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ZONING NEIGHBORHOODS FOR RESILIENCE: DRIVERS, TOOLS AND IMPACTS

*Shelby D. Green**

“[W]e’re now, in my view, inevitably going to pass through a rough patch . . . and in the geopolitical, economic, and climate chaos involved I expect we’ll tragically lose a few billion people.”¹

I. INTRODUCTION

We must heed the warnings and act now! The scientists have confirmed that because of climate change, all manner of calamities and evils are on the horizon, from rising sea levels of up to 3 feet in the next century to melting glaciers, to burning temperatures, to searing drought. And these evils all portend losses of life, of communities, of property, of the rhythms of living. Perhaps the only thing that might be left standing will be the Statue of Liberty (it was relatively unscathed after Superstorm Sandy).

But, what is to be done? There is nowhere to run. Climate change is a vagabond; going everywhere, when it chooses. It is omnipotent and omnipresent. As the prevailing view is that climate change is human caused,² reversing it may be beyond human powers, at least in the short-term. Still, we ought not to give up, for although we cannot stop the fierce blizzards or ravaging hurricanes, we can work to reduce the conditions giving rise to them and their ferocity; to halt the progression of climate change and adapt. We can act to enable resistance and resilience to its effects.

Although there are still denialists, the initiatives, plans and policies aimed at the study and responses to climate change have been

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1. Paul Gilding, *The Great Disruption* 53 (2011).

2. *See* CYNTHIA ROSENZWEIG ET AL., *CLIMATE CHANGE AND CITIES: FIRST ASSESSMENT REPORT OF THE URBAN CLIMATE CHANGE RESEARCH NETWORK (ARC3)* 4 (Cynthia Rosenzweig et al. eds., 2011).

voluminous, indeed too numerous to recount here.³ Climate change almost rivals concerns about nuclear armaments in international relations.⁴ Because it is a global phenomenon, it makes sense that the analysis should concern global impacts and mitigation efforts in this regard seem largely in sync—essentially to control the emission of greenhouse gases.⁵ Yet, because vulnerability to the effects of climate change will vary by location, the degree of development and demographic factors (where and how people live), for purposes of adaptation, we must also direct our focus at the micro-level within cities. This is because neighborhoods experience micro-climates—locales with distinct climate conditions⁶—that require systems calibrated to

3. *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, CLIMATE CHANGE 2014: IMPACTS, ADAPTATION, AND VULNERABILITY (2014); U.S. GLOBAL CHANGE RESEARCH PROGRAM, THIRD NATIONAL CLIMATE ASSESSMENT (2014); GEORGETOWN CLIMATE CENTER, www.georgetownclimate.org (last visited 2016); and PACE ENERGY AND CLIMATE CENTER, <http://energy.pace.edu/> (last visited 2016) (providing compilations of materials and analyzing this phenomenon).

4. *See* Conference of the Parties' Twenty-first Session, U.N. Framework Convention on Climate Change, *Paris Agreement*, U.N. Doc. FCCC/CP/2015/L.9/Rev.1 (Dec. 12, 2015) [hereinafter *Paris Agreement*]. The *Paris Agreement* went into effect on Nov. 4, 2016. *Id.*

5. The Paris Agreement was adopted on December 12, 2015. *See id.* It recognized that climate change is a common concern of human kind. Article 2(2) states that “adaptation is a global challenge faced by all, with local, subnational, national, regional and international dimensions.” *See id.* Article 7(1) establishes a “global goal on adaptation of enhancing adaptive capacity, strengthening resilience and reducing vulnerability to climate change, with a view to contributing to sustainable development and ensuring an adequate adaptation response in the context of the temperature goal referred to in Article 2” [well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increases to 1.5°C above pre-industrial levels]. *See also Green Light: What to Expect After a Deal that Exceeded Expectations*, THE ECONOMIST (Dec. 19, 2015), <http://www.economist.com/news/international/21684144-what-expect-after-deal-exceeded-expectations-green-light> [<https://perma.cc/5BVY-XEBM>] (reporting that more than 195 countries attending the meeting agreed to the stated goals).

6. Michael A. Catalano, *New York City Microclimate Policy: Applying Green Infrastructure to Mitigate Environmental Health Impacts caused by the Urban Heat Island Effect and Heat Waves 3* (Jul. 31, 2012) (unpublished Ph.D. dissertation, Pratt Institute, School of Architecture Graduate Center for Planning and the Environment) (on file with author). “Microclimates [may be] created naturally by geographical changes in the environment such as coastal zones, topographical differences in altitude, and [by] manmade environments.” *Id.* An urban micro-climate is said to refer to discrete area, where as a consequence of urban development, environmental

address the unique challenges and the range of disaster risks manifest from climate effects in the local vicinity.

A new urban design is needed, one that if not *climate-determinist*, is *climate-cognizant*. The built environment should be structured and the natural environment must be managed and protected in a way that regards climate forces that if left unchecked will sap the energy, the very existence of the city.⁷ A new urban design must begin with a statement of clear ends to be achieved, be based upon authoritative scientific, legal and social principles and must be implemented with an understanding of the costs—monetary and socio-political, that are demonstrably justified in the light of the alternatives. The extravagant and pretentious historical course of disasters, irrevocable losses, recovery, new disaster, and more losses is too luxurious to bear in the long-term. In particular, in this paper I explore a long-used tool of urban design—zoning—for resiliency. How it expresses itself on the ground must be left to the planners, architects, and residents; in this article, I strive to lay out the urgency and legal paradigm for use of this tool against increasingly malevolent natural forces.

Part II briefly describes the scientific phenomena and why we should be worried. Part III discusses the particular vulnerabilities of cities to climate change. In Part IV, I discuss the role of urban planning toward resiliency. Part V introduces “resiliency zoning.” Part VI presents ongoing examples of resiliency zoning. Part VII shows the virtues and impacts of this newly configured land use tool. Part VIII proposes a new way of thinking about rights and limits in the Anthropocene era. I conclude with thoughts on going forward with the notions discussed in this paper.

II. WHAT THE SCIENTISTS ARE PREDICTING: CHANGES AND IMPACTS

Temperatures have risen by more than 1.5°F since 1895, with most of the increases occurring since 1980, and rises are projected to reach

conditions vary from those in nearby regions. The environmental variations include temperature, light, wind speed and moisture. See R. GEIGER, *THE CLIMATE NEAR THE GROUND* (1965); see also EYVATAR ERELL ET AL., *URBAN MICROCLIMATE: DESIGNING THE SPACE BETWEEN BUILDINGS* 15-17 (2012); MET OFFICE, *MICROCLIMATES* (2011).

7. G. Mills, *Progress Toward Sustainable Settlements: A Role for Urban Climatology*, 84 *THEORETICAL & APPLIED CLIMATOLOGY* 69-70 (2006).

3 to 8°F by 2100.⁸ Last year, 2015, was the hottest year since the advent of record-keeping.⁹ Along with higher temperatures, there will be increased precipitation by as much as 10% by the 2020s and by as much as 21% by the 2080s.¹⁰ Paradoxically, with the increased rainfall, many areas will experience drought, have to engage in water rationing¹¹ and experience lower crop yields.¹² Sea levels will rise leading to increased flooding, along with coastal erosion and salt water intrusion.¹³ As oceans become more acidic, they become inhospitable to many aquatic species.¹⁴

Some of the particular impacts include dramatic changes in natural hydrology and water resources; shifts in the timing of spring will affect

8. C ROSENZWEIG ET AL., *ARC3.2 SUMMARY FOR CITY LEADERS 3* (Urban Climate Change Research Network ed., 2nd ed. 2015). The Climate Change Research Program states that temperatures are already rising in cities around the world due to both climate change and the urban heat island effect. Mean annual temperatures in 39 ARC3.2 cities have increased at a rate of 0.12 to 0.45°C per decade between 1961 and 2010. Mean annual temperatures in the 100 ARC3.2 cities around the world are projected to increase by 0.7 to 1.5°C by the 2020s, 1.3 to 3.0°C by the 2050s, and 1.7 to 4.9°C by the 2080s; *see also* U.S. GLOBAL CHANGE RESEARCH PROGRAM, *CLIMATE CHANGE IMPACTS IN THE UNITED STATES* (2014).

9. Dwayne Brown et al., *NASA, NOAA Analyses Reveal Record-Shattering Global Warm Temperatures in 2015*, NASA (Jan. 20, 2016), <http://www.nasa.gov/press-release/nasa-noaa-analyses-reveal-record-shattering-global-warm-temperatures-in-2015> [<http://perma.cc/DAW6-4LFG>].

10. C ROSENZWEIG ET AL., *supra* note 7, at 3. Mean annual precipitation in the 100 ARC3.2 cities around the world is projected to change by -7 to +10% by the 2020s, -9 to +15% by the 2050s, and -11 to +21% by the 2080s; *see also* U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 7.

11. *Id.* The State of California declared a state of emergency on account of drought two years ago, which called for among other things, a 25% statewide reduction in water consumption. Cal. Exec. Order No. B-29-15 (Apr. 1, 2015), https://www.gov.ca.gov/docs/4.1.15_Executive_Order.pdf; *see also* CALIFORNIA DROUGHT, <http://drought.ca.gov/> (last visited 2016).

12. CENTER FOR SCIENCE IN THE EARTH SYSTEM (THE CLIMATE IMPACTS GROUP) ET AL., *PREPARING FOR CLIMATE CHANGE: A GUIDEBOOK FOR LOCAL, REGIONAL, AND STATE GOVERNMENTS* 131 (2007).

13. C ROSENZWEIG ET AL., *supra* note 7, at 3. Sea levels in the 52 ARC3.2 coastal cities are projected to rise 4 to 19 cm by the 2020s, 15 to 60 cm by the 2050s, and 22 to 124 cm by the 2080s; U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 7, at 8.

14. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 7, at 10.

snowmelt and encourage invasive species.¹⁵ Dry forests will lead to increased risk of wildfires.¹⁶ The increased demand for energy for cooling will result in greater reliance on fossil fuels and more carbon-dioxide emissions. Erratic storms will lead to more road surface damage from buckling and snow removal.¹⁷ More flooding will mean damage to beaches, loss of cultural sites,¹⁸ and disruptions of travel and commerce.¹⁹ Many will suffer from heat-related stress.²⁰ There will be more billion-dollar loss events.²¹

Some populations will suffer more than others, such as those who labor outdoors and live in homes without modern climate control technology; the elderly who suffer more from the heat and are less able

15. CENTER FOR SCIENCE IN THE EARTH SYSTEM (THE CLIMATE IMPACTS GROUP) ET AL., *supra* note 11, at 131.

16. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 7, at 11.

17. *Id.* at 13.

18. *Id.* at 17.

19. *See* NICOLE T. CARTER, FEDERAL FLOOD POLICY CHALLENGES: LESSONS FROM THE 2008 MIDWEST FLOOD (Congressional Research Service ed., 2009). The flooding of Mississippi River in 2008 affected several states and caused the closure of Interstate 80 for more than a week.

20. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 7. “Climate change affects human health in two main ways: first, by changing the severity or frequency of health problems that are already affected by climate or weather factors; and second, by creating unprecedented or unanticipated health problems or health threats in places where they have not previously occurred.” *Id.* at 29. Climate Change will exacerbate temperature related illness, respiratory ailments from poor air quality impacts, including particles from wildfires, and increase pollen and pathogens in water from storm runoff. *Id.* at 70-72.

Extreme weather events associated with climate change will increase disruptions of food distribution by damaging existing infrastructure or slowing food shipments. These impediments lead to increased risk for food damage, spoilage, or contamination, which will limit availability of and access to safe and nutritious food depending on the extent of disruption and the resilience of food distribution infrastructure.

Id. at 190. There are also concerns about the increased stress from suffering severe weather events. *Id.* at 218-28.

21. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 7, at 12. The billion-dollar loss events rose from \$9 billion in 1995-2003 to \$24b in 2004, a nearly 300% increase. From 2004-2013, the losses were \$392 billion from hurricanes, \$78 billion from heatwaves/drought, \$46 billion from tornadoes/severe storms, \$30 billion from flooding/severe storms, and \$59 billion from weather/climate disaster events. The cost of urban flooding exceeds \$1 trillion a year. *Id.*

to plan and prepare for disasters; and those relegated to areas prone to receive the brunt of the impacts from climate change.²² Those hardest hit by Hurricane Katrina were those not so well-protected, by not so well-constructed levees, that were unable to hold back the flood waters of the lake; those situated in the poorer lower ninth ward of New Orleans.²³ Even though greenhouse gas emissions are directly correlated with income and wealth, middle and upper income families will outbid the poor in the competition for public investment in infrastructure to adapt to climate change.²⁴

III. THE VULNERABILITIES OF CITIES TO CLIMATE CHANGE

Lewis Mumford, one of our most celebrated twentieth-century public intellectuals, both championed and fretted for the city. One of his musings about the idea of the city reveals the stark philosophical conundrum. He asked:

What is the city? How did it come into existence? What processes does it further: What functions does it perform? What purposes does it fulfill? No single definition will apply to all its manifestations and no single description will cover all its transformation, from the embryonic social nucleus to the complex forms of its maturity and the corporeal disintegration of its old age. The origins of the city are

22. C ROSENZWEIG ET AL., *supra* note 7, at 8.

23. Juliette Landphair, “*The Forgotten People of New Orleans*”: *Community, Vulnerability, and the Lower Ninth Ward*, 94 J. OF AMERICAN HISTORY 837 (2007). The parts of New Orleans that were destroyed were the low rent districts. The depth of the waters ranged from one foot in the Jefferson Parish in the west, up to 8 feet on the lower Ninth ward; *see also* C ROSENZWEIG ET AL., *supra* note 7, at 6.

24. *See* Miss. State Conf. NAACP v. U.S. Dept. of Hous. & Urban Dev., 677 F. Supp. 2d 311, 312 (D.D.C. 2010) (plaintiffs challenged HUD’s approval of Mississippi’s plan to divert \$570 millions of Hurricane Katrina federal relief funds away from the construction of low-income housing, toward plans to expand a high-end port). After Hurricanes Katrina and Sandy, Congress relaxed the requirement that most of CDBG grants be spent on the poor to only 50% and funds were then being used for redevelopment and not for housing.

obscure, a large part of its past buried or effaced beyond recovery, and its further prospect are difficult to weigh.²⁵

In Mumford's view, the function of cities as a theater for social action, for the flourishing of arts and for collectively pursuing social ends was threatened by architectural changes and new urban design philosophies that seemed to resist the human dynamic.²⁶ Today, the absence of urban design features are escalating climate change, threatening the health of cities and their people and offering the prospect of dangerous ecological change. Failing to heed the climate change omens will channel us into a world that may be unable to sustain fundamental human values, affecting our basic physical needs—how we make and use energy, the way we collect and use water, the extent we are allowed to grow food, and what we eat—as well as our larger social needs—where and how we build, how we travel, how we communicate, and how we interrelate among the segments of society. The portents and sirens all exclaim that our land use patterns are precariously out of sync with the ecological trends of the natural world. The suburban frontiers and the urban footprint, their reach and resource demands, have expanded in ways that are unsustainable in both the short and long-term, while the world's capacity to support these demands remains flat, if not shrinking. Yet, collective movement toward sustainability and resilience, in some regard, seems languid²⁷ as actors persist in watching one tree, not

25. LEWIS MUMFORD, *THE CITY IN HISTORY: ITS ORIGINS, ITS TRANSFORMATIONS, AND ITS PROSPECTS* 3 (Harcourt, Inc. ed., 1961). “Mumford saw the urban experience as an essential component in the development of human culture and the human personality. He consistently argued that the physical design of cities and their economic functions were secondary to their relationship to the natural environment and to the spiritual values of human community.” *Id.*

26. *See id.* at 93.

27. *See* Nicholas A. Robinson, *Keynote: Sustaining Society in the Anthropocene Epoch*, 41 *DENV. J. INT'L L. & POL'Y* 467, 478 (2013). Professor Robinson “explores the argument that human transformation of Earth's systems is eclipsing the international law-making of nation states[;] . . . that trends of sustainable development or social networked communications transcend individual nations.” *Id.* at 468. He goes on to consider how “the concepts of environmental sustainability permeate how human society is responding to the many changes humans have made affecting the Earth.” *Id.* He explains that “[a]lthough, since the 1970s, environmental law seeks to restore reciprocity between natural systems and human polity, . . . the

seeing the depletion of the forests on the periphery. This stance may be entirely rational from an individualist perspective, but is inimical to preserving the community.

A. The Challenge of the Isolation Paradox Toward Community Responses to Climate Change

Modern economists have warned about the “isolation paradox,” “a category of scenarios in which individuals, acting in relative isolation and guided only by their short-term self-interest, generate long-term results that are destructive to all.”²⁸ While it may appear anywhere,

remedies of environmental law [may be] coming too late to avert irreversible change to Earth.” *Id.* It seems that the “promise of ‘sustainable development’ remains elusive, despite many best efforts to embrace the many sensible prescriptions around the concept.” *Id.* at 475.

28. See A.K. Sen, *Isolation, Assurance, and the Social Rate of Discount*, 81 Q. J. OF ECON., 81, 112-124 (1967). Sen describes the isolation paradox as follows:

[A]n individual has to choose between a unit of consumption now, and three units in twenty years. But he knows that in twenty years he will be dead. He is concerned about future generations, but not enough to sacrifice one unit of his present consumption for three units of the generation that will be alive in twenty years. So he decides to consume the unit. But another man comes along and tells him that if he saves this consumption unit, he, the other man, will do the same. It is therefore not unreasonable for the first man to change his mind and agree to save. The ensuing gain for the future generation is a lot greater (six units), and he, the man, can bring this about simply by sacrificing one consumption unit.

