Georgia Law Review

Volume 58 | Number 4 Article 5

6-10-2024

Building Climate Resilience with Local Tools

Shelley Saxer
Pepperdine University, shelley.saxer@pepperdine.edu

BUILDING CLIMATE RESILIENCE WITH LOCAL TOOLS

Shelley Ross Saxer[*]

The first Earth Day on April 22, 1970, celebrated the grassroots environmental movement that began in the '60s and early '70s and ushered in the creation of a new legal framework for controlling pollution and addressing environmental concerns in the United States. However, more than fifty years later, some experts fear that the environmental progress achieved during the '70s and '80s has begun to stall as the United States and other nations experience broad economic hardship and must shift their focus to more immediate concerns. Therefore, even as the damaging effects of climate change threaten communities across the globe, the next major environmental movement is unlikely to happen at the federal or global level. Instead, state and local citizens and governments must address the increasing impacts of climate change by exploring short- and long-term approaches to land use planning and environmental regulation to prepare communities to be resilient to coming changes.

This Article attempts to consolidate the various land use tools, such as planning, zoning, sustainable and green development, eminent domain, inverse condemnation, nuisance law, renewable energy incentives, and smart cities, which can help communities and individuals deal with past, current, and future impacts from climate change. These more localized tools present greater opportunities to prepare for climate change and continuing disasters, address systemic inequalities and disruptive histories, and build or rebuild resilient communities through mitigation and adaptation.

---

[*] Laure Sudreau Chair in Law, Pepperdine University Caruso School of Law. I appreciate the invitation from the *Georgia Law Review* Board to present this paper at the 2024 *Georgia Law Review* Symposium: "Evolving Landscapes: American Land Use Law & Resiliency." I am also grateful for the excellent editing assistance provided by my research assistant, Dylan Goodale, law review editors Braden T. Meadows and Jake Shatzer, and the *Georgia Law Review*. Any errors or omissions are mine.

This Article suggests that the principle of social ecological resilience is an effective concept to deal with climate change when our ecosystems are prone to disruption, promoting a land use system that manages risk through mitigation and adaptation. By incorporating principles of social-ecological resilience, sustainability, and adaptation into the circle of disaster risk management and other regulatory responses, communities can better prepare for the future while also establishing equitable laws and policies.

The Article continues by assessing local land use concepts that are available to mitigate and adapt to climate change at the community level. While local governments have a vital role in establishing mitigation and adaptation strategies through a variety of land use regulations and policymaking, the participation of all citizens who live and work in the community—particularly the vulnerable ones—is also essential for creating planning and governance strategies that further a community's resilience goals. This inclusive, community-wide approach provides a framework for assessing emergency response strategies at the local level, analyzing various compensation models to spread risks following a disaster, and facilitating cohesive and effective rebuilding efforts. Bearing all these tools in mind, this Article concludes that adaptive governance informed by resilience thinking at the local level will help build (and rebuild) communities capable of withstanding whatever the future holds.

TABLE OF CONTENTS

I. INTRODUCTION

The first Earth Day on April 22, 1970, celebrated the grassroots environmental movement that began in the '60s and early '70s and ushered in a new legal framework for controlling pollution.[1] President Richard Nixon created the Environmental Protection Agency (EPA) in 1970, and Congress adopted new or amended federal legislation to address land, air, and water pollution; endangered species and natural resources; coastal and marine resources; and the impact of land use, production, and consumption on the environment.[2] The EPA's history between 1970 and 1985 reflects these major and significant changes.[3] The federal environmental statutes divide authority between the state and federal governments, known as "cooperative federalism," where "Congress has set minimum federal environmental standards that states may exceed but not fall below."[4]

Before the environmental movement created environmentalism, as it is known today, some cities in the United States provided clean drinking water as early as 1652[5] and managed wastewater during the 1800s and the early 1900s to protect their citizens from environmental pollution.[6] States became more involved in

---

[1] *See The Guardian: Origins of the EPA,* EPA (1992), https://www.epa.gov/archive/epa/aboutepa/guardian-origins-epa.html [https://perma.cc/X2B3-6STC] (recounting how "Earth Day launched the idea of environmentalism in its present sense"); John E. Bonine, *Private Public Interest Environmental Law: History, Hard Work, and Hope*, 26 PACE ENV'T L. REV. 465, 465–66 (2009) (noting how interest in environmental law originated from grassroots movements).

[2] *See* Phil Wisman, *EPA History (1970–1985)*, EPA (Nov. 1985), https://www.epa.gov/archive/epa/aboutepa/epa-history-1970-1985.html [https://perma.cc/5W7E-KMNL] (detailing the environmental protection efforts made in the 70s and 80s).

[3] *Id.*

[4] Jody Freeman, *The Uncomfortable Convergence of Energy and Environmental Law*, 41 HARV. ENV'T. L. REV. 339, 350 (2017).

[5] *See The Guardian: Origins of the EPA*, *supra* note 1 ("[A]s early as 1652, the city of Boston established a public water supply . . . .").

[6] *See* Katrina M. Wyman & Danielle Spiegel-Feld, *The Urban Environmental Renaissance*, 108 CAL. L. REV. 305, 306 (2020) ("In the 1800s and early 1900s, cities arranged for the supply of drinking water for their growing populations, passed laws in an effort to keep that water clean, developed systems to manage wastewater, and enacted pioneering air pollution ordinances.").

environmental protection following World War II and established regulatory agencies supported by federal funding and technical support.[7] The alleged failure of these state and federal actions to curb pollution led to the circa 1970 shift of primary responsibility for controlling pollution from states to the federal government.[8]

More than fifty years later, after a global pandemic and growing political partisanship, some experts fear that the environmental progress achieved in the past fifty years will stall and perhaps retreat as the United States and other nations experience economic hardship.[9] Even when facing the damaging impacts of climate change—including rising and warming oceans, extreme weather events, flooding, droughts, and wildfires—immediate needs come first.[10] With partisan fighting over support for climate science and environmental regulation, it is unlikely that we will see consensus at the national level that we saw in the '70s.[11] The laws from the '70s and early '80s dramatically improved the land, air, and water in the U.S. and established environmental protection as an enterprise with a central function located in both state and federal governments.[12] However, the next major movement is unlikely to happen at the federal or global level in the near future. Instead,

---

[7] *See* William L. Andreen, *Of Fables and Federalism: A Re-Examination of the Historical Rationale for Federal Environmental Regulation*, 42 ENV'T. L. 627, 633 (2012) (discussing environmental actions taken by the states following World War II).

[8] *Id*. at 633–34 (noting that some legal scholars "dispute the accuracy of this account" and claim that "state and municipal regulatory programs were making considerable progress before the federal regulatory era").

[9] *See* Priya Priyadarshini, *The COVID-19 Pandemic Has Derailed the Progress of Sustainable Development Goals*, 1 ANTHROPOCENE SCI. 410, 411 (2022) (noting that UN reports establish that the "pandemic and the Ukraine crisis [have] halted, limited or reversed progress" in environmental sustainability and climate change).

[10] *See* Vinod Thomas, *The Truth About Climate Action Versus Economic Growth*, BROOKINGS (May 3, 2023), https://www.brookings.edu/articles/the-truth-about-climate-action-versus-economic-growth/ [https://perma.cc/23GF-JVNU] (explaining the difficulty of focusing on climate change when trying to meet the demands of issues like poverty or natural disasters).

[11] *See* Wyman & Spiegel-Feld, *supra* note 6, at 331–32 ("The increasing polarization surrounding preferences for environmental protection is evident in the gridlock over environmental matters in Washington. Congress has not passed a major piece of environmental legislation since 1990, except for the 2016 reform to the Toxic Substances Control Act.").

[12] *See* Wisman, *supra* note 2 (listing the legislation, regulations, and other changes implemented from 1977–1981 that affected the EPA).

state and local citizens and governments must address the increasing impacts of climate change by taking short-term and long-term approaches to land use planning and regulations to prepare communities to be resilient to coming changes.[13]

This Article builds on the work of many and attempts to consolidate the various land use tools—such as planning, zoning, sustainable and green development, eminent domain, inverse condemnation, nuisance law, renewable energy incentives, and smart cities—that can help communities and individuals deal with past, current, and future impacts from climate change.[14] Imagine a new development of undeveloped land with fewer demands to keep current zoning in place or an area decimated by either a man-made or a natural disaster, such as Lāhainā, Hawaii, or Malibu, California.[15] In building out the undeveloped land or rebuilding destroyed areas, there are greater opportunities to prepare for climate change and continuing disasters, address systemic inequalities and disruptive histories,[16] and build or rebuild resilient communities through mitigation and adaptation. Nevertheless, we must also address our existing built environment to increase community resilience and prepare for known disasters to come, as

---

[13] *See* Wyman & Spiegel-Feld, *supra* note 6, at 306–09 (arguing that state and local governments are now better suited than the federal government to make a positive environmental impact).

[14] *See, e.g.*, John R. Nolon, *In Praise of Parochialism: The Advent of Local Environmental Law*, 26 HARV. ENV'T L. REV. 365, 374 (2002) (describing how communities have used zoning to protect the environmental functions of land).

[15] *See* Associated Press, *Heart of Hawaii's Historic Lahaina, Burned in Wildfire, Reopens to Residents and Business Owners*, NBC NEWS (Dec. 12, 2023, 3:43 AM), https://www.nbcnews.com/news/us-news/heart-hawaiis-historic-lahaina-burned-wildfire-reopens-residents-busin-rcna129221 [https://perma.cc/VHF4-9FXZ] (reporting on the state of the Lāhainā community after being burned by wildfire); Matt Stiles & Jon Schleuss, *Woolsey Fire Likely Worst Ever to Hit Malibu, with Home Losses Topping $1.6 Billion*, L.A. TIMES (Dec. 3, 2018), https://www.latimes.com/projects/la-me-malibu-woolsey-destruction-map/ [https://perma.cc/7V7F-JYYB] (reporting the aftermath of the wildfire affecting Malibu, California, in 2019).

[16] *See, e.g.*, Craig Anthony Arnold et al., *Justice, Resilience, and Disruptive Histories: A South Florida Case Study*, 34 COLO. ENV'T L.J. 213, 215 (2023) (explaining that "the histories of disruptive struggles for freedom, dignity, and justice—including efforts to dismantle the systems that oppress—play central parts in the human-environment narrative").

well as those we cannot possibly fathom as the "worst case" scenario.[17]

There are many approaches to managing climate change and its impacts at the international, national, and state levels, but this Article focuses on local land use tools and foregoes the challenge of addressing all levels of governance. This Article does not attempt to gather all the articles and books written about these local concepts. Instead, it seeks to provide a toolbox that might be readily available at the local level. Federal, state,[18] and international law may preempt local-level governance, and networking multiple jurisdictions to address national, regional, and cross-boundary challenges is essential in the long term,[19] but local action is an effective path to achieving the goals of mitigation and adaptation in the short term.[20]

---

[17] *See* Robert R.M. Verchick & Abby Hall, *Adapting to Climate Change While Planning for Disaster: Footholds, Rope Lines, and the Iowa Floods*, 2011 BYU L. REV. 2203, 2215 (noting the value of precaution in disaster law because of "the unusual difficulty in this field of imagining what the next risk or threat could even be" (emphasis omitted)).

[18] *See* Dan Farber, *The Bumper Crop of New State Climate Policies Since July*, LEGALPLANET (Jan. 8, 2024), https://legal-planet.org/2024/01/08/six-months-of-state-climate-initiatives/ [https://perma.cc/7YB9-3DQE] (listing recent state climate policies).

[19] *See* J.B. Ruhl, *Climate Change Adaptation and the Structural Transformation of Environmental Law*, 40 ENV'T L. 363, 428–30 (2010) (noting that "adaptation policy must operate at all scales in an interconnected network of decision making" and "Dynamic Federalism" has the advantage of "multiple agencies working on a problem within overlapping scales" to "promote synergy" and "informal networks"); Sarah J. Adams-Schoen, *Sink or Swim: In Search of a Model for Coastal City Climate Resilience*, 40 COLUM. J. ENV'T L. 433, 504 (2015) (noting that state and federal governments can support local mitigation and adaptation efforts by removing existing preemption burdens and that "'the true potential of [the State's substantial activity with respect to climate change and energy efficiency issues] will not be fully realized' without 'a coordinated, comprehensive, and fully integrated inter-jurisdictional approach to addressing these challenges'" (alteration in original) (quoting Patricia E. Salkin, *New York Climate Change Report Card: Improvement Needed for More Effective Leadership and Overall Coordination with Local Government*, 80 U. COLO. L. REV. 921, 926 (2009))).

[20] *But see* Ruhl, *supra* note 19, at 428 (stating that "adaptation policy must operate at all scales in an interconnected network of decision making"); David L. Markell & Robert L. Glicksman, *Dynamic Governance in Theory and Application* (pt. 1), 58 ARIZ. L. REV. 563, 572–73 (2016) ("Professor J.B. Ruhl predicts that '[d]emands on the legal system will be intense and long term' and anticipates that, as a consequence, climate change is likely to effect a 'structural transformation' of the field of environmental law." (alteration in original) (footnote omitted) (quoting Ruhl, *supra* note 19, at 374, 377)).

Urban areas and the corresponding local governments are appropriate focal points for building resilience, even without linking to state, federal, and international forces.[21] In 2023, the United Nations Office for Disaster Risk Reduction released a special Global Assessment Report on Disaster Risk Reduction (GAR23: Special Report), "*Mapping Resilience for the Sustainable Development Goals*."[22] The report identified key resilience deficits holding back efforts to achieve the sustainable development goals accepted and applied by United Nations Member States.[23] Resilience Deficit 8 ("Increasing flood risk and urbanization") identifies urban areas as particularly vulnerable to significantly higher flood risk because impervious urban surfaces do not absorb rain, and urban areas are the world's most populated areas.[24]

Of the world's population, 55% currently live in urban areas, and by 2050, that number will likely rise to 68%.[25] Therefore, it is imperative that "policies to manage the urban growth need to consider the needs" of all and "focus on the urban poor and other vulnerable groups" as it pertains to housing, education, healthcare, decent work, and a safe environment.[26] As U.S. cities renew their historical efforts to provide environmental protection,[27] we should ensure that state and federal regulation of environmental impacts does not hamper the "flowering of local environmental initiatives in some U.S. cities" through preemption or other such obstacles.[28] Indeed, transformational change in regulatory design needs not only to operate through a "cooperative federalism" structure but

---

[21] *Cf.* Edward J. Sullivan & A. Dan Tarlock, *The Paradox of Change in the American West: Global Climate Destruction and the Reallocation of Urban Space and Priorities*, 37 J. ENV'T L. & LITIG. 23, 38 (2022) (stating that "[a]llowing each local jurisdiction to chart its own land use vision is not sustainable").

