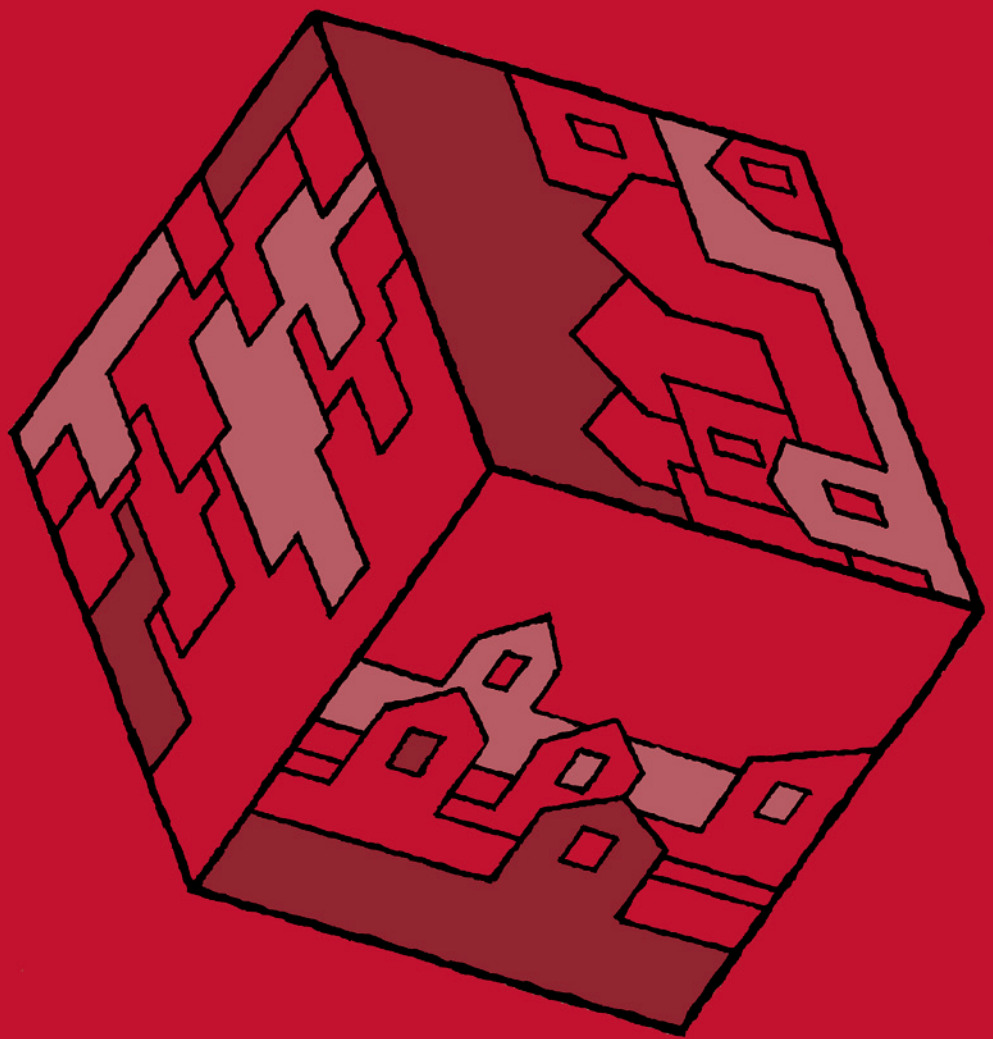
The Post Carbon Reader Series: Cities, Towns, and Suburbs

The Death of Sprawl

Designing Urban Resilience for the Twenty-First-Century Resource and Climate Crises

By Warren Karlenzig



About the Author

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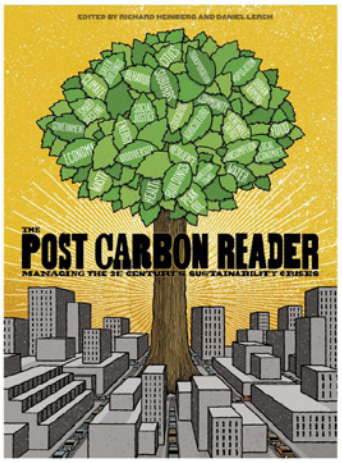

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This publication is an excerpted chapter from *The Post Carbon Reader: Managing the 21st Century's Sustainability Crises*, Richard Heinberg and Daniel Lerch, eds. (Healdsburg, CA: Watershed Media, 2010). For other book excerpts, permission to reprint, and purchasing visit http://www.postcarbonreader.com.

In April 2009—just when people thought things couldn't get worse in San Bernardino County, California—bulldozers demolished four perfectly good new houses and a dozen others still under construction in Victorville, 100 miles northeast of downtown Los Angeles.

The structures' granite countertops and Jacuzzis had been removed first. Then the walls came down and the remains were unceremoniously scrapped. A woman named Candy Sweet came by the site looking for wood and bartered a six-pack of cold Coronas for some of the splintered two-by-fours.[1]

For a boomtown in one of the fastest-growing counties in the United States, things were suddenly looking pretty bleak.

The adobe-colored two-story houses had been built by speculators in a desert region dubbed the "Inland Empire" by developers. The unsold homes faced vandalism and legal liabilities when the town's average home sales prices dropped from well over $300,000 in 2007 to $120,000 in 2009. These plummeting prices pushed Victorville over the edge, making the city one of the nation's foreclosure capitals.[2]

After people began to ransack fixtures from the vacant homes, Victorville town officials warned the bank owning the sixteen-home development that it would be on the hook for security and fire calls. The bank, which had inherited the mess from the defaulted developer, assessed the hemorrhaging local real estate market and decided to cut its losses. A work crew was dispatched to rip the houses down and get what they could—money, beer, whatever—for the remains.[3]

Boom and Bust

Why did this town boom and then bust so spectacularly? After all, it followed a seemingly tried-and-true model of suburban growth that was replicated across the United States for decades.

