CHAPTER 12

RESILIENCE

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1. Introduction

A resilient city is able to survive a traumatic blow to its physical infrastructure, its economy, or its social fabric. The resilient city bends but does not break; it absorbs impacts without shattering. Even if the bridges and roads are ruined and the buildings toppled, the resilient city's core institutions survive; its social fabric holds; and in time, its economy rebounds—all, ideally, without undue infusions of aid or assistance from external actors, such as the federal government. Urban resilience is an elusive state that resists easy metrics or qualification. It can be difficult or even impossible to gauge a city's true rebound capacity until an actual disaster is at hand. A city's degree of resilience can also change over time; the very same kind of event can yield very different outcomes depending on prevailing socioeconomic conditions. The blackouts of 1969 and 1977 in New York City are a case in point. The initial events were virtually identical. The first blackout occurred during an economic boom, when the city was in robust overall health; strangers aided one other in the streets and the city was enveloped by a sense of collective goodwill and common purpose. The second blackout, in 1977, occurred in a time of economic decline and rising poverty and lawlessness in the city. The hale spirit and communalism of 1969 was gone, and the city was wracked instead by looting and vandalism. For many, the 1977 "Night of Terror" was the nadir of New York's long downward spiral in the postwar era.

Urban resilience is determined by a complex web of interlocking factors that resist easy measurement or visualization. A city can build a dazzling new sports stadium or airport, and the finished thing will look great on the evening news or in annual reports. Banking up a city's rebound capacity, on the other hand, cannot

be so easily imaged or sold. Planners can work for years to boost a city's immune system with seemingly little to show taxpayers or the press corps. Urban resilience is also difficult to achieve quickly. A city cannot purchase or implement resilience per se, but it can bolster incrementally the various systems and infrastructures—both physical and social—deemed essential to metropolitan functionality and well-being. In this sense, a resilient city is much like a person in good health, whose strong heart and robust immune system are the result of years of careful attention to diet and exercise. Building up urban resilience requires similar commitment, like a person working out daily to keep fit and healthy. Though the benefits of such conditioning may not been immediately apparent, a sudden trauma or catastrophe will quickly reveal a city's level of fitness. The resilient city, like a well-conditioned body, will fend off infectious agents and recover swiftly from illness or trauma.

In the following chapter we describe and analyze some of the key elements that can augment a city's fitness, adaptability, and resilience. The chapter begins with a historical survey of urban resilience through the ages, examines the present status of policies and programs aimed at building resilience, and concludes with a series of essential lessons for enhancing future resilience.

2. Urban Resilience in History

Cities are extraordinarily resilient entities, capable of rebounding from even horrific devastation. History is filled with examples of urban disasters both natural and human-made—of cities burned, flooded, shaken, pummeled by artillery, and infected by dread disease. But despite these horrors, virtually no major city has been permanently ruined in the last 300 years. Even in the ancient world, cities were rarely abandoned in the wake of a catastrophic event. There was, of course, Pompeii, buried forever by an eruption of Mount Vesuvius; Monte Albán, near Oaxaca in modern Mexico, was crushed for good by the Spanish; and in the Xingu region of the Brazilian Amazon, a vast network of quasi-urban settlements that flourished 1,500 years ago mysteriously vanished and was quickly reclaimed by jungle.[1] Jared Diamond describes the early settlements on Easter Island and Norse Greenland that lost resilience, declined, and eventually died out.[2] The mythic city of Atlantis has yet to be found, let alone lost. But these are history's exceptions, not the rule. Even the storied destruction of Carthage by the Romans after the Third Punic War was not permanent. The Centurions may have leveled the city and spread salt on its fields to render it barren. But the Romans themselves resurrected the city during the reign of Augustus, eventually making Carthage the administrative hub of their African colonies.

More typical are stories of durability and resilience. For reasons that are not fully clear, cities become effectively indestructible after the eighteenth century,

and this in spite of humankind's increasing ability to destroy and the increasingly larger populations living in known danger zones. No city has been permanently lost due to either warfare or natural disaster in the last several hundred years, with the sole exception of St. Pierre, Martinique, whose 30,000 inhabitants were annihilated by a volcanic eruption in 1901. Lisbon endured a triple blow in 1755—an earthquake followed by fire and a tsunami that, together, killed some 60,000 people and destroyed nearly all of the city's buildings; yet Lisbon recovered and would go on to become one of Europe's great cities. Chicago was incinerated in 1871 but resurrected itself seemingly overnight and mightier than before. Galveston, Texas, rebounded from a catastrophic hurricane in 1900—still the deadliest natural disaster in American history—even if it was largely displaced as a major port by Houston. San Francisco lifted itself up from the ashes and rubble of its own catastrophe six years later. Each of these cities suffered appalling destruction of life and property; each was forever changed by the catastrophe, sometimes radically. Yet each survived and even flourished. Even the twentieth century—with its industrial warfare, wholesale genocide, and unprecedented urban devastation—has failed to take a city. Hiroshima, Tokyo, Warsaw, Dresden, Berlin, Beirut—all were subjected to terrible devastation, yet all are with us still. So too are Tangshan and Mexico City, cities leveled by powerful earthquakes in 1976 and 1985, respectively. Even benighted New Orleans has rebounded to some degree, though it is a very different city from the one struck by Hurricane Katrina.

To what can we ascribe this extraordinary capacity for resilience among cities in the modern era? The reasons are many and complex. Partly it has to do with the rise of the nation-state, which has a vested interest in the well-being of its constituent cities. Notwithstanding Washington's infamous snub of New York City during the 1975 fiscal crisis—"Ford to City: Drop Dead," reported the *Daily News*—a nation will usually go to great lengths to help a city in need, for good public relations if nothing else: a country that can do little for one of its own cities telegraphs a message of weakness to the world. This is never more so than when the city in distress is the seat of national government; the capital represents the nation on the global stage and must be protected at all cost. The advent of fee-simple property ownership in the eighteenth century also helped make urban sites more "sticky" and less prone to abandonment. Parcel boundaries and property lines—recorded in plats and deeds and other legal documents—may not seem all that robust, but they represent a virtually indestructible system of spatial organization; providing the documents themselves survive somewhere, lot lines can easily be redrawn, even atop the ashes of a city rubbed out by a nuclear blast. Other factors have contributed to the persistence of urban places in the modern era. By the end of the eighteenth century, many cities must have passed a magical tipping point in terms of sheer amount of built matter; there was simply too much investment on the ground to warrant total abandonment, even in the face of a terrible disaster. Ancient cities were small and compact; pulling up the stakes and moving to a fresh site was relatively easy. Related to this is embedded infrastructure. Concrete foundations and deeply buried utilities can often survive a major catastrophe, and

they virtually guarantee that new roads and buildings will be erected in the very same place. Finally, there is the rise of the modern insurance industry, which is fundamentally conservative and resistant to change. Insurance awards are generally based on what was lost, where it was lost; property owners are typically urged to rebuild in situ and as before—and as speedily as possible.

