenting). Justice Scalia also expressed doubt that "Laidlaw's violations, even though harmless to the environment," were responsible for the plaintiffs' decreased use. *See id.* at 200.

139. *Id.* at 184-85 (majority opinion).

140. *Lujan*, 504 U.S. at 563 (quoting Sierra Club v. Morton, 405 U.S. 727, 735 (1972)); *see Laidlaw*, 528 U.S. at 184; *cf.* Cassuto, *supra* note 135, at 93 (noting that the Court's standing cases "have consistently marginalized the environment while elevating the importance of the perceived woes of the humans litigating under environmental statutes").

141. *See* Fletcher, *supra* note 111, at 221; Cass R. Sunstein, *Informational Regulation and Informational Standing:* Akins *and Beyond*, 147 U. PA. L. REV. 613,

difficulty is that many people suffer injuries 'in fact' every day"—that is, harm—"but these injuries do not become legally cognizable . . . unless and until some source of law creates a relevant legal interest and a right to bring suit."[142] Similarly, Professor William Fletcher has proposed that the injury-in-fact requirement be abandoned and that standing be understood as "simply . . . a question on the merits of plaintiff's claim."[143] The concept of injury necessarily incorporates substantive judgments about underlying legal rights, a point the Court has often ignored.[144]

To some extent, the injury-in-fact requirement addresses the question of who may bring suit for a harm, as opposed to whether there is harm at all. In *Laidlaw*, for example, the government surely could have prosecuted Laidlaw's violations, even if the citizen plaintiffs had not been allowed to.[145] But in other citizen suits—particularly those challenging government action—determining whether the government action resulted in harm decides whether any judicial review of that action will occur at all.[146]

Notwithstanding difficulties with the doctrine, the injury-in-fact requirement remains. Its persistence reflects the intuitive appeal of the notion of objective harm. Yet as the confusion over injury-in-fact

639-40 (1999); Sunstein, *supra* note 111, at 167 (characterizing the notion of injury-in-fact as "a large-scale conceptual mistake").

142. Sunstein, *supra* note 141, at 639-40; *see also* Sunstein, *supra* note 111, at 188-89 ("In classifying some harms as injuries in fact and other harms as purely ideological, courts must inevitably rely on some standard that is normatively laden and independent of facts." (footnote omitted)); Fletcher, *supra* note 111, at 231-32 (arguing that "the 'injury in fact' requirement cannot be applied in a non-normative way").

143. Fletcher, *supra* note 111, at 223.

144. *See id.* at 232-33 (contending that injury-in-fact is not a factual question, but rather "part of the question of the nature and scope of the substantive legal right on which plaintiff relies").

145. *See Laidlaw*, 528 U.S. at 174; *cf.* Thomas W. Merrill, *Global Warming as a Public Nuisance*, 30 COLUM. J. ENVTL. L. 293, 300-01 (2005) (noting that courts have not applied standing requirements to certain public actions brought by public authorities, such as criminal cases and public nuisance suits).

146. *Cf. Lujan*, 504 U.S. at 561-62.

> When the suit is one challenging the legality of government action or inaction, the nature and extent of facts that must be averred (at the summary judgment stage) or proved (at the trial stage) in order to establish standing depends considerably upon whether the plaintiff is himself an object of the action (or forgone action) at issue. If he is, there is ordinarily little question that the action or inaction has caused him injury, and that a judgment preventing or requiring the action will redress it. When, however, as in this case, a plaintiff's asserted injury arises from the government's allegedly unlawful regulation (or lack of regulation) of someone else, much more is needed.

Id.

indicates, defining harm objectively is not an easy task. The struggles over harm in standing and takings law establish a fundamental need to analyze the concept of harm in environmental law more carefully.

II. WHAT IS HARM IN ENVIRONMENTAL LAW?

In exploring harm in environmental law, we thus far have made only preliminary attempts to tease out the nature and meaning of the concept. The challenge of understanding harm is the subject of this Part, which reviews philosophical discussions of the harm principle and then incorporates analyses of harm from environmental law. The law's struggles with the subject indicate that it may be impossible to define harm objectively. Ultimately rejecting an objective approach to harm, this Article instead adopts a normative understanding of harm as a setback to significant interests in human autonomy.

A. A Liberal Approach to Harm

In a liberal society—one that is premised on individual liberty and autonomy[147]—harm is the leading philosophical, political, and legal rationale for limiting liberty.[148] As articulated by John Stuart Mill, the harm principle provides that "the only purpose for which power can be rightfully exercised over any member of a civilized community, against

147. The term "liberal" is used here in its classic sense to describe a society that values most highly the individual's capacity to make choices. *See* Westbrook, *supra* note 63, at 682.

148. *See* Randy E. Barnett, *The Proper Scope of the Police Power*, 79 NOTRE DAME L. REV. 429, 493-95 (2004) (suggesting that the Supreme Court's invalidation of a law prohibiting sodomy in *Lawrence v. Texas*, 539 U.S. 558 (2003) effectively constitutionalized the harm principle by rejecting morality alone as basis for regulation); Bernard E. Harcourt, *The Collapse of the Harm Principle*, 90 J. CRIM. L. & CRIMINOLOGY 109, 131 (1999) (noting the dominance of the harm principle in the debate over the enforcement of morality); *see also* JOHN RAWLS, A THEORY OF JUSTICE 114 (1999) (describing the "duty not to harm or injure another" as a natural duty); Christopher H. Schroeder, *Rights Against Risks*, 86 COLUM. L. REV. 495, 495 (1986) ("The admonition 'do no harm' has been thought to be a natural duty all persons owe to others."). The ancient roots of the harm principle are reflected in the maxim *sic utere tuo ut alienum non laedas* ("use your own so as not to harm another"). Epstein, *supra* note 12, at 369. The harm principle is also reflected in Western political thought in social contract theory, under which the government is organized principally for the purpose of preventing citizens from harming each other. *See, e.g.*, JOHN LOCKE, TREATISE OF CIVIL GOVERNMENT AND A LETTER CONCERNING TOLERATION 82 (Charles L. Sherman ed., 1937) (1690) (explaining that each individual consents to government because "the enjoyment of the property he has in [the state of nature] is very unsafe, very unsecure").

his will, is to prevent harm to others."[149] Implicit in the principle is the existence of an agent of harm—specifically, people do harm, and they do so through harmful acts.[150]

Philosophers have suggested various rationales for limiting individual liberty other than the prevention of harm to others. These rationales include the paternalistic interest in preventing harm to the individual, preventing offense to others, and preventing immoral conduct.[151] This Article neither accepts nor rejects these alternative justifications for the exercise of state authority. Rather, this Article focuses on understanding the scope of harm in the harm principle. Harm is the most widely accepted justification for the exercise of police power,[152] and it is the rationale most applicable to environmental regulation.[153]

At first glance, harm may appear to be a simple and objective concept, capable of ready definition. But as the discussion so far suggests, the concept is surprisingly elusive.[154] One possible conception, for example, would define harm with respect to utilitarian goals of maximizing happiness, pleasure, or the fulfillment of

149. MILL, *supra* note 2, at 80.

150. *See* Kleinig, *supra* note 24, at 27; *see also* Katharine K. Baker, *Consorting with Forests: Rethinking Our Relationship to Natural Resources and How We Should Value Their Loss*, 22 ECOLOGY L.Q. 677, 704 (1995) (arguing that natural resource damages should be available only for destruction of natural resources by humans because "law is a human construct, created to judge human action; it does not exist to judge (nor could it govern) the conduct of volcanoes").

151. *See, e.g.*, FEINBERG, *supra* note 113, at 26-27 (defining ten "liberty-limiting principles"); RONALD DWORKIN, TAKING RIGHTS SERIOUSLY 240-58 (1977) (discussing the debate between Sir Patrick Devlin and Professor H.L.A. Hart over the legal enforcement of morals); Ronald M. Dworkin, *Introduction* to THE PHILOSOPHY OF LAW 1, 9-11 (R.M. Dworkin ed., 1977) (same); Kleinig, *supra* note 24, at 34 n.23 ("Not that harm constitutes the only basis for legitimate legal interferences. Nevertheless, an onus is placed on those who support interference with acts which are only fictionally harmful to provide some independent moral basis.").

152. *See* FEINBERG, *supra* note 113, at 187 ("[T]he harm-to-others principle is virtually beyond controversy.").

153. *See* Thaddeus Mason Pope, *Balancing Public Health Against Individual Liberty: The Ethics of Smoking Regulations*, 61 U. PITT. L. REV. 419, 433-34 (2000) ("Regulating public health risks with the goal of preventing harm to others has proven to be the most politically compelling rationale for government intervention."); *see also* NAGLE, *supra* note 18, at 171 (stating that "[e]nvironmental law views pollution as harmful for several distinct reasons," including physical harm to humans, interference with human use of the environment, and injury to the environment itself); *cf.* Westbrook, *supra* note 63, at 682, 693 (contending that liberalism, which prizes individual autonomy, "explains and rationalizes the majority of environmental law").

154. *See* DOUGLAS N. HUSAK, PHILOSOPHY OF CRIMINAL LAW 234 (1987) ("Harm is not an 'empirical' characteristic the presence or absence of which can be detected by scientific instruments.").

subjective preferences.[155] In this framework, harm would be synonymous with pain or the frustration of one's preferences.[156] Such an account of harm, however, is simply too subjective to provide a workable basis for defining the permissible scope of government power. A harm principle based on this conceptualization of harm would be boundless because "[a]ny sort of conduct to which some people object *will* inflict pain of various sorts and will interfere with the satisfaction of some people's preferences."[157]

Mill himself provided only modest guidance on the critical question of what constitutes harm, despite his attention to the harm principle.[158] In various passages of *On Liberty*, Mill suggested that harm involves "encroachment" on others' rights,[159] or the injuring of "certain interests" of another, "which, either by express legal provision or by tacit understanding, ought to be considered as rights."[160] Mill also classified the violation of a specific duty to the public—such as drunkenness in an on-duty police officer—as a harm.[161] Mill excluded from the scope of the harm principle intemperate behavior and conduct that people with different religious beliefs might find offensive, even though they might cause physical or mental pain in others.[162] As commentators have pointed out, Mill's distinctions rely heavily on unstated moral and social assumptions that may not be universally shared.[163]

Perhaps the most extensive analysis of harm can be found in *Harm to Others*, the first part of the four-volume work, *The Moral Limits of the Criminal Law*, by Professor Joel Feinberg.[164] Feinberg, an

155. *See, e.g.*, Smith, *supra* note 19, at 19-23.

156. *See id.*

157. *Id.* at 24.

158. *See* Kernohan, *supra* note 19, at 51 ("The problem with applying Mill's principle is determining what is to count as a harm."); John P. Safranek & Stephen J. Safranek, *Can the Right to Autonomy Be Resuscitated After* Glucksberg*?*, 69 U. COLO. L. REV. 731, 745 (1998) ("As formally articulated by Mill, the harm principle neither justifies nor precludes any particular act; it merely asserts that the state can proscribe an act if it is harmful. . . . Mill does not offer any method for determining what constitutes harmful behavior . . . .").

159. MILL, *supra* note 2, at 142.

160. *Id.* at 139.

161. *Id.* at 145.

162. *Id.* at 145, 148 (designating such conduct as "inconveniences" rather than harm); Ernest Nagel, *The Enforcement of Morals*, *in* MORAL PROBLEMS IN CONTEMPORARY SOCIETY 137, 142 (Paul Kurtz ed., 1969).

163. Nagel, *supra* note 162, at 142-43; Smith, *supra* note 19, at 32-35 (observing that Mill's conception of harm is tied to his view that a good life values lively, independent thought).

164. FEINBERG, *supra* note 113.

influential legal philosopher in the liberal tradition,[165] concerned himself with the limits of the state's criminal authority. Building on Mill's work, Feinberg examined in *Harm to Others* the limits imposed by the harm principle.[166] Feinberg's analysis merits careful consideration not only because it is thorough, but also because it is rooted in the classic liberal political philosophy that dominates American political culture.[167]

Harm to Others begins with a discussion of everyday uses of the word "harm." Harm, according to Feinberg, generally refers to three different concepts: damage to things, setting back of another's interests, or wrongful violation of another's rights.[168] Feinberg contends that, for the purposes of criminal law, harm incorporates the second and third concepts: "only setbacks of interests that are wrongs, and wrongs that are setbacks to interests, are to count as harms."[169] Feinberg also distinguishes harms from hurts or offenses; hurts or offenses may distress a person or be unpleasant, but unlike harms, generally have only passing effects.[170] Setbacks to interests, in contrast to the passing

165. Feinberg's work has been praised as "a highly contextualized, concrete rendition of the liberal point of view, rooted in the actual practices and culture of a distinctive society, rather than in an abstract and ahistorical conception of the moral agent." Allen Buchanan & Jules L. Coleman, *Preface* to IN HARM'S WAY: ESSAYS IN HONOR OF JOEL FEINBERG, at vii (Jules L. Coleman & Allen Buchanan eds., 1994); *see also* Christopher Lehmann-Haupt, *Joel Feinberg, 77, Influential Philosopher*, N.Y. TIMES, Apr. 5, 2004, at B7 (noting Feinberg's "groundbreaking work in the fields of individual rights and the authority of the state"); BIOGRAPHICAL DICTIONARY OF TWENTIETH-CENTURY PHILOSOPHERS 230 (Stuart Brown et al. eds., 1996) ("Liberalism, the view that individual freedom is of preeminent value, has been the core topic of Feinberg's very influential work.").

166. FEINBERG, *supra* note 113, at 3. Unlike Mill, Feinberg did not view the prevention of harm to others as the only justification for the exercise of criminal authority. *See generally* JOEL FEINBERG, OFFENSE TO OTHERS (1985).

167. *See* ROGERS M. SMITH, LIBERALISM AND AMERICAN CONSTITUTIONAL LAW 13 (1985) (describing how Enlightenment liberalism "shaped the framing of the American constitution" and how liberalism "has pervasively influenced America's constitutional evolution"); Anthony V. Alfieri, *Community Prosecutors*, 90 CAL. L. REV. 1465, 1480 (2002) ("Liberalism is the essence of American public philosophy. It emphasizes the autonomy of the rational self, private-contractarian obligation between free economic agents, and state-circumscribed forms of public deliberation.").

168. FEINBERG, *supra* note 113, at 32-35.

169. *Id.* at 36; *cf.* Robert W. Drane & David J. Neal, *On Moral Justifications for the Tort/Crime Distinction*, 68 CAL. L. REV. 398, 404 (1980) ("[H]arm involves (1) the intentional or negligent acts of moral agents that interfere with the interests of some other person, and (2) an evaluation of the interference resulting in the conclusion that it was unjustified.").

170. FEINBERG, *supra* note 113, at 45. Feinberg explained that unpleasant experiences such as a grating noise or a badly performed play cause "passing unpleasantness," but do not involve a setback to one's interests. *See id.* at 45-46. Feinberg recognized, however, that unpleasant experiences may qualify as harms if they are so intense or prolonged as to set back one's interests. *See id.* at 46.

effects of hurts or offenses, are harmful because they involve lasting detriments to personal autonomy.[171]

Intuitive notions of harm, however, do not necessarily incorporate wrongfulness.[172] For example, a police officer in hot pursuit of a suspect harms an innocent bystander when he runs into the bystander and causes her to fall and break her arm, even if the officer's conduct was not wrongful in any way. Similarly, harm in environmental law—whether in nuisance, regulatory law, or otherwise—does not always require wrongdoing.[173] Consider the operation of a brickyard in a residential area. If the brickyard's presence long predates construction of the neighboring residences, and if the brickyard complies with applicable regulations, its operations could hardly be termed wrongful. Yet the noise and dust it generates surely harm its neighbors, and the brickyard's operations would almost certainly qualify as a nuisance.[174] Likewise, the release of pollutants by a power plant during normal operations may harm nearby residents, even if such releases are lawful under the plant's permit and subject to the most advanced emission control devices available.

Including wrongfulness in the concept of harm thus seems contingent on the criminal law context of Feinberg's inquiry.[175] The primary purpose of criminal law is to punish and to deter wrongful conduct that has resulted in or is likely to result in harm if allowed to proceed.[176] Civil law, however, has a broader reach: tort law seeks to

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171. *See* JOSEPH RAZ, THE MORALITY OF FREEDOM 415 (1986) (contending that the harm principle "is derivable from a morality which regards personal autonomy as an essential ingredient of the good life").

172. *See* Stephen Perry, *Harm, History, and Counterfactuals*, 40 SAN DIEGO L. REV. 1283, 1285-86 (2003).

> Intuitively, it seems clear that if *A* acts and thereby adversely affects *B*'s self-interest, she has harmed *B*, whether or not she acted faultily or violated one of *B*'s rights. Fault or a rights violation may well be a necessary condition of moral blameworthiness on *A*'s part, or of her civil or criminal liability at law, but there does not seem to be any basis for saying that in their absence *A* did not, in fact, harm *B*.

Id.; *see also supra* note 65 (discussing economic rationales for the environmental regulation of harm).

173. *See* Oswald, *supra* note 86, at 1473 ("[N]uisance law is not intended to address blameworthy or morally incorrect behavior.").

174. *See* Hadacheck v. Sebastian, 239 U.S. 394 (1915) (holding that the prohibition on the operation of a brickyard was not a compensable taking).

175. Philosopher Joseph Raz similarly suggested a wrongfulness aspect to harm. *See* RAZ, *supra* note 171, at 414 ("Since 'causing harm' entails by its very meaning that the action is prima facie wrong, it is a normative concept acquiring its specific meaning from the moral theory within which it is embedded.").

176. *See* WAYNE R. LAFAVE, PRINCIPLES OF CRIMINAL LAW 12 (2003); *cf.* Richard W. Wright, *The Grounds and Extent of Legal Responsibility*, 40 SAN DIEGO L.

compensate for harm and to foster corrective justice as well as to deter;[177] and public law seeks to accomplish these aims and others as well.[178] The differences between criminal and civil law suggest that Feinberg's conception of harm can serve best as a starting point for understanding environmental harm if the element of wrongfulness is set aside.[179] Consistent with this approach, and perhaps reflecting the origins of environmental law, the *Restatement (Second) of Torts* defines harm as a "loss or detriment in fact of any kind to a person resulting from any cause."[180] Accordingly, a working understanding of harm in

REV. 1425, 1434 & n.25 (2003) (contrasting tortious conduct, which involves "discrete harm to another's person or property," with criminal conduct, which involves "nondiscrete harm to everyone in society").

177. *See, e.g.*, GUIDO CALABRESI, THE COSTS OF ACCIDENTS: A LEGAL AND ECONOMIC ANALYSIS 24-33 (1970) (describing the principal goals of accident law as justice and the reduction of accident costs, the latter of which includes the subgoals of deterring accidents, reducing societal costs—typically through compensation—and reducing administrative costs); DON DEWEES ET AL., EXPLORING THE DOMAIN OF ACCIDENT LAW: TAKING THE FACTS SERIOUSLY 5-9 (1996) (identifying deterrence, compensation, and corrective justice as the three major normative perspectives of tort law); Heidi Li Feldman, *Science and Uncertainty in Mass Exposure Litigation*, 74 TEX. L. REV. 1, 34 (1995) (explaining that tort law "seeks to allocate resources to those who have been injured by unduly risky conduct or products," "aims to deter excessively risky conduct," and "tries to expressively yoke victims of overly risky activity with their injurers by requiring injurers to compensate those they have harmed"); *see also* LAFAVE, *supra* note 176, at 12 (contrasting the punitive function of criminal law with the compensatory function of tort law). *But cf.* Coleman, *supra* note 19, at 371 (contending that the corrective justice principles underlying negligence require wrongfulness); Goldberg, *supra* note 24, at 1335 (suggesting that tort law is "designed to empower victims of wrongs to seek redress from their wrongdoers"); Ernest J. Weinrib, *Corrective Justice*, 77 IOWA L. REV. 403, 410 (1992) (arguing that the corrective justice logic that underlies tort law involves rectification of injustices).

178. *See* Peter M. Shane, *Structure, Relationship, Ideology, or, How Would We Know a "New Public Law" If We Saw It?*, 89 MICH. L. REV. 837, 842 (1991) (suggesting that public law consists of "all aspects of law which have a major impact on the implementation of public policy or collective interests").

179. *Cf.* Finkelstein, *supra* note 25, at 964 (noting that "moral wrongdoing is obviously of greater significance" in criminal law than in tort law); Paul H. Robinson, *The Criminal-Civil Distinction and the Utility of Desert*, 76 B.U. L. REV. 201, 206 (1996) ("Criminal liability signals moral condemnation of the offender, while civil liability does not."). Feinberg himself hinted at this line of reasoning in discussing environmental pollution. *See* FEINBERG, *supra* note 113, at 230-31.

> In the context of industrial polluting, "wrongful" must mean unlawful as judged by a regulative agency applying rules for allocating permits in accordance with specified requirements of fairness and efficiency. In these contexts, no prior standard of wrongfulness exists. There is nothing inherently wrongful or right-violating in the activity of driving an automobile, generating electricity, or refining copper.

Id. at 230.

180. RESTATEMENT (SECOND) OF TORTS § 7 (1965).

environmental law[181] should begin with harm as a setback to a person's interests.[182]

B. Harm to What?

If harm is a setback to one's interests, the obvious question is as follows: what sort of interests can give rise to harm?[183]

1. WHAT INTERESTS MIGHT BE AT ISSUE

First, consider the ordinary use of the word "interest" to denote a desire or "an inclination to pay attention to something."[184] One might have an interest, for instance, in following a certain football team or in enjoying a certain dessert. While a person might care very passionately about these things, to say that person is "harmed" when there is a setback to these sorts of interests trivializes harm.[185] Such interests are quite different from the interests that matter to the law—the more

181. This Article treats environmental law as civil, which it primarily is. For discussions regarding the use of criminal sanctions in environmental law, see Richard J. Lazarus, *Meeting the Demands of Integration in the Evolution of Environmental Law: Reforming Environmental Criminal Law*, 83 GEO. L.J. 2407 (1995); Kathleen F. Brickey, *Environmental Crime at the Crossroads: The Intersection of Environmental and Criminal Law Theory*, 71 TUL. L. REV. 487 (1996).

182. *See* JEROME HALL, GENERAL PRINCIPLES OF CRIMINAL LAW 215 (2d ed. 1960) ("[H]arm implies the existence of values, interests or natural conditions."); Stuart P. Green, *Why It's a Crime to Tear the Tag Off a Mattress: Overcriminalization and the Moral Content of Regulatory Offenses*, 46 EMORY L.J. 1533, 1549 (1997) (defining harm as "an intrusion into a person's interest" (citing JOSHUA DRESSLER, UNDERSTANDING CRIMINAL LAW 96 (2d ed. 1995) (defining social harm as the "negation, endangering, or destruction of an individual, group or state interest which was deemed socially valuable"))).

183. For further discussion of this difficult question of moral philosophy, see FEINBERG, *supra* note 113, at 31-64; Epstein, *supra* note 12, at 376-78; Kleinig, *supra* note 24, at 28-34; Perry, *supra* note 172, at 1305-08; Seana Valentine Shiffrin, *Wrongful Life, Procreative Responsibility, and the Significance of Harm*, 5 LEGAL THEORY 117, 123-24 (1999).

