INTRODUCTION: LEGAL SCHOLARSHIP, THE DISASTER CYCLE, AND THE FUKUSHIMA ACCIDENT

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There is no gainsaying the importance of the subject of this Symposium. Year after year, disasters exact a toll on our society. This Symposium marks significant advances in our understanding of the legal system's role in managing disaster risks.

The figures are sobering. According to a nationwide database of U.S. disaster losses, disaster costs have averaged twelve billion dollars per year over the past half-century.[1] From 1980 through 2004, the U.S. experienced sixty-two weather events causing an average of a billion dollars or more in damages.[2] Averages, however, are misleading—Hurricane Katrina alone caused about $100 billion in direct damage.[3] Losses are highly skewed, with the top twenty percent of the most destructive events accounting for eighty percent of the damages.[4] These mega-disasters pose unique challenges to the legal system.

This Symposium reflects an increasing recognition of the role the legal system plays in disaster prevention, response, and recovery.[5]

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1. Carolyn Kousky, *Informing Climate Adaptation: A Review of the Economic Costs of Natural Disasters, Their Determinants, and Risk Reduction Options* 14 (Res. for the Future Discussion Paper No. 12-28, 2012). Kousky discusses the data and methodological issues involved in such estimates in detail. *Id.* at 11–13.

2. JAMES F. MISKEL, DISASTER RESPONSE AND HOMELAND SECURITY: WHAT WORKS, WHAT DOESN'T 25 (Stanford Security Studies 2008) (2006) (citing *Nat'l Climatic Data Ctr., Billion Dollar Weather/Climate Disasters*, NAT'L OCEANOGRAPHIC & ATMOSPHERIC ADMIN., http://www.ncdc.noaa.gov/oa/reports/billionz.html#chron (last updated Apr. 24, 2012)).

3. *Id.* at 99.

4. Kousky, *supra* note 1, at 16.

5. For a discussion of these issues, *see generally* DANIEL A. FARBER, JIM CHEN, ROBERT R.M. VERCHICK, & LISA GROW SUN, DISASTER LAW AND POLICY (2d ed. 2010).

Since Hurricane Katrina, which revealed a disturbing lack of preparation to handle disasters, a growing community of scholars has focused on disaster law. This emerging legal field seeks to inform and improve disaster-related decisionmaking, as evidenced by a spate of recent books[6] and a rapidly expanding number of law review articles on the subject.[7]

This Symposium features prominent examples of legal scholarship's ability to illuminate—and hopefully help to reform—the network of legal rules and institutions that deals with disaster risks. We can learn a great deal about the nature of this network and about the significance of the Symposium contributions by considering the events surrounding the Fukushima meltdown.

In this Introduction, I will put the Symposium articles in context by setting them within the disaster cycle, as exemplified by the recent Fukushima disaster. The disaster cycle provides a unifying framework for disaster law. I will begin by explaining the disaster cycle and its significance for understanding disaster policy. I will then go through the major stages of the cycle, showing how the Symposium articles help illuminate the situation facing Japan after the Fukushima accident.

I. THE DISASTER CYCLE AS A UNIFYING FRAMEWORK

As shown by the following figure, the disaster cycle delineates a set of strategies including mitigation, emergency response, compensation, and rebuilding, with rebuilding completing the circle by including (or failing to include) mitigation measures:[8]

6. *See, e.g.*, *id.*; ENVTL. LAW INST., LOSING GROUND: A NATION ON EDGE (John R. Nolon & Daniel B. Rodriguez eds., 2007); ROBERT R.M. VERCHICK, FACING CATASTROPHE: ENVIRONMENTAL ACTION FOR A POST-KATRINA WORLD (2010); NAN D. HUNTER, THE LAW OF EMERGENCIES: PUBLIC HEALTH AND DISASTER MANAGEMENT (2009).

7. 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 23 documents; for 2007–2012, the search produced 131 documents (search of JLR database on Aug. 1, 2012). A search for "Hurricane Katrina" in the same database on August 1, 2012 produced 3997 documents, of which 128 had the term in their titles.

8. FARBER ET AL., *supra* note 5, at 3.

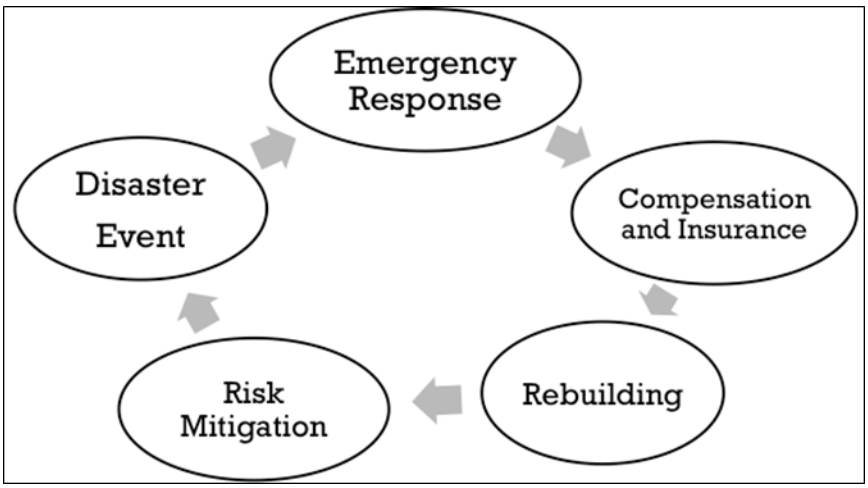

Fig 1. The Cycle of Disaster Law.[9]

Each stage of the circle of disaster—mitigation, emergency response, insurance/liability compensation, rebuilding—is part of society's risk management portfolio. In the popular mind, the focus may be on the drama of the disaster itself and the immediate emergency response. But this focus can be quite misleading.