Barring a direct asteroid strike, no disaster will fully wipe out a city; but even a minor disaster can profoundly alter the fate and future of an urban place. Therein lay the rub of urban resilience: we can rest assured that our cities will survive; the question is *how well* they survive. Related to this is the fact that a city can be rebuilt, even heroically, without fully recovering. This is because true urban resilience involves much more than roads and buildings and other physical things. As Vale and Campanella argue in *The Resilient City: How Modern Cities Recover From Disaster*, "The process of building is a necessary but, by itself, insufficient condition for enabling recovery and resilience." Broken highways can be mended; office towers can be repaired; and communications systems can be patched back together. But a city is more than the sum of its buildings. It is also a complex of intermingled social and cultural networks—the messy magical human "software." Recovering *this* city "fundamentally entails reconnecting severed familial, social and religious networks of survivors"—a process that cannot be imposed, but must be cultivated from below, "network by network, district by district, not just building by building." This requires painstaking reconstruction of the "myriad social relations embedded in schools, workplaces, childcare arrangements, shops, places of worship, and places of play and recreation." It is a terrible thing for a city's buildings to be reduced to rubble; but it is much worse when a city's communal institutions and social fabric is also torn asunder. Indeed, a city can be brought to its knees without hardly even touching the buildings.[3]

This is what happened in Wilmington, North Carolina, in the wake of the race riot of 1898. Wilmington was then the largest and most economically vital city in the state. It was also home to a majority African-American population, and was known as "one of the best cities for blacks in the American South." Blacks were well represented among the city's mercantile elite, and the *Daily Record* was among the only black newspapers in America at the time. Moreover, blacks and whites got along relatively well. By the 1880s, however, whites began agitating against reconstruction, and in 1898, they launched a "white supremacy campaign" to neutralize the racially mixed political coalition then in power—the Republican Populist Fusion. On November 10, 1898, a band of whites burned the *Daily Record* and began a killing spree that left scores, possibly hundreds, of blacks dead. Thousands of black residents fled the city. The city's elected officials were replaced by a cabal of segregationists. Remaining blacks were soon banished from every form of occupation and public office. Though only a few buildings were destroyed, the race riots ruined Wilmington's unique and vibrant social fabric, while the departure of black businessmen and skilled craftsmen brought the city's economy to a halt. Wilmington survived, but it never fully recovered and sank into a century of irrelevance. Only with the extension of Interstate 40 from Raleigh in the 1990s was the city revived.[4]

The Basque city of Guernica in northern Spain offers another insight into how social factors can alter the mechanics of recovery. Guernica was subjected to an infamous act of violence in 1937, when Franco sought Hitler's assistance in bombing this center of Basque autonomy into submission. Hitler obliged, seeing it as a chance to perfect saturation and dive-bombing techniques he would later use in England, Poland, and elsewhere. On a busy market day in late April the town was pulverized by the Luftwaffe's Condor Legion, causing extensive loss of life. The bombing became known to the world largely as the subject of Picasso's monumental painting, *Guernica*, which was exhibited at the 1937 Paris World's Fair. Less than a decade later, the entire city center of Guernica had been meticulously rebuilt—on orders by none other than Franco himself. But only in outward appearance did the city seem healed. In fact, Guernicans resisted the forced reconstruction of the city by the hated Franco regime. In this case, the physical infrastructure was restored to good order, but on terms that chafed against the will of the local citizenry. Full recovery of the city—its emotional and psychological healing—did not take place until well after Franco's death in 1975.[5]

Just as a city is more than the sum of its buildings, it may also be only as resilient as its citizens. Resilient citizens have enabled urban resilience throughout history. At the outset of the Second World War, a "Blitz spirit" enabled Londoners to carry on in spite of daily—and nightly—bombardment by the German Luftwaffe. Even the class divide seemed breached; the defiant cry of "We can take it!" echoed from the East End to Coventry. "Some of the damage in London has been pretty heartbreaking," wrote filmmaker Humphrey Jennings in the fall of 1940, "but what an effect it has had on the people!…What warmth—what courage! What determination…a curious kind of unselfishness is developing."[6] To some extent this street-level resilience was romanticized and exaggerated by the media, and it is true that many people simply fled the bombs. (London's population sank by about 20 percent, and industrial boroughs like Shoreditch and Stepney lost as many as 50 percent of their residents in the wake of the Blitz.) On the other hand, government ministers had been convinced that the bombs would cause widespread chaos and a collapse of morale; they were happily proven wrong. Traces of the Blitz spirit were seen in New York after the terrorist attacks of September 11, 2001. The impromptu candlelight vigils and informal monuments to the lost and fallen brought the vast and often fractious city together in an extraordinary way; for months the city had the social cohesion and warmth of a small town. The great Tangshan, China, earthquake of July 1976 unleashed a force 400 times as powerful as the Hiroshima atomic bomb. Ninety-seven percent of the city's residential buildings were destroyed and at least 240,000 people killed. Yet China and the Tangshan people pulled together and rebuilt the city in less than a decade, and without the aid of any foreign nation. Local citizenry rallied to rebuild, giving real meaning to the Chinese Communist Party's official earthquake rhetoric: *Kang Zhen Jiu Zhai*—"Resist the earthquake and rescue ourselves."[7]

