

A Strategy Paper from Island Press and The Kresge Foundation

BOUNCE FORWARD

*Urban Resilience in the Era
of Climate Change*



ABOUT ISLAND PRESS

ISLAND PRESS is a leading source of ideas—and inspiration—for a sustainable future.

As a mission-driven, nonprofit organization, Island Press stimulates, shapes, and communicates ideas that are essential to the well-being of people and nature. We forge partnerships and spark thinking across traditional disciplines and sectors. And we share ideas through multiple channels and platforms—in print, in person, and online.

Since 1984, Island Press has built a deep body of knowledge, with more than 1,000 books in print and some 30 new releases each year. Our books tackle the crucial challenges of the twenty first century: designing livable, resilient cities with opportunities for all; ensuring abundant fresh water; protecting the beauty and diversity of the natural world; limiting the scale and impact of climate change.

And Island Press brings ideas to those who can turn them into action. Through workshops, webinars, and events, we bring authors into conversation with business and civic leaders, advocates, and engaged citizens. Our work has measurable impact on thinking, policy, and practice—building knowledge to inspire change.

ABOUT THE KRESGE FOUNDATION

AND ITS ENVIRONMENT PROGRAM

THE KRESGE FOUNDATION is a \$3.5 billion private, national foundation that works to expand opportunities in America's cities through grant making and investing in arts and culture, education, environment, health, human services, and community development in Detroit. Its Environment Program helps communities build environmental, economic, and social resilience in the face of climate change.

For Kresge, resilience is more than just withstanding stresses—it also includes the capacity to prosper under a wide range of climate-influenced circumstances. In the long term, resilience is possible only if society reduces greenhouse gas emissions and avoids the worst impacts of climate change. So, strengthening a community's resilience requires efforts to:

- Reduce the greenhouse gas emissions that contribute to climate change;
- Plan for the changes that already are under way or anticipated;
- Foster social cohesion and inclusion.

As a foundation committed to creating opportunity for low-income people and communities, Kresge is particularly concerned with the effect climate change has on people with limited economic resources. It works to engage people from historically underrepresented groups in efforts to build resilient communities and plan for climate change.

Bounce Forward: Urban Resilience in the Era of Climate Change is one effort toward advancing those aims.

URBAN RESILIENCE PROJECT

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People enjoying the revitalized Campus Martius park in Detroit, MI. *Photo courtesy of iStockphoto.com.*

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The High Line is a popular park built on a repurposed railroad spur in Manhattan. *Photo courtesy of iStockphoto.com.*

The need for resilience could spark transformative changes in American cities.

FOREWORD

AS A FOUNDATION COMMITTED TO CREATING OPPORTUNITY for low-income people in American cities, The Kresge Foundation is keenly aware of the severity and pervasive nature of climate change, as well as its disproportionate impact on vulnerable people and communities.

While climate change is a global problem, its effects are—and increasingly will be—felt locally in communities across the United States and around the globe. Just as federal- and state-level action on climate change is required, cities also play a critical role in mitigating climate change and helping society prepare for those impacts that it is too late to prevent.

Given this important role of cities, the Kresge Environment Program has focused its efforts to help communities build their resilience in the face of climate change.

To build climate resilience, communities must simultaneously:

- Lessen overall demand for energy and increase the proportion derived from renewable energy sources;
- Anticipate and prepare for pressures and shocks that climate change will introduce or worsen; and
- Strengthen connections among individuals and networks while advancing social inclusion to foster social cohesion.

It is a tall order, and urban decision makers have only begun to wrestle with the challenges.

As effectively described in this framing paper, building climate resilience requires that urban leaders rethink the systems that supply their cities' energy, transportation, food, water, and housing. It requires practitioners to work across disciplines and sectors, something that has been historically difficult to achieve. It also should require us to make transparent the value judgments that are reflected in resilience strategy choices; that is, what is being made resilient and for whose benefit?

Kresge has partnered with Island Press on this Urban Resilience Project for several reasons. We share the view that a holistic, transformative approach to urban climate resilience requires new frameworks for analyzing challenges and devising responses. Both organizations see a need to bring new voices into the conversation, particularly those of experts and advocates who approach climate-resilience work with a strong grounding in the experiences and interests of low-income communities. We want to accelerate the pace with which practical, actionable information reaches urban leaders and those who will assist them in their climate-resilience efforts.

We look forward to continued work with our partners at Island Press and others in the nonprofit sector who are working to build a strong, diverse field of practice to advance climate resilience. As this framing paper advocates, the need for resilience could spark transformative changes in American cities. We hope that will be the case.

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Job trainees get hands-on experience installing a solar electric system for a low-income homeowner in Richmond, CA. *Photo: Solar Richmond and Green for All.*

We define urban resilience as the capacity of a community to anticipate, plan for, and mitigate the risks—and seize the opportunities—associated with environmental and social change.

EXECUTIVE SUMMARY

IN AN ERA ROCKED BY CLIMATE CHANGE AND OTHER LARGE-SCALE DISRUPTIONS, OUR CITIES MUST BE RESILIENT in order to survive and thrive. But what does that mean, exactly? What is known about urban resilience, and what remains to be explored? And how can we put thinking into practice to create the resilient cities of the future?

To help answer those questions, Island Press launched the Urban Resilience Project in 2013, with support from The Kresge Foundation. We began with a survey of the existing literature on resilience and reached out to a diverse group of organizers, researchers, planners, and other urban change agents. In a series of interviews and an all-day assembly, we listened deeply to what they had to say. This report endeavors to capture what we learned.

A FEW KEY POINTS:

Resilience is about coping with change. We live in an era of unprecedented environmental and social change. Some changes—like the rising seas and powerful storms of a changing climate—are unambiguously negative. Others—including the emergence of new technologies—can be positive or negative, depending on one’s situation and perspective. Urban resilience, in this context, can be defined as the capacity of a community to anticipate, plan for, and mitigate the risks—and seize the opportunities—associated with environmental and social change.

In a world of rising inequality, risks and opportunities are not equally shared. In an increasingly unequal world, the affluent are well-positioned to seize the opportunities that come with change and shield themselves from harm, while the disadvantaged and marginalized face disproportionate risks. These dynamics are self-perpetuating: the affluent consolidate their gains while the poor fall farther behind. Equity, then, is central to resilience.

Cities are key. Because a majority of the world’s people now live in urban areas, cities are an important focus of efforts to build resilience. Cities can concentrate risk, but they can also incubate solutions. The stakes are high: urban infrastructure, resource use, and social systems will have profound consequences for our planet and its people in the centuries to come.

Urban resilience is multidimensional. The capacity of cities to cope with change is shaped by a broad array of factors, including social systems; the health and integrity of ecosystems; and the nature of the built environment. As a result, urban resilience spans disciplines and sectors—from sociology to ecology, from public health to landscape architecture.

Current understanding of resilience remains siloed. There is a growing body of knowledge about resilience within the natural and social sciences, and in the field of disaster risk reduction. Yet, while each of these perspectives is necessary to address the challenges our cities face, none is sufficient on its own. There is a great need for interdisciplinary, cross-sectoral systems thinking and action on urban resilience.

Resilience is an idea with potentially transformative power. The need for resilience could spark transformative changes in American cities. True resilience calls on us to rethink the urban systems that

supply our energy, transportation, food, water, and housing. It calls on us to live within planetary limits, to avoid further destabilizing natural systems. And it calls on us to eradicate the inequities that magnify vulnerability to disaster, and to distribute opportunities more fairly—so that all people have a chance to adapt and thrive in a fast-changing world.

Many have embraced the resilience framework. Recent years have seen an explosion of interest in resilience, both in academia and in public policy. And many of those consulted for this project have embraced resilience as a framework for thinking and practice and/or as a means of garnering new support for their work. Some believe a resilience framework could help build mainstream support for paradigm-shifting changes like distributed, renewable energy and social policies that promote greater equity and inclusion.

But the transformative potential of resilience is far from assured. There are several potential pitfalls. Notably, if resilience is conceived simply as “bouncing back” from disaster, it could prove harmful, by reinforcing systems that compound the risks our cities face. More insidiously, the concept of resilience could be co-opted by opponents of meaningful reform. And if efforts to build resilience do not also mitigate climate change, they will be of limited use.

The Urban Resilience Project can help seize the opportunities—and avoid the pitfalls—that accompany the new attention to resilience. To that end, we will advance a holistic, transformative approach to thinking and practice on urban resilience, which is grounded in a commitment to sustainability and equity.

We can—and must—take action. Turbulent times present us with extraordinary opportunities to make our cities more sustainable, equitable, and resilient. In the pages that follow, you will find a provisional framework for thinking about that challenge. And, importantly, you will find a call to action.

The Island Press Urban Resilience Project and its partners are working to advance transformative approaches to resilience that are grounded in sustainability and equity. To that end, we will spark inquiry across disciplines and sectors, and leverage short- and long-form content to shape thinking and practice. We will lift up new voices that can speak from and to a broad range of communities. We will help imagine and inspire the cities of the future, and provide practical, actionable information to create them. We invite you to join us in this important effort.

**Resilience calls us to eradicate inequities
so that all people have a chance to adapt
and thrive in a fast-changing world.**

THE CONTEXT

AN ERA OF RAPID CHANGE

CHANGE IS A CONSTANT in human (and natural) history. But today, we are in an era in which the pace, scale, and impact of change may be greater than anything our species has previously confronted.