To begin with, gasoline prices had risen from under $2 in the boom years to over $4 by 2008. Thanks to

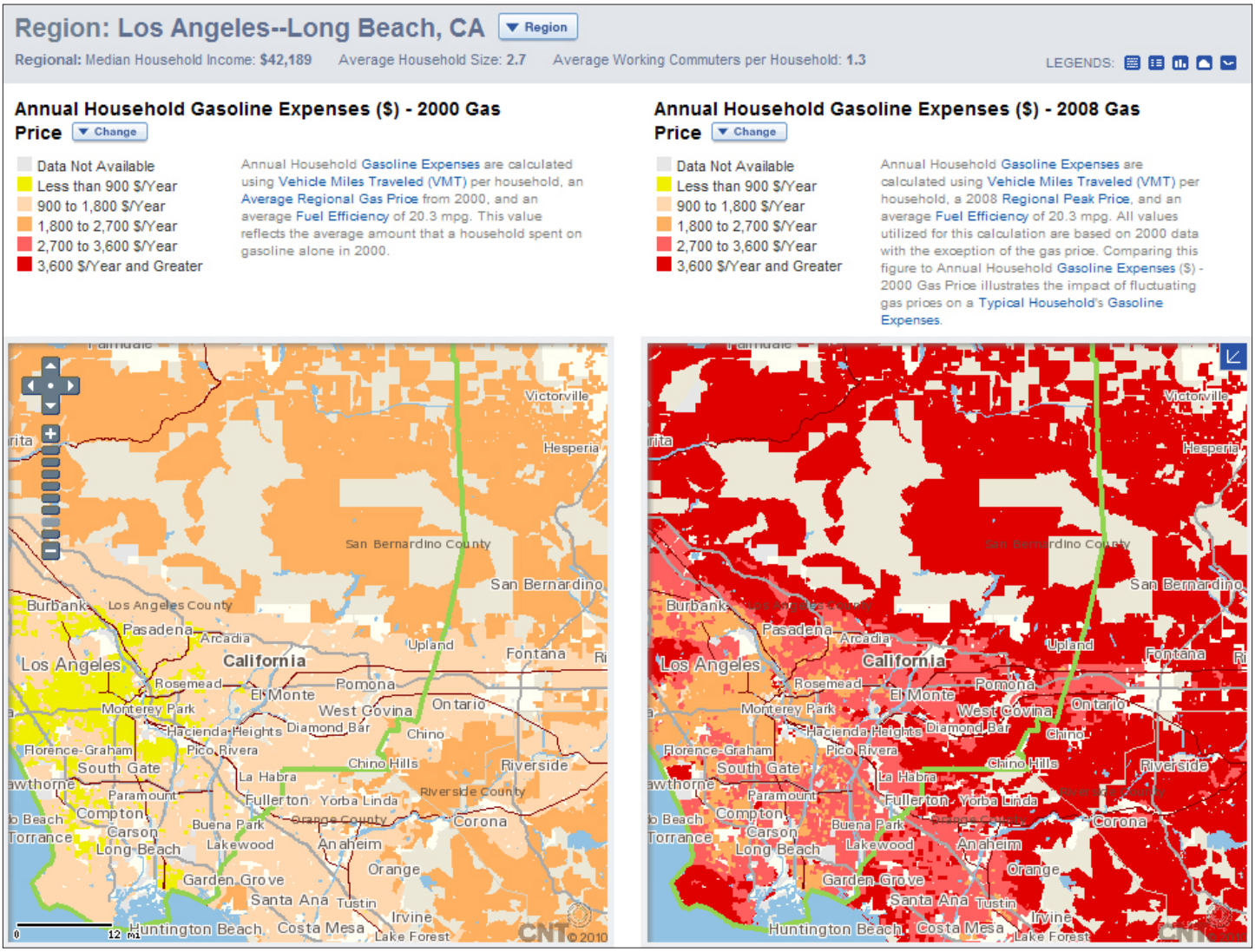
Candy Sweet looks for lumber at a newly-demolished house in Victorville.

such massively increased personal transportation costs, Victorville by 2009 had an extremely thin margin between what people *thought* they could afford and what they now *actually* could afford. By one estimate, Americans as a whole spend $1.25 billion less on consumer goods for each one-cent increase in the price of gasoline.[4] Thus by 2008, compared to 2005, consumers nationwide had $250 billion *less* to spend on cars, furniture, appliances, and all the other items families typically purchase when moving into a growing area like Victorville. To the alarm of real estate developers, city officials, and investors, the true total costs of living in Victorville (including gasoline and time spent commuting) also weighed heavily against market valuation.

Victorville's residents are mostly dependent on private cars to get to work—or anywhere else. The town has a few seldom-used local bus routes (less than 1 percent commute ridership) and, statistically in 2007, close to *zero* percent of people in town walked or rode bikes to get to work. Lacking other viable options, private cars are economic necessities in Victorville; they can also be serious economic burdens, especially in times of high gasoline prices (see figure 23.1). The same is true for millions of people living in similar exurban boomtowns across the U.S. Sun Belt.[5]

Mandatory car ownership is more than a financial burden—it constantly drains people's time and health as

FIGURE 23.1.
Annual household gasoline expenses, Los Angeles region (2000 vs. 2008).



Source: Map created with Housing + Transportation Affordability Index, copyright 2010 Center for Neighborhood Technology, http://htaindex.cnt.org/. Victorville is in the upper-right corner of the maps.

well as community and family involvement. Making matters worse, because San Bernardino County has only seven jobs for every ten working-age adults, many residents must become supercommuters to where there are more employment opportunities—such as Los Angeles County, which has nearly nine jobs for every ten working-age adults living in the county.[6] In 2007, almost a quarter of the people in Victorville spent more than two hours driving to and from work each day, and 10 percent wasted more than three hours in their daily work commute. At least partially because of traffic jams on the 80-mile route into Greater Los Angeles, 15 percent of commuters in Victorville in 2007 left home before 5 a.m.[7]

Victorville illustrates a story that became all too familiar over the past two decades in the United States, particularly in the West. The town's explosive growth—from 64,000 people in 2000 to 107,000 in 2007—was in part the result of lax land-use policies combined with a deregulated, no-holds-barred mortgage industry that approved loans for almost any live body that walked in the door. Home buyers and real estate investors also implicitly assumed that there

Ultimately, the car-dominant model of urban and suburban development is not sustainable.

would always be unlimited supplies of inexpensive water and, of course, cheap gasoline.