A very different form of resilient citizenry emerged in the aftermath of the Mexico City earthquake of 1985. A major catastrophe often reveals the fault lines

in a society, exposing the inequalities of race and class. It can also reveal long-concealed abuses of authority. The Mexico City earthquake not only rattled the city's buildings but also shook the very legitimacy of the political system and its leadership. As Diane Davis describes it in *The Resilient City*, the earthquake exposed a raft of official corruption and abuses—in some cases quite literally: new government buildings pulverized by the earthquake were found to be of substandard construction quality, and the exposed cellars of ruined police stations contained evidence of torture. These revelations galvanized the capital's "resilient citizens" to demand political accountability and a reordering of reconstruction priorities. "Within days of the earthquake," writes Davis, "people began to organize on their own and reclaim the city for themselves by taking over the business of recovery and reconstruction without assistance from government authorities. Their efforts ensured that certain activities were recovered or restored, ranging from housing to medical services." The grassroots mobilizing triggered by the disaster led, in turn, to lasting political reforms, new political leadership, and a successful movement to secure affordable housing.[8]

The devastating blow inflicted by the floods following Hurricane Katrina to New Orleans led many to predict that the city would be effectively lost. Not only was much of the city's physical infrastructure ruined, so was its social fabric. Tens of thousands of New Orleanian families scattered to the four winds in the wake of the flood. More affluent residents had packed up and left town well ahead of the storm. But members of the impoverished, largely African-American underclass lacked the means to get out and were largely abandoned by the tragically inept evacuation efforts on the part of state and local officials. The poorest of the poor were thus left to their own devices. Many, of course, never made it out alive. This was a demographic group already burdened by numerous and intractable socio-economic problems long before Katrina formed over the Atlantic. The immune system of these people was already down, so to speak, much the way a person battling the flu will have lowered resistance to a secondary infection. To be resilient, an urban population needs to have a certain threshold level of communal wellness, cohesion, and self-esteem—something that the poorest of the New Orleanian poor largely lacked.

But it is not a matter of poverty alone. The citizen activists of Mexico City were poor; so too were the residents of industrial East London pounded by Nazi bombs. The Vietnamese population in New Orleans at the time of Hurricane Katrina was also poor, but it benefited mightily from strong social cohesion and an ethic of self-determination born out of adversity (many of the older residents had fled Vietnam after the fall of Saigon in 1975).[9] The Vietnamese enclave in New Orleans East was hard hit by the storm and subsequent floods; homes and stores and restaurants were destroyed. But the social fabric of the community held fast, and few looked outward to the government for help. As the *New York Times* reported:

> [the Vietnamese] formed neighborhood groups to rebuild, using the [Mary Queen of Vietnam Roman Catholic Church] as headquarters. One team repairs and decontaminates the houses. Others arrange tetanus shots to prevent illness,

and acupuncture sessions to ease stress. Another team buys food to make spicy stews and rice for the families who visit for the day to check on property. Friends and family members drive one another to work, church or even back and forth to cities in Texas where they have temporarily settled. Now they are working on a plan with the Federal Emergency Management Agency to place a core group of Vietnamese into trailers in the neighborhood, planting the seeds of resettlement.[10]

Of course, New Orleans did not simply disappear from the map. It lives on, but in an altered state. Many former residents of the Ninth Ward and neighboring districts simply chose to abandon what, to them, had become a deeply dysfunctional city, home of the highest murder rate in America. New Orleans had effectively failed its most needy citizens—failed to give them good educations, failed to provide them decent jobs, failed to protect them from gang violence, failed even to give them a lift out of harm's way. Thus, it came as no surprise that the first broad survey of hurricane victims—conducted in October 2005 using data from the American Red Cross—found that 39 percent of New Orleans residents, some 50,000 households, mostly poor and black, had no plans to return to the city.[11] This is a staggering number, easily the largest single movement of Americans since the "Great Migration" of African Americans in the post-World War II era. By January 2006, about one-third of the city's pre-Katrina population of 455,000 had returned, and a year later—on the second anniversary of the disaster—only about half had made their way back.[12] The loss of these residents, many of whom had deep family roots in New Orleans, throws a real warp in the New Orleans recovery picture. These people were part of the lifeblood of the Big Easy, and they carried with them—in their traditions and cuisine and mannerisms and habits of speech—a kind of urban genetic code that made New Orleans what it was. This code has been splicing itself into hundreds of local cultures across the country since the Katrina diaspora, enriching places far beyond Louisiana. But mostly it was a loss for New Orleans.

The ongoing struggle to bring New Orleans back from the brink provides a rich glimpse into the mechanics of postdisaster recovery and reconstruction. It would require a separate chapter to describe the tangled web of planning initiatives drafted and promoted by a diversity of commissions, governmental agencies, quasi-governmental authorities, and well-intentioned actors from the design professions, the business community, universities, and the public at large. The city's near total lack of a priori planning for such a disaster, along with seemingly insurmountable political realities, has made recovering New Orleans an enormous task, indeed. As Olshansky and colleages have written, "Neither the FEMA, the state of Louisiana, nor the city of New Orleans was prepared for the task of rebuilding a city after a catastrophic urban disaster." New Orleans also lacked, in the best of times, "a system for citizen involvement in governance," and it possessed "no pre-existing plan for the city's future." Not long after the flood, Mayor Ray Nagin actually *reduced* the city's planning staff by two-thirds. Indeed, most of the home rebuilding, clean-up, and community organizing work was carried out not by the

government but by a variety of emergent grassroots, faith-based, and university organizations that descended on the region in a cloud of goodwill. "Clearly, this experience has confirmed much of what we know about postdisaster recovery, including the importance of previous plans and planning capacity, citizen involvement, information infrastructure and data clearinghouses, and external resources. It has also confirmed that recovery is a complex and often chaotic process, requiring nimble institutions and creative ways of harnessing the power of emergent organizations."[13] As Olshansky et al. conclude, the real benchmark of urban resilience is how quickly and how effectively the recovery process "returns the area to a state equal to or better than before the disaster."[14] By this standard, New Orleans can hardly be termed a model of urban resilience. Entire neighborhoods remain derelict, and according to the 2010 census, only about 75 percent of the pre-Katrina population now lives in the city, an estimated 343,829 people.