In reality, the emergency response is only one part of the risk management portfolio. Each stage of the disaster cycle offers opportunities to reduce the social costs of disasters. If we begin in the lower corner of the figure, mitigation efforts attempt to lessen the potential impact of disaster events before disaster strikes. Successes and failures at this stage can spell the difference between a routine disruption and a major catastrophe. As early as Rousseau, scholars understood the connection between land-use decisions and disaster impacts.[10] The significance of the emergency response needs no explanation. After the emergency has passed, insurance, tort law, and government disaster assistance provide ways of spreading and shifting risks. When we cannot (or simply do not) mitigate risks before the

9. Verchick's version of this chart is similar but uses slightly different phrasing and omits the event itself as a node. *See* Robert R.M. Verchick, *Disaster Justice: The Geography of Human Capability*, 23 DUKE ENVTL. L. & POL'Y F. 23, 27 fig.1 (2012).

10. *See* Verchick, *supra* note 9, at 32 (discussing Rousseau's letter to Voltaire which argued, in part, that if the population of Lisbon had been more uniformly distributed when the earthquake of 1755 struck, "the damage would have been much less") (quoting Russell R. Dynes, *The Dialogue between Voltaire and Rousseau on the Lisbon Earthquake: The Emergence of a Social Scientific View*, 18 INT'L J. MASS EMERGENCIES & DISASTERS 97, 106 (2000)).

event, or avoid them through swift response afterwards, these compensation mechanisms can help blunt the impact and prepare for reconstruction or rebuilding. Rebuilding has significance in its own right, but in some sense it is also just the beginning of a new cycle—inasmuch as it incorporates mitigation efforts for the next disaster down the road.

The cycle would have limited interest if it merely represented a chronology of unrelated events and actions. But complex interactions and structures characterize both the disaster cycle and its components. Risk mitigation involves a sub-cycle of interconnected strategies, while disaster response involves careful institutional design that takes place before the event, and recovery involves the interplay between funding mechanisms (some private, some state or federal) and local government efforts. Other fields of law may touch on parts of the puzzle (e.g., state and local government law, insurance law, land use law, tort law), but miss the larger picture that is incorporated into the concept of the disaster cycle.

An advantage of using the disaster cycle as a framework is that the emergency response, which usually gets the lions' share of attention, is put into context. Risk mitigation failures often contribute to the impact of the later disaster, turning an otherwise manageable event into a more serious risk to life or property, or amplifying what would otherwise be a less significant risk to calamitous proportions. Post-emergency compensation mechanisms and rebuilding are as important as the emergency response in determining the severity of the impact on many victims.

The disaster cycle is also important because no one stage can be considered in isolation. For instance, the appropriate degree of risk mitigation may depend on expectations about emergency response. If project planners assume that a disaster will lead to successful evacuation, they will downplay potential risks to life in their planning. On the other hand, if disaster responders assume that risk mitigation will be successful, they will make less of an investment in planning for an emergency response, and the response will focus on those risks that could not be effectively mitigated in advance. Similarly, if insurance coverage is universal, project planners will not have to consider risk aversion in choosing mitigation measures, and they may find it less important to invest in preventing certain kinds of property harm.

Finally, the disaster cycle is illuminating simply because the loop is closed. It is always tempting to downplay the risk of future disasters

after a disaster has taken place. For instance, we might like to believe that the U.S. Gulf Coast will never be hit by another Katrina or BP oil spill, or that Fukushima was a unique example of a severe natural disaster impacting a nuclear power plant. But risks of this kind do not disappear. Every disaster merely begins the cycle again, calling for a new round of risk mitigation.

As we will see, the Fukushima disaster involved serious problems at every stage of the cycle. The articles in this Symposium provide a source of insight at each of these stages. I will begin with the issue of risk mitigation before the event. The outlines of the disaster are commonly known, but more details will be developed in the course of discussing the emergency response. Proceeding clockwise through the disaster cycle illustrated in the figure above, I will then briefly discuss the compensation and insurance issues, and what we can foresee in terms of rebuilding after Fukushima. At each stage, the Symposium contributions are relevant, highlighting failures at Fukushima or pointing toward future reforms.

II. RISK MITIGATION

The most effective emergency response is that which is never needed because the emergency is forestalled. However well-executed an emergency response might be, it is always better if there is no emergency to respond to, or if a disaster is small rather than large. As we will see, the Fukushima accident involved some serious lapses in risk assessment and risk management, and the articles in the Symposium help shed light on these issues.

The damage wrought by a natural event—extreme weather or earthquakes, for example—is linked with human agency and manipulation of the natural environment, both at the site of the disaster itself and more generally due to anthropogenic climate change. It is almost a cliché in the field that there is no such thing as a truly natural disaster. Physical "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."[11] Therefore, the study of disaster must arguably begin with a definition of the term "disaster" as an event with *both* natural and artificial

11. Daniel A. Farber, Robert G. Bea, Karlene Roberts, Edward Wenk & Kofi Inkabi, *Reinventing Flood Control*, 81 TUL. L. REV. 1085, 1089–90 (2006).

(human-induced) causes, or perhaps with solely artificial causes, as in the case of terrorism events.

