

Symposium Introduction: Navigating the Intersection of Environmental Law and Disaster Law

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In an environmental disaster, a disaster causes environmental harm, or an environmental change causes an acute risk to humans, or a combination of both takes place. Examples include the BP oil spill, the London killer fog of 1952, the 2003 European heat wave, and the 2011 Japanese tsunami. Climate change will intensify the connection between disaster issues and the environment. Given the interwoven nature of disasters and the environment, we should consider what environmental law and disaster law can learn from each other. Environmental law has the most to teach disaster law about risk management and prevention. Disaster law, in contrast, directs attention to issues of unequal risk exposure and to compensation as a supplement to risk mitigation.

I. INTRODUCTION

The worst natural disaster to strike the developed world in modern history came upon us within the past ten years.¹ On reading this, Americans may instantly think of Hurricane Katrina or of the most recent disaster in Japan but, measured in terms of loss of life, Katrina was far less serious than a catastrophe that quietly struck Europe in 2003. Leaving tens of thousands dead, the summer of 2003 was the hottest in at least five hundred years.² A high pressure area sat over Western Europe, preventing cooler air from the Atlantic

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1. Disasters in the developing world have sometimes caused hundreds of thousands of deaths. See Jason K. Levy & Chennat Gopalakrishnan, *A Policy-Focused Approach to Natural Hazards and Disasters—Toward Disaster Risk Reduction (DRR): Introduction to a Special Issue of the Journal of Natural Resources Policy Research*, 2 J. NAT. RESOURCES. POL'Y RES. 317, 317 (2010).

2. Janet Larsen, *Setting the Record Straight: More than 52,000 Europeans Died from Heat in Summer 2003*, EARTH POL'Y INST. (July 28, 2006), http://www.earth-policy.org/index.php?/plan_b_updates/2006/update56.

from entering.³ Temperatures reached extraordinary heights. The summer weather in Geneva was similar to the normal summer in Rio de Janeiro.⁴ In August, temperatures in parts of Italy were over fifteen degrees Fahrenheit warmer than the preceding year; in Portugal, temperatures were over 104 degrees for many days, while, for the first time in its history, London recorded temperatures of over a hundred degrees.⁵

The prolonged heat was catastrophic. Estimates of the total number of deaths begin at thirty thousand and run as high as fifty thousand.⁶ In rough terms, the heat wave's death toll was equivalent to ten to fifteen 9/11 incidents, or fifteen to twenty-five Katrinas. In Paris alone, there were over twelve hundred deaths.⁷ The estimate for France as a whole was over fourteen thousand.⁸ The biggest risk factors were "being a woman 75 years old and older and living alone at home."⁹ In addition to its health impacts, the heat wave also impacted agriculture and caused numerous forest fires, destroying over 640,000 hectares of forest (roughly 2500 square miles, an area about the size of Delaware).¹⁰

The heat wave was extreme compared to historical temperatures, but less abnormal compared to recent decades because of the long-term increase in very hot days in Europe.¹¹ Although it is impossible to say whether climate change "caused" this particular heat wave, it is possible to ask whether climate change increased the likelihood of such a heat wave. Scientists have concluded that "past human influence has more than doubled the risk of European mean summer temperatures as hot as 2003" and that "the likelihood of such events [is] projected to increase 100-fold over the next four decades."¹²

3. United Nations Environment Programme (UNEP), *Impacts of Summer 2003 Heat Wave in Europe*, 2 ENV'T ALERT BULL. 1 (2003).

4. *Id.* "In Switzerland, June was the hottest month ever recorded in 250 years of archives." Geneva's temperatures exceeded the average by 5.4°C (approximately 10°F). *Id.*

5. Larsen, *supra* note 2, at 2.

6. *Id.*

7. Emmanuelle Cadot, Victor G. Rodwin & Alfred Spira, *In the Heat of the Summer: Lessons from the Heat Waves in Paris*, 84 J. URB. HEALTH, 466, 466-68 (2007).

8. *Id.*

9. *Id.*

10. UNEP, *supra* note 3, at 4.

11. Martin Rebetez et al., *Heat and Drought 2003 in Europe: A Climate Synthesis*, 63 ANNALS FOREST SCI. 569, 572 (2006).

12. Peter A. Stott, D. A. Stone & M. R. Allen, *Human Contribution to the European Heatwave of 2003*, 432 NATURE 610, 613 (2004).

This Article focuses on environmental disasters like the 2003 heat wave. We can consider environmental disasters to be in two categories: one that destroys important environmental amenities or one that causes harm to human interests via an environmental change.¹³ The 2003 European heat wave damaged natural systems and, at the very least, was made much more likely due to human-made changes in the Earth's atmosphere. Other examples, as we will see in Part III, include the BP oil spill, the London killer fog of 1952, the 2011 Japanese tsunami, and (less obviously) the destruction of New Orleans in the aftermath of Hurricane Katrina. The BP oil spill easily fits both criteria: it was harmful to natural ecological systems, and the harm was caused by water pollution. Although it would not be hard to add to the list, these examples alone prove the importance of the topic.

Environmental disasters fall in the intersection between disaster law and environmental law. Given the interwoven nature of disasters and the environment, it is crucial to consider what environmental law and disaster law can learn from each other. Environmental law can teach disaster law about risk management and prevention. Disaster law, in contrast, directs attention to issues of unequal risk exposure and compensation as a supplement to risk mitigation.

Environmental disasters, like large natural disasters, strike unpredictably enough that we are somehow always surprised and never quite prepared. The risks are also diverse and the harms are varied: an earthquake is not a hurricane is not an oil spill. But there is also a deep underlying predictability to disasters in general and environmental disasters in particular. Nothing is more predictable than the fact that someday a major hurricane will again hit a Gulf Coast city, that major heat waves will hit American cities, or that devastating accidents will occur within poorly regulated, dangerous industries. It is also all too predictable that, if we do not address climate change, our coastal cities will be at greater risk and heat waves will be more devastating. It is heartening that the legal academy is beginning to pay serious attention to these, but much more needs to be done.¹⁴

13. For a discussion of common features of environmental disasters and their role in the development of environmental law, see Keith H. Hirokawa, *Disasters and Ecosystem Services Deprivation: From Cuyahoga to the Deepwater Horizon*, 74 ALB. L. REV. 543, 547–50 (2011).

14. Although this lecture focuses on the legal literature, disasters are also the subject of a robust and growing body of work in economics and policy analysis. See, e.g., HOWARD

Part II introduces disaster law and argues for its recognition as a distinctive field. It also shows that disaster law can learn from environmental law by finding better methods of risk management. Part III explores four examples of environmental disasters. It deepens the analysis of the interplay between disaster law and environmental law, showing how environmental disasters stem from gaps in environmental regulation: weak protection of wetlands, badly planned infrastructure, and, above all, climate change. Part IV considers how environmental law could learn from disaster law as the two fields are drawn closer together. In particular, disaster law has important lessons about protection of vulnerable groups and about the role of insurance and compensation in managing risks. Finally, Part V offers some closing thoughts about the linkages between disasters and the environment.

II. DISASTER LAW AS AN EMERGING FIELD

More than any other disaster in American history, Hurricane Katrina brought into sharp relief the limitations in the law's capacity to anticipate and respond to catastrophic events. From the amplification of already-entrenched social injustices and the exhaustion and failure of compensation systems, to the paralysis on the ground resulting from ambiguous divisions of disaster management responsibilities among state and federal governments, Katrina and its aftermath made manifest the American legal regime's inability to handle disaster risks effectively.¹⁵

The legal system plays a central role in disaster prevention, response, and management.¹⁶ Katrina was merely a further confirmation that the law is woefully unprepared to handle disasters. A growing community of researchers recognizes this problem and is formulating solutions under the rubric of disaster law. This emerging

KUNREUTHER & MICHAEL USEEM, *LEARNING FROM CATASTROPHES: STRATEGIES FOR REACTION AND RESPONSE* (2010); INT'L BANK FOR RECONSTRUCTION AND DEV. (WORLD BANK), *NATURAL HAZARDS, UNNATURAL DISASTERS: THE ECONOMICS OF EFFECTIVE PREVENTION* (2010); Special Issue, *A Policy-Focused Approach to Natural Hazards and Disasters*, 2 J. NAT. RESOURCES POL'Y RES. 317-408 (2010).

15. See Kim J. Askew, *Recommendation to the House of Delegates*, 2007 A.B.A. SEC. LITIG. 113, available at <http://www.abanet.org/leadership/2007/annual/docs/hundredthirteen.doc> (recommending principles to govern preparation in response to major disasters).

16. These issues are the subject of DANIEL A. FARBER, JIM CHEN, ROBERT R.M. VERCHICK & LISA GROW SUN, *DISASTER LAW AND POLICY* (2d ed. 2010).

legal academic field encompasses a wide-ranging, interdisciplinary body of research that seeks to inform and improve disaster-related decision-making, as evidenced by recent books¹⁷ and a rapidly expanding number of law review articles.¹⁸ To provide a sense of this growing body of scholarship, the Appendix to this essay contains a sample of these law review articles.

The emergence of disaster law may be compared to the birth of environmental law in the late 1960s and early 1970s, when a small group of practitioners and professors recognized the dire need for a coordinated legal approach to a sprawling and life-threatening problem.¹⁹ Their efforts created a new field of legal studies;²⁰ the task and the potential of disaster law are no less critical in the current tumultuous era.

A. Defining Disaster Law

The common conception of disaster focuses on events that are sudden, significant, and natural. But “disaster” is in practice a malleable term.²¹ The suddenness criterion emphasizes the emergency period, but an important consideration in defining the field is whether prevention and development of resilience before the event, and compensation and rebuilding after the event, are to be included. The second factor, significance, is to some extent in the eye of the beholder. The third factor, naturalness, turns out to be

17. FARBER, CHEN, VERCHICK & SUN, *supra* note 16; NAN D. HUNTER, *THE LAW OF EMERGENCIES: PUBLIC HEALTH AND DISASTER MANAGEMENT* (2009); JOHN NOLON & DANIEL RODRIGUEZ, *LOSING GROUND: A NATION ON EDGE* (2007); ROBERT R.M. VERCHICK, *FACING CATASTROPHE* (2010) [hereinafter VERCHICK, *FACING CATASTROPHE*]. *See also supra* note 14.