184. Kleinig, *supra* note 24, at 28; *see also* Epstein, *supra* note 12, at 376.

185. *See* FEINBERG, *supra* note 113, at 43 (contending that setbacks to such desires do not constitute harm because such desires are not linked to an individual's ultimate goals and are not sufficiently stable and durable to represent any investment of a stake); Matthew D. Adler, *Risk, Death, and Harm: The Normative Foundations of Risk Regulation*, 87 MINN. L. REV. 1293, 1309 (2003) ("Welfare changes are, intuitively, changes in the subject's life. They are not remote changes in the world that she (or someone else) prefers or that are good in a general sense."). Of course, one's desires may not be in one's interests. *See* Kleinig, *supra* note 24, at 30.

serious and stable interests in which one might have a stake and that are integral to one's life.[186]

The definition of harm found in the *Restatement (Second) of Torts* hints at the wide range of interests that might be implicated:

> [H]arm . . . is the detriment or loss to a person which occurs by virtue of, or as a result of, some alteration or change in his person, or in physical things, and also the detriment resulting to him from acts or conditions which impair his physical, emotional, or aesthetic well-being, his pecuniary advantage, his intangible rights, his reputation, or his other legally recognized interests.[187]

With respect to environmental harm in particular, one commentator has suggested various classes of harm: immediate and future physical injury to people, emotional distress from fear of future injury, social and economic disruption, remediation costs, property damage, ecological damage, and regulatory harms.[188]

The variety of interests just mentioned raises a number of issues. First, the absence of an obvious unifying theme suggests that the task of determining what interests matter is a subjective one—perhaps hopelessly so. As a commentator has noted, "what constitutes harm . . . will be governed by one's view of the good."[189] Even physical injuries, which Professor John Goldberg characterizes as "particularly brutish in their factualness," qualify as harms "not because harm is a matter of unadorned fact," but because most reasonable normative accounts of harm would encompass such injuries.[190] The *Restatement*'s definition, which limits the interests that can be harmed to "legally recognized interests," underscores the

186. *See* Epstein, *supra* note 12, at 376; Kleinig, *supra* note 24, at 28. The interests the law protects must be *legitimate* interests. A person who has stolen property may have an interest in it, but such an interest is illegitimate, and the return of the property to the rightful owner does not harm the thief. *See* Coleman, *supra* note 19, at 369 (distinguishing interests, legitimate interests, and rights).

187. RESTATEMENT (SECOND) OF TORTS § 7 cmt. b (1965).

188. *See* Michael M. O'Hear, *Sentencing the Green-Collar Offender: Punishment, Culpability, and Environmental Crime*, 95 J. CRIM. L. & CRIMINOLOGY 133, 160-65 (2004).

189. Safranek & Safranek, *supra* note 158, at 745; *cf.* Nagel, *supra* note 162, at 143 ("[A]n explication of what is to be understood as harmful to others . . . cannot escape reference to some more or less explicit and comprehensive system of moral and social assumptions"); Smith, *supra* note 19, at 20-22 (suggesting that within the framework of utilitarianism, what counts as harm is subjectively defined in terms of personal preferences).

190. Goldberg, *supra* note 24, at 1317.

normative nature of harm and begs the question of what interests are to be legally recognized.[191]

Second, if a setback to any interest qualified as a harm, the harm principle might become useless as a limit on societal jurisdiction.[192] And if indirect harms—that is, setbacks to interests that flow from long chains of causation—are considered regardless of their magnitude, virtually any activity could be said to be "harmful."[193] "Almost every act in a complex, crowded, industrial society involves externalities, but we would not expect [the] government to institute rules for all of them."[194] Thus, implicit in the harm principle may be limits as to the types and the insignificance of interests that the principle will protect.[195] Absent such limits, harm may lose its force and utility as a critical principle for determining the legitimacy of government action, regulation, or judicial intervention.[196] Justice Scalia's writings on injury-in-fact reflect this very concern.[197] In his view, limiting standing

191. RESTATEMENT (SECOND) OF TORTS § 7 cmt. b (1965); *cf.* Epstein, *supra* note 12, at 376-77 (distinguishing subjective interests from legal interests and noting that "[i]t is precisely because my subjective interest exceeds my legal interest that liberty is so difficult to preserve").

192. *See* Kernohan, *supra* note 19, at 51 ("If we count mere hurt, offence, annoyance, and mental distress as harms, the principle will countenance political interference with nearly every activity, and liberty will amount to naught.").

193. *Cf.* MILL, *supra* note 2, at 143 (recognizing that "[n]o person is an entirely isolated being" and acknowledging the difficulty of distinguishing between self-regarding and other-regarding acts); Pope, *supra* note 153, at 435 (contending that "the notion of indirect harm is subject to limitless expansion," given that "harm to others or, in the parlance of economists, 'negative externalities,' can be found in almost any type of behavior" (footnotes omitted)).

194. ALAN STONE, REGULATION AND ITS ALTERNATIVES 91 (1982).

195. *See* Pope, *supra* note 153, at 450 ("[S]ome threshold of harm to others must be met before the state can interfere . . . ."); *cf.* Epstein, *supra* note 12, at 400 (denying that "small harms are no harms," but promoting a "mutual renunciation of a right to sue" over "invasions . . . done solely to annoy and harass"); FEINBERG, *supra* note 113, at 189 (citing the maxim "*de minimis non curat lex*" ('the law does not concern itself with trifles') to argue that "bare minimal invasions of interest just above the threshold of harm are not the appropriate objects of legal coercion"). Note that Feinberg and Epstein suggest that small setbacks to interest are harms, but that government intervention to address such harms may be unwise.

196. *See* Dripps, *supra* note 21, at 8-9 (arguing that the concept of harm is insufficiently determinate); Harcourt, *supra* note 148, at 113 & n.12 (noting increased efforts to enforce morality through law and suggesting that "[c]laims of harm [from prostitution, homosexual conduct, and certain other activities] have become so pervasive that the harm principle has become meaningless"); Pope, *supra* note 153, at 448-49 (criticizing the invocation of speculative causal chains of social harm to justify government regulation that "would otherwise have to be supported on paternalistic grounds").

197. *See, e.g.*, Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc., 528 U.S. 167, 201 (Scalia, J., dissenting) ("By accepting

to people who have suffered "actual" and "concrete" harm is necessary to ensure that plaintiffs in public law actions possess a sufficient and appropriate stake to litigate a genuine controversy.[198]

Justice Scalia's quest in the doctrine of standing for "actual" and "concrete" injury is nevertheless a quixotic one.[199] The difficulties in identifying the interests that can be the object of harm dispel any notion that the harm principle provides a simple and objective guide to the limits of government action. Justice Scalia himself seemed to realize this point in the takings cases, where he rejected the harm-benefit test as too subjective.[200] Justice Scalia's contrasting approaches to harm in takings law and standing law suggest the utility of reexamining these two bodies of law to further our understanding of environmental harm.

This reexamination will reveal that the concept of harm depends on community norms. Despite the normative nature of the inquiry, the concept is neither unworkable nor useless. Ultimately, certain interests—such as physical and emotional well-being—lie at the core of what the harm principle protects. Whether setbacks to other interests constitute harm is subject to an ongoing social debate with which legislatures, agencies, and courts should be concerned.

2. TAKINGS LAW REVISITED

The Supreme Court's takings decisions illustrate the normative nature of environmental harm. Indeed, Justice Scalia rebuffed the notion of objective harm when he rejected the harm-benefit test in *Lucas*.[201] Justice Scalia reasoned that one cannot make a principled

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plaintiffs' . . . unsubstantiated allegations of 'concern' about the environment as adequate to prove injury in fact, and accepting them even in the face of a finding that the environment was not demonstrably harmed, the Court makes the injury-in-fact requirement a sham."); Lujan v. Defenders of Wildlife, 504 U.S. 555, 566 (1992) ("Standing is not 'an ingenious academic exercise in the conceivable,' but as we have said requires . . . a factual showing of perceptible harm." (quoting United States v. Students Challenging Regulatory Agency Procedures (SCRAP), 412 U.S. 669, 688 (1973))).

198. *See* Antonin Scalia, *The Doctrine of Standing as an Essential Element of the Separation of Powers*, 17 SUFFOLK U. L. REV. 881, 894-95 (1983) (arguing that the concrete injury requirement restricts courts to their constitutionally assigned role of protecting minority interests); *see also Laidlaw*, 528 U.S. at 198 (Scalia, J., dissenting) (arguing that majority opinion in *Laidlaw* "proceeds to marry private wrong with public remedy in a union that violates traditional principles of federal standing—thereby permitting law enforcement to be placed in the hands of private individuals").

199. *See supra* Part I.E.

200. *See supra* Part I.D.

201. 505 U.S. 1003, 1026 (1992).

distinction between preventing a harm and conferring a benefit,[202] echoing economist Ronald Coase's description of conflicting land uses as "problem[s] of a reciprocal nature."[203] Coase had illustrated this point through an example in which a farmer's crops were damaged by cattle owned by a neighboring rancher.[204] One's initial reaction might be to find the rancher at fault and to say that the farmer was harmed when his crops were damaged. But Coase suggested that an alternative view was equally valid: the farmer was at fault for planting crops that could be damaged by cattle, and the rancher would be harmed if required to take measures to prevent such damage.[205] In other words, imposing a legal responsibility on the rancher not to damage the farmer's crops could be described either as preventing harm to the farmer, or as conferring a benefit on him.[206]

Coase's analysis broke new ground in illustrating that, in a world without transaction costs,[207] rational actors would reach the same economically efficient outcome regardless of the law's initial assignment of liability.[208] Thus, in the farmer-rancher example, the size of the rancher's herd would be the same whether the rancher were liable for damage to the crop or not.[209] In either case, the rancher would set the size of the herd at the point where the marginal benefit of additional cattle equaled the marginal cost.[210] And in either case, the rancher's consideration of marginal cost would account for the damage to the farmer's crop: under a liability regime, the rancher would

202. *Id.* at 1022-25.

203. *See* Coase, *supra* note 66, at 2.

204. *Id.*

205. *See id.* ("The nature of the choice is clear: meat or crops.").

206. Like Justice Scalia, various legal academics relied on Coase's insight in criticizing the harm-benefit test. *See* Frank I. Michelman, *Property, Utility, and Fairness: Comments on the Ethical Foundations of "Just Compensation" Law*, 80 HARV. L. REV. 1165, 1197 (1967) (criticizing the test because of the difficulties in establishing a "neutral" benchmark for distinguishing harm-preventing and benefit-conferring conduct); Rubenfeld, *supra* note 100, at 1099 (contending that "this distinction is impossible to draw"); Joseph L. Sax, *Takings and the Police Power*, 74 YALE L.J. 36, 49 (1964) (contending that "the problem is not one of noxiousness or harm-creating activity at all; rather it is a problem of inconsistency between perfectly innocent and independently desirable uses"); *cf.* Byrne, *supra* note 65, at 681 ("Skilled advocates can describe the securing of benefits as the prevention of harm, and vice versa.").

207. This "no transaction costs" condition assumes "both perfect knowledge and the absence of any impediments or costs of negotiating." Guido Calabresi & A. Douglas Melamed, *Property Rules, Liability Rules, and Inalienability: One View of the Cathedral*, 85 HARV. L. REV. 1089, 1094-95 (1972).

208. *See* Coase, *supra* note 66, at 15.

209. *See id.* at 7.

210. *See id.*

consider what he would owe the farmer for damage to the crop; and under a no-liability regime, the rancher would consider as foregone profits the money that the farmer would be willing to pay the rancher for not grazing additional cattle.[211]

Less convincing, however, was Coase's equating the prevention of a harm with the conferring of a benefit. Consider again the farmer and the rancher. Most people simply would say that the trespass of cattle on the farmer's land harmed the farmer. Far fewer would say that the farmer's planting of crops harmed the rancher. The damage to the farmer's crops seems palpable and concrete, and the trespass of the cattle violates social expectations regarding private property. In this context, the rancher's construction of a fence is more accurately described as the prevention of a harm than as the conferring of a benefit. Harm, as this example suggests, is not purely subjective. Rather, what qualifies as harm rests largely on societal norms about acceptable behavior.[212]

Following this line of reasoning, some academics defend the harm-benefit test as a basis for deciding takings cases.[213] In their view,

211. *See id.*

212. *See* John E. Fee, *The Takings Clause as a Comparative Right*, 76 S. CAL. L. REV. 1003, 1046 (2003) ("While it is conceptually possible to describe any law as either harm-preventing or benefit-conferring, doing so ignores normal societal judgments of acceptable and unacceptable behavior."); *see also* WILLIAM A. FISCHEL, REGULATORY TAKINGS: LAW, ECONOMICS, AND POLITICS 354 (1995) ("'Down' does not become 'up' just because one can invert oneself on a trapeze."); Robert C. Ellickson, *Alternatives to Zoning: Covenants, Nuisance Rules, and Fines as Land Use Controls*, 40 U. CHI. L. REV. 681, 729 (1973) (arguing that "normalcy is often used as a legal standard" and that community norms properly serve as a basis for distinguishing harms and benefits); Andrea L. Peterson, *The Takings Clause: In Search of Underlying Principles Part II—Takings as Intentional Deprivations of Property Without Moral Justification*, 78 CAL. L. REV. 53, 91 (1990) (criticizing the Coasean analysis as "inconsistent with ordinary perceptions of the world"); Shiffrin, *supra* note 183, at 123-25 (noting asymmetries between harms and benefits, and suggesting that only the former involve a "stark cleavage between one's will and one's experience, life, or circumstances").

213. *See, e.g.*, FISCHEL, *supra* note 212, at 354-55 (advocating that the harm-benefit test apply a "normal behavior" standard, to be decided by legislators rather than judges); Freyfogle, *supra* note 17, at 122-24 (urging that the harm-benefit test incorporate communal understandings); Oswald, *supra* note 86, at 1488 ("A principled application of the harm/benefit test will take care of most cases, which are, after all, essentially easy ones."); *cf.* Ellickson, *supra* note 212, at 729.

> Systems of compensating plaintiffs are also labeled according to the normalcy of the plaintiff's welfare after compensation has been provided. Generally, a plaintiff in a nuisance case is not "benefited" by being awarded judgment, he is simply "made whole." The defendant is not "harmed" by an adverse judgment, he is merely required to "make good the damage he has done."

harmful conduct is defined by community norms, and the government must compensate for regulation only when it prohibits normal behavior.[214] The pre-*Lucas* regulatory takings decisions that employed the harm-benefit test indeed reflect ordinary societal judgments about harm, rooted in historical expectations.[215] For instance, in *Hadacheck v. Sebastian*, a 1915 case in which the Court held that prohibiting the operation of a brickyard within city limits did not require compensation,[216] the ordinary social judgment would be that the brickyard harmed the neighboring residents, and not vice versa.[217] And in *Miller v. Schoene*, in which the Court, thirteen years later, upheld an order for the destruction of cedar trees without compensation because cedar rust threatened nearby apple trees,[218] one would ordinarily say that the cedar trees threatened to harm the apple trees,

Id.; Perry, *supra* note 172, at 1292 ("The paradigm of harm is an historical worsening."). Proponents of the harm-benefit test generally do not argue that compensation is *never* required for regulations aimed at preventing harm. *See, e.g.*, Robert C. Ellickson, *Suburban Growth Controls: An Economic and Legal Analysis*, 86 YALE L.J. 385, 419-20 (1977) (proposing the use of the harm-benefit distinction not to decide a taking claim outright, but rather "to vary the prima facie case and defenses to be applied"); Oswald, *supra* note 86, at 1488 (suggesting that a harm-preventing regulation may require compensation if the means chosen bear little relationship to the regulatory purpose and the burden on the property owner is excessive). For these commentators, the harm-benefit line distinguishes between the state's exercise of police power and its exercise of eminent domain. *See* FISCHEL, *supra* note 212, at 354. A regulation classified as within the exercise of police power generally would not require compensation. *See id.* Without some sort of limitation, however, gross abuses of police power might occur if a legislature could avoid a taking simply by articulating some harm-preventing justification. *See* Ellickson, *supra*, at 420.

214. *See* FISCHEL, *supra* note 212, at 354-55; Byrne, *supra* note 65, at 682 (contending that the characterization of a regulation "as either preventing harm or securing a benefit is essentially a political judgment" that should not be decided by the Supreme Court alone, but by more democratic means).

215. *See* Oswald, *supra* note 86, at 1481; *cf.* EPSTEIN, *supra* note 81, at 117-18 (contending that the presence or absence of physical invasion is the critical question under common law nuisance, and that this factor can resolve most takings cases). Professor Andrea Peterson has argued that the critical issue in these cases is not whether a regulation is aimed at harm, but rather "whether the government is preventing or punishing wrongdoing." Peterson, *supra* note 212, at 85. Peterson herself admits, however, that her theory accounts for the nuisance cases only if "wrongdoing" is used very loosely to describe "quite weak judgments of condemnation." *Id.* at 92.

216. *See* 239 U.S. 394, 410 (1915).

217. *See* Oswald, *supra* note 86, at 1481 (discussing *Hadacheck* and contending that "ordinary people would describe the situation as one in which the brickyard intruded upon residential uses, rather than the residential uses intruding upon the brickyard").

218. 276 U.S. 272, 277-80 (1928).

not the reverse.[219] These cases undermine Coase's analysis and suggest the harm-benefit test to be a more nuanced approach than might initially appear to be the case.

The harm-benefit distinction has proven durable even in the face of *Lucas*. Although *Lucas* purported to reject the harm-benefit test as neither "objective" nor "value-free,"[220] *Lucas* itself incorporated common law nuisance into takings law.[221] Both the harm-benefit test and the approach adopted in *Lucas* share the notion of harm as socially defined. The critical difference between the two approaches is that the *Lucas* inquiry attempts to enshrine common law historical understandings of harm into the takings doctrine, whereas the harm-benefit test looks to contemporary community norms, which are influenced but not dictated by historical allocations of rights.[222]

Presumably, the appeal of a historically focused understanding of harm to the *Lucas* majority was that such an understanding would be more favorable to property owners.[223] But there might also be less result-oriented justifications for *Lucas*. If common law nuisance were well-defined,[224] the *Lucas* standard might be easier to apply than a test

219. *See* Oswald, *supra* note 86, at 1481 (discussing *Miller* and contrasting the apple tree owners, who "did not infringe on the rights of others," with the cedar tree owners, who "were, albeit inadvertently and passively, the cause of injury to property outside their own borders").

220. Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1026 (1992).

221. *See supra* Part I.D; *see also* Freyfogle, *supra* note 17, at 123 ("As applied, nuisance law is little more than the harm-benefit test."); Oswald, *supra* note 86, at 1472 (arguing that in *Dolan v. City of Tigard*, 512 U.S. 374, 391 (1994), where the Court held that a government body may impose conditions upon a land-use permit so long as those conditions are roughly proportional to the harm caused by the proposed land use, "the Court implicitly reembraced the tenets of the harm-benefit distinction that it had sought to reject in the context of *Lucas*").

222. *See supra* Part I.D; *see also* Freyfogle, *supra* note 17, at 123 (suggesting that conservative justices turned to common law nuisance to "keep the law of takings back in the pre-ecological era, empowering landowners to draw upon norms of the past to resist evolving norms of the present").

223. *See* Freyfogle, *supra* note 17, at 123. *But see* Michael C. Blumm & Lucus Ritchie, Lucas*'s Unlikely Legacy: The Rise of Background Principles as Categorical Takings Defenses*, 29 HARV. ENVTL. L. REV. 321, 335 (2005) (discussing lower court decisions interpreting nuisance law and other background principles broadly so as to provide greater protection to government defendants in takings cases than had been anticipated at the time *Lucas* was decided).

224. The *Lucas* opinion gives the impression that this is so. *See* 505 U.S. at 1030 (referring to prohibited uses of property that were "*always* unlawful"); *see also* Freyfogle, *supra* note 17, at 123 ("In *Lucas* the Supreme Court held firm to the distinction between common law ownership and the statutory rules of the ecological age, as if one were static, neutral, and sound, the other shifting, political, and suspect.").

contingent on contemporary norms.[225] *Lucas*'s historical approach also might be fairer if property owners' expectations were based on definite and long-established norms. Common law nuisance and common law understandings of harm, however, are neither well-defined nor long-established.[226] The determination of what constitutes a nuisance involves a fact-specific balancing inquiry into what activities a community would have considered harmful at a particular point in time.[227]

Takings law makes evident that harm is unavoidably dependent on historical circumstances and community norms.[228] The injury-in-fact requirement in the law of standing, discussed next, likewise demonstrates that harm is neither an objective concept whose content can be deduced from abstract principles, nor a hopelessly subjective concept lacking substantive content.

3. INJURY-IN-FACT REVISITED

Commentators have criticized the injury-in-fact component of standing and have contended that the proper question is one of legal injury rather than factual injury.[229] The debate, however, is not really about whether a particular injury should be classified as legal or factual. Rather, it is about what counts as an actionable harm.

Unpacking the concept of "harm to the environment"—and its potential relevance to standing law—makes this apparent. Environmentalists sometimes advocate that the environment be

225. In a dramatic example of how norms change over time, William Fischel noted that the prevention of air pollution might once have been described as the provision of a social benefit, for which polluters should receive compensation, rather than as the avoidance of a social cost. FISCHEL, *supra* note 212, at 354.

226. *See* KEETON ET AL., *supra* note 24, § 86, at 616 (remarking that nuisance "has meant all things to all people"); Hope M. Babcock, *Should* Lucas v. South Carolina Coastal Council *Protect Where the Wild Things Are? Of Beavers, Bob-o-Links, and Other Things That Go Bump in the Night*, 85 IOWA L. REV. 849, 854-55 (2000) (suggesting that the *Lucas* Court, in attempting to "convert[] a landowner's relative use right into an unassailable privilege," "may have perversely achieved precisely the opposite result" through its reliance on common law nuisance, the principles of which "come from an era when property rights were anything but absolute"); Freyfogle, *supra* note 17, at 123 (noting that common law courts decided nuisance cases by drawing on a community's sense of value); Humbach, *supra* note 34, at 10 ("The notion that nuisance law can provide a suitable exogenous anchor for takings law is unrealistic.").

227. *See supra* Part I.A.

228. *See* Freyfogle, *supra* note 17, at 123.

229. *See supra* Part I.E.

protected for its own sake.[230] Aldo Leopold's land ethic is perhaps the most familiar statement of this view: "A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise."[231] Professor Christopher Stone expressed a similar view in his seminal Article, *Should Trees Have Standing?*.[232] In that Article, Stone observed that natural objects, lacking legal rights, depend on human beings to bring actions to protect them.[233] Those actions do not protect so much the natural objects themselves, however, as they protect humans' interests in those objects.[234] Deeming such protection insufficient, Stone proposed instead that natural objects' inherent interests—however those might be defined—be protected through legal actions by the objects themselves, with humans serving as their guardians or trustees.[235]

The Supreme Court's standing cases, however, have insisted on finding harm to humans, and not just harm to the environment.[236] The majority and dissent agreed on this point in *Laidlaw*.[237] This agreement reflects an understanding of harm consistent with liberalism: "harm to the environment" is of little consequence unless it is measured with reference to human values.[238] Ironically, the majority and dissent in *Laidlaw* reached different conclusions in light of the district court's

230. *See, e.g.*, ALDO LEOPOLD, A SAND COUNTY ALMANAC 240 (1966); Christopher D. Stone, *Should Trees Have Standing?—Toward Legal Rights for Natural Objects*, 45 S. CAL. L. REV. 450, 456 (1972).