The Fukushima accident is a prime example of how risk mitigation failures and natural events interact with horrendous results. During the Fukushima nuclear crisis, government officials and industry representatives said that the tsunami that struck the reactors was beyond imagination, thus excusing their failure to consider such a risk in the planning process.[12] As it turns out, there actually had been warnings about the possibility of a tsunami of this magnitude, but the warnings were ignored.[13]

The reactors were situated on a small bluff, which was thought to provide sufficient protection from tsunamis.[14] History indicated otherwise. There is a historical record of a huge tsunami in July of 869 and geological evidence indicating a thousand-year return cycle.[15] Indeed, in 2008, experts at TEPCO (the Tokyo Electric Power Company) had performed some preliminary modeling suggesting that the tsunami hazard was much greater than its previous estimate.[16] Until 2006, the government did not even discuss tsunamis in its safety guidelines, and even then it insisted that the "robust sealed containment structure around the reactor itself would prevent any damage to the nuclear part of the reactor from a tsunami . . . No radiological hazard would be likely."[17]

This confidence in seismological safety would have been hard to support even when the statement was made, but within a year it would be definitively rebutted. On July 16, 2007, an earthquake damaged the Kashiwazaki-Kariwa Nuclear Power Plant. The designers had used the historical record and added a margin of safety—but still reached only forty percent of the actual quake

12. Rodney C. Ewing & Jeroen Ritsema, *Underestimating Nuclear Accident Risks: Why Are Rare Events So Common?*, BULL. ATOMIC SCIENTISTS (May 3, 2011), http://www.thebulletin.org/web-edition/roundtables/fukushima-what-dont-we-know.

13. *Id.*

14. *Id*.

15. *Id.*

16. James M. Acton & Mark Hibbs, *Why Fukushima was Preventable*, THE CARNEGIE PAPERS, Mar. 2012, at 1, 13 (citing Jin Nishikawa & Eisuke Sasaki, *TEPCO Warned of Big Tsunami 4 Days Prior to March 11*, THE ASAHI SHIMBUN: ASIA & JAPAN WATCH (Aug. 25, 2011), http://ajw.asahi.com/article/0311disaster/quake_tsunami/AJ201108257639), *available at* http://carnegieendowment.org/2012/03/06/why-fukushima-was-preventable.

17. Charles Perrow, *Fukushima, Risk, and Probability: Expect the Unexpected*, BULL. ATOMIC SCIENTISTS (Apr. 2011), http://thebulletin.org/web-edition/features/fukushima-risk-and-probability-expect-the-unexpected.

strength.[18] Apparently, what they thought were three small faults were actually part of one large fault.[19] The accident also involved unforeseen mechanisms of harm. One company official said, "It was beyond our imagination that a space could be made in the hole on the outer wall for the electric cables."[20] This event should have been a warning about the unreliability of seismic predictions, the potential for unprecedented harm mechanisms, and the need to widen "imagination" beyond the comfort zone of well-documented risks. Yet officials and industry continued as if they had a full understanding of all the risks, rather than realizing the need for additional precaution.

Some investigators reported that the earthquake, even without the supposedly unexpected tsunami, had been enough to trigger fuel meltdowns at Fukushima.[21] Whether the cause was the earthquake itself or the subsequent tsunami, company and government officials were surely on notice of the dangers of overconfidence and the potential for severe events outside of recent historical experience.

Flaws in the regulatory structure may have further fostered the officials' complacency before Fukushima. Critics point to the "extremely fragmented" nature of the Japanese nuclear regulatory system.[22] They also point to the "close rapport between officials and industry"—as exemplified by the fact that "thirteen former high-ranking bureaucrats were members of the boards of directors in the power companies."[23] The head of the regulatory commission held a university chair endowed by TEPCO and may have received research grants from the company.[24]

The cozy relationship between the industry and regulators may have contributed to complacency and overconfidence about the future and the corresponding failure to anticipate the severity of future disaster risks. But these problems are far from being unique to

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18. Ashwin Kumar & M.V. Ramana, *Nuclear Safety Lessons from Japan's Summer Earthquake*, BULL. ATOMIC SCIENTISTS (Dec. 4, 2007), http://www.thebulletin.org/web-edition/features/nuclear-safety-lessons-japans-summer-earthquake.

19. *Id.*

20. *Id.*

21. Verchick, *supra* note 9, at 37.

22. Akira Nakamura & Masao Kikuchi, *What We Know, and What We Have Not Yet Learned: Triple Disasters and the Fukushima Nuclear Fiasco in Japan*, 71 PUB. ADMIN. REV. 893, 897 (2011).

23. *Id*.

24. *Id*.

Fukushima or to Japanese regulators. We can readily find examples closer to home.

In his contribution to this Symposium, Dan Tarlock points to a similar failure of risk assessment in terms of U.S. flood control policy and law. He argues that U.S. flood policies are out of sync with climate change, which will amplify future risks outside of historic patterns.[25] Among other reforms, he seconds the EU Flood Directive's call for scenario planning, including consideration of low-probability extreme events, medium-probability events, and routine events.[26]

When a disaster proves that risk assessments and mitigation methods were inadequate, reforms such as those that Tarlock recommends would seem necessary. Again, Fukushima is an apt example. Regulatory failure was part of the Fukushima story. Experts point to a "growing body of evidence that suggests the accident was the result of failures in regulation and nuclear plant design and that both were lagging behind international best practices and standards."[27] Not surprisingly, following the Fukushima accident, "there has been much more extensive domestic and international criticism of the Japanese regulatory system."[28] But whether real reform will result is unclear.