As sobering as the Katrina experience has been, prospects for urban resilience in the years ahead may be even more daunting. We are just beginning to understand and respond to the new specter of fundamental climate change, coupled with the likelihood of declining oil supplies, global pandemics, terror attacks, sea level rise, and other threats. The twentieth-century governmental policy apparatus constructed to cope with hurricanes, floods, and other natural hazards will require major reform in order to guide twenty-first-century cities toward a more resilient future. The next section briefly reviews the current state of urban readiness and identifies changes needed to maintain a sustainable future balance.

3. RESILIENT CITIES TODAY AND TOMORROW

While cities continue to age and change in response to population movements and development activities, one of the biggest challenges to present and future resiliency is likely to spring from devastating impacts of climate change.[15] This challenge spans all areas of urban planning, from infrastructure to housing, health, transportation, and land use. The United Nations forecasts that some 50 million people will become environmental refugees by the end of this decade due to forecasted storm surges and floods, sea level rise, ice storms, floods, wildfires, droughts and other natural hazards.[16] Coupled with climate change are anticipated major increases in world population, projected by the United Nations to increase by 2.5 billion between 2007 and 2050,[17] and anticipated passing of the world's peak oil supply by 2020.[18] While the bulk of those affected are likely to live in the developing countries, or the so-called Global South, many people in developed countries—the Global North—will find that these changes demand major shifts in their living environments and behavior patterns if their cities are to remain resilient.

Implementing the changes will require a range of innovative management and urban design responses by both governments and the design professions.

Two types of necessary responses have been identified: (1) *avoiding* the unmanageable impacts (preparing for climate change), and (2) *managing* the avoidable impacts (slowing climate change). Avoiding the unmanageable impacts is achieved through *adaptation* of urban development patterns and lifestyles to respond to the new realities of unprecedented increases in greenhouse gases that trigger environmental changes such as alterations in weather and ecosystems and increases in pollution. Managing the avoidable impacts is achieved through *mitigation* of the greenhouse gas impacts themselves by decreasing the amounts of carbon dioxide and other heat-trapping gases entering the atmosphere. These definitions have arisen out of contemporary efforts to deal with climate change. Semantics can be confusing, however. The term "mitigation" has a long history in the field of emergency management, where it refers to predisaster actions to reduce damage and injury from natural hazards, a definition that includes *both* adaptation and mitigation measures.[19]

While the definitions separate adaptation (bowing to the inevitable by smart development that reduces vulnerability to climate change effects) from mitigation (proactive efforts to reduce greenhouse gas emissions), in fact the actions taken under both banners are often similar, as in the case of emergency management. For example, redirecting urban sprawl to increase sustainable development is seen as both an adaptive response and a mitigation response in the 2006 Climate Change Adaptation and Mitigation Action Plan of Durban, South Africa.[20] Durban mapped its risks to sea level rise, flooding, and drought, and targeted its resilience measures by risk levels in its economic urban core, its large informal settlements, its rural drought belt, and its major transportation routes. The city is improving drainage, increasing the height of shoreline stabilization structures, building water retention ponds, and maintaining wetlands. It is revising its land-use zones to prevent building in the high-risk areas. And it is educating its population on how to reduce the human health effects of a flood.

The Durban case highlights the many dimensions that a resilient city strategy must deal with, including physical urban form and development processes, environmental hazards and resources, infrastructure and transportation facilities, economic activities and employment areas, social and institutional relationships, and demographic conditions. It is not enough to consider only one aspect of this integrated system, as New Orleans discovered in the Katrina tragedy where levees alone provided little social or environmental resilience. Ideal resilient cities are sustainable networks of strong and flexible physical systems, natural environments, human communities, and economic enterprises.[21] Resilient physical systems build in redundancy and diversity, so that if one part of a lifeline system fails there are other parts to keep it operating; think of substituting an alternative transportation or communication channel for a broken one. Resilient natural environments replenish their resource bases and adapt to changing impacts, so that their carrying capacity is not exceeded; think of maintaining healthy wetlands that absorb

floods and storm surges. Resilient human communities are collaborative and interdependent, so that communication flows are maintained in times of stress; think of neighborhoods and institutions that trust and rely on each other in the face of disasters. Resilient economic enterprises are adaptable and foresighted, so that they maintain reserve capacity to accommodate for disaster losses; think of corporations that employ sound risk-management strategies. Learning and planning together, these networks continuously evolve toward higher degrees of resiliency.

In practice, resilient city strategies must be crafted to reflect the unique conditions of each urban area. The largest divide falls between cities of industrialized nations of the Global North, which are well established and growing slowly under effective regulations, and cities in developing countries of the Global South, which must cope with rapid growth owing to the wholesale migration of rural populations seeking to better their lives. In the North, feasible government policies linking development to climate change targets are under way (see box p.XXX; see also De Shazo and Matute this volume). In the Global South, lack of financial resources and legal authority limits the effectiveness of governmental intervention into settlement activity. Bangladesh, for example, has earned the dubious distinction as the world's capital for natural disasters, thanks to its vulnerable natural environment coupled with poverty, corruption, and inadequate infrastructure.[22]

The U.S. experience in mitigating the impacts of natural hazards offers a case study that can shed light on creation of resilient cities coping with climate change. National policy is described in the Stafford Act, which establishes an intergovernmental system led by the Federal Emergency Management Agency (FEMA) to provide funding and technical assistance to state and local governments, which must prepare hazard-mitigation plans to become eligible for aid. When a disaster strikes, the affected state government requests a Presidential Disaster Declaration in order to receive federal aid. Over time, the federal policy has evolved from a focus on postdisaster response and recovery to one on predisaster mitigation planning and action, as defined in the Disaster Mitigation Act of 2000, which contain both requirements and incentives. In order to be eligible for federal disaster aid, state and local emergency management agencies must prepare and adopt hazard-mitigation plans. Best-practice procedures and lessons have been derived for local emergency management[23] and postdisaster recovery.[24]