Id. Alan Randall offers additional insight into the isolation paradox:

The intuition that for a core and important set of economic problems, coordinated action is essential and may well be stable is hardly new. Adam Smith discussed the case of 100 farmers in the upper end of a valley, beyond the reach of the existing barge canal. While all would benefit from extending the canal, none could bear the cost alone. Yet, every single one of them would enjoy the benefits larger than 1/100 of the costs. Acting alone, each can do nothing, but everyone could enjoy a net benefit from coordinated action. The isolation paradox is the general name given to problems of this kind . . . An isolation paradox is present whenever individual action fails, but there exists a cost allocation, (not necessarily an equal sharing of costs, as in Smith example), such that all parties would be better off with coordinated action than with no action at all. The essential idea is that when an isolation paradox exists, there is in principle the possibility of converting a conflict situation into a sustainable cooperative solution; and we may benefit from exploring that possibility. . . . This

this phenomenon seems more pronounced in areas where industry is possible because of the confluence of labor, material, resources and markets.²⁹ This phenomenon may not be limited to individuals, but

suggests an openness to solutions that invoke a variety of institutional forms, from private property, voluntary associations and government from the most local level to the national and beyond.

Alan Randall, *Property Rights and Economics for Helping Address Environmental Problems*, in PROPERTY RIGHTS, ECONOMICS AND THE ENVIRONMENT: THE ECONOMICS OF LEGAL RELATIONS VOL. 5, at 10 (Michael D. Kaplowitz ed., 2005).

29. T.J. Stiles, *Robber Barons or Captains of Industry*, GILDER LEHRMAN INSTITUTE OF AMERICAN HISTORY: HISTORY NOW (Sept. 21, 2016), <https://www.gilderlehrman.org/history-by-era/gilded-age/essays/robber-barons-or-captains-industry> [<https://perma.cc/CL8F-FD4U>]. Our captains of industry made their fortunes in cities.

In the nature of things there must be causes that explain why an industrial enterprise—mill, factory, foundry, dairy, refinery—is located at just this or that place, and not somewhere else. Some of these causes are non-rational, such as accident and caprice. Others are rational, but personal. The enterprise is started in order to boom the town, to give work to the unemployed, to utilize some plot or site otherwise unusable, to confer value on adjoining real estate or to give safe employment to capital under the watchful eye of the owner. The remaining causes are rational and economic; that is, the selected locality is deemed to offer certain advantages in production or marketing over any other equally available point. If we seek what determines location, not of a single enterprise, but of a cluster of like enterprises or of an entire industry, the non-rational and personal causes are eliminated; and our inquiry lies almost wholly in the field of economic advantage.

Id.

A host of factors, including the presence of natural deposits or supplies (mines, fish, trees, soil), the availability of power, a conducive climate, labor, specialized capital and access to markets are essential drivers. See Edward A. Ross, *The Location of Industries*, 10 THE Q. J. OF ECON. 247 (1896). Eventually, Ross explains there are:

[D]ynamic factors to disturb the repose of industry, and compel movement. The exhaustion of local natural deposits or growths, such as coal field, forest, or seal herd; the continual progress of science and the arts, involving the displacement of this or that material of production . . . the changes in human wants, due to new ways of thinking, feeling, and living, by which is altered the relative importance of the elements in consumption; the changes in the distribution and massing of population, springing from recognition of social, political, or residential differences between localities, . . . will inevitably alter the comparative advantages of places, and lead to relocation of industries.

Id. at 268.

may be equally concerning as cities are asked to shift fiscal priorities in response to climate change. Given the grave threats faced, radical changes—a transmogrification—of rights and ideas are imperative in order to mediate the persistent contest between narrow, self-interested, and parochial attitudes on the one hand, and the new demands for stewardship over private property and public activities on the other. In other words, a shift from individualism to community is vital.

As ideology, individualism, long-revered in political and legal jurisprudence, envisions an absolute view of social and individual life. Individualism takes “no account of social or cultural factors that may remove the possibility of choice from the individual actors or severely limit the choices available to them, or determine the way these choices are interpreted.”³⁰ This view manifested itself in classic notions of property—long associated with, indeed, asserted as the quintessential component of liberty.³¹ Private property, though conceived of as a social-legal relationship, is often expressed as a matter of power—“to control and use goods and resources, to make choices, to set agendas, and to make decisions about the rights of others;”³² a matter of sovereignty;³³ “as a contest [over] the right to divide and exert control over nature.”³⁴

These philosophical notions carried over into market relations. Our most revered free market economist, Adam Smith, believed that individual choices could best be made if society refrained from imposing artificial restraints on markets; that each individual, in seeking his own advantage, would actually promote the advantage of

30. ROGER COTTERELL, *THE SOCIOLOGY OF LAW* 119 (2d ed. 2005). That individualism led to the ideology of freedom based upon the voluntary bargain of free individuals. *Id.*

31. Eric T. Freyfogle, *Property and Liberty*, 34 *HARV. ENVTL. L. REV.* 75, 80-81 (2010) (exploring the many links between the two).

32. Paul Babie, *Choices That Matter: Three Propositions on the Individual, Private Property, and Anthropogenic Climate Change*, 22 *COLO. J. INT’L ENVTL. L. & POL’Y* 323, 333 (2011).

33. Morris Cohen, *Property and Sovereignty*, 13 *CORNELL L. Q.* 8, 11, 14, 29 (1927) (asserting that ownership of property confers power over other people).

34. ERIC FRYFOGLE, *PRIVATE PROPERTY: FINDING COMMON GROUND ON THE OWNERSHIP OF LAND* XIX (2007) (finding ownership must mean accommodation of new circumstances and understandings). *Id.* at xv.

the country as a whole,³⁵ such that government regulations should be relaxed and leave the development of trade to individual action.³⁶

While in this conception, choices on the employment of land or property were thus driven by their impact on and relationship to market value—where and at what intensity of use, as the market would bear,³⁷ given the existential threats posed by climate change, few today would assert that realizing market value should be the sole focus of a city’s land use policy. Indeed, where private property rights run head on with the public’s interest in healthy rivers and sensibly-designed cities, we must recognize that “the inherent limitation of private property supposedly limits the externalities that may follow from its exercise.”³⁸ In this respect, we must employ the tools of land use to improve a

35. ADAM SMITH, *THE WEALTH OF NATIONS* 363-64, 512 (1776).

36. See COTTERELL, *supra* note 30, at 20-21. Professor Cotterell explains that this laissez-faire philosophy was not sustainable over the centuries. It fell out of favor, as it needed to adapt to act upon processes of social change. Although the claim of a free agreement led early to the doctrine of *caveat emptor* (let the buyer beware), the reality was that those freely entered into bargains were “characterized by one party having the economic or other power to impose its terms on the other.” *Id.* This idea being exposed to its true form sparked further examination in the nineteenth and early twentieth centuries by judges “who saw that the social and economic conditions upon which legal ideology had been superimposed were changing, and who understood that ideology in terms of the conditions of free enterprise capitalism, sought doctrinal devices to avoid its effects in the very different conditions.” *Id.* These courts intervened in bargains to impose limits, such as on the extent to which clauses excluding liability to the consumers would be upheld.

Since the nineteenth century, many important controls on contractual terms and their effects have been introduced to take account of problems posed in the conflict of doctrine and experience by the individualist outlook of the law while, nevertheless, preserving that outlook (for example, by the use of fictional ‘implied terms’) in the basic form and principles of contractual transactions.

Id.

37. Adam Smith’s notion of self-regulating markets fueled the rational choice theory that predicts that societal actors will seek to maximize individual utility on the basis of stable preferences when presented with a choice, including one created by a legal rule or regime. However, recent scholarship has highlighted the limits of the rational choice approach. See Kenneth J. Arrow, *Economic Theory and the Hypothesis of Rationality*, in *THE NEW PALGRAVE: UTILITY AND PROBABILITY* 25-31 (John Eatwell et al. eds., 1990); see also HERBERT A. SIMON, *MODELS OF BOUNDED RATIONALITY* 20-75 (The MIT Press ed., 1982).

38. Babie, *supra* note 32, at 348.

community's overall capacity to mitigate risk and to thrive. Industry that produces stream and air polluting debris and flood prone developments must acknowledge the unforgiving stance of climate change and must be constrained by it. What is needed is a new urban ethic, one that recognizes the virtues of urban communities as vessels for economic opportunity, cultural connections, vitality, innovation, as well as for marshaling efforts to respond to the fateful arc of the Anthropocene era.

B. The Dynamics of the City

Cities are particularly vulnerable to the effects of climate change for reasons that pertain to geography and demography, as well as the cultural, economic and political dynamics that define cities as a peculiar construct. These dynamics have drawn more than half the world's population³⁹ and more than 80% of the United States' population to urban areas. And this level is increasing.⁴⁰ Urban areas rely on and are served by various kinds of infrastructure, both natural and man-made, that are intricate and interconnected. But this infrastructure is aging and becoming increasingly fragile and deficient; it will eventually fail to support growing urban populations.⁴¹ The infrastructure at risk includes not only the physical structures that allow the transport of people (roads, bridges, and rail lines), water (pipes and pump stations), waste (sewage treatment plants) and light (power plants), but also the networks that facilitate living and transacting business, such as telephone communications for banking

39. See *EVYATAR ERELL ET AL.*, *supra* note 5, at 7.

40. See *C ROSENZWEIG ET AL.*, *supra* note 7, at 5; see also U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 2, at Chapter 13 ("Approximately 245 million people live in U.S. urban areas, a number expected to grow to 364 million by 2050."). Since 2000, many major cities have increased their share of new home construction while regional levels have declined. In 2008, the city of Portland issued 28% of all building permits compared to 9% in the region. In Denver, that level was 32%, compared to 5% in the region. In Sacramento, 27% compared to 9% in the region. New York City issued 63% of all building permits and Chicago issued 45%. See *PETER CALTHORPE, URBANISM IN THE AGE OF CLIMATE CHANGE* (2011).

41. Take for example, the lead and other contaminants that leached into the drinking water from corroded pipes in Flint, Michigan. *FLINT WATER ADVISORY TASK FORCE FINAL REPORT, EXECUTIVE SUMMARY 2-36* (2016) (reporting on the confluence of failing infrastructure, governmental mismanagement and corruption as factors in the crisis).

and emergency services.⁴² System failure in one part of the network will cascade throughout the urban area—as the electric system fails, so will water delivery and water treatment, transportation, telecommunications, and public health. When systems fail, no food can be delivered, no cash can be dispensed, and no surgery can be performed.

Inadequate infrastructure has social as well as economic consequences. Lack of full access to vital networks—whether roads or broadband or running water—serves to reinforce existing patterns of economic growth and stagnation . . . threaten[ing] to create new classes of haves and have-nots[;] individual Americans can be diminished by inadequate access.⁴³

Urban areas are also the situs of clusters of supporting resources and industry such as oil refineries and storage facilities, and a shut-down in transportation routes can cripple dependent industries.⁴⁴ As nearly two-thirds of urban areas are in low elevation coastal zones,⁴⁵ or located along flood-prone rivers, sea level rise and storm surges could

42. On August 8, 2007, an intense rainfall and thunderstorm event in New York City during the morning commute dumped between 1.4 and 3.5 inches of rain within two hours, starting a cascade of transit system failures – eventually stranding 2.5 million riders, shutting down much of the subway system, and severely disrupting the city’s bus system. See U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 2, at 286. In August 2003, a blackout in power grid in the northeast caused shutdowns of water treatment plants and pumping stations, and interruptions in communication systems for air travel and control systems for oil refineries. The lack of air conditioning and elevators stranded urban residents in over-heated high-rise apartments. See U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 2, at 286.

43. Bruce Seely, *Infrastructure: The Secret is the System*, THE WILSON Q. 12, 58 (2008).

44. See U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 2, at 285-86. “Hurricane Katrina disrupted oil terminal operations in southern Louisiana, not because of direct damage to port facilities, but because workers could not reach work locations through surface transportation routes and could not be housed locally because of disruption to potable water supplies, housing, and food shipments.” *Id.* at 285-86.

45. William Solecki, *Climate Change and U.S. Cities: Vulnerability, Impacts, and Adaptation*, in LAND AND THE CITY 105 (McCarthy et al eds., 2014).

result in the eventual abandonment of some urban districts.⁴⁶ Venice? New York City?⁴⁷

Cities are dense with population and structures—high rise and multi-unit buildings are historically more affordable and were originally in close proximity to employment. These phenomena conspire to produce the “urban heat island effect,”⁴⁸ one attribute of the urban microclimate.⁴⁹ “The [UHIE] . . . occurs when naturally vegetated surfaces are replaced with impervious surfaces that absorb, retain, and reradiate more solar energy than do grass and trees.”⁵⁰ The rate of this effect depends on “the physical properties of different surface types, their configuration within the urban fabric, regional meteorology, [and] localized microclimate,” among other things.⁵¹ As average air temperatures rise, so does the urban heat island effect. The cities that are most threatened by this effect are our nation’s older cities, which evolved spontaneously, in response to trade—the need for access to the waterfront and for easy transport to markets—rather than in response to the virtues of preserving open space and tree canopies.⁵²

46. See U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 2, at 580-81; see *id.* at 671; see *id.* at 284.

47. Yet, cities continue to encourage development in flood plains, including the 17 million square feet or 26 acre Hudson Yards development on the West Side of New York City, which is within the 100-year flood zone. The developers insist that much of the construction will occur on a platform 40 feet above sea level and will be designed to resist flooding—the platform puts the first floor above the floodplain and electrical and support systems will be above ground. See Jim Dwyer, *Still Building at the Edge of the City, Even as Tides Rise*, N.Y. TIMES, Dec. 4, 2012; see also Kyle Chayka, *Developers Keep Building in Sandy Flood Zones*, NYMAG, Oct. 2, 2015.

48. New York City, like other large cities, is warmer than surrounding areas due to the UHIE. Currently, New York City’s summertime temperatures average 7.2°F (4°C) warmer than surrounding suburban and rural areas. See VIRGINIA HEWITT, COOL POLICIES FOR COOL CITIES: BEST PRACTICES FOR MITIGATING URBAN HEAT ISLANDS IN NORTH AMERICAN CITIES (American Council for an Energy-Efficient Economy ed., 2014).

49. See *supra* note 5 and accompanying text.

50. NYSERDA, *New York City Regional Heat Island Initiative: Mitigating New York City’s Heat Island with Urban Forestry, Living Roofs, and Light Surfaces*, NEW YORK STATE (2016), www.nyserda.ny.gov/.

51. *Id.*

52. The larger urban parks, like Central Park in New York City, were built to enable urban dwellers to breathe. See FREDERICK LAW OLMSTED, SR., FORTY YEARS OF LANDSCAPE ARCHITECTURE: CENTRAL PARK (Frederick Law Olmsted, Jr. et al. eds., 1973); see also Robert Smithson, *Frederick Law Olmsted and the Dialectical*

At the same time, cities' compact form means less consumed farmland, fewer miles of roads and impervious surfaces, and less polluted runoff. These characteristics suggest that cities should be seen as the canvas for the design of progressive climate change resilience measures.⁵³

While cities reveal diversity—racial, ethnic and economic—the poor often build housing on difficult or undesirable land, more likely in low-lying areas, on steep slopes, in ravines and other risk prone areas, exposed to extreme conditions such as floods and landslides, as well as on deficient infrastructure—roads, drainage, water, sewages.⁵⁴ The poor are often unable to move to more protected areas or further inland. They have low, unstable incomes and limited access to housing finance. Social and cultural barriers (racism, zoning and land use limits) also operate to limit the mobility of this demographic.⁵⁵ Inadequate public transportation makes them dependent on local goods, services and jobs, with less ability to access other markets. They are unable to afford standard materials or upgraded structures.⁵⁶

Landscape, in THE WRITINGS OF ROBERT SMITHSON: ESSAYS WITH ILLUSTRATIONS 117 (Nancy Holt ed., 1979).

53. Discussed *infra*.

54. See Alice Kaswan, *Climate Adaptation and Land Use Governance: The Vertical Axis*, 39 COLUM. J. ENVTL. L. 390, 470 (2014).

55. See Robert L. Liberty, *Ninth Annual Norman Williams Distinguished Lecture in Land Use Planning and the Law, February 7, 2013 & Rising to the Land Use Challenge: How Planners and Regulators Can Help Sustain Our Civilization*, 38 VT. L. REV. 251, 257 (2013) (“The essence of most residential zoning, from the time of its inception a century ago, is the use of the state’s police powers to separate housing by its type and cost and thereby segregate the residents by their income, and by extension, their race, ethnicity, and national origin”); see also Christopher Serkin & Leslie Wellington, *Putting Exclusionary Zoning in its Place: Affordable Housing And Geographical Scale*, 40 FORDHAM URB. L. J. 1667, 1667 (2014) (“the conventional narrative surrounding the term “exclusionary zoning” [is that] [i]t describes a particular phenomenon: a suburb adopting large-lot zoning or other density controls that reduce the supply of developable land, thereby driving up prices and making housing unaffordable for lower-income households.”). Nonetheless, discriminatory zoning can be addressed under the Fourteenth Amendment if there is discriminatory intent. See *Village of Arlington Heights v. Metro Hous. Dev. Corp.*, 429 U.S. 252 (1977). Also, discriminatory zoning can be addressed under the Fair Housing Act if there is either discriminatory intent or disparate impact. See *Tex. Dep’t of Hous. & Cmty. Affairs v. Inclusive Cmty. Project, Inc.*, 135 S. Ct. 2507 (2015); see also *Mhany Mgmt. v. Cnty. of Nassau*, 2016 U.S. App. LEXIS 5441 (2d Cir. 2016).