[22] U.N. OFF. FOR DISASTER RISK REDUCTION, GAR SPECIAL REPORT 2023: MAPPING RESILIENCE FOR THE SUSTAINABLE DEVELOPMENT GOALS (2023).

[23] *Id.* at 10.

[24] *Id.* at 56–57.

[25] POPULATION DIV., U.N. DEP'T OF ECON. & SOC. AFFS., WORLD URBANIZATION PROSPECTS: THE 2018 REVISION, at 1 (2019).

[26] *Id.* at 2.

[27] *See* Verchick & Hall, *supra* note 17, at 2215 (noting that "[c]limate change adaptation in the United States has largely been the work of cities and states").

[28] *See* Wyman & Spiegel-Feld, *supra* note 6, at 311 ("[C]ertain legal obstacles, especially limits on local authority established by state law, are hamstringing cities' ambitions to pursue their environmental goals.").

also to involve citizens, regulated parties, and, in some cases, local governments in a regulatory compliance regime.[29]

Part II addresses the principle of social ecological resilience as an effective concept to deal with climate change when our ecosystems are vulnerable to disruption.[30] This part will also provide the framework for evaluating local land use tools within the disaster cycle model of managing risk through mitigation and adaptation, emergency response, compensation, and rebuilding. Part III presents local land use concepts that are available to mitigate and adapt to climate change at the community level. Community resilience is the ability of a community to survive disruptive events such as disasters, bounce back, and more effectively adapt to future disruptions.[31] Part IV briefly discusses emergency response at the local level, and Part V offers various compensation models to spread the risk following a disaster. Part VI concludes by pointing back to mitigation and adaptation strategies that should inform rebuilding efforts.

II. RESILIENCE, SUSTAINABILITY, AND DISASTER RISK MANAGEMENT

Conventional risk analysis is appropriate for addressing threats and their consequences so long as we understand the type of threat, the possible consequences, and the probability that the threat will

---

[29] *See* Markell & Glicksman, *supra* note 20, at 608–17 (discussing the EPA's Next Generation Compliance (Next Gen) initiative to improve EPA regulatory enforcement and address the problem of significant noncompliance with regulatory obligations).

[30] *See* Manuela Andreoni, *An Ally in the Climate Fight: Nature Itself*, N.Y. TIMES (Dec. 15, 2023), https://www.nytimes.com/2023/12/15/climate/an-ally-in-the-climate-fight-nature-itself.html (noting the final agreement by attendees of COP28 to halt all deforestation and forest degradation by 2030 and recognizing the value of conservation and preservation of valuable ecosystems as crucial to preventing carbon from being released from forests that recent studies have found to hold thirty percent more carbon than countries previously reported).

[31] *See* Elizabeth A. Andrews & Jesse Reiblich, *Reflections on Rural Resilience: As the Climate Changes, Will Rural Areas Become the Urban Backyard?*, 44 WM. & MARY ENV'T L. & POL'Y REV. 745, 748 (2020) (noting that, based on a number of factors, rural communities are "particularly in danger of not having the necessary resilience to face predicted climate change impacts").

occur.[32] However, conventional risk assessment is difficult when there is uncertainty or a lack of knowledge, especially when the system is complex, data is unavailable, and managing human behavior is uncertain.[33] Professor Timothy Malloy proposes that conventional risk analysis should expand to incorporate principles of prevention and resilience, and he presents "a generalized framework for understanding the relationship among them and specifying how prevention and resilience can address the limits of conventional risk analysis."[34]

Under this framework, "[p]revention includes *reduction* and *resistance* as mitigation strategies."[35] Reduction looks to remove or reduce the threat itself, and resistance focuses on building the vulnerable subject's ability to withstand the threat.[36] Resilience "relies upon *resistance*, *restoration*, and *adaptation* as mitigation strategies."[37] Resilience thinking frames the resistance mitigation strategy as "optimiz[ing] the capacity and flexibility of the vulnerable subject to sense and respond to subtle shifts from normal operations to disruptions as they occur" by monitoring and anticipating leading performance indicators to detect, alert, and adjust to "emerging variations and disturbances."[38] If there were a major disturbance, the mitigation strategy of restoration, as applied to an ecological system, would assist in recovering "an ecosystem that has been degraded, damaged or destroyed."[39] Restoration endeavors to address the harms and adverse consequences that the mitigation strategies of reduction, control, or resistance could not

---

[32] *See* Timothy Malloy, *Re-Imagining Risk: The Role of Resilience and Prevention*, 22 NEV. L.J. 145, 146–47 (2021) ("Risk assessment works well enough when the threat in question and the consequences that flow from that threat are pretty well understood, including the probability that the threat will become reality.").

[33] *See id.* at 147 ("[C]onventional risk analysis works poorly when data is unavailable due to cost or methodological challenges or when the human behavior being managed is indeterminate.").

[34] *Id.* at 149.

[35] *Id.* at 186.

[36] *See id.* (explaining that "[r]eduction focuses on the inherent nature of the threatening agent itself" while "resistance directs attention to the vulnerable subject").

[37] *Id.* at 188.

[38] *Id.* at 189.

[39] *Id.* at 190 (quoting GEORGE D. GANN ET AL., SOC'Y FOR ECOLOGICAL RESTORATION, INTERNATIONAL PRINCIPLES AND STANDARDS FOR THE PRACTICE OF ECOLOGICAL RESTORATION 78 (2d ed. 2019)).

prevent.[40] Finally, the adaptation mitigation strategy is closely linked to resilience in that it "leverages the capacity of a system to change in light of events and experience" if risks become a reality.[41] Adaptation management reconsiders mitigation measures based on continued monitoring of their implementation and modifying or replacing failing mitigation measures.[42]

Professor Malloy makes a persuasive argument that fundamental changes to the architecture of conventional risk analysis are required to systematically integrate the important principles of prevention and resilience and recognize advances in risk assessment and decision analysis.[43] This Article argues for a slightly different approach, which would incorporate the principles of social-ecological resilience, sustainability, and adaptation into the circle of disaster risk management identified by Professor Dan Farber and discussed below.[44] A resilient city will rebound from disruptions and stresses and requires both mitigation and adaptation measures.[45] Mitigation reduces greenhouse gas emissions, while adaptation requires compromise with a changed world and response to these changes in the form of protection, accommodation, and relocation.[46]

---

[40] *See id.* (noting that restoration may also be in the form of emergency response).

[41] *Id.* at 191.

[42] *See id.* (noting "that adaptation involves reconsideration of . . . mitigation measures based on monitoring of their implantation" and that adaptation allows for adjustment or replacement when mitigation measures are failing).

[43] Malloy, *supra* note 32.

[44] *See infra* section II.B.

[45] *See* Shelby D. Green, *The Intentional Community: Toward Inclusion and Climate-Cognizance*, 62 WASHBURN L.J. 243, 264 (2023) (evidencing that a resilient city is one that can rebound from stress and commenting that "[r]esiliency is predicated upon both mitigation and adaptation measures").

[46] *See id.* at 264–65 ("The main aim of mitigation measures is the reduction of . . . greenhouse gas emissions . . . . Adaptation measures require reconciliation with a changed world. Adaptation comes in three forms: protection, accommodation, and retreat."). Some scholars, such as Professor Mark Nevitt, now prefer the term "relocation" rather than "retreat" in order to reframe this form of adaptation from the concept of "giving up" to one of response.

A. SOCIAL-ECOLOGICAL RESILIENCE AND SUSTAINABILITY

Social-ecological systems are the joining of natural systems with social systems and provide the link between "the 'human system' (e.g.[,] communities, society, economy) and the 'natural system' (e.g.[,] ecosystems) in a two-way feedback relationship."[47] Resilience and sustainability are distinct analytical frameworks that help us understand how we create, worsen, or fix problems arising in economic, social, and ecological systems.[48] The *Oxford Dictionary* "defines sustainability as something, '[a]ble to be maintained at a certain rate or level,' and resilience as, '[t]he capacity to recover quickly from difficulties; toughness,'" but these terms are contextual and relative to a system or condition.[49] However, there are common definitions to understand these concepts as applied to the properties of a system, the law that informs the system by altering behaviors, and how the law impacts that system. *Engineering resilience* is distinct from *ecological resilience* and is defined as "stability near an equilibrium steady state, where resistance to disturbance and speed of return to the equilibrium are used to measure the property."[50] Whereas we measure *ecological resilience* by "the magnitude of disturbance that can be absorbed before the system changes its structure by changing the variables and processes that control behavior."[51]

Comparing the concepts of sustainability and resilience based on their relative dependence upon one another illustrates that a sustainable system must be resilient to survive for future generations, but resilience is a system characteristic that does not

---

[47] FIKRET BERKES ET AL., GUIDELINES FOR ANALYSIS OF SOCIAL-ECOLOGICAL SYSTEMS 2 (2014).

[48] *See* SHELLEY ROSS SAXER & JONATHAN ROSENBLOOM, SOCIAL-ECOLOGICAL RESILIENCE AND SUSTAINABILITY 3 (2018) ("At their core, resilience and sustainability (R&S) represent new and innovative ways to help understand our role in creating, exacerbating, or remedying challenges arising in economic, social, and ecological systems.").

[49] *Id.* at 7–8 (alterations in original) (footnote omitted) (quoting OXFORD ENGLISH DICTIONARY, https://www.oed.com/).

[50] C.S. Holling, *Engineering Resilience Versus Ecological Resilience*, *in* ENGINEERING WITHIN ECOLOGICAL CONSTRAINTS 31, 33 (Peter C. Schulze ed., 1996).

[51] *Id.*

necessarily imply a sustainable system over a longer time.[52] In terms of analyzing and managing systems, "[r]esilience is largely a process-driven concept reflecting the ability of a system to minimize the negative effects of destructive events," while "sustainability is primarily a goal-focused concept for maximizing the ability of a system to function over the long-term."[53]

Social-ecological resilience thinking emphasizes "the state and functions of ecosystems" and the importance of using adaptive governance to manage and plan for substantial and uncertain disruptions to these ecosystems, and improve cross-system resilience.[54] However, adaptive management, planning, and governance for building resilience in our social-ecological systems must not marginalize the least powerful people and communities, as they "are the most vulnerable to shocks, disturbances, and changes in social-ecological-institutional systems (e.g., climate change, disasters, ecosystem collapse)."[55] Instead, we need to recognize the role of social justice in resilience thinking so that we honestly evaluate "injustices in our institutions, environments, and society."[56]

Local communities should govern for resilience justice in addition to nature's eco-resilience and our institutions' structural resilience.[57] Marginalized and vulnerable populations should share adaptive governance power with government officials, dominant stakeholders, and land use professionals.[58] Governance assessment and reforms of policies and structures should incorporate resilience

---

[52] *See* KATHERINE F. CHAMBERS, ANNE CLARK BAKER, S. KYLE MCKAY & HEATHER MORGAN, ECOSYSTEM MGMT. & RESTORATION RSCH. PROGRAM, RETROSPECTIVE SUSTAINABILITY AND RESILIENCE: COMPLEMENTARY CONCEPTS FOR MANAGING SYSTEMS 6 (2019), https://apps.dtic.mil/sti/tr/pdf/AD1069283.pdf [https://perma.cc/C6U6-UNFT] (comparing sustainability and resilience via their relative dependence upon one another, highlighting that "a sustainable system must demonstrate resilience in order to persist over time" but "resilience may not inherently imply a sustainable system").

[53] *Id.*

[54] Arnold et al., *supra* note 16, at 219–20.

[55] *Id.* at 224.

[56] *Id.*

[57] *See id.* at 263 (arguing that governance arrangements for resilience justice should look beyond a merely "eco-resilience or structural resilience perspective").

[58] *See id.* (discussing adaptative co-governance, which means that "[p]ower should be shared with marginalized, oppressed, and vulnerable communities, not just concentrated in government officials or powerful stakeholders").

justice perspectives.[59] Finally, "[t]he social histories of marginalized, oppressed, and vulnerable communities should be studied and robustly used in the governance of complex social-ecological-institutional systems."[60]

As we look to transform our social and institutional systems to adapt to climate change and become resilient to disruptions to the state and functions of our ecosystems, adaptive governance (as discussed in more detail in Part III) will allow us to respond more effectively to these disruptions. We cannot forget, however, that the social and institutional transformations necessary to build climate resilience must be equitable as well as adaptive.[61]

B. DISASTER RISK MANAGEMENT

Natural disasters are those tragedies sparked by geological or meteorological forces such as hurricanes, heavy rainfall, flooding, earthquakes, volcanic eruptions, tsunamis, drought, heatwaves, or wildfires.[62] While these are "natural" hazards, humans contribute to these disasters through poor planning and construction, urban sprawl, building in areas prone to disasters, nonresilient development and infrastructure, and human-induced climate change.[63] Professor Dan Farber defines disasters "in terms of the governmental and legal responses they demand" based on a "circle of risk management."[64] This circle includes mitigation, emergency response, compensation, and rebuilding, which returns us to the beginning of the circle, focusing on mitigating the next disaster.[65]

---

[59] *See id.* (noting that "[t]oo often resilience issues in complex social-ecological-institutional systems are considered only from an eco-resilience or structural resilience perspective").

[60] *Id.* at 264.

[61] *See id.* at 228 (detailing how some scholars emphasize the importance of historical and cultural narratives in calls for transformation)*; see also*, Amy E. Turner, *The Legal Case for Equity in Local Climate Action Planning*, 50 FORDHAM URB. L.J. 1245, 1293–94 (2023) (concluding that "[l]ocal governments and advocates for local equity-infused climate action planning can find support for an equity-infused approach in federal law and should amplify these federal law opportunities to support an equitable and just climate policy approach").

[62] DANIEL A. FARBER, JAMES CHEN, ROBERT R.M. VERCHICK & LISA GROW SUN, DISASTER LAW AND POLICY 3 (2d ed. 2010).