231. LEOPOLD, *supra* note 230, at 240.

232. Stone, *supra* note 230, at 456.

233. *See id.* at 459.

234. *See id.* at 459-62.

235. *See id.* at 464-65.

236. *See* Westbrook, *supra* note 63, at 635-36 (discussing the Court's attention to individual harms in *Sierra Club v. Morton*, 405 U.S. 727, 734-35 (1972)). Justice Douglas's dissent in *Sierra Club*, 405 U.S. at 741-42, argued that environmental objects should have standing to sue. Although the Court did not adopt this view, it has never directly ruled on the issue. *But see* Cetacean Cmty. v. Bush, 386 F.3d 1169, 1175 (9th Cir. 2004) ("Article III does not compel the conclusion that a statutorily authorized suit in the name of an animal is not a 'case or controversy.'").

237. Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc., 528 U.S. 167, 181 (2000); *id.* at 199 (Scalia, J., dissenting).

238. *See* Cassuto, *supra* note 135, at 92 ("Harm is a subjective measure of damage. Subjectivity requires a subject—an entity with a definable conscious perspective. Yet, the environment does not define itself; we define the environment."); *id.* at 86 (arguing that "the concept of harm to the environment is meaningless" because the concept of harm "derives from traditional property interests" that do not apply to the environment); *infra* notes 478-484 and accompanying text. *But see* James L. Huffman, *The Past and Future of Environmental Law*, 30 ENVTL. L. 23, 25-26 (2000) ("Detriment to the environment is regulated not because environmental degradation may have negative impacts on human beings, but rather because the environment has intrinsic worth.").

finding that Laidlaw's excessive discharges had not harmed the environment.[239] For the majority, the plaintiffs' decreased use of the river established injury-in-fact, even though the plaintiffs had failed to prove that the environment had been harmed.[240] For the dissent, the plaintiffs' decreased use was insufficient for standing in the absence of demonstrated harm to the environment.[241]

The key to resolving this paradox is to understand that the "harm to the environment" the plaintiffs had failed to establish was largely anthropocentric harm.[242] As the district court stated, the violations in *Laidlaw* "did not result in any health risk or environmental harm" such as a "fish kill, beach closing, or restrictions on the use of a water body."[243] Unlike the intrinsic harm that concerned Leopold and Stone, all of the examples mentioned by the district court arguably involved environmentally mediated harm to human use.[244] The absence of these harms was irrelevant to the majority, however, because the plaintiffs ultimately *did* show anthropocentric harm—loss of use based on a reasonable belief that the river was polluted.[245]

The Court's struggle to conceptualize injury-in-fact underscores the difficulty of developing any criteria of intrinsic harm free of human normative judgments. Indeed, even Leopold's land ethic, which esteems the "integrity, stability, and beauty of the biotic community,"[246] inevitably incorporates human judgments. Neither integrity nor stability is a given in the natural world, and beauty is in the eye of the human beholder.

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239. 528 U.S. at 184-85; *id.* at 199 (Scalia, J., dissenting).

240. 528 U.S. at 181-85 (majority opinion); *see* Cassuto, *supra* note 135, at 102.

241. *See Laidlaw*, 528 U.S. at 199 (Scalia, J., dissenting). Justice Alito's views appear to be consistent with those of the *Laidlaw* dissent. While on the Third Circuit, Justice Alito joined a 2-1 majority in *Public Interest Research Group v. Magnesium Elektron, Inc.* that rejected the contention that knowledge of Clean Water Act violations was sufficient to establish injury in fact. 123 F.3d 111, 120-21 (3d Cir. 1997). The majority opinion noted that the citizen suit plaintiffs had "shown only that they reduced certain of their recreational activities near the Delaware River" and had not alleged any injury to the Delaware River itself. *Id.* at 121.

242. *See Laidlaw*, 528 U.S. at 181 (majority opinion) (noting that the district court found "'no demonstrated proof of harm to the environment'" and that permit violations "'did not result in any health risk or environmental harm'" (quoting Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc., 956 F. Supp. 588, 602 (D.S.C. 1997))).

243. 956 F. Supp. at 602.

244. *See id.*

245. *Laidlaw*, 528 U.S. at 181-85.

246. LEOPOLD, *supra* note 230, at 240.

The injury-in-fact doctrine, like takings law, supports the general thesis that harm is a normative concept. The injury-in-fact cases also suggest the dangers inherent in a subjective understanding of harm. Surely, the *Laidlaw* majority would not go so far as to find standing based on a purely subjective, but erroneous, belief of harm. Under such a circumstance, one might instead rely on a different theory of injury-in-fact that rests on the injury to society at large from the violation of law itself.[247] Consistent with our discussion of harm as a normative concept, this setback to collective human interests would constitute harm if society has defined it as so.[248]

4. BUILDING ON *LUCAS* AND INJURY-IN-FACT

As the foregoing examination of standing law and takings law demonstrates, harm is a normative concept, defined in the context of a human community with respect to human interests. Regulatory takings law—in particular, *Lucas*—is problematic because it has turned to the community of the past to define harm.[249] From the standpoint of democratic self-governance, the values of the present community, and not those of the past, should inform the law's normative standards. The injury-in-fact doctrine is subject to a different criticism: rather than acknowledging the normativity of harm, the Court has wrongly posited that injury-in-fact is objective and independent of the law.[250] The Court's standing decisions have also tended to obscure the environmental harms that might be included within its objective conception of injury.

Despite these criticisms, Justice Scalia's insistence that there is something *real* and objective about injury-in-fact has some intuitive appeal.[251] Harm is not purely subjective; it depends on social norms, not on mere personal judgments or preferences.[252] The appeal of Scalia's approach may simply reflect the fact that certain interests are so undisputedly critical that setbacks to them are commonly recognized

247. *See* Cassuto, *supra* note 135, at 119-22 (arguing that the injury-in-fact concept should encompass the general public injury from actions that undermine a legal regulatory regime, including "virtually any allegation of statutory violations").

248. *See id.* at 122.

249. Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1029-31 (1992).

250. *See supra* Part I.E.

251. *See* Lujan v. Defenders of Wildlife, 504 U.S. 555, 560 (1992) (Scalia, J., writing for the majority) (injury-in-fact must be "concrete and particularized" and "actual or imminent, not conjectural or hypothetical" (internal quotations omitted)).

252. *See* Green, *supra* note 182, at 1554.

as harm, regardless of the social norms applied.[253] These interests may include physical well-being, emotional well-being, and property interests. Exploring these interests will further our understanding of harm and will help to analyze more difficult cases in which harm is less clear.

a. Physical Injury

A setback to physical well-being, such as death, is the archetype of harm. Indeed, it is generally undisputed that actions resulting in physical injury to others are harmful.[254] One's bodily integrity is intensely personal and—Cartesian philosophy notwithstanding[255]—fundamental to one's existence and one's individuality. The importance of physical well-being is reflected in the criminal law's severe treatment of acts that cause physical harm, including homicide, rape, and battery.

Feinberg counted the interest in physical well-being within a broader class of interests that he viewed as critical. He called these "welfare interests," a term that encompassed:

> the interests in the continuance for a foreseeable interval of one's life, and the interests in one's own physical health and vigor, the integrity and normal functioning of one's body, the absence of absorbing pain and suffering or grotesque disfigurement, minimal intellectual acuity, emotional stability, the absence of groundless anxieties and resentments, the capacity to engage normally in social intercourse and to enjoy and maintain friendships, at least minimal income and

253. *Cf. id.* at 1554 (noting, in considering harm in the context of criminal law, that "when we say that a person is culpable or that an act is wrongful or harmful, we mean, at least in part, that a consensus of society would view the person or act in that manner").

254. *See* Nagel, *supra* note 162, at 143 (contending that society generally considers "actions resulting in physical injury to others, or in depriving them of their possessions" to be harmful); *see also* RICHARD A. EPSTEIN, PRINCIPLES FOR A FREE SOCIETY 76 (1998) (describing death and personal injury as "easy cases" of harm); Goldberg, *supra* note 24, at 1317 ("[O]n almost any plausible normative account of human well-being, dramatic loss of physical integrity will count as a significant setback."); Perry, *supra* note 172, at 1305-06 (identifying physical injury as one of "the main targets of harm"); *cf.* MILL, *supra* note 2, at 139 (suggesting that governmental power may be used to defend persons "from injury and molestation").

255. Descartes famously reasoned that the act of thinking, rather than the presence of the physical body, most strongly demonstrates one's existence. *See* RENÉ DESCARTES, MEDITATIONS ON FIRST PHILOSOPHY 18 (John Cottingham trans., Cambridge Univ. Press 1986) (1641) ("At last I have discovered it—thought; this alone is inseparable from me. I am, I exist—that is certain. But for how long? For as long as I am thinking.").

> financial security, a tolerable social and physical environment, and a certain amount of freedom from interference and coercion.[256]

These interests, Feinberg explained, are welfare interests in that they involve interests in achieving and maintaining the minimum level of health, resources, and liberty necessary to achieve more ulterior goals.[257] Although Feinberg hinted that setbacks to certain interests other than welfare interests may also constitute harm, he did not expand on the issue.[258] Rather, Feinberg concentrated on welfare interests because he viewed setbacks to these interests as the most serious kind of harm.[259]

What makes physical well-being so fundamental such that a setback to it constitutes harm? For materialists, the answer is straightforward: physical well-being is critical because it is the essence of existence.[260] But physical well-being is also critical for others, including liberals like Feinberg, because of the relationship between physical well-being and one's will.[261] One's will is expressed in ulterior interests—a person's ultimate goals or aspirations, such as having a successful career or raising a family.[262] Although bodily integrity and other welfare interests may seem mundane by comparison, they are nevertheless critical because they enable the individual to make autonomous choices and to achieve one's own conception of the

256. FEINBERG, *supra* note 113, at 37; *cf.* Perry, *supra* note 172, at 1305-06 (identifying the "core" interests of bodily integrity, pain avoidance, and emotional tranquility that, when adversely affected, generate harms); Shiffrin, *supra* note 183, at 123-24 (describing harm as "the imposition of conditions from which the person undergoing them is reasonably alienated" and listing pain, disabilities, injured limbs, illnesses, and death as examples of harm).

257. *See* FEINBERG, *supra* note 113, at 57.

258. *See id.* at 37-38 ("In general then, an invasion of a welfare interest is the most serious, but not the only kind of harm a person can sustain.").

259. *See id.* at 37-38; *see also* Kleinig, *supra* note 24, at 31 (describing welfare interests as the sort of interests that are "indispensable to the pursuit and fulfillment of characteristically human interests"); *cf.* Adler, *supra* note 185, at 1308-10 (identifying experience, preference, value, and integration as the "main plausible elements of a welfare account").

260. Materialists subscribe to "[t]he view that the world is entirely composed of matter." SIMON BLACKBURN, THE OXFORD DICTIONARY OF PHILOSOPHY 233 (1994).

261. *See* Shiffrin, *supra* note 183, at 123 ("[H]arm involves conditions that generate a significant chasm or conflict between one's will and one's experience, one's life more broadly understood, or one's circumstances." (citing Thomas Nagel, *Death*, *in* MORTAL QUESTIONS 1-11 (1979))); FEINBERG, *supra* note 113, at 37.

262. *See* FEINBERG, *supra* note 113, at 37; *see also* Schroeder, *supra* note 148, at 520 (arguing that a just society should value not only bodily integrity, but also individual initiatives that make human life distinctively human).

good.[263] Indeed, welfare interests are arguably more important than ulterior interests because satisfaction of the former is necessary for achievement of the latter.[264] Moreover, setbacks to welfare interests tend to constitute setbacks to an individual's more ultimate interests as well.[265]

b. Emotional Injury

Under an account of harm centered on welfare interests, harm includes not only physical injuries, but also fear and other emotional injuries. Indeed, the word "harm" derives from the Old English word "hearm," which referred primarily to grief and sorrow.[266] There is overwhelming psychological evidence of the serious welfare setbacks often associated with fear.[267] The prolonged hazards that are characteristic of many environmental problems may trigger anxiety and depression, which themselves may result in physical symptoms such as insomnia, fatigue, headaches, diarrhea, muscle pain, and a weakened

263. *See* FEINBERG, *supra* note 113, at 37.

264. *See id.* Various aphorisms reflect this perhaps obvious point: "Health is better than wealth." (proverb); "Without health life is not life; it is unlivable." (François Rabelais); "The health of a people is really the foundation upon which all their happiness and all their power as a State depend." (Benjamin Disraeli). *See* THE MACMILLAN DICTIONARY OF QUOTATIONS 246-47 (1989).

265. *See* FEINBERG, *supra* note 113, at 37 ("In one way, then, they are the very most important interests a person has, and cry out for protection, for without their fulfillment, a person is lost.").

266. *See* Kleinig, *supra* note 24, at 27; 6 THE OXFORD ENGLISH DICTIONARY 1121 (2d ed. 1989) (listing a secondary definition of harm as "[g]rief, sorrow, pain, trouble, distress, affliction").

267. *See* DEBORAH DU NANN WINTER & SUSAN M. KOGER, THE PSYCHOLOGY OF ENVIRONMENTAL PROBLEMS 139 (2d ed. 2004) (noting that awareness of risk can cause stress, which can seriously compromise physical and mental health); Johan M. Havenaar & Wim van den Brink, *Psychological Factors Affecting Health After Toxicological Disasters*, 17 CLINICAL PSYCHOL. REV. 359, 361-62 (1997) (stating that stressful experiences of toxicological disasters tend to involve uncertainty, housing and job insecurity, social rejection, media siege, and cultural pressure); Levit, *supra* note 25, at 184 ("The toll of anxiety and depressive states involves economic, social, and physical costs."); *see also* Antonio Chirumbolo & Johnny Hellgren, *Individual and Organizational Consequences of Job Insecurity: A European Study*, 24 ECON. & INDUS. DEMOCRACY 217, 219 (2003) (summarizing research findings that the risk of losing a job may cause physical and mental health problems, impaired emotional and family relations, and more anxiety than the actual loss of a job); Csilla T. Csoboth et al., *Living in Fear of Experiencing Physical and Sexual Abuse Is Associated with Severe Depressive Symptomatology Among Young Women*, 14 J. WOMEN'S HEALTH 441 (2005) (reporting a strong correlation between fear of abuse and severe depression); Cass R. Sunstein, *Terrorism and Probability Neglect*, 26 J. RISK & UNCERTAINTY 121, 132 (2003) ("In many domains, widespread fear is not merely a loss in itself . . . , but also leads to an array of additional problems.").

immune system.[268] These detriments to one's well-being can be sufficiently serious to impede the pursuit of one's ultimate goals.[269]

That reasonable conceptions of harm would include setbacks to emotional well-being is reflected in the courts' recognition of fear as harm in tort cases.[270] Notwithstanding the etymology of "harm," common law tort was historically unfriendly to claims of psychological injury.[271] Although courts gradually allowed recovery for some emotional harms, most courts required those harms to be related to physical injury and placed restrictions on liability even in those cases.[272] In modern tort cases, however, most courts acknowledge that fear is a harm.[273] Courts limit recovery for fear and other emotional impacts not because such impacts are harmless, but because of concerns about unlimited damages and fraudulent claims.[274]

268. Lisa Heinzerling, *Environmental Law and the Present Future*, 87 GEO. L.J. 2025, 2034-35 (1999); *see* Havenaar & van den Brink, *supra* note 267, at 366 (summarizing studies finding that victims of toxicological disasters suffered from diminished performance on cognitive tasks, elevated rates of depression, posttraumatic stress, and other anxiety disorders); Levit, *supra* note 25, at 185-86 & n.253 (citing studies confirming a correlation between anxiety and physical illness).

269. For example, researchers found lower pregnancy rates and higher abortion rates in western European countries in the months after the Chernobyl disaster, suggesting that fear of radiation may have caused more fetal deaths than the released radioactivity itself. Havenaar & van den Brink, *supra* note 267, at 367.

270. *See* DOBBS, *supra* note 11, § 302, at 821 ("Courts have long recognized that tortfeasors should be responsible for causing distress, emotional harm, anxiety, diminished enjoyment, losses of autonomy, and similar intangible harms. . . . Such harms are real. They represent the antithesis of happiness or enjoyment of life which everyone pursues."); *see also* WILLIAM PROSSER, HANDBOOK OF THE LAW OF TORTS 579 (4th ed. 1971) (stating that fear that is common to most of a community may constitute a nuisance, even if the fear lacks a scientific foundation).

271. *See supra* Part I.B.

272. *See* RESTATEMENT (SECOND) OF TORTS § 456(a) (1965) (allowing recovery in negligence cases for "fright, shock, or other emotional disturbance resulting from the bodily harm or from the conduct which causes it"); Guzelian, *supra* note 55, at 766-67; *supra* Part I.B.

273. *See, e.g.*, Dillon v. Legg, 441 P.2d 912, 917 (Cal. 1968) (noting that sudden fright or fear may result in physical injury).

274. *See, e.g.*, Norfolk & W. Ry. Co. v. Ayers, 538 U.S. 135, 157 (2003) (cautioning that an asbestosis sufferer seeking compensation for fear of cancer must "prove that his alleged fear is genuine and serious"); Consol. Rail Corp. v. Gottshall, 512 U.S. 532, 544-46 (1994) (noting that "[n]early all of the States have recognized a right to recover for negligent infliction of emotional distress," but that the scope of the right is limited by policy considerations, such as the "very real possibility of nearly infinite and unpredictable liability for defendants"); *Dillon*, 441 P.2d at 919 (allowing bystanders to recover damages for emotional distress only where injuries were reasonably foreseeable "[i]n order to limit the otherwise potential infinite liability").

c. Property Damage

Damage to or deprivation of one's property is another type of setback to interests that society and the law, including environmental law, generally recognize as harm.[275] In a capitalist society, private property is a means of asserting one's liberty; it is virtually an extension of oneself.[276] Property has both use and exchange value, and depriving people of property causes harm because it denies them opportunities to use or to exchange it to pursue their ultimate goals.[277] The criminal law, of course, protects private property interests from deprivation (through larceny, robbery, fraud, and the like) as well as from damage (through vandalism and trespass). Takings law protects property owners from deprivations of property by the government without just compensation. Common law nuisance goes even further, recognizing harm not only in physical damage to property, but also in interference with the use of property.[278] Environmental nuisance cases may even include claims of injury for the stigma that attaches to one's property from nearby contamination.[279] And finally, the standing cases

275. *See* Nagel, *supra* note 162, at 143; James R. Beattie, Jr., *Taking Liberalism and Religious Liberty Seriously: Shifting Our Notion of Toleration from Locke to Mill*, 43 CATH. LAW. 367, 381 (2004). Impacts on property value alone, however, are generally deemed insufficient to establish a nuisance. NAGLE, *supra* note 18, at 299.

276. *See* JOHN ADAMS, *Discourses on Davila*, *in* THE WORKS OF JOHN ADAMS 280 (Charles Francis Adams ed., 1851) ("Property must be secured, or liberty cannot exist."); Note, *Distributive Liberty: A Relational Model of Freedom, Coercion, and Property Law*, 107 HARV. L. REV. 859, 860 (1994) (contending that "the configuration of property law—the organization of power over economic resources—is profoundly part of liberty" because liberty depends on one's capacity to pursue one's life plans in the context of relationships with others); *see also* William W. Van Alstyne, *The Recrudescence of Property Rights as the Foremost Principle of Civil Liberties: The First Decade of the Burger Court*, 43 LAW & CONTEMP. PROBS. 66, 70, 73 (1980) (contending that the Burger Court decisions reflected the importance of private property to the expression of individual liberty).

277. *See* RAZ, *supra* note 171, at 413; Joseph Raz, *Autonomy, Toleration, and the Harm Principle*, *in* ISSUES IN CONTEMPORARY LEGAL PHILOSOPHY 313, 327 (Ruth Gavison ed., 1987) (characterizing injury to property as analogous to physical injury because both reduce a person's ability to act in desired ways).

278. *See* EDWARD H.P. BRANS, LIABILITY FOR DAMAGE TO PUBLIC NATURAL RESOURCES 12-13 (2001) (noting that tort law covers environmentally related damage, including infringement of property rights); Nagle, *supra* note 28, at 276 (observing that sensory nuisances, such as noise, light, and odor, generate few physical injuries or other readily measurable harms); *supra* Part I.A; *see also* J.B. Ruhl, *Ecosystem Services and the Common Law of "The Fragile Land System,"* NAT. RESOURCES & ENV'T, Fall 2005, at 3, 8-9 (proposing that common law nuisance recognize the loss of ecosystem services as an actionable economic loss).

279. *See, e.g.*, Bradley v. Armstrong Rubber Co., 130 F.3d 168, 175-76 (5th Cir. 1997) (discussing cases regarding recoverability of stigma damages from

recognize that interference with one's use of the environment constitutes harm, even if the resource at issue is publicly owned.[280]

The harms that environmental law claims to address are not limited to bodily injuries, emotional injuries, or damage to property.[281] Professor John Nagle has suggested, for instance, that "[e]nvironmental law views pollution as harmful for several distinct reasons: pollution causes human illness, it interferes with our ability to use the affected environment, it injures the environment itself and the wildlife and plants that live in it, it is aesthetically displeasing, and it is immoral."[282] Although the welfare interests highlighted by Feinberg include interests other than physical well-being, emotional well-being, and property interests,[283] welfare interests do not obviously extend to aesthetic

environmental contamination); Scheg v. Agway, Inc., 645 N.Y.S.2d 687, 688 (N.Y. App. Div. 1996) (stating that plaintiff's nuisance claim, "insofar as it alleges that the value of [plaintiff's] property was diminished as a result of its proximity to the landfill, does state a cause of action").

280. *See* Friends of the Earth, Inc. v. Laidlaw Envtl. Servs. (TOC), Inc., 528 U.S. 167, 183 (2000) ("We have held that environmental plaintiffs adequately allege injury in fact when they aver that they use the affected area and are persons for whom the aesthetic and recreational values of the area will be lessened by the challenged activity." (internal quotation marks omitted)); Sierra Club v. Morton, 405 U.S. 727, 735 (1972) ("The alleged injury will be felt directly only by those who use Mineral King and Sequoia National Park . . . ."); Lujan v. Defenders of Wildlife, 504 U.S. 555, 565-66 (1992) ("[A] plaintiff claiming injury from environmental damage must use the area affected by the challenged activity and not an area roughly 'in the vicinity' of it." (quoting Lujan v. Nat'l Wildlife Fed'n, 497 U.S. 871, 887 (1990))). The recognition of injury to the use of public resources represents an extension of the common law conception of harm, which was concerned primarily with interference with the use of privately owned land. Under the common law, an individual citizen could bring a public nuisance claim only by showing a "special" injury—an injury "different-in-kind" and not just "different-in-degree" from the general public who might also be affected by the nuisance. Denise E. Antolini, *Modernizing Public Nuisance: Solving the Paradox of the Special Injury Rule*, 28 ECOLOGY L.Q. 755, 761-62 (2001) (criticizing the "ancient" doctrine of special injury as "an anomalous technical defense in tort law" that has acted "as an unduly strict gatekeeper rather than honoring the fundamental purpose of public nuisance"); *see* KEETON ET AL., *supra* note 24, at 646-50 (discussing the special injury requirement); RODGERS, *supra* note 27, § 2.2, at 36 (discussing and criticizing the special injury requirement).