56. See Kaswan, *supra* note 54, at 454-55, 470.

Despite what seems like an ever-growing search for the new and modern, cities are great repositories of historic properties, cultural resources and archeological sites, all of which will be threatened by severe storms and floods.⁵⁷ All these climate-related disturbances add to the normal urban stressors, thereby affecting the mental health of city dwellers.⁵⁸

1. Mitigation and Adaptation: Their Breadth and Impact

Hardly any topic has been written about, debated and analyzed more than the Civil War or World War II, save climate change. Conceiving

57. A recent report by the World Heritage Convention speaks about the increasing threat to world heritage sites by climate change. UNION OF CONCERNED SCIENTISTS, *WORLD HERITAGE AND TOURISM IN A CHANGING CLIMATE* (UNESCO et al. ed., 2016). The historic South Street Seaport in New York City suffered tremendous damage after Superstorm Sandy. See PLANYC, *A STRONGER, MORE RESILIENT NEW YORK*, 373-74, 376 (City of New York ed., 2013). Hurricane Katrina was disastrous to the historic city of New Orleans. About one-fifth of New Orleans' urban area is in a historic district listed on the National Register of Historic Places. It was the single largest disaster for cultural resources in the United States since the National Historic Preservation Act of 1966 ("NHPA") was enacted. HURRICANE KATRINA IN THE GULF COAST, FEMA 549: OVERVIEW OF HURRICANE KATRINA IN THE NEW ORLEANS AREA (2014). As the Federal Emergency Management Agency (FEMA) arrived on the scene, it discovered that the task of removing damaged structures would be complicated by obligations under Section 106 of NHPA, which requires in a federal undertaking, the agency consider the effects of the project on historic properties and consult with applicable state, tribal, and local parties to develop ways of mitigating any adverse effects. See Trimble, *GPS and GIS Technologies Speed Assessment of Historic Sites in Post-Katrina New Orleans*, GIS LOUNGE (May 12, 2010), <http://www.gislounge.com/gps-historic-sites-katrina> [<https://perma.cc/V268-8J5C>]. To meet its obligation under the NHPA while quickly carrying out its own functions, FEMA employed the National Park Service's Cultural Resource GIS Facility, which enabled the assessment of more than 40,000 structures. New York City's historic South Street Seaport was ravaged by Superstorm Sandy. See Erica Pearson, *Manhattan's South Street Seaport still a ghost town one year after Sandy*, NEW YORK DAILY NEWS (Oct. 26, 2013, 6:22 PM), <http://www.nydailynews.com/new-york/hurricane-sandy/sandy-1-year-manhattan-article-1.1494421> [<https://perma.cc/NH3H-CAZR>]. A comprehensive report on the need to preserve historic properties was first compiled by the United States Conference of Mayors' Special Committee on Historic Preservation. See SPECIAL COMMITTEE ON HISTORIC PRESERVATION UNITED STATES CONFERENCE OF MAYORS, *WITH HERITAGE SO RICH* (1966).

58. U.S. GLOBAL CHANGE RESEARCH PROGRAM, *supra* note 2, at 290.

responses to climate change as waging war may be an apt approach, as the necessary responses may be the same kind of maneuvers used in battle—that is, strategies for resilience and sustainability must be tactical and come from all fronts. In this regard, there have been responses in the form of appropriations, strategic policies and new laws and directives. Unprecedented sums for disaster relief, mitigation and adaptation have been spent and are planned to be spent by the federal and state governments in fighting climate change.⁵⁹ From the federal executive branch, there are task forces (after Katrina and Sandy),⁶⁰ directives on sustainability,⁶¹ and directives to agencies (requiring climate change impacts assessments for federal funding).⁶² The Department of Homeland Security and the Federal Emergency Management Agency (“FEMA”) have adopted new standards for fortified buildings.⁶³ The EPA has promulgated a Sustainable Design

59. See NICOLE SMITH & JESSICA GRANNIS, UNDERSTANDING THE ADAPTATION PROVISIONS OF THE SANDY DISASTER RELIEF APPROPRIATIONS ACT (H.R. 152) (Georgetown Climate Center ed., 2013); GEORGETOWN CLIMATE CENTER, www.georgetownclimate.org (last visited 2016); see generally FEMA, INTEGRATING HAZARD MITIGATION INTO LOCAL PLANNING: CASE STUDIES AND TOOLS FOR COMMUNITY OFFICIALS (2013) https://www.fema.gov/media-library-data/20130726-1908-25045-0016/integrating_hazmit.pdf [hereinafter FEMA HAZARD MITIGATION GUIDE]. New York State’s plan for recovery is estimated at \$19 billion. See PLAN NYC, *supra* note 57, at 6.

60. *About the Hurricane Sandy Rebuilding Task Force*, U.S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT (Sept. 21, 2016), <https://portal.hud.gov/hudportal/HUD?src=/sandyrebuilding/about>. Adaptation strategies are reflected in the Hurricane Sandy Rebuilding Task Force (Chaired by then HUD Secretary, Shaun Donovan and including additional members from 33 executive department agencies and offices) by encouraging resiliency in building and regional coordination of infrastructure investment. See *id.*

61. Planning for Federal Sustainability in the Next Decade, 80 Fed. Reg. 15,869 (Mar. 25, 2015).

62. See generally Sarah Adams-Schoen and Edward Thomas, *A Three-Legged Stool on Two Legs: Recent Federal Law Related to Local Climate Resilience Planning and Zoning*, 47 URB. LAW. 525 (2015) (discussing the new floodplain management executive order risk management standards; FEMA guidance requiring consideration of future climate change risks; updated Council on Environmental Quality standards directing agencies to consider their actions’ effects on climate change; and HUD initiatives, including buyouts, sustainable communities and the resilience competition).

63. They have awarded the Resilience Star™ under the Home Pilot Project, which promotes home design features, specifically, the IBHS Fortified Home. The

and Green Building Toolkit for Local Governments.⁶⁴ HUD, EPA and DOT have united to create a sustainable communities program.⁶⁵

There are legions of toolkits, guides and prescriptions prepared by think tanks. Perhaps the leader on this front is the International Council for Local Environmental Initiatives (“ICLEI”), which has established a national climate campaign for local governments,⁶⁶ offering materials for resiliency and sustainability.⁶⁷ The ICLEI has fashioned five milestones for creating a plan for resiliency, which starts with the decision to do something, then assessing the current state of affairs, followed by planning, implementing, then monitoring and finally review.⁶⁸ The Urban Land Institute has designed an eighteen point plan

Wind Retrofit Guide for Residential Buildings, provides guidance on how to improve the wind resistance of existing residential buildings (as part of the Hazard Mitigation Grant Program, which funds up to 75% of eligible costs of retrofits, such as roof deck attachments, roof to wall connections, and opening protections) as well as the Pre-Disaster Grant Programs. *See* FEMA, *FEMA P-804, Wind Retrofit Guide for Residential Buildings (2010)*, FEMA (Jul. 14, 2014), <https://www.fema.gov/media-library/assets/documents/21082>.

64. *See* EPA, *SUSTAINABLE DESIGN AND GREEN BUILDING TOOLKIT FOR LOCAL GOVERNMENTS (2013)*.

65. *See* United States Environmental Protection Agency, *About Smart Growth*, EPA (Aug. 15, 2016) <https://www.epa.gov/smartgrowth/hud-dot-epa-partnership-sustainable-communities>.

66. *See* INTERNATIONAL COUNCIL FOR LOCAL ENVIRONMENTAL INITIATIVES USA, <http://www.icleiusa.org/> (last visited 2016).

67. ICLEI, *Guidance for Local Governments and their Partners: Toolbox of Methodologies on Climate and Energy*, CCP CAMPAIGN (2016) <http://toolbox.climate-protection.eu/search/?cmd=view&uid=1628b7e2>.

68. *See id.* The five milestones are:

A. Initiate the process. Identifying stakeholders. Assess knowledge on how regional climate is changing and its anticipated climate change impacts on the community. Garner political support for the process. Identify a climate change champion to lead.

B. Research. Scope the climate change impacts for your region and conduct both a vulnerability and risk assessment.

C. Plan. Establish a vision and set adaptation goals and objectives. Identify adaptation options, and examine possible constraints and drivers to action. Draft Adaptation Action Plan; establish baseline data, address financing and budget issues. Create an implementation schedule; determine who is responsible for implementation; and estimate how implementation progress will be measured and evaluated.

D. Implement.

for improving community capacity and mitigating risk.⁶⁹ The United States Green Building Council Leadership in Energy and Environmental Design (LEED) offers a system for implementing and assessing energy efficiency and design.⁷⁰ Private industry and trade associations have also weighed in on the need for sturdier construction of buildings.⁷¹ While the prescriptions may seem somewhat scattershot, common notions on what actions must be taken up in defense against climate change seem to have emerged. They all appear to embrace the need for fortifying and achieving resilience.

E. Monitor/Review. Assess whether the goals and objectives previously set by your community have been achieved, identify any problems that have been encountered and develop solutions. Communicate progress to the general public.

69. URBAN LAND INSTITUTE, RESILIENCE STRATEGIES FOR COMMUNITIES AT RISK (2014).

70. *About USGBC*, U.S. GREEN BUILDING COUNCIL, <https://new.usgbc.org/about>. The LEED standard gives five credits (sustainable sites, water efficiency, energy/atmosphere, materials/resources, indoor environmental quality), six points for Innovation in Design, four points for Regional Priority, and has four levels of achievement: Certified, Silver, Gold and Platinum.

71. *See Fortified for Safer Living*, INSURANCE INSTITUTE FOR BUSINESS & HOME SAFETY (2008) <https://disastersafety.org/fortified/safer-living/>. The Federal Alliance for Safe Homes (“FLASH”) and the IBHS are urging all states to adopt fortified home standards and the federal government to take the lead in this initiative. LESLIE CAHPMAN-HENDERSON ET AL., BUILDING CODES: THE FOUNDATION FOR RESILIENCE (Federal Alliance for Safe Homes ed., 2014). The Institute for Business & Home Safety (“IBHS”) promulgated fortified building standards, for resiliency to all events, including winds and wildfires, such as dry floodproofing (using seals, veneers, film); wet floodproofing (employing flow through mechanisms); structural design to withstand winds; elevation of appliances, furnace, water heater, compressor, and electrical systems; sturdier roof structures, secondary barriers, and improved connections between roof and structural materials. *See* News Release, Insurance Institute for Business & Home Safety, IBHS Urges New York To Adopt 2015 Model Building Codes (Oct. 20, 2014) (on file with author). The National Association of Home Builders opposes across-the-board increases in code stringency, asserting that such measures make housing less affordable, burden code officials with enforcing unclear, infeasible or onerous requirements, and fail to properly target actual issues while ignoring where structures have performed well. *See* NATIONAL ASSOCIATION OF HOME BUILDERS, OVERVIEW ON CLIMATE CHANGE AND RESILIENCY 2 (2013).

C. What Resiliency Means

The Rockefeller Foundation defines a “resilient city” as one that can absorb and recover from shocks or stresses while maintaining its essential functions, structures and identity.⁷² It is one that pursues strategies that are evidence-based, long-term, inclusive and reveals an integrated, systematic approach to reduce vulnerability and disaster risk.⁷³ A resilient city learns from past experience and is constructed to avoid failure when original design thresholds are exceeded.⁷⁴ It contains spare capacity to accommodate disruption and employs new technologies along with traditional knowledge.⁷⁵ The resilience of a city is not just concerned with man-made structures, but equally so with the health and well-being of its residents, the economy, and the social and financial systems that sustain the community. In this respect, resilience also calls for the engagement in collective action and leadership with widespread citizen engagement.⁷⁶ Becoming resilient requires that cities adopt both mitigation and adaption measures in response to the impacts of climate change.⁷⁷ Mitigation aims to reduce greenhouse gas emissions, the main culprit driving climate change. It means new levels of regulation of industry and private conduct, requiring radical changes in the way the world operates, its productivity goals and industrial investments. Adaptation is fundamentally about reorienting communities and building up defenses against the forces that threaten them. It is typically described

72. ARUP INTERNATIONAL DEVELOPMENT, CITY RESILIENCE FRAMEWORK (Dec. 2015).

73. *See id.* ARUP is a design engineering firm. It is a strategic partner with the 100 Resilient Cities (100RC), supporting a “Chief Resilience Officer” to prepare City Resilience Strategies.

74. *See id.*

75. *See id.*

76. CITY RESILIENCE INDEX, FACING UP TO THE FUTURE: THE CITY RESILIENCE INDEX (2016).

77. SECTION OF ENVIRONMENT, ENERGY, AND RESOURCES, THE LAW OF ADAPTION TO CLIMATE CHANGE: U.S. AND INTERNATIONAL ASPECTS 3 (Katrina Fischer Kuh et al. eds., 2012) (explaining that “adaptation” refers to “efforts to moderate, cope with, and prepare for the current and anticipated impacts of climate change on human and natural systems;” and that “resilience,” a “closely related” concept, refers to “the capability to anticipate, prepare for, respond to, and recover from climate impacts”).

in three forms: protection, accommodation, and retreat.⁷⁸ Protection measures feature armoring, by building up barriers against the sea (by seawalls, levees, automatic gates that open and close in response to sea level rise, like that being built around the Venice Lagoon⁷⁹ and proposed for New York City).⁸⁰ Accommodation measures employ technologies and planning for efficient heating and cooling; capturing rainwater; through structures that resist wind; and infrastructure that channels stormwater.⁸¹ Retreat measures may contemplate the relocation of vulnerable populations.⁸²

IV. THE ROLE OF URBAN PLANNING IN ACHIEVING RESILIENCE

Achieving resilience can be frustrated by the “isolation paradox” and the resulting “negative externalities”—impacts from atomistic activities that are not taken into account as a cost by the actor, because they fall on others.⁸³ Because externalities fall not solely on neighbors (who might have a remedy in nuisance or trespass against the actor),

78. 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. 554-45 (2015).

79. MOSE Project, *Venice, Venetian Lagoon, Italy*, WATER-TECHNOLOGY, <http://www.water-technology.net/projects/mose-project/> [https://perma.cc/2G26-Y5SQ]. The MOSE project is for the defense of the City of Venice from high tides.

80. ERIKA SPANGER-SIEGFRIED ET AL., *Encroaching Tides: How Sea Level Rise and Tidal Flooding Threaten U.S. East and Gulf Coast Communities over the Next 30 Years*, 42 (Union of Concerned Scientists ed., 2014). “Most defensive measures are meant to help minimize wave action, reduce erosion, and protect against storm surge—up to a certain level Many communities along the East and Gulf Coasts have employed armoring or ‘grey’ infrastructure measures, such as seawalls, tide gates, and levees. Some have used ecosystem-based, or ‘green,’ infrastructure measures, such as beach nourishment, saltmarsh restoration, and the creation of new offshore reefs. However, in the face of rising seas, hard structures can actually aggravate coastal erosion and beach loss, diminishing both the protective function of natural shorelines and the beaches we treasure. Such structures typically do not protect against infiltration of saltwater from below.” *Id.*

81. Discussed *infra*.

82. See SPANGER-SIEGFRIED ET AL., *supra* note 80, at 38.

83. See Lisa Grow Sun & Brigham Daniels, *Mirrored Externalities*, 90 NOTRE DAME L. REV. 135, 137 (2014); see also Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347, 350-53 (1967) (“Property rights develop to internalize externalities when the gains of internalization become larger than the cost of internalization.”).

but on the environment, land use decisions cannot be the sole decision of the landowner. Instead, a host of influences and constraints already operate to channel and limit harmful, unproductive and suboptimal practices. These constraints concern not only the extent to which proposed activity disturbs the air or quiet of residents, but also the viability of communities and their essential infrastructure systems, which will be increasingly compromised by climate change impacts that are exacerbated by unconstrained land uses.

The measures that are essential for constraining injurious land use practices must go beyond merely employing green technology, adjusting thermostats, and controlling pollution, but will require a rethinking about the underlying form of our communities. The urban historian, Witold Rybczynski, has remarked that “[c]ities are man-made things, and because they are man-made, we can recognize a continuity of the ideas that went into their making.”⁸⁴ These ideas include not only the grid layout for the facilitation of traffic and sale of lots, but also the spacing of houses and planting of trees for shade and beauty.⁸⁵ While it is doubtful that the early planners and designers were driven by climate considerations, in the wake of climate change, climate must form a basic determinant of design; climate must inform the “structural, environmental, economic, social, organizational, visual criteria of design.”⁸⁶

“Urban design [has become] shorthand for the composition of architectural form and open space in a community context,”⁸⁷ finding meaning and purposes from physical spaces, social equity and economic viability, toward the making of places of beauty, function and distinct identity.⁸⁸ But, because of the demonstrable differences in climate conditions in a man-made urban environment from the natural world; the urban man-made elements: buildings, roads, industrial sites producing its own a modified climate,⁸⁹ particular attention to these differences is imperative for the design of the resilient city. Because

84. WITOLD RYBCZYNSKI, *CITY LIFE* 50 (1996).

85. *See id.* at 79, 81. Despite some overarching ideas for city design, Rybczynski describes cities as organic, reflecting centuries of additions of different neighborhoods, gradually knitted together, growing by accretion. *See id.* at 46.