18. We can get some sense of the expansion from a Westlaw search for ti(“flood insurance” “levees” “oil spill” “forest fire” “natural disaster”). For 2000–2005, the search produced twenty-three documents; for 2006–2011, the search produced 116 documents (search of JLR database on October 12, 2011). A search for “Hurricane Katrina” in the same database on October 12, 2011 produced 3649 documents, of which 126 had the term in their titles. For comparison purposes, an October 12, 2011 search for post-2004 articles with “9/11” in their titles produced 222 documents.

19. RICHARD J. LAZARUS, *THE MAKING OF ENVIRONMENTAL LAW* 47–49 (2004).

20. The conference resulted in the formation of the Environmental Law Institute. *Id.* at 48.

21. Michele L. Landis, “*Let Me Be Next Time ‘Tried By Fire’*”: *Disaster Relief and the Origins of the American Welfare State 1789-1874*, 92 NW. U. L. REV. 967, 971 (1998) (“Although the category ‘disaster’ at first may seem unproblematic, I suggest that we should see its definition and boundaries as precisely what is at stake in many contests over the allocation of federal resources.”).

somewhat misleading to the extent it implies that the impacts of natural disasters are outside of human control. It has been argued that there is actually “no such thing as a natural disaster.”²² “[P]hysical phenomena are a necessary component of risk, but they are only the starting point in addressing safety concerns”: to be fully effective, the work of calculating and planning for disaster risk must account for “acts of nature, . . . weaknesses of human nature, and . . . side effects of technology.”²³

Thus, the field of disaster law does not have sharp boundaries. Despite these blurry boundaries, however, the core cases are fairly clear. Hurricanes, floods, and earthquakes are clearly disasters, even before considering the importance of human factors that assist in determining the extent of harm.

B. Disaster Law and the “Law of the Horse”

Presently, disasters and their applicable legal regimes are addressed within diverse areas of legal study and practice, most notably tort, contract, environmental, and constitutional law. Issues such as liability and liability-sharing, breach of contract (with possible defenses of commercial impracticability or frustration of purpose), and federalism each bear upon disaster response and management. Disaster issues span insurance law, land use law, and administrative law, which are normally considered very different fields. This section considers the ways in which these disparate issues interconnect in the distinctive context of disasters. What most characterizes the field is the “circle of risk management”: a set of strategies including “mitigation, emergency response, compensation, and rebuilding,” with rebuilding completing the circle by including or failing to include mitigation measures.²⁴

Given the extent that disaster law overlaps with other fields, it may seem susceptible to Frank Easterbrook’s “law of the horse”

22. Neil Smith, *There’s No Such Thing as a Natural Disaster*, UNDERSTANDING KATRINA (June 11, 2006), <http://understandingkatrina.ssrc.org/Smith> (“It is generally accepted among environmental geographers that there is no such thing as a natural disaster. In every phase and aspect of a disaster—causes, vulnerability, preparedness, results and response, and reconstruction—the contours of disaster and the difference between who lives and who dies is to a greater or lesser extent a social calculus.”).

23. Daniel A. Farber et al., *Reinventing Flood Control*, 81 TUL. L. REV. 1085, 1089–90 (2006); see also FARBER, CHEN, VERCHICK & SUN, *supra* note 16, at 3.

24. FARBER, CHEN, VERCHICK & SUN, *supra* note 16, at 3.

critique.²⁵ Judge Easterbrook criticized the concept of cyberlaw as a separate field akin to a course on the law of the horse, which would simply involve compiling cases from diverse fields of law that happened to involve horses.²⁶ He viewed this as a foolish endeavor:

Lots of cases deal with sales of horses; others deal with people kicked by horses; still more deal with the licensing and racing of horses, or with the care veterinarians give horses, or with prizes at horse shows. Any effort to collect these strands into a course on “The Law of the Horse” is doomed to be shallow and to miss unifying principles. Teaching 100 percent of the cases on people kicked by horses will not convey the law of torts very well.²⁷

Although Easterbrook was not successful in killing “Law and Cyberspace” courses,²⁸ his essay has left a permanent mark: anyone proposing the addition of a new area of law is immediately challenged to show that the new field is not, in fact, simply the law of the horse.²⁹

Fields of law can be defined in a variety of ways. They can focus on a specific type of legal remedy—thus, tort law involves common law actions for damages other than contract breach. They can focus on a type of transaction (contract law), a type of institution (corporations), a specific market (securities law), a specific legal text (the Constitution or the Bankruptcy Code), or a set of procedures (civil procedure, federal courts, evidence law). They can also focus

25. See Frank H. Easterbrook, *Cyberspace and the Law of the Horse*, 1996 U. CHI. LEGAL F. 207.

26. *Id.* at 208.

27. *Id.* at 207–08.

28. As a critic of Easterbrook said,

As is often the case when my then-colleague speaks, the intervention, though brilliant, produced an awkward silence, some polite applause, and then quick passage to the next speaker. It was an interesting thought But it did not seem a very helpful thought So marked as unhelpful, it was quickly put away. Talk shifted in the balance of the day, and in the balance of the contributions, to the idea that either the law of the horse was significant after all, or the law of cyberspace was something more.

Lawrence Lessig, *The Law of the Horse: What Cyberlaw Might Teach*, 113 HARV. L. REV. 501, 501–502 (1999).

29. Although Easterbrook’s critique of the law of the horse may seem powerful, it is not actually clear that the law of the horse would lack interest or coherence. Horses combine two traits: economic value and biological individuality, the latter of which creates pervasive information problems about current traits and future behavior and value. This inherent biological risk factor could well shape outcomes across a broad range of legal doctrines in ways that might contrast interestingly with cases involving inanimate objects and mechanisms.

on the protection of a specific set of interests (property law, environmental law, health law), on mechanisms for dealing with risks (insurance law), or on a specific institution (family law). Alternatively, fields can be built around perspectives or methodologies such as Law and Economics, Empirical Legal Studies, and Feminist Legal Theory.

Easterbrook's paradigm for a legal field, based on a requirement of intellectual generality and coherence, has not gone unchallenged. In an essay on health law, Ted Ruger suggests that "it should not surprise us if some fields display greater classical coherence than others."³⁰ Indeed, he argues,

some of the very features of health law that distance it from the classical coherence paradigm—its mix of various legal forms, its institutional multiplicity, its permeability to external historical development and political pressure—are themselves generalizable features that are worthy of further examination from a theoretical and empirical perspective.³¹

Much the same could be said of disaster law.³²

In short, fields of law require some common element, but that common element can take many forms. Some fields may have several common elements. For instance, securities law involves some canonical texts (the federal securities statutes), a specific type of market, an intellectual tie with finance theory, and specific governing institutions (the SEC and the stock exchanges). Other well-established fields like family law focus on a single institution that triggers a distinctive set of concerns, but lack other elements such as a canonical text or single transaction type. There is no single way of constituting a field of law.

Despite the fragmentation of legal doctrines and institutions governing disasters, disaster law is far from being the law of the horse. First, it involves a number of distinctive statutes, such as the

30. Theodore W. Ruger, *Health Law's Coherence Anxiety*, 96 GEO. L.J. 625, 627 (2008).

31. *Id.* at 628.

32. Another effort to understand legal taxonomy indicates that "[w]e can conceptualize a legal field as the interaction of four underlying constitutive dimensions of the field: (1) a factual context that gives rise to (2) certain policy trade-offs, which are in turn resolved by (3) the application of values and interests to produce (4) legal doctrine." Todd S. Aagaard, *Environmental Law as a Legal Field: An Inquiry in Legal Taxonomy*, 95 CORNELL L. REV. 221, 225 (2010). Disaster law also seems to meet this standard.

Stafford Act, and doctrines such as martial law.³³ If these legal rules fit anywhere within the existing curriculum, it would be within administrative law as part of the study of how executive power is administered—but a perusal of casebooks shows that the subject focuses much more on judicial review of administrative activity. Thus, there are distinctive legal texts associated with disaster law as there are with other fields such as bankruptcy law or evidence law.

More importantly, in the context of disaster law, legal rules interact in unique ways. For example, the availability of insurance coverage and public benefits after a disaster may affect predisaster mitigation measures—it follows that issues in land use, disaster response, mitigation, and compensation cannot be considered in isolation. Individual courses on land use, torts, insurance, administrative law, etc., cannot adequately treat the interactions between these areas of law.

Further, complex interactions and structures characterize both the “circle of disaster” and also its components. Risk involves a network of interconnected strategies, while disaster response involves careful institutional design, and recovery involves the interplay between funding mechanisms (some private, some state or federal) and local government efforts. Other fields of law (state and local government law, insurance law, land use law, tort law) may touch on parts of the puzzle but miss the larger picture.

Finally, disaster law as a whole is unified by the concept of risk management. Each stage of the circle of disaster—mitigation, emergency response, insurance/liability compensation, government assistance, rebuilding—is part of this risk management portfolio. Mitigation efforts attempt to lessen the potential impact of disaster events before the fact, while disaster response attempts to do so afterwards. Insurance, tort, and government disaster assistance provide ways of spreading and shifting risks. Rebuilding is in some sense just the mitigation phase for the next disaster down the road.

These risk management techniques are interwoven. For instance, the prospect of generous disaster assistance creates moral hazard, which may necessitate government intervention to ensure adequate mitigation. In turn, adequate mitigation before the fact reduces the need for disaster assistance or insurance after the event. Disaster

33. FARBER, CHEN, VERCHICK, & SUN, *supra* note 16, at 90–160 (devoting seventy pages to federal laws dealing specifically with disasters response).

response can have a similar relationship with mitigation—a quick and effective response reduces the need for precautionary measures. For instance, if complete evacuation of an area is anticipated, the need for flood control may be reduced. To complete the cycle, postdisaster assistance, insurance, and other forms of compensation help shape postdisaster rebuilding and the degree to which future disaster risks are mitigated. Thus, the tight linkage between various risk management strategies provides a conceptual framework for disaster law.