The political dynamics of post-disaster reform efforts can be complex. The Symposium article by Tom McGarity and Rena Steinzor examines the dynamics of post-disaster reform in the context of the contemporary United States.[29] They focus on a case study of coal ash retention ponds and a 2008 disaster in Tennessee. Calling the Tennessee event a "preventable disaster," they explore the catastrophe, EPA's failure to anticipate and prevent it, and EPA's tepid response to it.[30] We will return to this issue in Part IV. But first we need to consider the intermediate portions of the disaster cycle, beginning with the emergency response.

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25. A. Dan Tarlock, *United States Flood Control Policy: The Incomplete Transition from the Illusion of Total Protection to Risk Management*, 23 DUKE ENVTL. L. & POL'Y F. 151, 171–76 (2012).

26. *Id*.

27. Acton & Hibbs, *supra* note 16, at 3.

28. *Id*. at 24.

29. *See generally* Thomas O. McGarity & Rena I. Steinzor, *The End Game of Deregulation: Myopic Risk Management and the Next Catastrophe*, 23 DUKE ENVTL. L. & POL'Y F. 93 (2012).

30. *Id.*

III. THE DISASTER AND EMERGENCY RESPONSE PHASES

Center stage in a disaster story is always taken by the event itself and the emergency response. This section opens with a description of the Fukushima disaster and response. Although officials undoubtedly tried to do as well as they could under extremely difficult circumstances, the response fell short in key respects. We will consider some of the specific issues relating to the emergency response that are illuminated by articles in the Symposium.

A. The Unfolding Fukushima Disaster and Emergency Response

We begin with the natural disaster preceding the reactor failures. On March 11, 2011, in an event that is now known in Japan as 3/11, a 9.0 magnitude earthquake struck off the east coast of Japan, about one-hundred miles east-northeast of Fukushima and two-hundred miles northeast of Tokyo.[31] The earthquake triggered a large tsunami that overwhelmed seawalls and contributed to massive destruction.[32] As a direct result of the earthquake and tsunami, over 15,000 people were killed and 340,000 were displaced.[33] The tsunami and earthquake struck quickly, but other portions of the disaster were only beginning to unfold.

During the earthquake, the Fukushima Dai-ichi nuclear power station lost outside power—the station no longer had a connection to the electrical grid. Backup diesel generators came on to supply the missing power needed to maintain the cooling system. The Dai-ni plant did not lose power but did face degraded safety systems.[34] About forty-six minutes after the quake, the first waves of an enormous tsunami reached the Fukushima Dai-ichi power station.[35] The tsunami measured about forty-five feet high at the Dai-ichi

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31. *Magnitude 9.0 – Near the East Coast of Honshu, Japan*, U.S. GEOLOGICAL SURVEY (Mar. 11, 2011, 05:46:24 UTC), http://earthquake.usgs.gov/earthquakes/eqinthenews/2011/usc0001xgp/.

32. Norimitsu Onishi, *Seawalls Offered Little Protection Against Tsunami's Crushing Waves*, N.Y. TIMES, Mar. 14, 2011, at A8, *available at* http://www.nytimes.com/2011/03/14/world/asia/14seawalls.html?pagewanted=all&_moc.semityn.

33. Katherine Harmon, *Japan's Post-Fukushima Earthquake Health Woes Go Beyond Radiation Effects*, SCI. AM., Mar. 2, 2012, http://www.scientificamerican.com/article.cfm?id=japans-post-fukushima-earthquake-health-woes-beyond-radiation

34. INT'L ATOMIC ENERGY AGENCY, MISSION REPORT: THE GREAT EAST JAPAN EARTHQUAKE EXPERT MISSION 20 (2011), *available at* http://www-pub.iaea.org/MTCD/Meetings/PDFplus/2011/cn200/documentation/cn200_Final-Fukushima-Mission_Report.pdf.

35. *Id.*

power station.[36] This four-story high wall of water overwhelmed the eighteen-foot seawall and knocked out emergency generators.[37] An International Atomic Energy Agency (IAEA) report provides a vivid sense of the post-tsunami state of the nuclear plant, detailing how the tsunami "caused widespread destruction of many buildings, doors, roads, tanks and other site infrastructure."[38]

At that point, the emergency response phase began. According to the IAEA, 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."[39] As a result, the reactor operators had to struggle "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."[40]

The severity of the earthquake and tsunami would have challenged any response system.[41] Perhaps understandably, the response to the disaster was confused and disorganized. For instance, a utility employee missed the fact that a key valve in Unit 1's backup cooling unit was closed, thinking instead that the absence of steam meant there was no cooling water.[42] Consequently, the cooling system was shut down for three hours.[43] Confusion also existed at much higher levels of responsibility. Since "there was no comprehensive disaster-management plan," the prime minister "had to improvise, which often involved yelling at regulators and Tepco executives."[44]

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36. *Id.*

37. *Id.*

38. *Id.* at 12. The operators suffered under great handicaps in responding to the crisis:

> The extreme difficulties that the operators on the site had to face in Fukushima Dai-ichi have to be once again strongly underlined: loss of all the safety systems, loss of practically all the instrumentation, necessity to cope with simultaneous severe accidents on four plants, lack of human resources, lack of equipment, lack of light in the installations, and general conditions of the installation after the tsunami and after damage of the fuel resulted in hydrogen explosions and high levels of radiation.

Id. at 43.

39. *Id.* at 12.

40. *Id.* at 40.

41. THE AM. NUCLEAR SOC'Y SPECIAL COMM. ON FUKUSHIMA, FUKUSHIMA DAIICHI (2012).

42. Yoichi Funabashi & Kay Kitazawa, *Fukushima in Review: A Complex Disaster, A Disastrous Response*, BULL. ATOMIC SCIENTISTS, 2012, at 9, 11.