86. *Id.*

87. ERELL ET AL., *supra* note 5, at 2.

88. *Id.*

89. BARUCH GIVONI, *URBAN DESIGN IN DIFFERENT CLIMATES* 1-2 (1989).

local climate is usually described with reference to temperature, level of sunlight, wind, and general air quality, among other things,⁹⁰ urban micro-climatology should manifest itself in decisions that certain areas should be shaded at particular times, that buildings should achieve a particular level of energy performance, that streets should be oriented to facilitate traffic and air flow, that public buildings should be located at accessible places, and that pedestrian walkways should be tree-canopied.

While the design of urban spaces historically has occurred at the local city level,⁹¹ as the costs of recovery from recent severe weather events were born very heavily by the federal government, the drivers of new urban policies have been almost as much national as local.⁹² Yet because local areas are affected by their own micro-climates and defined by their own climate-affecting activities, actions to reduce greenhouse gas emissions and build resilience to climate risks must be developed first at the urban scale.⁹³ Strategies for improving resilience and managing risks in cities require the integration of land use planning and innovative urban design in ways that are responsive to,

90. ERELL ET AL., *supra* note 5, at 5.

91. See Kaswan, *supra* note 54, at 450 (asserting that ensuring democratic and inclusive decision-making requires a tiered governance system, with stages set aside for federal, state, and local control). This proposition has given rise to the old saw that “land use, like politics is all local.” *Id.* But when it comes to land use regulation in the context of climate change, the saying may no longer hold. This is because climate change is a global phenomenon, the impacts of which are not confined to the source of the CO² emissions. The history of public land use controls is discussed *infra* notes 147-48 and accompanying text.

92. See *id.* at 393.

93. This is not to disavow the importance of regional planning. In fact, the most efficacious method of implementing the ideas of ecological design is through regional efforts. See Frederick R. Steiner et al., *Nature and Cities: The Ecological Imperative in Urban Design and Planning*, LINCOLN INSTITUTE OF LAND POLICY (2016). This is because the effects of climate change are not isolated within a particular geographical area or confined to political borders. Sea level rise will first impact coastal areas, but the ripple extends far inland. The unruly Hurricane Sandy was felt on Lake Michigan in Chicago. See John Schwartz, *A Far Reaching System Leaves 8 Million Without Power*, N.Y. TIMES, Oct. 30, 2012, at A21. Salt water will intrude upon the water supply many miles away from the ocean. See also Emily Eisenhaur, *Socio-ecological Vulnerability to Climate Change in South Florida* (Mar. 26, 2014) (unpublished Ph.D. dissertation, Florida International University) (on file with author).

and appropriate for, local conditions. At this level, the particular capacity and commitment (of residents and leaders) to integrate and implement mitigation and adaptation strategies can be taken into account. Strategies that hold the greatest promise of success are those that contemplate public/private partnerships in management as they address the structural reconfiguration of communities and the channeling and/or controlling of industrial activities and output.⁹⁴ Resiliency measures must merge a variety of mitigation actions at various levels of city function and governance—those involving energy, transport, waste management, and water policies—with adaptation actions—those involving infrastructure, natural resources, health, and consumption policies, among others—in synergistic ways.⁹⁵

A. The Foundations of Urban Planning

What is needed is a *form* of the city that can withstand the extreme weather promised by climate change and that can provide the conditions for thriving and security for its citizens. Urban design is about constructing cities, guiding growth and creating patterns of development to improve the quality of life. It plays a critical role in the global response to climate change because planning and design are forward-looking and can survive over time and political challenges.⁹⁶ It starts with zoning ordinances, which are enacted based upon comprehensive plans and become law. Comprehensive plans are visioning documents that seek to assess the state of the community and to project a future based on community values and demographics.⁹⁷

94. See CYNTHIA ROSENZWEIG ET AL., *supra* note 1, at 5.

95. See *id.* at 6.

96. See *id.* at 7.

97. See DANIEL MANDELKER, *LAND USE LAW* (5th ed. 2012). Comprehensive plans typically contain current and future land use maps that establish land uses. Comprehensive plans and mapping serve to provide city leaders with mechanisms to carryout citywide decisions on the allocation of land uses, resisting pressures to make political deals and works to encourage rational development since information costs are reduced by *ex ante* decisions on what can be built as-of-right and where; see generally DAWN JOURDAN & ERIC J. STRAUSS, *PLANNING FOR WICKED PROBLEMS: A PLANNER'S GUIDE TO LAND USE LAW* 3-4 (2014). Comprehensive plans are fortified by zoning ordinances that regulate the intensity and location of uses pursuant to the vision laid out in the plans. Sometimes the consequences of the failure of development to conform with the comprehensive plan can be quite severe; see,

The rootedness of urban planning and design in the enacted law and the concomitant repertoire of strategies and tools mean that decisions on urban form will have long-term consequences.⁹⁸

The morphology of urban planning and design cannot be reduced to a single metric, but consists of “art, social science, political theory, engineering, geography and economics,” as great cities are defined by their qualitative characteristics—public spaces, diversity of population, architectural styles.⁹⁹ Urban planning is effective toward building resiliency when it constrains land uses—those that emit greenhouse gases, or remove too much soil or vegetation from the land, use too much energy or water, or produce too much waste. Planning can require efficiency and waste capturing technologies: the design and layout of buildings and urban districts can be required to facilitate cooling and air flow; buildings can be required to reduce the overall temperatures within through the use of specific materials and reflective coatings. Trees can be required in places and patterns to define usable urban space, at dimensions and paths for movement can be forged and calculated to aid cooling and invite use. Urban planning can also incorporate protocols for improving the insurability of property through prophylactic measures and for ensuring the availability of essential emergency services through decentralization.¹⁰⁰

The 100 Resilient Cities program sponsored by the Rockefeller Foundation aims to guide cities toward resiliency planning and

e.g., *Pinecrest Lakes v. Shidel*, 795 So.2d 191 (Fla. 2001) (ordering the demolition of multi-family housing whose construction did not comport with comprehensive plan).

98. *See* DANIEL MANDELKER, *supra* note 97, at §3.16. There are differing views on the degree of court review available for a rezoning. Some courts find that it is a legislative act, meaning great deference is afforded to the legislative body. *See Hyson v. Montgomery Cnty. Council*, 217 A.2d 578, 583 (Md. 1996). Other courts find that a decision by a local government’s legislative body in piecemeal rezoning cases is an “exercise of judicial authority” subject to judicial review. *See Fasano v. Bd. Of Cnty. Comm’rs of Washington Cnty.*, 507 P.2d 23, 26 (Or. 1973).

99. CALTHORPE, *supra* note 40.

100. *See* GOVERNOR’S OFFICE OF STORM RECOVERY, NEW YORK STATE COMMUNITY RECONSTRUCTION ZONE PLANNING PROGRAM (2016). New York City’s place-based ‘Community Reconstruction Zone’ approach to post-disaster redevelopment of areas most impacted by Hurricane Sandy involves intensive collaboration between local stakeholders at the scale of each priority vulnerable area. It embraces downscale zoning that incorporates the assumption that land use decisions are best based on an analysis of conditions in the neighborhood.

implementation.¹⁰¹ Premised on a holistic conception of the world and its idiosyncratic movements, the program embraces a degree of foresight and an expansive commitment of resources by planners and scientists,¹⁰² including both political and economic capital;¹⁰³ new thinking and methodical evaluative approaches—assessing and mitigating flood risk, with a scientific and engineering understanding,¹⁰⁴ can lead to more accurate pricing of flood insurance.¹⁰⁵ Systems-thinking, viewing the region as a microcosm of interdependent and interconnected parts, should drive resilience measures at the building or structural level. The waterfront must be defended to protect property along its edges and to ensure access for incoming shipments of goods. Transportation systems must be shored up to enable the movement of people and goods out of harm’s way and to their intended destinations.¹⁰⁶

101. Amy Armstrong, *Norfolk: A Resilient City Taking Action*, 100 *RESILIENT CITIES* (May 20, 2016), http://www.100resilientcities.org/blog/entry/norfolk-a-resilient-city-taking-action#/-_/ [<https://perma.cc/5MGR-2AAF>].

102. *See infra*, notes 215 to 220 and accompanying text. Some have proposed the Local Area Risk Analysis (“LARM”) for risk assessment. LARM approaches district-scale risk management as a practice not only to avoid risks, but also to reduce impediments to the achievement of local economic development, policy and place-making objectives. The aim is to use risk assessment and risk management planning to reinforce the guarantee of a premium location for residents and/or businesses relative to other location choices. The first step in LARM analysis is preparing an inventory of risks that will be faced by the current and future owners, service providers, businesses, households, and visitors, and customers.

103. URBAN LAND INSTITUTE, *supra* note 69, at 6.

104. URBAN LAND INSTITUTE, *supra* note 69, at 9. The Urban Land Institute states that:

Insurance pricing should be examined to determine whether market distortions are occurring because of a misunderstanding of climate events: in some areas, insurance premiums have increased in response to climate events for types of insurance coverage not directly affected by such events. Furthermore, certain insurance markets still require federal backstops, both for catastrophic risk and to support a graduated transition for lower-income communities to full risk pricing.

Id.

105. *See Green, supra* note 78, at 562, n. 255. The new National Flood Insurance Program legislation calculates insurance premiums, in part, by the extent to which the landowner has installed mitigation features, such as elevating critical systems.

106. CERES, *BUILDING RESILIENT CITIES—FROM RISK ASSESSMENT TO REDEVELOPMENT* 14 (2013). “Examples of variations of this approach being

B. Resiliency Strategies in Place

Cities are requiring,¹⁰⁷ and others are encouraging,¹⁰⁸ resiliency and sustainability measures. Hundreds have adopted climate action plans, climate mitigation plans and/or resiliency plans; some carrying out state mandates;¹⁰⁹ others under their own local land use powers.¹¹⁰ These plans and strategies touch on all aspects of life in the city,¹¹¹ including the built world, energy usage, water usage, diversion and

recognized and championed by insurers already exist, *e.g.*, the Institute for Catastrophic Loss Reduction's RSVP . . . for Cities' program in Canada, the US National Flood Insurance Program's Community Rating System, The Community and Regional Resilience Institute (CARRI) in the United States and the South African insurance industry's 'Adopt the 'Municipality' programme.'" *Id.*

107. Elizabeth C. Black, *Climate Change Adaptation: Local Solutions for a Global Problem*, 22 GEO. INT'L ENVTL. L. REV. 359, 378 (2010). The author discusses the two primary tracks that cities could use in accomplishing these dual goals of increasing green space and encouraging green building: first, through mandatory "sticks," such as zoning requirements, including changes to building codes and second, through regulatory "carrots," such as tax incentives for buildings that achieve LEED standards and for green building, grants or fee waivers. Other cities offer non-monetary incentives such as expedited permitting, density bonuses, free technical consultations, and awards programs. Some cities have established green building funds that provide free technical assistance to developers or awards programs that identify energy efficiency leaders within communities. She explains that each technique has its benefits and limitations, causing most cities to employ a combination of the two approaches.

108. *See id.* at 380-82.

109. *See* CALIFORNIA CLIMATE STRATEGY, <http://climatechange.ca.gov/> (last visited Sept. 22, 2016); NYS 2100 COMMISSION, RECOMMENDATIONS TO IMPROVE STRENGTH AND RESILIENCE OF THE EMPIRE STATE'S INFRASTRUCTURE (2012).

110. *See, e.g.*, CHICAGO CLIMATE TASK FORCE, <http://www.chicagoclimateaction.org/> (2008); *Sustainability*, THE CITY OF SAN DIEGO (2016), <https://www.sandiego.gov/planning/genplan/cap>; PLAN NYC, *supra* note 57.

111. *See* CALIFORNIA CLIMATE STRATEGY, *supra* note 109. Chicago's plan contains 5 strategies: energy efficient buildings, clean/renewable energy sources, improved transportation options, reduced waste and industrial pollution, and adaptation (manage heat, innovative cooling, air quality, manage stormwater, green design, preservation, planting trees, engaging the public, businesses plan). San Diego's plan has 5 strategies: energy and water efficient buildings; clean, renewable energy; bicycling, walking, and transit land uses; zero waste (gas & waste management); and climate resiliency (separate adaptation plan). *See* THE CITY OF SAN DIEGO, *supra* note 110.

treatment, transportation efficiency, communications and emergency services, the natural environment, comprehensive planning and public relations.¹¹² They include updated building codes that require fortifications—some adopting FEMA’s standards, others developing their own.¹¹³ In some states, insurance incentives are offered for fortifying structures.¹¹⁴ Fortification of buildings includes: elevations (of sites, structures, and critical systems), the use of wind and water resistant materials,¹¹⁵ fire safe design and emergency back-ups.¹¹⁶ Cities are also fortifying public infrastructure, elevating roads and bridges, installing permeable pavements and green alleys,¹¹⁷ reconfiguring and narrowing sidewalks, modifying curbs and

112. *See generally*, FEMA *supra* note 59; *see also* GEORGETOWN CLIMATE CENTER, 20 GOOD IDEAS FOR PROMOTING CLIMATE RESILIENCE: OPPORTUNITIES FOR STATE AND LOCAL GOVERNMENTS (2014).

113. *See* FEMA, *supra* note 59, at § 5-9.

On May 4, 2007, an EF-5 tornado struck the City of Greensburg, Kansas, destroying more than 90 percent of its building stock. In the wake of the disaster, the community set forth to rebuild and become a model sustainable rural community. The city adopted a Long-Term Community Recovery Plan²² in 2007, prepared through FEMA’s Long-Term Community Recovery (LTCR) program.

Id. The program led to a sustainable comprehensive plan as the blueprint for all new development and for rebuilding. The Greensburg Sustainable Comprehensive Master Plan contains an entire section dedicated to “hazard mitigation, focusing on tornado, thunderstorm, and other high windstorm hazards.” It calls for the “integrati[on] of hazard mitigation into the recovery plan or land development code by requiring that power lines be buried to reduce damage and decrease the frequency of power outages.” It also “require[s] back-up generators for critical facilities and test them regularly.” Another measure that calls for the use of native species in the local land development code or tree ordinance and the use of native plants and trees for ornamental plantings to decrease vegetation damage and as a brace against winds. Building codes would be strengthened to reduce wind related damages. Safe rooms in accordance with FEMA guidelines would be built. *See id.*

114. *See* Green, *supra* note 78, at 551.

115. URBAN GREEN COUNCIL, BUILDING RESILIENCY TASK FORCE 14 (2013).

116. PLANYC, *supra* note 57, at 126, 129 (describing hookups for access to generators, anti-backflows, and faucets in common areas).

117. *See* SPANGER-SIEGFRIED ET AL., *supra* note 80, at 13.

gutters,¹¹⁸ fortifying sewage systems,¹¹⁹ utilizing buffers and setbacks from sea shores,¹²⁰ demolishing rickety buildings¹²¹ and even deciding not to rebuild roads and bridges.¹²² Many communities are revising their land development standards to require the incorporation of green

118. See generally Josh Foster et al., *The Value of Green Infrastructure for Urban Climate Adaptation*, THE CENTER FOR CLEAN AIR POLICY (2011) (describing the principles and efficacy of green infrastructure measures).

119. The “New York Rising Community Reconstruction Plan,” published by the Governor’s Office of Storm Recovery (“GOSR”), has awarded millions of dollars for planning and implementation in New York City. The plan envisions a state safe from the evils of climate change, such as severe storms like Superstorm Sandy. It focuses largely on local communities, aiming to reduce flooding by stabilizing the coastal edge, discouraging development of at-risk locations, and mitigating negative impacts of new projects; improving stormwater and wastewater management; making power supply more resilient and redundant; enhancing emergency preparedness and response; and improving resiliency of commercial corridors and critical supply chains. The plan allocates funding for health and social service providers to make building-level capital upgrades to ensure continuity of service during and after an emergency through the critical facility upgrades program. A Homeowner Assistance Program funds resiliency educational programming, counseling, and audits for homeowners in the community and addresses strategies to improve residential resiliency. See GOVERNOR’S OFFICE OF STORM RECOVERY, NY RISING COMMUNITY RECONSTRUCTION PLANS (2016).

120. See SPANGER-SIEGFRIED ET AL., *supra* note 80, at 7, 13, 14 (describing steep slope mountain ridge protection; maximum grading allowances; preservation of green space).

121. See Kellen Zale, *Urban Resiliency and Destruction*, 50 IDAHO L. REV. 85, 86 (2014) (discussing destroying buildings to create resiliency). Zale asserts:

[D]estruction is as necessary to urban resiliency as creation. Destruction allows cities to eliminate outdated, underutilized, and vacant buildings; create the necessary physical space for redevelopment and innovation; and redirect the city’s economic resources to best meet the needs of residents. As one government official recently explained: ‘By tearing down houses, we are building neighborhoods. We are opening up land to stop the decline in property values, stimulate many types of economic development, and help our neighborhoods grow and prosper.’

Id.