C. Disaster Law and Risk Management

Disaster risk management would benefit from more sophisticated methods of understanding risk. For example, engineers have traditionally safeguarded their projects through the technique of overdesign, a practice of compensating for uncertainties in loading, materials, quality of construction and maintenance, etc. Overdesign is accomplished by adopting some multiple of loading as a margin of safety ranging from 1.4 to 5.0 and even greater. How these margins are set is of critical importance, especially when tradeoffs with cost, deadlines, or other factors may compromise the intended reduction of risk.³⁴ We need a fuller understanding of risk, going beyond this engineering rule of thumb, if we are to deal with environmental disasters.

Other fields of law such as torts, insurance, and toxics regulation deal with risks, but disaster law provides a comprehensive look at how to handle risks rather than limiting itself to specific mechanisms such as compensation. Thus, it centers on the design of a portfolio of risk management tools, including prevention, emergency response, compensation, and restoration. Disaster law also involves public risks, which inherently affect multiple individuals and interests, rather than personal risks that can be managed purely through individual responses.

Because of this similarity, disaster law can benefit from environmental scholarship. Much of environmental law involves principles for determining the seriousness of risks and the extent to which society should invest in reducing those risks. There is no

34. For a good introduction to margins of safety and how they are set, see HENRY PETROSKI, *TO ENGINEER IS HUMAN: THE ROLE OF FAILURE IN SUCCESSFUL DESIGN* 98–106 (1982).

consensus about the proper approach. Cost-benefit analysis is central to current agency decisions, but its legitimacy is sharply contested. For the past three decades, regulatory agencies like the Environmental Protection Agency (EPA) have been required to perform cost-benefit analyses and to presumptively base their decisions on the results.³⁵ Economists applaud this practice, but advocates for worker safety, consumer protection, and environmental regulation are far less enthusiastic.³⁶ These advocates prefer the more precautionary approach embodied in many environmental statutes.³⁷ Disaster law involves similar issues about risk mitigation, and the debates about environmental law can illuminate the risk management issues that are central to disaster law.

There is also a more direct connection with environmental law, which is discussed below. Disasters are often caused or exacerbated by failures in environmental protection. In a recent book, Robert Verchick highlights the importance of what he calls natural infrastructure—that is, the role of nature “as a substructure in human flourishing” in providing essential services such as protection against floods, carbon sequestration, and food supplies like fisheries.³⁸ As Verchick explains, “an infrastructure perspective helps remind us that natural goods and services come as part of larger, interconnected systems.”³⁹ Damaged built-infrastructure, such as defective levees, ruptured pipelines or breached reactor containers, can harm the environment; damaged natural infrastructure can lead to or amplify natural disasters. Thus, environmental law not only illuminates disaster law but also represents a form of disaster mitigation. This relationship is the theme of Part III.

35. Regulatory review takes place within the Office of Information and Regulatory Affairs (OIRA). For descriptions of the development of the Office of Management and Budget’s (OMB) role in regulatory oversight, along with some useful suggestions for improving cost-benefit analysis, see REFORMULATING REGULATORY IMPACT ANALYSIS (Winston Harrington, Lisa Heinzerling & Richard D. Morgenstern eds., 2009), and RICHARD L. REVESZ & MICHAEL A. LIVERMORE, RETAKING RATIONALITY: HOW COST-BENEFIT ANALYSIS CAN BETTER PROTECT THE ENVIRONMENT AND OUR HEALTH (2008).

36. The environmentalist view is elaborated in DOUGLAS A. KYSAR, REGULATING FROM NOWHERE (2010), and VERCHICK, FACING CATASTROPHE, *supra* note 17.

37. KYSAR, *supra* note 36, at 2–3, 11. *See also id.* at 241 (discussing the need to live up to existing environmental laws).

38. VERCHICK, FACING CATASTROPHE, *supra* note 17, at 22.

39. *Id.* at 23.

III. ENVIRONMENTAL DISASTERS AS FAILURES OF ENVIRONMENTAL LAW

People tend to think of a disaster as a physical phenomenon stemming from natural events or complex engineering projects such as a nuclear reactor. Such physical phenomena are a necessary component of risk, but they are only the starting point in addressing safety concerns. Whether a risk materializes, and the extent of the resulting harm, are almost always mediated by human actions. Those actions, in turn, take place inside organizations with their own histories and cultures. To understand risk, we need to see the human context as well as the physical events that cause harm. Only then can we begin to determine the appropriate response to risk. As Gregg Macey's contribution to this Symposium shows, the kinds of organizational flaws that lead to disasters are often replicated in the responses, which are hindered by fragmented, poorly coordinated organization.⁴⁰

Environmental disasters are striking events, but we need to look past the events themselves to learn more about the sources of risk and their mitigation. Doing so reveals that environmental disasters are not simply accidents or acts of God—they stem from the failure of the legal system to effectively address risks. Thus, in the context of environmental disasters, disaster law (dealing with disaster preparation, response, and recovery) is closely linked with environmental law (dealing specifically with control of environmental risks). That link is the subject of Part A. As Part B then shows, climate change will vastly strengthen this linkage between environmental law and disaster law.

A. Lessons from Four Environmental Disasters

We typically think of environmental law as addressing long-term problems such as air and water pollution, climate change, and biodiversity. In contrast, we think of disasters as being sudden events, though as discussed earlier this is a contestable idea. Hence, environmental law and disaster law may seem unrelated. But disasters are often the result of long-term failure of environmental regulations, while pollution incidents can be sudden and devastating. We saw in

40. Gregg Macey, *Environmental Crisis and the Paradox of Organizing*, 2011 BYU L. REV. 2061.

the introduction that the European heat wave was probably due to climate change, caused by the lengthy accumulation of greenhouse gases in the atmosphere. Other environmental disasters display the same relationship between environmental damage and disasters.

1. The 2011 Japanese tsunami

At 2:46 p.m. Japan Standard Time on March 11, 2011 (9:46 p.m. PST on March 10), a 9.0 earthquake struck off the east coast of Honshu, Japan, 109 miles east-northeast of Fukushima and 231 miles northeast of Tokyo.⁴¹ The earthquake also triggered a large tsunami that overwhelmed seawalls and contributed to massive destruction.⁴² The enormous tsunami waves reached a maximum height of 127 feet at Aneyoshi, Miyako.⁴³ As of September 7, more than 15,000 people were known to be dead and over 4000 people were still missing.⁴⁴ Additionally, more than 275,000 buildings had totally or partially collapsed, and 3,559 roads, 77 bridges, and 29 railways had been damaged.⁴⁵ As of August 25, 78,852 people had been evacuated.⁴⁶ Economic losses from the earthquake are estimated at \$210 billion, making it the costliest natural disaster on record; the overall economic loss from Hurricane Katrina was \$125 billion.⁴⁷

The environmental dimension of the disaster involved regulation of nuclear power, which turned out to be inadequate for the emergency. During the earthquake, the Fukushima Dai-ichi nuclear

41. U.S. Geological Survey, *Magnitude 9.0—Near the East Coast of Honshu, Japan*, EARTHQUAKE HAZARDS PROGRAM, <http://earthquake.usgs.gov/earthquakes/eqinthenews/2011/usc0001xgp/> (last modified Sept. 18, 2011).

42. Norimitsu Onishi, *Seawalls Offered Little Protection Against Tsunami's Crushing Waves*, N.Y. TIMES, Mar. 14, 2011, at A8.

43. INT'L ATOMIC ENERGY AGENCY, MISSION REPORT, THE GREAT EAST JAPAN EARTHQUAKE EXPERT MISSION 19 (2011) [hereinafter GREAT EAST JAPAN EARTHQUAKE EXPERT MISSION REPORT].

44. Nat'l Police Agency of Japan, *Damage Situation and Police Countermeasures Associated with 2011 Tohoku District*, NAT'L POLICE AGENCY OF JAPAN (Sept. 7, 2011), http://www.npa.go.jp/archive/keibi/biki/higaijokyo_e.pdf.

45. *Id.*

46. Ministry of Foreign Affairs of Japan, *Great East Japan Earthquake*, MINISTRY OF FOREIGN AFFAIRS OF JAPAN (Sept. 2, 2011), http://www.mofa.go.jp/j_info/visit/incidents/index.html.

47. Press Release, Munich RE, *Accumulation of Very Severe Natural Catastrophes Makes 2011 a Year of Unprecedented Loss* (July 12, 2011), *available at* <http://tinyurl.com/6agp4yb>.

power plant lost outside power and was no longer connected to the electrical grid.⁴⁸ Backup diesel generators came on at this time.⁴⁹ The Dai-ichi plant did not lose power, but did face degraded safety systems.⁵⁰ About forty-six minutes after the quake, the first waves of a large tsunami reached the Fukushima Dai-ichi power station.⁵¹ The tsunami reached about fourteen meters (forty-five feet) at the Dai-ichi power station, overwhelming the six-meter (eighteen-foot) seawall.⁵² The International Atomic Energy Agency report provides a vivid description of the post-tsunami state at the nuclear plant:

The tsunami and associated large debris caused widespread destruction of many buildings, doors, roads, tanks and other site infrastructure at Fukushima Dai-ichi, including loss of heat sinks. The operators were faced with a catastrophic, unprecedented emergency scenario with no power, reactor control or instrumentation, and in addition, severely affected communications systems both within and external to the site. They had to work in darkness with almost no instrumentation and control systems to secure the safety of six reactors, six nuclear fuel pools, a common fuel pool and dry cask storage facilities.⁵³

Explosions occurred at the Dai-ichi power station in units one through four; the explosions at units one, two, and three were caused by a build-up of hydrogen, and the cause of the explosion at unit four remains unknown.⁵⁴ Diesel generators at unit six remained functional in the aftermath of the tsunami, and workers were able to use them to achieve a cold shutdown at units five and six.⁵⁵ As of September 2011, unit two still had not reached cold shutdown.⁵⁶ Nuclear Emergency Situations were declared for both the Fukushima

48. GREAT EAST JAPAN EARTHQUAKE EXPERT MISSION REPORT, *supra* note 43, at 20.

49. *Id.* at 29.