The rapid ascent of exurbia created conditions for steady nationwide growth in private-car ownership and driving (measured in "vehicle miles traveled"). By 2005, Americans on average were driving about 35 percent more than they were in 1980, and private-vehicle ownership had almost doubled since 1960.[8] Car ownership costs—at an average of $5,783 per vehicle—take an even greater toll on personal finances than fuel costs, which averaged $1,514 per vehicle in 2009.[9] In addition, the exurbs brought a flood of massive single-family homes built for size as symbols of affluence—but not for energy efficiency. In 2004 the average new house was 40 percent bigger than in 1970,[10] requiring additional energy to heat, cool, and maintain.

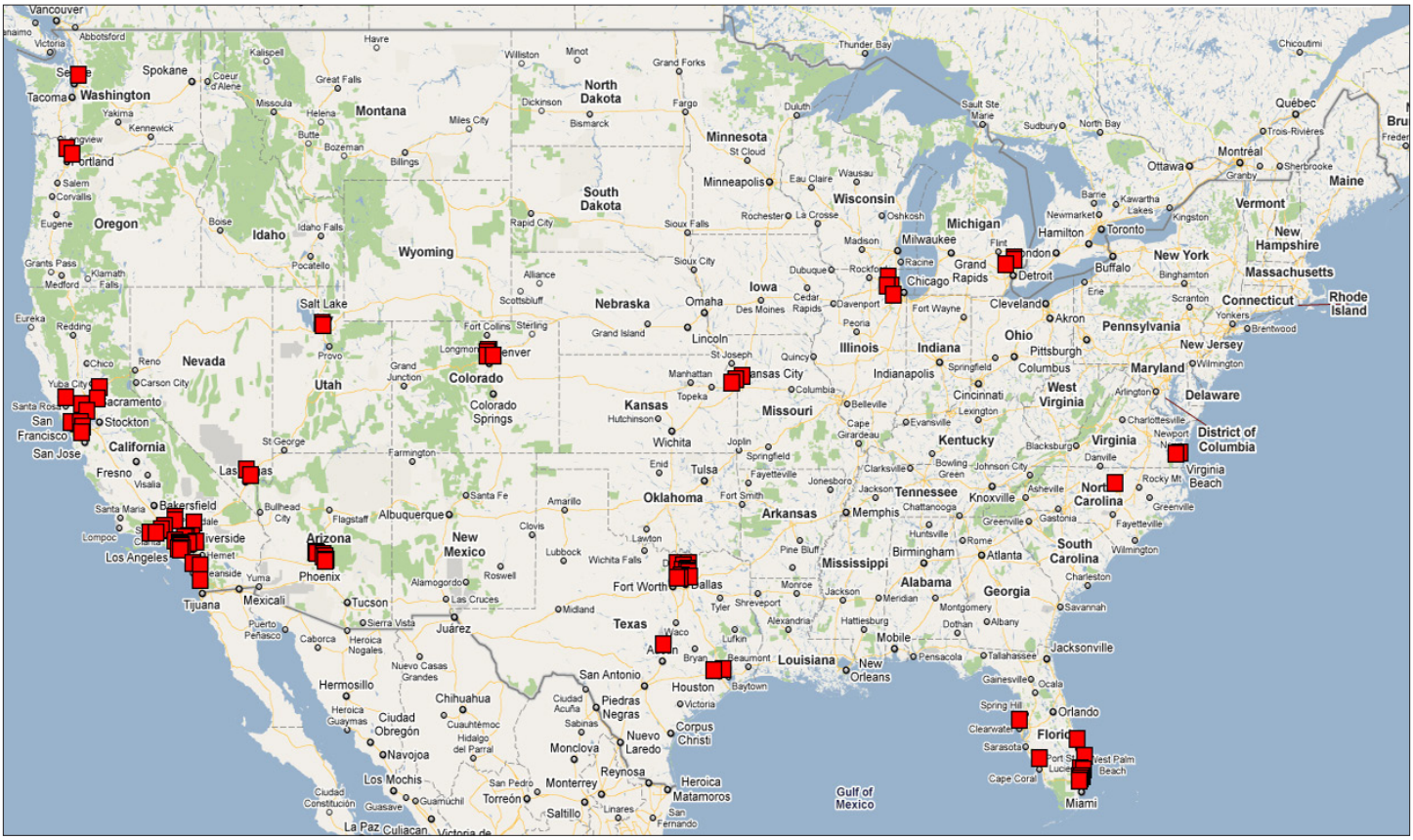
Even if cars are made to be more fuel efficient or eventually run on more renewable energy sources (e.g., solar-powered electric), the growth of large car-dependent communities will contribute to continued climate and environmental damage beyond tailpipe emissions. A significant amount of the carbon footprint produced by cars comes from their manufacturing, shipping, and eventual disposal. Indirect carbon impacts are also caused by constructing and maintaining parking spaces, roads, and other infrastructure.[11] The slurry of discharged auto fluids (oil, antifreeze, transmission fluids) that combines with particulates from engines and brake pads is a key source of water pollution in the United States, causing an estimated $29 billion a year in damages.[12]

Ultimately, the car-dominant model of urban and suburban development is not sustainable. Recognizing the limitations of this outmoded model is the first step in planning for our future of economic, energy, and environmental uncertainty.

Exurban Sunset: Failing the Milk Test

The least environmentally and economically sustainable form of urbanization over the past twenty years has been the exurb. Defined as smaller cities located outside of—yet dependent upon—major cities, exurbs usually are more than 50 miles from the original city center. Typically built on "greenfields" (a category that can include agricultural land as well as undeveloped wetlands, deserts, forests, or other biologically sensitive natural habitat), they leapfrog existing communities, jobs, and infrastructure. Even more than established suburbs, exurbs are designed almost exclusively for cars, needing massive supporting highway and parking infrastructure. A relatively new kind of exurb is the "boomburb," with populations over 100,000 and boasting double-digit percentage population growth within an average ten-year period.[13]

FIGURE 23.2.
"Boomburbs" in the United States.



Source: Data updated from http://en.wikipedia.org/wiki/Boomburb.

A quintessential boomburb, Victorville grew from 64,000 residents in 2000 to 107,000 in 2007, similar to the fast-growing population gains in other U.S. boomburbs during this time period. Relatively cheap real estate, flat land, and single-purpose zoning meant big profits for real estate developers and construction companies. Builders could easily and quickly build vast residential neighborhoods without thinking about where residents would work or how they would get there. Relaxed federal regulations on the financial industry meant first-time home buyers could "own" their home without a down payment, and sit back while home prices climbed.