122. See Green, *supra* note 78, at 552; see generally Robert R.M. Verchick & Lynsey R. Johnson, *When Retreat is the Best Option: Flood Insurance After Biggert-Waters and Other Climate Change Puzzles*, 47 J. MARSHALL L. REV. 695, 697 (2013) (explaining that retreat involves the removal of people and property and restricting development in existing communities).

infrastructure,¹²³ which uses, among other things, natural wetlands for the infiltration of wastewater, onsite vegetated swales as opposed to curbs, rainwater harvesting (cisterns), low-water use plants, xeriscaping, rain gardens, tree wells, and tree canopies.¹²⁴

Cities are adopting measures on energy usage,¹²⁵ aiming for energy efficiency, from a number of different angles including: new standards, the most common of which is the LEED standard;¹²⁶ adopting

123. *See* Josh Foster et al., *supra* note 118, at Appendix 1-6. To meet the city's ambitious green infrastructure goals, Philadelphia's Public Works Department (PWD) developed a three-pronged strategy: 1) invest in greening public property and rights-of-way, integrating green infrastructure into public space improvements, including street, sidewalk, and park projects; 2) require green infrastructure investments for new development and redevelopment on private property; permit regulations require new development and redevelopment projects that disturb more than 15,000 square feet of land install/maintain green infrastructure sufficient to manage the first inch of stormwater that falls on the site; and 3) encourage voluntary retrofits by existing private parcel owners. The Greened Acre Retrofit Program incentivizes "private parcel retrofits by modifying commercial property owners' monthly stormwater fees to reflect each property's relative contribution to stormwater runoff" by assessing stormwater fees based on the size of impervious areas on individual lots. There are incentives to encourage property owners to install green infrastructure practices sufficient to manage the first inch of stormwater runoff—a savings of up to 80 percent on their monthly stormwater fees. Unfortunately, fewer property owners than hoped took advantage of this reduction in monthly stormwater fees; the low rate of green infrastructure retrofits resulted from unfavorable project economics. Potential stormwater fee savings were dwarfed by the upfront capital costs of green infrastructure retrofit projects and would take some time to recoup from the savings in fees. The city has taken steps to catalyze voluntary green infrastructure retrofits on private property through a new competitive grant program that positions local contractors as marketers, champions, and partners in the program's execution. Also, the City of Portland, Oregon has adopted a comprehensive green infrastructure program, using bioswales and rain gardens, among other things. *See* CITY OF PORTLAND AND MULTNOMAH COUNTY, CLIMATE ACTION PLAN 2009 (Office of Sustainability ed., 2nd ed. 2012), *see also* MIKE STEINHOFF ET AL., MEASURING UP 2015: HOW U.S. CITIES ARE ACCELERATING PROGRESS TOWARD NATIONAL CLIMATE GOALS 35 (2015).

124. *See* Josh Foster et al., *supra* note 118, at Appendix 1-6. San Diego plans to cover 35% of the city with tree canopies by 2035; *see also* CITY OF KEENE, KEENE COMPREHENSIVE MASTER PLAN 123 (2010) (requiring zoning ordinance that ensures walkability, green infrastructure, sustainable building, and permeable pavements).

125. *See* NEW YORK STATE ENERGY PLAN, THE ENERGY TO LEAD: 2015 NEW YORK STATE ENERGY PLAN 18-23, 69-77 (2015).

126. *See* MIKE STEINHOFF ET AL., *supra* note 123, at 22-30.

requirements for reflective coatings, green and cool roofs;¹²⁷ supporting energy star qualified homes;¹²⁸ encouraging geothermal, solar and wind energy;¹²⁹ low-impact hydro-power, alternative fuels and smart grids;¹³⁰ and green banks.¹³¹ To limit water waste, cities are employing metered water use;¹³² advanced plumbing technologies;¹³³ and filtration by soil and roots runoff capture systems.¹³⁴ Transportation systems are being upgraded and cities are investing in measures to facilitate less polluting means of transportation; installing charging stations for electric cars;¹³⁵ and facilitating biking and walking as desirable modes of transportation.¹³⁶

V. ZONING FOR RESILIENCY: AN ANCIENT TOOL FOR MODERN ENDS

Resiliency planning, employing the measures already being implemented by cities and states, can manifest itself into “resiliency zoning.” CERES¹³⁷ describes a “resilience zone” as “a special improvement district, precinct, neighborhood, or corridor designated in official planning documents for comprehensive risk management

127. Chicago Climate Action Plan, *supra* note 110, at 22. To reduce the urban heat island effect, Chicago will add 6,000 buildings with cool roofs by 2020, which is expected to reduce temperatures by average of 7 degrees.

128. *See Learn how Portfolio Manager helps you save*, ENERGY STAR (2016), <http://www.energystar.gov/buildings/facility-owners-and-managers/existing-buildings/use-portfolio-manager/learn-how-portfolio-manager>.

129. *See, e.g.*, Cal. Pub. Resources Code § 25980 (striving to balance the interest in solar panels against shade from trees).

130. *See* MIKE STEINHOFF ET AL., *supra* note 123, at 26.

131. *Id.* at 8.

132. PLAN NYC, *supra* note 57, at 27.

133. *See id.*

134. *See* CITY OF PORTLAND AND MULTNOMAH COUNTY, *supra* note 123, at 41.

135. 2014 CAL. STATS. Ch. 529.

136. *See* CITY OF PORTLAND AND MULTNOMAH COUNTY, *supra* note 123, at 20, 26 (calling for bike paths or lanes and increased walkability).

137. Ceres is a United States-based organization that advocates for the adoption of sustainable business practices and solutions to build a healthy global economy. Ceres Insurance Program is working with leaders and investors in the insurance industry to set new standards and expectations that can enable insurers to plan for emerging climate risks while moving companies and individuals toward low-carbon activities. In conjunction with ClimateWise, Ceres convened insurance industry leaders to inform and participate in the workshop series. CERES, <https://www.ceres.org/> (last visited 2016).

and upgrading so that it is more resilient in the face of a variety of predictable and unpredictable extremes.”¹³⁸ The resiliency zone aims “to better anticipate and respond to climate events, by designating districts, neighborhoods that are at-risk (based on commercial and social activity patterns, location in floodplain, vulnerability of population);” it may involve special planning areas or overlays for each typology, in formal planning and zoning documents.¹³⁹

As planning for resilience has become an essential component of land use regulation, an area or zone that is purposefully managed and upgraded to have increased resilience relative to competing areas is an important step in our collective responses to climate change. Resiliency zoning not only will work to minimize losses from climate disasters, but it will also have the positive effects of spurring economic activity in the zones and increasing asset values and returns on investment.¹⁴⁰ In financial terms, a ‘resilience zone’ will “create market conditions for reinvestment in areas that would otherwise be burdened by high risk management costs and disinvestment pressures.”¹⁴¹ It may even create a market premium on assets because of improved amenities and guarantees of uninterrupted function. This reinvestment dynamic results from the use of existing market-stimulation devices, such as “performance-based economic instruments, special improvements tax assessments and value capture schemes.”¹⁴²

The tools for creating resiliency zones are the ancient ones—that allow governments to determine the form and layout of buildings and urban districts;¹⁴³ to establish growth boundaries; and to limit development.¹⁴⁴ Although the conditions giving rise to their development have evolved over time, these tools are firmly established in the law.

138. *See CERES, supra* note 106, at 8.

139. *See id.* at 23.

140. *See id.* at 8.

141. *See id.* at 6.

142. *See id.*

143. *See Village of Euclid v. Ambler*, 272 U.S. 365 (1926); *see also* SMARTCODE CENTRAL, <http://smartcodecentral.com/> (last visited 2016).

144. *See Columbia Venture, LLC v. Richland Cty.*, 776 S.E.2d 900 (S.C. 2015).

A. Zoning for Health and Safety

We have long since abandoned Blackstone's concept of property as that "despotic dominion"¹⁴⁵ In fact, it is doubtful that the idea was ever seen in its fullest measure. While nuisance principles and trespass actions grew up alongside private property principles and served to curtail the so-called dominion a landowner could exercise over his land, it was the ugly effects of increased urbanization and industrialization in the mid- to late- 19th century—overcrowding, noise, odors, soot—making living by residents unpleasant and doing business by shopkeepers difficult, that prompted prospective public land use controls. The absence of schemes for constructing housing, directing traffic, and disposing of wastes (household and factory) led to dangerous health effects—tuberculosis, cholera—as well as unsightliness,¹⁴⁶ prompting social reformers to address these conditions through systems of land use controls.¹⁴⁷ There was also a push by retailers for distance from factories and by upper classes from the poor.¹⁴⁸ By the mid-1920's, nearly 1000 cities had adopted comprehensive zoning laws. These laws were enacted pursuant to state enabling acts, many based on the Standard Zoning Enabling Act created by the Department of Commerce in 1920.¹⁴⁹ The state enabling

145. WILLIAM BLACKSTONE, COMMENTARIES ON THE LAWS OF ENGLAND 1765-69 (1979).

146. See Charles M. Haar, *Reflections on Euclid: Social Contract and Private Purpose*, in ZONING AND THE AMERICAN DREAM: PROMISES TO KEEP 339 (Charles M. Haar et al., eds., 1989) (explaining that advocates of the "City Beautiful" movement sought "purposeful intervention of government to achieve urban beautification"). In 1866, New York adopted the Metropolitan Health Act to regulate unsanitary conditions on private property at the urging of architects, seeking more aesthetics in building construction. The city of Los Angeles became the first city to enact a comprehensive zoning ordinance in 1909. The ordinance divided the city into districts—one residential and seven industrial. New York City followed in 1916, with an ordinance that regulated not only uses by zones, but also limited the size and height of buildings. *Id.*

147. See *id.* at 339-40 (explaining that "a ragtag grouping of idealists and special interest groups" believed that zoning would allow the poor to live amid "plenitudes of fresh air and sunlight" by "keeping industry and trade from residential sections").

148. See generally Michael Lewyn, *New Urbanist Zoning for Dummies* 58 ALA. L. REV. 257, 261-62 (2006).

149. See *id.* at 262 (citing ADVISORY COMMITTEE ON ZONING, U.S. DEPARTMENT OF COMMERCE, A STANDARD STATE ZONING ENABLING ACT (rev. ed. 1926)).

acts delegate to local governments control over the use of private land, usually requiring land use plans and creating zoning districts.¹⁵⁰ SSZEA delegated to cities the power to restrict building size and height, the size of yards and other open spaces, the density of population, and the location and use of buildings.¹⁵¹ The stated aim of the model act was “to prevent the overcrowding of land [and] to avoid undue concentration of population.”¹⁵²

Though some sort of municipal control over noxious activities seems eminently reasonable, it was the prospective prohibition of particularly threatening uses in certain areas that was the basis for a challenge in the Supreme Court. As stated, land use ordinances are justified as the exercise of police powers and that predicate was broadly affirmed in *Village of Euclid v. Ambler Realty Co.*¹⁵³ There, the court ruled that it was a lawful use of police power to adopt an ordinance to protect the public against nuisance-like conditions from nearby land, even though no noxious uses were at issue. The zoning ordinance there was adopted on the asserted need to segregate certain uses deemed incompatible from existing uses in the same zone. The court ruled that so long as the rationality of the relationship between the ordinance and its purposes is “fairly debatable,” the court will defer to the legislative judgment. Emerging from the case was the concept of Euclidean zoning, involving the rigid separation of what is deemed incompatible uses, in that case, even justifying the separation of single-family housing from multi-unit dwellings.¹⁵⁴ The subtext in the ordinance upheld in *Euclid* was that the most important land use in the community was for single-family homes and that use was threatened by different uses if allowed in the same vicinity. Hence, the safety of families rested upon its separation from all other land uses: residential areas must be separated from retail zones and retail zones from manufacturing activities. The perceived threats were found not solely in noxious activities, but also from uses that were innocuous (churches and schools could not reside in the same areas as single-family homes) as well as those from people of different means (multi-unit apartment

150. *See id.* at 262 (citing Thomas B. Griffen, *Zoning Away the Evils of Alcohol*, 61 S. CAL. L. REV. 1373 (1988)).

151. *See id.* at 262 (citing ADVISORY COMMITTEE ON ZONING, at § 1).

152. *See id.* at § 3.

153. 272 U.S. 365 (1926).

154. *See id.* at 394.

homes could not be allowed to “block the sun” from detached residences).¹⁵⁵

In modern times, there are a plethora of other limits on private ownership serving similar ends. Among these are environmental laws,¹⁵⁶ historic preservation laws,¹⁵⁷ the Endangered Species Act,¹⁵⁸ and affordable housing requirements,¹⁵⁹ to name a few. Environmental laws aim to prevent harm to the natural world from acts that pollute the air, soil, and waters. In doing so, planned development must be analyzed for their impacts on the environment, how stream flow might be changed, how soil might be eroded.¹⁶⁰ Historic preservation laws work to prevent the destruction or degradation of structures and places that reveal some historic, archeological or architectural value. This means that owners of historic properties, even though privately owned, must preserve them in their historical guise and may not destroy them

155. *See id.* Indeed, Justice Sutherland even goes so far as to describe apartment homes (or their dwellers) as “parasites” and “that the development of detached house sections is greatly retarded by the coming of apartment houses, which has sometimes resulted in destroying the entire section for private house purposes; that in such sections very often the apartment house is a mere parasite, constructed in order to take advantage of the open spaces and attractive surroundings created by the residential character of the district.” *Id.*

156. *See, e.g.*, Clean Water Act, 33 U.S.C. § 1251 (1972); Clean Air Act, 42 U.S.C. § 7401; NEPA, 42 U.S.C. § 4321; *see generally* JEFFREY MILLER ET AL., INTRODUCTION TO ENVIRONMENTAL LAW: CASES & MATERIALS ON WATER POLLUTION CONTROL (2008).

157. Nicholas A. Robinson, *Historic Preservation Law: The Metes and Bounds for a New Field*, 1 PACE L. REV. 511 (1981). The preservation of historic structures and sites is done on two levels: on the federal level, the National Historic Preservation Act permits historic structures and properties to be listed on the National Register; and on the local level, historic properties and districts may be designated as landmarks, regulating their alteration and destruction. Local historic preservation laws were upheld against a takings challenge in *Penn Central Railroad v. New York City*, 438 U.S. 104 (1978).

158. 16 U.S.C. § 1531.

159. *See, e.g.*, *Alto Eldorado Partners v. Santa Fe*, 634 F.3d 1170 (10th Cir. 2011), *cert. denied*, 2011 U.S. Lexis 5378 (Oct. 2011); *Cal. Bldg. Indus. Ass’n v. City of San Jose*, 61 Cal 4th 435 (2015) (holding affordable housing requirements do not constitute an exaction, only limits on use and finding valid legislative purpose in increasing affordable housing).

160. Under NEPA, agencies about to embark upon a major federal action must consider the impacts on the human and physical environment and that analysis must be contained in an environmental impact statement. 42 U.S.C. § 4321 (1970).

without a Certificate of Appropriateness issued by a local commission.¹⁶¹ The Endangered Species Act strives to ensure biological diversity by prohibiting, among other things, the taking of endangered species. This means that a landowner is not only prohibited from killing or harming the animal, but is also enjoined from destroying a tree that serves as its habitat.¹⁶² The concerns and justifications for these limits emerge in large part from our collective interests in public resources, sometimes under the public trust doctrine.¹⁶³ They all build upon and operate alongside the form of legislative controls over nuisance-like acts, an exercise of police powers.

Euclid, settling the issue of a municipality's power to regulate land use under its police powers, can serve as the predicate for resiliency requirements that prescribe building size, height and orientation, require elevation of structures and systems, and mandate setbacks from the coasts. Buildings can be required to be airtight, to emit natural light, or to employ technologies for water recycling. Housing can be required to be clustered and situated in areas offering public services or shopping. Site development can be conditioned on the use of green landscaping, drought-tolerant plantings, or indigenous plants. Zoning and building codes can prevent the dendritic growth of buildings along roads, instead promoting a better urban geometry that facilitates human connections that focus inwardly.¹⁶⁴ These are measures essential for resilience.

B. Zoning for Sustainability

It is debatable whether Euclidean zoning led to suburban development or the other way around. In any case, what emerged from

161. *See, e.g.*, New York City Landmarks Preservation Law, N.Y. STAT. tit. 63.

162. *See* Babbitt v. Sweet Home Chapter of Cmty. for a Great Or., 515 U.S. 687 (1995).

163. *See* Shelby D. Green, *No Entry to the Public Lands: Towards a Theory of a Public Trust Servitude for a Way Over Abutting Private Land*, 14 WYO. L. REV. 19 (2014).

164. *See generally* *Land Use Law Primer*, PACE LAW (2016), www.law.pace.edu/landuse; *see also* ROBERT C. ELLICKSON & VICKI L. BEEN, *LAND USE CONTROLS: CASES AND MATERIALS* 87 (2nd ed., 2000); John R. Nolon, *An Environmental Understanding of the Local Land Use System*, 45 ENVTL. L. REP. 10215, 10234 (2015).

the middle of the 19th century to the end of the 20th century was a pattern of land development that was not sustainable. The invention of the suburb also created sprawl and pollution—from commuting long distances to and from work, the segregation of populations along racial and economic lines, and the loss of open space, as houses were built in the farm fields.¹⁶⁵ A consequence and perversely, a driver, of sprawl is exclusionary zoning. In response, planners came to recognize that their police powers could be used to address these modern kinds of undesirable uses,¹⁶⁶ and courts have recognized that zoning authority includes the ability to contain sprawl, avoid declining land values, protect the environment, and preserve open space.¹⁶⁷ Zoning ordinances thus evolved to embrace a particular vision of the desirable and inclusive community. As one scholar has remarked, to reduce sprawl,

End . . . exclusionary zoning . . . to save land, natural resources, and money invested in infrastructure; allowing the market to build more densely, [leads to] patterns of urbanization that work better with transit, active transportation, and mixed uses. What is essential for fairness and opportunity is also integral to the conservation of our land and resources.¹⁶⁸

More land for increasing housing demands can be found through infill and redevelopment, not greenfield sprawl.¹⁶⁹ Developers can be required to build houses closer to each other and to sidewalks, to

165. *See generally* WITOLD RYBCZYNSKI, CITY LIFE (1996); *see also* KENNETH T. JACKSON, CRABGRASS FRONTIER: THE SUBURBANIZATION OF THE UNITED STATES (1985).