50. *Id.* at 20.

51. *Id.* at 29.

52. *Id.* at 11.

53. *Id.* at 12.

54. O.M. Nice, *Japan's Nuclear Disaster: Piecing Together Fukushima*, *ECONOMIST* (May 5, 2011, 8:53 AM), <http://tinyurl.com/3njd2ff>.

55. GREAT EAST JAPAN EARTHQUAKE EXPERT MISSION REPORT, *supra* note 43, at 11, 22. Even after the cooling rods are inserted and fission stops, the radioactive products continue to generate significant heat. Cold shutdown is achieved after several days once the reactor is no longer critical (i.e., at temperatures below 200° F).

56. *Nuclear Reactors at Fukushima Reach Cold Shutdown Temperature*, *POWER ENGINEERING* (Sept. 7, 2011), <http://www.power-eng.com/articles/2011/09/nuclear-reactors-at-fukushima-reach-cold-shutdown-temperature.html>.

Dai-ichi and Fukushima Dai-ni power stations, resulting in evacuations and emergency measures.⁵⁷

As the 2011 tsunami illustrates, the interdependency of modern societies makes them especially prone to disruption by disasters, as damage to basic networks interferes with the delivery of key services. In his Symposium article, Lincoln Davies argues that our vulnerabilities are also increased by the growing inadequacy of the electric grid and other key elements of the energy system.⁵⁸ The combination of an inadequate grid with natural disasters does not bode well.

2. *The BP oil spill*

Another recent example is the BP *Deepwater Horizon* oil spill of 2010. On April 20, 2010, while the *Deepwater Horizon* was drilling at the Macondo Prospect about fifty-two miles southeast of Venice, Louisiana, an explosion caused by a blowout killed 11 of 126 crewmen.⁵⁹ Two days later, despite efforts to put out the blaze on the oil rig, the *Deepwater Horizon* sank in 5000 feet of water.⁶⁰ Throughout the end of April, May, and June, estimates of the flow of oil increased from 1000 barrels of crude per day (bpd), to 5000 bpd, and later to as many as 60,000 bpd.⁶¹ On July 15, BP finally stopped the flow of oil for the first time in nearly three months.⁶² About three weeks later, on August 4, BP executed a successful “static kill,” and a cement plug introduced on September 19 left the well effectively dead and the crisis officially over.⁶³ However, despite the closure of the well, environmental and economic recovery will

57. See *Roadmap Towards Restoration*, TEPCO, http://www.tepco.co.jp/en/press/corp-com/release/betu11_c/images/110517e3.pdf (last visited Sept. 9, 2011).

58. Lincoln Davies, *Beyond Fukushima: Disasters, Nuclear Energy, and Energy Law*, 2011 BYU L. REV. 1935.

59. Associated Press, *Deepwater Horizon Oil Rig Fire Leaves 11 Missing*, THE GUARDIAN (Apr. 21, 2010, 12:04 PM EDT), <http://www.guardian.co.uk/world/2010/apr/21/deepwater-horizon-oil-rig-fire>.

60. *BP Oil Spill Timeline*, THE GUARDIAN (Jul. 22, 2010, 5:25 AM EDT), <http://tinyurl.com/3x3w42x>. For a detailed discussion of the events leading up to the spill, see NAT'L COMM'N ON THE BP DEEPWATER HORIZON OIL SPILL AND OFFSHORE DRILLING, DEEP WATER: THE GULF OIL DISASTER AND THE FUTURE OF OFFSHORE DRILLING 89–122 (2011) [hereinafter NAT'L COMM'N].

61. Justin Gillis, *Estimates of Oil Flow Jump Higher*, N.Y. TIMES (Jun. 15, 2010), <http://www.nytimes.com/2010/06/16/us/16spill.html>.

62. *BP Oil Spill Timeline*, *supra* note 60.

63. *Id.*

take much longer. It remains unclear to what extent oil will continue to pollute coastal areas, whether species such as the dwarf seahorse can overcome the loss of habitat, and whether dispersants used during cleanup efforts may have unforeseen consequences on the environment.⁶⁴ As Robin Craig explains in her article in this Symposium, we need to know much more about ecosystem resilience if we are to plan well for future risks.⁶⁵

In terms of the “root causes” of the blowout, the Presidential Commission investigating the accident identified management failures by industry and a dysfunctional regulatory system.⁶⁶ The accident

resulted from clear mistakes made in the first instance by BP, Halliburton, and Transocean, and by government officials who, relying too much on industry’s assertions of the safety of their operations, failed to create and apply a program of regulatory oversight that would have properly minimized the risks of deepwater drilling.⁶⁷

Thus, the oil spill fundamentally stemmed from a failure of environmental regulation as well as negligence by private firms.

3. *London’s killer fog*

The third example is the London pollution incident of 1952. Beginning on December 4, 1952, winds over the Thames valley began to die down just as a temperature inversion was developing.⁶⁸ The next morning, as emissions from coal-fired stations and domestic chimneys entered the atmosphere, the morning fog became massively polluted, and by early evening that same day, the death toll had begun.⁶⁹ The killer smog lasted only four days, but in that short time nearly one out of every two thousand residents of London died.⁷⁰ For comparison purposes, the number of deaths was about one-and-a-half times the number who died in the Twin Towers on

64. *See id.* The difficulties encountered in closing the well are discussed in NAT’L COMM’N, *supra* note 60, at 129–70.

65. Robin Kundis Craig, *Legal Remedies for Deep Marine Oil Spills and Long-Term Ecological Resilience: A Match Made in Hell*, 2011 BYU L. REV. 1863.

66. NAT’L COMM’N, *supra* note 60, at 122–27.

67. *Id.* at 127.

68. WILLIAM WISE, *KILLER SMOG* 15–16 (1968).

69. *Id.* at 16.

70. *Id.*

9/11. The severity of the 1952 smog is hard to fathom today. Even police cars were forced off the streets because of the lack of visibility.⁷¹ An observer reported that a bride's dress had been turned "nearly black" because she and the groom "had been compelled to walk a considerable distance, about a quarter of a mile, from the church to the Underground station," no taxis being available.⁷²

This incident was the culmination of centuries of serious pollution, which as early as 1578 had resulted in a royal proclamation banning the burning of coal while Parliament was in session.⁷³ Reformers had struggled in vain for action against air pollution; "the problem of Great Britain's polluted atmosphere was no nearer a solution . . . than it had been at the turn of the century."⁷⁴

4. Hurricane Katrina

A fourth example is Hurricane Katrina. The hurricane caused billions of dollars in property damage and "kill[ed] more than 1,500, [left] hundreds of thousands homeless, and ravag[ed] one of America's most storied cities."⁷⁵ Estimates of economic loss approach \$150 billion.⁷⁶ It is unclear whether climate change increased the chances of harm, but what is clear is that failures of risk management turned a relatively routine event into a catastrophe. Hurricane Katrina and the resulting New Orleans flood offers a good illustration of this relationship: damage would have been very limited if the levees had not failed. The situation illustrated what can happen when technology (flood control measures) fails to protect against a predictable, risky, and potentially lethal event.⁷⁷

After floods in 1927, the U.S. built levees along the Mississippi that have prevented silt from reaching Louisiana wetlands.⁷⁸ Since

71. *Id.* at 124.

72. *Id.* at 131.

73. *Id.* at 19.

74. *Id.* at 50.

75. COMM. ON HOMELAND SEC. AND GOVERNMENTAL AFFAIRS, HURRICANE KATRINA: A NATION STILL UNPREPARED, S. REP. NO. 109-322, at 21, 60 (2006).

76. *Id.* at 37.

77. For an overview of the failures in planning the levee system, see JOHN MCQUAID & MARK SCHLEIFSTEIN, *PATH OF DESTRUCTION* 71-86 (2006).

78. Ken Wells, *Collapsing Marsh Dwarfs BP Oil Blowout as Ecological Disaster*, BLOOMBERG (Aug. 17, 2010 10:01 PM), <http://www.bloomberg.com/news/2010-08-18/collapsing-louisiana-marsh-dwarfs-bp-oil-blowout-as-environmental-disaster.html>.

the construction of these levees, wetlands have been “starved of sediment,” causing them to “become waterlogged, sink and die.”⁷⁹ Instead of periodically rebuilding wetlands after floods, the silt ends up uselessly collecting at the bottom of the Gulf of Mexico. Thus, efforts to reduce flooding in the Mississippi River basin have increased the risk of flooding along the coast of the Gulf of Mexico.

After Hurricane Katrina, it became apparent that the disappearance of the wetlands increased disaster risks to the region. Wetlands absorb the impact of storms, slowing them down once they make landfall.⁸⁰ For every 2.7 miles of wetlands, storm surges are reduced one foot.⁸¹ However, New Orleans is now increasingly exposed to violent storms because so many of the wetlands have collapsed, in part due to the levee system that surrounds the city.⁸² In addition, barrier islands provide protection for “half a million people from violent storms, along with an international commercial-industrial complex worth billions.”⁸³ Yet these barrier islands are rapidly disappearing.⁸⁴

Although it is unclear whether climate change contributed to Hurricane Katrina, the Intergovernmental Panel on Climate Change (IPCC) predicts that climate change will lead to future Katrinas. According to the IPCC, “[I]t is likely that future tropical cyclones (typhoons and hurricanes) will become more intense, with larger peak wind speeds and more heavy precipitation associated with ongoing increases of tropical sea surface temperatures.”⁸⁵ We know with somewhat more confidence that climate change will destroy the wetlands that buffer storm surges. Sea-level rise is one of the most predictable consequences of climate change.⁸⁶ Apart from the unknown contribution from melting ice sheets in Greenland and

79. *Id.*

80. Bob Sullivan, *Wetlands Erosion Raises Hurricane Risks*, MSNBC.COM (Aug. 29, 2005, 9:17 PM), <http://www.msnbc.msn.com/id/9118570/>.