And for a few years, climb they did. When home prices were rising in the region in the early 2000s, Victorville seemed like a sound investment. But by 2006 the price of gasoline began its steady ascent above $2 a gallon and a burst bubble in Victorville and other exurban housing markets created the first wave of foreclosures that helped set off a national economic crisis.

A complex and devastating chain of events began with people losing confidence in the seemingly ever-upward growth of exurban economies. Across the country, home foreclosures began to appear overnight in exurban hyper-growth markets, most notably inland central and southern California, Las Vegas, Phoenix, and much of Florida. The house of cards that had been built on cheap energy, imported water, easy lending terms, and massive speculation tumbled down like a tar-paper shack in a windstorm.

The nationwide exurban decline that has ensued may prove to be the last gasp of the Sun Belt's decades-long development frenzy. We will be absorbing or trying to erase the unwanted surplus of this

end-of-the-twentieth-century building spree for years, if not decades. A recent report by the Urban Land Institute and PricewaterhouseCoopers, "Emerging Trends in Real Estate 2010," cautioned commercial and institutional investors against spending a penny in exurban and outer-suburban markets: "Avoid neighborhoods wracked by foreclosures, especially in outer suburbs—these places may have no staying power." And "shy away from fringe places in the exurbs and places with long car commutes or where getting a quart of milk takes a 15-minute drive."[14]

Californian exurbs like Victorville will have to contend not only with dismal real estate outlooks but also with the ramifications of a statewide (and global) push to fight carbon emissions. In 2007 California successfully sued San Bernardino County, charging that its out-of-control growth endangered the state's air quality and its goals for greenhouse gas reduction.[15] San Bernardino and other California counties will now have to forecast the greenhouse gas emissions of future development and provide detailed actions for how they will keep total emissions within state limits—a major change in how communities are allowed or are not allowed to grow, and a precedent that other states may ultimately follow (see box 23.1).[16]

Remaining Functional

Exurban communities will need to do more than adapt to changing economics and regulations. In the long term, the biggest challenge of the exurbs will be keeping them *functional* after the global peaking of oil production.[17] Many exurbs—especially in the Sun Belt—will also need to contend with the regional peaking of freshwater availability. Again, Victorville illustrates this monumental challenge: Substantial amounts of electricity are needed to power the city's ubiquitous air conditioning (the average late July high temperature is 100 degrees), while the city's water comes from arsenic-contaminated groundwater supplies that are diminishing.[18] Moreover, like much of the rest of the nation, Victorville's food supply has become utterly dependent on a global corporate supply chain fueled by cheap oil. Even if the Inland Empire wanted to grow more of its own food, the lack of rainfall (less than 4 inches a year) makes agriculture without constant irrigation highly challenging.

The speculative model that came to a grinding halt in Victorville and at the fringes of dozens of other Sun

BOX 23.1.
California Assembly Bill 32 Climate Change Regulations' Impact on Metro Area Land Use Planning

In 2006 California's Assembly Bill 32 (AB 32)—the "California Global Climate Warming Act"—set for the first time in the United States a legal goal for greenhouse gas reduction: 80% of the state's greenhouse gases would have to be cut from 1990 levels by the year 2050. Next came California's Senate Bill 375 (SB 375), which in 2008 created a regulatory process for cutting transportation-related greenhouse gases by limiting the sprawl of communities (like Victorville) throughout California. SB 375 was the most ambitious statewide measure linking transportation investments, jobs-housing balance, and land use decisions ever initiated in the United States.[1]

These regulations mandate regional collaboration for land use and transportation planning. Each of the state's 18 regional Metropolitan Planning Organizations (MPOs) will have to come up with greenhouse gas reduction goals for transportation by September 2010, with each MPO required to create its own Sustainable Communities Strategy for meeting greenhouse gas targets.[2]

California had started a voluntary Regional Blueprint Planning Process in 2005 as way for regions to collaboratively plan transportation, development and resource use based on 20 to 30 year growth scenarios.[3] Regional Blueprints have proven to be important first steps in helping citizens visualize and then shape the future of their metro area. Through this process, people begin to understand the consequences associated with a lack of regional planning—including environmental and health consequences—which lead to declining quality of life and reduced regional economic competitiveness. Well-planned Regional Blueprints are powerful tools with the potential to cut carbon emissions, decrease congestion, reduce local air pollution, and make communities economically more attractive to residents, businesses, and visitors.

1 The actual greenhouse gas reduction goals that regions will need to achieve through this land use and planning will be set by the state in 2010, though penalties have not yet been defined.

2 Personal correspondence with Jeff Caton, ESA Associates, Oakland, California, September 25, 2009.

3 See http://calblueprint.dot.ca.gov/.

Belt cities was largely predicated on the underlying assumption that energy (whether for vehicles or for houses) would always be cheap and readily available, which led to high per capita community energy use and greenhouse gas emissions. But the world has changed. With climate change now an almost universally recognized challenge, and top analysts in government and industry warning of a global "oil crunch" by 2014–2015,[19] communities have little choice but to make better use of energy—through smarter practices in land use, transportation, and food production, and in the use of resources, particularly water.