[63] *Id.*

[64] *Id.*

[65] *Id.*

Farber explains that several factors have increased both the risks and costs of disaster: "(1) modern economic conditions, including the just-in-time economy and the interdependence and privatization of our critical infrastructure; (2) population growth and demographic shifts that increase exposure to hazards; (3) land use planning that exacerbates, rather than mitigates, disaster risk; (4) failure to maintain green and built infrastructure; and (5) climate change."[66]

The United Nations GAR23: Special Report stated that "[g]lobal warming will surpass 1.5°C above pre-industrial levels during the next decade, due to greenhouse gas emissions" and "factors such as the rapid deterioration of biodiversity, the degradation of land and stress on water resources, lower the capacity of human systems to withstand hazards that are occurring more frequently and with greater intensity."[67] Even though progress has increased "access to electricity, water, healthcare and education," there are "growing inequities and pressures on the planet," particularly as to lower-income countries with the most vulnerable populations, because we have not sufficiently taken into account the impact of human development on ecosystems and livelihoods.[68] The report concludes that we must build in resilience thinking, with interventions and investments that are "more targeted, more systems-oriented and more capable of scaling-up" so that systems can recover from disasters and become "adaptive and transformative to build a more sustainable, prosperous and equitable future."[69] Indeed, the measure of disaster law success is whether we have minimized disaster costs and the disparate impacts on vulnerable communities.[70]

City and municipal governments are "essential to disaster preparedness planning" as they control land use patterns, development, and infrastructure at the local level where disasters happen, and their residents directly experience the consequences.[71] Courts have not yet recognized claims against local governments for flooding damages based on their failure to act in response to climate

---

[66] *Id.* at 10.

[67] U.N. OFF. FOR DISASTER RISK REDUCTION, *supra* note 22, at 10.

[68] *Id.*

[69] *Id.*

[70] FARBER ET AL., *supra* note 62, at 4.

[71] Adams-Schoen, *supra* note 19, at 445.

change.[72] If local governments, however, institute adaptation measures but do so unreasonably under the circumstances, there could be tort liability based on negligence.[73] Putting aside the potential tort liability for local actions or inactions, cities and municipalities are vital in adapting to and mitigating climate change impacts, according to the Intergovernmental Panel on Climate Change (IPCC) 2023 report:

> Urban systems are critical for achieving deep emissions reductions and advancing climate resilient development. Key adaptation and mitigation elements in cities include considering climate change impacts and risks (e.g., through climate services) in the design and planning of settlements and infrastructure; land use planning to achieve compact urban form, co-location of jobs and housing; supporting public transport and active mobility (e.g., walking and cycling); the efficient design, construction, retrofit, and use of buildings; reducing and changing energy and material consumption; sufficiency; material substitution; and electrification in combination with low emissions sources. Urban transitions that offer benefits for mitigation, adaptation, human health and well-being, ecosystem services, and vulnerability reduction for low-income communities are fostered by inclusive long-term planning that takes an integrated approach to physical, natural and social infrastructure. Green/natural and blue infrastructure supports carbon uptake and storage and either singly or when combined with grey infrastructure can reduce energy

[72] *See id.* at 448 (noting that plaintiffs typically bring claims against local governments alleging the "municipalities' negligent design, construction, or operation of flood control structures").

[73] *Id.* at 447 ("[A]lthough no affirmative duty exists for governments to provide protection from natural hazards, once a local government begins instituting adaptation measures, that action triggers a duty to adapt reasonably under the circumstances and failure to do so can result in liability for negligence." (citing Maxine Burkett, *Duty and Breach in an Era of Uncertainty: Local Government Liability for Failure to Adapt to Climate Change*, 20 GEO. MASON L. REV. 775, 780–81 (2013))).

> use and risk from extreme events such as heatwaves, flooding, heavy precipitation and droughts, while generating co-benefits for health, well-being and livelihoods.[74]

Wildfires are another potential disaster risk exacerbated by climate change that threatens the resilience of communities, particularly those in the Wildland-Urban Interface (WUI).[75] Wildfire planning "is typically delegated to the fire function of federal, state, and local governments" and does not involve the local government functions that permit and regulate development in the WUI or the citizens who reside in these areas susceptible to wildfires.[76] Instead, the typical fire community should involve local officials, development staff, and citizens when drafting a Community Wildfire Protection Plan (CWPP) so that land use planning can provide mitigation tools other than those needed to fight fire.[77]

Three additional steps for wildfire planning include: 1. local community drafting of wildfire regulations, programs, and incentives down to the neighborhood level; 2. implementing, maintaining, and enforcing local regulations such as requiring fire-resistant vegetation, weed abatement, defensible space, and fire-resistant roofs; and 3. updating the CWPP based on adaptive governance assessments and changes to Federal Emergency Management Agency (FEMA) compliance standards.[78] The concepts of adaptive governance, as they relate to institutions and scale, will

---

[74] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2023: SYNTHESIS REPORT: SUMMARY FOR POLICYMAKERS 29 (Hoesung Lee et al. eds., 2023) (footnote omitted) (omitting level of confidence qualifiers).

[75] *See* Stephen R. Miller, *Planning for Wildfire in the Wildland-Urban Interface: A Guide for Western Communities*, 49 URB. LAW. 207, 210–11 (2017) (discussing how the rising risk of wildfires affects WUI communities).

[76] *Id.* at 207–08, 264–65 (providing an approach to wildfire planning that integrates these functions and communities by involving lawyers, planners, building officials and developers who need to understand the ecology and the allocation of wildfire resources).

[77] *See id.* at 209 ("This article advocates a broadening of the typical participants in CWPP drafting that would extend beyond the typical fire community to include local officials, local staff in the development-related departments, and a citizens advisory board.").

[78] *See id.* at 209–10 (discussing the four steps of wildlife planning).

aid in building community resilience to wildfires.[79] The ability to learn and adapt will be the strongest when there is a connection between decision-making and responsibility for adaptive responses, when communication occurs across scales and institutions, and when institutions are open to new information and adaptable in response.[80]

III. MITIGATION & ADAPTATION

Mitigation can take many forms, depending on the application. For example, in planning for new development, we must avoid building in flood-prone and/or ecologically sensitive areas, and for existing development in hazardous areas, we should promote gradual and voluntary resettlement.[81] Although many mitigation strategies will likely involve adaptation tools, this Article explicitly identifies adaptive management and governance as a key component of mitigation. Local governments have a vital role in both climate change mitigation and adaptation.[82] Climate change mitigation can help slow the speed and intensity of global warming and thus provide more time for local governments to adapt to these changes.[83] Therefore, local governments should aggressively mitigate to limit their own substantial greenhouse gas (GHG) emissions while integrating adaptation strategies and resilience planning at the local level to respond to these disruptions.[84] For example, New York City has taken a comprehensive approach with PlaNYC, which includes mitigating climate change by reducing its GHG emissions and improving its coastal zone resilience by

---

[79] *See* Jesse B. Abrams et al., *Re-Envisioning Community-Wildfire Relations in the U.S. West as Adaptive Governance*, 20 ECOLOGY & SOC'Y, Sept. 2015 (discussing the institutions and adaptive governance in fire resistance).

[80] *See id*. (discussing when "the potential for learning and adaptation appears to be greatest" according to resilience and adaptive governance scholarship).

[81] FARBER ET AL., *supra* note 62, at 3–4.

[82] *See* Adams-Schoen, *supra* note 19, at 440–41 (discussing the role of local governments in climate change mitigation).

[83] *See id*. at 438 (discussing the benefits incurred by New York City because of its adaptation strategies).

[84] *See id*. at 440–41 (discussing the importance of local governments' aggressive mitigation efforts).

planning for flood risk and adapting its waterfront infrastructure and policies.[85]

There are three classifications of adaptation strategies—resistance, adjustment, and relocation.[86] First, resistance uses manmade or natural barriers to shield communities from natural hazards such as flooding and storm surge.[87] Second, adjustment strategies take various forms, including engineering and technology innovations, changing land use practices and policies, modifying risk-spreading tools such as insurance and tort law, and improving public health and safety methods and systems.[88] Finally, relocation requires vulnerable populations and property to relocate to areas less prone to risk.[89] Relocation strategies may include restricting development in disaster-prone areas, prohibiting rebuilding structures in hazard areas already impacted by disaster, or abandoning communities and development we can no longer protect.[90] In short, climate adaptation strategies address the hazardous impacts of global warming,[91] including climate migration. National[92] and international entities are facing the

---

[85] *See id.* at 464, 449–64 (suggesting that "a number of New York City initiatives, as well as their underlying planning processes, provide excellent models for regional, county and sub-county level resilience planning efforts"); *see generally* Danielle Spiegel-Feld & Katrina M. Wyman, *Local Action, Global Problem: Why and How New York City Is Tackling Climate Change*, 50 FORDHAM URB. L.J. 1187 (2023) (using New York City as the central case study to examine why cities have taken on climate change).

[86] *See* Verchick & Hall, *supra* note 17, at 2209 ("We can divide adaptation strategies into three broad categories: resistance, adjustment, and retreat.").

[87] *See id*. at 2209–10 ("Resistance is most commonly associated with flood or storm surge—using manmade or natural buffer systems to block the punch of souped-up 'natural hazards.'").

[88] *See id.* at 2210 ("Adjustment strategies include innovations in engineering, settlement, and land-use practices; modifications to risk-pooling systems like insurance or tort law; and changes to public health and safety programs.").

[89] *Id.* (describing retreat as involving "the migration of people and property to less hazardous areas").

[90] *Id.* (expanding discussion of retreat to include abandoning developments and imposing limits on development).

[91] *Id.* (stating that climate change adaption's distinguishing factor as its specific intention to address effects of global warming).

[92] *See, e.g.*, Press Release, White House, Fact Sheet: Marking the Two-Year Anniversary of the Report on the Impact of Climate Change on Migration (Dec. 1, 2023), https://www.whitehouse.gov/briefing-room/statements-releases/2023/12/01/fact-sheet-marking-the-two-year-anniversary-of-the-report-on-the-impact-of-climate-change-on-

challenge of climate migration as populations move from rural to urban areas, sending and receiving communities deal with relocation efforts, immigration rules strain to accommodate asylum or temporary protected status, and people confront the social and cultural impacts of leaving their historical ties to a place.[93]

Adaptive governance serves to "enhance[] an institution's capability to deal flexibly with new situations," while adaptive management "is the process of learning from experience by monitoring ecosystem responses to actions taken by institutions that manage ecosystems."[94] Adaptive governance adopts "patterns of consumption and production that work in synergy with ecosystem functions and processes,"[95] and decision-making approaches such as cost-benefit analysis, the precautionary principle, risk management, and environmental impact assessment guide this governance model.[96] Monitoring, constant assessment of results, both short-term and long-term, and enforcement of decisions made under the adaptive governance model inform the continuing adaptive management of these ecosystems under the principle of resilience.[97] For example, community preparedness for wildfires is not just a one-time event; it requires ongoing monitoring of

---

migration/ [https://perma.cc/RUG3-TD8X] (stating that "[t]he Department of State released a new approach in June 2023 to address the impacts of the climate crisis on migration and displacement, including four objectives: 1) strengthen and expand the protection of refugees and migrants in situations of vulnerability affected by climate change; 2) enhance existing climate action by partnering with key humanitarian partners, through regular dialogue with international, governmental, and non-governmental organizations, and through engagement with members of affected populations; 3) expand U.S. multilateral diplomacy and leadership to address the impacts of climate change on migration and displacement in international for a; and 4) strengthen coordination between agencies to advance policy solutions for refugees and migrants affected by climate change").

[93] Jessica A. Shoemaker, *Re-Placing Property*, 91 U. CHI. L. REV. (forthcoming 2024) (manuscript at 33), https://papers.ssrn.com/abstract=4562406 (describing the cultural and emotional attachment that people, and specifically indigenous groups, may have to land and that legal processes and rights fail to recognize these attachments).

[94] Lia Helena Monteiro de Lima Demange, *The Principle of Resilience*, 30 PACE ENV'T L. REV. 695, 698 (2013) (arguing further that while these are useful tools for addressing resilience, changing management methodology is not sufficient and instead requires a change of values in humankind's relationship with nature).

[95] *Id.* at 734.

[96] *Id.* at 736–78 (discussing these decision-making tools in depth).

[97] *Id.* at 782–83 (describing long term application and management under the principle of resilience).

conditions, enforcing compliance with wildfire maintenance, and continuing evaluation and communication between fire officials, local government, and community members.[98]

Rural communities experience more threats from the impacts of climate change based on the many challenges they face.[99] Climate change impacts are more intense, and they are less able to recover from disruption because they depend on agriculture and natural resources. In addition, poverty, insufficient education, and political disregard for their needs have socially damaged them and reduced their ability to respond to disaster.[100] Some of the contributing factors to a lack of resilience include demographic shifts from young people leaving, lower income levels, lack of broadband internet service, a decreasing tax base causing diminished resilience capabilities, a loss of character and sense of place from changing land uses, absentee land ownership, and a breakdown of traditional community support networks.[101]

Mitigation and adaptation focus on reducing future carbon dioxide emissions and protecting society from the current and future risks of adverse climate change impacts.[102] Unfortunately, these otherwise well-intentioned responses negatively affect the poor, who live in aging and inadequate structures in areas vulnerable to the threats of climate change.[103] Adaptation measures focus on "protection, accommodation, and retreat," which consider courses of action including redesigning structures, lifestyle changes, reconfiguring communities, armoring shorelines, restricting

---

[98] *See* Miller, *supra* note 75, at 257–58 (outlining recommendations for effective community preparedness and prevention of wildfires).

[99] Andrews & Reiblich, *supra* note 31, at 746 (describing challenges rural communities face today).

[100] *See id.* at 748 (citing to a working group of the Intergovernmental Panel on Climate Change (IPCC) that considered rural area characteristics that make these areas "uniquely prone to climate change impacts").

[101] *See id.* at 749–57 (discussing these key challenges in depth); *see also*, Stephen Clowney, *Do Rural Places Matter?*, 56 CONN. L. REV. (forthcoming 2024), https://ssrn.com/abstract=4757944 (same).

[102] *See* Shelby D. Green, *Building Resilient Communities in the Wake of Climate Change While Keeping Affordable Housing Safe from Sea Changes in Nature and Policy*, 54 WASHBURN L.J. 527, 527 (2015) (stating mitigation seeks to reduce future carbon dioxide emissions and adaption focuses on current and future emissions).

[103] *Id.* at 528 (stating that mitigation and adaption inflict additional hardship on poor persons living in "aging, not so-well-crafted structures" in vulnerable areas).

rebuilding and development in vulnerable areas, removing structures, establishing setback buffers, establishing stricter building regulations to improve infrastructure and building resilience to extreme weather, and involuntarily relocating communities.[104] Building resilience through these adaptation measures will benefit both private and public interests but will necessarily impede our efforts to provide available and affordable housing as we focus on infrastructure and comply with strict building standards for new construction, retrofitting existing buildings, building green, and returning land to its natural state in disaster-prone areas.[105]

Participation of all citizens who work and live in the community, particularly the vulnerable ones, is essential in adaptive planning and governance for municipal resiliency.[106] When adopting mitigation and adaptation strategies, the local community should take into account the following factors: cost and efficacy of upgraded standards, flood insurance premium caps, funding in the secondary mortgage market, environmental impact statements, uniform building appraisal standards, protections for displaced people, affordable housing, and zoning revisions to allow the rebuilding of neighborhoods.[107] As we seek "to fortify and renew the urban environment in the wake and advent of climate change," we must not forget the failures of the urban renewal programs that sought to prevent or reverse urban economic decline by "renew[ing] and revitaliz[ing]" urban communities.[108]

A. LOCAL LAND USE TOOLS

1. Planning, Zoning, and System Flexibility. Local or regional governments create land use and zoning regulations to determine

---

[104] *See id.* at 544–46 (describing the practices of adaption).