Part of that change is environmental, reflecting humanity's transformation of the natural world. Over the last half century or so, human beings have altered the planet's ecosystems more than in all of previous history combined—clearing forests, diverting rivers, replacing the riotous diversity of nature with uniform monocultures. While those changes have improved the lives of many who are alive today, they have weakened nature's ability to protect and sustain us in the longer term.¹

Of all the modifications we have made to the biosphere, perhaps none are as destructive and far-reaching as climate change. Human activity has increased atmospheric carbon dioxide by forty percent above preindustrial levels, trapping heat and warming the planet.² The impacts are increasingly visible: in monstrous storms and devastating droughts; in skyrocketing food prices and wrecked infrastructure. In what has become a regular occurrence, a new record for weather-related disasters was set in 2013.³ Worse, the Pentagon has characterized climate change as a “threat multiplier” that aggravates humanity's other challenges—including poverty, environmental degradation, and political instability.⁴

At the same time, the quickening pace of change reflects the growing scale and interconnectedness of the human enterprise. World population has more than tripled in the last hundred years, and the planet's inhabitants are now linked as never before, by dense global networks of commerce and information.⁵ Those networks can accelerate the spread of innovation, information, and opportunity—and of social reforms.⁶

But connectedness can also amplify crises, from grid failures to epidemics. The World Economic Forum has warned of “the prospect of rapid contagion through increasingly interconnected systems and the threat of disastrous impacts.”⁷ As just one example, the financial crisis that began in 2007 was triggered by risky mortgage lending in the United States, but its repercussions were felt in every part of the globe. As ecologist David Orr observes, “We live in a world without firebreaks or even fire departments.”⁸

It is also a world of stark—and growing—inequality. Globally, the richest one percent of the population lays claim to forty-six percent of the world's wealth; the bottom half—some three and a half billion people—together possess less than one percent of global assets. In the United States, more than three-quarters of all wealth is owned by the richest ten percent.⁹ It is getting worse: though disparities narrowed in the twentieth century, they are widening again.¹⁰

Inequality is linked to a host of social ills, including violence, imprisonment, and addiction; it erodes social cohesion and drives the unsustainable consumption that is depleting our planet's resources.¹¹

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A pier destroyed by Superstorm Sandy. *Photo courtesy of iStockphoto.com.*

In a world of rising inequality, risks
and opportunities are not equally shared.

And, in unequal societies, the interests of elites often diverge from those of the majority and can lead to disinvestment in education, health care, infrastructure and other vital public goods.¹²

Cities are the crucibles of change in the twenty-first century.

The changes our societies face are manifold. Some—like the rising seas and powerful storms associated with climate change—are unambiguously negative, and call for an all-out effort to mitigate their root causes and reduce their harm. Others could be positive or negative, depending on context and perspective. For example, a breakthrough technology may be a boon for its investors and consumers, but it may render other technologies obsolete, devastating the workers and communities who produced them.

But, in a world of rising inequality, the risks and opportunities associated with rapid change are not equally shared. Some are well-positioned to seize opportunities and shield themselves from harm, while the disadvantaged and marginalized face disproportionate risks. These dynamics are self-perpetuating: the affluent consolidate their gains while the poor fall farther behind—a widening gyre of inequality and exclusion.

THE URBAN CHALLENGE AND OPPORTUNITY

Cities are the crucibles of change in the twenty-first century. They are, increasingly, the places people call home: after a half century of breakneck urbanization, a majority of humanity now lives in urban areas.¹³ And that trend is accelerating—in the next twenty years, the urban population is expected to swell to five billion, sixty percent of the world's people.¹⁴ The United States, already more than eighty-five percent urban, will add another 100 million city dwellers by mid-century.¹⁵

The nature of those cities—their infrastructure, resource use, and social systems—will have profound consequences for our planet and its people, and for the ultimate sustainability of the human enterprise. And the greenhouse gases they emit will shape the trajectory of climate change for centuries to come. Of course, cities do not exist in isolation; they are connected to larger regions and the world through trade, migration, and ecosystems. Yet cities are spatially and socially separate from the suburbs and rural areas that surround them, and they present distinct challenges and opportunities.

Cities can concentrate risk. For example, most urban growth is taking place in coastal areas, which are dangerously exposed to the rising seas and intensified storms of a changing climate.¹⁶ That vulnerability tends to fall disproportionately on the urban poor, who often live in low-lying areas and lack resources to flee or rebuild. Indeed, researchers from the Center for American Progress have found that low-income urban residents are bearing the brunt of climate change impacts, and that those impacts exacerbate underlying inequities.¹⁷ “Communities of color are particularly vulnerable,” says Jacqueline Patterson,

While cities concentrate risk, they can also incubate solutions.

director of the NAACP Climate Justice Initiative, “because they are more likely to live in poor housing and be underinsured and disenfranchised.”¹⁸

Yet, while cities concentrate risk, they can also incubate solutions. Urban density fosters synergies that spur innovation. As a result, an impressive ninety percent of U.S. gross domestic product and eighty-six percent of jobs are generated in cities.¹⁹ Globally, urbanization is strongly correlated with improvements in human development, such as reducing extreme poverty and increasing education and economic mobility for women.²⁰

Cities also offer clear advantages for sustainability. Urban density and economies of scale can—in theory, at least—encourage more efficient use of resources. For example, cities are more suited to public transit rather than auto-dependent sprawl—one reason why New York City’s carbon emissions per capita are just one third of the U.S. average.²¹ Well-planned cities, with compact development and strong transit systems, offer considerable hope for mitigating climate change.

The current wave of urbanization presents an unprecedented opportunity to capture that advantage. As the National Intelligence Council observes, “The volume of urban construction for housing, office space, and transport services over the next forty years could roughly equal the entire volume of such construction to date in world history.”²² Even in the already urbanized United States, virtually all population growth is now taking place in cities.²³ As those cities stretch to accommodate new residents, and as existing infrastructure reaches the end of its useful life, decisions about development and infrastructure will shape our nation’s environmental impact—including its carbon footprint—for decades, and even centuries, to come.

And cities present opportunities for transformative change. Despite the challenges they face, in the current political context—with a gridlocked federal government and resource-strapped states—cities offer a promising scale for getting things done. Cities are already taking the lead on climate change mitigation: more than 1,000 U.S. mayors have signed an agreement to reduce greenhouse gas emissions by eighty percent from 1990 levels by 2050.²⁴ Cities are also leading on social issues by, for example, guaranteeing their citizens a living wage, fighting foreclosures, and generating affordable credit.²⁵

THE NEED FOR RESILIENCE

To survive and thrive in volatile times, cities—and their people—must mitigate crises and seize opportunities to shape the future they desire. They must be, in a word, resilient.

Today, there is new interest in urban resilience—prompted, in part, by a growing number of high-profile disasters. Numerous initiatives in the public and nonprofit sectors seek to bolster cities’ resilience to environmental, economic, and other crises. Indeed, resilience has become, in

the words of former Regional Plan Association President Bob Yaro, “the word that launched a thousand conferences.”²⁶

Yet the ubiquity of resilience has not advanced public understanding. In fact, “as the use of the term explodes, it becomes less clear,” says Elizabeth Malone, staff scientist at the Joint Global Change Research Institute.²⁷ And, while there is a large body of knowledge about resilience in both the natural and social sciences, the knowledge is not yet informing public discourse, much less driving urban planning. It mostly resides in the academic or “gray” literature, where it is inaccessible to those who plan, manage, and inhabit American cities. And because it largely remains siloed within discrete disciplines, it is not useful to those working to address multidimensional urban problems.

The emergent conversation about resilience—and the gap between expert knowledge and public understanding—presents a significant opportunity to shape thinking and practice. A majority of those consulted for this project are interested in seizing that opportunity. Many have embraced resilience as a guiding principle and/or as a means of garnering new support for their work.

Resilience is “uniquely salient in areas exposed to catastrophic risk,” according to Jeb Bruggmann, founder and board president of ICLEI-USA.²⁸ When systems fail in a crisis or disaster, it can start a conversation about how to design better systems—and open the door to a host of beneficial changes. For example, grid failures have catalyzed new interest in cleanly sourced, distributed micro-grids.²⁹ And in New York City, Superstorm Sandy sparked a vibrant public conversation about how to build a more resilient city—by modifying the built environment, restoring ecosystems, and strengthening social networks. Sandy created “an opportunity to engage people differently,” says Maya Wiley, former president of the Center for Social Inclusion, now Counsel to New York City Mayor Bill de Blasio.³⁰

The emergent conversation about resilience presents an opportunity to shape thinking and practice.

Interviewees also noted that conversations about resilience can transcend political gridlock, in part because they typically take place in the wake of disaster. “That’s when you cross the aisle,” says Sue Zielinski, managing director of the University of Michigan SMART Program.³¹ Unlike its cousin sustainability, resilience is “not wholly owned by the environmental community,” says Jason Reece, director of research at the Kirwan Institute for the Study of Race and Ethnicity.³² And, unlike climate adaptation, addressing resilience does not require a belief in anthropogenic climate change. This grants access to a far broader swath of Americans than can be reached by environmental messages and messengers. According to Russell Unger, executive director of the Urban Green Council, “Resilience enables us to reach new audiences that we couldn’t reach with sustainability.”³³

The exigencies of resilience can even trump ideology. For example, a largely conservative Republican community in Florida engaged in participatory disaster planning with the University of South



A woman shops for fresh produce at Union Square Greenmarket in New York City, where regional farmers, fishermen, and bakers sell their products. *Photo courtesy of iStockphoto.com.*

Florida's Metropole project. With a better understanding of the risks they faced, the community elected to increase taxes in order to lift buildings above the flood zone.³⁴

Resilience can also offer a positive, engaging vision of the future. Although it is often necessitated by the threat of disaster, resilience is “not fatalistic,” says Jason Reece. It can be affirming: the resilience imperative asks communities to take stock of assets—physical, environmental, and social—and to build on existing strengths.