43. *Id.*

44. *Japan After the 3/11 Disaster, The Death of Trust*, ECONOMIST, Mar. 10, 2012, at 35, 38.

The crisis rapidly worsened. The offsite emergency control center was inoperable because of earthquake and tsunami damage as well as a lack of protections such as air-purification.[45] Explosions occurred at Units 1 through 4; the explosions at Units 1 through 3 were caused by a build-up of hydrogen while the cause for the explosion at Unit 4 still remains unclear.[46] Because it was at a slightly higher elevation and was air-cooled (so it did not need cooling water),[47] diesel generators at Unit 6 remained functional in the aftermath of the tsunami, and workers were able to use the power to achieve a cold shutdown at Units 5 and 6.[48] Emergency Situations were declared for both the Fukushima Dai-ichi and Fukushima Dai-ni power stations, resulting in evacuations and emergency measures.[49]

With the evacuation and emergency measures, a new set of issues took the forefront. These issues related to the relationship between the officials managing the emergency and the public—first, the officials' efforts to manage the public response, and second, the officials' failure to adequately provide for the special needs of portions of disadvantaged groups. These issues are discussed in the next two subsections.

B. Managing the Public Response

As the evacuation measures illustrate, emergency responses involve not only physical and technological measures, but also management of the public's behavior. Those responses are partly shaped by expectations about public behavior—expectations that are often distorted.

These distortions are the subject of Lisa Sun's Symposium article about disaster myths and the process that perpetuates these myths.[50] As she points out,

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45. *Id.*

46. THE AM. NUCLEAR SOC'Y SPECIAL COMM. ON FUKUSHIMA, *supra* note 41, at 11-12.

47. *Id.* at 10.

48. *Id.* Cold shutdown is achieved after several days once the reactor is no longer critical (temperatures below 200° F)—even after the cooling rods are inserted and fission stops, the radioactive products continue to generate significant heat.

49. For the May 17 update of the TEPCO Roadmap towards Restoration, *see Current Status of Roadmap*, TOKYO ELECTRIC POWER CO., http://www.tepco.co.jp/en/press/corp-com/release/betu11_e/images/110517e3.pdf.

50. Lisa Grow Sun, *Disaster Mythology and Availability Cascades*, 23 DUKE ENVTL. L. & POL'Y F. 73, 74 (2012).

> [D]isaster sociologists [have] identified several important public misconceptions about typical human behavior in the aftermath of disasters. These misconceptions—also called "disaster myths"—include (1) the myth that widespread antisocial behavior, such as violence and looting, is common after disasters; (2) the myth that most disaster survivors will panic and engage in irrational flight behavior; and (3) the myth that disaster survivors commonly suffer a shock reaction that paralyzes them and interferes with their ability to respond to the disaster and care for themselves and others.[51]

These disaster myths distorted responses during the Fukushima crisis and led to a lack of transparency that, in the end, only created distrust.

During the Fukushima event, TEPCO "played down the extent of the calamity, and initial reports avoided using the term 'meltdown,'" that phrase surfaced only much later.[52] Information about radioactivity was "partly held back to avoid causing panic."[53] For a couple of days after the accident, the officials were "driven by a fear that public disclosures of radiation levels would cause widespread panic."[54] Unfortunately, this tactic backfired. "Lacking real information from the Japanese government, the media quickly focused on Chernobyl as a convenient comparison for predicting fallout deposition and radiation health effects."[55] Ironically, when TEPCO did release information five days after the accident, it was alarmist and inaccurate. Consequently, "[w]hat little confidence that the international community and media had in reports coming from the Japanese authorities evaporated, and speculation ran rampant."[56]

Even before the accident, fear of public response was a problem in emergency planning. In order to avoid causing "unnecessary anxiety and misunderstanding," a drill involving an earthquake and nuclear accident was cancelled, and instead the prefecture held an emergency drill for heavy snow.[57]

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51. *Id.* at 74–75 (internal citations omitted).
52. Nakamura & Kakuchi, *supra* note 22, at 897.
53. *Japan after the 3/11 Disaster, supra* note 44.
54. Funabashi & Kitazawa, *supra* note 43, at 18.
55. THE AM. NUCLEAR SOC'Y SPECIAL COMM. ON FUKUSHIMA, *supra* note 41, at 31.
56. *Id.*
57. Funabashi & Kitazawa, *supra* note 43, at 14.

These efforts to submerge information about risks ultimately backfired and led to more public distrust. Professor Sun suggests some avenues for reducing the influence of disaster myths, such as the spread of disaster mythology. This influence can perhaps be mitigated by changing the incentives of "availability entrepreneurs" who might otherwise perpetuate the myth. Options include hiring more educated emergency managers to advise local officials in disaster decisionmaking and creating targeted public information campaigns—particularly campaigns aimed at young people.[58]

Sun's specific proposals are aimed at the special problems posed by the myth of post-disaster crime. For instance, involving more educated emergency managers in decisionmaking would help reduce the fear of panic among decisionmakers. In addition to Sun's proposals, it might also be worth considering changing the incentives of decisionmakers by creating liability against them individually or against the government generally for failing to reveal reliable information during the course of the response.

C. Disaggregating the Public

Planning for emergency response requires particular attention to the needs of vulnerable populations. Poverty, old age, and disability can heighten an individual's vulnerability to catastrophic loss. In the case of Fukushima, sixty-five percent of the deaths involved individuals who were over sixty years old.[59] Such individuals often possess limited or no access to the economic and social resources necessary for self-care and self-rescue during a disaster—often necessary when the government's own resources are overtaxed, disorganized, or insufficient—and thereby are much more likely to suffer during a disaster.[60]

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58. Sun, *supra* note 50, at 81–92.