[105] *See id.* at 550–52 (discussing how building resiliently benefits both public and private interests but requires stricter zoning and particular construction standards).

[106] *See id.* at 567–68 (arguing for the need for private landowners to cede some control over their land and for the input of "historically excluded persons" in the adaptive planning process).

[107] *See id.* at 568–72 (listing eight factors communities should consider when developing strategies for mitigation and adaptation).

[108] *See id.* at 572 (discussing what we can learn from the failures of the urban renewal programs of the 1950s and 60s).

the community development direction.[109] Through zoning, local governments exclude or restrict specified uses within particular areas and establish construction densities and structural limitations on property use.[110] Many "land use regulations influence ecological resilience" by exacerbating disaster risk because they lack green infrastructure and allow high-density development in risk-prone areas.[111] Instead, land use regulations should promote ecological resilience and safety, even if such policies compromise economic growth in the short term.[112] Local governments have at their disposal many existing tools to help their communities adapt, including the use of building codes, comprehensive planning, and zoning and subdivision regulation.[113]

Zoning in the City of Boston, Massachusetts, provides an interesting example of how local governments may respond to ongoing municipal needs, such as affordable housing and climate resilience. Boston's zoning regulations are independent of the Massachusetts Zoning Act and reflect "the city's special circumstances, including its relative density, its long history, and its role as the Commonwealth's capital and commercial center."[114] Amendments to the Enabling Act, effective in 2020, gave the City greater authority to modify affordable housing policies through its Zoning Commission rather than by legislative action.[115] The Zoning Commission now has the authority to amend linkage payment amounts used to fund affordable housing, codify the city's

---

[109] *See* Demange, *supra* note 94, at 783 ("Land use and zoning regulations are usually created by local or regional governments. The zoning plan analyzes the existing land uses and determines the community development direction.").

[110] *See id.* ("Through land use and zoning regulations, local governments prohibit certain uses within certain areas . . . .").

[111] *See id.* at 784 ("[L]and use regulations greatly influence ecological resilience. . . . [I]ll land use planning can exacerbate the risk of disaster by concentrating populations in risk-prone areas and by failing to keep green infrastructure.").

[112] *See id.* ("The principle of resilience requires that land use regulations prioritize ecological resilience and safety, even if it limits economic growth in certain circumstances.").

[113] *See* Adams-Schoen, *supra* note 19, at 445 (listing ways local governments can help their communities deal with climate change).

[114] CYNTHIA M. BARR & JENNIFER R. SCHULTZ, MASSACHUSETTS ZONING MANUAL § 16.1 (7th ed. 2021).

[115] *See id.* at Exhibit 16E ("Amendments to the Enabling Act in 2020 authorized the Zoning Commission to codify the [affordable housing policy] in the Zoning Code and to change its requirements and applicability.").

Inclusionary Development Policy, as well as change its requirements and applicability, and take other actions under the Affirmatively Furthering Fair Housing and Smart Growth Overlay Districts programs to support affordable housing.[116]

Several of Boston's zoning provisions respond to the city's *Climate Ready Boston* plan and "are designed to minimize damage to the environment, facilitate the use of alternative energy sources, and address long-term impacts of climate change."[117] These provisions address a project's impacts, including resource consumption, energy efficiency, infrastructure resilience, conservation, and protection of sensitive areas, environmental protection in waterfront districts, coastal flood resilience due to sea level rise and storm surge, flood hazards, groundwater protection, and smart growth.[118] The *Climate Ready Boston* plan anticipates additional zoning to address climate-induced hazards, and "planning is under way for zoning to achieve the city's goal of reaching zero net carbon for new construction," as well as other climate resilience planning.[119]

Zoning ordinances can be particularly useful for ensuring wildfire mitigation. For example, the City of Sisters, Oregon, has a municipal code ordinance establishing standards for property in the urban/rural interface.[120] The purpose of the ordinance is "to incorporate 'urban/rural interface' standards and criteria as a means of reducing the risk of the spread of wildfire," and those standards apply to any property in city limits that the Oregon Department of Forestry has designated on its fire risk map as an "extreme fire risk" property.[121] Additionally, cities may work with Homeowner's associations (HOAs), where homeowners in the same neighborhood establish rules through private restrictive covenants

---

[116] *See id.* (sharing examples of Boston zoning provisions aimed at promoting affordable housing development).

[117] *Id.*

[118] *See id.* (discussing the variety of ways that zoning provisions "respond to [Boston's] *Climate Ready Boston* plan").

[119] *Id.*

[120] *See* SISTERS, OR., MUN. CODE tit. 8, ch. 20 (2023), https://www.codepublishing.com/OR/Sisters/#!/Sisters08/Sisters0820.html#8.20 (establishing the City's "urban/rural interface standards").

[121] *Id.* §§ 11–12(1).

to incorporate wildfire planning and prevention in their private covenants.[122]

The zoning system allows for flexibility through rezoning, use, area variances, and conditional uses or special exceptions when appropriate. For example, making neighborhoods more resilient may require rezoning for accessory dwelling units (ADUs) to increase density and provide affordable housing.[123] Single-family residential zoning could expand to allow mixed uses and revitalize neighborhoods by increasing fresh food options and providing places for community gatherings. Restrictions that prohibit mechanical and electrical systems in yards could allow area variances for homes built in floodplains, allowing this vital equipment to be located outside the house instead of in a basement subject to flooding.[124] These individualized exceptions to zoning could improve resiliency so long as they do not impede resiliency by allowing building on wetlands, flood plains, or coastlines. In addition to making exceptions to zoning regulation, local governments may use Transferable Development Rights (TDRs) to protect environmentally sensitive land by facilitating a market-driven system based on valuing the development potential of the protected property.[125] Finally, nuisance law is also available to fill gaps in local government regulation and planning, and many communities have nuisance ordinances to support public health and safety objectives.[126]

---

[122] *See* Miller, *supra* note 75, at 253–56 (noting that the Firewise *Safer from the Start* publication "contains several examples of Firewise-friendly HOA CC&Rs" (citing FIREWISE CMTYS., SAFER FROM THE START: A GUIDE TO FIREWISE-FRIENDLY DEVELOPMENTS 25–26 (2009), https://www.nfpa.org/downloadable-resources/guides-and-manuals/safer-from-the-start-firewise-pdf [https://perma.cc/H2CG-HJ52]))

[123] *See, e.g.*, Owen Minott, *Accessory Dwelling Units (ADUs) in California,* BIPARTISAN POL'Y CTR. (Sept. 12, 2023), https://bipartisanpolicy.org/blog/accessory-dwelling-units-adus-in-california/ [https://perma.cc/2ZBK-N27G] (discussing changes to California state law that have removed many of the obstacles to building ADUs).

[124] *See* Green, *supra* note 102, at 572 (suggesting cities allow placement of mechanical and electrical systems that are normally located in a basement outside the home to prevent flood damage).

[125] *See, e.g.*, Suitum v. Tahoe Reg'l Plan. Agency, 520 U.S. 725, 730 (1997) (describing granting TDRs instead of variances and exceptions to "address[] the potential sharpness of its restrictions").

[126] *See* Miller, *supra* note 75, at 262 (stressing the importance of nuisance ordinances in supporting wildfire mitigation).

2. Eminent Domain, Exactions, and Impact Fees. Large investor-owned utility companies (IOUs) with regional monopolies have provided electricity to most people in the United States for many years.[127] Recently, however, local communities have sought to gain control of energy systems through community choice aggregation (CCA), where the local government takes over energy procurement[128] through municipalization by using eminent domain to gain ownership of local businesses,[129] or by using microgrids to allow neighborhoods to operate as energy islands.[130] This increase in energy localism may generate benefits such as lower prices and greener power, but it is unclear whether this movement toward local energy control will achieve its anticipated goals.[131] Similarly, some communities in Western drought-plagued states have considered using municipalization to take control of water distribution in an effort to reduce utility prices.[132] Because the local government may use the power of eminent domain to acquire private property for the benefit of the public, this power is a potent local tool for building climate resilience by taking control of private energy and water resources and managing private land use.

Floodplains are a form of wetlands that perform vital functions within an ecosystem by filtering contaminants and reducing sediment.[133] They are also biologically diverse and store water during high water times.[134] To retain the functions and resilience of

---

[127] *See* Sharon Jacobs & Dave Owen, *Community Energy Exit*, 73 DUKE L.J. 251, 253–54 (2023) (observing that many Americans get their power from investor-owned utilities (IOUs)).

[128] *See id.* at 254 n.12 (defining community choice aggregation).

[129] *See* Shelley Ross Saxer, *Eminent Domain, Municipalization, and the Dormant Commerce Clause*, 38 U.C. DAVIS L. REV. 1505, 1506 (2005) (defining municipalization).

[130] *See* Jacobs & Owen, *supra* note 127, at 278 (defining microgrids).

[131] *See id.* at 256–58 (listing concerns that alternatives to IOUs may not achieve equity among energy consumers).

[132] *See, e.g.*, Golden State Water Co. v. Casitas Mun. Water Dist., 186 Cal. Rptr. 3d 64, 73 (Cal. Ct. App. 2015) (holding the publicly owned water utility has the power of eminent domain to acquire a private water corporation).

[133] *See* Barbara Cosens, *Resilience and Law as a Theoretical Backdrop for Natural Resource Management: Flood Management in the Columbia River Basin*, 42 ENV'T. L. 241, 248 (2012) (describing floodplains as "the low lying areas adjacent to a river that are periodically inundated with flood water when a river is left to its natural state," and wetlands as "the transition zone between land and water").

[134] *See id.* (stressing the importance of wetlands in storing water in times of high water and as repositories of biodiversity).

floodplains, we should stop trying to prevent floods and consider the alternative of moving development out of floodplains. After Hurricane Katrina, instead of reconnecting the river to the floodplain, we chose to rebuild New Orleans in an emotional, not a rational, response.[135] However, if we work with the natural adaptive capacity of an ecological system, we can intervene in a way that enhances the resilience of a flooding cycle rather than altering the state of the system.[136] Rebuilding in New Orleans with the *Make it Right Project* earned LEED awards, but the homes became unlivable less than ten years later because of design and construction flaws.[137] Instead of rebuilding, we can reconnect with nature by using green infrastructure, setting aside open spaces, and either using hard armoring against the sea or building "living shorelines" by restoring natural habitats such as marshes and relocating people and structures.[138] For example, Ellicott City, Maryland, responded to destructive flooding in 2016 and 2018 by adopting a five-year mitigation plan that included rehabilitating, relocating, and even razing some of the area's historic structures.[139]

Coastlines subject to inundation, particularly in coastal rural areas such as Virginia, may risk the destruction of historic and cultural resources such as Indian tribal lands, colonial settlements such as Jamestown, and historic birthplaces, homes, churches, and

---

[135] *See id.* at 243 ("[I]n the nation's response to Hurricane Katrina, the emotional drive to rebuild New Orleans overwhelmingly prevailed over the rational plea to reconnect the river to the floodplain.").

[136] *See id.* at 246–47 (noting that by allowing a stream to flood beyond its natural boundaries during heavy rains, the ecosystem increases its resilience through its natural response to the disruption).

[137] *See* Green, *supra* note 45, at 278–80 (noting that some of the problems from the construction flaws included "water intrusion, black mold, rotting porches, collapsing stair rails, electrical fires, plumbing problems, poor ventilation, and termite infestations").

[138] *See id.* at 271 (discussing programs cities and states are adopting to reconnect with nature (citing The NOAA Ocean Podcast, *Breaking Down Barriers: Natural Infrastructure*, NAT'L OCEAN SERV. NAT'L OCEANIC & ATMOSPHERIC ADMIN. (July 30, 2020), https://oceanservice.noaa.gov/podcast/july20/nop37-natural-infrastructure.html [https://perma.cc/AJJ9-RRDT])).

[139] *See id.* at 272–73 (noting that these accommodation and mitigation measures impose a significant financial, historical, and cultural cost).

national parks.[140] Saltwater intrusion due to sea level rise will also impact coastal rural areas by turning domestic freshwater wells into water that is unable to support current crop irrigation and requires a conversion to growing saltwater-resistant crops, which may not be economically feasible.[141] Rural communities may be able to use adaptive planning to protect marshes that migrate upland with sea level rise so that they continue to yield the benefits of water filtration and flood control.[142] They may also adapt by establishing an aquaculture industry, substituting salt-tolerant crops in areas of saltwater intrusion, harvesting timber before saltwater reaches forestland, and, as a last resort, relocating from recurring flood areas to higher ground.[143]

Some cities use voluntary purchasing or eminent domain to acquire land to preserve green space, demolish housing already severely damaged in a disaster, and convert property in hazard-prone areas to open space.[144] The Department of Housing and Urban Development has also established the Disaster Recovery Enhancement Fund to support long-term disaster projects such as buying out homeowners in high-risk areas, providing relocation funds to incentivize residents to move, and giving home improvement grants for projects such as fortifying or retrofitting structures and elevating property.[145] Relocating will likely impact vulnerable communities the most as people are barred from

---

[140] *See* Andrews & Reiblich, *supra* note 31, at 757–58 (observing that "[t]he problem of rising tides is worse for Jamestown because it continues to settle into the ground, and the waters around it are rising at more than twice the global average").

[141] *See id.* at 762 ("This is an important issue in coastal agricultural states because it could prompt existing farmers to retire and inhibit new farmers from replacing them because they cannot afford the new equipment that is required.").

[142] *See id.* at 772 (discussing potential plans to protect marshes from rising sea levels).

[143] *See id.* at 772 ("A thriving aquaculture industry can help to strengthen and diversify a rural coastal economy.").

[144] *See* Green, *supra* note 102, at 552, 557 (discussing cities' efforts at creating open space).