281. NAGLE, *supra* note 18, at 197 ("The premise that environmental pollution responds to physical human injuries, and only such injuries, is a myth."); *cf.* Finkelstein, *supra* note 25, at 977 ("The problem with the traditional requirement of physical harm is that physical harm clearly is *not* the only kind of harm there is, nor is it always the *worst* kind of harm."); Schroeder, *supra* note 148, at 519 (criticizing as "unacceptably authoritarian" the valuing of survival or bodily integrity over all other ends).

282. NAGLE, *supra* note 18, at 171.

283. *See supra* text accompanying note 256; *see also* Kleinig, *supra* note 24, at 31 (noting that human welfare interests relate not only to normal biological functioning, but also to ulterior interests).

interests or to interests in the environment itself. This suggests that Feinberg's analysis alone may not explain environmental law. Moreover, Feinberg's description of welfare interests does not directly address situations of risk and uncertainty—circumstances that frequently characterize environmental issues.[284] Whether the harm principle provides adequate justification for governmental action in these circumstances poses more difficult questions that will be considered in the next Part.

III. CHALLENGES OF ENVIRONMENTAL HARM

Physical injury, emotional injury, and damage to property are easy, core cases of harm. Environmental law, however, has in many instances failed to recognize the harmfulness of emotional injuries. This Part begins by seeking to explain this omission. Three scenarios that present more difficult questions of harm are then addressed: (1) chromosomal damage and heightened risk from exposure to toxic substances, (2) uncertain effects of emerging technologies, and (3) damage to the environment itself. These scenarios, which are of increasing concern due to trends of globalization, technological change, and an expanding human ecological footprint,[285] provide concrete factual settings for applying the framework developed thus far. In each instance, society has not conclusively determined that harm is present, and there is debate over if and how society should respond. Understanding how these cutting-edge issues of harm might be resolved will help shape future environmental law.

A. Fear and Emotional Injury

1. THE HARMFULNESS OF FEAR RESULTING FROM TOXIC EXPOSURE

As discussed above, fear, anxiety, and other emotional injuries constitute serious setbacks to welfare interests.[286] In the environmental

284. *See* Richard J. Lazarus, *Restoring What's Environmental About Environmental Law in the Supreme Court*, 47 UCLA L. REV. 703, 747 (2000).

285. The concept of an ecological footprint provides a measure of the human pressures being placed on global ecosystems by estimating the amount of land required to support a particular population. *See* PERCIVAL ET AL., *supra* note 1, at 4.

286. *See supra* Part II.B.4.b; *see also* Perry, *supra* note 172, at 1305-06 (identifying severe fright and emotional distress as setbacks to interests that qualify as harm); Cass R. Sunstein, *The Laws of Fear*, 115 HARV. L. REV. 1119, 1168 (2002) (book review) ("The mere fact of fear is a social loss, in some cases a large one . . . .").

context, the fear that may accompany toxic exposure can debilitate individuals and communities.[287] The term "dread" is often used to describe this kind of fear, which is a serious and substantial setback to the affected individuals' welfare interests.[288] The latent hazards characteristic of environmental problems are dreaded not only because of their involuntary nature, catastrophic potential, and fatal consequences,[289] but also because they often have no clearly defined end.[290] People exposed to invisible contaminants, unlike victims of natural disasters such as floods or hurricanes, may be left without closure for years or decades.[291] As case studies of Love Canal, Times Beach, and other communities exposed to toxics have found, the emotional impacts may ultimately include loss of trust in society's institutions and fracturing of the affected community.[292]

Various trends likely will draw more attention to psychological injury in the future. First, rapidly developing technologies will give rise to new fears. New technologies with the potential for significant, unprecedented, and wide-ranging impacts include nanotechnology, biotechnology, and cloning.[293] Potentially catastrophic environmental

287. *See* Heinzerling, *supra* note 268, at 2030; Lazarus, *supra* note 284, at 747 ("The injury is not confined to that which occurs if the risk is itself realized. There is often psychological harm resulting from the risk itself, whether or not ever realized."); *see also* Margaret S. Gibbs, *Factors in the Victim that Mediate Between Disaster and Psychopathology: A Review*, 2 J. TRAUMATIC STRESS 489, 494 (1989) (reporting a "breakdown of meaning" in the lives of victims of disasters).

288. *See* Heinzerling, *supra* note 268, at 2030-31 (citing psychologist Paul Slovic's discussion of dread risk as risk "characterized by 'a perceived lack of control, dread, catastrophic potential, fatal consequences, and the inequitable distribution of risks and benefits'" (citing Paul Slovic, *Perception of Risk*, 236 SCIENCE 280, 283 (1987))).

289. *See* Donovan, *supra* note 44, at 1340 ("Although individuals living in a modern society voluntarily subject themselves to serious health risks on a daily basis without giving it a second thought, involuntary exposure to toxins . . . at the hands of another is sufficient to create a panic over the possible long-term effects.").

290. *See* Heinzerling, *supra* note 268, at 2033 (citing Kai Erikson's observations in A NEW SPECIES OF TROUBLE: EXPLORATIONS IN DISASTER, TRAUMA, AND COMMUNITY 147-48 (1994), that toxic emergencies generate special anxiety because they are temporally unbounded).

291. *See id.* at 2033-34.

292. *See id.* at 2036-39.

293. *See* RICHARD A. POSNER, CATASTROPHE: RISK AND RESPONSE 92 (2004) (suggesting that catastrophic risks are increasing in part because of the "breakneck pace of scientific and technological advance[s]"); Rebecca Bratspies, *The Illusion of Care: Regulation, Uncertainty, and Genetically Modified Food Crops*, 10 N.Y.U. ENVTL. L.J. 297, 299 n.14 (2002) (suggesting that environmental harms created by genetically modified crops might include "evolving insect resistance; genetic erosion of wild land races; inadvertent creation of super weeds resistant to herbicides; and loss of beneficial insects"); Barnaby J. Feder, *Tiny Ideas Coming of Age*, N.Y. TIMES, Oct. 24, 2004, at

risks posed by the use or misuse of these technologies are already beginning to arouse widespread concern.[294]

Second, even if objective levels of risk remain the same—indeed, even if they decrease—public concern about risks may nevertheless rise.[295] As the ability to detect low-level risks improves, scientists will generate more risk-related information.[296] In addition, the digital revolution will continue to make more information, including information about environmental risks, available to the general public.[297] Public responses to this information are likely to be varied.

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12 (describing the surge of nanoscale inventions for which patent applications have been submitted); Gina Kolata, *Promise, In Search of Results: Stem Cell Science Gets Limelight; Now It Needs a Cure*, N.Y. TIMES, Aug. 24, 2004, at F1 (reporting on the progress of stem cell research); Andrew Pollack, *No Foolproof Way Is Seen to Contain Altered Genes*, N.Y. TIMES, Jan. 21, 2004, at A10 (describing a National Academy of Sciences report suggesting that it will be difficult to prevent genetically engineered plants and animals from having unintended environmental and public health effects); *see also infra* Part III.C.1 (providing a brief discussion of nanotechnology). *See generally* Robert A. Bohrer, *Fear and Trembling in the Twentieth Century: Technological Risk, Uncertainty and Emotional Distress*, 1984 WIS. L. REV. 83, 86-87 (noting that modern technology qualitatively differs from the technology prevalent in the common law era with respect to the size of the population potentially affected, unpredictable mechanisms of causing harm, and the length of exposure and latency periods).

294. *See, e.g.*, POSNER, *supra* note 293, at 35-38 (describing the catastrophic risks posed by, inter alia, nanomachines and genetically modified crops); MARTIN REES, OUR FINAL HOUR (2003) (discussing the risk of human extinction from various threats, including nanotechnology); Dan Ferber, *GM Crops in the Cross Hairs*, 286 SCIENCE 1662 (1999) (reporting the growing public controversy over genetically modified crops); Chris Phoenix & Eric Drexler, Opinion, *Safe Exponential Manufacturing*, 15 NANOTECHNOLOGY 869 (2004) (mentioning the risks posed by nanotechnology, including uncontrolled replication and environmentally destructive effects); Erik Stokstad, *Experts Recommend a Cautious Approach*, 303 SCIENCE 449 (2004) (reporting scientists' recommendations for more research and efforts regarding the confinement of genetically engineered species).

295. *See infra* text accompanying notes 391-394 (noting an increased concern about risks as levels of actual risk have declined).

296. *See* STEPHEN BREYER, BREAKING THE VICIOUS CIRCLE: TOWARD EFFECTIVE RISK REGULATION 39 (1993); Daniel C. Esty, *Environmental Protection in the Information Age*, 79 N.Y.U. L. REV. 115, 192-93 (2004) (contending that increasing scientific documentation of the harms that an average person cannot sense will curb the tendency to ignore such harms); *see, e.g.*, Lin, *supra* note 12, at 1470-81 (describing technological advances that will generate more information about the risks from toxic exposure); Peter Waldman, *Common Industrial Chemicals in Tiny Doses Raise Health Issue*, WALL ST. J., July 25, 2005, at A1 (describing the growing evidence of toxic effects from extremely low doses of commonly used chemicals).

297. *See* BREYER, *supra* note 296, at 39 (noting a larger pool of accident stories available to the press as a result of improved international communications); Esty, *supra* note 296, at 160-61 (noting the greater availability and dissemination of information among policy communities and also to the general public); Sunstein, *supra* note 286, at 1160 (noting changes in the news media that enable instantaneous reporting

Take toxic risk as an example. Greater information about exposure and about the risks of exposure may allow individuals to make more informed decisions in terms of product use or precautionary measures.[298] But such information may also increase public apprehension in both rational and irrational ways.[299] Indeed, greater discussion of toxic risk information may only exacerbate public anxiety[300] by emphasizing the uncertainty and incompleteness of data.[301]

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of risk-related events around the world, with particular emphasis on bad, trust-destroying events).

298. *See* Clifford Rechtschaffen, *The Warning Game: Evaluating Warnings Under California's Proposition 65*, 23 ECOLOGY L.Q. 303, 314-15 (1996) (suggesting that through greater information dissemination, "citizens can make better-informed decisions and are thus in a better position to bargain with private corporations and government").

299. *See* Vincent T. Covello et al., *Risk Communication: A Review of the Literature*, 3 RISK ABSTRACTS 171, 172-75 (1986) (identifying problems that complicate the task of changing behavior, including lack of interest and excessive fear); Guzelian, *supra* note 55, at 848-49 ("The concept of fear amplification . . . implies that even *properly* functioning risk communication about just one risky act can spawn countless genuine fears."); Rechtschaffen, *supra* note 298, at 315-17 (noting the limitations of individuals in seeking out, understanding, and acting upon information about risk). *But cf.* Frank B. Cross, *The Naïve Environmentalist*, 53 CASE W. RES. L. REV. 477, 483 (2002) (contending that environmentalists who "cry wolf" undermine the credibility of warnings about risk).

300. *See* Lisa Heinzerling, *Terrorism, Toxics, and Tort*, 9 WIDENER L. SYMP. J. 545, 547 (2003).

> In the absence of information about the actual physical effects of pollution—which, with long-term threats, may not be available for many years, if ever—people are forced to come to their own conclusions about the risks they face. In the absence of good information about insidious threats, people often end up fearing the worst.

Id.; Sunstein, *supra* note 286, at 1161 ("[H]igh levels of public participation in technical domains could simply heighten public fear, with unfortunate consequences for policy."); Donovan, *supra* note 44, at 1339 n.10 ("[E]ven information that is actually released with the intent to reduce fears, such as the minor nature or degree of exposure to a toxin in a given instance, may actually increase anxiety."). A recent example of public anxiety fueled by the discussion of uncertain toxic risk information took place in El Dorado Hills, California. Public officials warned the community of potential dangers from exposure to naturally occurring asbestos, but also cautioned that much was unknown about the exact nature of the risk. Chris Bowman et al., *Residents Demand Asbestos Answers: Officials Criticized at El Dorado Hills Meeting*, SACRAMENTO BEE, May 7, 2005, at A1. The warning left some community members anxious and angry that the government was "raising too many questions and providing too few answers on the health risks." *Id.*; *see* Carrie Peyton Dahlberg, *Balancing Fear, Hope in Foothills: Experts Face Daunting Task of Explaining Asbestos Peril, Not Alarming Public*, SACRAMENTO BEE, May 15, 2005, at A1.

301. As the Supreme Court has stated, "Scientific conclusions are subject to perpetual revision." Daubert v. Merrell Dow Pharms., Inc., 509 U.S. 579, 597 (1993); *see also* Holly Doremus, *Constitutive Law and Environmental Policy*, 22 STAN. ENVTL. L.J. 295, 318, 359 (2003) (contending that environmental problems are

Third, attention to psychological injuries may increase as a more objective accounting of such injuries becomes possible. The American Psychiatric Association's *Diagnostic and Statistical Manual*, first published in 1952 and periodically revised ever since,[302] incorporates elaborate diagnostic criteria that have reduced unreliable or inconsistent diagnoses of mental illness.[303] Moreover, psychiatrists and psychologists have created increasingly sophisticated tools for measuring fear and other forms of psychological injury.[304] Scales for measuring fear have been applied in environmental contexts to quantify anxiety resulting from perceived and actual air pollution, accidental releases of toxic chemicals, and proximity to landfills containing hazardous waste.[305]

2. ENVIRONMENTAL LAW'S NEGLECT OF FEAR

Despite the potentially devastating impacts and growing importance of psychological injury, Congress and the Environmental Protection Agency (EPA) generally have not recognized fear as a harm in environmental statutes. Environmental law, in contrast to areas of law such as that governing hostile work environments, gives relatively little weight to emotional impacts.[306] Nuisance actions against environmental pollution, for example, cannot rely on emotional injuries alone.[307] The National Environmental Policy Act (NEPA), which requires federal agencies to consider the environmental impacts of their proposed actions, does not require consideration of anxiety and fear

"characterized by high levels of uncertainty" and that much of the uncertainty is simply unavoidable); Feldman, *supra* note 177, at 16 ("In science, revisability is always an option. As scientists acquire new data and change their collective judgments about which background assumptions to hold constant, they revise and replace even well-established scientific theories.").

302. The current edition is AM. PSYCHIATRIC ASS'N, DIAGNOSTIC AND STATISTICAL MANUAL OF MENTAL DISORDERS: DSM-IV-TR (4th ed. text rev. 2000).

303. Jules B. Gerard, *The Usefulness of the Medical Model to the Legal System*, 39 RUTGERS L. REV. 377, 414-15 (1987); *see also* ANDRE A. MOENSSENS ET AL., SCIENTIFIC EVIDENCE IN CIVIL AND CRIMINAL CASES 1084-88 (1995) (summarizing the classification of principal mental disorders in DSM-IV).

304. Matthew D. Adler, *Fear Assessment: Cost-Benefit Analysis and the Pricing of Fear and Anxiety*, 79 CHI.-KENT L. REV. 977, 989-91 (2004).

305. *Id.* at 991-92.

306. *See* NAGLE, *supra* note 18, at 196; *see also* Adler, *supra* note 304, at 978-81 (describing the EPA rulemaking to set arsenic levels in drinking water and contrasting the sophisticated risk assessment techniques used to estimate the value of physical harms with the failure to quantify or monetize the benefits of reducing public anxiety, and contrasting this practice with that used in creating regulations for acceptable defect rates in rubber gloves).

307. *See* NAGLE, *supra* note 18, at 196.

caused by the risk of an accident.[308] And pollution control statutes provide the EPA with no explicit instruction to consider emotional injuries in determining permissible levels of pollution.[309] For most environmental statutes, Congress did not expressly consider fear as a harm. Rather, the more direct, tangible, and easily quantified health effects have driven the regulatory process.[310] The question is not whether reasonable fear is a harm, but why environmental law generally has failed to treat reasonable fear as harm. Absent adequate justification for differential treatment, environmental law should address fear in a manner consistent with other areas of law.

Fear undoubtedly played a significant role in the passage of many modern environmental statutes. As pesticides and other chemicals were linked to cancer and other harmful effects in the 1950s and 1960s, fear of chemical hazards escalated.[311] Congress responded by enacting laws such as the Federal Insecticide, Fungicide, and Rodenticide Act; the Safe Drinking Water Act; and the Toxic Substances Control Act.[312] While these statutes were largely prompted by public fears, they did not formally treat fear itself as a harm.[313] Moreover, the EPA sometimes has mentioned the reduction of fear as a benefit of a proposed rule reducing toxic exposure, but it generally has not analyzed the costs of fear in a serious and systematic manner.[314]

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308. *See* Metro. Edison Co. v. People Against Nuclear Energy, 460 U.S. 766, 774-78 (1983) (holding that the Nuclear Regulatory Commission, in deciding whether to allow nuclear plants to resume operation, was not required to consider psychological health damage from the risk of a nuclear accident).

309. *See* NAGLE, *supra* note 18, at 196; *see, e.g.*, Clean Water Act, 33 U.S.C. § 1313(c) (2000) (establishing that states are to set water quality standards, consisting of designated uses and water quality criteria, so as to protect the public health and welfare); Clean Air Act, 42 U.S.C. § 7409(b) (2000) (stating that primary air quality standards are to be set at a level so as to protect public health with an adequate margin of safety, and secondary standards are to be set at a level so as to protect public welfare); Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. § 9621(d) (2000) (providing that remedial actions are to attain a degree of cleanup that assures the protection of human health and the environment).

310. *See, e.g.*, Adler, *supra* note 304, at 978-81.

311. *See* RICHARD N.L. ANDREWS, MANAGING THE ENVIRONMENT, MANAGING OURSELVES: A HISTORY OF AMERICAN ENVIRONMENTAL POLICY 242 (1999).

312. *Id.* at 242-44; *see also* Federal Insecticide, Fungicide, and Rodenticide Act, 7 U.S.C. §§ 136-136y (2000); Toxic Substances Control Act, 15 U.S.C. §§ 2601-2692 (2000); Safe Drinking Water Act, 42 U.S.C. §§ 300f-300j-26 (2000).

313. *See, e.g.*, Toxic Substances Control Act, 15 U.S.C. § 2605(a) (2000) (providing the authority to regulate claims contingent upon an "unreasonable risk of injury to health or the environment").

314. *See* Adler, *supra* note 304, at 977; *see also* Radon in Drinking Water Health Risk Reduction and Cost Analysis, 64 Fed. Reg. 9560, 9560, 9575 (Feb. 26, 1999) (requesting comments on the analysis and noting that nonquantifiable benefits from reducing radon in drinking water may include "peace of mind benefits"); *infra*

Because these statutes place the burden of demonstrating health or environmental risks on the EPA, the legislative and administrative inattention to fear arguably has undermined the EPA's regulatory power.[315] The magnitude of the emotional harms ignored may be especially large because of the degree of uncertainty often associated with environmental impacts. The complexity of the natural environment means that we often cannot understand environmental impacts before—or even after—they occur.[316] This uncertainty puts proponents of greater environmental regulation at a tremendous disadvantage: costs and benefits are difficult to pin down, and regulatory opponents assert that there is too much uncertainty to meet standards of "sound science."[317]

Environmental law's disregard of fear as a harm is especially surprising when one considers the status of emotional injuries in standing law and in tort law. Standing precedents hold that fear and other emotional injuries can constitute injury-in-fact;[318] and in tort law, assault and the torts of emotional distress recognize fear as harm.[319]

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note 333 and accompanying text; *cf.* 1996 Food Quality Protection Act, Amendments to the Laws Governing the Regulation of Pesticides; EPA's Implementation Plan, 62 Fed. Reg. 12,829, 12,830 (Mar. 18, 1997) (noting that President Clinton described the Food Quality Protection Act as "'the peace of mind act' because it will 'give parents the peace of mind that comes from knowing that the fruits, vegetables, and grains that they set down in front of their children are safe'").

315. *See* ANDREWS, *supra* note 311, at 245 (stating that "substance-by-substance regulatory statutes placed [the] EPA in a no-win situation" because they appear to give the EPA extensive regulatory powers, but also place on the EPA the heavy burden of proving health and environmental risks and of balancing these risks against economically valuable uses).

316. Lazarus, *supra* note 284, at 747.

317. *See* Howard A. Latin, *The "Significance" of Toxic Health Risks: An Essay on Legal Decisionmaking Under Uncertainty*, 10 ECOLOGY L.Q. 339, 339 (1982) (noting that a response of "no decision" in the face of uncertainty perpetuates the status quo and promotes some interests at the expense of others). "Sound science" is a slogan often invoked by antiregulatory interests in their efforts to block regulation except where supported by strong scientific justification. *See* Holly Doremus, *The Purposes, Effects, and Future of the Endangered Species Act's Best Available Science Mandate*, 34 ENVTL. L. 397, 414-15 (2004).

318. *See*, *e.g.*, Duke Power Co. v. Carolina Envtl. Study Group, Inc., 438 U.S. 59, 73-74 (1978) (noting that the plaintiffs' injury-in-fact consisted not only of the risk of harm from radiation exposure, but also from the plaintiffs' apprehension of harm); Covington v. Jefferson County, 358 F.3d 626, 641 (9th Cir. 2004) (holding that the plaintiffs established an injury-in-fact where they observed leaking hazardous material and feared that this liquid would contaminate their property). *But cf.* Valley Forge Christian Coll. v. Ams. United for Separation of Church & State, Inc., 454 U.S. 464, 485 (1982) (stating that "psychological consequence[s] . . . produced by observation of conduct with which one disagrees" did not amount to "an injury sufficient to confer standing").

319. *See supra* Part I.B; *see also* Adler, *supra* note 185, at 1380.

The tort of nuisance also recognizes the disturbance of peace of mind as an actionable harm.[320] If tort law, grounded in common law tradition, has been willing to recognize fear as a harm and to compensate for it, modern environmental law's relative indifference to fear requires an explanation.

Although tort law has formally accepted fear and other emotional injuries as harm, that acceptance has been begrudging and incomplete.[321] In part, this reflects difficulties of proof and concerns about insincere claims. More fundamentally, it also signifies a social reluctance to recognize such injuries as harm.[322] Thus, it is not just environmental statutes, but also the legal system and society at large, that have downplayed the significance of intangible harms.

In the case of environmental regulation, Congress's and the courts' direction to the EPA to focus on risk assessment in the regulatory process is also to blame. Although modern environmental statutes do not require the EPA to wait for "dead bodies" before regulating toxic substances, they generally do require a threshold finding as to a substance's harmful potential.[323] The landmark cases interpreting these statutes steered the EPA toward quantification of risk, particularly in terms of deaths and other health impacts.[324] The most important of these cases was the 1980 *Benzene* decision, in which the Supreme Court invalidated an Occupational Safety and Health Administration (OSHA) exposure standard because OSHA failed to demonstrate the

320. *See supra* Part I.A.

321. *See supra* Part I.B.

322. *See* Levit, *supra* note 25, at 175 (suggesting that the "implicit message" of the courts' skepticism toward emotional injury claims "is that the injury is not a harm that would be meaningful to reasonable people").

323. *See* PERCIVAL ET AL., *supra* note 1, at 346.