166. Elisa Paster, *Preservation of Agricultural Lands Through Land Use Planning Tools and Techniques*, 44 NAT. RESOURCES J. 283, 285 (2004); John R. Nolon & Jessica A. Bacher, *Zoning and Land Use Planning*, 36 REAL ESTATE LAW J. 211 (2007).

167. *See id.*; *see also* Berman v. Parker, 348 U.S. 26, 33 (1954) (“public safety, public health, morality, peace, law and order—these are some of the more conspicuous examples of the traditional application of police power to municipal affairs. Yet, they merely illustrate the scope of the power and do not delimit it.”); *see generally*, Nolon, *supra* note 4, at 10,215, 10,234.

168. *See* Liberty, *supra* note 55, at 260.

169. *See id.* at 261.

integrate transit-oriented features, that conduce to communities that are sustainable.¹⁷⁰ The cutting down of trees on private land can be limited; parks and opens space can be required.¹⁷¹

C. Zoning for Livability

Euclidean zoning worked well to keep factories away from homes (except to the extent the scheme came to be compromised by variances), but it can be criticized as it banished from residential areas uses like libraries and schools that did not threaten the interests in peace, solitude and safety. By this rigid separation of all different, though not threatening, uses, Euclidean zoning operated to deprive communities of the vitality that comes from diverse populations and activities. The Congress for New Urbanism, believed that rather than promoting community, Euclidean zoning stifled it. The Congress saw the “disinvestment in central cities, the spread of placeless sprawl, increasing separation by race and income, environmental deterioration, loss of agricultural lands and wilderness, and the erosion of society’s built heritage as one interrelated community-building challenge.”¹⁷² It developed a new approach to zoning that allows mixed uses and embraces walkability.¹⁷³ Among its principles are the restoration of existing urban centers and towns, the reconfiguration of

170. See John R. Nolon, *Zoning’s Centennial, Part 18: Shaping and Attracting Economic Development*, LAND USE PROF BLOG, http://lawprofessors.typepad.com/land_use/2016/05/zonings-centennial-part-18-shaping-and-attracting-economic-development-a-series-by-john-r-nolon.html. Some of the techniques being employed towards these ends are fast-tracking the planning and rezoning of downtowns, offering density bonuses, and creating traffic improvements; infill development, and creative development of open spaces adjacent to corporate, medical, educational, and non-profit buildings; adopting the USGBC’s LEED-ND standards; and zoning to allow scattered sites throughout the neighborhoods within walking distance of train stations. See *id.* See also Nolon, *supra* note 164, at 10219-10220, 10224 (discussing clustering, planned unit development and preservation districts).

171. See, e.g., *N.J. Shore Builders v. Twp. of Jackson*, 972 A.2d 1151 (N.J. 2009) (upholding a local ordinance that prescribed taking down trees on private property or requiring an in-lieu payment into a fund); see generally Nolon, *supra* note 164, at 10220, 10223.

172. *Sustainability*, NEW URBANISM (Sept. 22, 2016), <http://www.newurbanism.org/sustainability.html>.

173. See *id.*; see also HENRY L. DIAMOND & PATRICK F. NOONAN, *LAND USE IN AMERICA: THE REPORT OF THE SUSTAINABLE USE OF LAND PROJECTS* (1996).

sprawling suburbs into communities of real neighborhoods and diverse districts, the conservation of natural environments, and the preservation of our built legacy.¹⁷⁴ The Congress states that:

communities should be designed for the pedestrian and transit as well as the car; cities and towns should be shaped by physically defined and universally accessible public spaces and community institutions; urban places should be framed by architecture and landscape design that celebrate local history, climate, ecology, and building practice.¹⁷⁵

New Urbanist zoning embraces sustainability goals by stating that development should have minimal environmental impact in development and respect the ecology and values of natural systems, embrace energy efficiency, and use compact growth.¹⁷⁶ Communities should be designed to be walkable (most destinations reachable within 10 minutes from home or work); streets should be pedestrian friendly, with buildings close to the streets, have porches and windows; street grids should reflect connectivity that disperses traffic and eases walking. There should be mixed uses and densities.¹⁷⁷ Such design features promise visual aesthetics, a practically accessible and climate-cognizant development.

174. *See id.*

175. *Id.* Essentially, New Urbanism's quest for more livable communities is through better design elements and has been embraced by the larger Smart Growth movement.

176. *See id.* A model "Smart Code" has been developed to achieve these ends. The City of Petaluma, California has adopted a smart code that contains provisions for building placement, urban standards on frontage, common areas, civic spaces, landscape guidelines and building materials. CITY OF PETALUMA, CENTRAL PETALUMA SPECIFIC PLAN (2016). The Smart Code is based on the "Transect" that defines areas by place types. "The appropriate mix of uses for each planning area is based on the existing character and future development potential for each." *Id.* at 27. The Code is designed to assess "new development and redevelopment potential and to provide maximum flexibility for future development consistent with the policies of the Specific Plan." *Id.* Among other things, the code contemplates redundant parallel streets, enabling the efficient dispersal of traffic. *See id.*; *see also* David Struck, *Smart Growth Zoning Codes*, 22 PLANNING & ZONING NEWS 12, 12 (2004) (describing the mechanics of zoning for smart growth).

177. *Sustainability*, NEW URBANISM, *supra* note 173.

1. Growth Controls

Throughout most of our history, the consequences of population and community growth—increased traffic, diminished open space, overloaded infrastructure, extravagant water use, an overall decline in the quality of life—were not addressed comprehensively because there were abstract effects, not felt at the time of development approval. As these effects have become manifest and worrisome, states and municipalities have determined to control growth within their borders, though legislation variously establishing “urban districts,” “growth management areas” and “urban growth boundaries.”¹⁷⁸ Smart Growth grew out of the early growth management legislation and is a technique for assuring a sustainable, desirable and affordable quality of life, by controlling the rate and direction and location of development and includes design elements.¹⁷⁹ A growing number of states have enacted urban growth boundary statutes, including Colorado, Kentucky, California, Florida, Maryland, New Jersey, New York, South Carolina, South Dakota, Washington State, Wisconsin, Pennsylvania, Delaware,

178. See generally Gabor Zovanyi, *The Role of Initial Smart Growth Legislation in Advancing the Tenets of Smart Growth*, 39 *URB. LAW.* 371, 372-73, 389 (2007) (discussing the emergence of growth management laws to confront the some of the pernicious effects of unconstrained growth, the environmental degradation of sprawl, and loss of community character). Growth management laws have been challenged and upheld in *Assoc. Home Builders, Inc. v. City of Livermore*, 557 P.2d 473 (Ca. 1976) (upholding a growth control ordinance that contained specific milestones for relief from the controls, rejecting assertions that growth control exceed police powers); *Golden v. Planning Bd. of Ramapo*, 30 N.Y. 2d 359 (1972) (upholding phased growth as valid zoning purpose). See generally Lisa Grow Sun, *Smart Growth in Dumb Places: Sustainability, Disaster, and the Future of the American City*, 2011 *B.Y.U. L. REV.* 2157, 2159, 2175 (2011) (describing the smart growth programs in a number of cities). “In Portland, the city’s Bureau of Planning and Sustainability has adopted ‘Neighborhood Design Policies’ that encourage ‘new development’ in areas that are losing housing and ‘increases in residential density’ through ‘residential infill development.’” *CITY OF PORTLAND BUREAU OF PLANNING, NEIGHBORHOOD DESIGN POLICIES* (2008).

179. See Zovanyi, *supra* note 178, at 384, 393-94. In addition to detailed design on the human scale, smart growth principles embrace concerns for the protection of natural resources, efficient use of land resources, improvement of urban services, revitalization of urban centers, multi-modal transportation, compact development, preservation of historic properties and adaptive reuse, energy conservation. See *id.* at 376-78.

and Oregon.¹⁸⁰ Similar ordinances have been enacted in various cities, some pursuant to state mandates.¹⁸¹ Growth management laws contain a commitment to preserve and protect open and green spaces.¹⁸² They do this not only by limiting development, but also by buying conservation easements, development rights, or the land outright;¹⁸³ in all, hundreds of millions acres of land across the states have been preserved.¹⁸⁴ Professor Liberty observes that the practical impediment to more conservation easements is limited funds, but he points out that “a lower-cost and effective way to protect rural resource lands is through zoning”—simply prohibiting rural residential development.¹⁸⁵

Growth controls are effective resiliency and sustainability measures because they contain the density of existing cities, thereby reducing disaster risk, particularly in low-lying coastal areas, along major earthquake faults, and along major rivers.¹⁸⁶ However, some have cautioned that population density can be seen both to exacerbate

180. See Liberty, *supra* note 55, at 261 (citing HEIDI A. ANDERSON, CENTER FOR REGIONAL AND NEIGHBORHOOD ACTION, USE AND IMPLEMENTATION OF URBAN GROWTH BOUNDARIES 4, 6 (1999)); see also Zovanyi, *supra* note 178, at 387.

181. See David Bollier, *Urban Growth Boundaries*, SPRAWL WATCH, <http://www.sprawlwatch.org/ubg.html>; see also Zovanyi, *supra* note 178, at 408; Sun, *supra* note 178, at 2159, 2175. In New York, the State Smart Growth Public Infrastructure Policy Act, N.Y. Envtl. Conserv. Law § 6-0101 focuses on containing sprawl by requiring state agencies to submit a “smart growth impact statement.” § 6-0107.3. For public projects and “advance projects” that meet the state’s Smart Growth criteria, which include “projects located in municipal centers,” “projects for the use, maintenance or improvement of existing infrastructure,” and “projects in developed areas or areas designated for concentrated infill development in a municipally approved comprehensive land-use plan, local waterfront revitalization plan, or brownfield opportunity area plan.” § 6-0107.2.

182. See Liberty, *supra* note 55, at 269-70.

183. See *id.* at 269. Vermont, Florida, Maryland, and New Jersey have worked to protect rural lands. “Growth controls can protect farmland by requiring rural cluster zoning and by limiting development in ways that are sensible in protecting the provision of infrastructure and services.” *Id.*

184. See *id.*

185. See *id.* Some growth management legislation operate by a mix of state-funded financial incentives and restrictions; see also Zovanyi, *supra* note 178 at 388-89, 394, 395-396.

186. See Sun, *supra* note 179, at 2167. Sun recounts that some commentators have previously identified urbanization as a factor in disaster risk. See *id.* However, the relationship between urbanization and disaster risk is likely more complicated than has sometimes been assumed.

(through the high percentage of impervious surfaces, urban heat island effect, and increase in evacuation time) and to mitigate (by multi-story buildings serving as refuge during flooding events) climate change effects.¹⁸⁷ Professor Sun states that “[i]ncreasing density concentrates not just population but also resources—including the resources needed for effective disaster response. This concentration of response resources can be advantageous if those resources emerge from the disaster unscathed . . . [If, however,] they are destroyed in the disaster event, the resulting equipment shortages and communication failures can seriously hamper response and relief activities.”¹⁸⁸

Growth controls typically operate by limiting the number of building permits that are issued during a particular time period, although they may also limit the extension of urban services and facilities (urban highways, sewers, and water lines) outside the boundaries. Benchmarks, such as infrastructure construction, adequate water supply, and affordable housing, are often incorporated for lifting limits.¹⁸⁹ Otherwise, the controls on development may not specify a particular duration. The Supreme Court has given some guidance on how long controls can be validly imposed without triggering takings compensation. In the celebrated *The Tahoe-Sierra Preservation Council, Inc. v. Tahoe Regional Planning Agency*,¹⁹⁰ the Supreme Court upheld a moratorium on development in the Lake Tahoe area against a takings challenge.¹⁹¹ The two jurisdictions, California and Nevada, maintained that in the previous decades residential development around the lake had been proceeding at a rapid pace, producing more impervious surfaces, which in turn caused runoff into

187. *See id.* (citing Michael MacRae, *Tsunami Forces Debate Over Vertical Evacuation*, ASME (Apr. 2011), <http://www.asme.org/kb/news—articles/articles/manufacturing—processing/tsunami-forces-debate-over-vertical-evacuation> [https://perma.cc/8U4H-5JVP]) (discussing the possibility of “vertical evacuation” to the higher floors of multistory buildings during tsunamis).

188. *See* Sun, *supra* note 179, at 2168.

189. *See generally* ANDERSON, *supra* note 180, at 7.

189. *See* Liberty, *supra* note 55, at 261 (citing HEIDI A. ANDERSON, CENTER FOR REGIONAL AND NEIGHBORHOOD ACTION, *USE AND IMPLEMENTATION OF URBAN GROWTH BOUNDARIES* 4, 6 (1999)).

190. 535 U.S. 302 (2002).

191. *See id.* Because they contemplated allowing development in the future although at an unspecified point, the owners had not been permanently deprived of property.

the lake, substantially reducing its renowned clarity.¹⁹² Even though the moratorium by its original schedule had prohibited virtually all development around the lake, for up to 32 months while the states studied the issue and formulated a plan for protecting the lake,¹⁹³ the court rejected a *per se* takings claim and instead applied the regulatory takings analysis used in *Penn Central Transportation Co. v. New York City*.¹⁹⁴ The court found that the limits on development did not amount to a permanent deprivation of property, explaining that “[l]and-use regulations are ubiquitous and most of them impact property values in some tangential way—often in completely unanticipated ways. Treating them all as *per se* takings would transform government regulation into a luxury few governments could afford.”¹⁹⁵ Instead, “a fee simple estate cannot be rendered valueless by a temporary prohibition on economic use, because the property will recover value as soon as the prohibition is lifted.”¹⁹⁶ The Court further pointed out that “[t]he consensus in the planning community appears to be that moratoria, or ‘interim development controls’ as they are often called, are an essential tool of successful development.”¹⁹⁷ They are little different from permit delays.¹⁹⁸

While reduced lake clarity does not portend severe weather impacts, it is a kind of environmental degradation to the ecological system that justified the substantial limits on development to sustainable levels. Overall, growth controls force developers to use existing land efficiently—less removal of trees and soil, fewer impervious roads—leaving us less exposed to the ravages of severe storms and searing heat.

D. Zoning for Improvement

Business improvement districts (“BIDs”), a form of public-private partnership operating within local governance, have been an effective

192. *See id.* at 307-08.

193. By the time the case was decided that moratorium had lasted some eighteen years.

194. 438 U.S. 104 (1978).

195. *See id.* at 324.

196. *Id.* at 332.

197. *Id.* at 338.

198. *See id.* at 337.

tool for urban development for more than three decades.¹⁹⁹ BIDs evoke a range of legal and regulatory disciplines—land use and zoning, public administration, geography, as well as constitutional rights.²⁰⁰ While the nomenclature varies—special improvement districts,²⁰¹ public improvement districts,²⁰² neighborhood improvement districts—²⁰³ all BIDs must have approval by the municipal government, usually pursuant to state enabling legislation; some require a ballot measure, others are approved by city councils.²⁰⁴ They are typically corporations, as a non-profit or a public-private nonprofit partnership.²⁰⁵ They are conferred the power to assess property owners within the district, but can also receive donations.²⁰⁶

In general, BIDs involve a territorial subdivision of a city in which property owners or businesses are assessed additional taxes to pay for specific improvements or services in the district, including refuse collection, street maintenance, security patrols, as well as

199. Lorlene Hoyt & Devika Gopal-Agge, *The Business Improvement District Model: A Balanced Review of Contemporary Debates*, 1 GEOGRAPHY COMPASS 946 (2007).

200. *See id.* at 947; *see also* Leah Brooks & Rachel Meltzer, *Does a Rising Tide Compensate for the Succession of the Successful? Illustrating the Effects of Business Improvement on Municipal Coffers*, in MUNICIPAL REVENUES & LAND POLICIES, PROCEEDINGS OF THE 2009 LAND POLICY CONFERENCE 273-74 (Ingram et al. eds., 2010).

201. Hoyt & Gopal-Agge, *supra* note 199, at 946.

202. *See id.*

203. *See id.*; *see also* Richard Briffault, *Our Localism: Part II-Localism and Legal Theory*, 90 COLUM. L. REV. 346 (1990). Briffault states “these variations make determining how many states authorize BIDs almost as difficult as calculating the number of BIDs.” *Id.* at 417.

204. Hoyt & Gopal-Agge, *supra* note 199, at 948-49.

205. *See id.* at 949.