[145] *See id.* at 557 ("The Disaster Recovery Enhancement Fund, established by HUD, aimed 'to encourage states to undertake long-term disaster' projects minimize the extent of damage from future natural disasters." (quoting *Issue Brief: Financing Efforts to Make Homes More Resistant to Natural Disasters*, CTR. FOR HOUS. POL'Y (Jan. 1, 2011), https://icma.org/documents/financing-efforts-make-homes-more-resistant-natural-disasters [https://perma.cc/TPJ3-8CNJ])).

returning to their homes, land is bulldozed to provide open space, and structures are cleared from disaster-prone areas.[146]

Obtaining physical, or even in-lieu, exactions as part of the permitting process or in conjunction with a development agreement offers local government the opportunity to mitigate adverse impacts from a development project. The negotiations between a developer and the local government provide a way to manage the development's potential to increase risk in the community and reduce its resiliency. In *Koontz v. St. Johns River Water Management District*, the state water district required the property owner to pay an in-lieu exaction to restore publicly owned wetlands located several miles from his property to receive approval to develop his property, including wetlands.[147] The U.S. Supreme Court decided this in-lieu exaction should be subject to judicial scrutiny under the *Nollan* and *Dolan* requirements for exactions.[148] However, so long as the required exaction had an "essential nexus" to the impacts from Koontz's development that the government was trying to mitigate and the exaction was "roughly proportional" in kind to the adverse impact, the water district could require the exaction as part of the permitting process.[149]

Requiring exactions as part of the development permitting process may also reduce wildfire risks. For example, a "city or county may require dedication of emergency access easements, dedication of land for firefighting facilities, on-going maintenance of those facilities, and subsequent review of fire safety plans before later phases of development can begin."[150]

Impact fees are another local tool that allows local governments to offset the adverse effects of land development on its ecosystems and infrastructure, which reduces the city's resilience and requires

---

[146] *See id.* at 560 ("Rather than rebuilding decent and affordable housing, in response to climate change, planners are arguing for open, green spaces within communities, meant to control stormwater runoff, provide public spaces, and decrease the urban heat island effect.").

[147] *See* Koontz v. St. Johns River Water Mgmt. Dist., 570 U.S. 595, 601–02 (2013) (discussing the District's requirements for the petitioner).

[148] *See id.* at 619 ("We hold that the government's demand for property from a land-use permit applicant must satisfy the requirements of *Nollan* and *Dolan* even when the government denies the permit and even when its demand is for money.").

[149] *See id.* at 612 (discussing the "nexus" and "rough proportionality" standards).

[150] Miller, *supra* note 75, at 261.

additional financing.[151] Legislative schedules of fees inform prospective developers of the costs they will be required to pay based upon the size and purpose of the project and the projected burden of the new development on infrastructure and services such as sewers, transportation, schools, and traffic control.[152] Because these fees must rationally relate to the anticipated burdens from the development and be "earmarked" and used for the specific purposes identified, they are not taxes to raise general revenue and local government will have the authority to impose them.[153] Some cities have used impact fees as affordable housing mandates and linkage fees to meet their fair share obligation to provide affordable housing.[154] In addition, local governments have used density bonuses and the builder's remedy to incentivize low-income housing development.[155]

3. Resilient and Green Development. While the federal government regulates pollution from industrial sources, cities have moved towards regulating individual behavior and combatting

---

[151] *See* Shelley Ross Saxer, *When Local Government Misbehaves*, 2016 UTAH L. REV. 105, 151–57 (discussing impact fees and the dual rational nexus test). *But see* Sheetz v. County of El Dorado, 144 S. Ct. 893, 900, 902 (2024) (rejecting the view that "the *Nollan/Dolan* test does not apply to 'legislatively prescribed monetary fees,'"and holding that the Takings Clause applies to prohibit legislative actions that impose unconstitutional conditions on land-use permits).

[152] *See id.* at 151 ("[I]mpact fees . . . are now used to finance community infrastructure improvements that are required to support the growth generated by land development.").

[153] *See id.* at 152 ("An impact fee that fails the dual rational nexus test because it appears to be general revenue-raising legislation, not reasonably related to the adverse impacts created by the development, may be treated as a tax.").

[154] *See id.* at 160 ("[L]ocal municipalities have attempted to address the critical need for affordable housing by various financing approaches including mandatory set-asides, density bonuses, and linkage fees.").

[155] *See, e.g.*, *Density Bonus Law: What Are Incentives/Concessions and Waivers?*, S. CAL. ASS'N OF GOV'TS 1, https://scag.ca.gov/sites/main/files/file-attachments/density_bonus_law_-_what_are_incentives_concessions_and_waivers.pdf?1667860893 [https://perma.cc/TU7X-YSHH] (describing a California law that "allows a developer to increase density on a property above the maximum set under a jurisdiction's General Plan" in exchange for the developer reserving "a certain number of the new affordable dwelling units . . . at below market rate (BMR) rents"); *The "Builder's Remedy" and Housing Elements*, ASS'N OF BAY AREA GOV'TS 1, https://abag.ca.gov/sites/default/files/documents/2022-10/Builders-Remedy-and-Housing-Elements.pdf [https://perma.cc/TWA6-JXFE] ("[I]f a locality has a noncompliant housing element[,] the city or county must approve the housing development project, regardless of the local zoning.").

global climate change through GHG emission reductions, especially by focusing on buildings as a major source of GHG emissions.[156] A survey of fifteen cities identified as leaders in sustainability highlighted seven common strategies cities have adopted – the majority of which target individual behavior:

> (1) green building codes for new construction; (2) regulations requiring the disclosure of energy efficiency information in existing buildings; (3) land use regulations to promote density . . . ; (4) anti-idling regulations to improve air quality; (5) mandates that parking lot developers or owners make electric vehicle-ready spaces; (6) requirements that certain traffic lanes be set aside for bicycles . . . ; and (7) plastic bag bans, taxes, or fees.[157]

As local governments employ resilience thinking to assess and monitor building codes in response to new information or the impacts of actual disasters, new construction standards will emerge from the private sector or local officials themselves to fortify structures and build green.[158] New York City is a leader among major cities in using green building codes to mitigate climate change by reducing GHG emissions and adapting to climate change by making buildings more efficient.[159] In 2016, the City adopted Local Laws 31 and 32 to amend Local Law 86, adopted in 2005 as one of the first green building laws in the United States.[160] These new laws established targets and limits for energy use intensity and required

---

[156] *See* Wyman & Spiegel-Feld, *supra* note 6, at 340–42 (discussing local governments' regulation of pollution by individuals and GHG emissions).

[157] *Id.* at 345–47 (including a table representing the common policies of the fifteen cities).

[158] *See* Green, *supra* note 102, at 550 ("Local governments are adopting either new private sector standards or using home-grown resilience standards[, which] feature fortification and building green.").

[159] *See* Adams-Schoen, *supra* note 19, at 492 (noting that "New York City [is] at the forefront of municipalities using building code reform as a means of climate change adaptation and mitigation").

[160] *See Green Building - OEC*, N.Y.C. MAYOR'S OFF. OF ENV'T COORDINATION, https://www.nyc.gov/site/oec/green-building/green-building.page [https://perma.cc/UA64-NC5W] (stating that "Local Law 86 . . . has been expanded upon through enactment of Local Laws 31 and 32 of 2016").

that most capital projects build to Leadership in Energy and Environmental Design (LEED) with green building standards developed by the U.S. Green Building Council (USGBC).[161] City-owned projects are required to reduce energy use intensity using ASHRAE 90.1 and other strict standards.[162]

Guidance on best practices for community development is also available to local governments from the Sustainable Development Code project started by Professor Jonathan Rosenbloom to help "build more resilient, environmentally conscious, economically secure, and socially equitable communities."[163] For example, the subchapter on climate change identifies actions such as energy benchmarking, auditing, and upgrading and provides specific examples of ordinances implemented by various cities.[164]

In addition to developing private industry and government building code standards to guide resilient and green building, private organizations like the American Society for Testing and Materials (ASTM) have developed standards to evaluate the quality of materials such as those used in buildings.[165] ASTM adopted the Standard for Environmental Assessments for Commercial Real Estate in 1993 to assess the "appropriate inquiry" due diligence standard to qualify for the innocent landowner defense under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA).[166]

Building on the success of these standards for commercial real estate investors, an ASTM task group is producing a Property

---

[161] *See id.* (describing the requirements of Local Laws 31 and 32).

[162] *See id.* (noting the requirement to reduce energy use intensity using "ASHRAE 90.1 and other established stringent standards").

[163] *About,* SUSTAINABLE DEV. CODE, https://sustainablecitycode.org/about/ [https://perma.cc/T24H-ZLL9].

[164] *See* Tyler Adams, *Energy Benchmarking, Auditing, and Upgrading*, SUSTAINABLE DEV. CODE, https://sustainablecitycode.org/brief/energy-benchmarking-auditing-and-upgrading/ [https://perma.cc/3SC3-PM4U] (providing examples of municipalities using "energy benchmarking, auditing, and upgrade requirements").

[165] Joseph Philip Forte, *Understanding Property Resilience: Confronting the Challenges of Natural Hazards and Climate Change* 5, (Am. Coll. Real Est. Laws. Papers, 2023); *see also Detailed Overview*, AM. SOC'Y TESTING & MATERIALS, https://www.astm.org/about/overview/detailed-overview.html ("ASTM International is a globally recognized leader in the development and delivery of voluntary consensus standards.").

[166] Forte, *supra* note 165, at 7.

Resilience Assessment Guide (PRA) to provide a property investor, lender, or other users with guidance as to a building's vulnerability and a plan for necessary "resilience measures such as temporary or permanent flood barriers, moving critical equipment, fortifying the building against fire hazards, upgrading HVAC equipment, etc."[167] For example, two buildings located at similar elevations will be subject to flood risk, but the building with critical equipment in the basement will experience the hazard differently than the other building that located essential equipment above the projected flood levels.[168] The PRA is intended "to provide a clear and consistent standard for identifying the probable risks, assessing the potential vulnerabilities and determining the physical resilience of commercial property to natural physical hazards—and those whose intensity and frequency are induced by climate change."[169]

4. Water Resources, Water Management, and Watershed Ecosystems. Water law and policy focus on allocating the rights of individuals and entities to use surface water and groundwater.[170] Water resource management for surface water occurs at state and local levels based on the common law systems of riparian rights, prior appropriation, or a hybrid of these two.[171] Groundwater resources are governed by separate common law regimes that may not correspond to the common law rule governing the same state's surface water.[172] Nevertheless, groundwater and surface water are generally hydrologically connected, and many states overlay their common law rules with regulations designed to manage access to these resources for local beneficial and reasonable uses.[173] Water management addresses "the economic, ecologic, and public health damages caused by too much water, not enough water, and/or the degradation of water quality."[174] Climate change impacts water resources and water management, including surface water.

---

[167] *Id.* at 12, 17.

[168] *Id.* at 16.

[169] *Id.* at 19.

[170] *See* SAXER & ROSENBLOOM, *supra* note 48, at 123–24 (noting various uses of water and legal frameworks for water apportionment).

[171] *See id.* at 124 (listing the "three major legal frameworks for water apportionment" in the U.S.).

[172] *Id.* at 146–47.

[173] *Id.* at 152–54.

[174] *Id.* at 155.

Watersheds are ecological systems (ecosystems) with multiple surface water processes and functions, which are impacted by human activities such as water consumption, use, and management, as well as land use and development.[175] Protecting the health, integrity, and functioning of watershed ecosystems requires a broad approach, as human activities affect water resources and water management.[176] The scope of these human activities includes:

> (1) the diversion, pumping, and consumptive uses of water; (2) water development projects and waterway alterations[;] (3) instream flow programs, including ecological and species protection, dredging for commercial navigation, fishing operations, and opportunities for recreational boating; (4) flood and runoff control; (5) land use and development patterns; (6) forestry, mining, and agricultural methods; and (7) introduction of pollutants into waterways, either direct[ly] or indirectly. Likewise, natural events that can substantially alter a watershed's hydrology, perhaps in synergy with human-created effects, include floods, major storms, hurricanes, and drought.[177]

Adaptive watershed management requires a dynamic system that avoids "static plans" and instead relies on adaptation and resilience to manage the uncertainty of changing conditions.[178] Generally, "[a]daptive management runs the risk of being an anti-planning, ad hoc, reactive experimentalism that has given up on

---

[175] *See* Craig Anthony Arnold, *Adaptive Watershed Planning and Climate Change*, 5 ENV'T & ENERGY L. & POL'Y J. 417, 424–26 (2010) (describing watersheds as "the ecosystems at which surface water processes and functions occur" and noting that "human consumption, use, and management of water supplies affect [watersheds'] functioning, health, and integrity").

[176] *See id.* at 426–27 (stating that "many different types of actions fall within the broad category of 'watershed management'" and "[a] truly comprehensive effort to conserve and protect the health and integrity of all of a watershed's functions is a large and potentially overwhelming task").

[177] *Id.* at 427 (footnote omitted).

[178] *Id.* at 434.

goal-setting and prediction and modeling altogether."[179] However, by combining adaptive methods, ecosystem scale, and planning processes into *adaptive watershed planning,* we may be able to build the resilience of these ecosystems to withstand climate change disruptions to our water systems.[180] Adopting this methodology will necessarily require that we accept uncertainty, mistakes, and changes in our policies and plans and be willing to use the precautionary principle to restrain our use and misuse of water resources and limit our modification of watersheds, even if the need is not immediate and our efforts may not yield the anticipated outcomes.[181]

Scaling adaptive watershed management to the local level is difficult as ecosystems are complex and watersheds are geographically bound to hydrological functions and processes.[182] Ideally, adaptive watershed management "should involve both scaling up for integration and coordination across levels of scale [state and federal] and scaling down for decentralization, localization, and attention to micro-scale effects [local communities]."[183] Choosing a higher or lower watershed scale should consider practical considerations such as where the planning and management are occurring, whether legal authority exists, is there jurisdictional cooperation, are resources available, and where do the problems we are addressing manifest.[184]

In the twentieth century, the United States government took over responsibility for flood control from state and local governments that had managed floods during the nineteenth

---

[179] *Id.* at 439.

[180] *See id.* at 487 ("[W]atershed institutions and organizations will prove resilient and adaptive if they use" adaptive watershed planning, which "combines iterative, experimental, adaptive processes, watershed focus and scale, and the functions and benefits of planning.").

[181] *Id.* at 484.

[182] *See id.* at 450–51 (noting that "[c]ertain groundwater resources might better be planned and managed by geographic regions corresponding to underground aquifers" because surface and ground waters are "usually interconnected" and watersheds are "interconnected with one another across multiple nested scales, necessitating choices about which level of watershed to select for planning purposes").

[183] *Id.* at 451.