Voting with Their Tires

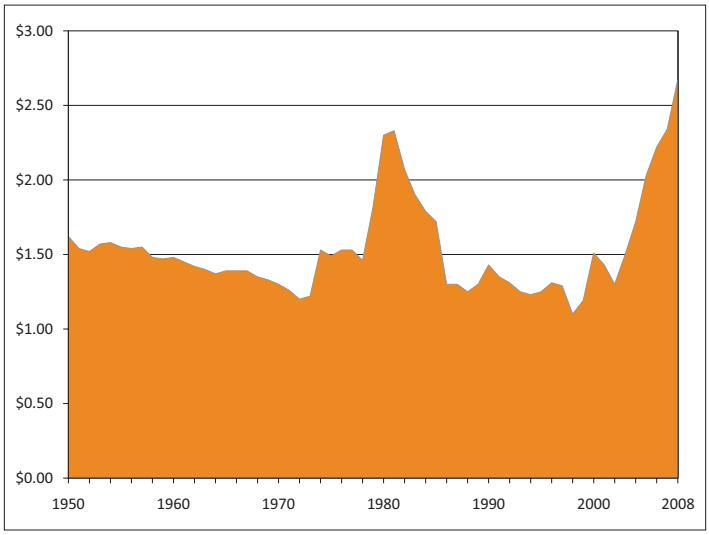
It is worth recalling that during the latter part of the twentieth century, urban living in the United States was widely viewed as an outmoded way of life, with high taxes, crime, blight, and vanishing manufacturing jobs. America's formerly urban middle class had been fleeing to the suburbs since the end of World War II, decimating inner-city economies while fueling near-continuous development in the suburbs and, by the 1980s, in the exurbs. Well into the twenty-first century, some experts went so far as to predict that the exurban development model was the key to the nation's economic future. Harvard economist Edward Glaeser, for example, argued that most boomburbs had two key ingredients necessary to drive economic growth: sun and sprawl. He even argued that the more cars a community had per person, the more likely that community would succeed economically.[20]

For a time, it seemed like Glaeser was right.[21] Not coincidentally, this was also the point when gas prices reached their lowest relative cost in U.S. history (see figure 23.3). But far from heralding the next era of the nation's suburban ascendency, boomburbs have proved instead to be the final expression of the unsustainable sixty-year development model driven largely by cheap oil.

Modern suburbia got its start in the 1950s when construction began on the federal Interstate Highway System.[22] Much of the system was in place by the 1960s, and vast areas of suburban and rural land were suddenly easily accessible from cities. Meanwhile, innovations in the mass production of tract housing and consumer goods made the cost of owning a new suburban home affordable to tens of millions of people. Together with the dominance of the United States in world oil production (which lasted until the late 1960s) and federal policies supporting both suburban house financing and road construction, the stage was set for the country's rapid suburbanization and concurrent deurbanization.

By the late 1980s and throughout the 1990s, ultra-cheap energy prices fueled the perfect conditions for the next phase of suburban development. Multiple "beltways" now ringed both large and medium-sized cities, while automobile manufacturers morphed the family car into the minivan and the oversized sport utility vehicle (SUV). Ever-larger gated communities of "McMansions"—served by malls designed not just for shopping but also for entertainment—sprouted beyond the farthest suburban edges and in between existing

FIGURE 23.3.
U.S. historic gasoline prices (dollars per gallon; real price in 2000 dollars).



Note: 1950–1975 prices are for leaded regular; 1976–2008 prices are for unleaded regular.

Source: U.S. Energy Information Administration, table 5.24, "Retail Motor Gasoline and On-Highway Diesel Fuel Prices, 1949–2008," in Annual Energy Review 2008, http://www.eia.doe.gov/emeu/aer/.

By the summer of 2008, the long era of gasoline-powered suburban expansion went into paralysis.

suburbs. New exurbs acted as petri dishes for different configurations of "big-box" retail centers and horizontal office campuses. Car ownership and vehicle miles traveled per person spiked dramatically upward, while once-vibrant downtown Main Streets were boarded up and left to fester.

Glaeser observed and condoned these cultural shifts in his foreword to Robert Lang and Jennifer LeFurgy's *Boomburbs: The Rise of America's Accidental Cities* (2007):

> Shopping malls increasingly play the role of downtowns. Lang and LeFurgy emphasize correctly that there is plenty of walking in boomburbs, but it takes place in the mall that you drive to. The boomburbs are able to deliver some sort of facsimile of a pedestrian experience, where people mix with each other and experience street life. The experience is, however, planned by developers rather than delivered by the chaotic functioning of the market. While traditional urbanists may find these malls no substitute for the market of the Ponte Vecchio, people do seem to be voting with their feet or at least their tires. It may make more sense to put effort into humanizing the mall than into reinvigorating many older downtowns.[23]

It wasn't just the physical appearance of the metro landscape that was transformed during the 1990s: Our own bodies began to change as well, despite all that walking in malls. The number of older adults (ages forty to seventy) not engaging in any regular physical activity increased from 15 percent in 1988–1996 to 35 percent in 2001–2006.[24] The main causes for this disturbing trend were attributed to longer commutes and more time spent on the computer.[25] Children began to have less physical activity because they were being driven more, and childhood obesity began to increase. In 1969 just over 40 percent of all children walked or bicycled to school; by 2001 this number had fallen to about 15 percent, and about half of all children were being driven to school in private vehicles.[26]

Cheap gasoline continued to drive runaway suburban and exurban growth into the twenty-first century. But in the middle of this century's first decade, around the same time that the term "peak oil" entered the public lexicon, oil prices began climbing, and quickly.[27] By the summer of 2008, when gasoline was more than $4 a gallon (over $5 in California) and oil hit an all-time record of $147 a barrel, the long era of gasoline-powered suburban expansion went into paralysis. As for future exurban development potential, the "Emerging Trends in Real Estate 2010" report summarized the inherent investment risks: "Road congestion, higher energy costs, and climate change concerns combine to alter people's thinking about where they live and work."[28]

BOX 23.2.
Future Resilient Cities of Asia and the Middle East

Some of the boldest attempts to build resilient communities can be found in a handful of brand new cities and urban districts emerging in the Middle East and Asia. Masdar, Abu Dhabi (United Arab Emirates), and a new "eco-city" district of Tianjin (China) are among the most anticipated; they aim to reduce carbon emissions as low as possible by making best use of energy-smart design and technology.

Masdar, meaning "the source" in Arabic, is a planned city of 50,000 scheduled to be completed by 2016.[1] Despite the inherent limitation of being located in a desert environment of severely limited resources, the project offers a surprisingly useful case study of how far sustainable design and technology can be taken in an urban environment. It boasts—in varying stages of planning, engineering and financing—systems for the production of necessities like sustainable building materials and mass-produced organic food, for both local use and export. Vertical gardens, rooftop greenhouses, and the use of local inputs for fertilizer, from algae to waste, represent a cutting-edge urban model of improved productivity. Masdar is the first large-scale attempt to create an "ecosystem" for clean technology development in renewables, with more than forty types of solar technologies from thirty manufacturers planned for testing. The city already serves as an innovation center for water, car-free transportation, smart grid appliance, and waste reuse technologies, as well as for the financing of sustainability projects with backing from companies like Credit Suisse and General Electric.