206. *See id.*; *see also* Richardson Dilworth, *Business Improvement Districts and the Evolution of Urban Governance*, 3 DREXEL. L. REV. 1, 9 (2010-2011) (“While BIDs have become a standard feature of cities, their meaning and significance is still open to question. They may or may not be considered governments, they may provide for either more or less meaningful public participation, and they are a new form of governance at the same time as they reflect political divisions and organizational forms from prior centuries.”)

beautification (district design, street signs, waste receptacles, sidewalk benches, parks).²⁰⁷

The drivers of the growth of BIDs are socio-economic and political—the decline in city centers, urban sprawl, the growth of mega-stores.²⁰⁸ They are credited with helping to restore pride in the community by cleaning up and beautifying areas.²⁰⁹ The positive effects of BIDs are undeniable—the provision of services paid for by the property owners, the betterment of the district, new investment, and the creation of distinct areas.²¹⁰ The net economic benefit from BIDs is also demonstrated, as most studies show increases in property values and commercial activities.²¹¹

207. See Briffault, *supra* note 203, at 428; see also Richard Briffault, *The Business Improvement District Comes of Age*, 3 DREXEL L. REV. 19, 22, 23, 24-25, 27 (2010-2011).

208. Hoyt & Gopal-Agge, *supra* note 199, at 949. The earliest form of BIDs was an effort by local business leaders in downtown San Francisco, after an earthquake and fire destroyed much of the downtown. In the 1930's and 1940's, voluntary membership associations sprung up in other parts of the country, seeking to attract customers and investors in the downtown, as well as to clean up blighted areas.

209. Briffault, *supra* note 203, at 448 (citing David Henry, *As City Cuts Services, Firms Tax Themselves to Keep Streets Clean and Safe; It Works but Is It Good Policy*, N.Y. NEWSDAY, Mar. 23, 1992, at 27 (community board chair who had opposed creation of New York City's 34th Street BID acknowledges, "It is no question that the streets are cleaner"))).

210. See *id.* at 369 (citing Heather MacDonald, *BIDs Really Work*, 6 THE CITY J. 29 (1996)). States and localities cite the successes of BIDs elsewhere in authorizing new BIDs. See Del. Code Ann. tit. 22, 1501(3) (1997); see also *Business Improvements Act of 1996* 23, 43 D.C. Reg. 1684 (1997).

211. See Hoyt & Gopal-Agge, *supra* note 199, at 956; see also Leah Brooks & Rachel Meltzer, *Does a Rising Tide Compensate for the Succession of the Successful? Illustrating the Effects of Business Improvement on Municipal Coffers*, in MUNICIPAL REVENUES & LAND POLICIES, PROCEEDINGS OF THE 2009 LAND POLICY CONFERENCE 275, 278 (Ingram et al. eds., 2010). The challenges to BIDs are typical of those in all organization—sharing in decision-making, accountability, agreements on mission. See, e.g., *Kessler v. Grand Central Dist. Mgmt. Ass'n*, 158 F.3d 92, 132 (2d Cir. 1998) (Weinstein, J., dissenting) (remarking on "the constitutional threat posed by the growth of unrepresentative and non-democratically elected BIDs"). The constitutional challenges relate to the apparent delegation of governmental powers to private entities; that they threaten democratic control in urban areas; threaten the principle of "public stewardship" of public spaces, and necessarily "represents a narrowing of the public sphere." Howard Wolfson, *New York Bets on BIDs*, METROPOLIS: THE URBAN MAGAZINE OF ARCHITECTURE AND DESIGN, 15, 21 (1992) (quoting Leanne Rivlin, Professor of Environmental

The BID can serve as an important model for a resiliency zone, where a common mission—resiliency—is identified and particular measures are mandatory and paid for by the landowners within the district. Decision-making on the design and structure of the district would be inclusive of those within the district. The branding that is typical of BIDs will serve to coax residents to buy into the project.

E. Resiliency Zoning

All the existing measures being employed for sustainability and adaptation suggest that the old philosophy of growth, building bigger and better, must give way to new concerns about resilience and conservation. What may not be apparent is that there is a shared solution for the environmental, social, and economic challenges—a new urbanism.²¹² The solution involves both technological and design innovations—what is built must reflect a consideration of existing geography and entry points. The solution will require coordination between a host of actors and thinkers, as well as government agencies. It cannot be a piecemeal effort, but must be overwhelming, comprehensive and broad-based. It cannot be limited to the immediate conditions (reducing emissions or using energy efficient machines and light bulbs), but must also focus on the social conditions that give rise to these impacts—communities must be designed and/or reconfigured to be less driven by climate-impactful activities, less water wasteful and more green. This can be accomplished by constructing new neighborhoods (or reconfiguring existing ones), through formal “resiliency zones” that demark climate vulnerable geographical areas and that limit building design, location and uses. As expressed by CERES, resiliency zoning contemplates measures to ensure “property

Psychology at the City University of New York). There are also identified negative societal effects, including the exclusion of the poor and street vendors from districts and greater distances between rich and poor areas, not unlike gated communities. By offering more services to neighborhoods willing to pay more in taxes, BIDs undermine the norm of equal provision of public services. *See Kessler v. Grand Central Dist. Mgmt. Ass’n*, 152 F.3d at 124-25 (Weinstein, J., dissenting). *See generally*, Briffault, *supra* note 207, at 28-30; Richard Schragger, *Does Governance Matter? The Case of Business Improvement Districts and the Urban Resurgence*, 3 *DREXEL L. REV.* 49, 52, 54 (2010-2011) (questioning the claimed benefits of BIDs).

212. *See* CALTHORPE, *supra* note 40.

performance” and the delivery of services.²¹³ It is related to traditional zoning in the sense that it zeroes in on a particular geographic area and shares the same broad aims to protect the health, safety and general welfare of the residents within them, but the nemesis is not incompatible land uses (factory/junkyard against single-family homes). Instead, it is the next Superstorm Sandy that presents a whole host of other risks and losses.

Resiliency zoning encapsulates and protects the microcosm defined by local conditions, the geographical configuration, demographics and industrial activities.²¹⁴ It is created by first identifying the vulnerabilities of the area, the known risks; assessing the adaptive capacities, the efficacy of proposed resilience measures, and their costs. Then, it is necessary to develop a set of priorities based on projected and observed impacts. From there, a comprehensive risk profile, with resilience at its center is developed.²¹⁵ In this effort, an inventory of risks to property owners, service providers, businesses and households should be made. CERES suggests that five areas of risks should be identified and explored: risks to performance,²¹⁶ risks

213. See CERES, *supra* note 106, at 6.

214. U.S. GLOBAL CHANGE RESEARCH PROGRAM, THE IMPACTS OF CLIMATE CHANGE ON HUMAN HEALTH IN THE UNITED STATES: A SCIENTIFIC ASSESSMENT (2016). Geographic data and tools for sophisticated mapping of risk factors and social vulnerabilities can be used to identify and protect specific locations and groups of people.

215. THE NEXT PRACTICE LTD. ET AL, EAST BAYFRONT RESILIENCE PRECINCT (2015). The Local Area Risk Analysis (LARM) framework supports stakeholders to identify the wide range of risk exposures associated with a planned area, and, importantly, with the delivery and maintenance of the area’s performance promises to investors, service providers, residents, tenants and visitors. The LARM framework applies concepts of Enterprise Risk Management (ERM) to places. ERM is now widely used as a core practice in corporate management, because it focuses risk management on the achievement of the organization’s business objectives within an environment of complex and manifold risks. Similarly, LARM approaches district-scale risk management as a practice not only to avoid risks, but also to reduce impediments to the achievement of local economic development, policy and place-making objectives. The aim is to use risk assessment and risk management planning to reinforce the guarantee of a premium location for residents and/or businesses relative to other location choices. *Id.* at 9.

216. “[T]he key performance promises of the precinct [is] defined in the precinct plan. Risks to performance are primarily managed through measures associated with design, staging/delivery, and ongoing property and place management, including

to function,²¹⁷ business and market risks,²¹⁸ risks to adaptability,²¹⁹ and risks to re-investment.²²⁰

CERES has developed four cornerstones of strategic planning and action to create resiliency zoning:

1. Asset-focused Risk Management. This cornerstone requires efforts to determine which risks to address and at what level of focus—individual or enterprise—then what strategy to employ—“policy [changes], planning, taxation, building standards, development

asset operations management, leasing, and place-making or ‘curation’ of the promised resident, business and activities mix.” *Id.*

217. “[R]isks to the basic function of the precinct includ[e] disruption of utilities and services, risks to efficient access and egress, and emergency events, as well as flood risk, power outages, [and] inadequate infrastructure capacity. Risks to function are primarily managed through design, utilities upgrades, the establishment of redundancies, and emergency planning and services provisions that are tailored to a precinct’s unique risk exposures. Maintaining the capacity for safe failure is a minimum objective.” *Id.*

218. “[D]isruptive changes in markets that undermine anticipated returns on property investments as well as the industries and businesses clustered in a precinct, includ[es] risks of commercial unit vacancies (property tax risk), currency risk exposure for companies dependent upon export markets or foreign inputs, cost inflation risks, equipment and power supply risks, labor supply/talent risks, [and] malicious computer risks (e.g., hackers, viruses).” *Id.* at 10. These risks “may be managed by diversifying individual business exposures through collective investments and the pooling of risks, including through insurance and other financial instruments.” *Id.* There are also “risks associated with technology change, including new on-line business models which enable the outsourcing of design and production, on-line retail, [and] on-line distance education.” *Id.*

219. These risks “[a]rise . . . from inflexible design, technology choices, capitalization, contracts, and regulation of activities, which prevents the adaptation of physical assets and space, and of precinct activities and business models to changing markets, technologies, social trends, and the natural environment.” *Id.* They include designs that create inflexible, underutilized spaces that cannot easily be converted to fuller uses (e.g., an inactivated plaza between two privately owned commercial buildings dedicated to underground parking access), dependencies on legacy infrastructure and grid networks, insufficient land allocation for new utilities or infrastructure, [and] fixed design of residential units for one demographic.” *Id.*

220. These risks refer to barriers “to capital access or to the attraction of capital for investment in new technology, infrastructure, building improvements, or redevelopment, including poor management of financial exposures of anchor businesses, and of local stakeholder relations.” *Id.* They are “primarily managed through the creation of pooled financing mechanisms, such as special assessments, or district utilities or redevelopment entities with access to capital markets.” *Id.*

approvals, insurance, property and business finance, and education and communications.” Some “critical risks . . . will remain exposed even if measures at the scale of individual properties are successful.”

2. Local Area Risk Management. This cornerstone focuses on urban areas at the district, precinct, or neighborhood level and requires local climate adaptation planning to address identified risks and vulnerabilities, such as “flooding, wildfire, severe heat, power loss, extreme winds—arising from the unique design, age and demographics, and the unique mix of activities in each local area.” It requires property owners and stakeholders in these areas to “establish mechanisms for collaborative management of risks that are unique to the area, protecting the area’s performance as a business, service, and/or residential location.” Among other things, these mechanisms may include “a body or institution that is specifically responsible for management of risks confronting the local area,” which “may . . . engage with the insurance industry, representing an insurance pool, to develop customized risk transfer solutions for its unique exposures.”

3. Resilience Upgrading. This cornerstone contemplates measures for “risk reduction and immediate local performance improvements,” that reinforce insurability while also improving the attractiveness of locating and residing in the area.” They include “‘greenscaping’ major road arterials by creating attractively landscaped medians and roadsides . . . to reduce storm water runoff and . . . flooding . . . ;” “voluntary land swaps with private owners followed by the development of an extensive system of river side parks, cycling trails, catchment ponds, and sports fields.” “Increased amenities, facilities, and local service improvements” create value. “The availability of green space . . . [makes the community] livable and attractive residential and business locations.” These measures work to encourage investments that lead to resilience and even generate performance premiums in the form of increased property values, rental, tax, and service revenues.

4. Communicating Resilience Benefits. This cornerstone focuses on memorializing the performance benefits of the Resilience Zone, through formal documentation and communication to the public to create market demand for location in the zone, thereby increasing the potential for a ‘resilience premium.’²²¹

221. CERES, *supra* note 106, at 9-10.

The first two cornerstones strengthen risk management and maintain insurability. The second two aim to strengthen an area's ability to attract investment, and to communicate resilience benefits as a way to maintain and even increase value in the Resilient Zone.²²²

F. Components of a Resiliency Zone

The first step in this effort—determining the unique vulnerability of the area—requires an assessment of the ability of a region to prepare for and respond to disasters, with reference to the physical (population density, transportation networks), social and economic characteristics of the region.²²³ While resiliency zoning will be set up within the context of traditional risk management practices, it will diverge in the sense of taking into account the unique risks of climate change impacts.²²⁴ It will also abandon the traditional practice of just passing on unmanaged risks to the public sector and downstream users, but rather will reflect collaboration between various constituents to reduce them.²²⁵ This approach is most effective when stakeholders believe that tangible benefits will accrue to them, in the form of security and market value increases in the property governed by the zoning.²²⁶ This means that engagement of stakeholders at the risk assessment level as well as at the planning level is crucial. A resiliency planning element—a set of policy, service and other spatially defined measures—can be prepared for a neighborhood plan.²²⁷

222. *Id.*

223. URBAN LAND INSTITUTE, *supra* note 69, at 6.

224. CERES, *supra* note 106, at 20.

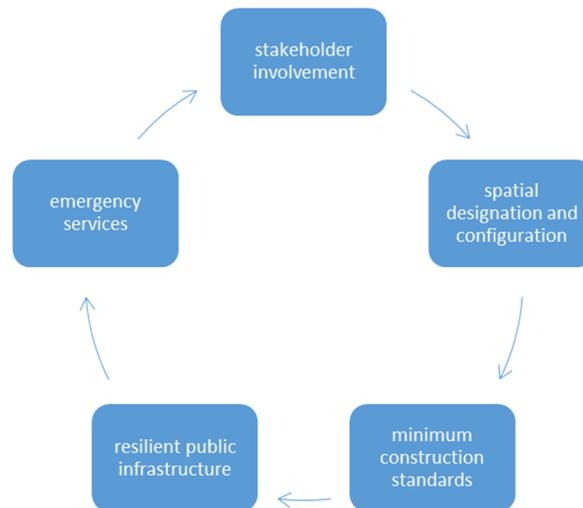
225. *Id.* at 8.

226. *See* Cédric Philibert, The Isolation Paradox and the [sic] Climate Change 5-6 (1998) (unpublished manuscript) (on file with author) (discussing the isolation paradox and what is required to move beyond it).

227. Five stages for building a resiliency plan are: 1) introduction, leadership consultation, with multi-stakeholder planning and design group; 2) participatory risk identification workshop using a risk analysis system, developing a precinct risk profile; 3) risk analysis workshop, with planning and design group, identification of priority risks and hotspots, identification of possible measures; 4) policy, market and cost benefit analysis of measures, workshop with planning and design group, selection of measures, targets and policy recommendations for resilience plan; 5) preparation of resilience plan, resilience zone branding and communication strategy, resilience zone mandate and mechanism. *See* THE NEXT PRACTICE LTD. ET AL, *supra* note 215.

Cities and states are already engaged in “resiliency zoning,” but most do not realize it and most do not denominate their efforts as such. As shown, using land use tools to keep development away from the shores, to require efficient energy uses and supporting green infrastructure, are all components of “resiliency zoning.”²²⁸ What remains is formalization.

A formal resiliency zone will have the following components.



Spatial designation and configuration

- A defined geographic area with definite edges and growth controls
- New street design that allows for walkability, air flow and light
- Form and layout of buildings and urban districts for cooling, ventilation and clustering
- Armoring along the coast
- Open space

Minimum Construction Standards

- Building code requiring fortifications to wind and water
- Efficient construction materials, reflective coatings
- Retrofitting to improve resilience

228. The various measures for resiliency are discussed, *supra* notes 107 to 172 and accompanying text.

- Elevated critical systems
- Green and cool roofs
- Green building that complies with LEED or some other standard

Infrastructure

- Green infrastructure, including green alleys, porous pavements, and vegetated swales, to serve as natural water filtration mechanisms and for capturing stormwater runoff
- Vegetated cover, tree canopies
- Bike paths, public transportation
- Energy efficient public lighting
- Rainwater capture systems
- Innovative waste water treatment facilities
- Permeable pavements
- Slow driving speeds

Emergency Services

- Communications hubs, including substations for fire and police
- Designated evacuation routes
- Shelters and safe places

Stakeholder Roles and Responsibilities

- Designing the new district
- Membership in Community Association for decision-making in the zone
- Mandatory recycling of waste products
- Assessments for common projects

The new zone should not be feared as a new kind of Stepford Community, as there is ample room in the zone for a mix of styles, designs, colors and layouts, as only the minimum standards are prescribed. In all respects, the zone must not be a top-down proposition, but must be done by the people, together.

VI. EXAMPLES OF “SORT OF” RESILIENCY ZONING

FEMA has developed a number of resiliency plans that can inform the development of resiliency zoning.²²⁹ A capital improvement and infrastructure program concerns infrastructure and transportation improvement, focusing on specific projects and targeted funds to complete the projects, and covers wastewater treatment plants, water and sewer lines, fire stations, or roadway expansions. FEMA offers ideas on the placement and design of such facilities to ensure their continued functioning in the event of a disaster, recognizing that such improvements are vital to the community as they portend hazard risks.²³⁰ FEMA warns that upgrades in waste disposal facilities or the construction of a highway interchange can spur growth in previously undeveloped areas, such that communities should be strategic about such improvements in high risk areas.²³¹

On the other side of the improvement plans are Area Plans—district, neighborhood, corridor—that focus on a defined area within a community to provide and integrate hazard mitigation in a targeted way. A waterfront district plan may focus on flooding or wind and wave hazards associated with the water feature; a wetlands area may deal with preventing inundation through structural measures.²³²

229. See FEMA Hazard Mitigation Guide, *supra* note 59, at § 1-1.

230. See *id.*

231. *Id.* at § 3-5.