324. In one of the early cases in this area, *Reserve Mining Co. v. EPA*, 514 F.2d 492 (8th Cir. 1975), the government and environmental groups sought to enjoin a mining facility's discharge of tailings into Lake Superior. The district court granted an injunction even though the effects on human health were inconclusive. United States v. Reserve Mining Co., 380 F. Supp. 11, 17 (D. Minn. 1974); *Reserve Mining Co.*, 514 F.2d at 528 (quoting 33 U.S.C. § 1160(g)(1) (1970)). Although the Eighth Circuit found that the applicable statutory standard—"endangerment"—had been met, it held that the immediate closure of the plant was an abuse of discretion, emphasizing the importance of quantifying the risk of harm and weighing it against the economic losses from shutting down the facility. *Reserve Mining Co.*, 514 F.2d at 536-37. Both courts' discussion of harm overlooked the plaintiffs' fear that resulted from the uncertain health effects of continued discharge. *See* Bohrer, *supra* note 293, at 108 ("What the plaintiffs in *Reserve Mining* should have argued was that the defendant's continued operation was a very real source of harm to their present enjoyment of their property and to their present emotional well-being.").

presence of a significant risk justifying the standard.[325] The holding arose from the Court's interpretation of the Occupational Safety and Health Act, and thus was specific to that statute.[326] Nevertheless, the *Benzene* decision was extremely influential in placing the burden of overcoming uncertainty on agencies seeking to impose new health or environmental standards,[327] thereby prompting the widespread use of risk assessments by the EPA and other regulatory agencies.[328]

Fear does not fit readily into risk assessments. Unlike deaths or illnesses, it is not easily quantified.[329] Fear is also highly variable: the amount of fear depends not only on the uncertainty associated with a particular risk, but also on individual affective responses to uncertainty.[330] Furthermore, in the "hard" calculations of cost-benefit analysis, agencies may be concerned that fear, like other intangible harms, may appear too "soft" to be taken seriously, especially because fear sometimes may be irrational. Agencies might address this last concern by giving credence only to reasonable fears.[331]

None of the above, however, demonstrates that it is infeasible for the EPA to take fear into account in its decision-making processes. To make this point, Professor Matthew Adler contrasted an EPA rulemaking to set arsenic standards in drinking water with a Food and Drug Administration (FDA) rulemaking to govern the acceptable rate of defects in medical gloves.[332] In the EPA rulemaking, the public's peace of mind from drinking less contaminated water was mentioned,

325. Indus. Union Dep't v. Am. Petroleum Inst. (*Benzene*), 448 U.S. 607, 652-55 (1980).

326. *See id.* at 653.

327. *See* Latin, *supra* note 317, at 341 (predicting that "the approach adopted in the benzene case may emasculate many regulatory programs designed to reduce environmental cancers" because uncertainty will prevent agencies from meeting the mandated burden of proof).

328. *See* PERCIVAL ET AL., *supra* note 1, at 377-78. Professor Matthew Adler also suggests the potential influence of the decision in *Metropolitan Edison Co. v. People Against Nuclear Energy*, in which the Court held that fear associated with the risk of a nuclear accident was too indirect a harm to be a required part of the National Environmental Policy Act analysis. *See* Adler, *supra* note 304, at 982; 460 U.S. 766, 774-78 (1983). A contrary outcome in that case, Adler contends, would have spurred the development and use of fear-assessment methodologies. *See* Adler, *supra* note 304, at 982-83.

329. *See* Adler, *supra* note 304, at 981 (noting that "fear *is* difficult to predict and value, and thus agencies are often justified in resisting the measurement of fear").

330. *See* Adler, *supra* note 185, at 1375-76; Wayne A. Davis, *The Varieties of Fear*, 51 PHIL. STUD. 287, 298-302 (1987) (defining experiential fear as involving uncertainty, involuntary arousal, and the perception of danger).

331. *See* Nagle, *supra* note 28, at 298 (contending that in nuisance cases, only reasonable fears should be recognized).

332. Adler, *supra* note 304, at 978-80.

but was neither quantified nor monetized.[333] In the FDA rulemaking, however, the FDA not only estimated the number of blood screening tests that would be avoided by a lower rate of defective gloves, but also assigned a monetary value to the accompanying anxiety-reduction benefit.[334] Granted, the discrete incident of using a defective glove is arguably more likely to trigger acute fear than chronic exposure to contaminants in drinking water. Nevertheless, the FDA example illustrates the feasibility of measuring fear using tools similar to those used by economists to quantify other costs and benefits.[335] What is often missing from the EPA's analysis and that of other agencies is the recognition that uncertainty itself has present and very real costs in terms of the fear associated with that uncertainty.[336]

The answer, then, is not necessarily to eliminate the quantification of costs and benefits of environmental regulation. Rather, the EPA must give serious weight—whether through quantification or other means—to fear as harm. It is undisputed that environmental regulation directly reduces physical harms of illness and death by reducing exposure to toxic substances. But it also provides other, more immediate benefits—including the reduction of emotional harms—that should not be overlooked. The EPA's failure to treat these impacts as harms has led to the undervaluing of the benefits of environmental regulation, as well as the undervaluing of research efforts that reduce uncertainties associated with toxic exposure.

333. *See* National Primary Drinking Water Regulations; Arsenic and Clarifications to Compliance and New Source Contaminants Monitoring, 66 Fed. Reg. 6976, 7012, 7021 (Jan. 22, 2001) (to be codified at 40 C.F.R. pts. 9, 141, 142).

334. *See* Medical Devices; Patient Examination and Surgeons' Gloves; Test Procedures and Acceptance Criteria, 68 Fed. Reg. 15,404, 15,408-13 (proposed Mar. 31, 2003) (to be codified at 21 C.F.R. pt. 800).

335. *See* Adler, *supra* note 304, at 989-95 (describing scales for measuring fear and anxiety).

336. *See* Bohrer, *supra* note 293, at 121 (arguing that agencies should "develop an analytical framework that accepts inevitable uncertainty, assesses it as an end product of modern technology, and recognizes that uncertainty may have real and determinable costs"); Frank I. Michelman, *Pollution as a Tort: A Non-Accidental Perspective on Calabresi's* Costs, 80 YALE L.J. 647, 684 (1971) ("[I]t would seem that the uneasy condition of suspicion accompanied by uncertainty should itself be counted a primary cost of pollution.").

B. Subcellular Damage and Risk of Harm

1. THE PROBLEM

Exposure to toxics can give rise not only to fear, of course, but also to various physical changes in the body. Technological advances have enhanced scientists' ability to detect subcellular changes—such as chromosomal aberrations—and other potential precursors of toxic illness. These advances pose the question of whether the existence of such precursors, in the absence of a clinical diagnosis of illness, constitutes harm.

Existing safety and environmental regulations may limit the level and duration of exposure to toxic substances,[337] but they do not eliminate all exposure or risk. Thus, an exposed individual may appear healthy, having no physical injuries or symptoms of illness, yet face a heightened level of risk. Because no physical harm is manifest—at least not yet—some might say there is no harm at all. Although courts increasingly allow plaintiffs in cases of toxic exposure to recover medical monitoring costs, such people are otherwise uncompensated for their heightened risk.[338]

Technological advances in the detection and measurement of biomarkers will force reconsideration of such cases and of the nature of harm. Biomarkers are chemical substances or events in the human body that provide concrete evidence of exposure to a chemical, the effects of such exposure, and a person's susceptibility to disease.[339] Of particular interest to this discussion are biomarkers of effect. These cellular responses to toxic exposure may signal or even increase the risk of adverse health consequences.[340] As scientists develop more sophisticated analyses of biomarkers of effect, they will be able to measure bodily changes that are quantitatively or qualitatively predictive of health impairment resulting from toxic exposure.

337. *See, e.g.*, 29 U.S.C. § 655(b)(5) (2000) (authorizing the Occupational Safety and Health Administration to set maximum levels of exposure to toxic materials in the workplace).

338. *See* Terry Morehead Dworkin, *Fear of Disease and Delayed Manifestation of Injuries: A Solution or a Pandora's Box?*, 53 FORDHAM L. REV. 527, 527-28 (1984).

339. *See* SAMUEL H. WILSON & WILLIAM A. SUK, BIOMARKERS OF ENVIRONMENTALLY ASSOCIATED DISEASE 6 (2002).

340. *See* William W. Au et al., *Biomarker Research in Occupational Health*, 47 J. OCCUPATIONAL ENVTL. MED. 145, 146-48 (2005) (noting that some, but not all, genetic mutations and abnormal proteins can be useful in predicting cancer).

For instance, chromosomal aberrations (CAs)—that is, abnormalities of chromosome number or structure[341]—have long been used to identify exposure to carcinogens.[342] Recent studies have found that high levels of CAs are also valuable biomarkers of effect in that they are significantly predictive of cancer incidence and mortality.[343] The correlation between CA levels and cancer is consistent with long-established theories regarding the origins of cancer in somatic mutations.[344] Thus far, CAs have not been used as a basis for regulatory decision making, in part because of uncertainty about long-term risks in individuals who have a high frequency of aberrations.[345] But as this uncertainty is reduced, CAs may provide a basis for policy interventions.[346]

341. CAs are visible in metaphase cells during cell division. *See* Henk C.A. Brandt & William P. Watson, *Monitoring Human Occupational and Environmental Exposures to Polycyclic Aromatic Compounds*, 47 ANNALS OCCUPATIONAL HYGIENE 349, 353 (2003). Examples of CAs include: translocations (where a fragment of one chromosome is broken off and then attached to another); aneuploidy (the occurrence of an abnormal number of a specific chromosome); and polyploidy (the occurrence of one or more extra sets of chromosomes). *See* Au et al., *supra* note 340, at 150; *Application of Biomarkers in Cancer Epidemiology: Workshop Report*, *in* APPLICATION OF BIOMARKERS IN CANCER EPIDEMIOLOGY 1, 10 (P. Toniolo et al. eds., 1997).

342. *See* Lars Hagmar et al., *Cancer Predictive Value of Cytogenetic Markers Used in Occupational Health Surveillance Programs*, 405 MUTATION RES. 171, 172 (1998). Chromosomal abnormalities resulting from exposure to air pollution have even been found in newborns, who were presumably exposed in the womb. *See* Linda Roeder, *Study Finds Combustion-Related Pollution May Cause Fetal Chromosomal Abnormalities*, 36 Env't Rep. (BNA) 323 (Feb. 18, 2005).

343. *See* Au et al., *supra* note 340, at 148; Stefano Bonassi et al., *Chromosomal Aberrations and Risk of Cancer in Humans: An Epidemiological Perspective*, 104 CYTOGENETIC & GENOME RES. 376 (2004) (summarizing multiple studies finding an increased cancer incidence associated with high levels of chromosomal aberrations). Scientists have not yet found a direct link between disease and other biomarkers of effect, such as somatic mutations. *See, e.g.*, Marinel M. Ammenheuser et al., *Assessment of 1,3-Butadiene Exposure in Polymer Production Workers Using HPRT Mutations in Lymphocytes as a Biomarker*, 109 ENVTL. HEALTH PERSP. 1249, 1254 (2001) (finding no direct connection between increased frequencies of HPRT mutant lymphocytes and an elevated cancer risk).

344. *See* Bonassi et al., *supra* note 343, at 376. It is worth noting that the correlation between CA frequency and increased cancer risk does not necessarily indicate a mechanistic causal link. *See* Lars Hagmar et al., *Chromosomal Aberrations in Lymphocytes Predict Human Cancer*, 58 CANCER RES. 4117, 4120 (1998).

345. *See* Bonassi et al., *supra* note 343, at 380.

346. *Id.* at 380 (suggesting that group CA data may "provide evidence supporting law-regulated interventions whenever a group of workers or subjects with hazardous exposures experiences an increased level of CA"); *see also* Saou-Hsing Liou et al., *Increased Chromosome-Type Chromosome Aberration Frequencies as Biomarkers of Cancer Risk in a Blackfoot Endemic Area*, 59 CANCER RES. 1481, 1483 (1999) (stating that findings support the usefulness of chromosomal aberrations in predicting cancer risk).

The question posed by such developments is whether the exposed individual has suffered harm. In contrast to the cancer victim, a person having high levels of CAs has not yet suffered an obvious setback to welfare interests. Nevertheless, our growing knowledge about CAs may soon give rise to the ability to diagnose disease in such people before any symptoms appear. This development will blur the line between good health and disease,[347] and that blurring will have implications for the law.[348] For instance, tort law generally requires that a potential plaintiff be harmed before bringing suit. Whether high CA levels constitute harm may determine who can bring an action, as well as when an action can or must be brought.[349] The scenario actually raises a further, related issue of whether harm is present in those who do not have high levels of CAs but are nevertheless at risk from their exposure to a toxic pollutant. This more general problem of increased risk challenges the notion that harm is simply physical, emotional, or economic injury.

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347. *See* Jamie A. Grodsky, *Genetics and Environmental Law: Redefining Public Health*, 93 CAL. L. REV. 171, 226-28 (2005) (contending that "traditional conceptions of 'health' will be challenged as new technologies reveal early effects of chemical exposure"); *see also* Gary E. Marchant, *Genetic Susceptibility and Biomarkers in Toxic Injury Litigation*, 41 JURIMETRICS 67, 86-88 (2000) (noting that biomarkers of effect may help provide objective proof of latent risk, but may also raise issues of liability allocation and damage calculation).

348. *See, e.g.*, Waldman, *supra* note 296 (describing research suggesting that "even minute traces of some chemicals" can affect processes such as gene activation, and suggesting that this "new science of low-dose exposure is . . . rattling the foundation of environmental law").

349. An example of a tort claim based on chromosomal damage can be found in *Brafford v. Susquehanna Corp.*, 586 F. Supp. 14 (D. Colo. 1984). In denying the defendant's motion for partial summary judgment, the court suggested that the plaintiffs' allegations of chromosome damage might satisfy the tort law requirement of a definite, present physical injury. *See id.* at 18; *see also* Werlein v. United States, 746 F. Supp. 887, 901 (D. Minn. 1990) (denying the defendant's motion for summary judgment on grounds that chromosomal breakage may constitute present physical injury); Anderson v. W.R. Grace & Co., 628 F. Supp. 1219, 1226-27 (D. Mass. 1986) (holding that the physical harm required for an emotional distress claim could be met by a showing of subcellular harm substantiated by expert medical testimony). Other courts, however, have been hostile to such claims. *See, e.g.*, Rainer v. Union Carbide Corp., 402 F.3d 608, 618-22 (6th Cir. 2005) (holding that "bodily injury" would not include subcellular damage under Kentucky law); Schweitzer v. Consol. Rail Corp., 758 F.2d 936, 942 (3d Cir. 1985) ("[S]ubclinical injury resulting from exposure to asbestos is insufficient to constitute the actual loss or damage to a plaintiff's interest required to sustain a cause of action under generally applicable principles of tort law."); *In re* Rezulin Prods. Liab. Litig., 361 F. Supp. 2d 268, 273-78 (S.D.N.Y. 2005) (predicting that asymptomatic subcellular injury would be insufficient to establish product liability claims under Texas and Louisiana law).

2. IS SUBCELLULAR DAMAGE HARM?

Because an individual who merely has high levels of CAs or subcellular damage suffers no pain or impairment of bodily functions, the case for harm is a difficult one. In the courts, the contention that microscopic physical damage is an actionable harm first arose in the context of asbestos exposure claims.[350] The lodging of asbestos fibers in the lungs triggers a reaction in the surrounding tissue that plaintiffs characterize as an actionable physical injury.[351] Some, but not all, courts have been skeptical of such claims.[352] These courts first explain that subcellular damage does not constitute harm.[353] They further reason that even if such damage constitutes harm, policy concerns caution against recognizing subcellular harm as a sufficient basis for a tort claim.[354] The first contention—that subcellular damage does not constitute harm—merits further consideration in light of our earlier conclusion that disease and physical symptoms are easy cases of harm.[355] Here, the courts' division over the issue reflects the still-

350. *See, e.g.*, *In re* UNR Indus., Inc., 725 F.2d 1111, 1119 (7th Cir. 1984) (Posner, J.) ("The states differ on whether a cause of action in an asbestosis case accrues upon inhalation or not until there is palpable disease or the disease is discovered." (citations omitted)).

351. *See id.* ("[S]ince no particular amount of injury is necessary to create tort liability, courts in these states might hold that a tort claim arises as soon as asbestos fibers are inhaled, however much time the victim might have for bringing suit.").

352. *See supra* note 349.

353. *See, e.g.*, *Schweitzer*, 758 F.2d at 942 (acknowledging that "subclinical asbestos-related injury prior to manifestation may be of interest to a histologist," but denying that such injury constitutes "actual loss or damage to a plaintiff's interest"); Caputo v. Boston Edison Co., CIV. A. No. 88-2126-Z, 1990 WL 98694, at *4 (D. Mass. July 9, 1990) (holding that alleged chromosomal damage "does not rise to the level of physical injury as a matter of law because nothing in the record relates [it] to any objective symptoms of illness or disease").

354. *See, e.g.*, *Rainer*, 402 F.3d at 621-22 (noting concerns that recognizing subcellular damage as a sufficient basis for a tort claim would open the floodgates to litigation and encourage speculative damage claims); *In re Rezulin*, 361 F. Supp. 2d at 275 (noting problems of proof and resource allocation); *see also* Frank B. Cross & Paula C. Murray, *Liability for Toxic Radon Gas in Residential Home Sales*, 66 N.C. L. REV. 687, 728 (1988) (suggesting that "[p]ermitting a subcellular change to meet the present injury requirement opens a huge loophole in the rule" requiring present injury); Gary E. Marchant, *Genomics and Toxic Substances: Part I—Toxicogenomics*, 33 ENVTL. L. REP. 10,071, 10,079 (2003) (observing that most jurisdictions balance competing policy considerations "by imposing restrictive threshold requirements that until now have excluded most latent risk claims" and suggesting that "gene expression assays may bring to fruition the fears that latent risk claims could flood the courts with an almost unlimited number of new, asymptomatic litigants").

355. The policy concerns, which include difficulties in calculating damages and a possible flood of litigation, present thorny line-drawing questions that are beyond the scope of this Article. For a discussion of the issues, see Kenneth S. Abraham,

developing nature of scientific knowledge regarding the significance of such damage, as well as a lack of social consensus regarding its normative meaning.

Illness is harm because it is a setback to physical well-being. Subcellular damage per se, however, does not constitute illness. Rather, it is a physical effect that may be a precursor or predictor of illness. Cancer, for instance, develops in a multistage process in which four to six critical genes must mutate before a malignant tumor appears.[356] Such mutations may result from exposure to a mutagen, but they also may arise spontaneously in the process of cell division.[357] Cancer results when a "sufficient number of mutations" have occurred in the "genes that control a cell's replication and repair functions so that the cell reproduces endlessly."[358] As the process of cancer development illustrates, the presence of subcellular damage hardly guarantees that an individual will become ill.

There is thus a very significant qualitative difference between a person who has subcellular damage and a person who has cancer, as the judicial skepticism of subcellular injury claims reflects. Subcellular damage is extremely common, and it does not have the same impacts as a cancer diagnosis on daily life or on one's more ultimate interests. Moreover, it is the relative frequency of chromosomal aberrations, and not simply their presence or absence, that has predictive force. Because even single low-level exposures to carcinogens may cause damage to DNA, and because people who will never develop cancer nonetheless have cells containing damaged DNA, a view that any subcellular damage qualifies as harm means that virtually any activity—such as living in a house with ordinary background levels of radiation,

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Environmental Liability and the Limits of Insurance, 88 COLUM. L. REV. 942, 972-74 (1988) (discussing potential issues pertaining to liability insurance coverage); Shirley K. Duffy, *"Risk Assessment": A Methodology for Deciding Claims for Increased Risk of Cancer*, 11 PENN. ST. ENVTL. L. REV. 213, 227-29 (2003) (discussing policy concerns); Jean Macchiaroli Eggen, *Toxic Torts, Causation, and Scientific Evidence After* Daubert, 55 U. PITT. L. REV. 889, 906-07 (1994) (listing reasons for courts' resistance to increased risk claims).

356. *See* ROBERT A. WEINBERG, ONE RENEGADE CELL: HOW CANCER BEGINS 47, 53 (1998) (inferring from epidemiological data and molecular analyses of tumor cell genomes that the appearance of tumors requires four to six mutations); *see also* MALCOLM ALISON & CATHERINE SARRAF, UNDERSTANDING CANCER: FROM BASIC SCIENCE TO CLINICAL PRACTICE 37 (1997) (suggesting that three to seven mutations are required for a cancer to form).

357. *See* R.J. Albertini & R.B. Hayes, *Somatic Cell Mutations in Cancer Epidemiology*, *in* APPLICATION OF BIOMARKERS IN CANCER EPIDEMIOLOGY 159, 159 (P. Toniolo et al. eds., 1997).

358. Donald T. Ramsey, *The Trigger of Coverage for Cancer: When Does Genetic Mutation Become "Bodily Injury, Sickness, or Disease?,"* 41 SANTA CLARA L. REV. 293, 310 (2001).

or breathing in cigarette smoke while visiting a casino—could be deemed harmful.[359]

Even so, the difficulty of drawing a line between good health and disease cautions against an outright rejection of subcellular damage as harm.[360] Here, it is instructive to consider the law on standing to see how the courts have handled the analogous question of whether a de minimis injury is "too small." In deciding what must be shown to establish injury-in-fact, the courts have not demanded a minimum quantum of injury. As long as it is "concrete" and "particularized," even a small amount of injury is sufficient.[361] The critical question is not the amount of injury, but whether a person has "a direct stake in the outcome of a litigation."[362]

Likewise, in deciding whether subcellular damage constitutes harm, it is more important to focus on what the physical phenomena represent, rather than on the phenomena themselves.[363] The ultimate

359. *See id.* at 329 (contending that the processes underlying cancer development are too common to be characterized as "injury"); *see also* Gary E. Marchant, *Genetics and Toxic Torts*, 31 SETON HALL L. REV. 949, 977 (2001).

> Given that over one-third of the population will eventually develop cancer, and that every human likely carries accumulated mutations that could eventually lead to cancer if the person lived long enough, it may be that with improved diagnostic capabilities of such mutations, every person could be a potential plaintiff claiming to be at an increased risk of cancer.

Id.

360. *Cf.* DENNIS W. ROSS, INTRODUCTION TO ONCOGENES AND MOLECULAR CANCER MEDICINE 71 (1998) ("[C]ancer is more complex than an all or none phenomenon.").

361. *See* United States v. Students Challenging Regulatory Agency Procedures (SCRAP), 412 U.S. 669, 689 n.14 (1973) (citing Kenneth Culp Davis, *Standing: Taxpayers and Others*, 35 U. CHI. L. REV. 601, 613 (1968) ("[A]n identifiable trifle is enough for standing to fight out a question of principle.")); *see also* Pub. Interest Research Group v. Powell Duffryn Terminals Inc., 913 F.2d 64, 72 n.8 (3d Cir. 1990) ("The size of the injury is not germane to standing analysis."); Saladin v. City of Milledgeville, 812 F.2d 687, 691 (11th Cir. 1987) ("There is no minimum quantitative limit required to show injury; rather, the focus is on the qualitative nature of the injury, regardless of how small the injury may be."); Bowman v. Wilson, 672 F.2d 1145, 1151 (3d Cir. 1982) (stating that "[t]he contours of the injury-in-fact requirement, while not precisely defined, are very generous," requiring only that the claimant "allege[] some specific, 'identifiable trifle' of injury" (citations omitted)); Tax Analysts & Advocates v. Blumenthal, 566 F.2d 130, 138 (D.C. Cir. 1977) (noting that a distinct and palpable competitive injury is an injury-in-fact for standing purposes even if slight in magnitude).