A large body of research by U.S. disaster scholars has analyzed the effectiveness of hazard-mitigation efforts. They have found that the bulk of mitigation expenditures have been directed toward *structural* actions (physical improvements such as levees, building elevation and strengthening, etc.). A smaller amount has been allocated to *process* mitigation that seeks to strengthen social and economic resiliency through planning, community outreach, and education, though some analysts have pointed out the importance of process mitigation to creating resilient cities.[25] They conclude that, in general, U.S. natural-hazard mitigation has been effective. For example, a 2005 national study for Congress of the aggregate costs and benefits of natural-hazard mitigation found that every federal dollar spent on mitigation results in four dollars in damages avoided, or a benefit-cost ratio of four

Box 12.1 Smart Growth and Climate Change in California[i]

California's climate change smart growth bill, Senate Bill 375, signed in October 2008, seeks to reduce greenhouse gas emissions by curbing urban sprawl, reducing commute times, and encouraging infill development.* Essentially a growth-management law that ties transportation funding to growth patterns, the bill asks each California region to create a preferred growth scenario to meet regional greenhouse gas reduction targets derived from the statewide reduction goal. Each metropolitan planning organization (MPO) must prepare a "sustainable communities strategy," which will be the land-use allocation in the regional transportation plan. The strategy is to identify land-use patterns and housing needs and set forth a forecasted development pattern, which, when integrated with the transportation network and policies, will reduce greenhouse gas emissions from automobiles and light trucks to achieve the approved reduction targets. Implementation is delegated to the regions and land-use regulation authority remains with the cities and counties.

The California sustainable communities strategy is distinguished from the smart-growth strategies of other states, such as Florida, Maryland, New Jersey, Oregon, and Washington, by its specific linkage of greenhouse gas reduction targets with growth-management techniques. While the smart-growth programs of other states may in fact help to mitigate climate-change impacts, they are not measured by the effectiveness of their actions in reducing greenhouse gases, as the California program requires.

California also provides funding for growth management planning. Its Regional Blueprint Planning Grants Program aims to build capacity for regional collaboration to plan for future growth and reduce sprawl. One of its key goals is to foster a more efficient land-use pattern that supports improved mobility and reduced dependency on single-occupant vehicle trips; accommodates an adequate supply of housing for all incomes; reduces impacts on valuable habitat, productive farmland, and air quality; increases resource use efficiency; and results in safe and vibrant neighborhoods.

[i]From David R. Godschalk, Raymond Burby, and Philip Berke, "Coping with Climate Change through Land Use Planning," Unpublished paper (Chapel Hill: Department of City and Regional Planning, University of North Carolina, 2008).

to one.[26] State-level studies have concluded that mitigation programs of structural strengthening generally have been effective, but that revising land-use policies has been less effective, owing to vested property rights.[27] Research on the impact of different policy styles on mitigation performance has concluded that collaborative approaches are more effective than state mandates.[28] Analyses of the role of public participation in hazard mitigation have concluded that it is important, but difficult, to involve citizens in comprehensive mitigation planning, owing to the

perception that it is a technical activity.[29] However, some citizen groups are aware of the need to increase resilience with respect to natural hazards. See for example, the seismic resilience strategy under development by the San Francisco Planning

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Box 12.2 SPUR Resilient City Policy Paper

The 1906 San Andreas Fault earthquake and fire caused over 3,000 deaths, destroyed over 28,000 buildings, and left about 225,000 homeless in Northern California. If the 1906 earthquake were to happen today on the San Andreas Fault, it could cause some 800 to 3,400 deaths, damage more than 90,000 buildings, and displace 160,000 to 250,000 households. It would cost between $90 and $120 billion to repair the damaged buildings, and damage to utilities and transportation systems would increase losses by another 5 percent to 15 percent. The total price tag for a repeat of the 1906 earthquake could reach $150 billion—about four times the total losses from the 1994 Northridge earthquake and ten times the losses from the 1989 Loma Prieta earthquake.

In anticipation of a repeat earthquake disaster, the San Francisco Planning and Urban Research Association (SPUR) has defined the resilient city in terms of seismic mitigation policies.[*] SPUR defines *seismic resilience* as the ability of the city to contain the effects of earthquakes when they occur, carry out recovery activities in ways that minimize social disruption, and rebuild following earthquakes in ways that mitigate the effects of future earthquakes.

SPUR proposes *performance goals* to restore everyday life in the wake of an earthquake disaster. Their goals, which are organized in three phases, are: initial response (1–7 days), mid-term planning (7–30 days), and long-term reconstruction (several years); these add specific target times to the recovery objectives set forth in the city's earthquake plan. For example, in the immediate phase, 90 percent of water, power, and wastewater systems should be operational and 90 percent of major transportation routes open for at least emergency response. In the mid-term phase, all utility systems and transportation routes should be restored to 95 percent of pre-event levels, public transportation running at 90 percent capacity, and airports open for general use at 95 percent capacity. In the long-term phase, within four months, temporary shelters should be closed, 95 percent of community retail services and 50 percent of nonworkforce support businesses should be reopened. And within three years, all business operations and city services should be restored to pre-earthquake levels.

SPUR also expands the city's performance standards for buildings and lifeline systems. They note that virtually all of the public-sector efforts are devoted to emergency response, and propose a focus on pre-disaster hazard mitigation to ensure that buildings and infrastructure do not fail in the future.

*SPUR. The Resilient City: A New Framework for Thinking About Disaster Planning in San Francisco. Available at: http://www.spur.org/policy; accessed 22 November 2011.

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and Urban Research Association (SPUR), a nonprofit group in San Francisco (see box, p.XXX).

Most scholars agree that, while it has been effective with some notable exceptions such as Hurricane Katrina, U.S. disaster policy still needs strengthening and reform.[30] They note that emergency management institutions have been weakened in the aftermath of the 9/11 terrorist attack on New York City by the rush to concentrate on terrorism, rather than on natural hazards. Rebuilding capacity will require new federal, state, and local policies, plans, and actions to further improve a relatively robust natural-hazard mitigation capability.