232. Functional plans focus on functions or services such as stormwater management, public utilities, transportation, or open space planning. These plans may consider the entire area of a community, have a regional focus, or be related to the boundaries of a special district such as a water district service area. Functional plans can provide opportunities for hazard mitigation integration, specifically as it relates to the function. Examples include: Stormwater Management Plans; Wastewater Management Plans; Park, Recreation, and Open Space Plans; Transportation Plans; Economic Development Plans; and Emergency Operations Plans. See *id.* at § 3-6. FEMA also notes that:

Neighborhood design and site planning in the community may be built around smart growth principles. Smart growth and hazard mitigation are not mutually exclusive and thoughtful planning can incorporate both. For example, among the basic Smart Growth Principles, taking advantage of compact building design and preserving open space, farmland, natural beauty, and critical environmental areas are effective methods to protect new development or redeveloped areas from the impacts of natural hazards.

Id. at § 3-7.

King County in the state of Washington, having had areas declared federal disasters ten times since 1990, adopted the “Flood Hazard Management Plan,” which among other things created a “Flood Control Zone District” covering areas that are most vulnerable to increased fall and winter flooding.²³³ The district is an independent special purpose district, managed pursuant to an inter-local agreement that includes native tribes.²³⁴ It contemplates using structural and non-structural flood risk reduction tools to manage river corridors for long-term flood risk reduction, including repairs of aging flood protection facilities, levee setback and removals, home elevations and acquisition of flood prone properties.²³⁵ The district also has in place a regional flood warning center and emergency response programs, flood facilities maintenance, mapping and technical studies, and has set up forums for citizen inquiries and public responses.²³⁶

In New Jersey, the “Meadowlands Resilient District,” was an entrant in the *Rebuild by Design* contest.²³⁷ The proposal focused on the “Meadowlands,” an area that emerged as one confronting many risks, principal among which was flooding. The proposal aimed to create a “resilient district” that defined edge zones between the natural and urban systems, striving for the co-existence of industrial (logistics) and residential programs. The “resilient district” entails measures to provide emergency amenities allowing critical supplies, data access, energy and waste management to adjacent communities for a two to three-week period after a disaster. It also includes a careful study of evacuation routes to high ground. The district situates residential properties alongside a large park and contains utility clusters. Eventually, there will be a conversion of substantial parts of the Meadowlands into “a regional landscape and infrastructural park that

233. Memorandum from Karen Wolf, Adapting to Climate Change: Strategies from King County, Washington (Mar. 22, 2006) (on file with author).

234. KING COUNTY FLOOD CONTROL DISTRICT, RIVER AND FLOODPLAIN MANAGEMENT IN KING COUNTY 1-2 (2006).

235. *See id.*

236. *See id.* The district is funded by a property tax levy of ten cents per \$1,000 of assessed value, initially raising \$35 million dollars. *Frequently asked questions – King County Flood Control District Hazard Mitigation Plan Update*, KING COUNTY (Sept. 11, 2015), <http://www.kingcounty.gov/services/environment/water-and-land/flooding/flood-control-zone-district/local-hazard-mitigation-plan-update/local-hazard-mitigation-plan-faq.aspx>.

237. REBUILD BY DESIGN, <http://www.rebuildbydesign.org/> (2016).

protects the edges from floods, rebuilds biodiversity lost over the past century, absorbs water and hosts recreational civic programs.” The district contemplates a mix of new residential density and other uses along the edges to take advantage of the park as a civic amenity.²³⁸

The Gentilly Resilience District in New Orleans was originally proposed as part of New Orleans’ application in the HUD National Disaster Resilience Competition, for which the city received \$141 million. It incorporates existing projects and investments funded by the FEMA Hazard Mitigation Grant Program and HUD CDBG grants. The district is described as containing innovative and creative solutions to flood risk, aims to slow subsidence and to further community revival. The design of the district is still being worked out, but the early contours include collaboration with local agencies for sustainable sewage and water management control, permeable pavements, water retaining landscape, and rain gardens, among other things.²³⁹

Florida has enacted legislation for the creation of “Adaptation Action Areas” to enable the local designation of areas vulnerable to climate impacts, including sea level rise, extreme tides, and storm surges. The legislation facilitates the design of policies toward resilience,²⁴⁰ by encouraging the use of innovative tools, including service designation, urban growth boundaries, mixed uses, and high-density development.²⁴¹

In New York, Governor Andrew Cuomo introduced the concept of Community Reconstruction Zones—areas that reflect the priorities of communities extensively damaged by the storms Sandy, Irene, and Lee. The body of these zones has yet to be developed, but they contemplate many of the “resiliency zoning” measures discussed here.²⁴²

238. *Id.*

239. *Id.*

240. 20 Good Ideas, *supra* note 112, at 5.

241. FLA. REV. STAT. §163.3164-65 (2011).

242. Press Release, Governor’s Press Office, Governor Cuomo Announces Community Reconstruction Zones Funded by Federal Supplemental Disaster Aid to Guide Local Rebuilding Process (Apr. 26, 2013) (on file with author).

VII. THE VIRTUES AND IMPACTS OF RESILIENCY ZONING

On the surface, the impacts of resiliency zoning are all positive: integrated and comprehensive plans, targeted to particular risks, increased property values and investments in the community, and a degree of ease. A resilience zone will encourage proactive investment to prevent losses and improve the city's capacity for better calibrated risk assessment in the area. It will enable risk assessment at the community or neighborhood level to address the profiles that are peculiar to these distinct locales, comprehensively. By limits on design and uses, it will facilitate the minimization of risks and the management of remaining exposures and vulnerabilities. Ultimately, 'resiliency zones' will lead to more predictable delivery of the promised benefits of residence and investment in the community, and in this regard, attract new investment, making the community a location of choice and not one to abandon.²⁴³

There are yet some negatives to bear in mind as zones are established. There are both direct costs and indirect costs. The direct costs include the out of pocket expenses of upgrading to new standards in the zone.²⁴⁴ These costs may be out of reach of many households.

243. *See CERES, supra* note 106, at 8.

244. The common estimated costs of resilient building are a 5% increase over traditional building, although some estimates vary widely from 1 to 200% depending upon who is doing the estimate and what features are added—laminated high impact windows, heavily anchored sheet metal roofs as opposed to shingles, and solid concrete storm rooms, will add significantly to the cost of new construction. *See Green, supra* note 78, at 555. On the efficacy and costs of building green, government data shows it is more efficacious to improve the average efficiency of older (pre-1991 homes) than those built after (because the newer homes use much less energy anyway). For example, spending \$10,000 to retrofit a typical home built in the 1960s could eliminate about 8.5 tons of emissions, whereas increasing the energy efficiency of a new home by 35 percent would cost about \$5,000, but only cut emissions by 1.1 tons. In other words, retrofitting existing homes with energy-efficient features is four to eight times more carbon- and cost-efficient than adding further energy-efficiency requirements to new housing. NATIONAL ASSOCIATION OF HOME BUILDERS, *BUILDING GREENER, BUILDING BETTER* (2008). Some states, like New York, contemplated loan programs for homeowners and businesses to retrofit their homes. Governor's Office of Storm Recovery (GOSR), *Housing Recovery*, NEW YORK STATE (2017), <https://stormrecovery.ny.gov/housing/single-family-homeowner-program>.

Green roofs may require shoring up of load bearing walls.²⁴⁵ More stringent requirements for new construction and development may add to the cost of construction and may operate as a new form of exclusion.²⁴⁶

The social costs include population displacement by new zoning and land use regulations that render certain parts of cities undevelopable; by regulations that preclude building too close to the sea; and by loss of communities, when populations are relocated. Some of these effects can be avoided by giving careful consideration to issues of social equity to ensure that the development of resiliency zoning does not further marginalize disadvantaged or the most at risk communities. Concerted efforts reaching out and educating all populations can work to avert exclusion and disproportionate impact. The legitimacy and acceptance of land use planning will turn on the identification of alternative futures and building consensus among stakeholders around the best options, taking into account their perceptions and preferences about their present and future well-being. In this effort, the participation of all stakeholders not only in the evaluation of potential scenarios but in the identification of explicit objectives that shape planning and scenarios is critical.²⁴⁷

Creating resiliency zoning will require substantial funding, for public infrastructure, retooling and reconfiguring, and for assistance to landowners for fortifying and upgrading property. The same sources being tapped for mitigation and adaptation planning should be

245. *Weight loading*, GROWING GREEN GUIDE (2014), <http://www.growinggreenguide.org/technical-guide/design-and-planning/site-analysis/weight-loading/>.

246. *See Green, supra* note 78, at 563 (describing the indirect costs such as: costs of burdensome permitting requirements in Boston; that new building construction in Los Angeles have Energy Star certified roofs; surcharges against homeowners for the costs of new stormwater retention systems in Pennsylvania; a real estate recording fee in North Carolina; a surcharge on property insurance; bridge tolls in New York; and fees for plastic/paper bags for costs of green roofs in the District of Columbia). Some of these costs of public mitigation and adaptation plans are already being passed onto those with strained budgets, but who may not be the prime contributor to the problem, and who will not benefit directly from those costs.

247. *See* Vanessa M. Adams, et al., *Using Optimal Land-Use Scenarios to Assess Trade-Offs between Conservation, Development, and Social Values*, PLOS ONE (2016).

available for the resilience zone.²⁴⁸ These sources are governments—state and federal for grants and loans; private institutions for loans and guarantees; custom debt instruments (municipal, utility and catastrophe bonds);²⁴⁹ insurance/re-insurance; and significantly value-capture, risk transfer and equity.²⁵⁰ There are also competitions that challenge governments and planners to develop innovative and workable designs for resilience.²⁵¹ In the end, a willingness to alter the financial priorities of the community will be required.

VIII. ADAPTATION OF PRINCIPLES AND RIGHTS: A NEW URBAN LAND ETHIC

Not only must physical systems be adapted to climate change, but so must our systems of rights and duties. The aims and limits of law must be allowed to flex in order to confront the new realities of the physical world. Of course, the law has always been conceived as a dynamic thing, growing and contracting as society demands.²⁵² In the climate context, ancient concepts of nuisance may need to be applied to embrace practices that contribute harmfully to climate change and police powers may need to expand to address practices that are not *per*

248. *Funding Opportunities*, U.S. CLIMATE RESILIENCE TOOLKIT (Jun. 29, 2016), <https://toolkit.climate.gov/content/funding-opportunities>.

249. See Shalini Vajhala, *Financing infrastructure through resilience bonds*, BROOKINGS (Dec. 16, 2015), <https://www.brookings.edu/blog/the-avenue/2015/12/16/financing-infrastructure-through-resilience-bonds/> [<https://perma.cc/49G8-XZLR>]; Rockefeller Foundation, *see also* Judith Rodin, *Innovative Finance Has a Major Role to Play in Tackling Climate Change*, ROCKEFELLER FOUNDATION (Dec. 4, 2015), <https://www.rockefellerfoundation.org/blog/innovative-finance-has-a-major-role-to-play-in-tackling-climate-change/> [<https://perma.cc/7SQD-5953>].

250. Jeb Brugmann, *Financing the Resilient City: A demand driven approach to development, disaster risk reduction and climate adaptation – An ICLEI White Paper*, ICLEI Global Report, (2011).

251. REBUILD BY DESIGN, *supra* note 237.

252. See COTTERELL, *supra* note 30 (law as evolving and as an instrument of change). Supreme Court Justice Oliver Wendell Holmes, Jr. long-ago advised that that law does not autonomously function in a strong box of legal rules and precepts. OLIVER WENDELL HOLMES, JR., *THE COMMON LAW* 5 (Transaction Publishers ed., 5th ed. 2005). Instead, it is driven by human agents of decision in different roles. His most famous aphorism, “the life of the law has not been logic, but experience” is particularly meaningful in the context of law here that law must change with a changing society instead of holding on to time-worn slogans and formulas. *Id.* at 1.

se nuisances, but are yet generally regarded as unwise.²⁵³ Property rights may need to contract in order to achieve the goal of a community that can withstand rapidly changing dynamics. Some are calling for a radical shift in the conception of rights. Professor Craig Arnold asserts that “the capacity of cities to build social-ecological resilience and adaptive capacity will depend, at least in part, on the legal system and frameworks that shape and constrain cities;” that “a new paradigm, . . . “call[ed] ‘adaptive law,’ is needed to replace features of the legal system that are rigid, ignore interrelationships among social and ecological systems, emphasize front-end prescriptive rules, and generally are ill-equipped to adapt to rapid, unexpected change.”²⁵⁴

New notions of federalism may emerge—as the best climate strategy may require in the first instance a national (indeed, international) policy. This may require preemption of local concerns—though coal may be an important economic driver in West Virginia, the national interest in containing its nasty effects through federal regulation may override the local interests.²⁵⁵

253. Trees must be allowed to stand. *See* Energy Conservation and Development, PUB. RES. CODE § 25980, 25984. Homes must be removed from flood prone areas. LOCAL GOVERNMENTS FOR SUSTAINABILITY, LOCAL GOVERNMENTS, EXTREME WEATHER, AND CLIMATE CHANGE 2012, at 5 (2012) (describing plan adopted in King County, Washington to demolish chronically flooded homes).

254. *See generally* Craig Anthony (Tony) Arnold, *Resilient Cities and Adaptive Law*, 50 IDAHO L. REV. 245, 248, 253 (2014). Arnold and Gunderson previously argued that the “U.S. legal system is maladaptive to [disturbances and change in complex, interconnected social-ecological systems] in at least three respects:” (1) the legal system “seeks to impose and protect stability and certainty in human affairs, often with narrow or singular goals and methods;” (2) “U.S. laws are based on assumptions about a globally stable nature, which is at odds with current scientific understandings of natural systems;” and (3) “[l]egal processes require up-front prescriptive decision making and treat elements of nature and society in fragmented ways.” *Id.* at 252.

255. *See* J.B. Ruhl, *General Design Principles for Resilience and Adaptive Capacity in Legal Systems - with Applications to Climate Change Adaptation*, 89 N.C. L. REV. 1373, 1393-94 (2011); *see also* Nicholas A. Robinson, *supra* note 27, at 482 (“some economic interests still benefit from ignoring externalities and are opposed the strictures of environmental law. Coal mining firms in Appalachia violated the Clean Water Act as they launched mountain top mining, and the natural gas hydraulic fracking companies secured an exemption from all federal environmental laws, producing widespread environmental degradations of air and water . . . Many government agencies require environmental norms of the private sector and exempt themselves from observing the same norms . . . It seems

The pollution of land, air, and water, and destruction of ecosystems are not just “externalities” or “market imperfections,” but infringements on the enjoyment of our own property and our freedom from breathing polluted air and drinking contaminated water and our desire for more benign climate conditions. This intellectual enterprise of rethinking property rights, responsibilities, and their connection to freedom must go hand in hand with the practical steps of designing and implementing new model codes for the use and conservation of land and resources.²⁵⁶

Professor Melissa M. Berry writes that we should work to achieve “urban resiliency” as a social-ecological phenomenon, which requires us to “shift our thinking and patterns of behavior, perhaps to become a different type of city.”²⁵⁷ She states that:

[S]ocial-ecological resilience for a city can be grounded in an urban ethic that reflects the interrelationship between humans and their built and natural environments. An urban land ethic recognizes that urban areas are different. Place matters, and cities are a particular type of place that affects how we interact with the land.²⁵⁸

She identifies three principles shaping an urban land ethic: it is rooted in a systems-based approach within the framework of resilience theory; it is place-based, encouraging both an individual and collective mindfulness; and it promotes interconnectivity between people, their natural and built environments, their community, and their government.²⁵⁹

The shaping and reshaping of the built world is not a new adventure, but something that has occurred both organically and deliberately since the beginning of time, at first by bare want, then by creative vision, and now it must change out of necessity. Aesthetics and resiliency need not be viewed antithetically, but instead as twins serving a

“[e]ndorsement of sustainability norms would appear to be opportunistic, useful selectively, and avoided when not wished for.”).

256. See Liberty, *supra* note 55, at 273.

257. Melissa M. Berry, *Thinking Like a City: Grounding Social-Ecological Resilience in an Urban Land Ethic*, 50 *IDAHO L. REV.* 117, 138 (2014).

258. *Id.* at 138.

259. See *id.* at 140.

common mission of the survival of the embodiment and spirit of the city. Creating physical zones to manage physical threats serves to achieve an urban land ethic that makes for resilient cities in all respects.

CONCLUSION

While some facts on the ground can be changed, many cannot without inflicting injury somewhere else. Tree canopies may block the sun from reaching solar panels. The little soil underneath city streets may defeat natural water diversion and filtration systems. Water diverted from Blue Street, may flood Apple Street. Elevated homes may keep out the disabled. Permeable surfaces may not be traversable by people in wheel chairs. Returning to the “isolation paradox,” because “nobody is willing to invest but everybody would like to see others doing so,” “yet each would be willing to invest himself provided others did so, for in this case the psychic gain from others’ investment would outweigh the loss on one’s own investment,”²⁶⁰ it is imperative for government and society to step in to urge collective and directed action and this through a new concept of urban space.

260. CÉDRIC PHILIBERT, *supra* note 226, at 7.