81. *Id.*

82. *Id.*

83. VERCHICK, *FACING CATASTROPHE*, *supra* note 17, at 34.

84. *Id.* at 34–35.

85. INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (IPCC), *SUMMARY FOR POLICYMAKERS 15* (Susan D. Solomon et al. eds., 2007) (emphasis omitted).

86. *See, e.g.*, K. Hasselmann et al., *The Challenge of Long-Term Climate Change*, 302 *SCIENCE* 1923, 1924 (2003) (predicting a two-meter increase in sea level under a “business-as-usual” scenario by 2100, but only twenty centimeters under an optimum regulatory strategy).

Antarctica,⁸⁷ the simple change in temperature of the oceans will contribute to thermal expansion, just as increased temperature causes the mercury in a thermometer to rise.⁸⁸ This rise in sea level will result in loss of coastal lands,⁸⁹ increased exposure to flood damage, and other harms such as saltwater intrusion into estuaries and drinking-water supplies.⁹⁰

The Katrina disaster illustrates the close relationship between disaster law and land-use planning. A key method of mitigating disaster risks is to avoid putting people and key facilities in harm's way. Moreover, land-use controls can help maintain key buffers like coastal wetlands. In his Symposium contribution,⁹¹ Blake Hudson argues that the federal government needs to play more of a role in promoting sound land-use decisions, particularly in the context of long-term risks such as those created by climate change.⁹²

In all four of these disaster examples, we see a close relationship between a sudden, catastrophic event and a long-term environmental problem or regulatory failure. Good environmental law decreases the likelihood and severity of natural disasters. Failure to protect the environment has the converse effect. The greatest environmental problem of our time is climate change. Part B shows how climate change will bring environmental issues and disaster law closer together.

87. On the potential for catastrophic melting in these areas, see IPCC, *supra* note 85, at 15; NICHOLAS STERN, *THE ECONOMICS OF CLIMATE CHANGE* 16 (2007).

88. Changes in ocean temperature will also affect fish stocks. See Hans O. Pörtner & Rainer Knust, *Climate Change Affects Marine Fishes Through the Oxygen Limitation of Thermal Tolerance*, 315 *SCIENCE* 95, 95 (2007).

89. A. BARRIE PITTOCK, *CLIMATE CHANGE: TURNING UP THE HEAT* (2005), gives examples, including China, *id.* at 264; India, Pakistan and Bangladesh, *id.* at 267–68; and the United States, *id.* at 278.

90. See ELIZABETH KOLBERT, *FIELD NOTES FROM A CATASTROPHE: MAN, NATURE, AND CLIMATE CHANGE* 123–24 (2006) (describing a British governmental study indicating that what are now hundred-year floods could become routine by late in this century); see also PITTOCK, *supra* note 89, at 118 (stating that without adaptive measures, annual flood losses would increase from less than £1 billion to around £27 billion in different scenarios).

91. Blake Hudson, *Reconstituting Federalism to Address Transitory and Perpetual Disasters*, 2011 *BYU L. REV.* 1989.

92. *Id.* As Hudson points out, the federal government does not currently regulate land-use activities related to a variety of land-use related disasters. *Id.* at 1997. Examples include non-point source water pollution contributing to dead zones in the Gulf; local zoning schemes that place homes and businesses in the path of destructive fires, floods, and rising sea levels caused by climate change; the location of impervious surfaces that exacerbate flooding; and the urban heat island effect.

*B. The Climate-Change Nexus Between Environmental Law and
Disaster Law*

Environmental law and disaster law encounter each other most fully in the arena of adaptation to climate change. With rare exceptions, recent years rank at the top of the list of the warmest global temperatures since 1850,⁹³ and depending on future emissions and climate sensitivity, the world “will end up somewhere between 2 and 7°C warmer” than it is today.⁹⁴ Temperature change in the arctic will be about twice as large.⁹⁵ Even warming of 2°C, which may be the best we can hope for, would leave “the Earth warmer than it has been in several million years.”⁹⁶

Other changes are also foreseeable. Snow cover will decrease in most areas,⁹⁷ and oceans will become increasingly acidic.⁹⁸ Even moderate climate change will trigger significant extinctions,⁹⁹ and extreme events such as fires, floods, and heat waves will become more widespread.¹⁰⁰ Adaptation to these impending changes poses serious challenges.¹⁰¹ The Stern Review estimates that the cost of adapting infrastructure to “a higher-risk future could be \$15–150 billion each year (0.05–0.5% of GDP), with one-third of the costs borne by the US and one-fifth in Japan.”¹⁰² “Extreme events such as floods and droughts cause extensive damage to many parts of society, and thus a critical issue for adaptation is the degree to which frequency, intensity, and persistence of extreme events change.”¹⁰³

93. DAVID ARCHER & STEFAN RAHMSTORF, *THE CLIMATE CRISIS: AN INTRODUCTORY GUIDE TO CLIMATE CHANGE* 43 (2010).

94. *Id.* at 129.

95. *Id.* at 133.

96. *Id.* at 225.

97. *Id.* at 147.

98. *Id.* at 148.

99. *Id.* at 161–63.

100. *Id.* at 174. *See generally* HEIDI CULLEN ET AL., *THE WEATHER OF THE FUTURE* (2010). On the hurricane issues, see HOWARD C. KUNREUTHER ET AL., *AT WAR WITH THE WEATHER* 11–12 (2009) (discussing the impact of climate change on catastrophic weather events).

101. These challenges are discussed in U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-10-113, *CLIMATE CHANGE ADAPTATION: STRATEGIC FEDERAL PLANNING COULD HELP GOVERNMENT OFFICIALS MAKE MORE INFORMED DECISIONS* (2009), *available at* <http://www.gao.gov/new.items/d10113.pdf>; TIM BONYHADY, ANDREW MACINTOSH & JAN McDONALD, *ADAPTATION TO CLIMATE CHANGE: LAW AND POLICY* (2010).

102. STERN, *supra* note 87, at 473.

103. WILLIAM E. EASTERLING III, BRIAN H. HURD & JOEL B. SMITH, PEW CTR. ON

The United States will experience significant temperature changes.¹⁰⁴ Temperatures are expected to rise everywhere—but more inland than in coastal or southern areas of the continental United States—with the greatest increases in Northern Alaska.¹⁰⁵ In the Southeast, even though absolute changes will be smaller, the baseline is high, resulting in many more “very hot days” later in this century.¹⁰⁶ In the Midwest, urban life will be burdened “by increasing heat waves” and “decreased air quality.”¹⁰⁷

Sea-level rise due to climate change may cause dramatic losses in wetlands in the United States.¹⁰⁸ Two-thirds of all U.S. coastal wetlands would be lost with a one-meter rise in sea level.¹⁰⁹ This loss would be in addition to extensive past losses of wetlands in Louisiana¹¹⁰ and continued loss of lands from other causes like oil industry construction projects that trigger erosion. The salinity of remaining wetlands, estuaries and tidal rivers would also change.¹¹¹ Hurricanes, which may increase in intensity, result in further loss of coastal lands. Hurricane Katrina, for example, eliminated over two hundred square miles (roughly 500 km²) of wetlands.¹¹² What used to be a one hundred-year flood in New York City is now an eighty-year flood, and may even be a twenty-year flood by midcentury.¹¹³ Correspondingly, even more severe floods will become more frequent. Changes stemming from sea-level rise will not necessarily

GLOBAL CLIMATE CHANGE, COPING WITH GLOBAL CLIMATE CHANGE: THE ROLE OF ADAPTATION IN THE UNITED STATES 17 (June 2004), <http://www.pewclimate.org/docUploads/Adaptation.pdf>.

104. The most recent information about U.S. climate impacts can be found in U.S. GLOBAL CHANGE RESEARCH PROGRAM, GLOBAL CLIMATE CHANGE IMPACTS IN THE UNITED STATES (Thomas R. Karl et al. eds., 2009), *available at* <http://downloads.globalchange.gov/usimpacts/pdfs/climate-impacts-report.pdf> [hereinafter U.S. IMPACTS].

105. *See id.* at 29.

106. *Id.* at 111–12.

107. *Id.* at 117.

108. *See* Cat Lazaroff, *Climate Change Could Devastate U.S. Wetlands*, ENV'T NEWS SERV., Jan. 29, 2002, <http://www.ens-newswire.com/ens/jan2002/2002-01-29-06.asp> (detailing “the problems which rising sea levels could pose for coastal wetlands and estuarine systems”).

109. U.S. IMPACTS, *supra* note 104, at 84.

110. *Id.*

111. *Id.* at 114.

112. *Id.* at 115.

113. CULLEN ET AL., *supra* note 100, at 238.

be gradual. There could be sudden loss of protective lands that buffer storm surges or abrupt intrusions of salt water into aquifers.¹¹⁴

Sea-level rise will also cause other harms. Because the slope of coastal areas on the Atlantic and Gulf Coasts is low, a forty-centimeter rise in sea level could “result in as much as 60 meters of [beach] erosion” and may cost billions of dollars.¹¹⁵ Sea-level rise can result in widespread salt intrusion into aquifers, as well as severe beach erosion, wetlands loss, and flooding.¹¹⁶

Adaptation measures are needed to limit the impacts of these changes. The U.S. government is just beginning to address adaptation issues seriously, following most of a decade in which climate-change issues of all kinds were ignored or downplayed. President Obama appointed a task force composed of key federal agencies to investigate adaptation. The Task Force’s Report¹¹⁷ is a solid step forward in preparing the United States to deal with the challenges of climate change. There are three key recommendations relating to domestic adaptation measures at the federal level.

First, according to the Report, government adaptation to climate change needs to become a standard part of agency planning.¹¹⁸ The plans should focus on ecosystems rather than either individual species or governmental jurisdictions.¹¹⁹ An important recommendation is that “[a]daptation plans should prioritize helping people, places, and infrastructure that are most vulnerable to climate impacts. They should also be designed and implemented with meaningful involvement from all parts of society. Issues of inequality and environmental justice associated with climate change impacts and adaptation should be addressed.”¹²⁰ This recommendation has obvious relevance for disaster planning as well.