59. Verchick, *supra* note 9, at 24.

60. *Cf.* David D. Caron, *Catastrophes Afflict Poor the Most*, S.F. CHRON., Jan. 5, 2005, at B9. As Hurricane Katrina demonstrated, when economically and socially disadvantaged communities are largely composed of people of color, the disaster's results take on even more epic proportions —because racial minority status and limited resources often go hand-in-hand, and because of the chilling effects of entrenched racism on disaster response and management. *See* Nils Gilman, *What Katrina Teaches about the Meaning of Racism*, June 11, 2006, http://understandingkatrina.ssrc.org/Gilman; Christopher Edley, Jr., *The New American Dilemma: Racial Profiling Post-9/11*, *in* THE WAR ON OUR FREEDOMS: CIVIL LIBERTIES IN AN AGE OF TERRORISM 170 (Richard C. Leone & Greg Anrig, Jr. eds., 2003).

In his Symposium contribution, Rob Verchick argues that we need to think about "disaster" and "justice" in new ways.[61] The social science research encourages us to think of disasters as part of the underlying social mechanism. Verchick provides a detailed review of some of the most important geographic studies of disaster and social vulnerability and discusses Susan Cutter's innovative mapping techniques.[62] He observes that Amartya Sen's capability approach to evaluating human welfare suggests the need to understand disaster risk in terms of real-life social vulnerabilities, which helps determine the capabilities that individuals have to respond to and recover from disasters. Verchick recommends legal changes that follow from this insight, including a proposal for a nationwide vulnerability mapping system and a Disaster Justice Executive Order.[63]

Disparate disaster impacts of the kind that Verchick discusses were present at Fukushima. The impacts of the Fukushima disaster were severe. The radiation risk is difficult to assess, but exposure could ultimately lead to anywhere from 15 to 1300 deaths, in addition to the roughly 600 deaths caused by the evacuation itself.[64] These harms do not fall equally on all parts of the population. The evacuation deaths were predominantly caused by fatigue and exposure among elderly or chronically ill evacuees.[65]

Physicians report that bedridden patients were hastily evacuated in police cars; many patients had to wait more than twenty-four hours before reaching medical facilities, often without heaters in Japan's

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61. Verchick, *supra* note 9.

62. *Id.*

63. *Id*. at 68–71.

64. Max McClure, *Stanford Researchers Calculate Global Health Impacts of the Fukushima Nuclear Disaster*, STAN. U. (July 17, 2012), http://news.stanford.edu/news/2012/july/fukushima-health-impacts-071712.html. The evacuation was extensive:

> The central government decreed two concentric crescent-shaped zones: a mandatory evacuation zone and an "evacuation preparation zone." Within the half-moon-shaped inner crescent twenty kilometers (twelve miles) from the reactors, no one is allowed to live or visit without special permission until the government lifts the edict. About 10,500 residents were ejected from their homes and businesses in this "no-go" evacuation zone. In the outer crescent twenty to thirty kilometers (twelve to nineteen miles) from the meltdown, a swath affecting almost 60,000 people, residents were told to prepare for evacuation in case of emergency and to stay indoors as much as possible.

Robert B. Leflar, Ayako Hirata, Masayuki Murayama, & Shozo Ota, *Human Flotsam, Legal Fallout: Japan's Tsunami and Nuclear Meltdown*, 27 J. ENVTL. L. & LITIG. 107, 110 (2012) (footnotes omitted).

65. McClure, *supra* note 64.

chilly March weather.[66] The physicians' recommendation for special evacuation plans of hospital inpatients and the elderly[67] resonates with Verchick's call for special attention to vulnerable populations. The mapping techniques discussed by Verchick could also be invaluable in emergency planning for vulnerable populations in future Fukushima-like situations.

Although discrimination against the elderly receives occasional attention from our society, their needs have a lower profile among academics and activists than other vulnerable groups. One reason, at least in the United States, may be that our social safety net for the elderly is relatively strong, given the existence of Social Security and Medicare. But in disaster situations, the elderly "are often at higher risk" and clearly require attention as a disadvantaged group.[68] The evacuation deaths at Fukushima exemplified this general trend.

Disaster response necessarily involves on-the-ground improvisation to deal with unforeseen problems. Nevertheless, the law also plays a role in setting the stage for the emergency response. As illustrated by Verchick's article, the legal system can help ensure appropriate organization, planning, and resources. Moreover, Sun's article shows how the disaster response is marred by persistent errors—errors that the legal system can help reduce. Thus, although at first sight emergency response might seem like an area beyond the control of the legal system, legal scholarship has a clear capacity to help guide reforms.

IV. AFTER THE DISASTER: COMPENSATION, INSURANCE, AND RECONSTRUCTION

No system of risk mitigation or disaster response can prevent all harm. Recovery from disaster requires funding to reconstruct, relocate, and otherwise respond to disaster impacts. This section will discuss compensation systems and the problems posed by post-disaster reconstruction, including efforts to improve risk mitigation before the next disaster.

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66. Koichi Tanigawa, Yoshio Hosoi, Nobuyuki Hirohashi, Yasumasa Iwasaki & Kenji Kamiya, *Loss of Life After Evacuation: Lessons Learned from the Fukushima Accident*, 379 LANCET 889, 890 (2012).

67. *Id.* at 890–91.