[184] *See id.* (discussing considerations for watershed planning).

century.[185] The initial approach to flood control by indigenous people and early settlers was passive adaptation by moving to higher ground; however, as the population grew and settlements located in flood-prone areas, retreat during a flood was no longer feasible.[186] State and local governments began using engineering strategies and construction to prevent flooding impacts, but these efforts were not coordinated across watersheds.[187] Eventually, the federal government assumed more responsibility for flood control, but it continued to use flood control structures to protect citizens and property and failed to consider planning across watersheds.[188] People expected structural defenses to prevent flood damage and thus continued to develop in flood-prone areas.[189] In the twenty-first century, flood policy has begun moving towards an adaptive management approach with resilience thinking informing increasing control at the state and local levels.[190] Rather than focusing on structural alternatives such as dams, levees, dikes, and fill, the Army Corps of Engineers is now looking to "'risk' management rather than 'flood control'" and working on nonstructural and natural ecological strategies to respond to the uncertainties and complex interactions of this social-ecological system.[191]

5. Agriculture and Soil Resilience. The ecological resilience of an agricultural ecosystem depends on the "agricultural system's ability to continue to function and provide yield despite changes or

---

[185] *See* Jacob Park & Christopher Brooks, *Local Flood Resiliency in an Era of Global Climate Change: Understanding the Multi-Sectoral Policy Dimensions*, 17 VT. J. ENV'T. L. 160, 165 (2015) ("The federal government slowly took control over flood control policy during the 20th century . . . .").

[186] *Id.*

[187] *Id.* at 165–66.

[188] *See id.* at 166 (noting that "[a] series of federal statutes, starting with the Flood Control Act of 1917, increased the federal government's authority" over flood control structures and policy).

[189] *See id.* at 167 (applying the "moral-hazard" problem where the incentive to reduce risk is eliminated by the expectation of government protection).

[190] *See id.* at 172–74 (discussing Vermont's efforts to create more flood resilient communities by recognizing that land use decisions occur at the local level and providing incentive programs to encourage landowners and municipalities to be proactive in building resilience to future floods).

[191] *See* Cosens, *supra* note 133, at 251–52 (discussing the federal government's change from flood risk management to flood control).

perturbations such as increased pest populations, disease, or changed rainfall patterns."[192] Biodiversity is key to a resilient ecosystem, and large-scale monoculture farming is the antithesis of a biodiverse and redundant system needed for resilience.[193] Instead of the industrial approach to farming, eco-agriculture, which "relies on modern knowledge about the interactions within natural systems," is a model that uses sustainable agriculture techniques.[194] These techniques can be individually tailored to specific farms and include commonly recognized practices such as crop rotation, pest management, and soil enrichment, as well as newer practices such as "enhanced genetic resistance to climatic extremes, pests, and other threats."[195] By adapting farming practices to local environments using individualized sustainable agricultural techniques, farms will be more resilient and capable of responding to climate change impacts and disruptions.[196]

Society has undervalued soil as a resource in comparison to other natural resources.[197] The failure of existing soil governance frameworks to take into account the ecosystem approach of "the relationship between soil, as living ecological communities, and the environment" has resulted in "erosion, biodiversity loss, declining agricultural productivity, desertification, and countless other impacts related to the health of soil (or lack thereof)."[198] Healthy soil protects water quality, promotes biodiversity, functions as flood control, and provides agricultural resources to support plant growth and capture carbon.[199]

---

[192] Mary Jane Angelo, *Building a Sustainable and Resilient Agricultural System for a Changing Global Environment*, 43 ENV'T. L. REP. 11079, 11082 (2013).

[193] *See id.* at 11083 (discussing the negative effects of mono-culture farming).

[194] *Id.*

[195] *Id.*

[196] *Id.* at 11084.

[197] *See* Sarah J. Fox, *Soil Governance and Private Property*, 2024 UTAH L. REV. 1, 3 (noting that "[s]oil may be 'our most underappreciated, least valued, and yet essential natural resource'" (footnote omitted) (quoting DAVID R. MONTGOMERY, DIRT: THE EROSION OF CIVILIZATIONS 3 (2012))).

[198] *Id.* at 4–5 (emphasis omitted) (quoting IAN HANNAM & BEN BOER, INT'L UNION FOR CONSERVATION OF NATURE, LEGAL AND INSTITUTIONAL FRAMEWORKS FOR SUSTAINABLE SOILS: A PRELIMINARY REPORT 17 (2002)).

[199] *See id.* at 8–9 (describing the benefits of healthy soil).

The law needs to shift to recognize soil as a common resource in order to assess and protect its health, and "local governments may be best positioned to take the lead on new forms of soil governance."[200] Local governments should balance soil health against private property rights by focusing on soil's interconnectivity to the health of the soil as a common resource and the goal of "managing the impacts of human development on the planet."[201] Better management of agricultural uses of natural resources, including soil, will reduce the consumption of resources and environmental impacts and improve ecological services.[202] Local land use regulations can prohibit water-demanding crops in areas that lack water, and water laws can classify irrigating crops that are inappropriate in drought-ridden local climates as non-beneficial uses of water.[203]

The GAR23: Special Report identified converting land for agriculture as the major cause of Resilience Deficit 5 (Increased land degradation and biodiversity loss).[204] Land degradation from deforestation and unsustainable agriculture practices causes major biodiversity loss, and agriculture threatens 86% of the species facing extinction.[205] While food productivity has increased, long-term food security and ecosystem functioning will require sustainable land-use management by allowing natural land restoration.[206] Current agricultural practices contribute to climate change by relying on the heavy use of fossil fuels, which produces GHG emissions that comprise approximately 15% of global GHG

---

[200] *Id.* at 5.

[201] *Id.* at 56.

[202] *See* Demange, *supra* note 94, at 792–93 ("[B]etter management of the use of natural resources by agriculture can generate a meaningful reduction in the consumption of resources and in environmental impacts, while improving ecological services.").

[203] *See id.* at 794 ("Local land use . . . can prohibit crops that are totally inadequate to local ecosystems, such as lettuce and alfalfa—high water demanding crops—in deserts.").

[204] *See* U.N. OFF. FOR DISASTER RISK REDUCTION, *supra* note 22, at 42 ("Land degradation, most of which is due to converting land for agriculture, is the primary driver for biodiversity loss." (citation omitted)).

[205] *See id.* ("Agriculture alone is the primary threat to 24,000 of the 28,000 (86 per cent) species at risk of extinction." (citation omitted)).

[206] *See id.* ("Reversing [land degradation] requires policies that encourage sustainable land-use management, including allowing nature to restore the land.").

emissions.[207] However, agricultural production is also vulnerable to "expected climate change impacts, including changes in precipitation, temperature, sea level, carbon dioxide levels, and disease and pest outbreaks."[208]

Professor Mary Jane Angelo and Joanna Reilly-Brown propose adopting a whole-system agricultural certification program modeled on the LEED green building certification program to build "an ecologically resilient agro-ecosystem that has high biodiversity and maintains ecosystem functions."[209] This proposed certification program

> integrates both mitigation and adaptation strategies in an effort to avoid the unmanageable impacts of climate change through practices that reduce emissions and sequester carbon, while at the same time managing the unavoidable impacts of climate change through practices that increase an agricultural system's resilience and adaptive capacity to respond to climate change-induced impacts.[210]

The program proposal draws from the field of eco-agriculture to provide specific agricultural practices that could increase agricultural resilience by promoting biodiversity and increasing ecosystem services.[211]

Angelo and Reilly-Brown describe the "whole-building approach" LEED uses to evaluate sustainable buildings using LEED rating

---

[207] *See* Mary Jane Angelo & Joanna Reilly-Brown, *Whole-System Agricultural Certification: Using Lessons Learned from LEED to Build a Resilient Agricultural System to Adapt to Climate Change*, 85 U. COLO. L. REV. 689, 699 (2014) ("Globally, agriculture is believed to comprise approximately 15 percent of GHG emissions . . . .").

[208] *Id.* at 701.

[209] *Id.* at 758. The U.S. Green Building Council promulgated the LEED (Leadership in Energy and Environmental Design) Rating Systems to "provide[] a framework for healthy, highly efficient, and cost-saving green buildings, which offer environmental, social and governance benefits." *LEED Rating System*, U.S. GREEN BLDG. COUNCIL, https://www.usgbc.org/leed [https://perma.cc/H3FT-XDM5].

[210] Angelo & Reilly-Brown, *supra* note 207, at 715.

[211] *See id.* at 723–27 (describing the "eco-agriculture" approach to agriculture sustainability).

systems.[212] They then explain how implementing a whole-system agricultural certification program will encourage a radical shift from industrial agriculture to a resilient and ecological agriculture system.[213] The scholars offer a roadmap and instructions to implement the LEED approach by convincing farmers to participate in the program and encouraging them to use farming practices that will meet the requirements for certification.[214] They conclude by challenging society to transform our agricultural system to ensure global food security and both mitigate and adapt to the impacts of climate change.[215]

6. Land Conservation, Brownfields, and Land Repurposing. Conservation easements protect environmentally sensitive land by allowing the government or a nonprofit organization to hold the benefit of a negative easement to restrict burdened land from development and ensure future use for conservation purposes.[216] This property right in the form of a written easement presents an alternative to having the government or a non-profit organization purchase a fee simple interest in the property in order to protect it. Instead, the easement holder acquires a nonpossessory interest to protect natural or historic property.[217]

Federal tax deductions are available for donations of conservation easements, but unfortunately, syndicated conservation easement tax schemes relying on the tax deduction claimant's corporate structure have abused these deductions.[218] In

---

[212] *See id.* at 736–47 (explaining in detail the operation, advantages, and disadvantages of the LEED certification program).

[213] *See id.* at 747–56 (mapping the components of LEED into the proposed agricultural certification program).

[214] *See id.* at 756–58 (outlining how farmers could put the LEED approach into practice).

[215] *See id.* at 758 ("If we, as a society, seek to develop and ensure global food security, it will become . . . necessary . . . to find ways of transforming our agricultural system to both mitigate the impacts and adapt to the changes as climate change becomes increasingly pronounced.").

[216] Demange, *supra* note 94, at 788–89.

[217] *Id.* at 789.

[218] *See* Jessica E. Jay, *Opportunities for Reform and Reimagining in Conservation Easement and Land Use Law: A To-Do List for Sustainable, Perpetual Land Conservation*, 46 VT. L. REV. 387, 391–92 (2022) (discussing syndicated conservation easement abuses); *Two Tax Shelter Promoters Found Guilty in Billion-Dollar Syndicated Conservation Easement Tax Scheme,* U.S. DEP'T OF JUST. (Sept. 22, 2023), https://www.justice.gov/opa/pr/two-tax-shelter-promoters-found-guilty-billion-dollar-syndicated-conservation-easement-tax

addition, the valuation of these gifts depends on "the highest and best use of land before and after placing a conservation easement."[219] Thus, landowners may not be as motivated to grant perpetual conservation easements over "[a]gricultural, forested, working lands, and land with abundant water and wildlife habitat resources" in geographic locations where development pressure is absent.[220] Local or state attention to these transactions could help prevent abuse or address past abuse involving communities of color.[221] Local involvement would also integrate private land protection with the community's land use policies, such as affordable housing and green development.[222]

Brownfields redevelopment is another way local government can work with private property owners to revitalize a neighborhood by restoring individual properties with marketplace potential.[223] Brownfields are former industrial, commercial, and other environmentally contaminated properties that require remediation before redevelopment.[224] Local governments, non-profits, and community organizations have benefited from the U.S. Environmental Protection Agency's (EPA) Brownfields and Land Revitalization Program to reclaim contaminated property and promote urban regeneration.[225] The EPA program provides technical support and resources to state and local governments and fosters a network of brownfields consultants, developers, private sector remediation companies, local policymakers and governments,

---

[https://perma.cc/4WYN-T29C] (highlighting a "fraudulent tax shelter scheme involving syndicated conservation easements dating back nearly two decades").

[219] Jay, *supra* note 218, at 412.

[220] *Id.*

[221] *Id.* at 409–10 ("These past wrongs include pushing indigenous populations onto reservations, failing to fulfill emancipation promises, redlining, and agricultural land divestiture from Black and Indigenous people and other communities of color.").

[222] *See id.* at 404 (detailing "charitable acts and exempt purposes under Code § 501(c)(3)").

[223] *See* Joseph Schilling, *Beyond Brownfields Redevelopment: A Policy Framework for Regional Land Recycling Planning*, 5 J. COMP. URB. L. & POL'Y 468, 468–69 (2022) (defining how brownfield redevelopment is accomplished).

[224] *Id.* at 470 (noting that federal law defines a brownfield as "real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant" (quoting 2002 Brownfields Act, 42 U.S.C. § 9601(39)(A))).

[225] *See id.* at 469 (noting that the "EPA's Brownfields and Land Revitalization Program remains somewhat of a niche initiative").

and community organizations.[226] This policy of land reutilization has been joined with other local community efforts such as sustainability, green development, smart growth, and infill development.[227]

The EPA has continued to launch new programs to promote innovative reuse strategies for brownfields, such as green infrastructure and renewable energy generation on contaminated property.[228] However, using brownfield housing and infill development strategies to move beyond a project-by-project approach through regional planning and promote climate equity, environmental justice, and resilience policies could take us toward a more integrated and resilient land recycling framework.[229]

In addition to recycling brownfields, local policies and actions need to address vacant, abandoned, underused, and surplus properties that result from shifts in the markets and society and climate change effects such as flooding, sea level rise, droughts, fires, and urban heat.[230] A national strategy for land recycling land would align federal, state, and local policies and programs and result in a universal and effective approach.[231] Nevertheless, even without federal and state governments providing guidance, funding, and incentives, local governments, private landowners, nonprofits, and community organizations should be able to act using inventory data collection, land banking, and specific site plans involving public-private partnerships (PPP).[232]

7. Localized Renewable Energy. The transition from coal-fired energy generation to renewable energy may be possible in the next few years as energy analysts expect that carbon-free power, especially wind and solar, will start replacing coal-fired electricity

---

[226] *Id.* at 472–73.

[227] *Id.* at 474–75.

[228] *Id.* at 475–76.

[229] *Id.* at 482.

[230] *Id.* at 478.

[231] *Id.* at 485 (recognizing that "such a comprehensive land recycling definition and scope might seem impossible to craft and then approve").