362. *SCRAP*, 412 U.S. at 689 n.14.

363. Thus, courts that focus on scientific testimony regarding the risks posed by the subcellular damage or the toxic exposure itself are on the right track. *See, e.g.*, Brafford v. Susquehanna Corp., 586 F. Supp. 14, 17-18 (D. Colo. 1984) (noting the importance of expert testimony that there had been chromosomal damage, that such damage was caused by the exposure, that "the 'trigger' of a cancer change ha[d] been

question, in other words, is whether particular levels of subcellular damage make a difference to the welfare of the exposed individual. The answer to that question depends on whether any risk associated with subcellular damage is a harm, which we turn to next.[364]

3. IS RISK OF HARM A HARM?

The question of whether risk constitutes harm is particularly important to toxic tort claims. Tort law has traditionally demanded physical, emotional, or economic injury as a prerequisite to recovery. Negligent behavior that imposes risk on another person, but causes no such injury, does not give rise to a cause of action. This is in contrast to preventative environmental regulation, which inherently regulates the risk of harm.[365] Risk of harm is the inevitable object of regulation because regulation generally seeks to prevent harm before it occurs. Such regulation is consistent with the harm principle because reducing or eliminating the risk of physical harm protects one's fundamental welfare interest in not being physically injured.[366] Tort law, however, requires proof of harm that has actually occurred. The question is whether risk alone can satisfy that requirement.

First, it is important to clarify the meaning of risk. In ordinary language, the definition of risk incorporates notions of both probability and harm.[367] A more studied account of risk might distinguish between

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cocked," and that "the subcellular changes operate[d] to deprive plaintiffs of a degree of immunity which they had enjoyed prior to their exposure").

364. *Cf.* Grodsky, *supra* note 347, at 226 ("The essential question is whether these preclinical changes are sufficiently reflective of injury or predictive of disease to warrant governmental intervention.").

365. *See* GLICKSMAN ET AL., *supra* note 63, at 674 ("[O]ne of the major innovations of environmental law has been to substitute the concept of risk as a proxy for injury for the common law's insistence that injury be established by proof that an action in fact caused demonstrable harm.").

366. *See* Perry, *supra* note 172, at 1306-08 (distinguishing between the primary interest of not being physically injured from the secondary interest of not being subject to a risk of physical injury, and suggesting that even though the "core" of harm concerns primary interests, regulation of secondary interests may be justified under the harm principle to protect primary interests).

367. *See* PERCIVAL ET AL., *supra* note 1, at 356-58 (discussing risk as "a composite of the probability of harm occurring and the magnitude of the harm that might occur"); THOMAS J. SCHOENBAUM ET AL., ENVIRONMENTAL POLICY LAW 428 (4th ed. 2002) (describing risk as "the probability of a harm occurring and the perceived magnitude of that harm"); Stephen R. Perry, *Risk, Harm, and Responsibility*, *in* PHILOSOPHICAL FOUNDATIONS OF TORT LAW 321, 322 (David G. Owen ed., 1995); *see also* Ethyl Corp. v. EPA, 541 F.2d 1, 18 (D.C. Cir. 1976) (interpreting danger as a function of probability and severity of harm); United States v. Carroll Towing Co., 159 F.2d 169, 173 (2d Cir. 1947) (employing the Learned Hand formula that imposes

objective and subjective conceptions of risk.[368] The objective interpretation of risk refers to the relative frequency with which a particular outcome occurs, given a class of events of relatively similar conditions.[369] The subjective interpretation of risk refers to a degree of belief or confidence about the likelihood of a certain event occurring.[370] With most phenomena, we have limited knowledge and thus operate in terms of subjective risk; our best estimate of the objective risk of cancer from toxic exposure is necessarily a subjective probability.[371] If risk refers merely to subjective lack of knowledge as to causal processes, however, it is difficult to conceive how such risk could be a setback to one's interests. Thus, in considering whether risk is a harm, our concern is objective risk—that is, risk that has some objective existence in the physical world.[372]

Having defined risk, we begin with a relatively simple case: if a sufficiently large population is exposed to a toxic substance, we might predict that a certain number of illnesses and deaths will result. In such a case, where risk is spread across a population, the harm is certain, although the victims are indeterminate. This is a clear instance of harm, because physical harm almost certainly will occur.[373]

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liability if the probability of harm multiplied by the gravity of potential injury exceeds the costs of additional precautions).

368. For a more thorough discussion of the different conceptions of risk, see Adler, *supra* note 185, at 1297, 1311-16 (describing four standard theories of probability); Perry, *supra* note 367, at 322-29 (distinguishing between objective and epistemic conceptions of probability).

369. Finkelstein, *supra* note 25, at 973; Adler, *supra* note 185, at 1313 (describing the frequentist account of probability).

370. *See* Finkelstein, *supra* note 25, at 973; *cf.* Adler, *supra* note 185, at 1312 (describing the Bayesian account of probability). The following example illustrates the difference between objective and subjective probability: if a bag contains twenty red balls and ten black balls, the objective probability of drawing a red ball is 2:1. The subjective probability of drawing a red ball would depend on one's experience in drawing balls from the bag (with replacement); as the number of draws becomes larger and larger, the subjective probability would approach 2:1.

371. *See* Perry, *supra* note 367, at 332-33 ("Objective risk cannot be directly observed. We must always rely on our best estimate of the objective risk, using whatever evidence is to hand. We necessarily operate, in other words, with the notion of epistemic risk.").

372. *See id.* at 332 (explaining that "risk damage must be understood in terms of objective, not epistemic, risk" because "harm involves interference with some aspect of well-being" that ordinarily has some "objective existence in the physical world"); Finkelstein, *supra* note 25, at 973 (applying an objective interpretation of risk in deciding whether risk of harm is a harm); Sunstein, *supra* note 286, at 1147 (contending that risks are real and objective even if they can be described in many different ways).

373. *See* Finkelstein, *supra* note 25, at 978; *see also* Schroeder, *supra* note 148, at 498-99 (noting that given the size of the exposed population or the length of

Such harm is distinct from "risk harm," which presents the more difficult question of whether there is harm when an individual is exposed to a one in one-hundred risk of cancer, but ultimately does not develop the disease. Here, the answer is less obvious because one cannot rely on the indisputably harmful nature of physical injuries. On the one hand, everyday activities are filled with numerous unrealized risks—risks that result in no physical harm and provide no recognized basis for a tort action. We simply accept such risks as part of daily life. For instance, one might drive each day on the same highway as another person who is driving negligently and thus be subject to the risk of an accident with that driver. Nevertheless, one would be hard-pressed to assert harm if no accident occurs. The adage "no harm, no foul" would seem to suggest that risk harm is no harm at all.

On the other hand, even when the risked physical harm does not come to pass, being subjected to risk by others is an unsettling matter, particularly when the risk exposure occurs without one's knowledge or consent. Professor Claire Finkelstein suggests an example in which an individual learns, after traveling on an airplane flight, that the airline had been negligent in maintaining its planes such that one of the two engines on the plane had quit in midflight.[374] Finkelstein deems it plausible to say that the traveler has been harmed because the traveler is worse off than someone who flew in a nondefective plane.[375] Similarly, a person who only after the fact becomes aware of high-level radiation exposure might still claim harm, even if no radiation-induced illness ever develops. Finkelstein contends that people subjected to such risks have been harmed because they have suffered an objective setback to their interests; the person exposed to radiation is now in a class of people with a higher risk of developing cancer, and thus is doing substantially less well in life.[376]

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exposure in many controversial cases of toxic exposure, "statistical deaths" or "statistical carcinomas" are virtually certain).

374. Finkelstein, *supra* note 25, at 970-71.

375. *Id.*

376. *Id.* at 973. Professor Stephen Perry reached a similar conclusion for risks where the processes that might cause physical harm are indeterministic: "[C]onduct that places someone's well-being at the mercy of an indeterministic roll of the dice" involves "a true detrimental shift in position." Perry, *supra* note 367, at 336-37. For causal processes that are deterministic, Perry suggested that risk merely refers to a subjective lack of knowledge about causal processes, rather than objective phenomena in the physical world, and thus does not constitute harm. *See id.* at 330-37; *see also* Adler, *supra* note 185, at 1360-62 (expressing support for the notion that causal laws at the level of human physiology are deterministic). Perry later qualified this point, stating that exposure to risk might affect secondary interests, but that it "cannot be regarded as adversely affecting any interest that has a strong or plausible claim to be in

To support her argument, Finkelstein points to case law in which the concept of risk harm is implicit.[377] Of particular interest are three areas of tort law: first, cases awarding damages for medical monitoring in the absence of any physical injury;[378] second, cases awarding damages for a lost chance of a benefit;[379] and third, certain cases imposing liability based on market share.[380] With respect to the first category, a majority of courts now allow recovery for medical monitoring without an existing physical injury.[381] Given the general requirement in tort law that a plaintiff demonstrate harm to recover damages of any sort, the recognition of such claims suggests a societal judgment that a plaintiff's increased risk itself constitutes a harm.[382] Second, the loss of a chance doctrine, recognized by some courts, allows a plaintiff to recover where a defendant's malpractice has reduced the probability of a medical cure.[383] The awarding of such compensation similarly acknowledges that increased risk constitutes a harm.[384] Finally, at least some of the case law imposing liability on

the set of core or primary interests" that are the main targets of harm. Perry, *supra* note 172, at 1306.

377. Finkelstein, *supra* note 25, at 975-90.

378. *Id.* at 977-79.

379. *Id.* at 985-86.

380. *Id.* at 979-83.

381. *See* James M. Garner et al., *Medical Monitoring: The Evolution of a Cause of Action*, 30 Envtl. L. Rep. (Envtl. Law Inst.) 10,024, 10,028-29 (2000).

382. *See* Finkelstein, *supra* note 25, at 977-78 (discussing *Ayers v. Township of Jackson*, 461 A.2d 184 (N.J. Super. Ct. Law Div. 1983), where the court denied damages for increased risk of disease but nevertheless allowed recovery for costs of medical testing and monitoring); *cf.* Christopher H. Schroeder, *Corrective Justice and Liability for Increasing Risks*, 37 UCLA L. REV. 439 (1990) (arguing that corrective justice requires liability for increasing risks of physical harm, whether or not physical harm actually occurs). *But cf. In re* Paoli R.R. Yard PCB Litig., 916 F.2d 829, 850-51 (3d Cir. 1990) (distinguishing between medical monitoring claims and the enhanced risk of harm claims); Kenneth S. Abraham, *Liability for Medical Monitoring and the Problem of Limits*, 88 VA. L. REV. 1975, 1977-78 (2002) (arguing that the underlying purpose of medical monitoring awards may be to mitigate future loss or to develop evidence for use in subsequent litigation). For a thorough discussion of the case law regarding recovery of damages for medical monitoring, see Garner et al., *supra* note 381.

383. *See* DOBBS, *supra* note 11, §§ 178-82, at 436-41; Joseph H. King, Jr., *Causation, Valuation, and Chance in Personal Injury Torts Involving Preexisting Conditions and Future Consequences*, 90 YALE L.J. 1353 (1981) (arguing that the loss of a chance of achieving a favorable outcome or of avoiding an adverse consequence should be compensable); *see also* Lars Noah, *An Inventory of Mathematical Blunders in Applying the Loss-of-a-Chance Doctrine*, 24 REV. LITIG. 369, 375-78 & nn.27-32 (2005) (summarizing the case law regarding the loss-of-a-chance doctrine).

384. *See* Finkelstein, *supra* note 25, at 986; Levit, *supra* note 25, at 155-56 & n.105 ("Courts and commentators explicitly acknowledge that the compensable injury is the lost chance itself.").

drug manufacturers based on market share also supports the notion of risk as a harm. In *Hymowitz v. Eli Lilly & Co.*, a suit against manufacturers of a defective drug taken during pregnancy, a state court allowed recovery based on the market share controlled by each defendant.[385] In doing so, the court refused to hear each individual defendant's assertion that it did not cause a particular plaintiff's injuries.[386] As the court forthrightly acknowledged, "[L]iability here is based on the over-all risk produced, and not causation in a single case."[387]

These arguments are tantalizing, but hardly dispositive.[388] As with the concept of harm generally, whether risk constitutes harm is ultimately a question of social norms. The above discussion demonstrates that there is a basis in logic and legal precedent for recognizing risk as harm. Further legal precedent for recognizing risk as harm can also be found in the law of standing. In *Duke Power Co. v. Carolina Environmental Study Group, Inc.*, the Supreme Court observed that exposure to radiation from nuclear power plants "would . . . seem a direct and present injury, given our generalized concern about exposure to radiation and the apprehension flowing from the uncertainty about the health and genetic consequences of even small emissions."[389] Moreover, numerous courts of appeals have held—both in the medical monitoring and environmental exposure contexts—that increased risk of future harm establishes injury-in-fact for purposes of standing.[390] All of the above reflects a growing normative recognition that at least some risks are harms.

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385. 539 N.E.2d 1069, 1078 (N.Y. 1989). *Hymowitz* is discussed in Finkelstein, *supra* note 25, at 981-82.

386. *See Hymowitz*, 539 N.E.2d at 1078. This is in contrast to other market share liability cases, in which the market share theory merely shifted to the defendant the burden of demonstrating that its product did not cause the harm. *See, e.g.*, Sindell v. Abbott Labs., 607 P.2d 924, 936-38 (Cal. 1980).

387. *Hymowitz*, 539 N.E.2d at 1078; *cf.* Jules L. Coleman, *Tort Liability and the Limits of Corrective Justice*, *in* IN HARM'S WAY: ESSAYS IN HONOR OF JOEL FEINBERG 139, 156-57 (Jules L. Coleman & Allen Buchanan eds., 1994) (suggesting that the market share theory of *Hymowitz* is not "an effort to implement corrective justice," but rather an effort to implement a "localized . . . at-fault pool[] to deal with injuries caused by certain kinds of defective products").

388. For instance, counting both the risk of harm and any resulting physical harm as "harms" may result in double counting, a problem that Finkelstein addresses by positing that the disvalue of the risk harm is absorbed into the loss in welfare if the risk actually materializes, and that the risk of harm persists only where the agent is not ultimately subject to physical harm. *See* Finkelstein, *supra* note 25, at 990-95.

389. 438 U.S. 59, 73-74 (1978).

390. *See* Sutton v. St. Jude Med. S.C., Inc., 419 F.3d 568, 575 (6th Cir. 2005) (holding that the increased risk of future physical injury from the implantation of an allegedly defective device constituted injury-in-fact); Covington v. Jefferson County,

Ultimately, whether a risk constitutes harm depends on factors in addition to the probability and magnitude of harm. Because harm is a normative concept, society may reach very different judgments about the harmfulness of quantitatively similar risks.[391] Indeed, gaps between public perceptions of risk and probabilistic notions of risk have widened over the last few decades.[392] Although society has in many ways grown physically healthier—as reflected in longer life expectancies and lower rates of industrial accidents and fatal contagious diseases[393]—the American public has become more worried about risk.[394] Studies of expressed preferences have found that public perceptions of risk depend on factors such as controllability, voluntariness, and equity—not just on raw probabilities.[395] Participation in activities such as smoking and hunting suggest that at least some people are far more tolerant of risk

358 F.3d 626, 638 (9th Cir. 2004) ("[C]oncrete risk of harm . . . is sufficient for injury in fact."); Baur v. Veneman, 352 F.3d 625, 633 (2d Cir. 2003) ("[E]nhanced risk of disease transmission may constitute injury-in-fact."); LaFleur v. Whitman, 300 F.3d 256, 270-71 (2d Cir. 2002) (holding that the likelihood of exposure to additional sulfur dioxide emissions qualified as injury-in-fact, even where the emissions would not exceed government air quality standards); Friends of the Earth, Inc. v. Gaston Copper Recycling Corp., 204 F.3d 149, 160 (4th Cir. 2000) ("Threats or increased risk thus constitutes cognizable harm. Threatened environmental injury is by nature probabilistic.").

391. *See* MARY DOUGLAS & AARON WILDAVSKY, RISK AND CULTURE: AN ESSAY ON THE SELECTION OF TECHNICAL AND ENVIRONMENTAL DANGERS 6 (1982) ("The perception of risk is a social process. . . . The different social principles that guide behavior affect the judgment of what dangers should be most feared, what risks are worth taking, and who should be allowed to take them.").

392. *Cf.* MARY DOUGLAS, RISK AND BLAME: ESSAYS IN CULTURAL THEORY 24 (1992) (suggesting that "risk" in political discourse commonly refers to danger—not to probabilistic conceptions of risk).

393. *See* Aaron Wildavsky, *No Risk Is the Highest Risk of All*, 67 AM. SCIENTIST 32, 32-33 (1979).

394. *See id.* at 32 ("The richest, longest-lived, best-protected, most resourceful civilization . . . is on its way to becoming the most frightened.").

395. *See* WINTER & KOGER, *supra* note 267, at 177; Adler, *supra* note 185, at 1310-11 (distinguishing between probabilistic and nonprobabilistic conceptions of risk); Timur Kuran & Cass R. Sunstein, *Availability Cascades and Risk Regulation*, 51 STAN. L. REV. 683, 709-10 (1999) (summarizing factors influencing acceptability of risks to the public); Paul Slovic, *Perception of Risk*, 236 SCIENCE 280, 283 (1987); *see also* Leslie Roberts, *Counting on Science at EPA*, 249 SCIENCE 616, 616 (1990) (comparing the EPA Science Advisory Board's assessment of top ecological and health risks with the public's assessment and finding large discrepancies); Sunstein, *supra* note 286, at 1152 (suggesting that the difference between public and expert assessments of risks may be due primarily to the public's failure to consider both the risks and benefits of the activity at issue).

when it is voluntarily incurred.[396] And some activities—such as skydiving—are undertaken precisely because they involve risk.[397] The risks associated with such activities are not considered harms because the people exposed to the risk have consented to—and even value—the risk.[398]

The risks to the individual exposed to toxic substances, however, are very different from the risks involved in skydiving. Risks from exposure to environmental toxins are not voluntary, readily observable, well-understood, or equally distributed among the population.[399] Even if it is theoretically possible to avoid such risks, it is often prohibitively difficult or costly to do so.[400] These factors point toward a low social tolerance for such risks, and hence a judgment that such risks qualify as harm. Indeed, the involuntary nature of such risks may explain why they constitute harm: the imposition of involuntary risks infringes on individual autonomy, which is the core value that the harm principle seeks to promote.[401]

The conclusion that involuntary risk is a harm does not necessarily dictate the recognition of a tort action. The use of substances that generate health or environmental risks, such as preservatives or

396. *See* Chauncey Starr, *Social Benefit Versus Technological Risk*, 165 SCIENCE 1232, 1237 (1969) (suggesting that the public is willing to accept voluntary risks that are approximately one thousand times greater than involuntary risks).

397. *See* Heinzerling, *supra* note 268, at 2032 ("Part of the reason why people enjoy activities such as skiing, boating, and motorcycling is that they are risky, and *immediately* so.").

398. Indulging the desire to engage in a risky activity could be harmful to the extent that it is a setback against one's objective interests. *Cf.* RALPH KEYES, CHANCING IT: WHY WE TAKE RISKS 35 (1985).

> Only an actual masochist enjoys danger as such. Yet we all enjoy its by-products: alertness, intensity, and a sense of elation once danger has past. . . . But it must be emphasized that this means occasional stress at tolerable levels. There is little good to be said for even occasional panic, constant phobias, or nagging anxiety.

Id.

399. *See* WINTER & KOGER, *supra* note 267, at 177. *But see* Sunstein, *supra* note 286, at 1154 (suggesting that people can avoid pesticides by selecting pesticide-free food, and air pollution by living in places with cleaner air).

400. *See* Cass R. Sunstein, *Bad Deaths*, 14 J. RISK & UNCERTAINTY 259, 271-72 (1997) (noting that risks are often said to be "involuntary" where persons exposed to a risk lack knowledge about the risk, or where it would be very costly for people to obtain such knowledge or to avoid such a risk).

401. *Cf.* Christopher H. Schroeder, *Corrective Justice, Liability for Risks, and Tort Law*, 38 UCLA L. REV. 143, 160 (1990) ("[R]ecovery for risk-exposure might be justified on the ground that exposure to the risk of harm was itself a violation of plaintiff autonomy sufficient to trigger recovery."). *But cf.* DOUGLAS & WILDAVSKY, *supra* note 391, at 16-21 (contending that the distinction between voluntary and involuntary risks is not objectively defensible).

pesticides, may reduce other risks.[402] And government regulation may be a more appropriate response to risk than an enforceable "right" against risk, particularly for broadly distributed, low-level risks.[403] To a large degree, this is the issue presented by standing cases such as *Laidlaw*: whether any individual has been harmed so as to justify a citizen's suit in addition to a government enforcement action. Notwithstanding the variety of possible responses to harm, the point remains: the imposition of significant involuntary risk is a serious setback to one's welfare because it interferes with one's autonomy.

C. Uncertainty and Emerging Technologies

1. THE PROBLEM

Exposures to potentially toxic chemicals raise a further challenge to the concept of harm, in addition to those posed by precursors of illness. Toxic exposures also involve uncertainty, a problem related to, but distinct from, the problem of toxic risk. As noted above, risk refers to the probability that harm will occur.[404] Uncertainty, in contrast, refers to the potential for error in estimating a risk.[405] For known risks, one may be able to estimate the probability of a particular event, such as a flood, as one in one hundred. There may nevertheless be a great deal of uncertainty regarding the accuracy of such estimates because of limited data or for other reasons.[406]

Some situations, moreover, involve "unknown risks."[407] Compared to situations of known risk, there is less information available, so it is difficult to assign statistical probabilities to possible

402. *See* Schroeder, *supra* note 148, at 517 (describing the use of DDT to prevent malaria). Other examples of chemicals whose use may involve both risks and benefits to the user include drugs and preservatives.

403. *See supra* Part I.C; *see also* Schroeder, *supra* note 148, at 517 (contending that conceptions of justice that value individual autonomy do not support the absolute rights of individuals against risk regardless of adverse consequences).

404. *See supra* Part III.B.3.

405. *See* Vern R. Walker, *The Myth of Science as a "Neutral Arbiter" for Triggering Precautions*, 26 B.C. INT'L & COMP. L. REV. 197, 204 (2003); *cf.* Charles Weiss, *Expressing Scientific Uncertainty*, 2 LAW, PROBABILITY & RISK 25 (2003) (proposing a scale of scientific uncertainty to express the subjective level of uncertainty associated with a particular assertion of scientific fact).

406. At least five distinct types of scientific uncertainty have been identified: conceptual uncertainty, measurement uncertainty, sampling uncertainty, modeling uncertainty, and causal uncertainty. *See* Walker, *supra* note 405, at 204-11.

407. Michelle E. Boardman, *Known Unknowns: The Illusion of Terrorism Insurance*, 93 GEO. L.J. 783, 810-11 (2005).

outcomes.[408] Indeed, the degree of uncertainty may be so great that it is impossible to characterize the risk at all.[409] Uncertainty of this nature may arise because of a lack of scientific or technical knowledge, or because the future is volatile.[410] Environmental problems, which tend to involve complex dynamic systems that behave in a nonlinear fashion, are frequently characterized by uncertainty.[411]

While a degree of uncertainty is inherent in almost any situation, emerging technologies pose prime examples of broad uncertainty. Nanotechnology, biotechnology, and cloning all involve great amounts of uncertainty with respect to potential applications, effects, and risks. This section discusses nanotechnology to illustrate the problems of uncertainty and to explore application of the harm principle to situations of uncertainty.