But there are downsides to a resilience framework as well. Several noted that the word resilience does not resonate in their community, though the concepts contained therein are useful. Some prefer terms such as community and local self-reliance instead.

More fundamentally, there are concerns about how the emerging discourse on resilience will play out. If resilience is defined narrowly as a community's capacity to “bounce back” after disaster, it could

Resilience calls on us to rethink the urban systems that supply our energy, transportation, food, water, and housing.

prove counterproductive. This is the crux of the problem: if cities bounce back to a status quo that degrades the environment, increases greenhouse gases, and widens inequality, it will only undermine their resilience in the longer term.

Others warn that resilience could be co-opted and offered as a substitute for addressing the root causes of environmental and social problems. To some degree, this is already happening: for example, the American Enterprise Institute—a staunch opponent of efforts to reduce greenhouse gas emissions—is promoting what it calls the “resilience option” for climate change.³⁵ Not surprisingly, there is concern about the reactionary potential of resilience and resistance to the use of the term.³⁶

Alternatively, the need for resilience could spark transformative changes in American cities. True resilience calls for an all-out effort to mitigate climate change, which poses a grave threat to our communities and our future. It calls on us to rethink the urban systems that supply our energy, transportation, food, water, and housing. It calls on us to live within planetary limits, to avoid further destabilizing the natural systems on which all life depends. It calls on us to eradicate the inequities that magnify vulnerability to disaster, and to distribute opportunities more fairly—so that all people have a chance to adapt and thrive in a fast-changing world.

It is this holistic, transformative understanding of resilience that the Island Press Urban Resilience Project will explore and promote. In this way, we can help cities bounce forward to a future that is sustainable, equitable, and resilient.



A young demonstrator at the People's Climate March, which drew more than 300,000 to New York City on September 21, 2014. *Photo courtesy of Robert van Waarden, Survival Media.*

THE PROJECT

AS OUR CITIES CONFRONT TURBULENT TIMES, MUCH DEPENDS ON HOW RESILIENCE IS DEFINED and implemented. Seeing an opportunity to shape that outcome, Island Press launched the Urban Resilience Project in 2013, with the support of The Kresge Foundation. For both Kresge and Island Press, the project grows from a long-standing interest in this topic. Kresge's Environment Program is committed to building resilience by investing in activities that mitigate the severity of climate change while strengthening communities against the changes already under way. And, over the last two decades, Island Press has incubated and published seminal works on resilience, ecosystems, and sustainable urban design.

THE GOAL

The project's goal is to advance a holistic, transformative approach to thinking and action on urban resilience in the era of climate change, an approach grounded in a commitment to sustainability and equity.

THE PROCESS

- Literature review (March–September 2013). In the project's first phase, an Island Press consultant conducted a review of the literature on resilience in several disciplines, exploring the variegated strands of thought that comprise the current discourse.³⁷
- Consultations and recommendations (October 2013–July 2014). In the project's second phase, Island Press:
 - Conducted thirty-nine individual interviews with a diverse and multidisciplinary group of researchers, organizers, funders, city planners, and others at the vanguard of urban resilience. (A list of interviewees appears in the Appendix.)
 - Convened a group of advisors (see page i) to refine our framework for thinking about urban resilience, identify information gaps, and sketch out an information-sharing agenda.
 - Prepared this paper, which draws on the literature review and consultations to propose a framework for thinking and action on urban resilience.
- Implementation (December 2014–December 2017). In the project's next phase, Island Press will work—with input and support from The Kresge Foundation—to implement an information development and communication strategy based on the findings and recommendations summarized below.



The Philadelphia Water Department has improved water quality in the Schuylkill River and reduced flooding with an emphasis on 'green' infrastructure. *Photo courtesy of iStockphoto.com.*

Urban resilience is shaped by a broad array of factors, including social systems; the health and integrity of ecosystems; and the nature of the built environment.

RESILIENCE DEFINED

FOR THE PURPOSES OF THIS PROJECT, we define urban resilience as the capacity of a community to anticipate, plan for, and mitigate the dangers—and seize the opportunities—associated with environmental and social change.

Our understanding of this concept draws from explorations in several academic disciplines and communities of practice—engineering, ecology, the social sciences, and the field of disaster risk reduction.³⁸ Each of these disciplines offers important contributions to our understanding of urban resilience. But while each is necessary, none—on its own—is sufficient to address the challenges that confront cities and their people. Below is a brief review of relevant explorations of resilience—and of the strengths and limitations of each.

ENGINEERING

Engineering resilience (also referred to as common sense resilience), describes the capacity of materials like steel to bend without breaking under force and straighten out when the force is removed.³⁹ This is the simplest conception of resilience, and it is largely synonymous with the dictionary definition of the word: to bounce back.

Indices of engineering resilience come from the field of materials science, which measures the behavior of objects under stresses and strains.⁴⁰ In an urban context, those indices can be used to assess and bolster the robustness of infrastructure, including bridges and water mains.

This concept of resilience is useful but limited to preserving the status quo; it does not allow for adaptation and transformation. If systems are viewed along a continuum from simple to complex, engineering resilience is suited only to the simplest systems in which—in the words of ecologist Carl Folke—the focus is on “resisting disturbance and change, to conserve what you have.”⁴¹

ECOLOGY

From the natural sciences comes resilience thinking, pioneered in the 1970s by ecologist (and Island Press author) C.S. Holling and others. Resilience, in the ecological domain, has been defined as “the capacity of a system to absorb disturbance and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks.”⁴²

The goal of ecological resilience thinking is to identify and avoid thresholds that will lead to undesirable “regime shifts” in natural systems. An ecosystem can fluctuate between different states within a general “stability basin” or “regime,” but then flip into a dramatically different state if key thresholds are crossed. For example, acid rain may fall steadily on a mountain lake for years, causing the lake’s pH to fluctuate without appreciable effect. But when a certain acidity threshold is reached, the pH falls rapidly, and the lake can no longer sustain life.⁴³ Other examples of regime change include grasslands turning to desert and coral reefs succumbing to algae.



Volunteer construction workers with Habitat for Humanity build homes for displaced musicians in the Upper Ninth Ward of New Orleans, Louisiana. *Photo courtesy of iStockphoto.com.*

Ecological resilience thinking is rooted in systems theory, which holds that nothing exists in isolation. While the prevailing Enlightenment worldview reduces systems to their component parts, systems thinkers endeavor to comprehend the integrated whole.⁴⁴ Resilience thinkers see ecosystems and human society as complex adaptive systems (CAS): they are complex in that they are diverse and composed of multiple, interconnected elements; they are adaptive in that they have the capacity to change and self-organize.

While CAS are characteristically unpredictable, they typically move through adaptive cycles of growth, conservation, release, and regeneration. Systems in the growth phase adapt easily to change, but gradually resources are locked into arrangements that are ever more rigid, precipitating collapse. As the system collapses, resources are released, and the cycle begins anew.⁴⁵

The concept of the adaptive cycle is, in effect, a theory of change; it can help identify tipping points or thresholds—moments when transformative change is possible or likely. Resilience thinking has also produced indicators to assess resilience: for example, resilient systems tend to be diverse, redundant, and modular, as described in the Draft Integrated Framework on page 19.

In a resilient social–ecological system, disturbance has the potential to create opportunity for doing new things, for innovation, and for development.

Originally employed to analyze and manage ecosystems, the resilience thinking framework has had considerable influence on natural resource management. In recent years, it has evolved to include nested social–ecological systems (SES). The Resilience Project, a five-year collaboration between ecologists, economists, social scientists, and mathematicians in the late 1990s, was a deliberate effort to bring resilience theory into the SES domain.⁴⁶

Efforts to build resilience reflect value judgments about what must be preserved and strengthened—so they must ask “resilience of what?” and “resilience for whom?”

This still-evolving hybrid social–ecological approach to resilience can help us understand the complex, nested systems that comprise urban areas. And, in contrast to engineering resilience, which focuses on preserving the status quo, SES resilience embraces the transformational potential of change. As Carl Folke has argued, “In a resilient social–ecological system, disturbance has the potential to create opportunity for doing new things, for innovation, and for development.”⁴⁷ Rather than simply surviving a disturbance, a resilient community may respond in creative ways that fundamentally transform the community—creating a positive regime shift.

Indeed, regime shifts in the social realm may be necessary to head off disastrous shifts in the biosphere. As a group of prominent ecologists concluded in 2010, “[S]ocial change is essential for SES resilience. This is why we incorporate adaptability and the more radical concept of transformability as key ingredients of resilience thinking.”⁴⁸ Transformability, in this context, is defined as “the capacity to create a fundamentally new system when ecological, economic, or social structures make the existing system untenable.”⁴⁹

Still, the SES framework has limitations as a tool for thinking about urban resilience. Notably, it has drawn criticism from social scientists and activists for what Island Press consultant Maureen Smith calls an “indifference to values and power.”⁵⁰ Certainly, there are challenges in applying a theory that grew from biophysical systems science to the social context. In human societies, regimes reflect power dynamics, with winners and losers. And efforts to build resilience reflect value judgments about what must be preserved and strengthened—so they must grapple with questions such as “resilience of what?” and “resilience for whom?” As SES resilience thinking continues to evolve, greater attention to these questions would render this framework more robust—and more just.

SOCIAL SCIENCES

Resilience has been investigated across the social sciences, in fields including psychology, sociology, and human geography. While there is no single definition of social resilience, there is a considerable body of knowledge about the factors that enable individuals and communities to cope, adapt, and transform in response to change and adversity. Other insights from the social sciences—from political economy to demography—are relevant, if not explicitly linked to, resilience.