In Tianjin, China, a city of 12 million, a district designated as the "Eco-City" is being designed to rely on low-carbon or carbon-neutral transport options (bicycle, walking, public transit) for more than 90% of its 350,000 residents' trips; additionally, 20% of electricity is planned to come from renewable sources by 2020.[2] All construction in the Eco-City is being managed to meet new Chinese green building standards. Another hallmark of this Sino-Singaporean development is low water consumption; water is becoming a scarcer resource in much of northern China because its Tibetan Plateau water sources are being reduced by climate change.[3] If built as planned, the Tianjin Eco-City's carbon impacts will be significantly lower than that of conventional development projects in China.[4]

Partially because of a strategic commitment to increased renewable energy for its cities, China in 2009 overtook the United States for the first time in production of both wind and solar energy technologies.[5]

1 Abu-Dhabi Future Energy Company, "Welcome to Masdar," http://www.masdar.ae/en/home/index.aspx.

2 Enorth English Channel, "Sino-Singapore Tianjin Eco-City" (English), http://english.enorth.com.cn/system/2009/08/18/004166041.shtml.

3 Central Tibetan Administration, "Tibetan Plateau Under the Mercy of Climate Change and Modernization," http://www.tibet.net/en/index.php.

4 See "Key Performance Indicators of the Eco-City," Sino-Singapore Tianjin Eco-City http://www.tianjinecocity.gov.sg/ (accessed September 28, 2009).

5 Keith Bradsher, "China Leading Global Race to Lead Clean Energy," New York Times, January 30, 2010, http://www.nytimes.com/2010/01/31/business/energy-environment/31renew.html.

From Green to Resilient Cities

As the U.S. exurban era was experiencing a (final?) rise and fall in the twenty-first century's first decade, the "green" urban movement was coalescing in North America.

Before this watershed decade, "green buildings," downtown streetcars, urban farms, carsharing companies, high-quality bicycle infrastructure, and other physical features now associated with urban sustainability were found in only a handful of North American cities. Today, these hallmarks of green cities are popping up *everywhere*. Big cities like New York, Los Angeles, Vancouver, Toronto, and Chicago are actively trying to "out-green" each other, while suburbs like Boulder, Colorado, and Alexandria, Virginia, are rolling out their own localized sustainability solutions. Some communities have taken pioneering steps toward protecting their surrounding agricultural lands, or "foodsheds,"[29] from well-established regional plans and policies in Portland, Oregon, to a comprehensive local food policy in San Francisco.[30]

This multifaceted movement is spreading nationally and internationally as cities recognize that they can't just "grow smarter"—they have to fundamentally remake themselves to be resilient for the unprecedented economic, social, and environmental challenges of the twenty-first century (see box 23.2). In the United States, existing metropolitan areas can be retrofitted to take advantage of breakthroughs in sustainability and efficiency technologies, as well as new financial incentives. The American Recovery and Reinvestment Act

of 2009 provided some funding for the energy-efficient redesign of buildings and transportation infrastructure.

Growing a green economy will be a fundamental facet of urban resilience. Key areas of future job growth are in green building and landscaping, water-conservation technologies, low-carbon materials design, advanced low-carbon transportation, green information and communications technologies, and smart-grid development. Some metro areas are already becoming home to "clean-tech" centers with significantly high job growth rates.[31] Clean-tech clusters are emerging in the San Francisco Bay Area, Boston, and Austin, as well as in some less-obvious locations. In Toledo, Ohio, for instance, more than 4 percent of all jobs are now in research, development, and manufacturing for solar energy.[32]

Multiple, concurrent steps need to be taken to prepare our cities, towns, and suburbs for the future. When analyzing the early adopters of sustainability planning, seven overall strategies stand out. These strategies can be expanded from sustainability planning to *resilience planning*:

1. **Planning:** Enable the development of vibrant mixed-use communities and higher-density regional centers that create a sense of place, allow for transportation choices (other than private automobiles), and protect regional agricultural, watershed, and wildlife-habitat lands.
2. **Mobility:** Invest in high-quality pedestrian, bicycle, and public transit infrastructure with easy access, shared connectivity, and rich information sources, from signage to cell-phone alerts.
3. **Built Environment:** Design new buildings and associated landscaping—and retrofit existing buildings—for state-of-the-art energy efficiency (e.g., smart-grid applications) and resource efficiency, integrated with mobility options.
4. **Economy:** Support businesses to provide quality local jobs and meet the needs of the new economy with renewable energy and other green technologies and services. Support local and regional economic decision-makers in adapting to the new world of rising prices, volatile energy supplies, and national demographic shifts.
5. **Food:** Develop regional organic food-production, food-processing, and metro-area food-distribution networks.
6. **Resources:** Drastically cut the use of water, the production of waste, and the use of materials, reusing them whenever possible.
7. **Management:** Engage government, businesses, and citizens together in resilience planning and implementation; track and communicate the successes, failures, and opportunities of this community-wide effort.

Unexpected Behavior Changes

As examples in transportation, food consumption, and energy use demonstrate, citizen behavior changes are proving to be a major factor in the growth of green urbanism.

By 2008, high energy costs and the slowing national economy made U.S. citizens do something few economists predicted: They began to drive less and take public transit more. They surprised economists again by continuing to drive less even *after* gas prices plummeted in 2009. Nationally, vehicle miles traveled decreased 3.6 percent between 2007 and 2008, one of the largest yearly decreases on record. In U.S. metropolitan areas, public transit ridership swelled in 2008—4 percent more than in 2007, setting a fifty-two-year record of 10.7 billion trips by public transit in one year.[33]