Nanotechnology is the science of manipulating matter at the nanometer scale—the building of things from the bottom up on an atom-by-atom or molecule-by-molecule basis.[412] The promise of nanotechnology is that these precise methods will serve as the basis of a manufacturing technology much cleaner and more efficient than the relatively crude, "top-down" manufacturing models that dominate today.[413] Materials produced via nanotechnology—nanomaterials—are

408. *See* Larry D. Silver, *The Common Law of Environmental Risk and Some Recent Applications*, 10 HARV. ENVTL. L. REV. 61, 63 (1986); *see also* Boardman, *supra* note 407, at 811-12 & n.136 (distinguishing risk and uncertainty).

409. Uncertainty is different from ignorance, however, in that under conditions of uncertainty, we have some notion of what might go wrong. *See* Boardman, *supra* note 407, at 810-11 (distinguishing ignorance from risk and uncertainty).

410. *See id.* at 811.

411. *See* Daniel A. Farber, *Probabilities Behaving Badly: Complexity Theory and Environmental Uncertainty*, 37 U.C. DAVIS L. REV. 145, 149 (2003). The problem of global climate change, with its many layers of uncertainty, appears to be a prime example of just such a chaotic system. *See* Douglas A. Kysar, *Climate Change, Cultural Transformation, and Comprehensive Rationality*, 31 B.C. ENVTL. AFF. L. REV. 555, 563-64, 568 (2004) (listing uncertainties with respect to variables relevant to climate change).

412. *See* Francisco Castro, *Legal and Regulatory Concerns Facing Nanotechnology*, 4 CHI.-KENT J. INTELL. PROP. 140, 141 (2004), *available at* http://jip.kentlaw.edu/archives.asp?vol=4&iss=1 (follow "Legal and Regulatory Concerns Facing Nantechnology" hyperlink); *see also* K. ERIC DREXLER, ENGINES OF CREATION 4-5 (1986) (contrasting nanotechnology with "bulk technology" as a means of manufacturing goods); Glenn Harlan Reynolds, *Nanotechnology and Regulatory Policy: Three Futures*, 17 HARV. J.L. & TECH. 179, 181 (2003) (contrasting nanotechnology with traditional industrial technologies, which operate from the top down).

413. *See* Barbara Karn, *Overview of Environmental Applications and Implications. How Does Nanotechnology Relate to the Environment? Or Why Are We Here?*, *in* NANOTECHNOLOGY AND THE ENVIRONMENT: APPLICATIONS AND IMPLICATIONS 2, 3 (Barbara Karn et al. eds., 2005).

manufactured from conventional chemical substances, but behave very differently from conventional materials because of their structure.[414] The small size and high surface-area-to-mass ratio of nanosized particles enhance the mechanical, electrical, optical, catalytic, or biological activity of a substance and make nanomaterials desirable as catalysts for chemical reactions and for other purposes.[415]

Nanomaterials are already being used in medical diagnosis and treatment, cosmetics, sunscreens, tires, stain-resistant clothing, and electronics.[416] The commercial potential of nanotechnology is tremendous, with some calling it the foundation for the "next industrial revolution."[417] Nanotechnology is expected to be even more revolutionary than biotechnology or computer technology because of its potential to transform multiple sectors of the economy.[418] Nanotechnology applications that may benefit the environment include manufacturing processes that use less energy and generate less waste, more efficient methods of cleaning up hazardous substances, and more sophisticated sensors to monitor the environment.[419]

414. *See* Rick Weiss, *For Science, Nanotech Poses Big Unknowns*, WASH. POST, Feb. 1, 2004, at A1.

415. Gunter Oberdorster et al., *Nanotoxicology: An Emerging Discipline Evolving from Studies of Ultrafine Particles*, 113 ENVTL. HEALTH PERSP. 823, 835 (2005).

416. *Id.* at 824-25, 836; DOUGLAS MULHALL, OUR MOLECULAR FUTURE: HOW NANOTECHNOLOGY, ROBOTICS, GENETICS, AND ARTIFICIAL INTELLIGENCE WILL TRANSFORM OUR WORLD 61-73 (2002) (discussing potential applications of nanotechnology). Nanomaterials might even be used to conduct environmental cleanups by trapping or filtering out pollutants. *See* Weiss, *supra* note 414. The U.S. market for nanomaterials is expected to top $1 trillion within a decade. *See* Rick Weiss, *Nanotechnology Precaution Is Urged: Minuscule Particles in Cosmetics May Pose Health Risk, British Scientists Say*, WASH. POST, July 30, 2004, at A2.

417. *See* Roger Allan, *Nanotechnology: Still Science Fiction or Finally Scientific?*, ELECTRONIC DESIGN, June 14, 2004, at 65, *available at* 2004 WLNR 14843295; Weiss, *supra* note 414; *see also* K. Eric Drexler & Jason Wejnert, *Nanotechnology and Policy*, 45 JURIMETRICS 1, 9 (2004) (noting the "broad economic, medical, environmental, and military implications" of nanotechnology). The federal government spends approximately $1 billion annually on nanotechnology research and development. *See* PRESIDENT'S COUNCIL OF ADVISORS ON SCIENCE AND TECHNOLOGY, THE NATIONAL NANOTECHNOLOGY INITIATIVE AT FIVE YEARS: ASSESSMENT AND RECOMMENDATIONS OF THE NATIONAL NANOTECHNOLOGY ADVISORY PANEL 1 (2005), *available at* http://nano.gov/FINAL_PCAST_NANO_REPORT.pdf.

418. *See* Paul C. Lin-Easton, Note, *It's Time for Environmentalists to Think Small—Real Small: A Call for the Involvement of Environmental Lawyers in Developing Precautionary Principles for Molecular Nanotechnology*, 14 GEO. INT'L. ENVTL. L. REV. 107, 118-19 & n.84 (2001).

419. *See* Karn, *supra* note 413, at 5; *see, e.g.*, K.J. Klabunde et al., *Nanocrystalline Metal Oxides: A New Family of Mesoporous Inorganic Materials Useful for Destructive Adsorption of Environmental Toxins*, *in* NANOTECHNOLOGY AND

Although humans have been exposed to nanosized particles throughout evolution, such exposure will grow as engineered nanomaterials come into wider use.[420] Increased intake of nanosized particles is likely to occur through different routes, including inhalation, ingestion, absorption through the skin, and injection.[421] The same properties that make nanoparticles attractive for use in certain medical and industrial processes, however, may also make them particularly harmful when taken into the body.[422] Based on studies in lab animals, it appears that nanoparticles can penetrate the body more readily and more deeply than larger particles.[423] And the fact that nanoparticles are, by nature, more biologically active suggests a greater potential to induce inflammation and other stress responses within the body.[424] Nevertheless, research efforts in nanotoxicology are just beginning, and very little information is presently available regarding potential negative health and environmental effects of exposure to nanosized particles.[425] Risk assessment of nanotechnology is simply not possible given the present state of uncertainty.[426] Despite the potential danger, the manufacture and use of nanotechnology products are not specifically regulated. Rather, nanomaterials are treated no differently than the conventional substances from which they are manufactured;[427]

THE ENVIRONMENT, *supra* note 413, at 272 (identifying the unique properties of nanomaterials that may make them particularly effective adsorbents and catalysts).

420. *See* Oberdorster et al., *supra* note 415, at 823.

421. *See id.*

422. *See id.* at 824; Weiss, *supra* note 414 (discussing studies reporting deaths and abnormalities after rats were exposed to nanoparticles).

423. *See* Gunter Oberdorster, *Effects and Fate of Inhaled Ultrafine Particles*, *in* NANOTECHNOLOGY AND THE ENVIRONMENT, *supra* note 413, at 37, 54 (summarizing the unique ability of airborne ultrafine particles to pass through epithelial layers and nerve tissue to reach the central nervous system and various organs).

424. *See* Oberdorster et al., *supra* note 415, at 836-37; Chiu-Wing Lam et al., *Toxicity of Single-Wall Carbon Nanotubes in the Lungs of Mice Exposed by Intratracheal Instillation*, *in* NANOTECHNOLOGY AND THE ENVIRONMENT, *supra* note 413, at 60, 64-65 (suggesting that carbon nanotube particles are particularly difficult to clear from the lungs and may result in lung lesions).

425. *See* Oberdorster et al., *supra* note 415, at 824; Weiss, *supra* note 414 ("It will be years before the first studies of nanotechnology's health and environmental impacts come together into a body of evidence."); Rick Weiss, *EPA Backs Nanomaterial Safety Research*, WASH. POST, Nov. 12, 2004, at A23 (reporting the first significant EPA award of federal grants to fund studies on the potential impacts of nanoparticles on the environment).

426. *See* Oberdorster et al., *supra* note 415, at 835 ("The lack of toxicology data on engineered NPs [nanoparticles] does not allow for adequate risk assessment.").

427. *See, e.g.*, Kristen M. Kulinowski & Vicki L. Colvin, *The Environmental Impact of Engineered Nanomaterials*, *in* NANOTECHNOLOGY AND THE ENVIRONMENT, *supra* note 413, at 21, 23 (noting that material-safety data sheets for most nanoparticles are identical to those of the bulk material of equivalent chemical composition).

therefore, they may be introduced into commerce without advance testing or approval.[428]

Over time, nanotoxicological research may reduce the uncertainty of health effects from exposure to nanomaterials. Nanotechnology also poses more intractable forms of uncertainty, however. Perhaps the most revolutionary aspect of nanotechnology is its "bottom-up" method of construction, using nanoscale chemical machinery.[429] Under the proper conditions, self-assembly, in which simple molecular components spontaneously form more complex, ordered structures, may be possible.[430] Nanotech self-assembly, in turn, may enable researchers to develop self-replication methods in which nanomachines reproduce themselves, as well as the instructions for their own construction, from relatively simple parts in a process akin to cell division.[431] The danger of self-replication is that nanomachines might proliferate, like a virus, in an uncontrollable manner and thus, ultimately consume the earth.[432]

Some have dismissed this seemingly far-fetched scenario as unrealistic.[433] Yet even the less remote possibilities are quite troubling.

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428. *See* Oberdorster et al., *supra* note 415, at 835. Under the Toxic Substances Control Act, a new chemical substance may be manufactured so long as advance notice is provided to the EPA describing the substance, the volume expected to be manufactured and used, and available data on health and environmental effects. 15 U.S.C. § 2607 (2000); *see also* Weiss, *supra* note 414 (arguing that the current regulatory scheme's focus on general questions of toxicity and volume is a poor fit for nanotechnology because substances that are nontoxic in bulk form can be deadly when produced on the nanoscale).

429. *See* Drexler & Wejnert, *supra* note 417, at 5-13 (describing the molecular manufacturing process); Phoenix & Drexler, *supra* note 294, at 870 (proposing the use of the term "molecular nanotechnology" to describe such fabrication methods).

430. *See* POSNER, *supra* note 293, at 35.

431. *See id.* at 35-36; REES, *supra* note 294, at 16-17 (describing nanotechnology assembly methods).

432. *See* POSNER, *supra* note 293, at 35-36; REES, *supra* note 294, at 58 (describing as "conceivable—though still far from reality—that nanomachines could be devised" with self-assembly capability, with ultimate potential to consume all life); John Tierney, Op-Ed., *Homo Sapiens 2.0*, N.Y. TIMES, Sept. 27, 2005, at A25 (summarizing an apocalyptic scenario resulting from out-of-control nanobots). "Grey goo" is the term sometimes used to refer to the material resulting from self-replication run amok. *See* Phoenix & Drexler, *supra* note 294, at 869-70; DREXLER, *supra* note 412, at 172-73. The grey goo scenario is the subject of a Michael Crichton novel. *See generally* MICHAEL CRICHTON, PREY (2002).

433. *See* Drexler & Wejnert, *supra* note 417, at 14-15 (contending that "there is no reason to build anything remotely like a 'grey goo' device" and that more probable scenarios such as nanotechnology-based weaponry warrant more attention); Phoenix & Drexler, *supra* note 294, at 869 ("[T]he easiest and most efficient [molecular manufacturing] systems will not have the capabilities required for autonomous runaway manufacturing.").

Rather than developing self-replicating systems, nanotechnology researchers are focusing on autoproductive systems—systems that can be used to produce duplicates of themselves, but only with substantial outside help.[434] Although autoproductive systems pose less of a threat than self-replicating systems, they still could do great damage if built to rely on energy sources from the environment around them.[435] Even if such systems could be controlled, the environmental consequences that might follow from the use or misuse of autoproductive nanotechnology are disturbing. Weapons could be developed that are more destructive, more manipulable, and harder to detect than weapons made with conventional materials.[436] Autoproductive manufacturing also could be used to produce vast quantities of environmentally destructive products, or produce weapons able to deliver other sorts of "imaginative" payloads.[437] Such consequences are especially troubling because nanotechnology, unlike nuclear technology, can be developed through small-scale activities, using common and inexpensive raw materials.[438]

2. APPLYING THE HARM FRAMEWORK

Nanotechnology challenges the harm principle because it is surrounded by so much uncertainty. Although the scenarios of nanotechnology gone awry indisputably involve toxic or even catastrophic harm, there is no concrete harm that one can point to today. In contrast to situations of known risk, one cannot even begin to estimate the probability of particular harms that might be associated with nanotechnology because there is almost no data on which to base such an estimate. One can only speculate upon mere possibilities. Given the undefined path of future developments in nanotechnology, we simply cannot know what the potential hazards might be.[439] In the face of uncertainty, the default response is to do nothing. Because there exists enough knowledge only to suspect the possibility of negative consequences, but not enough to describe those risks in a meaningful

434. *See* Phoenix & Drexler, *supra* note 294, at 870.

435. *See* Joel Rothstein Wolfson, *Social and Ethical Issues in Nanotechnology: Lessons from Biotechnology and Other High Technologies*, 22 BIOTECH. L. REP. 376, 382 (2003).

436. *See id.* at 381.

437. *See* POSNER, *supra* note 293, at 37 (quoting a private communication from Eric Drexler regarding a potential weapons system based on nanotechnology); Phoenix & Drexler, *supra* note 294, at 871 (discussing the risks of exponential manufacturing).

438. *See* Lin-Easton, *supra* note 418, at 114-15 (discussing an article by the CEO of Sun Microsystems calling for the relinquishing of molecular nanotechnology because of potential dangers).

439. *See* Silver, *supra* note 408, at 63-64.

way, such a course—as questionable as it might seem—appears consistent with the harm principle.[440]

The general approach of environmental law to uncertainty has been inaction. Under the Toxic Substances Control Act,[441] for example, new chemicals are "presumed innocent," and there must be a finding of harm or a risk of harm before regulation can occur.[442] The mere possibility of detrimental effects from chemical exposure is not a sufficient basis for regulation.[443] Likewise, new technologies generally may be developed and marketed unless there is an affirmative demonstration of harm.[444] By placing the evidentiary burden on advocates of regulation, the law presumes that uncertainty itself is not a harm and that inaction is the appropriate response to uncertainty.[445] The result is that situations of uncertain risk are treated as equivalent to situations of no known risk.[446]

This approach, however, overlooks the distinction between uncertainty resulting from inadequate knowledge and uncertainty resulting from the undetermined path of technological development. As to the first type of uncertainty, the harm principle neither requires nor prohibits a regulatory response: although our lack of information regarding the dangers of nanotechnology may generate a subjective risk of zero, the biologically active nature of nanoparticles suggests—but

440. *See id.* at 65 ("[R]isks that are totally uncertain are not problems for society at all. To illustrate, try to evaluate the risk of an invasion of Earth from the star Alpha Centauri.").

441. 15 U.S.C. §§ 2601-2692 (2000).

442. *See* 15 U.S.C. § 2605 (authorizing regulation if the EPA Administrator finds a reasonable basis to conclude that a chemical substance "presents or will present an unreasonable risk of injury to health or the environment"); *see also* Flournoy, *supra* note 77, at 328 ("The traditional decisionmaking structure embodied in protective statutes identifies a single factual prerequisite and predicates regulation on the agency's ability to demonstrate that fact with a specified measure of proof.").

443. The *Benzene* case, discussed *supra* notes 325-28 and accompanying text, illustrates this general approach. *See generally* Indus. Union Dep't v. Am. Petroleum Inst., 448 U.S. 607 (1980).

444. For example, the federal government has generally taken a hands-off approach to genetically modified crops. *See* Food and Drug Administration, Statement of Policy: Foods Derived From New Plant Varieties, 57 Fed. Reg. 22,985, 22,985-86 (May 29, 1992) (announcing that the agency would presume that foods produced through recombinant DNA processes are "generally recognized as safe" and therefore not subject to regulation as food additives).

445. *See* Flournoy, *supra* note 77, at 366.

446. *See id.* (contending that the binary structure of agency decision making—action if there is a finding of unreasonable risk, and inaction in all other circumstances—"embodies a fundamental assumption that inaction is always the appropriate response to uncertainty"); *see also* Silver, *supra* note 408, at 62 ("From the beginning of the Industrial Revolution until very recently our society has followed an implicit policy of ignoring uncertain environmental risks until disaster hits.").

does not establish—a nonzero level of objective risk. However, the second type of uncertainty—that arising from the uncertain path of future nanotechnological development—involves indeterminacy that cannot be readily described in terms of risks, let alone as setbacks to one's interests in human autonomy.

Harm, as discussed earlier, encompasses only those setbacks to interests that community norms have deemed significant.[447] Thus, the law's treatment of uncertainty as lying outside the harm principle can be explained in terms of normative understandings of uncertainty. Uncertainty is not obviously a setback to one's physical well-being or other fundamental welfare interests. Except in unusual cases or where uncertainty gives rise to fear or other emotional impacts,[448] the presence of uncertainty does not impede one's daily life. Nor does uncertainty impede one's pursuit of one's ultimate goals. Social norms thus seem consistent with the conclusion that uncertainty is not a harm, but rather an inevitable aspect of one's existence.

Insurance provides a possible counterexample to this conclusion. The willingness to pay premiums to reduce uncertainty, one might argue, supports the notion that uncertainty is a harm. Insurance, however, is more a means of spreading risk than a guard against uncertainty. For truly uncertain events, insurance is unavailable.[449] Nanotechnology involves just such uncertainty. One proposal to internalize the risks posed by nanotechnology, for instance, might involve payment by nanotechnology companies to a fund that would provide compensation for future harms. There is no way of estimating how much funding would be appropriate, however, because of the grave uncertainty. For nanotechnology, uncertainty cannot be characterized as harm because the effects at issue are unknown and—at least at present—unknowable.

If social authority to regulate nanotechnology cannot be grounded in the harm principle, one possible conclusion is that such authority is not justified until harm can be demonstrated. Another possible conclusion, however, is that an alternative basis for social authority over the development of nanotechnology is necessary. Interestingly,

447. *See supra* Part II.B.

448. *See supra* Part III.A.1.

449. *See* POSNER, *supra* note 293, at 172 ("[O]nly a gambler . . . will write insurance when a risk cannot be estimated."); Boardman, *supra* note 407, at 784, 812 (arguing that the risk of terrorism in the United States is not insurable because uncertainty makes the necessary actuarial data unobtainable); *cf.* Robert J. Rhee, *Terrorism Risk in a Post-9/11 Economy: The Convergence of Capital Markets, Insurance, and Government Action*, 37 ARIZ. ST. L.J. 435, 467-73 (2005) (arguing that the terrorism risk is insurable despite uncertainty because enough information may be available to quantify risks).

even advocates of nanotechnology caution that the potentially irreversible and catastrophic ramifications of nanotechnology warrant some form of oversight.[450] This oversight presently occurs in the form of self-regulation, but could also take the form of government intervention. Although the development or defense of an alternative to the harm principle is beyond the scope of this Article, the precautionary principle is one possible alternative.[451] The basic premise of the precautionary principle is that "one should not wait for conclusive evidence of a risk before putting control measures in place" to address the risk.[452] The principle takes an entirely different approach to uncertainty by shifting the burden to industry to demonstrate lack of harm before allowing innovations to be adopted.[453] The principle has been criticized for various reasons, including its potential to stifle

450. The Foresight Institute, for example, which bills itself as "the first organization to educate society about the benefits and risks of nanotechnology," has developed guidelines for the safe development of nanotechnology in the form of self-assessment scorecards. *See* NEIL JACOBSTEIN & GLEN HARLAN REYNOLDS, FORESIGHT GUIDELINES VERSION 4.0: SELF-ASSESSMENT SCORECARDS FOR SAFER DEVELOPMENT OF NANOTECHNOLOGY (2004), *available at* http://www.foresight.org/guidelines/04 GuidelinesBooketFinal.pdf. The authors of the Guidelines recognize that "the Guidelines need to become sufficiently specific that they can form the basis for a legally enforceable framework within which MNT [molecular nanotechnology] development can be safely pursued." *Id.* at 8 (also noting that guidelines "might eventually be enforced via a variety of means, possibly including . . . stiff legal and economic penalties for violations"); *see also, e.g.*, Lin-Easton, *supra* note 418, at 119 (noting that many in the nanoscience community "recognize the need for precautionary regulation"); Phoenix & Drexler, *supra* note 294, at 871 ("Problems [arising from the use of nanotechnology] including weapon systems, radical shifts of economic and political power, and aggregate environmental risks . . . will require close attention and careful policymaking."). Similarly, Drexler and Wejnert note:

> [W]hile there are many reasons to want to regulate slowly and only in response to actual stubborn problems, the urge to avoid over-regulation must be tempered by an understanding that there are certain developments that we can already foresee that must be forestalled, certain broad outcomes that we need to achieve, and other broad outcomes that we need to avoid.

Drexler & Wejnert, *supra* note 417, at 17.

451. *See* Lin-Easton, *supra* note 418, at 119-32 (examining the potential application of the precautionary principle to nanotechnology).

452. Christian Gollier & Nicolas Treich, *Decision-Making Under Scientific Uncertainty: The Economics of the Precautionary Principle*, 27 J. RISK & UNCERTAINTY 77, 77 (2003).

453. *See* HUNTER ET AL., *supra* note 68, at 406 ("[M]any commentators . . . argue that the precautionary principle acts to switch the burden of proof necessary for triggering policy responses from those who support prohibiting or reducing a potentially offending activity to those who want to continue the activity.").

innovation.[454] A more measured approach would be to limit the application of the principle to situations in which there is a plausible potential of not just ordinary harm, but catastrophic harm.[455] Such an approach would accommodate much innovation while guarding against the most threatening harms.

D. Harm to the Environment

The preceding scenarios present dilemmas of harm in which the impacts of environmental problems fall directly upon human beings. It is human individuals who experience emotional harms, chromosomal aberrations, and the potential downside of nanotechnology. Environmental concerns that do not involve individual well-being in a direct way, such as endangered species protection, pose a very different challenge to the concept of harm.[456] Here, the question is whether we can speak in a meaningful way of "harm to the environment" itself, absent anthropocentric value judgments.

Both deontological and consequential concerns can drive environmental protection, as the Endangered Species Act (ESA) illustrates.[457] The human impact on the natural world is ever-

454. *See* Farber, *supra* note 411, at 168-70 (describing three common criticisms of the precautionary principle—that it is vague, its application can create additional risks that tend to be overlooked, and it is irrational).