Psychologists, notably Ann Masten, have found that individual resilience rests on a foundation of ordinary factors, including close relationships with others, opportunities for agency and mastery, and

communities that support human development. As Masten has written, “Resilience does not require anything rare or extraordinary, but instead requires that basic human adaptive systems are operating normally.”⁵¹ Humans are, for the most part, resilient, but that capacity can be undermined by social factors including abuse, violence, and deprivation.

Sociologists and others have examined factors that create differential vulnerabilities, such as structural racism, gender inequality, and other forms of social exclusion.⁵² They have also explored the social construction of disaster—the inequities and failures of governance that turn hazards into catastrophe.⁵³ This work also sheds light on the social policies and practices that bolster resilience.

For example, sociologist Eric Klinenberg studied a devastating 1995 heat wave in Chicago, which killed nearly 800 people. He found disproportionately high mortality rates in low-income, African-American neighborhoods, where many lacked air conditioning. But there were telling exceptions to this rule. Auburn Gresham, a poor, black neighborhood on the city’s south side, reported lower mortality than in many affluent communities. What made the difference, Klinenberg found, was Auburn Gresham’s social capital. It was the “sidewalks, stores, restaurants, and community organizations that bring people into contact with friends and neighbors” that mattered, nurturing a community where residents checked on the elderly, sick, and vulnerable. That web of social ties offers protection even when disasters are not happening: life expectancy in Auburn-Gresham is five years higher than in neighboring communities.⁵⁴

Other social scientists have called for greater attention to agency—the capacity to make choices and enact them in the world—as a component of resilience.⁵⁵ As geographers Hans-Georg Bohle, Benjamin Etzold, and Markus Keck have written, “Agency is a vital issue in the conceptualization of social resilience and a theme that resilience discourse has, so far, failed to satisfactorily address.”⁵⁶ Bohle and his colleagues argue that agency emerges from a context of “entitlements, capabilities, freedoms, and choices” and, “even more broadly, of justice, fairness and equity.”⁵⁷

Resilience, some have argued, is akin to an immune response; it is protective when functioning normally, but it can be compromised.

This conceptualization closely aligns with the capabilities approach elaborated by Amartya Sen and Martha Nussbaum, which formed the basis for the UN’s Human Development Index.⁵⁸ Sen and Nussbaum found that poverty stems not only from deprivation, but also from a lack of agency and self-determination. The capabilities approach calls for ensuring that all people have the means and power to live the lives they want. Essential capabilities include bodily health and integrity, freedom of affiliation, political participation, and control over one’s environment. Others have argued that these capabilities are central to climate adaptation.⁵⁹

Hazards happen. It takes vulnerability for a hazard to become a disaster.

A common theme in this work is the need for policies and practices that support—or at the very least, do not undermine—the innate resilience of human beings and communities. Resilience, some have argued, is akin to an immune response; it is protective when functioning normally, but it can be compromised. And just as a healthy body is better able to fight disease, capable and empowered people are better able to mitigate crises and seize opportunities in a rapidly changing world.⁶⁰

Social science perspectives offer important insights for cultivating urban resilience. But there are limitations to this work as well. To the extent that these perspectives remain compartmentalized—with specialists addressing psychology, sociology, and economics as discrete concerns rather than as an interrelated whole—they will fail to capture the complexity of urban challenges. The social sciences, on the whole, have been slow to recognize the threats to social systems posed by climate change. More broadly, social science perspectives often fail to account for ecosystem health as a crucial component of human well-being and prosperity—though it is not possible to meaningfully address poverty, human development, and resilience without confronting ecological limits.

DISASTER RISK REDUCTION

Disaster risk reduction (DRR) is a field of study and practice that focuses on hazards, vulnerability, and resilience. DRR evolved from decades of research in multiple disciplines, including engineering, ecology, and the social sciences. In the DRR framework, disaster risk is often presented as a function of hazard plus vulnerability. In other words, hazards happen; it takes vulnerability for a hazard to become a disaster.⁶¹

Vulnerability may be biophysical—for example, resulting from a community’s location on a geologic fault line—and/or it may socially constructed. In the DRR framework, vulnerability can be countered by resilience, defined by the United Nations Office for Disaster Risk Reduction as “the ability of a system, community, or society exposed to hazards to resist, absorb, accommodate to, and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions.”⁶²

Building resilience is therefore one way to reduce disaster risk. Another is to reduce or prevent vulnerability. The Pressure and Release (PAR) model in DRR explores the “progression of vulnerability” from underlying causes, such as inequitable distribution of power and wealth, to intermediate dynamic pressures such as poor governance and corruption. These pressures channel the underlying cause into an unsafe condition in which people and property are exposed to the risk of disaster.⁶³

DRR is, of necessity, holistic and interdisciplinary: it integrates the study of biophysical hazards and the built environment with attention to the social construction of risk. And the field has spawned numerous sets of indicators on vulnerability and resilience.⁶⁴



This waterfront home in Union Beach, NJ was destroyed by Superstorm Sandy. *Photo courtesy of iStockphoto.com.*

At the same time, DRR—like other perspectives on resilience—has its limitations. For example, DRR practice has been criticized for paying insufficient attention to the underlying causes of vulnerability.⁶⁵ And as DRR is largely focused on discrete hazards, such as hurricanes or earthquakes, it may be less well-suited to the long-term changes wrought by climate change, or to problems that span multiple sectors—such as the 2011 tsunami/nuclear disaster that devastated Japan.⁶⁶

Moreover, DRR is focused on what might be called known unknowns—disasters that are unpredictable, perhaps, but not entirely without precedent. As climate change unspools in a newly urbanized, interconnected world, the future is not likely to resemble the past. In the twenty-first century, it is necessary to confront the exponentially more-difficult task of building resilience to unknown unknowns.

TOWARD A HOLISTIC UNDERSTANDING OF RESILIENCE

The perspectives outlined above make important contributions to our understanding of resilience, yet, they each have significant limitations. Urban resilience requires a holistic, interdisciplinary approach that incorporates insights from each of these fields.

The legendary urban critic Jane Jacobs wrote that cities, like living beings, are models of “organized complexity,” presenting “situations in which a half-dozen or even several dozen quantities are all varying

simultaneously and in subtly interconnected ways.”⁶⁷ It is an apt description of what resilience thinkers call a complex adaptive system.

Cities must cultivate resilience to known threats while also building general resilience for an era of unprecedented change.

Cities are complex adaptive systems, composed of subsystems both natural and social, each moving through its own adaptive cycle. The people in cities are divided by profound inequities—often the legacies of historic injustices—which compromise their innate resilience. And, facing an uncertain future, cities must cultivate specified resilience to known threats while also building general resilience for an era of unprecedented change.

The problems cities face are messy and huge, sprawling across sectors and dimensions. But the institutions in place to address those problems (and the disciplines that inform them) remain rigidly compartmentalized. As David Orr observes:

Separate agencies, departments, and organizations specialize in energy, land, food, air, water, wildlife, economy, finance, building regulations, urban policy, technology, health, and transportation—as if each were unrelated to the others....The results are often counter-productive, overly expensive, risky, sometimes disastrous. . . .⁶⁸

These are the problems we seek to address by advancing a holistic, transformative approach to urban resilience. Through this work, we will generate thinking and practice that includes and transcends the sectoral perspectives outlined above, and that is accessible—and actionable—for those who will shape a resilient future.



In the pages that follow, we offer a draft framework on urban resilience in the era of climate change. This framework represents a preliminary effort to integrate what we learned from our literature review and conversations with urban change agents. We recognize, however, that this work is still in its infancy. Accordingly, it is best seen as a skeletal framework to be revised and expanded by the Urban Resilience Project and its many partners in the coming years.