68. Verchick, *supra* note 9, at 45.

A. Compensation Issues

Post-disaster compensation to disaster victims generally takes one of three forms: private insurance, government aid, or the tort system.[69] The first method of compensation is private insurance; however, private insurance is often unavailable or fails to provide prompt and efficient compensation. Significant hurdles are created by the frequent unavailability of separate private insurance for catastrophic risks, the exclusion of catastrophic risks from insurance coverage, and the difficulty of handling very large numbers of claims. The second method of compensation, litigation against responsible private parties, also has its limitations. These limitations include the need for proof of negligence or other bases for liability and limits on the financial assets and insurance coverage of potential defendants, along with other judicial doctrines limiting recovery. Third is the possibility of obtaining compensation from the government through various routes. These possibilities include 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.[70] In the United States, at least, 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, including insurance, tort liability, and direct government assistance.

In their Symposium contribution, Véronique Bruggeman, Michael Faure, and Tobias Heldt argue that government can play a role in stimulating the insurability of catastrophic risks. The authors present arguments in favor of an active government role in compensation, either by acting as a primary insurer or as reinsurer of last resort.[71] Of course, they point out, such an active role should not

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69. For a detailed discussion of these issues in a multi-national comparison, *see* Robert L. Rabin & Suzanne A. Bratis, *United States*, *in* FINANCIAL COMPENSATION FOR VICTIMS OF CATASTROPHES: A COMPARATIVE APPROACH 303, 356 (Michael Faure & Ton Hartlief eds., 2006). The remainder of the paragraph in the text presents some of their findings.

70. Liability and government-supported insurance can also be combined. *See* W. Kip Viscusi & Richard J. Zeckhauser, *Deterring and Compensating Oil-Spill Catastrophes: The Need for Strict and Two-Tier Liability*, 64 VAND. L. REV. 1717 (2011) (suggesting a combination of private liability and tax-supported compensation for damages that exceed the defendant's financial capacity).

71. Véronique Bruggeman, Michael Faure & Tobias Heldt, *Insurance Against Catastrophe: Government Stimulation of Insurance Markets for Catastrophic Events*, 23 DUKE ENVTL. L. & POL'Y F 185, 186 (2012).

serve to relieve injurers of liability in cases of technological accidents, since providing immunity would be an indirect subsidy to the risky activity.[72] Thus, their article seems to point toward a dual system in which the government fosters compensation after the liable party's ability to compensate is exhausted, either by providing direct financial support or by providing reinsurance or other support for private insurance.[73]

Fukushima provides an apt example of the compensation problem. In theory, the operator of a Japanese nuclear power plant is strictly liable for harm, with no liability cap.[74] But the reality may be different. The government has been afraid to let TEPCO go bankrupt, preferring a bailout that protects shareholders.[75] Of course, this weakens the incentive effect of liability to induce care. In addition, the Japanese tort system is not geared toward producing prompt, full compensation. Obtaining compensation may require often-lengthy recourse to administrative or political processes. For instance, numerous victims of Minamata disease, which is caused by methyl-mercury poisoning, began an effort to obtain compensation in 1957, but did not receive a judicial ruling until 1973, resulting in an administrative compensation system that functioned poorly.[76] Litigation was still pending as of 2009.[77]

To expedite settlement in the Fukushima setting, the government has established a Dispute Reconciliation Committee for Nuclear Damage (DRC).[78] The DRC is off to a slow start.

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72. *Id.* at 207.

73. For a similar proposal in the context of oil spills, *see* Viscusi & Zeckhauser, *supra* note 70, at 1722–24.

74. *See* X. Vásquez-Maignan, *Fukushima: Liability and Compensation*, 29.2 NEA NEWS 9, 9 (2011) (noting that in the Japanese system, the owner of the plant where a nuclear disaster occurs is strictly liable for the resulting harm). There is an exception for a "grave natural disaster of an exceptional character," meaning a "huge natural disaster beyond all expectations of humankind." Taro Hokugo, *Nuclear Liability System of Japan in Relation to the Accident at Fukushima Nuclear Power Plants* 4 (Feb. 6, 2012), www.aec.gov.tw/www/fukushima/files /index_15_06.pdf. However, the government takes the position that the exception does not apply to Fukushima. *Id*.

75. *See* Hatsuru Morita, Rescuing Victims and Rescuing TEPCO: A Legal and Political Analysis of the TEPCO Bailout 7–8 (March 21, 2012) (working paper), *available at* www.ssrn.com/abstract=2026868.

76. Eri Osaka, *Reevaluating the Role of the Tort Liability System in Japan*, 26 ARIZ. J. INT'L & COMP. L. 393, 403–07, 412 (2009).

77. *Id.*

78. Vásquez-Maignan, *supra* note 74, at 9.

The alternative dispute resolution (ADR) process was launched in September 2011. As of February 2012, however, few cases have been resolved through ADR. Issues that will inevitably arise in court, such as the extent to which cases will be tried individually or through mass litigation, remain to be resolved. Judicial and administrative precedents provide no clear answers.[79] In addition, there are questions about the amount of compensation for victims.[80]

Legal resources are also quite limited. Fukushima Prefecture has a population of two million, but has "only 155 attorneys and 284 *shihō shoshi* (quasi-lawyers with limited law licenses)."[81] Yet local bar associations have shown some resistance to efforts by foreign lawyers to offer services.[82] Moreover, there is considerable doubt among victims about whether TEPCO will ultimately have the assets to pay more than a fraction of their claims.[83]

After compensation, the next step in the disaster cycle is reconstruction. In the Fukushima context, reconstruction involves decontamination. This, in itself, is a huge task. Tracking the radioactive contamination is a first step.[84] At least a thousand square kilometers of land will be cleaned up, requiring disposal of fifteen to thirty-one million cubic meters of contaminated soil and debris.[85] By

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79. Leflar et al., *supra* note 64, at 118 (footnote omitted)

80. Leflar et al. discuss the uneven start of compensation provided by TEPCO:

> TEPCO initially responded by providing a first round of partial provisional compensation payments to residents displaced by government orders from the "no-go" inner crescent: ¥1 million (US$12,500) for households and ¥750,000 (US$9400) for individuals. The compensation amount was recommended by the national government and paid by TEPCO. Businesses were eligible for compensation for half their demonstrated losses up to ¥2.5 million (US$31,000) upon submission of documentation. A second round of further compensation payments was announced August 4, 2011.