Second, the government needs to ensure that scientific information about the impacts of climate change is easily accessible

114. U.S. IMPACTS, *supra* note 104, at 115.

115. David A. Grossman, *Warming Up to a Not-So-Radical Idea: Tort-Based Climate Change Litigation*, 28 COLUM. J. ENVTL. L. 1, 12–14 (2003).

116. U.S. IMPACTS, *supra* note 104, at 114.

117. THE WHITE HOUSE COUNCIL ON ENVTL. QUALITY, PROGRESS REPORT OF THE INTERAGENCY CLIMATE CHANGE ADAPTATION TASK FORCE (Oct. 5, 2010), <http://tinyurl.com/3yj3sjx>.

118. *Id.* at 10, 25–26.

119. *Id.* at 22.

120. *Id.* at 21.

to decision makers.¹²¹ Without solid scientific information, public and private sector decision makers cannot plan intelligently. This effort would build on the U.S. Global Change Research Program and its National Climate Assessment.¹²² There is a similar need for public information regarding disaster risks.

Third, the government needs to address climate impacts that cut across agency jurisdictions and missions.¹²³ Unfortunately, this is the case for many of the main impacts, such as those that threaten water resources,¹²⁴ public health,¹²⁵ oceans and coasts,¹²⁶ and communities.¹²⁷ Some important arenas for agency action are to improve water-use efficiency,¹²⁸ strengthen public health systems,¹²⁹ integrate climate risks into insurance,¹³⁰ and develop an open-source risk assessment model.¹³¹

Disaster planning is increasingly connected with adaptation planning. In the coming era, disasters will come as “not single spies [b]ut in battalions,”¹³² resulting from interlinked changes in physical and ecological systems due to climate change. Thus, disaster planning will need to be part of a broader effort that takes into account climate change, natural capital, and societal resilience. As Rob Verchick and Abby Hall’s contribution to this Symposium explains, several significant pilot projects are underway.¹³³

In his contribution to this Symposium, Alex Camacho explores the coordination issues involved in climate adaptation, going beyond the Task Force recommendations by advocating the use of a virtual collaborative network or “collaboratory.”¹³⁴ He uses as examples two of the most advanced climate change adaptation initiatives by the

121. *Id.* at 30–33.

122. *See id.* at 23, 49.

123. *Id.* at 34.

124. *Id.* at 35–36.

125. *Id.* at 37–38.

126. *Id.* at 42–43.

127. *Id.* at 39–40.

128. *Id.* at 36.

129. *Id.* at 38.

130. *Id.* at 41.

131. *Id.* at 41–42.

132. WILLIAM SHAKESPEARE, *HAMLET*, act 4, sc. 5.

133. Robert R.M. Verchick & Abby Hall, *Adapting to Climate While Planning for Disaster: Footholds, Rope Lines, and Iowa Floods*, 2011 BYU L. REV. 2201.

134. Alejandro E. Camacho, *Building Capacity to Manage Climate Change through Adaptive and Collaborative Learning*, 2011 BYU L. REV. 1821.

federal government to date: the Environmental Protection Agency's Climate Ready Estuaries program and the Council on Environmental Quality's *Federal Agency Adaptation Planning Implementing Instructions*. Though better than the existing management framework, these initiatives do not yet provide the necessary framework that will help agencies and the public manage uncertainty. Camacho advocates the development of an interactive information-sharing network combined with systematic monitoring and adjustment of management decisions.

Symposium contributions by Lisa Grow Sun and Lesley McAllister explore two aspects of the connection between climate change mitigation: adaptation and disaster. Sun's article considers how efforts to create more compact communities in order to minimize carbon emissions from transportation can potentially make those communities more vulnerable to disasters.¹³⁵ Sun also points out that efforts to channel growth into existing cities (infill development) can increase disaster risks given the hazardous locations of some current cities and the tendency for redevelopment to favor waterfront locations. She recommends that the criteria for sustainability give more emphasis to disaster risks.¹³⁶

McAllister establishes a framework for considering climate adaptation issues when designing carbon reduction strategies.¹³⁷ She observes that mitigation strategies focus on the use of the market to coordinate mitigation efforts, whereas adaptation—like disaster law—uses multi-level coordination and planning to enhance impact/results, such as federal/state watershed plans.¹³⁸ Focusing on the electric power industry, she calls for adaptive mitigation with attention to whether a mitigation option conserves water resources, withstands disasters, or functions in spite of fuel shortages. She also calls for options that involve evaluation by various stakeholders, coordination across jurisdictions, and flexible management.¹³⁹

135. Lisa Grow Sun, *Smart Growth in Dumb Places: Sustainability, Disaster, and the Future of the American City*, 2011 BYU L. REV. 2155.

136. *Id.* at 2157.

137. Lesley McAllister, *Adaptive Mitigation in the Electric Power Sector*, 2011 BYU L. REV. 2113.

138. *Id.* at 2148.

139. *Id.* at 2149.

IV. WHAT ENVIRONMENTAL LAW CAN LEARN FROM DISASTER LAW

As the boundary between environmental law and disaster law begins to erode, environmental lawyers will also find that disaster law has insights to offer for more conventional environmental issues. As pointed out in Brigham Daniels' contribution to this Symposium, the link between disasters and climate change might reduce the risk that resistance to carbon regulation could cause a backlash against environmental law more generally.¹⁴⁰ Disaster law could also help broaden environmentalists' vision. Environmental law has tended to focus on discrete environmental problems. Disaster law necessarily focuses on broader social systems and circumstances. Part A will show that disaster law may offer insights into environmental justice that have not yet been appreciated. Part B shows how disaster law can direct attention beyond mitigating risk exposure to other mechanisms for coping with a hazardous world.

A. Risk and Inequality

Earthquakes and hurricanes are not, of course, the products of inequality; yet, their impacts can fall very unevenly on different segments of society.¹⁴¹ Equality issues were impossible to miss during the Hurricane Katrina disaster. Consider the New Orleans Superdome, which offered shelter of last resort: "The Dome was a brewing public health disaster. . . . the number of people inside had doubled in twenty-four hours, becoming a virtual city of twenty-thousand, overwhelmingly poor and African American."¹⁴² For days, it was "clear to anyone watching television that the majority of people trapped in New Orleans were African Americans, most from the low end of the income scale."¹⁴³ For "much of New Orleans'

140. Brigham Daniels, *Addressing Global Climate Change in an Age of Political Climate Change*, 2011 BYU L. REV. 1897.

141. For background on this problem, see DANIEL A. FARBER & JIM CHEN, *DISASTERS AND THE LAW: KATRINA AND BEYOND* 109–60 (2006). As the National Research Council (NRC) observes, some "population segments are more likely to experience casualties, property damage, psychological impacts, demographic impacts, economic impacts, or political impacts—as direct, indirect, or informational effects." NAT'L RESEARCH COUNCIL, *COMM. ON DISASTER RESEARCH IN THE SOC. SCIS., FACING HAZARDS AND DISASTERS* 73 (2006) [hereinafter NRC]. The NRC refers to this phenomenon as "social vulnerability." *Id.*

142. MCQUAID, *supra* note 77, at 235.

143. *Id.* at 300. Outside the city, in St. Bernard Parish, whites were more heavily impacted and many died. *Id.*

white population had departed before the storm hit, while the remainder lived in areas closer to dry land and found it easier to escape.”¹⁴⁴ Ultimately, the Congressional Research Service found that “an estimated 272,000 black people were displaced by flooding or damage, accounting for 73% of the population affected by the storm in the parish.”¹⁴⁵

The connection of race and poverty with evacuation rates was not unique to Katrina. As the National Research Council found:

[R]esearch has shown that different racial, ethnic, income, and special needs groups respond in different ways to warning information and evacuation orders Lower-income groups, inner-city residents, and elderly persons are more likely to have to rely on public transportation, rather than personal vehicles, in order to evacuate.¹⁴⁶

Both globally and within the United States, “social injustice contributes so heavily to the incidence and intensity of natural disasters that the quest for equality may be regarded as a valuable tool for improving disaster preparedness, response, mitigation, compensation, and rebuilding.”¹⁴⁷

The relationship between race, poverty, and disaster risk can be complex. For example, in 1995, over seven hundred Chicago residents died in a week-long heat wave.¹⁴⁸ African Americans were the group most at risk, being 1.5 times more likely to die than whites.¹⁴⁹ But Hispanics were the least likely of any group to be victims. Although their “overall level of poverty placed them at a heightened risk of mortality,” they “experienced a surprisingly low death rate.”¹⁵⁰ The reason for the contrast between the African American and Hispanic risk levels may be related to the social ecology of the neighborhoods where they live, with Hispanic neighborhoods being more likely to encourage the elderly to get out

144. *Id.*

145. THOMAS GABE, GENE FALK & MAGGIE MCCARTY, CONG. RESEARCH SERV., RL 33141, HURRICANE KATRINA: SOCIAL-DEMOGRAPHIC CHARACTERISTICS OF IMPACTED AREAS 16 (2005).

146. NRC, *supra* note 141, at 129.

147. FARBER, CHEN, VERCHICK, & SUN, *supra* note 16, at 204.

148. See ERIC KLINENBERG, HEAT WAVE 9 (2002) (“Between July 14 and 20, 739 more Chicago residents died than in a typical week for that month.”).

149. *Id.* at 18.