Runners in a Boston park. *Photo courtesy of iStockphoto.com.*

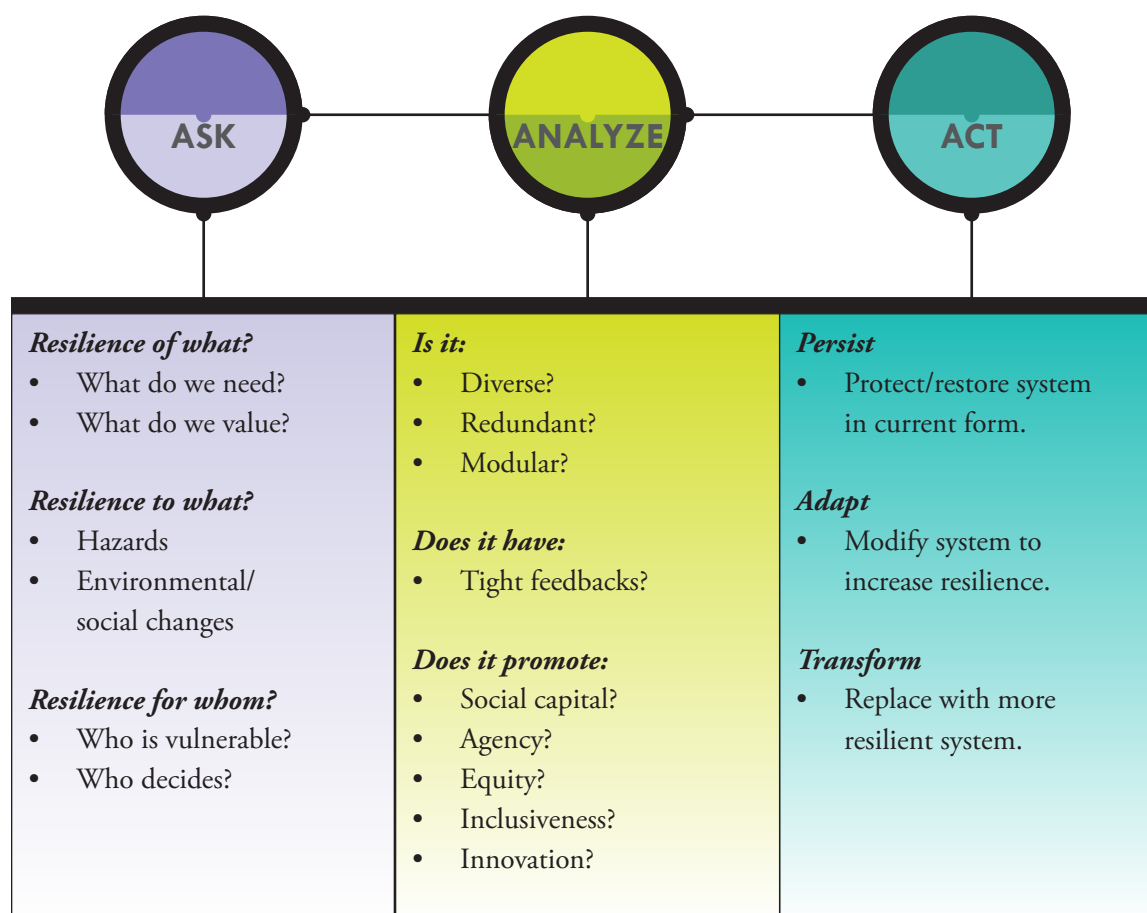
URBAN RESILIENCE

A DRAFT INTEGRATED FRAMEWORK

RESILIENCE IS THE CAPACITY OF A COMMUNITY TO ANTICIPATE, PLAN FOR, AND MITIGATE THE DANGERS—and seize the opportunities—associated with environmental and social change.

The process of building resilience is not value-neutral; decisions about what to protect and strengthen reflect deeply entrenched values and power structures. Therefore, true resilience begins with a searching inventory of the systems that comprise cities, and of their capacity to meet human needs sustainably and equitably.

To that end, those who work to build resilience must first ask what is being made resilient, to what, and for whom. They must analyze the systems that supply a community's needs and reflect its values to determine their resilience in the face of expected and unknown changes. And they must act by protecting, restoring, adapting—and, if necessary, transforming—the systems on which they depend. Moreover, resilience is not an end state; it involves an iterative process of learning and adaptation. Accordingly, the steps outlined here must be frequently revisited as circumstances change.





RESILIENCE OF WHAT?

WHAT DO WE NEED?*

- **Basic needs:** Nutritious food; clean water and air; secure shelter
- **Public health:** Accessible health care; protection from toxins and infectious agents; communities that support healthy lifestyles
- **Economic well-being:** Jobs, livelihoods, and social supports that enable people to achieve a decent quality of life
- **Safety:** Protection from crime, violence, and hazards
- **Mobility:** Freedom of movement; convenient access to employment, housing, health care, education, commerce, and recreation
- **Education:** Schools and other learning opportunities that enable individuals to fulfill their potential and participate fully in society

WHAT DO WE VALUE?

- **Relationships:** Personal connections to family and community
- **Fairness:** A just society in which opportunity is available to all, and risks are equitably shared
- **Freedom:** The capacity to live the life one chooses
- **Democracy:** Representative decision making and an inclusive political process
- **Beauty:** Aesthetically appealing places to live and work
- **Nature:** Healthy, functioning ecosystems, valued in their own right as well as for the services they provide to human well-being

WHAT ARE THE SYSTEMS THAT MEET OUR NEEDS—AND REFLECT OUR VALUES —AT SCALES FROM LOCAL TO GLOBAL?

- **Built environment:** Buildings; transit systems; water and sanitation systems; the electrical grid; communications networks
- **Natural environment:** Atmosphere and climate; watersheds and oceans; forests; agriculture and fisheries
- **Institutions:** Governments, legal systems, civil society, the private sector

*The lists below are not necessarily comprehensive or universal; they are offered in order to model an approach to thinking about urban resilience.

RESILIENCE TO WHAT?

WHAT ARE LIKELY CHANGES—SHORT- AND LONG-TERM; POSITIVE, NEGATIVE, AND NEUTRAL—THAT WILL AFFECT EXISTING URBAN SYSTEMS?

- ***Climate change impacts:*** Drought; flood; wildfires; sea-level rise; intensified storms; heat waves; changes in distribution of disease vectors; displacement and migration
- ***Other natural disasters:*** Volcanoes, earthquakes, tsunamis, mudslides
- ***Other environmental crises:*** Resource depletion; land degradation; pollution/contamination of air, water, or soil; nuclear disasters
- ***Demographic changes:*** Population gains or losses; migration; changes in age distribution
- ***Public health issues:*** Epidemics; drug use; changes in health indicators such as infant mortality, obesity, and life expectancy
- ***Economic changes:*** Rise or collapse of key industries; changes in financial or regulatory systems; changes in wealth distribution
- ***Technological changes:*** Breakthroughs in energy, communications, or transportation; obsolescence of existing technologies
- ***Social changes:*** Institutional or political shifts; reform movements, outbreaks of violence, or terrorism; changes in degree of globalization; gentrification/displacement
- ***“Black Swans”:*** Highly unpredictable, low-probability, high-impact changes

RESILIENCE FOR WHOM?

Who may be affected by changes, and how can they shape decision making?

WHO IS VULNERABLE?

- ***Biophysical:*** Who lives in proximity to potential hazards such as geologic faults, low-elevation coastal zones, or unsafe conditions?
- ***Social:*** Who is vulnerable due to lack of resources and power; discrimination based on race, class, gender, age, or sexual orientation; frailty/poor health?

WHO DECIDES?

- ***Decision making:*** What are relevant decision making processes? How are decisions made at different scales: family, neighborhood, city, region, nation, world—and in a range of sectors: civil society, government, industry?

- **Representation:** Are stakeholders—particularly the most vulnerable—represented in those processes? What are barriers to participation, and how can they be overcome?



Assess the resilience of existing urban systems. Is the system:

- **Diverse?** An urban system with many different components will have a wide range of responses to change and is therefore unlikely to fail all at once. For example, a city with a diverse economic base is less vulnerable to economic upheaval than one that relies on a single industry. In governance and decision making, a collaborative process that incorporates a variety of actors and perspectives is likely to produce better outcomes.
- **Redundant?** Similarly, a resilient city has multiple ways to perform basic functions, so that the failure of any one component does not cause the entire system to crash. A multimodal transportation system that includes a variety of public transit options as well as opportunities for walking and bicycling will weather disruptions better than a system that relies wholly on automobiles.
- **Modular?** Modular systems in which individual units retain some self-sufficiency when disconnected from larger networks will fare better in times of change. For example, people living in a city with a robust local food culture (nearby farms, a farmers' market) will be less likely to go hungry if there is a disruption in national or global supply chains. Modularity allows a system to manage its connectivity to larger regions and the world; it is a way to reinstate "firebreaks" that have been lost in a hyper-connected, globalized economy.

Does it have:

- **Tight feedbacks?** A resilient system has tight feedbacks, allowing it to quickly detect changes in its constituent parts and respond appropriately. Tight feedbacks enable swift responses to changing conditions. If a reservoir is low, for example, water conservation measures may be put in place. But, in today's globalized economy, consumers may be thousands of miles away from the source of resources on which they depend—so feedback loops go slack. Inequality also weakens feedbacks, as affluent communities routinely outsource production and pollution to poorer ones.

Does it promote:

- ***Social capital?*** For an individual, social capital is about relationships with family, friends, and colleagues. In communities, social capital can be measured by levels of trust, the cohesion of social networks, and the quality of leadership. Resilient cities build social capital with neighborhoods and public spaces that encourage interaction and through participatory, inclusive governance.
- ***Agency?*** Resilient people have a sense of control over their destiny; resilient cities fully engage their citizens in decision making. Fundamentally, agency is about power, personal and political. Strategies to build agency include: community organizing; education (including participatory action learning); public health and safety initiatives; and civic engagement.
- ***Equity?*** Equity means that opportunities—and risks—are equally shared. It is a building block of social cohesion—the sense that “we’re all in it together” that enables communities to cooperate in times of disaster. And equity improves performance on a broad range of human development indicators that form the bedrock of individual and community resilience.
- ***Inclusiveness?*** Inclusive social institutions—economic, political, and cultural—can strengthen resilience at every level, by increasing social capital, agency, and equity. In an inclusive society, power and opportunity are shared broadly, not concentrated in the hands of a few. Inclusive governance has practical benefits: for example, it tightens feedback loops so that problems are more readily detected and it expands the depth and diversity of knowledge available for problem solving.
- ***Innovation?*** A resilient system generates novel responses while learning and adapting to changing conditions. In nature, this is accomplished by evolution. In human society, it requires innovation—the ability and willingness to try new things. The capacity to innovate derives from many of the qualities just described. A diverse system generates more novelty than a monoculture; in social systems, innovation often comes from the margins. An inclusive society is better able to engage the agency and creativity of all of its citizens. And tight feedbacks provide timely and accurate information about changing conditions, which is essential for appropriate innovation.