[232] *See About PPPLRC and PPPs,* THE WORLD BANK: PUB.–PRIV. P'SHIP LEGAL RES. CTR., https://ppp.worldbank.org/public-private-partnership/about-us/about-public-private-partnerships [https://perma.cc/6UHG-D3D5] (defining PPPs as "a mechanism for government to procure and implement public infrastructure and/or services using the resources and expertise of the private sector").

globally.[233] However, rapidly developing countries continue to rely on coal electricity generation to develop their economies, millions of people still do not have access to any form of electricity,[234] and we are not cutting our carbon emissions rapidly enough to cap global warming at 2.0°C above pre-industrial levels.[235] In addition to reducing carbon pollution, we need to adapt flexibly and equitably because we do not know how much or how quickly we need to adapt.[236]

The energy power grid includes three essential elements: electricity generation, the transmission infrastructure to move the power, and the end user.[237] Building a resilient power grid will require "hardening, smartening, and greening" by protecting the grid against physical threats, making the network flexible and responsive using computerized communications, and replacing "carbon-based power generators with renewable [and resilient] sources like wind and solar."[238]

In the United States, annual GHG emissions decreased by 12% between 2005 and 2019 because we used less coal for electricity generation and more natural gas and renewable energy.[239] We have reduced the amount of energy required for economic activity as our population and per capita GDP have grown, and "[i]ncreasing capacities and decreasing costs of low-carbon energy technologies are supporting efforts to further reduce emissions."[240] However, the

---

[233] *See* Nadja Popovich, *How Electricity Is Changing, Country by Country*, N.Y. TIMES (Nov. 20, 2023), https://www.nytimes.com/interactive/2023/11/20/climate/global-power-electricity-fossil-fuels-coal.html (noting that "the rapid growth of solar and wind generation so far shows that 'this transition is doable and it's well under way'").

[234] *See id.* ("Millions of people around the world also continue to go without access to any form of electricity.").

[235] *See* Robert Verchick, *Renewable Energy: 2023 and Beyond*, 39 GA. STATE U. L. REV. 1163, 1166 (2023) (stating that "we are *not* cutting our carbon pollution down as fast as we need to").

[236] *See id.* at 1167 (explaining that "[w]e don't know how sensitive the planet is to these sorts of heating arrangements" nor "how fast things are going to change").

[237] *See id.* at 1168 (describing the power grid as representing three circles).

[238] *Id.* at 1171.

[239] *See* Alexa K. Jay et al., *Overview: Understanding Risks, Impacts, and Responses*, *in* FIFTH NATIONAL CLIMATE ASSESSMENT 2, 8 (Emily K. Laidlaw ed., 2023), https://nca2023.globalchange.gov/ [https://perma.cc/EG5Z-KG5J] (noting that "[t]his trend was largely driven by changes in electricity generation").

[240] *Id.* at 9.

current rate of decline in GHG emissions will not be enough to meet national and international goals; we must more quickly and more widely implement renewable energy and other zero-and low-carbon energy options.[241]

A sobering assessment of our state of climate resilience by Professors J.B. Ruhl & James Salzman suggests that the local tools to build resilience presented in this Article and elsewhere are too little and too late.[242] Ruhl and Salzman point out that the goals identified by both public and private sectors to make a significant shift to net-zero emissions "all require massive new infrastructure initiatives," and the current rate of this transition will not achieve national grid decarbonization by 2035 or net-zero emissions by 2050.[243] A major obstacle to the "immediate and massive deployment of all available clean and efficient energy technologies," advised by the International Energy Agency in 2020, is our corpus of environmental laws, designed to modify, slow, or stop traditional infrastructure that jeopardized our environmental quality.[244] Renewable energy projects have already faced local opposition, and balancing the conflict "between building climate infrastructure quickly versus ensuring strong environmental protection and social justice goals" will require reform of the environmental and land use law permitting processes and the associated litigation.[245]

Ruhl and Salzman's Article addresses the need for urgency in building climate infrastructure, identifies environmental law's impact on cost and timing due to permitting and litigation, describes the conflicts between climate infrastructure and conservation and social justice, and presents four strategies to enable streamlining.[246] The scholars then examine the alternatives of maintaining the status quo, tweaking existing rules, or forcing projects through

---

[241] *See id.* at 15 ("Faster and more widespread deployment of renewable energy and other zero- and low-carbon energy options can accelerate the transition to a decarbonized economy . . . .").

[242] *See* J.B. Ruhl & James Salzman, *The Greens' Dilemma: Building Tomorrow's Climate Infrastructure Today*, 73 EMORY L.J. 1, 4 (2023) ("We need big changes to address the climate threat, and quickly.").

[243] *Id.* at 5–6.

[244] *Id.* at 6 (quoting INT'L ENERGY AGENCY, NET ZERO BY 2050: A ROADMAP FOR THE GLOBAL ENERGY SECTOR 14 (2021)).

[245] *Id.* at 8.

[246] *See id.* at 11–12 (summarizing the contents of the Article).

without environmental protections.[247] They conclude that the best way forward is to design "a New Grand Bargain" driven by speed and climate impact metrics, with "distributional equity and public participation . . . integrated in the new regime at the outset."[248] Using the four streamlining strategies of "limiting coverage, centralizing decisions, establishing timelines, and increasing information," the proposal would centralize permitting and monitoring at the federal level, recognizing that this is "a radical change, going beyond any existing or proposed consolidation of federal authority for climate infrastructure."[249]

This "New Grand Bargain" prioritizes "the scale and urgency of climate infrastructure needed" to meet our national climate policy goals and outcomes over our existing permitting-litigation system.[250] Speeding up our system to build the necessary climate infrastructure to avert "dire economic, social, and environmental consequences" may involve trade-offs that interfere with "conservation, distributional equity, and public participation."[251] However, the authors believe that politicians have started to listen and that bipartisan action at the national level is possible to make a new bargain: "the political tide has started to turn."[252] The argument for a new regime that would allow climate infrastructure to happen now is compelling and revolutionary, and it corresponds with the Fifth National Climate Assessment's call for "transformative adaptation."[253] However, the political partisan bickering that continues at all levels of our government and society compels society to continue advocating for local tools within our control.

8. Smart cities, Smart Regions, and Pollution Control. Various concepts of smart cities include "core elements such as the use of new technological tools for public services, local economies driven by entrepreneurship and innovation, renewed public participation in local government functions, or collaboration across urban

---

[247] *See id.* at 12 (introducing potential approaches that have been proposed).

[248] *Id.* at 69.

[249] *Id.* at 70, 74.

[250] *Id.* at 81.

[251] *Id.* at 82.

[252] *Id.* at 11.

[253] *See* Jay et al., *supra* note 239, at 44–45 (addressing transformative adaptation).

sectors."[254] Technological innovations can help municipalities assess and respond to numerous challenges from the interconnected systems of "water, energy, food, and climate change."[255] However, local and regional governments seeking to incorporate smart city products or services should understand that the use of big data and digital technology might affect resident safety, privacy, and equity.[256] In addition, policymakers must acknowledge that because of the links and interconnections among the various policy sectors of climate, energy, housing, food, water, and social equity, intervention in one sector could influence the resilience of other policy spheres.[257]

Encouraging municipalities to collaborate with private groups in developing public policy goals in planning and governance may enhance smart city technologies.[258] Smart city pilot projects provide the opportunity to assess the achievements and vulnerabilities of municipal partnerships with private entities.[259] For example, New York City established an open data project in 2012, and its NYC Open Data platform encouraged residents to be innovative participants and enabled both public and private initiatives to address infrastructure and water conservation.[260] Although smart city projects have experienced successes and failures, some point out that "[t]o be truly 'smart'" cities must work collaboratively across municipal boundaries to benefit the entire region.[261]

The smart region model adopted by Phoenix, Arizona has shown great potential by including public, private, academic, and civil society voices in a coordinated structure of multiple municipalities

---

[254] Walter G. Johnson & Diana M. Bowman, *Partnering with Non-State Actors to Govern Nexus Problems and Promote Climate Action in Smart Cities and Regions*, 62 JURIMETRICS 111, 113 (2022).

[255] *Id.* at 112.

[256] *See id.* at 113 (cautioning policymakers against the effects of the purchase of smart city products or services from technology firms).

[257] *See id.* at 114 (discussing the "interrelatedness of policy spheres").

[258] *See id.* at 112 ("[L]ocal governments may benefit by cooperating with private, academic, and civil society entities to achieve public policy goals.").

[259] *See id.* at 118 (introducing "'smart city' pilot projects").

[260] *See id.* at 119 (describing a 2012 New York City data project).

[261] *Id.* at 121.

that promotes efficient interventions to common regional issues.[262] Nevertheless, there may still be concerns about power dynamics, politics, and private entities overriding local public needs and goals.[263] Monitoring these internal power issues and promoting transparency and accountability will help ensure that proposed policies and remedies reflect local, stakeholder, and environmental needs and preferences.[264]

IV. EMERGENCY RESPONSE

Emergency response occurs on several levels, including federal, state, and local government agencies. It requires consultation and collaboration to establish a coordinated response to disasters and terrorism. The Federal Emergency Management Agency provides a comprehensive, federal approach to emergency management.[265] Formerly an independent agency, it was reorganized to focus on terrorist acts in addition to disasters, and its functions were incorporated within the Department of Homeland Security (DHS), created after 9/11 when Congress enacted the Homeland Security Act.[266] The Act assigned responsibility to the secretary of the DHS to "coordinate and plan multijurisdictional response to disasters and terrorism" in conjunction with state, local government, and tribal agencies and personnel.[267] The federal government recognized the primary role of state government in disaster response as well as the contributions of nongovernmental entities and the private sector.[268] Although state and local governments will be critical in emergency management and response, the federal government

---

[262] *See id.* at 122–27 (discussing the implications of the "smart region project" in Phoenix, Arizona).

[263] *See id.* at 127 (highlighting the potential pitfalls of the "smart region project" in Phoenix, Arizona).

[264] *See id.* at 128 (noting the steps to take to ensure "that the proposed approaches and solutions are reflective of community needs and policy preferences").

[265] DANIEL A. FARBER, JAMES MING CHEN, ROBERT R.M. VERCHICK & LISA GROW SUN, DISASTER LAW AND POLICY 155 (3d ed. 2015).

[266] *Id.*

[267] *Id.* at 159.

[268] *Id.*

must be proactive in responding when the magnitude of the disaster overwhelms or incapacitates state and local resources.[269]

State, local, and tribal governance structures assume primary responsibility for emergency response, but similar to their federal counterparts, there is overlapping authority, and establishing a chain of command may impede the response.[270] Declarations of a state of emergency and evacuation orders require coordination of those who assume extraordinary powers during an emergency and conditions "on the ground" in local communities.[271] Private disaster responders are not included in most of the federal and state disaster relief statutes, other than those private companies that are "essential service providers," but large corporations, private hospitals, private utilities, and local businesses may be very effective in responding in both the short-term and long-term.[272] Nongovernmental organizations such as the American Red Cross are critical in responding to disasters as are nonprofits.[273] However, the true first responders in a disaster are likely to be the survivors who act to rescue and support their family, friends, and neighbors.[274]

Local disaster response recognizes the importance of neighbors, community centers, and personal preparedness. Individuals should be encouraged to store disaster supply kits and keep them up to date (i.e., batteries for flashlights); participate in training for first aid, CPR, and fire suppression; and consider joining a local Community Emergency Response Team (CERT), if available.[275] Get to know your neighbors, as they may be your first line of response. Neighborhood apps such as nextdoor.com can be valuable in times of emergency so long as communication networks remain operable.

---

[269] *Id.* at 162.

[270] *See id.* at 186–87 (discussing challenges with disaster response planning and coordination).

[271] *See id.* at 188–89 (discussing the difficulties of mandatory evacuation).

[272] *Id.* at 203–05.

[273] *See id.* at 205–06 (discussing the American Red Cross's involvement).

[274] *See id.* at 207 (discussing the involvement of citizens and citizen groups).

[275] *See id.* at 207–08 (discussing steps that should be taken by citizens to prepare for disasters); *see also Get Involved with CERT,* FED. EMERGENCY MGMT. AGENCY, https://community.fema.gov/PreparednessCommunity/s/welcome-to-cert?language=en_US [https://perma.cc/ST44-WYWE] (listing how to get involved with CERT and providing links to CERT resources).

Information derived from these local social networking services will be able to reference specific geographic areas and neighborhoods and disseminate up-to-date information that may not be available to authorities.[276] Early warning systems are also valuable local tools that "can help minimize the harm to people, assets, and livelihoods by triggering early action that is well prepared and tested."[277] One-third of the world's population does not have early warning systems, but the United Nations Educational, Scientific and Cultural Organization (UNESCO) is expanding its capacity to include risks other than tsunamis—such as floods, droughts, wildfires, and melting glaciers—to "increase society's resilience to natural hazards around the world."[278]

V. COMPENSATION

The underpinning for sharing the benefits and burdens of climate change impacts comes from concepts such as insurance, government funding, and the Fifth Amendment Takings Clause: "nor shall private property be taken for public use, without just compensation."[279] This clause "was designed to bar Government from forcing some people alone to bear public burdens which, in all fairness and justice, should be borne by the public as a whole."[280] Therefore, when local government uses eminent domain or harsh regulation to prepare for continuing disasters and impacts from warming and rising seas, it must not burden individual landowners and should instead require the public as a whole to bear the cost.[281]

---

[276] *See generally* NEXTDOOR, https://nextdoor.com/ [https://perma.cc/ABC5-ZF2L] (explaining the benefits of using Nextdoor).

[277] *Early Warning Systems*, UNESCO DISASTER RISK REDUCTION (July 21, 2023), https://www.unesco.org/en/disaster-risk-reduction/ews [https://perma.cc/3RJS-UK6E]; *see also*, Josh Funk, Heather Hollingsworth, & Margery A. Beck, *Midwest Tornadoes Flatten Homes in Nebraska Suburbs and Leave Trails of Damage in Iowa*, AP NEWS (Apr. 26, 2024), https://apnews.com/article/tornado-nebraska-midwest-iowa-missouri-kansas-491cd033f91eb27f4139bf5582e57903 (Omaha Police Chief Todd Schmaderer commented that there were few serious injuries because "[p]eople had warnings of this and that saved lives").

[278] *Early Warning Systems*, *supra* note 277.

[279] U.S. CONST. amend. V.

[280] Armstrong v. United States, 364 U.S. 40, 49 (1960).

[281] *See* Shelley Ross Saxer, *Paying for Disasters*, 68 KAN. L. REV. 413, 416 (2020) (exploring mechanisms to fairly compensate individual landowners for government action that creates "climate change winners and losers").