455. *Cf. id.* at 167 (suggesting that for complex systems subject to a power law rather than a bell-curve distribution, consideration of worst-case scenarios "can compensate for the tendency to focus too heavily on the likely outcomes of an action and dismiss speculation about possible disasters").

456. *See* Westbrook, *supra* note 63, at 622-23 & n.3 (contrasting the "inward" concern of political liberalism for the individual with the "outward" concern for the environment found in statutes such as the Endangered Species Act).

457. 16 U.S.C. §§ 1531-1544 (2000); *see also* Joe Mann, Note, *Making Sense of the Endangered Species Act: A Human-Centered Justification*, 7 N.Y.U. ENVTL. L.J. 246, 252-53, 260-61 (1999) (distinguishing between instrumental reasons for acting—reasons based on expected consequences—and intrinsic reasons—reasons based on moral convictions regardless of consequences). Other environmental statutes that reflect a concern for harm to the environment itself include the Marine Mammal Protection Act ("MMPA"), 16 U.S.C. §§ 1361-1421h (2000); the Bald and Golden Eagle Protection Act, 16 U.S.C. § 668 (2000); the Wilderness Act, 16 U.S.C. §§ 1131-1136 (2000); and the Wild and Scenic Rivers Act ("WSRA"), 16 U.S.C. §§ 1271-1287 (2000). *See also* MICHAEL J. BEAN & MELANIE J. ROWLAND, THE EVOLUTION OF NATIONAL WILDLIFE LAW 109-10 (3d ed. 1997) (noting that some supporters of the MMPA "believed that marine mammals, because of their apparent intelligence and highly developed social systems, ought to be left undisturbed and made off-limits to human use"); Robert L. Glicksman & George Cameron Coggins, *Wilderness in Context*, 76 DENV. U. L. REV. 383, 387 (1999) (stating that, in the Wilderness Act, "Congress acted to preserve lands in a pristine state for their own sake, not as 'pleasuring grounds' or bird breeding areas"); Eric L. Hiser, Note,

expanding, reducing the amount of relatively undisturbed habitat and pushing more species toward extinction.[458] There are often instrumental reasons for protecting species or habitats,[459] a point the ESA recognizes in declaring threatened and endangered species to be "of esthetic, ecological, educational, historical, recreational, and scientific value to the Nation and its people."[460] An animal may be a keystone species vital to the functioning of a particular ecosystem on which humans depend,[461] obscure plants may be potential sources of a cure for cancer,[462] and the Amazon may function as a carbon sink to mitigate the effects of fossil fuel use on global climate.[463] These rationales for protecting endangered species or habitats all measure

Piloting the Preservation/Development Balance on the Wild and Scenic Rivers, 1988 DUKE L.J. 1044, 1048 (1988) (stating that the purpose of the WSRA was to emphasize river preservation and balanced development); Daniel Rohlf & Douglas L. Honnold, *Managing the Balances of Nature: The Legal Framework of Wilderness Management*, 15 ECOLOGY L.Q. 249, 255 (1988) (contending that Congress's explicit goal of protecting land "from 'expanding settlement and growing mechanization'" suggests an underlying belief "that natural communities have an inherent right to exist" (quoting Wilderness Act, 16 U.S.C. §§ 1131-1136 (2000))).

458. *See* John Charles Kunich, *Preserving the Womb of the Unknown Species with Hotspots Legislation*, 52 HASTINGS L.J. 1149, 1155-62 (2001) (describing the widely held view of scientists that "the earth is now in the midst of a mass extinction" caused by habitat destruction and other human actions).

459. *See id.* at 1163-69 (identifying reasons for species protection); John Copeland Nagle, *Playing Noah*, 82 MINN. L. REV. 1171, 1207-11 (1998) (cataloging utilitarian justifications for protecting all species); Zygmunt J.B. Plater, *The Embattled Social Utilities of the Endangered Species Act—A Noah Presumption and Caution Against Putting Gasmasks on Canaries in the Coalmine*, 27 ENVTL. L. 845, 853 (1997).

460. 16 U.S.C. § 1531(a)(3) (2000); *see also* Andrew E. Wetzler, Note, *The Ethical Underpinnings of the Endangered Species Act*, 13 VA. ENVTL. L.J. 145, 168-70 (1994) (noting instrumental justifications for species protection in the statute and its legislative history); *cf.* Mann, *supra* note 457, at 248 ("[T]he relevant legislative and administrative materials conclusively show that the values behind the ESA are strictly human-centered . . . .").

461. *See, e.g.*, Robert J. Naiman et al., *Riparian Ecology and Management in the Pacific Coastal Rain Forest*, 50 BIOSCIENCE 996, 1006 (2000) ("[In the Pacific Northwest,] anadromous salmon play a key role in the nutrient and trophic dynamics of both aquatic and riparian ecosystems.").

462. *See* Eric Chivian, *Environment and Health: 7. Species Loss and Ecosystem Disruption—the Implications for Human Health*, 164 CANADIAN MED. ASS'N J. 66, 66-67 (2001) (listing species that have served as sources of important medicines, including the Pacific yew, a source of a cancer-fighting drug).

463. *See* Oliver L. Phillips et al., *Changes in the Carbon Balance of Tropical Forests: Evidence from Long-Term Plots*, 282 SCIENCE 439, 441 (1998) (presenting a study of biomass in mature tropical forests, including those in the Amazon, concluding that "intact forests may be helping to buffer the rate of increase in atmospheric CO2, thereby reducing the impacts of global climate change").

harm with respect to human interests.[464] Even aesthetic interests, though less tangible than the interests just mentioned, are human-centered and instrumental, and harm to those interests is measured in terms of human impacts.[465]

For some environmentalists, however, these rationales are secondary to the main justification for greater protection: that habitats and species have intrinsic value.[466] The ESA protects endangered species regardless of their value or potential value to humans,[467] a fact that suggests an ethical basis independent of instrumental concerns.[468]

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464. Similarly, the harm at issue in *Lucas*—damage to the natural ecosystem from residential development on sand dunes—was rooted in the instrumental value of the sand dunes in providing flood protection and other ecological services for humans. Lucas v. S.C. Coastal Council, 505 U.S. 1003, 1008-09, 1021 n.10 (1992); *see also* Joseph L. Sax, *Property Rights and the Economy of Nature: Understanding* Lucas v. South Carolina Coastal Council, 45 STAN. L. REV. 1433, 1439-41 (1993) (contending that the *Lucas* decision rejected the notion of ecological harm). As the devastation left by Hurricane Katrina demonstrates, the ecological services that wetlands might provide include protection against obvious catastrophic harm. *See* Michael Grunwald & Susan B. Glasser, *The Slow Drowning of New Orleans*, WASH. POST, Oct. 9, 2005, at A1 (describing the wetlands' role in absorbing storm surges, and how destruction of the wetlands left New Orleans more vulnerable).

465. *See* Mann, *supra* note 457, at 258-59 ("A third instrumental rationale behind the ESA was the importance of species preservation as a means of securing aesthetic benefits."). *See generally* NAGLE, *supra* note 18, at 186-89 (discussing environmental law's protection of aesthetic interests from harm).

466. *See* Westbrook, *supra* note 63, at 694. Westbrook also notes that certain environmental concerns, such as the protection of endangered species, "do not make much sense to a thorough-going liberal because they do not protect individual well-being." *Id.* at 623 n.3.

467. *See* Nagle, *supra* note 459, at 1193-95 (remarking that the ESA does not provide for value judgments about the intrinsic worth of any particular species, but also noting that endangered plants and insects receive less protection than endangered animals generally). The ESA makes it unlawful to "take" (that is, to "harass, harm, pursue, hunt . . . kill," etc.) any endangered fish or wildlife. 16 U.S.C. §§ 1538(a)(1)(B), 1532(19) (2000). The ESA provides more limited protection to endangered plants. *See* 16 U.S.C. § 1538(a)(2).

468. *See* George Cameron Coggins, *A Premature Evaluation of American Endangered Species Law*, *in* ENDANGERED SPECIES ACT: LAW, POLICY, AND PERSPECTIVES (Donald C. Baur & William Robert Irvin eds., 2002) ("The act represents a culmination of preservation thinking: species must be preserved even if they are of no ascertainable economic value to humans."); Holly Doremus, *The Rhetoric and Reality of Nature Protection: Toward a New Discourse*, 57 WASH. & LEE L. REV. 11, 39-41 (2000) (describing the ethical overtones underlying ESA); Plater, *supra* note 459, at 852 (arguing that "[e]thics and morality are surely part of" the justification for endangered species protection); Wetzler, *supra* note 460, at 174 (arguing that the ESA's protection of all species "does not make sense in the absence of intrinsic justifications for species protection"); Holly Doremus, Comment, *Patching the Ark: Improving Legal Protection of Biological Diversity*, 18 ECOLOGY L.Q. 265, 273-75 (1991) (recounting the ethical arguments for preserving biodiversity).

Likewise, the Clean Water Act declares as one of its primary goals "that the discharge of pollutants into the navigable waters be eliminated by 1985" without inquiry into the level of harm.[469] Environmental law thus addresses not only anthropocentric harm, but also moral wrongs.[470]

How might a deontological ethical basis for environmental law be articulated? Many environmental ethicists contend that the natural world has intrinsic value because it is a self-maintaining system.[471] Animals and plants, one might argue, have a purpose of self-perpetuation,[472] and, like humans, have welfare interests in physical health that can be harmed.[473] Alternatively, one might look to entire ecosystems, rather than individual organisms or species, as the loci of intrinsic value.[474] Aldo Leopold's land ethic, for instance, judged as wrongful those acts that tend to degrade the "integrity, stability, and beauty of the biotic community."[475] Whether the focus is on an individual species or on entire ecosystems, "environmental harm" in this context refers to harm to the environment itself, and not to human interests mediated by the environment.

To protect against intrinsic harm to the environment requires an understanding of what the environment is and how it can be harmed. If

469. 33 U.S.C. § 1251(a)(1) (2000); *see* GLICKSMAN ET AL., *supra* note 63, at 508-09 (noting that the 1972 Clean Water Act substituted the goal of no pollution discharges for the goal of calibrating discharges to water use, suggesting a retreat from a harm-based approach).

470. *See* NAGLE, *supra* note 18, at 190; Daniel C. Esty, *Toward Optimal Environmental Governance*, 74 N.Y.U. L. REV. 1495, 1527 n.101 (1999) ("Many of the environmental laws of the United States . . . are built on the premise that pollution is immoral and should be entirely stopped.").

471. *See* J. BAIRD CALLICOTT, IN DEFENSE OF THE LAND ETHIC: ESSAYS IN ENVIRONMENTAL PHILOSOPHY 3-4 (1989) (describing ecocentrism as shifting the locus of intrinsic value from individuals to the ecosystem as a whole); FREYA MATHEWS, THE ECOLOGICAL SELF 118 (1991); Michael Bowman, *Biodiversity, Intrinsic Value, and the Definition and Valuation of Environmental Harm*, *in* ENVIRONMENTAL DAMAGE IN INTERNATIONAL AND COMPARATIVE LAW: PROBLEMS OF DEFINITION AND VALUATION 41, 43 (Michael Bowman & Alan Boyle eds., 2002); *see also* Mann, *supra* note 457, at 265-66 (distinguishing between the intrinsic human-centered perspective, in which nonhuman species are protected out of a "self-obligating duty not to engage in acts of a disruptive or reckless nature," and the nature-centered perspective, in which such protection rests on "a pre-existing right" possessed by nonhuman species).

472. *See* Bowman, *supra* note 471, at 48.

473. *See* Kleinig, *supra* note 24, at 32 ("[H]arm may be done to animals as well as people.").

474. *See, e.g.*, Holmes Rolston, *Duties to Ecosystems*, *in* COMPANION TO A SAND COUNTY ALMANAC 246, 258-61 (J. Baird Callicott ed., 1987) ("[A]n ecosystem has 'heritage . . . .'").

475. *See* LEOPOLD, *supra* note 230, at 240; *see also* CALLICOTT, *supra* note 471, at 84 (explaining that Leopold's land ethic is "holistic with a vengeance" in that it values the biotic community over individual members of that community).

"environment" refers to the natural world,[476] and if the source of value in the natural world is its self-maintaining properties, then harm to the environment involves setbacks to these self-maintaining properties. Harm to the environment, in other words, might be defined as a change from the environment's "natural," self-maintaining state. The problem with this view, however, is that the environment is not in static equilibrium; rather, it is a dynamic entity undergoing constant change.[477] Preserving the environment in its natural state is likely an impossible, and perhaps undesirable, mission.

Furthermore, the concept of deontological harm to the environment is in tension with the classical liberal account of harm. Liberalism, by definition, focuses on the human condition; it seeks to promote individual autonomy.[478] Mill, for example, was most concerned with moralistic legislation that would infringe upon individual liberty to pursue one's own view of the good.[479] Within the liberal framework, the harm principle distinguishes between actions having effects on other humans—which can be subjected to governmental authority—and self-regarding actions involving choices of personal morality.[480] This distinction is reflected in Feinberg's rejection of damage to things as a basis for the harm principle in favor of a conception of harm as damage to human interests.[481] When natural objects are damaged, Feinberg suggested, there can be harm only in a "transferred sense," that is, the word "harm" "is elliptical for the harm

476. *See, e.g.*, BRANS, *supra* note 278, at 10 (offering various definitions of "environment"); ROBIN KUNDIS CRAIG, ENVIRONMENTAL LAW IN CONTEXT: CASES AND MATERIALS 1 (2005) (observing that "[a]rguably, 'the environment' is everything," but narrowing the definition for purposes of environmental law to refer to "biological, chemical, and physical processes that occur on or near the surface of the Earth or in its atmosphere").

477. *See* Bosselman & Tarlock, *supra* note 72, at 848 (stating that current ecological theories "tend to see the environment as in a process of constant change rather than in search of a stable end-state"); J.B. Ruhl, *Thinking of Environmental Law as a Complex Adaptive System: How to Clean Up the Environment by Making a Mess of Environmental Law*, 34 HOUS. L. REV. 933, 935 (1997) (describing the environment as "a mess" in that it is inherently chaotic and dynamic).

478. *See* Westbrook, *supra* note 63, at 622-23; *cf.* Richard J. Arneson, *Liberalism, Freedom, and Community*, 100 ETHICS 368, 378 (1990) (criticizing the individualistic bias of Feinberg's approach).

479. *See* MILL, *supra* note 2, at 146-47.

480. *See* RAZ, *supra* note 171, at 413 ("The harm principle is a principle of freedom. The common way of stating its point is to regard it as excluding considerations of private morality from politics."); Beattie, *supra* note 275, at 380 ("[T]he harm principle excludes as a method of political justification the moral distress that others have with our actions . . . .").

481. *See* FEINBERG, *supra* note 113, at 32-33; *supra* notes 168-169 and accompanying text.

done to those who have interests" in the things that have been damaged.[482] Environmental damage qualifies as harm, in other words, only to the extent that it is mediated by human values and experience.[483] Deontological harm to the environment, in contrast, appears to lie outside the liberal framework.[484]

The environment, however, differs from other objects of moral consideration in an important way. The liberal argument against regulation based on morality is that such conduct is consensual, private, and self-regarding.[485] For instance, regulation of prostitution or sexual behavior is unjustified, so the argument goes, to the extent that it is truly consensual and does not directly affect any people other than the parties immediately involved. The same argument cannot be made, however, for conduct that harms the environment. Conduct that harms the environment—even if only in an intrinsic way—is not self-regarding because the environment is shared in common with other people. *A*'s conduct that destroys species *X* is not just A's business; it concerns *B* and any other person who places moral value in the existence of species *X*.

One difficulty with this argument is that it risks broad expansion of the harm principle. If *B* can prevent *A*'s harming of species *X*, what is to stop *B*, who values *A*'s well-being, from preventing *A*'s harming of himself through conduct that *B* views as immoral? *B* might contend further that *A*'s private, but immoral, conduct harms *B* by causing severe emotional distress in *B* and degrading the quality of life in the community to which *A* and *B* belong.[486] One answer to these arguments may be that *B*'s ability to complain about these indirect

482. FEINBERG, *supra* note 113, at 32. Although Feinberg rejected the characterization of intrinsic environmental damage as "harm," he did suggest that the extinction of a species might be described as a "free-floating evil[]." JOEL FEINBERG, HARMLESS WRONGDOING 24-25 (1988).

483. *See* Westbrook, *supra* note 63, at 694 (contending that "liberal environmental law is restricted to harms that can be expressed as reductions of autonomy," such as the regulation of hazardous waste sites that endanger human health and reduce property values); *cf.* CALLICOTT, *supra* note 471, at 63 (discussing the contention that the dominant Western ethical tradition excludes an environmental ethic because its concern for natural objects is defined in terms of human interests and rights).

484. Disagreement over the existence and scope of aesthetic harm supports the notion that the existence of harm is inevitably a subjective inquiry, in that it only can be determined by reference to social norms.

485. *See* MILL, *supra* note 2, at 139 (denying societal jurisdiction "when a person's conduct affects the interests of no persons besides himself, or needs not affect them unless they like"); Harcourt, *supra* note 148, at 147.

486. *See* Harcourt, *supra* note 148, at 139-81 (describing examples of the potential expansion of the harm principle).

harms is outweighed by *A*'s interest in *A*'s own autonomy. In the case of harm to the environment, by contrast, *A* cannot claim a stronger interest in species *X* than *B*. Even so, the tension here between deontological harm to the environment and the classical liberal view of harm remains. A view concerned only with utilitarian interests might protect endangered species only to the extent that such species are useful or potentially useful to humanity. Only a broader view of harm—one that understands welfare interests to include moral interests in the existence of species or ecosystems—can explain the full breadth of the ESA.[487] This broader view of harm is plausible, given the normative nature of harm. Nevertheless, the controversy that surrounds the ESA[488] suggests a lack of social consensus regarding this broader view.[489] Until society grapples with the question of what interests matter and how to account for differing values, struggles will continue over environmental law at the boundaries of the harm principle.

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487. *See* Nagle, *supra* note 459, at 1211-16 (noting limitations to the utilitarian justifications for endangered species protection); Victor B. Flatt, *Should the Circle Be Unbroken? A Review of the Hon. Stephen Breyer's* Breaking the Vicious Circle: Toward Effective Risk Regulation, 24 ENVTL. L. 1707, 1722 (1994) (acknowledging that the breadth of the ESA cannot be explained on utilitarian grounds).

488. *See* Shi-Ling Hsu, *A Game-Theoretic Approach to Regulatory Negotiation and a Framework for Empirical Analysis*, 26 HARV. ENVTL. L. REV. 33, 49 (2002) ("In some places in the United States, the ESA is so controversial that it is avoided in casual conversation like religion or politics."); Plater, *supra* note 459, at 845 (describing the ESA as a "lightning rod for politics, passion, and philosophizing"); Donald C. Baur & William Robert Irvin, Overview, *in* ENDANGERED SPECIES ACT: LAW, POLICY, AND PERSPECTIVES, *supra* note 468, at xi ("Even among these landmark environmental laws, the ESA stands out as perhaps the most stringent, most comprehensive, and most controversial."). Recent efforts to change the ESA include a bill sponsored by Representative Richard Pombo that would curb the Act's restrictions and mandate compensation to property owners unable to develop their land as a result of the Act. *See* Threatened and Endangered Species Recovery Act, H.R. 3824, 109th Cong. (2005).

489. *Cf.* Plater, *supra* note 459, at 846-47 (describing the ESA as "one of the most embattled and vulnerable federal environment statutes . . . in part because it is primarily justified and explained in limited terms of aesthetic and ethical social norms, not utilitarian human benefits," but noting that "in many, if not all, cases the Act . . . also represent[s] tangible important human social and economic utilities"). *But cf.* Federico Cheever, *The Endangered Species Act Issues: An Introduction*, SF34 A.L.I.-A.B.A. 289, 291 (2000) (contending that the ESA is controversial not because of widespread social disruption, but because the statute reflects our ignorance of and our dependence on the natural world); Mark Squillace, *Applying the Park City Principles to the Endangered Species Act*, 31 LAND & WATER L. REV. 385, 399 (1996) (reasoning that the implementation of ESA has been controversial "[b]ecause of its reputation as an inflexible law, and because of the limited margin for error in achieving the ESA's goals").

CONCLUSION

Harm is indeed the pivotal concern of much of environmental law. The aims of toxic tort, nuisance, and statutory environmental law are to prevent, deter, mitigate, and compensate for harm. Harm, however, is not an objective concept possessing a fixed meaning. Rather, harm is a normative concept dependent on social judgments about the interests that matter, bound up in social visions of the good and the bad.

Some commentators within and outside of environmental law have bemoaned the expansion of the concept of harm.[490] The main complaint is that the harm principle, originally set forth by Mill as a limit on government power, is often employed to justify the regulation of morals under the guise of preventing harm. If harm is too broadly understood, jurisdiction to legislate might extend to almost any behavior. The expansion of the traditional concept of harm in environmental law beyond physical injury, however, does not—for the most part—pose such a danger. Rather, it reflects a more sophisticated understanding of the relationship between humans and the environment. There are a number of reasons why our understanding of harm is much broader than Mill's: we know much more about the natural world and the processes that cause harm; we have become far more numerous, and our cumulative activities are more likely to reach thresholds of harm; and our ever-increasing global interconnectedness spreads the effects of human action—both good and bad—more broadly than ever before.[491]

Ultimately, the harm principle's primary function in environmental law may not be to demarcate discrete areas of civil life free of government involvement. The plain truth is that many of our activities can, and do, cause harm to others. Rather, the harm principle's most important role today may be to serve as a reminder of our interconnectedness. This realization does not dictate government involvement wherever harm is present; case-by-case policy decisions are still necessary. In such decisions, the nature and extent of harm at

490. *See, e.g.*, Epstein, *supra* note 12, at 371 ("The principle that was once a shield of individual liberty has been forged into a sword against it."); Harcourt, *supra* note 148, at 113 (criticizing the use of harm principle to regulate moral offenses) ("[T]he harm principle no longer serves the function of a *critical principle* because non-trivial harm arguments permeate the debate."); *see also supra* notes 192-197 and accompanying text.

491. *See* Dripps, *supra* note 21, at 9 (noting that the expansion of the idea of harm during the twentieth century was due not only to "changes in normative thinking," but also to "the simple fact that our understanding of causation is broader than it used to be"); Schroeder, *supra* note 148, at 534 ("Risks of harm are ubiquitously produced by human action, the more so as the degree of interdependence of humans and the rate and scale of their activities increase.").

issue should be a critical consideration—as should interests in autonomy and other factors.[492]

As illustrated by the scenarios in Part III, however, the harm principle is not without limits even in our more informed and interconnected world. Most of modern environmental law is not really about deontological harm to the environment; it is about setbacks to fundamental human interests. These setbacks lie firmly within the harm principle. The challenges of uncertainty and protection of the environment for its own sake, however, raise questions about the adequacy of the harm principle in grounding our responses to the values and concerns of tomorrow.

492. *Cf.* Smith, *supra* note 19, at 31 ("Harm, of course, still is and always will be a crucial consideration in evaluating governmental decisions, including decisions to restrict liberty; but *the harm principle* . . . proves upon examination to be of no use for its designated purpose.").