Armed with an understanding of what we want to make resilient and of the resilience or vulnerability of existing systems, the next step is to act:

- ***Persist:*** Protect (or restore) the existing system in its current/pre-existing form (restore wetlands; reinforce bridges; rebuild after disaster).
- ***Adapt:*** Modify the system to increase resilience, using the above criteria as a guide (decentralize food and energy systems; adapt buildings and infrastructure to rising sea levels; build social capital through inclusive governance).
- ***Transform:*** Replace the existing system with one that is more resilient (shift from fossil fuels to renewable energy; replace authoritarian governance with inclusive decision making processes; build economic alternatives such as worker-owned cooperatives).

What these strategies might look like in practice is explored more fully below.

RESILIENCE IN PRACTICE

BUILDING RESILIENCE IN URBAN SYSTEMS will likely require some combination of the actions outlined above: persisting, adapting, and transforming.

Take, for example, the electrical grid, which is now staggeringly vulnerable to disruption. According to a recent analysis by the Federal Energy Regulatory Commission, if saboteurs or disaster were to destroy just nine interconnection substations and one transformer manufacturer, “the entire United States grid would be down for at least eighteen months, probably longer.”⁶⁹ A more resilient grid requires persisting—urgent action to protect those vulnerable links in the chain. It also requires adapting—measures to make the grid more redundant and modular, as some are doing now. For example, Co-op City, a housing complex in the Bronx, kept their lights on during Superstorm Sandy with a micro-grid that disconnected temporarily from the larger system.⁷⁰ But ultimately—given the limited supply and disastrous climate effects of fossil fuels—the existing electrical grid must be transformed to one that relies instead on a diverse array of renewable power sources.

Efforts to build resilience must first do no harm. That means taking careful stock of what the community values, as outlined above. And, because human beings and communities are inherently resilient, interventions should begin with a deep understanding of existing strengths and adaptive mechanisms and make every effort to keep them intact. Denise Fairchild, president of the Emerald Cities Collaborative, observes that many low-income communities have a great deal of unacknowledged resilience, thanks to a history of adversity and recurring disasters with minimal outside help. “When disasters occur,” she says, “we are our own first responders.”⁷¹ Any attempt to build capacity in struggling communities must be mindful of, and reinforce, those hard-won strengths.



Community gardens can improve public health and provide food security in times of crisis. *Photo courtesy of iStockphoto.com.*



Bicycle commuter, New York City. *Photo courtesy of iStockphoto.com.*

Resilience requires a holistic view: focusing myopically on the system at a single scale, or managing for a single outcome, is likely to yield surprises from unanticipated feedbacks. So, managing resilient cities begins with an understanding of urban systems and their functions at many scales, from many perspectives. But, given the extraordinary complexity of cities, it also calls for a certain amount of humility; an admission of what is unknown—and unknowable.⁷²

There are opportunities to enhance resilience at multiple scales, from the personal to the global. For example, someone who is vulnerable to food price increases might start a garden in a backyard or vacant lot. She might engage in local action, such as starting a food co-op or buying club. She might take action at the county, state, national, or global level, such as through activism on farm subsidies that discourage local self-sufficiency. Thinking and acting at multiple scales also requires attention to impacts of our actions that are distant in space or time. For example, a community that diverts floodwaters to a neighboring town has simply displaced, rather than solved, its problem.

To avoid a narrow focus on one scale or component of the system, interventions to build resilience should endeavor to solve more than one problem. “We look for nested solutions,” says Jason McLennan, CEO of the International Living Future Institute, “solutions that serve multiple challenges, one of which is making sure that the infrastructure or the community is resilient.”⁷³ For example, energy efficiency in affordable housing can help low-income people save money on utilities. It also makes homes more habitable during power outages, so that residents can shelter in place during a disaster. And it reduces energy usage, mitigating climate change and improving air quality and public health.

There are many other such win-win-win solutions. For example, the Evergreen Cooperatives of Cleveland, Ohio combine job creation, wealth building, and sustainability. Evergreen’s employee-owned, for-profit companies—laundry services, urban agriculture, and renewable energy—create green jobs that pay a living wage and enable workers to build equity. Because Evergreen is linked to the supply chains of the city’s anchor institutions, it helps keep financial resources in the community. Evergreen builds resilience by protecting workers from the vicissitudes of the global economy, and also by protecting the ecosystems on which the city depends.

Of course, with any resilience-building initiative, the how is as important as the what. For example, an energy efficiency initiative that is spearheaded by local community groups will build more social capital—and therefore more resilience—than a top-down effort. Meaningful community engagement is key. According to Jason Reece, director of research at the Kirwan Institute for the Study of Race and Ethnicity, that means “sitting down with people as equals, and deferring to and respecting that community’s lived experience.”⁷⁴

There are many potential opportunities to build resilience into the physical and social fabric of our cities. As noted above, post-disaster rebuilding offers a unique window in which to effect change. For example, when a tornado destroyed the (aptly named) town of Greensburg, Kansas in 2007, city and community leaders resolved to rebuild the town as a model of sustainability and resilience. The rebuilding plan included LEED Platinum certification in public buildings (which has saved \$200,000 in energy costs), decentralized wind power, and a walkable town center. Town buildings were rebuilt to withstand extreme conditions and every building in town has a safe room or storm shelter. The rebuilt town also nurtures social capital by encouraging interaction: many homes in Greensburg now feature roomy front porches. “We need to get back to being front-porch people,” said Greensburg mayor Bob Dixon.⁷⁵

Infrastructure repair and rebuilding presents another such opportunity. Much of our nation’s critical infrastructure is in poor condition, and/or is nearing the end of its useful life. For example, America’s water infrastructure received a “D” grade from the American Society of Civil Engineers in 2013.⁷⁶ More than 700 water districts have antiquated combined sewer systems, which discharge sewage into waterways during heavy rains.⁷⁷ In response, some cities are incorporating green infrastructure into their water systems—including permeable pavement, rain gardens, and constructed wetlands. Green infrastructure is a win-win-win solution: it prevents sewer overflows, minimizes flood risk, protects water quality, and improves public health. And, importantly, it creates jobs for less-skilled workers in construction and maintenance.⁷⁸



San Francisco at Alamo Square. *Photo courtesy of iStockphoto.com.*

Cities are complex adaptive systems,
and building urban resilience calls for a holistic,
integrated approach.

OPPORTUNITIES FOR ACTION

THROUGH RESEARCH AND CONSULTATIONS CONDUCTED FOR THIS PROJECT, we have uncovered significant opportunities to shape thinking and practice on urban resilience. Here, we outline key opportunities and recommended actions. Some of these will be implemented by the Island Press Urban Resilience Project; others may be undertaken by our partners in academia, philanthropy, nonprofits, and government.

The Island Press Urban Resilience Project and its partners will:

BROADEN AND DEEPEN KNOWLEDGE ABOUT URBAN RESILIENCE

A holistic, transformative approach to urban resilience requires new ways of thinking about challenges and solutions. To that end, we must reach across disciplinary and sectoral boundaries, bring new voices into the conversation, and find ways to spark imagination and inspiration:

- ***Think across boundaries.*** Cities are complex adaptive systems, and building urban resilience calls for a holistic, integrated approach. But this is new and unknown territory; most cities remain stuck in the siloed approaches of the past. Resilience thinking, which is rooted in systems theory, has much to contribute to the study and management of cities, but it must be adapted to the urban context. That requires a deeper engagement with the social realm and with the power dynamics that determine resilience and vulnerability. Recommendation: Connect thinkers and ideas from the ecological and social sectors, cultivating interdisciplinary approaches.
- ***Value social capital.*** A recurring theme in our consultations is that social capital—the bonds of trust and good faith that enable societies to function—is also crucial to urban resilience. Yet, while there is growing appreciation of its importance, too little is known about how to measure, cultivate, and maintain social capital. Recommendation: Work with experts to identify emerging knowledge in this area and to share that knowledge with a variety of urban change makers.
- ***Amplify new voices.*** Diversity is central to resilience. But the public conversation about urban resilience is often rarefied, despite its potential for mainstream appeal. Notably missing are the voices and perspectives of those working at the local/community level. That omission impoverishes the public conversation on resilience because local activists—of necessity—tend to be less siloed in their thinking than “inside-the-Beltway” groups, often taking a holistic approach to the linked environmental and social justice issues that plague their communities. Recommendation: Lift up and amplify the voices of those advocates and others on the cutting edge of resilience. Identify and promote the work of thought leaders who can speak from—and to—a diverse range of communities about resilience.

- ***Imagine and inspire.*** Today, in this era of unprecedented social and environmental change, it is tempting to seek the comfort of the status quo. But the status quo cannot be sustained—environmentally, socially, or morally. Instead, we must imagine a future that is different from the present, yet connects with deeply held values such as freedom and fairness. Recommendation: Work with leading thinkers and new voices to envision the sustainable, equitable, resilient cities of the future.

DEVELOP PLANNING AND MANAGEMENT TOOLS

Urban change makers are already working to make cities more resilient; they need practical, actionable information to help them navigate the way. And they need that information in real time, in formats tailored to their specific needs and circumstances. Such tools could include:

- ***Case studies.*** There is a growing wealth of case studies—both in academia and among practitioners—that could help point the way. Recommendation: Capture, shape, and share those lessons learned, especially from replicable projects that integrate social justice and sustainability.
- ***Translations from theory to practice.*** A large body of research and writing on resilience in social–ecological systems resides in obscure academic literature. Recommendation: Translate key concepts from that literature into plain language, making it accessible and useful for practitioners and laypeople.
- ***Tools for community engagement.*** Resilience requires meaningful, inclusive community engagement. How can we ensure that urban design and planning processes represent all stakeholders—including marginalized citizens and those who lack educational or technical backgrounds? Social justice organizations and researchers possess a wealth of relevant knowledge and experience on this subject, which could inform resilience planning and civic life. Recommendation: Identify useful resources on community engagement and translate/package them for use by diverse stakeholder groups.
- ***Teaching and learning materials.*** The siloed approaches of the past will not solve the problems of the future. It is essential to reach and influence the next generation of urban decision makers and encourage more holistic thinking and practice. Recommendation: Work with experts to develop curricular materials for upper-division undergraduates and graduate students in design, architecture, and the natural and social sciences.
- ***Tools for assessment and action.*** True resilience begins with a searching inventory of the systems that comprise our cities, and of their capacity to meet human needs sustainably and

equitably. Recommendation: Create tools for communities to ask, analyze, and act to improve their resilience—based on the framework outlined above.