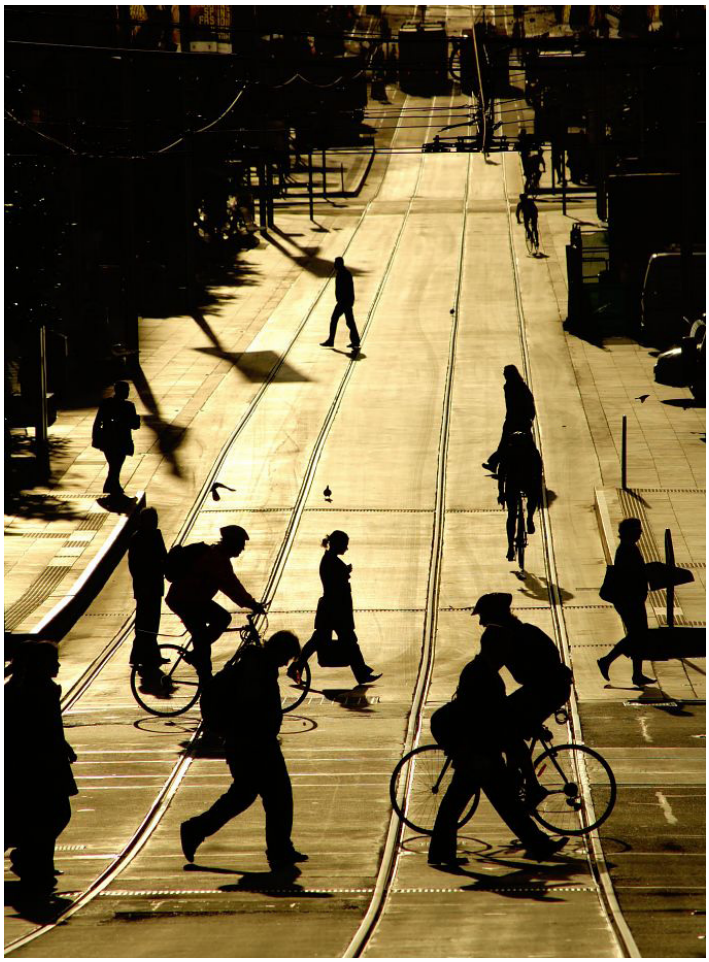
Cities that had already developed and maintained alternatives to private automobile travel saw nonautomotive commute rates rise as fast as pump prices. While most commuting U.S. citizens were behind the wheel in 2007, half of all commuters in Washington, D.C., San Francisco, and Boston went without cars, making use of their regions' already-existing and extensive transit infrastructure. In New York City, a full two-thirds

of commuters went to work car free. It wasn't only big cities experiencing this freedom of mobility: Residents of small cities and suburbs—like Cambridge, Massachusetts; Berkeley, California; and Evanston, Illinois—used transit, walking, or biking to get to work almost as much as they used cars to commute. Bicycling in particular became a viable form of transit: New York City's commute bicycle ridership increased 35 percent from 2007 to 2008, while Portland, Oregon, saw its already-impressive cycling trip rates double from 1997 to 2007, and then increase again by a third from 2007 to 2008.[34]

The quest for reduced fossil-fuel dependency and increased self-sufficiency has also begun to impact other sectors, especially food. Farmers' markets featuring locally grown and organic produce (which does not require fossil-fuel-based fertilizers and pesticides) have sprouted up like fresh shoots, first in downtown urban districts, then in outer-city neighborhoods, suburbs, and small towns around the country. The evocative concepts of foodsheds, "locavorism" (preferring local food), and even backyard chickens are taking root—or roost!

A few U.S. cities have made significant strides in developing opt-in renewable energy choices for their citizens and businesses, while also producing renewable energy and alternative fuels for local government's own needs. Austin, Texas, has one of the largest residential and business renewable energy programs in the country, providing nearly 800 million kilowatt-hours in wind energy from western Texas in a voluntary program through the city-owned utility.[35] San Francisco generates more than 2 megawatts of solar power from eight major projects on city buildings, funded by a voter-approved bond measure.[36] Many other western and midwestern cities are converting public vehicles to less carbon-intensive alternative fuels.[37]

Portland, Seattle, and Austin are leading the national drive to create energy- and resource-conserving green building ordinances, which started with city-owned buildings and then expanded to office buildings, condominiums, and houses. Early on, Portland and Seattle created privately funded cash incentives for developers to build to greener standards, supporting hundreds of projects and making the Northwest the leading U.S. region for energy- and resource-efficient building.



A key strategy of urban resilience planning is investing in high-quality pedestrian, bicycle, and transit infrastructure.

Thousands of miles of lanes and trails for pedestrians, cyclists, runners, and skaters are being created in cities and suburbs across the country. In New York City, bicycle lanes have appeared on major thoroughfares in every borough, and a world-class cycling/skating/walking trail now rings much of Manhattan Island. San Francisco began a program in 2009 to restrict private auto traffic on its busiest downtown bicycle thoroughfare.[38] Even suburban and exurban developments have begun to include "must-have" pedestrian and cycling

features like wide sidewalks, human-scale building facades, and dedicated bike parking—together with mixed-use zoning—so people can shop, eat out, play, work, and sleep in the same neighborhood without needing to drive so much. As significant as these efforts may be, however, they represent only an initial step in the long, complex task of systemically building the resilience of our communities for future energy and climate constraints.

Of the many differences between cities building for resilience and cities stuck in the unsustainable "boomburb" model, two stand out: transportation choices and regional planning. If Victorville and San Bernardino County represent the consequences of little or no planning, Portland, Oregon, represents a model of collaborative foresight.

Portland has been a national leader in transportation choices and regional planning since the 1970s, when an unlikely combination of state land-conservation legislation, regional waste-management needs, federal highway expansion plans, and local community activism led to the creation of:

- An urban growth boundary separating land for development from land for agricultural preservation.
- An elected regional government to coordinate and manage regional issues such as waste management, land-use planning, and transportation planning.
- One of the nation's first light-rail transit lines, built as an alternative to a new interstate highway extension.

Portland metro-area stakeholders drew a line between land for development and land for agriculture, and then invested heavily in public transit, bicycle infrastructure, and pedestrian infrastructure to make urban living as attractive and convenient as possible. The region has become one of the few metropolitan areas in the United States that can claim reduced vehicle miles traveled per household over the past fifteen years.[39] Today it is hard to believe that the Portland region once had declining property values and poor air quality. Many other metropolitan areas have recently noticed these obvious changes and have since followed Portland's forward-looking example, almost always with a primary focus on providing new multimodal alternatives to private car travel, largely through public transit.

BOX 23.3.
Portland's "Brewery Blocks"

While twentieth-century-style American suburbanization was racing madly to its end in Victorville and elsewhere, many older cities—notably New York, San Francisco, and Chicago[1]—were enjoying a re-development boom as new generations of young professionals and retirees consciously sought high-quality urban living. Portland, Oregon, the unassuming national poster child for energy-conscious land use and transportation, continued to forge new ground with its hit Brewery Blocks project.