Unfortunately, no similar widespread awareness or action planning is yet in place to increase U.S. resilience in the face of climate change. This serious vacuum results from a lack of clear nationwide leadership, standards, and funding. The U.S. federal government has not enacted a significant law to deal with the impacts of climate change on urban areas. To fill this vacuum, a number of states are beginning to develop climate action plans, but most are stated in general terms and fail to provide adequate funding or specific requirements.[31] The California state program, a leader, has been discussed here, but most other states lag well behind. Moreover, most of the present programs focus on mitigating greenhouse gases, but do not deal with the need for cities to adapt to climate-change impacts. However, there is a workable template for adaptation guidelines to be found in the smart-development movement, led by the design profession under the banner of New Urbanism.[32]

Smart development draws together concerns for creating sustainable and livable cities that respond to twenty-first-century challenges. As the statement from a 2008 urban design conference summed up:

> Changing climate patterns and diminishing supplies of inexpensive oil require us to design our cities in radically different ways. Reducing energy usage and carbon emissions is necessary to limit global warming, address severe weather events and rising sea levels, and face the threats of reduction of food production, loss of biodiversity, and dependence on unreliable energy supplies.[33]

As compared with natural-hazard mitigation governmental programs, which are focused on management, smart-development efforts focus on urban design, calling on architects, planners, landscape architects, and developers to incorporate green features and sustainable structures in their plans for buildings and neighborhoods. The result is to expand on and broaden the concept of sustainable development, generally seen as balancing the needs of economic development, environmental preservation, and social equity—the three "e's."

For the past two decades, the concept of sustainable development has been defined by the Brundtland Report as "development that meets the needs of today without compromising the ability of future generations to meet their own needs."[34] However, Janis Birkeland challenges this definition as based on the simplistic idea that negative impacts and trade-offs are necessary accompaniments of economic growth--a vicious circle.[35] The Brundtland Report assumed that sustainability was simply industrial growth with fewer impacts, marginalizing ecology and framing sustainability as resource efficiency and equitable distribution. Birkeland

advocates a radical new concept of sustainable design in which cities and buildings are eco-productive and socially satisfying as well as eco-efficient. Under her Positive Development model, cities would *increase* the earth's ecological health, habitats, and carrying capacity through renaturalizing the built environment—a "virtuous circle." Designers would create cities that offer greater life quality, health, amenities, and safety for all without sacrificing resources or money, increasing both the public estate and the ecological base. Through both new development and eco-retrofitting of existing urban areas, cities would become generators of sustainability, rather than consumers of resources, judged not only by the degree to which they generate zero waste but also the amount that they contribute to net positive outcomes. Some heartening evidence that the concept of net positive development is taking hold can be found in designs for buildings and neighborhoods that contribute power to the grid, restore the natural functions of wetlands and aquifers, and generate jobs and wealth enhancement for poor and minority residents. While still very limited, this approach could be one harbinger of the future resilient city.

4. Conclusions: Lessons for Resilience and Directions for Research

What does history tell us about urban resilience in the face of past disasters? What are the implications for future resilient cities threatened by climate change, as well as peak oil and population growth, of the U.S. experience with natural-hazard mitigation? What are the implications from the literature on urban design and sustainable development? We conclude with some summary thoughts on overall lessons for resilience and adaptation and on future directions for resilience research and scholarship.

Lesson 1. History reveals that cities have an extraordinary capacity for rebounding from major disasters, and in the modern era, virtually no major city has been permanently lost or abandoned in the wake of catastrophe. On the other hand, contemporary cities and metropolitan regions face challenges that our ancestors could hardly have imagined. The cold-war threat of atomic annihilation may be gone, but we now have the specter of rogue nuclear weapons and "dirty bombs" in the hands of terrorists. Fast-mutating new viruses like SARS and swine flu have already threatened our cities with pandemic disease, and they could turn world cities like Hong Kong, Guangzhou, and Mexico City into ghost towns. The permeable borders of our global village assure the rapid diffusion of contagious disease. Unprecedented immigration and population growth, the threat of climate change and sea level rise, and the coming end of cheap oil also threaten the world's cities in new and troubling ways.

Lesson 2. The United States has developed the world's most robust and systematic governmental policy framework for anticipating and responding to natural hazards—the predominant twentieth-century threat to urban resilience. In its present form, however, this framework is inadequate to cope with the forecast impacts of climate change, peak oil, and other major twenty-first century threats. Still, its approach to nationwide *predisaster planning* provides a model for other countries and cities around the world. This model combines knowledge generated by scientific risk analysis with actions designed to build social, environmental, and economic resilience in advance of probable threats. It implements the resulting plans through a combination of governmental requirements and incentives, as well as organizational and individual activities. Worldwide efforts to set limits on carbon emissions provide one example of the necessary planetary scope of future efforts; more aggressive positive urban development policies and programs will be needed at the scale of metropolitan regions.

Lesson 3. Smart planning and development, geared to national, regional, and local contexts, are critical to achieving future resilient cities. Smart development in the Global North will differ from that in the Global South, owing to different demands and capabilities. But the essential elements are similar: (1) careful analysis of potential future risks; (2) widespread communication of mitigation and adaptation guidelines; (3) agreement on region-wide standards for positive development; (4) creation of resilient development plans that knit together social, environmental, and economic actions; and (5) forceful program implementation backed up by real-time outcome monitoring. Achieving true resiliency will demand significant levels of investment, as well as significant behavioral changes. Land use and physical planning and design, environmental conservation programs, and economic development initiatives must generate net positive returns in order to counter the negative impacts of future threats.

Given these broad conclusions, what are the relevant questions for tomorrow's resilience researchers? In this current age of uncertainty about not only the scientific projections of climate change but also the efficacy of planning responses, careful, continuing research will play a critical role in bringing evidence to the often roiling debates over what is actually happening and what we should do about it. This turbulent situation presents an unprecedented opportunity for research contributions to our understanding about the effectiveness of new planning strategies, the promise of new theoretical paradigms, and the need for new planning roles. While debates over the reality of climate change and the impact of human activities on it undoubtedly will continue,[36] we suggest that planning researchers focus on topics where their expertise gives them an advantage in framing and analyzing the issues central to planning theory and practice. Here are some recommendations:

New Planning and Implementation Strategies. At the federal level, climate change response is in gridlock.[37] State and local responses to climate change range from

disappointingly deliberate (e.g., sea level rise) to promisingly proactive (e.g., reducing greenhouse gas emissions), depending on the difficulty of mitigation and adaptation involved.[38] The present status is difficult to grasp because there are lots of initiative scattered over many jurisdictions. Research is needed to categorize the various strategies into credible typologies and to analyze their effectiveness. In order to derive comparative findings, it will be important to agree on standardized indicators of feasibility (political, economic, engineering, etc.), equity, and sustainability of outputs, and outcomes. Researchers, such as Adam Rose,[39] are beginning to analyze the economic implications of proposed solutions, but there remains much work to be done in the areas of land use, transportation, housing, and environmental management.