GENERATE DATA AND INDICATORS

Many interviewees and advisors stressed the need for hard data that would make resilience and its key performance indicators more concrete. Some of this data already exists but is not accessible; some is yet to be developed or collected. Recommendation: Aggregate, curate, and disseminate existing data, and work with technical experts to develop and share new analyses, including:

- Economic cost–benefit analyses. Explore the cost-effectiveness of resilience, comparing the growing cost of disasters with that of preventive measures.
- Information on hazards. Provide localized information about climate change impacts and other threats, including natural and human-made hazards as well as scenarios for disaster planning.
- Mapping. Deploy GIS tools to map community vulnerability and assets, “ground-truthing” the map data and connecting citizens with experts and policy makers.
- Indicators for social resilience. Develop rigorous indicators and metrics that include social capital, agency, and equity.
- Scenarios. Create guidelines for modeling a range of scenarios, including business-as-usual and alternatives.

DELIVER IDEAS THROUGH DIVERSE CONTENT AND MEDIA

While the written word remains vital for expressing and learning new ideas, the forms into which words are poured—and the media through which they flow—are being radically transformed. Technology is revolutionizing the production and dissemination of information, expanding control beyond a limited number of gatekeepers. Today, public conversations are sparked by thought leaders at all levels of society, and move through a wide variety of digital and print media. This new landscape presents opportunities to disseminate the content described above through two primary channels:

- Short-form media can shape the dialogue around urban resilience in real time. Blogposts, op-eds, tweets, and webinars can respond quickly to current events. Longer opinion pieces

and feature articles can enrich the conversation by examining a subject in greater depth. Moreover, short-form media offer an accessible forum for emerging thought leaders and a means to reach key audiences, including public officials, architects, environmentalists, and advocates for social justice. Recommendation: Cultivate new thought leaders and facilitate dissemination of their ideas through print and digital short-form media.

- Long-form media—books—remain the gold standard for developing and disseminating ideas. Books enable authors to examine complex topics in detail and craft careful arguments for intervention and change. As powerful tools for shaping conversations and debates, books establish authors' reputations and build the audience for their contributions in other media. Recommendation: Work with authors to develop and publish a comprehensive body of long-form literature on urban resilience.

CONCLUSION

THE FUTURE WILL BE SHAPED BY A RAPIDLY CHANGING CLIMATE, and by other disruptions we cannot even imagine. Many of these will play out in the cities so many of us call home. To build the resilience of cities in volatile times, it is necessary to approach those cities as complex living systems, devising new ways to mitigate crises, seize opportunities, and choose a desired future.

True resilience asks us to make profound changes in our relationships with the natural world and with one another. Indeed, resilience is a concept with potentially transformative power: it could help build broad-based support for paradigm shifts like distributed renewable energy, greater social equity, and inclusive governance. Or, alternatively, it could be deployed to strengthen social and economic arrangements that are neither sustainable nor just. The choice is ours to make.

To seize the positive potential of resilience, Island Press and its partners will advance a holistic, transformative approach to thinking and practice on urban resilience in the era of climate change, grounded in a commitment to sustainability and equity. We invite you to join us in this important effort—because, in the twenty-first century, our cities must be resilient, or nothing will be.

APPENDIX

STAKEHOLDERS
INTERVIEWED**LAUREL BLATCHFORD**

Senior Vice President, Solutions,
Enterprise Community Partners

DANA BOURLAND

Vice President, Environment
JPB Foundation

JEB BRUGMANN

Founder, ICLEI and Board President,
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SUSAN CUTTER

Professor of Geography and Director, Hazards
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DENISE FAIRCHILD

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ENDNOTES

- 1 Vitousek, Peter M., et al., "Human Domination of the Earth's Ecosystems," *Science* 277, July 25, 1997; Millennium Ecosystem Assessment Board of Directors, *Living Beyond Our Means: Natural Assets and Human Well-being* (Washington, DC: Island Press, 2005).
- 2 U.S. Global Change Research Program, 2014 National Climate Assessment, at <http://nca2014.globalchange.gov/>; IPCC, 2014: Summary for Policymakers, In: Climate Change 2014, Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, 2014.
- 3 Aon Benfield, *Annual Global Climate and Catastrophe Report*, (Chicago: Impact Forecasting, 2014).
- 4 United States Department of Defense, Quadrennial Defense Review 2014, (Washington, DC: U.S. Department of Defense, 2014).
- 5 United Nations Population Division, *World Population Prospects: The 2012 Revision*, (New York: 2012) at: <http://esa.un.org/wpp/>
- 6 Howard, P.N., et. al. "Opening Closed Regimes: What Was the Role of Social Media During the Arab Spring?" (University of Washington, Project on Information Technology and Political Islam, 2011).
- 7 World Economic Forum, *Global Risks 2011* (Geneva: 2011), 10.
- 8 David Orr, "Living and Breathing in a 'Black Swan' World," *Solutions Journal*, October 2014, at: <http://www.thesolutionsjournal.com/node/237195>
- 9 Anthony Shorrocks and Jim Davies, *Credit Suisse Global Wealth Databook*, (Zurich: Credit Suisse Research Institute, 2013).
- 10 Thomas Piketty, *Capital in the Twenty-First Century*, (Cambridge, MA and London: The Belknap Press of Harvard University Press, 2014).
- 11 Richard G. Wilkinson and Kate Pickett, *The Spirit Level: Why More Equal Societies Almost Always Do Better*, (New York: Bloomsbury Press, 2009).
- 12 Joseph E. Stiglitz, *The Price of Inequality: How Today's Divided Society Endangers Our Future* (New York: W.W. Norton, 2012).
- 13 Population Division of the Department of Economic and Social Affairs of the United Nations Secretariat, *World Population Prospects: The 2010 Revision and World Urbanization Prospects: The 2011 Revision*, at: <http://esa.un.org/unup/unup/p2k0data.asp>
- 14 National Intelligence Council, *Global Trends 2030: Alternative Worlds* (Washington, DC: National Intelligence Council, 2013) at: <http://www.dni.gov/index.php/about/organization/national-intelligence-council-global-trends>
- 15 U.S. Census Bureau, "2010 Census Urban and Rural Classification and Urban Area Criteria," at: <http://www.census.gov/geo/reference/ua/urban-rural-2010.html>; Marc Perry, "A More and More Metropolitan America," *Random Samplings, The Official Blog of the U.S. Census Bureau*, March 27, 2014, at: <http://blogs.census.gov/2014/03/27/a-more-and-more-metropolitan-america/>
- 16 Sarah Goudarzi, "Flocking to the Coast: World's Population Migrating into Danger," *LiveScience*, July 18, 2006, at: <http://www.livescience.com/4167-flocking-coast-world-population-migrating-danger.html>
- 17 Cathleen Kelly and Arpita Bhattacharyya, *Storm-Ready Cities: How Climate Resilience Boosts Metro Areas and the Economy* (Washington, DC: Center for American Progress, 2013); Tracey Ross, a *Disaster in the Making: Addressing the Vulnerability of Low-Income Communities to Extreme Weather* (Washington, DC: Center for American Progress, 2013).
- 18 Interview with Jacqueline Patterson, November 25, 2013.
- 19 Vishan Chakrabarti, "America's Urban Future," *The New York Times*, April 16, 2014.
- 20 United Nations Population Fund, *State of World Population 2007: Unleashing the Potential of Urban Growth*, (New York: United Nations Population Fund: 2007).
- 21 Jonathan Dickinson and Andrea Tenorio, *City of New York Inventory of New York City Greenhouse Gas Emissions*, (New York: Mayor's Office of Long-Term Planning and Sustainability, 2011).
- 22 National Intelligence Council, *Global Trends 2030: Alternative Worlds* (Washington, DC: NIC, 2013).
- 23 United States Census Bureau, "Growth in Urban Population Outpaces Rest of Nation, Census Bureau Reports," News release, March 26, 2012; and United States Census Bureau, Metropolitan and Micropolitan Statistical Areas, accessed at: <http://www.census.gov/popest/data/metro/totals/2013/index.html>; and Marc Perry, op. cit.
- 24 Ari Phillips, "Mayors Sign Climate Protection Agreement, Endorse Innovative Climate Solutions," *Climate Progress*, June 22, 2014, at: <http://thinkprogress.org/climate/2014/06/22/3451702/mayors-conference-climate-change/>
- 25 David Morris, "Can Cities Lead the Way on Inequality?" *Alternet*, January 27, 2014, at: <http://www.alternet.org/news-amp-politics/can-cities-lead-way-inequality>