The government should justly compensate individual landowners when it uses eminent domain, enacts a regulation that results in a regulatory taking, or damages private property in pursuit of a public benefit under state constitutional law.[282]

Government funding in the form of federal and state disaster relief can also distribute public funds to offset private harm.[283] Land use tools at the local level, such as incorporating disaster management as part of the general plan or local ordinances and budgeting for local disaster relief, can also offset these burdens for the benefit of having a resilient community.[284] Although the government may not be liable in tort for failing to address community resilience to climate change and disasters, private parties, such as investor-owned utilities, may be liable in tort for any negligent actions that contribute to damages from disasters.

One of the ways to handle the compensation phase, referred to by some as "socializing the risk," after a disaster is through insurance. Insurance offers a mechanism for spreading the costs of disaster and other casualty nationwide.[285] Insurance can also serve as a market-based approach to prevent development in areas more prone to disaster risk from flooding, coastal surge, severe storms, and wildfires.[286] Insurance costs are increasing, and some insurance companies have refused to insure structures in certain areas or withdrawn completely from risk-prone areas or states.[287] However,

---

[282] *See id.* at 422–23 (exploring the concept of just compensation under the Fifth Amendment).

[283] *See, e.g.*, *How FEMA Works*, FED. EMERGENCY MGMT. AGENCY, https://www.fema.gov/about/how-fema-works [https://perma.cc/455P-YFNG] (providing an overview of FEMA funding); CAL. WILDFIRE FUND, https://www.cawildfirefund.com [https://perma.cc/XGK7-DYPV] (providing an example of a state fund that can distribute funds to assist private landowners who are impacted by a disaster).

[284] *See* Saxer, *supra* note 281, at 483 (explaining the preference for local land use planning by citing the difficulties operating at federal agency level).

[285] *See* Green, *supra* note 102, at 561 (noting that "[s]ome form of risk spreading, casualty insurance everywhere, and flood insurance in floodplains, is not only wise, but required for the purchase of a home and to comply with the terms of a mortgage").

[286] *See* Miller, *supra* note 75, at 252 (explaining that the market-based insurance approach hypothesizes that "where there is high wildfire risk, insurance costs will be prohibitively high and that will prevent development in the most wildfire-prone areas").

[287] *See* Eamon Murphy, *Insurance Commissioner, Irwin Address Coverage Issues*, THOUSAND OAKS ACORN (Apr. 19, 2024), https://www.toacorn.com/articles/insurance-commissioner-irwin-address-coverage-issues/ [https://perma.cc/93SE-C39R] (observing that

development or redevelopment in these disaster-risk areas has continued.[288] This disconnect is seen in areas of the wildland-urban interface where there is a high risk of wildfire, particularly in the Western states, and could be the result of using state and federal resources to protect buildings from wildfires, giving local governments little incentive to require development on safer lands.[289] In addition, since insurance companies do not typically pay the firefighting costs, their only liability is for those buildings lost or damaged; thus, the insurance market does not reflect the total cost of a wildfire.[290]

Insurance companies may reduce home insurance rates or retain coverage if the property owner can show they have mitigated any structural and property vulnerabilities to risk.[291] They may also be willing to insure property at exorbitant rates in high fire zones by contracting with private firefighters who not only join first responders in fighting the fire but also mitigate risk by clearing debris and spraying flame retardant.[292] Firewise USA is a community-based program administered by the National Fire Protection Association (NFPA), which "help[s] neighbors . . . get organized, find direction, and take action . . . to reduce wildfire risks

---

"[t]he top 12 insurers cover 85% of California's homeowners market . . . and since 2022 seven of those companies have paused or restricted new business" and suggesting that streamlining the insurance rate approval by the commissioner and introducing risk management tools could help "move residents off of the FAIR Plan, California's 'insurer of last resort'").

[288] *See* Miller, *supra* note 75, at 252 (reporting on a study that showed increasing insurance costs alongside continued homebuilding on fire-prone lands (citing Headwaters Economics, *Does Insurance Affect Home Development on Wildfire-Prone Lands?*, HEADWATERS ECONS. (June 28, 2016), http://headwaterseconomics.org/wildfire/solutions/insurance-wildfire-home-development/ [https://perma.cc/2Q3U-HYDE])).

[289] *See id.* (explaining the lack of incentive for local governments to build on safer lands).

[290] *See id.* at 252–53 (exploring the impact of the fact that insurance companies are not responsible for paying firefighting costs or any "after-effects of the fire that may lessen the home's value or otherwise affect tourism or economic development in a community").

[291] *See id.* at 253 (asserting that several insurance companies accept "proof of adequate fire mitigation sufficient to reduce rates or retain coverage").

[292] *See* Tanza Loudenback, *People Are Outraged Kim and Kanye Reportedly Hired Private Firefighters to Protect Their $60 Million Mansion from the California Wildfires – But It's Not That Uncommon*, BUS. INSIDER (Nov. 15, 2018, 5:31 PM), https://www.businessinsider.com/california-wildfires-private-firefighters-insurance-2018-11 [https://perma.cc/R6MP-8222] (documenting private firefighters' various jobs and asserting that they are "more common than you may think").

at the local level." [293] If the NFPA grants a community Firewise USA status, community members may be able to reduce their insurance rates.[294] To help control the reasonableness of insurance rates, California enacted a new regulation code in 2022 to consider mitigation factors and Wildlife Risk Models in setting insurance rates based on a policyholder or applicant's wildfire risk.[295]

In flood-prone areas, homeowners may not be entitled to flood insurance unless they elevate their property or take other measures to mitigate flood damage.[296] Requiring such mitigation efforts to obtain insurance eligibility will likely exacerbate the already high costs of home ownership.[297] The federal government makes flood insurance available to homeowners when private insurers decline to cover the risk, although this National Flood Insurance Program (NFIP) requires the local community to enact risk reduction ordinances in exchange for coverage.[298] Disaster relief from the Federal Emergency Management Agency requires homeowners to use flood insurance payments before FEMA pays any housing benefits.[299] Because FEMA provides temporary housing, which flood insurance does not, and receiving benefits under flood insurance policies may be cumbersome and delayed, the availability of federal disaster relief may reduce the demand not only for flood insurance but for other forms of disaster insurance as well.[300]

---

[293] *Firewise Communities,* CAL. FIRE, https://www.readyforwildfire.org/prepare-for-wildfire/firewise-communities/ [https://perma.cc/LL4X-EKNS].

[294] *See* Michele Willer-Allred, *Officials Provide Guidelines to Help Minimize Fire Risk*, CAMARILLO ACORN (Nov. 18, 2023), https://www.thecamarilloacorn.com/articles/officials-provide-guidelines-to-help-minimize-fire-riskaround/ [https://perma.cc/7GLN-2QQC] (providing that "[i]f the National Fire Protection Association grants a community Firewise USA status, it can lead to lower insurance rates").

[295] *See* CAL. CODE REGS. tit. 10, § 2644.9(d)(1) (2022) (listing the mitigating factors that Californian insurers must consider when setting rates).

[296] *See* Green, *supra* note 102, at 562 ("As eligibility for flood insurance now requires mitigation (such as elevation and floodproofing), the cost of homeownership may become prohibitive." (footnote omitted)).

[297] *Id.*

[298] *See* Jennifer B. Wriggins, *In Deep: Dilemmas of Federal Flood Insurance Reform*, 5 U.C. IRVINE L. REV. 1443, 1446 (2015) (outlining the complex structure of the NFIP and its "public and private aspects").

[299] *Id.* at 1451.

[300] *See id.* at 1452 (explaining why flood insurance may not be desirable against the backdrop of the NFIP).

VI. REBUILDING

As we advance through each phase of the disaster cycle, social and economic inequities are exacerbated.[301] Climate change contributes to the continuing disparities in resources required to mitigate, respond, and recover from climate disturbances.[302] Furthermore:

> [L]ow-income communities and communities of color often lack access to adequate flood infrastructure, green spaces, safe housing, and other resources that help protect people from climate impacts. In some areas, patterns of urban growth have led to the displacement of under-resourced communities to suburban and rural areas with less access to climate-ready housing and infrastructure. Extreme heat can lead to higher rates of illness and death in low-income neighborhoods, which are hotter on average. Neighborhoods that are home to racial minorities and low-income people have the highest inland (riverine) flood exposures in the South, and Black communities nationwide are expected to bear a disproportionate share of future flood damages—both coastal and inland.[303]

The rebuilding phase of the disaster cycle should necessarily incorporate the resilience strategies developed in the initial mitigation and adaptation phase. In some cases, managed relocation or adaptive migration may be the best strategy under the circumstances. For example, FEMA provides mitigation grant funds to support relocations of individuals or even entire communities for hazard mitigation projects "designed to increase resilience, reduce injuries and loss of life, and reduce damage and destruction to

---

[301] *See* Jay et al., *supra* note 239, at 19 ("Some communities are at higher risk of negative impacts from climate change due to social and economic inequities caused by ongoing systemic discrimination, exclusion, and under- or disinvestment.").

[302] *Id.*

[303] *Id.* (citation omitted).

property."[304] Nevertheless, relocation may be the least palatable option as there may be "negative consequences for emotional well-being, mental health, and other factors that are difficult to measure," and people may desire a return to their communities for their place-based identity, traditional livelihood, and cultural heritage.[305]

Adaptive governance should allow our communities to learn from a disaster and incorporate transformative adaptation rather than incremental adaptation—using these opportunities to redesign cities and buildings to address heat or to direct rebuilding to less disaster-prone areas.[306] Transformative adaptation will include assessing trade-offs; incorporating equity and resilience justice in adaptation planning; making fundamental changes to policies, practices, and values; and understanding the disparate vulnerability and risk present in our communities.[307] Ideally, private entities and all levels of government will cooperate and coordinate to ensure that adaptation measures are inclusive, participatory, and workable for local communities where plan implementation will be most relevant.[308]

VII. CONCLUSION

Cities controlled environmental degradation, especially water supplies and waste management, before state control, and finally, the federal government took over responsibility in the 1970s.[309] The current political reality of extreme partisanship may prevent both federal and state actions from responding to the existential threat

---

[304] *FEMA Efforts Advancing Community-Driven Relocation*, FED. EMERGENCY MGMT. AGENCY (Dec. 2, 2022), https://www.fema.gov/fact-sheet/fema-efforts-advancing-community-driven-relocation [https://perma.cc/Y84V-6AQP].

[305] Kira Vinke, Jonas Bergmann, Julia Blocher, Himani Upadhyay & Roman Hoffmann, *Migration as Adaptation?*, 8 MIGRATION STUD. 626, 629 (2020).

[306] *See* Jay et al., *supra* note 239, at 44–45 (offering examples of transformative adaptation in practice).

[307] *Id.* at 45.

[308] *See id.* ("Adaptation measures that are designed and implemented using inclusive, participatory planning approaches and leverage coordinated governance and financing have the greatest potential for long-term benefits, such as improved quality of life and increased economic productivity.").

[309] *See supra* Part I.

of climate change in the short term.[310] This Article has identified various local tools available to citizens and local government to address the increasing impacts of climate change and build resiliency at the local level.[311] Urban areas are an appropriate focal point as they are increasingly vulnerable to these impacts and contain more than half the world's population.[312]

This Article assessed these local tools within the disaster cycle framework of managing risk through mitigation and adaptation, emergency response, compensation, and rebuilding. However, rather than relying on conventional risk analysis, which is difficult when there is uncertainty or lack of knowledge, the risk analysis for climate change should be expanded to incorporate the principles of social-ecological resilience, sustainability, and adaptation into the circle of disaster risk management. A resilient city will rebound from disruptions and stresses and requires both mitigation and adaptation measures. Resilience thinking emphasizes the importance of using adaptive governance to manage and plan for substantial and uncertain disruptions to the state and functions of ecosystems.[313] We also need to recognize the role of social justice in our resilience thinking so that the social and institutional transformations necessary to build climate resilience are equitable as well as adaptive.

The 2023 report from the Intergovernmental Panel on Climate Change (IPCC) recognized that "[u]rban systems are critical for achieving deep emissions reductions and advancing climate-resilient development."[314] Mitigation at the local level to control carbon release can reduce the risk of extreme events, and adaptive governance will help build community resilience through efforts such as wildfire planning and monitoring.[315] New York City has developed a comprehensive approach with PlaNYC, which mitigates GHG emissions by reducing them and uses adaptation strategies

---

[310] *See supra* section III.A.*7*.

[311] *See supra* section III.A.

[312] *See supra* Part I.

[313] *See supra* section II.A.

[314] INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 74, at 29 (omitting level of confidence qualifiers).

[315] *See supra* section III.A.

such as resistance, adjustment, and relocation.[316] Rural areas, by contrast, have less capacity to mitigate climate change, but they experience more intense climate change impacts and are less able to recover from disruption due to diminished resilience capabilities.[317]

This Article discussed the following local tools for mitigation and adaption, but it is likely that there are others available now and there will be even more in the future:

- land use and zoning regulations;
- municipalization of private utilities and water systems using eminent domain;
- microgrids at the neighborhood level for greener power;
- eminent domain to relocate from flood plains and coastal areas;
- exactions and impact fees to mitigate adverse impacts from development and increase community resilience;
- resilient and green development of the built environment through building codes, disclosure of energy efficiency, monitoring of building emissions, and fines for noncompliance;
- sustainable development codes;
- assessing property resilience for commercial real estate investment and management in light of new building standards and compliance;
- adaptive watershed planning scaled to the local level;
- flood risk management rather than flood control;
- local soil governance to adapt farming practices to local environments and balance soil resiliency against private property rights;
- a whole-system agricultural certification program modeled on LEED;
- land conservation through easements and tax deductions;
- brownfields redevelopment;

---

[316] *See supra* Part III.

[317] *See supra* section III.A.*2*.

- land recycling using data collection, land banking, and public-private partnerships;
- renewable energy and a resilient power grid;
- reform of federal and state environmental laws, the local land use permitting process, and associated litigation to allow for accelerated climate infrastructure building;
- collaboration between cities and private groups to enhance smart city technologies;
- local disaster response connecting neighbors, community centers, and personal preparedness;
- early warning systems;
- compensation for impacted landowners using "just compensation" under the Fifth Amendment, insurance, and federal and state disaster relief funding;
- incorporation of disaster management into the city's general plan, local ordinances, and the budgeting process;
- lower insurance costs through property owner risk mitigation;
- the incorporation of resilience strategies developed in the mitigation and adaptation phase into the rebuilding phase.

Adaptive governance informed by resilience thinking at the local level will help build resilient communities by using the available local tools identified and discussed above. While coordinated and collaborative action at all levels of government and private operations is the most desirable response to the climate change crisis, local communities and their citizens must continue to act to build resilience and respond to increasing disaster risks. Resilience thinking and adaptive governance should be inclusive, participatory, and equitable to transform our systems to respond to imminent climate change risks and protect the most vulnerable communities.