New Planning Theory Paradigms. Some authors believe that responding to climate change demands a new planning paradigm. Given the long time horizons and wide bands of uncertainty in climate change projections, they argue for an incremental approach informed by continuous monitoring of both scientific findings and observable trends. For example, Ray Quay has called for "anticipatory governance" based on a flexible decision framework that uses a range of possible futures to guide decisions and prepare for change.[40] Others cite the use of modeling tools, coupled with citizen workshops, to create future land-use scenarios and to evaluate their effectiveness in reducing greenhouse gas emissions, as a way to build the community consensus necessary for behavior change.[41] Community-based research and case studies are needed to explore the theoretical implications of the new practices.

New Planning Roles. Planners need to become more activist in order to lead communities toward resilient futures. The traditional role of planners as visionary advocates of desirable futures has been eclipsed by their responsibilities as bureaucrats in governmental systems. Creativity has been submerged in the day-to-day operations of permit processing, zoning changes, and subdivision approvals. Success as a bureaucrat is too often measured in terms of job security, particularly in times of political conflict. The new planners will need to be consensus builders, but they will also need to be leaders in interpreting and acting on the stability-shattering changes their communities are expected to face. Research on municipal climate action plans suggests that planning departments so far have played a minor role in their development.[42] New research is needed to identify the successes of innovative and activist planning roles.

The bottom line is this: *urban resiliency is an urgent matter*. Planning must adapt to an era of fierce volatility in which the old assumptions of stable social, economic, and environmental systems no longer hold. The questions are critical. Can cities weather the impacts of climate change? Can we create effective institutions and planning approaches to respond to the threats ahead? Can smart-development approaches be implemented on a global basis? We are at a historic juncture and the answers matter greatly.

Notes

1. See, for example, David Grann, "The Lost City of Z," *The New Yorker,* September 19, 2005.

2. Jared Diamond, *Collapse: How Societies Chose to Fail or Succeed* (New York: Viking, 2005).

3. Lawrence J. Vale and Thomas J. Campanella, eds., *The Resilient City: How Modern Cities Recover from Disaster* (New York: Oxford University Press), 335–337, 347.

4. David S. Cecelski and Timothy B. Tyson, eds*., Democracy Betrayed: The Wilmington Race Riot of 1898 and Its Legacy* (Chapel Hill: University of North Carolina Press, 1998), 16–20, 37–39.

5. Julie B. Kirschbaum and Desirée Sideroff, "A Delayed Healing: Understanding the Fragmented Resilience of Gernika," in *The Resilient City: How Modern Cities Recover from Diaster,* ed. David S. Cecelski and Timothy B. Tyson (Chapel Hill: University of North Carolina Press, 1998), 159–76.

6. James Heartfield, "Revisiting the Blitz Spirit." Available at: http://www.spiked-online.com/index.php/site/article/869/.

7. Beatrice Chen, "'Resist the Earthquake and Rescue Ourselves': The Reconstruction of Tangshan after the 1976 Earthquake," in *The Resilient City*: *How Modern Cities Recover from Disaster*, ed. David S. Cecelski and Timothy B. Tyson (Chapel Hill: University of North Carolina Press, 1998), 235–53.

8. Diane E. Davis, "Reverberations: Mexico City's 1985 Earthquake and the Transformation of the Capital," in *The Resilient City: How Modern Cities Recover from Disaster*, ed. David S. Cecelski and Timothy B. Tyson (Chapel Hill: University of North Carolina Press, 1998), 261–72.

9. As one man put it, "My mother walked from North Vietnam to South Vietnam pregnant with my sister in 1954 when the communists forced the French out of the north. She fled communism to get to freedom and freedom of religion. My parents fled South Vietnam in 1976 to get to America, the land of freedom, freedom of choice, and freedom of religion. My parents are gone now but after Hurricane Katrina we had but one option: to rebuild without complaint. The government would never have saved us as well as we could save ourselves." Quoted in John E. Carey, "The Unspeakable Truth: Katrina, New Orleans and Culture," *Peace and Freedom*, August 30, 2007.

10. Christine Hauser, "Sustained by Close Ties, Vietnamese Toil to Rebuild," *New York Times*, October 20, 2005.

11. Susan Page, "Evacuees Shun Going Home," *USAToday*, October 13, 2005.

12. Robert B. Olshansky, Laurie A. Johnson, Jedidiah Home, and Brendan Nee, "Planning for the Rebuilding of New Orleans," *Journal of the American Planning Association* 74, no. 3 (Summer 2008): 273. For a more detailed account, see Robert B. Olshansky and Laurie A. Johnson, *Clear as Mud: Planning for the Rebuilding of New Orleans* (Chicago: APA Planners Press, 2010).

13. Ibid., 274, 279, 284.

14. Ibid., 274.

15. For a comprehensive summary of anticipated impacts, see Thomas R. Karl, Jerry M. Melillo, and Thomas C. Peterson, eds. *Global Climate Change Impacts in the United State* (New York: Cambridge University Press, 2009).

16. Cited in Neal R. Pierce and Curtis W. Johnson, with Farley M. Peters, *Century of the City: No Time to Lose* (New York: Rockefeller Foundation, 2008), 106.

17. Cited in Thomas L. Friedman, *Hot, Flat, and Crowded: Why We Need a Green Revolution and How It Can Renew America* (New York: Farrar, Straus and Giroux, 2008), p. 28.

18. Cited in Peter Newman, Timothy Beatley, and Heather Boyer, *Resilient Cities: Responding to Peak Oil and Climate Change* (Washington, DC: Island Press, 2009), 22.

19. See the types of potential measures discussed in David R. Godschalk, "Mitigation," chapter 6 in W. L. Waugh Jr. and K. Tierney, eds., *Emergency Management: Principles and Practice for Local Government* (Washington, DC: ICMA Press, 2007).