- 26 Telephone interview with Bob Yaro, November 11, 2013.
- 27 Interview with Elizabeth Malone, November 4, 2013.
- 28 Telephone interview with Jeb Brugmann, November 5, 2013.
- 29 Beth Gardiner, "Bypassing the Power Grid," op. cit.
- 30 Telephone interview with Maya Wiley, December 3, 2014.
- 31 Telephone interview with Sue Zielinski, November 12, 2013.
- 32 Telephone interview with Jason Reece, November 22, 2013.
- 33 Telephone interview with Russell Unger, December 4, 2013.
- 34 Telephone interview with Mark Pelling, op. cit.; Project description at: <http://www.loicz.org/science/challenges/belmont/metropole/index.html.en>
- 35 Kenneth P. Green, "Climate Change: The Resilience Option," *AEI online*, October 13, 2009, accessed at: <http://www.aei.org/article/energy-and-the-environment/climate-change-the-resilience-option/>
- 36 See, for example, Tom Slater, "The resilience of neoliberal urbanism," *OpenDemocracy*, accessed at: <http://opendemocracy.net/opensecurity/tom-slater/resilience-of-neoliberal-urbanism>
- 37 Maureen Smith, "The chimera of resilience: A brief look at selected concepts in theory and practice," white paper prepared for Island Press, October 2013.
- 38 Maureen Smith, op. cit.
- 39 Patrick Martin-Breen and J. Marty Anderies, *Resilience: A Literature Review*. (Rockefeller Foundation: Bellagio Initiative Background Paper, 2011).
- 40 Beer, F.P., E.R. Johnston, et al. *Mechanics of Materials*, 6th edition. (New York: McGraw-Hill, 2011).
- 41 Carl Folke, "Resilience: The Emergence of a Perspective for Social-ecological Systems Analyses," *Global Environmental Change* 16, no. 3 (August 2006): 253–267. doi:10.1016/j.gloenvcha.2006.04.002.
- 42 Brian Walker, et. al. "Resilience, Adaptability and Transformability in Social-Ecological Systems," *Ecology and Society* 9, no. 2 (2004). <http://www.ecologyandsociety.org/vol9/iss2/art5/>.
- 43 John Harte, "Numbers Matter: Human Population as a Dynamic Factor in Environmental Degradation," in Laurie Mazur, ed., *A Pivotal Moment: Population, Justice and the Environmental Challenge* (Washington, DC: Island Press, 2009).
- 44 See, for example, Donella Meadows, *Thinking in Systems II* (White River Junction, VT: Chelsea Green, 2008).
- 45 Brian Walker and David Salt, *Resilience Thinking: Sustaining Ecosystems and People in a Changing World* (Washington, DC: Island Press, 2006).
- 46 Gunderson and Holling's *Panarchy* (op.cit) was one outcome of this effort.
- 47 Carl Folke, "Resilience: The emergence of a perspective for social- ecological systems analyses," *Global Environmental Change*, 16 (2006) 253-267.
- 48 Carl Folke, et. al. "Resilience thinking: integrating resilience, adaptability and transformability," *Ecology and Society*, 15(4): 20. At: <http://www.ecologyandsociety.org/vol15/iss4/art20/>
- 49 Brian Walker, C. S. Holling, Stephen R. Carpenter, and Ann Kinzig, "Resilience, adaptability and transformability in social-ecological systems," *Ecology and Society*, 9(2): 5, 2004, at: <http://www.ecologyandsociety.org/vol9/iss2/art5/>
- 50 Maureen Smith, op. cit.
- 51 Ann Masten, "Ordinary Magic," blog, PBS *This Emotional Life*, at: <http://www.pbs.org/thisemotionallife/blogs/ordinary-magic>
- 52 See, for example, Mark Pelling, *The Vulnerability of Cities: Natural Disasters and Social Resilience* (London: Earthscan, 2003).
- 53 See, for example, Ted Steinberg, *Acts of God: The Unnatural History of Natural Disaster in America*, (New York: Oxford University Press, 2nd edition, 2006); Mike Davis, *Ecology of Fear: Los Angeles and the Imagination of Disaster*, (New York: Metropolitan Books, 1998); and Timothy Egan, *The Worst Hard Time: The Untold Story of Those Who Survived the Great American Dust Bowl* (New York: Houghton Mifflin Harcourt, 2006).
- 54 Eric Klinenberg, "Adaptation: How can cities be "climate-proofed?" *The New Yorker*, January 7, 2013; Eric Klinenberg, *Heat Wave: A Social Autopsy of Disaster in Chicago* (Chicago: University of Chicago Press, 2002).
- 55 See, for example, Katrina Brown and Elizabeth Westaway, "Agency, Capacity, and Resilience to Environmental Change: Lessons from Human Development, Well-Being, and Disasters," *Annual Review of Environment and Resources*, 2011, pp. 321–42; Hans-Georg Bohle, Benjamin Etzold and Markus Keck, "Resilience as Agency," *IHDP Update*, 2009.
- 56 Bohle, et. al. op.cit.
- 57 Bohle, et. al. op.cit.

- 58 Amartya Sen, *Commodities and Capabilities*, (New York: Oxford University Press, 1999); Amartya Sen, *The Idea of Justice* (Cambridge, MA: Harvard University Press, 2009); Martha Nussbaum, *Creating Capabilities: The Human Development Approach* (Cambridge MA: Harvard University Press, 2011); United Nations Development Program, *Human Development Index*, at: <http://hdr.undp.org/en/statistics/hdi>
- 59 David Schlosberg, "Climate Justice and Capabilities: A Framework for Adaptation Policy," Carnegie Council, *Ethics and International Affairs*, online journal, at: <http://www.ethicsandinternationalaffairs.org/2013/climate-justice-and-capabilities-a-framework-for-adaptation-policy/>; Marlene Roy and Henry David Venema, "Reducing risk and vulnerability to climate change in India: the capabilities approach," in Geraldine Terry, ed., *Climate Change and Gender Justice* (Warwickshire, UK: Practical Action Publishing/Oxfam, 2009).
- 60 Joshua Cooper Ramo, *The Age of the Unthinkable: Why the New World Disorder Constantly Surprises Us and What we Can Do About It* (New York: Little, Brown and Co./Hachette Book Group, 2009).
- 61 Maureen Smith, op. cit. Smith draws on the following sources: Wisner, Benjamin, Piers Blaikie, Terry Cannon, and Ian Davis, *At Risk: Natural Hazards, People's Vulnerability, and Disasters*. 2nd ed. (New York: Routledge, 2004); Wisner, Ben, J.C. Gaillard, and Ilan Kelman, eds. *Handbook of Hazards and Disaster Risk*, (New York, NY: Routledge, 2011); Lewis, James, and Ilan Kelman. "Places, People and Perpetuity: Community Capacities in Ecologies of Catastrophe." *ACME: An International E-Journal for Critical Geographies* 9, no. 2 (2010) at <http://www.acme-journal.org/volume9-2.html>
- 62 United Nations International Strategy for Disaster Risk Reduction (UNISDR). *2009 UNISDR Terminology on Disaster Risk Reduction*. Geneva, Switzerland: United Nations, 2009. <http://www.unisdr.org/we/inform/terminology>
- 63 Benjamin Wisner, et. al., op. cit.
- 64 See, for example, Elizabeth Malone and Antoinette Brenkert, *Vulnerability, Sensitivity, and Coping/Adaptive Capacity Worldwide* (Northampton, MA: Edward Elgar Publishing, 2009); David R. Godschalk, "Urban Hazard Mitigation: Creating Resilient Cities," *Natural Hazards Review* 4, no. 3, August 1, 2003.
- 65 James Lewis and Ilan Kelman, op.cit.
- 66 Jon Kolko, "Wicked Problems: Problems Worth Solving," *Stanford Social Innovation Review*, March 6, 2012, at: http://www.ssireview.org/articles/entry/wicked_problems_problems_worth_solving
- 67 Jane Jacobs, *The Death and Life of Great American Cities*, (New York: Modern Library ed., 1993).
- 68 David Orr, op.cit.
- 69 Rebecca Smith, "U.S. Risks National Blackout From Small-Scale Attack: Federal Analysis Says Sabotage of Nine Key Substations Is Sufficient for Broad Outage," *The Wall Street Journal*, March 12, 2014.
- 70 Beth Gardiner, "Bypassing the Power Grid," *The New York Times*, October 8, 2013.
- 71 Telephone interview with Denise Fairchild, November 6, 2013.
- 72 Fikret Berkes and Carl Folke, "Back to the Future: Ecosystem Dynamics and Local Knowledge," in Gunderson and Holling, *Panarchy* op. cit.
- 73 Telephone interview with Jason McLennan, December 6, 2013.
- 74 Telephone interview with Jason Reece, November 22, 2013
- 75 Robert Fraga, "Sustainable Architecture and the Power of Community: Rebuilding Greensburg, Kansas," *Mother Earth News*, May 4, 2012, at: <http://www.motherearthnews.com/nature-and-environment/sustainable-architecture-greensburg-kansas-ze0z1205zkon.aspx#ixzz34AkCflk9>; Interview with Greensburg Mayor Bob Dixon, at: <http://www.pwc.com/gx/en/capital-projects-infrastructure/disaster-resilience/community-infrastructure-resiliency.jhtml>; Patrick Quinn, "After devastating tornado, town is reborn 'green,'" *USA Today*, April 25, 2013, at: <http://www.usatoday.com/story/news/greenhouse/2013/04/13/greensburg-kansas/2078901/>
- 76 Alvaro Sanchez Sanchez, *Clean Water, Strong Communities: Translating the Value of Water Infrastructure Using Community Benefit Strategies* (Oakland, CA: Green for All, 2014).
- 77 U.S. Environmental Protection Agency, "Municipal Storm Water: Combined Sewer Overflows, Sanitary Sewer Overflows Compliance Monitoring," at: <http://www.epa.gov/compliance/monitoring/programs/cwa/csos.html>
- 78 Alvaro Sanchez Sanchez, *Clean Water, Strong Communities*, op. cit.



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