150. *Id.* at 19.

and connect with others.¹⁵¹ Social isolation is a critical risk factor in heat waves because isolated individuals are less likely to receive information about sources of help or to have family members or others check on them during the event.¹⁵²

Unequal disaster harms may follow class, gender, or racial lines, but other characteristics such as age also matter. Age is correlated with gender because women live longer, and with disability because the elderly have more health problems. The elderly are exposed to special risks. In the 1995 Chicago heat wave, almost three quarters of the victims were over sixty-five.¹⁵³ The elderly are also at higher risk from hurricanes:

During Hurricane Katrina the elderly and disabled died in the Convention Center and in their homes throughout the city of the symptoms of diseases such as asthma, diabetes, and high blood pressure that are easily managed under normal conditions but that become lethal when access to medicine and treatment is cut off.¹⁵⁴

Nearly half of the elderly living in the Katrina impact zone reported having at least one disability, and a quarter reported that their disability impaired their ability to leave their dwellings unassisted.¹⁵⁵ Not surprisingly, over forty percent of the dead were identified as over seventy-one years old.¹⁵⁶

Disaster inequality also has much in common with the issue of environmental justice. As one leading environmental law scholar has explained: “Minority interests have traditionally had little voice in the various points of influence that strike the distributional balances necessary to get environmental protection laws enacted, regulations promulgated, and enforcement actions initiated.”¹⁵⁷ He points out that the organizations most interested in environmental issues include a range of groups such as the Sierra Club and the Natural

151. *Id.* at 35.

152. *Id.* at 45–46.

153. *Id.* at 18–19.

154. Elizabeth Fussell, *Leaving New Orleans: Social Stratification, Networks, and Hurricane Evacuation* (June 11, 2011), <http://understandingkatrina.ssrc.org/Fussell/>.

155. FARBER & CHEN, *supra* note 141, at 139.

156. Audie Cornish, *Katrina Took Deadly Toll on Elderly* (NPR radio broadcast Mar. 5, 2006), transcript available at <http://tinyurl.com/4xhx9lc>.

157. Richard J. Lazarus, *Pursuing ‘Environmental Justice’: The Distributional Effects of Environmental Protection*, 87 NW. U. L. REV. 787, 812 (1993).

Resource Defense Council rather than civil rights groups.¹⁵⁸ Consequently, he observes, “the implications for racial minorities of environmental protection laws have not been a focal point of concern for any of these organizations.”¹⁵⁹

Environmental economics has also avoided engagement with issues of inequality. Indeed, advocates of cost-benefit analysis have actually defended the idea that it is preferable to have harm fall on the poor than on the rich. According to a leading academic who now heads the governmental agency in charge of cost-benefit analysis, the government should devote more resources and attention to saving the lives of rich people than poor people,¹⁶⁰ and perhaps more resources to whites than to racial minorities because of wealth differentials.¹⁶¹ This perspective is, of course, completely at odds with concerns about environmental justice.

Disasters illuminate some aspects of inequality that do not seem to have been considered extensively in the environmental literature. First, the dominant concern among advocates of environmental justice has been unequal exposure to risk. Exposure is an important concern, but the disaster experience also shows that vulnerability and access to resources are also important. For instance, in New Orleans, blacks lived in neighborhoods exposed to heavy flooding, but some affluent white neighborhoods were exposed as well. The difference was that the whites found it easier to evacuate.¹⁶² Similarly, even if exposure levels are not different, inner-city residents may have worse access to health care and may therefore suffer more from the effects of pollution than more affluent individuals. Different ethnic groups may also differ in the proportion of the population with health problems that may impair their ability to fend for themselves or that may worsen because of the disaster. Differential ability to cope with the harms of pollution may be as important as exposure levels. Thus, we should consider more than just whether exposure to pollution or toxic chemicals is higher in minority neighborhoods, because even lower levels of exposure may cause more harm to groups that lack adequate medical care or diet.

158. *Id.*

159. *Id.*

160. Cass R. Sunstein, *Valuing Life: A Plea for Disaggregation*, 54 DUKE L.J. 385, 390 (2004).

161. *See Lazarus, supra* note 157, at 114–15.

162. *See supra* text accompanying notes 143–45.

Second, environmental justice originally went under the banner “environmental racism.” But race is only one part of the equation. In addition, minority status does not always have clear-cut implications for disaster impacts. As disasters illustrate, the forms of inequality are more complex than any simple vision of social hierarchy. The elderly are not necessarily the subject of systematic societal oppression, but they were far more likely to die in the Chicago heat wave and in Katrina. Hispanics and African Americans are both disadvantaged in Chicago, but they had very different experiences in the heat wave. In considering differential effects from pollution or toxics exposure, we should expect to see equally rich variation. A reductionist white-versus-minority model may miss other important forms of inequality or nuanced differences between minority groups.

Thus, consideration of disasters can help provide environmental law with a much richer vision regarding inequality. The reason is simply that victimhood is so much easier to observe in the disaster setting, allowing a much fuller picture of who is exposed to hazards, their vulnerability, and their ability to recover. The same factors are relevant to environmental law, however, even if they are less obvious.

B. Compensation and Restoration

Victim compensation is a central focus of disaster law. Postdisaster compensation to disaster victims generally takes one of three forms: “private insurance, government programs, or the tort system.”¹⁶³ The legal system provides a mix of public and private sector methods for compensating victims of natural disasters. Each of the methods that have been used to provide compensation for catastrophic risks has its limitations.

The first method of compensation is private insurance. However, the unavailability of insurance for catastrophic risks (due to expense or underwriting risks), exclusion of catastrophic risks by contract, and the difficulty of handling very large numbers of claims create significant hurdles. Insurance is not commonly considered as a way of dealing with risks in the area of environmental law, perhaps because the harm generally relates to health rather than property. But it may not always be feasible to eliminate environmental risks, and insurance could provide a useful backup.

163. FARBER & CHEN, *supra* note 141, at 161.

The second method of compensation, litigation against responsible private parties, also has its limitations: the need for proof of negligence or some other basis for liability, limits on the financial assets and insurance coverage of potential defendants, and other judicial doctrines limiting recovery. Toxic torts remains a relatively secondary area of environmental law, with the main focus being on regulation or cleanup to reduce risks.

Third is the possibility of obtaining compensation from the government through various routes: tort claims against federal or state government for negligence (subject to immunity defenses), claims under special compensation schemes for particular disasters, and claims based on constitutional provisions requiring compensation for the taking (or in some states, damaging) of property. In addition, the United States government provides flood insurance.¹⁶⁴ We have no similar system of insurance for other hazards.

In a sense, it is a mistake to speak of a “system” of compensation for catastrophic losses. Instead, our society has a makeshift assembly of jerry-rigged components:

In the final analysis, the U.S. has what might well be termed a patchwork system for providing financial compensation for catastrophic loss Inevitably, in such a multifaceted milieu, where the tendency has been to develop discrete schemes in response to particularized categories of disasters (or rely on general welfare schemes that were enacted without disaster relief in mind), there will be ongoing fine-tuning of the system and a continuing dialogue over the efficacy of the measures in place.¹⁶⁵

Recovery is also a key part of disaster law. The process can be difficult and lengthy. A decade after a major earthquake, recovery in Kobe, Japan was still incomplete.¹⁶⁶ Recovery in New Orleans from Hurricane Katrina has also been a complex and protracted process.¹⁶⁷ Besides the physical task of rebuilding, communities also face the

164. For a discussion of the system and issues about its functioning, see Erwann O. Michel-Kerjan, *Catastrophe Economics: The National Flood Insurance Program*, 24 J. ECON. PERSP. 165 (2010).

165. Robert L. Rabin & Suzanne A. Bratis, *United States*, in 14 TORT AND INSURANCE LAW: FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES: A COMPARATIVE APPROACH 303, 356 (Michael Faure & Ton Hartlief eds., 2006).

166. FARBER, CHEN, VERCHECK & SUN, *supra* note 16, at 368.

167. RICHARD CAMPANELLA, BIENVILLE'S DILEMMA 351-54 (2008).

question of whether to require builders to take certain measures to mitigate future risks.¹⁶⁸

With the exception of oil spills and toxic cleanup, environmental law seldom focuses on compensation or recovery. Admittedly, those are major exceptions, such as the twenty billion dollar compensation fund established after the BP *Deepwater Horizon* spill.¹⁶⁹ The complex problems posed by climate change combine traditional issues of pollution control with the sorts of complex issues regarding compensation, insurance, and resilience that have been more typical of disasters. This may encourage closer attention to recovery and compensation issues in environmental law.

This point deserves elaboration. Although reducing carbon emissions is indispensable, some degree of climate change is inevitable. Mitigation may affect the degree of adaptation that is ultimately required, but whatever mitigation measures are adopted, a significant degree of climate change seems unavoidable.¹⁷⁰ As the IPCC explains, “warming and sea level rise would continue for centuries due to the time scales associated with climate processes and feedbacks, even if greenhouse gas concentrations were to be stabilized.”¹⁷¹ Thus, unlike conventional pollution, controlling the sources of the problem will not eliminate the potential for harm. Defensive measures (adaptation) to prevent harm are also needed, just as such measures are needed for natural disasters. In both situations, there are limits to the effectiveness of defensive measures. Environmental law will then need to consider the possibility of compensating or insuring victims of harm for residual risks from climate change. There are some valuable lessons to be learned about compensation systems from disaster law.

V. CONCLUSION

We can consider an environmental disaster to be one that destroys important environmental amenities or one in which harm to human interests is mediated by an environmental change. The BP oil

168. Anna K. Schwab & David J. Brower, *Increasing Resilience in Natural Hazards: Obstacles and Opportunities for Local Governments under the Disaster Mitigation Act of 2000*, in NOLON & RODRIGUEZ, *supra* note 17, at 281.

169. Hirokawa, *supra* note 13, at 544.

170. Indeed, some effects of climate change are already being seen. See IPCC, *supra* note 85.

171. *Id.* at 16.

spill easily fits both criteria: it was harmful to natural ecological systems, and the harm was mediated by water pollution. The 2003 European heat wave also damaged natural systems, and it was at least made much more likely by human changes in the Earth's atmosphere. The tsunami was not caused by human activities, but the ensuing nuclear reactor failures were as much a failure of effective regulation as they were the effect of the tsunami itself.