20. See Neal R. Pierce and Curtis W. Johnson, with Farley M. Peters, *Century of the City: No Time to Lose* (New York: Rockefeller Foundation, 2008), chapter 3, "Climate Change Resilience: An Urgent Action Agenda."

21. See David R. Godschalk, "Urban Hazard Mitigation: Creating Resilient Cities," *Natural Hazards Review*, August 2003, 136–43. See also D. R. Godschalk, A. Rose, E. Mittler, K. Porter, and C.T. West, "Estimating the Value of Foresight: Aggregate Analysis of Natural Hazard Mitigation Benefits and Costs," *Journal of Environmental Planning and Management* 52, no.6 (September 2009): 739–56.

22. Pierce and Johnson, *Century of the City*, 119.

23. Waugh and Tierney, "Emergency Management."

24. J. Schwab, K. C. Topping, C. C. Eadie, R. E. Deyle, and R. A. Smith, *Planning for Post-Disaster Recovery and Reconstruction*, PAS Report 483/484 (Chicago: American Planning Association, 1998).

25. Godschalk et al., "Estimating the Value of Foresight."

26. Multihazard Mitigation Council (MMC) of the National Institute of Building Sciences (NIBS), *Natural Hazard Mitigation Saves: An Independent Study to Assess the Future Savings from Mitigation Activities* (Washington, DC: NIBS, 2005).

27. See R. E. Deyle, T. S. Chapin, and E. J. Baker, "The Proof of the Planning Is in the Platting: An Evaluation of Florida's Hurricane Exposure Mitigation Planning Mandate," *Journal of the American Planning Association* 74, no. 3 (2008): 349–70; P. R. Berke, D. J. Roenigk, E. J. Kaiser, and R. J. Burby, "Enhancing Plan Quality: Evaluating the Role of State Planning Mandates for Natural Hazard Mitigation," *Journal of Environmental Planning and Management* 37, no. 2 (2006): 155–169; S. D. Brody, "Are We Learning to Make Better Plans? A Longitudinal Analysis of Plan Quality Associated with Natural Hazards," *Journal of Planning Education and Research* 23, no. 2 (2003): 191–201; R. J. Burby and L. C. Dalton, "Plans Can Matter! The Role of Land Use Plans and State Planning Mandates in Limiting the Development of Hazardous Areas," *Public Administration Review* 54, no. 3 (1998): 229–38; A. Nelson and S. French, "Plan Quality and Mitigating Damage from Natural Disasters: A Case Study of the Northridge Earthquake with Planning Policy Considerations," *Journal of the American Planning Association* 68, no. 2 (2002): 194–207.

28. P. J. May and R. J. Burby, "Coercive versus Cooperative Policies: Comparing Intergovernmental Mandate Performance," *Journal of Policy Analysis and Management* 15, no. 2 (1996): 171–201.

29. S. D. Brody, D. R. Godschalk, and R. J. Burby, "Mandating Citizen Participation in Plan-Making: Six Strategic Planning Choices," *Journal of the American Planning Association* 69, no. 3 (2003): 245–64; and D. R. Godschalk, S. D. Brody, and R. J. Burby, "Public Participation in Natural Hazard Policy Formation: Challenges for Comprehensive Planning," *Environmental Planning and Management* 46, no. 5 (2003): 733–54.

30. See, for example, R. T. Sylves, *Disaster Policy and Politics: Emergency Management and Homeland Security* (Washington, DC: CQ Press, 2008); K. J. Tierney, "Testimony on Needed Emergency Management Reforms," *Journal of Homeland Security and Emergency Management* 4, no. 3 (2007); and David R. Godschalk, Timothy Beatley, Philip Berke, David J. Brower, and Edward J. Kaiser, *Natural Hazard Mitigation: Recasting Disaster Policy and Planning* (Washington, DC: Island Press. 1999).

31. For an overview of state and local climate action plans, see the EPA climate change Web site, http://www.epa.gov/statelocalclimate/; accessed November 22, 2011. See also the Pew Trust Center on Global Climate Change, http://www.pewclimate.org/; accessed December 20, 2008.

32. See the Web site of the Congress for the New Urbanism, www.cnu.org.

33. Symposium on Re-Imagining Cities: Urban Design After the Age of Oil, Symposium, University of Pennsylvania, Philadelphia, November 6–8, 2008. http://penniur.upenn. edu/research/initiatives/re-imagining-cities; accessed November 22, 2011.

34. World Commission on Environment and Development, Report of the Brundtland Commission, *Our Common Future* (Oxford: Oxford University Press, 1987).

35. Janis Birkeland, *From Vicious Circles to Virtuous Cycles Through Built Environment Design* (London: Earthscan, 2008).

36. Although the overwhelming predominance of scientific opinion is clear that warming is occurring and that it is influenced by human activities, discussion of these issues is ongoing. See, for example, the Web sites, http://www.climatedebatedaily.com, and http://en.wikipedia.org/wiki/Global_Warming. For a planning oriented view, see Randall Crane and John Landis, "Planning for Climate Change: Assessing Progress and Challenges," *Journal of the American Planning Association* 76, no. 4 (2010): 389–401.

37. See Ryan Lizza, "As the World Burns: How the Senate and the White House Missed Their Best Chance to Deal with Climate Change," *The New Yorker*, October 11, 2010, 70–83.

38. As of 2010, only a handful of local governments in California and Maryland have developed plans to adapt to sea level rise, while scores of localities (such as Chicago, whose Climate Action Plan contains 452 action steps) have developed proactive climate action plans.

39. Adam Rose, *The Economics of Climate Change Policy: International, National and Regional Mitigation Strategies* (Northampton, MA: Edward Elgar, 2009).

40. Ray Quay, "Anticipatory Governance: A Toll for Climate Change Adaptation," *Journal of the American Planning Association* 76, no. 4 (2010): 496–511.

41. See Patrick Condon, Duncan Cavens, and Nicole Miller, *Urban Planning Tools for Climate Change Mitigation* (Cambridge, MA: Lincoln Institute of Land Policy, 2009).

42. Ellen Bassett and Vivek Shandas, "Innovation and Climate Action Planning: Perspectives from Municipal Plans," *Journal of the American Planning Association* 76, no. 4 (2010): 435–50.