Id. at 112–13 (footnotes omitted). As one local observer said about the compensation for business losses, "[t]here's nothing you can do but laugh. How can business people who have lost everything get going again with that?" *Id*. at 122.

81. *Id*. at 115 (footnote omitted).

82. *Id.* at 118.

83. Community leaders in Minami Soma articulated their concerns:

> "The question is, when we get past these partial payments and it comes time for TEPCO to pay the full amount of damages they owe, what kind of financial shape will TEPCO be in, and how much of what they owe will they be able to pay? A fifth? A tenth?

Id. at 120.

84. For a discussion of the efforts taken to track radioactive fallout, *see generally* Naohiro Yoshida & Jota Kanda, *Tracking the Fukushima Radionuclides*, 336 SCI. 1115 (2012).

85. Winifred Bird, *As Fukushima Cleanup Begins, Long-term Impacts are Weighted,* YALE ENVT. 360 (Jan. 9, 2012), http://e360.yale.edu/feature/as_fukushima_cleanup_begins_long-term_impacts_are_weighed/2482/.

February 2012, the Japanese government had begun to distribute thirteen billion dollars in contracts.[86] We can hope for the best in the rebuilding process. But rebuilding will be for naught unless better risk mitigation measures are in place against future disasters.

B. Post-Disaster Mitigation Reforms

Often, regulatory measures are strengthened from post-disaster response. This process has been an important factor in shaping U.S. environmental law. But the process may no longer be functioning effectively. Tom McGarity and Rena Steinzor attempt to explain why disasters like the Kingston spill, the BP Horizon spill, and the Upper Big Branch coal mine disaster no longer appear to stimulate Congress and EPA to initiate the sort of immediate governmental response that past disasters generated (such as the Exxon Valdez spill and the Bhopal toxic release).[87]

McGarity and Steinzor attribute this shortfall in the disaster response to political polarization, industry dominance of the legislative process, and distrust of government.[88] As an antidote to this toxic political brew, they recommend shifting authority from White House and Congressional overseers back to line agencies, such as the EPA. In addition, they recommend making a focus on corporate accountability central to a new narrative about the role of government.[89] It appears to an outside observer that the Japanese political system, too, suffers from its own maladies.

Suggesting cures for these political woes is far beyond the scope of this Introduction. Nevertheless, at the risk of merely restating the obvious, it is worth observing that disasters are teachable moments which can help build better understanding even if they do not result in immediate reforms. They can shed a harsh light on regulatory failures and political dysfunctions leading up to disasters. They can often highlight the need for corporate accountability that McGarity and Steinzor herald.

As academics, part of our jobs should be to objectively document the failures that lead to disasters or amplify harm. We should not shrink from proposing solutions, even if the political system may not

86. Hiroko Tabuchi, *A Confused Nuclear Cleanup*, N.Y. TIMES (Feb. 10, 2012), at B1, http://www.nytimes.com/2012/02/11/business/global/after-fukushima-disaster-a-confused-effort-at-cleanup.html?pagewanted=all&_moc.semityn.

87. McGarity & Steinzor, *supra* note 29, at 137–38.

88. *Id.* at 145.

89. *Id*. at 147.

be ready to adopt all of them. Finally, whatever work we do to improve systems of disaster response and recovery can pay a dividend in terms of civic education by showing that government can indeed effectively and efficiently assist people when they need help the most. A better appreciation of the government's ability to deliver vital services in the aftermath of disasters may indirectly help build confidence in the government's ability to mitigate risks in advance.

V. CONCLUSION

Appropriate legal structures 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. This Symposium makes a notable contribution to that intellectual enterprise.

Disasters, both natural and human-induced, are an increasingly common feature of twenty-first century life. Yet, despite some improvements, the legal system remains gravely unprepared for the next major disaster—the occurrence of which is nothing short of a certainty in a world characterized by global warming and complex, dangerous technologies. It is therefore incumbent upon legal scholars to undertake an intensive effort to examine and reform the interlocking structures of governance and regulation that pertain to disasters. The Symposium editors have assembled a remarkable group of articles in this vein.

Legal scholarship, such as the articles in this Symposium, is beginning to develop a coherent intellectual map of disaster issues that will guide the near- and long-term future of disaster law scholarship and dialogue. Over time, scholars 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.

As we have seen, many of the shortcomings in current disaster law have surfaced in the Fukushima context. Throughout the cycle of disaster, the Japanese legal system has struggled to control risks, respond when risks materialize, and provide the financial basis for reconstruction. Some of the issues relate specifically to Japanese society, but the general problems seem to be universal. Whether Japanese or not, we can learn about the needs of our own societies from the events in Japan.

Scholarship such as this Symposium can shed light on these problems and suggest possible cures. We can only hope that society, in Japan and elsewhere, uses this teachable moment well, to become better prepared for the future.