In the era of climate change, environmental law will no longer be able to marginalize disaster law as a distant cousin. Disasters, both natural and human-induced, are an increasingly common feature of twenty-first century life; appropriate legal guidance can ensure that disasters are anticipated and contained in a comprehensive and equitable manner. Disaster law is a complex, multi-faceted, and rapidly expanding body of thought, one that addresses the dire need for a systematic, thoughtful approach to managing the chaos of disasters.

As academics, we should lead in developing a coherent intellectual map of the sprawling legal landscape that will guide the near-term and long-term future of disaster law scholarship and dialogue. Over time, scholars hopefully will further refine and explore the wide variety of avenues for research within the field, and will continue to influence disaster prevention, response, and management policy for the better.

The ultimate goal, of course, is not merely intellectual achievement but to improve society's ability to cope with risks. The linkage between legal scholarship and real-world change can be tenuous and difficult to trace. But work on environmental disasters provides something rare in legal scholarship: the possibility, however small, of helping to save lives and guard against catastrophe.

APPENDIX:

Selected Post-2005 Law Review Publications on Disaster Law

1. Abbott, Ernest B., *Law, Federalism, the Constitution, and Control of Pandemic Flu*, 9 ASIAN-PAC. L. & POL'Y J. 185 (2008).
2. Carlson, Ann E., *Heat Waves, Global Warming, and Mitigation*, 26 UCLA J. ENVTL L. & POL'Y 169 (2008).
3. Condon, Bradley J. & Tapen Sinha, *The Effectiveness of Pandemic Preparations: Legal Lessons from the 2009 Influenza Epidemic*, 22 FLA. J. INT'L L. 1 (2010).
4. Cords, Danshera, *Charitable Contributions for Disaster Relief: Rationalizing Tax Consequences and Victim Benefits*, 57 CATH. U. L. REV. 427 (2008).
5. Depoorter, Ben, *Horizontal Political Externalities: The Supply and Demand of Disaster Management*, 56 DUKE L.J. 101 (2006).
6. Duhart, Olympia, *Improving the Odds of Government Accountability in the Disaster-Prone Era: Using the 9/11 Fund Factors to Remedy the Problem of Toxic Katrina Trailers*, 24 J. LAND USE & ENVTL. L. 253 (2009).
7. Ekins, Matthew D., *Large-Scale Disasters Attacking the American Dream: How to Protect and Empower Homeowners and Lenders*, 30 W. NEW ENG. L. REV. 351 (2008).
8. Farber, Daniel A., *Disaster Law and Inequality*, 25 LAW & INEQ. 297 (2007).
9. Farber, Daniel A. et al., *Reinventing Flood Control*, 81 TUL. L. REV. 1085 (2007).

10. Farber, Daniel A., *Tort Law in the Era of Climate Change, Katrina, and 9/11: Exploring Liability for Extraordinary Risks*, 43 VAL. U. L. REV. 1075 (2009).
11. Feinberg, David L., *Hurricane Katrina and the Public Health-Based Argument for Greater Federal Involvement in Disaster Preparedness and Response*, 13 VA. J. SOC. POL'Y & L. 596 (2006).
12. Gould, Charles W., *The Right to Housing Recovery After Natural Disasters*, 22 HARV. HUM. RTS. J. 169 (2009).
13. Griffin, Stephen M., *Stop Federalism Before It Kills Again: Reflections on Hurricane Katrina*, 21 ST. JOHN'S J. LEGAL COMMENT. 527 (2007).
14. Greenberger, Michael, *Yes, Virginia: The President Can Deploy Federal Troops to Prevent the Loss of a Major American City from a Devastating Natural Catastrophe*, 26 MISS. C. L. REV. 107 (2006).
15. Hausrath, Katherine, *Tough Love: Should We Analyze Federal Emergency Management Agency Disaster Planning Under the National Environmental Policy Act?*, 13 HASTINGS W.-N.W. J. ENVTL. L. & POL'Y 161 (2007).
16. Hodge, Jr., James G. et al., *Principles and Practice of Legal Triage During Public Health Emergencies*, 64 N.Y.U. ANN. SURV. AM. L. 249 (2008).
17. Hodge, Jr., James G. et al., *The Legal Framework for Meeting Surge Capacity Through the Use of Volunteer Health Professionals During Public Health Emergencies and Other Disasters*, 22 J. CONTEMP. HEALTH L. & POL'Y 5 (2005).
18. Hoffman, Sharona, *Preparing for Disaster: Protecting the Most Vulnerable in Emergencies*, 42 U.C. DAVIS L. REV. 1491 (2009).

19. Hoffmeister, Thaddeus, *The Transformative Power of Law: An Insurrection Act for the Twenty-First Century*, 39 STETSON L. REV. 861 (2010).
20. Hooks, Jonathan P. & Trisha B. Miller, *The Continuing Storm: How Disaster Recovery Excludes Those Most in Need*, 43 CAL. W. L. REV. 21 (2006).
21. Houck, Oliver A., *Retaking the Exam: How Environmental Law Failed New Orleans and the Gulf Coast South and How It May Yet Succeed*, 81 TUL. L. REV. 1059 (2007).
22. Hudson, Blake, *Reconstituting Federalism to Address Transitory and Perpetual Disasters*, 2011 BYU L. REV. (forthcoming 2012).
23. Klein, Christine A. & Sandra B. Zellmer, *Mississippi River Stories: Lessons from a Century of Unnatural Disasters*, 60 SMU L. REV. 1471 (2007).
24. Kunreuther, Howard C. & Erwann O. Michel-Kerjan, *Climate Change, Insurability of Large-Scale Disasters, and the Emerging Liability Challenge*, 155 U. PA. L. REV. 1795 (2007).
25. Kuo, Susan S., *Speaking in Tongues: Mandating Multilingual Disaster Warnings in the Public Interest*, 14 WASH. & LEE J. CIVIL RTS. & SOC. JUST. 3 (2007).
26. Kysar, Douglas A. & Thomas O. McGarity, *Did NEPA Drown New Orleans? The Levees, the Blame Game, and the Hazards of Hindsight*, 56 DUKE L.J. 179 (2006).
27. Lazarus, Richard J., *Environmental Law After Katrina: Reforming Environmental Law by Reforming Environmental Lawmaking*, 81 TUL. L. REV. 1019 (2007).
28. Lempert, Richard, *Low Probability/High Consequence Events: Dilemmas of Damage Compensation*, 58 DEPAUL L. REV. 357 (2009).

29. Moreteau, Oliver, *Catastrophic Harm in United States Law: Liability and Insurance*, 58 AM. J. COMP. L. 69 (2010).
30. Morin, Laurie A., *A Tale of Two Cities: Lessons Learned from New Orleans to the District of Columbia for the Protection of Vulnerable Populations from the Consequences of Disaster*, 12 UDC/DCSL L. REV. 45 (2009).
31. Nicholson, William C., *Obtaining Competent Legal Advice: Challenges for Emergency Managers and Attorneys*, 46 CAL. W. L. REV. 343 (2010).
32. Pogue, Eric R., *The Catastrophe Model of Risk Regulation and the Regulatory Legacy of Three Mile Island and Love Canal*, 15 PENN ST. ENVTL. L. REV. 463 (2007).
33. Rapp, Geoffrey, *Gouging: Terrorist Attacks, Hurricanes, and the Legal and Economic Aspects of Post-Disaster Price Regulation*, 94 KY. L.J. 535 (2005–06).
34. Richmond, Douglas R., *Insurance and Catastrophe in the Case of Katrina and Beyond*, 26 MISS. C. L. REV. 49 (2006).
35. Robbins, Ira P., *Lessons From Hurricane Katrina: Prison Emergency Preparedness as a Constitutional Imperative*, 42 U. MICH. J.L. REFORM 1 (2008).
36. Silber, Norman I., *Thriving on Adversity: Corporate Treatment and Mistreatment of Consumers in the Wake of Hurricane Katrina*, 22 LOY. CONSUMER L. REV. 139 (2009).
37. Sun, Lisa Grow, *Disaster Mythology and the Law*, 96 CORNELL L. REV. 1131 (2011).
38. Tolan, Jr., Patrick E., *Tax and Insurance Consequences of Major Disasters: Weathering the Storm*, 31 NOVA L. REV. 487 (2007).

39. Tolan, Jr., Patrick E., *The Flurry of Tax Law Changes Following the 2005 Hurricanes: A Strategy for More Predictable and Equitable Tax Treatment of Victims*, 72 BROOK. L. REV. 799 (2007).
40. Torrance, Andrew W., *Patents to the Rescue—Disasters and Patent Law*, 10 DEPAUL J. HEALTH CARE L. 309 (2007).
41. Verchick, Robert R.M., *Katrina, Feminism, and Environmental Justice*, 13 CARDOZO J.L. & GENDER 791 (2008).
42. Volpe, Maria R., *Taking Stock: ADR Responses in Post-Disaster Situations*, 9 CARDOZO J. CONFLICT RESOL. 381 (2008).
43. Waysdorf, Susan, *Returning to New Orleans: Reflections on the Post-Katrina Recovery, Disaster Relief, and the Struggle for Social Justice*, 12 UDC/DCSL L. REV. 3 (2009).
44. Weeks, Elizabeth, *Lessons from Katrina: Response, Recovery and the Public Health Infrastructure*, 10 DEPAUL J. HEALTH CARE L. 251 (2007).
45. Weeks, Elizabeth, *After the Catastrophe: Disaster Relief for Hospitals*, 85 N.C. L. REV. 223 (2006).
46. Wilkinson, Major Kevin J., *More Effective Federal Procurement Response to Disasters: Maximizing the Extraordinary Flexibilities of IDIQ Contracting*, 59 A.F. L. REV. 231 (2007).
47. Wildermuth, Amy J., *The Legacy of Exxon Valdez: How Do We Stop the Crisis?*, 7 ST. THOMAS L.J. 130 (2009).
48. Winston, Pamela et al., *Federalism After Hurricane Katrina: How Can Social Programs Respond to a Major Disaster?*, 81 TUL. L. REV. 1219 (2007).

49. Wood, Diane P., *The Bedrock of Individual Rights in Times of Natural Disaster*, 51 HOW. L.J. 747 (2008).