The Brewery Blocks' five blocks of mixed retail, office and residential LEED-certified green buildings are based on integrated planning, real estate, and construction approaches that will need to be more commonplace if cities are to become better engineered for resilience. This public-private redevelopment project sold for $291 million in 2007 after the developer purchased the area as industrial land for $19 million in 1999.

Now an anchor for a whole redeveloped and pedestrian-friendly city quarter called the Pearl District, the Brewery Blocks are easily accessible by foot, bike, bus, free local streetcar, and regional light rail. The energy-efficient designs of the Brewery Blocks use not only the latest technologies but also preserve and showcase historic buildings and old-growth timber, providing jobs in preservation, architecture, deconstruction, and green construction.

Significant savings on transportation expenses are an added bonus of living and working in and near the Brewery Blocks. Households in Portland's Pearl District in 2008 paid an average of less than $75 in monthly gasoline costs, compared to a monthly average of $300 or more for Victorville's households.[2] And those that could get by without a car realized a savings of $5,500 to $10,000 per year (the average ownership, maintenance and fuel costs for a single car).[3]

1 After the apparent end of the Great Recession, some analysts characterized New York and San Francisco as "resilient" despite the economic downturn. See Urban Land Institute and PricewaterhouseCoopers, "Emerging Real Estate Trends 2010," p.29.

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These efforts represent only an initial step in the long, complex task of systemically building the resilience of our communities.

For metro regions across the country, transit systems might well become the difference between a functioning regional economy and an economy in chaotic free fall when gasoline once again becomes extremely high priced, scarce, or unavailable. Fuel-delivery disruptions in the Southeast provide a cautionary tale. The Southeast depends on two major pipelines to deliver petroleum products like gasoline and diesel from refineries on the Gulf Coast. But in September 2008, these pipelines were shut down when Hurricane Ike struck Texas and refineries across the region were forced to reduce or halt production. While U.S. oil reserves fell to their lowest level in more than forty years, Atlanta, Nashville, Knoxville, Charlotte, and many other southeastern cities suffered intermittent fuel shortages for weeks.[40] In most of these cities, few alternatives to private vehicles exist to move people and goods around, and outraged residents, businesses, and city officials were left stranded.

In addition to being at risk for energy-supply disruptions, either from natural disasters or from other threats, urban areas have another large-scale consideration: the need to reduce their greenhouse gas contributions while adapting to the already unavoidable effects of climate change. Climate change mitigation will be a serious challenge for all communities, but will be especially difficult and costly for car-dependent, sprawling suburbs and towns. Large freestanding houses and one-story office campuses with manicured lawns need far more energy and resources to heat, cool, clean, and water than smaller houses, row houses, apartments, and multistory offices landscaped with native plants.

In contrast, compact developments in cities and suburbs save energy beginning with physical proximities: Shared walls mean shared heating, cooling, and insulation. Accommodating growing populations and expanding businesses with repurposed existing buildings—rather than constructing new buildings—is another energy saver; rehabilitating and retrofitting areas that have already been built means that new streets, curbs, sidewalks, and utility lines often do not need to be installed. Compared to exurban sprawl, where all amenities have to be created with each new development, the infrastructure of denser preexisting urban environments saves energy and water and reduces waste because of shorter and more efficient electric, sewage, and water distribution lines.[41]

Building for energy and climate resilience represents a safer investment, as evidenced during times of high instability in energy prices. From 2006 to 2008, a period of unprecedented exurban real estate collapse, many exurban communities experienced 30 to 50 percent year-to-year property value decreases.[42] In contrast, property values in communities served by public transit, bicycling, and walking held up very well, and some of these areas actually *increased* in value during this

tumultuous period. According to "Emerging Trends in Real Estate 2010":

> The lifestyle cost-of-living equation starts to swing away more dramatically from bigger houses on bigger lots at the suburban edge to greater convenience and efficiencies gained from infill housing closer to work. These homes may be more expensive on a price-per-pound basis, but reduced driving costs and lower heating/cooling bills provide offsets... near-in suburbs will do well especially if they link to business cores by mass transportation.[43]

Getting to the Resilient City

If the "Great Recession" that began in late 2008 taught us anything, it is that allowing the unrestrained sprawl of energy-inefficient communities and infrastructure is a bankrupt economic development strategy and constitutes a recipe for continued disaster on every level. Twentieth-century-style sprawl has destroyed valuable farmland, sensitive wildlife habitat, and irreplaceable drinking-water systems at great environmental, economic, and social cost. We can no longer manage and develop our communities with no regard for the limits of natural resources and ecological systems that provide our most basic needs.

What lessons emerge from metropolitan areas that have begun to plan for the future by building their resilience with economic, energy, and environmental uncertainty in mind?

BUILD AND REBUILD DENSER AND SMARTER

Most suburban and urban population densities need to be increased so that energy-efficient transportation choices like public transit, bicycling, and walking can flourish. Multimodal mobility cannot succeed at the densities found in most American suburban communities today.[44] Increasing density doesn't have to mean building massive high-rises: Adding just a few stories on existing or new mixed-use buildings can double population density—and well-designed, increased density can also improve community quality of life and economic vitality.[45] Resource-efficient building technologies, as rated and certified by the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED) green building program or the U.S. Environmental Protection Agency's Energy Star rating, can be retrofitted onto existing building stock and mandated for all new construction.

TRACK AND MEASURE PROGRESS AND CONSIDER STANDARDS

As communities increasingly come under the stresses of extreme weather induced by climate change—more frequent heat emergencies, smog alerts, floods, water shortages, and power outages—planning for resilience will be seen as an act of survival, not ingenuity or trendiness. But without implementation of large-scale resilience planning based on standards and measures, individual programs will have isolated impacts. Promising ways to measure the resilience of urban systems are being devised and refined, such as LEED for Neighborhood Development (LEED-ND), which gives credit for mixed real estate uses and access to public transit for neighborhoods or developments. On the citywide level, sustainability standards and measures are emerging from organizations like ICLEI–Local Governments for Sustainability and the Global Footprint Network.[46]

FOCUS ON WATER-USE EFFICIENCY AND CONSERVATION

Our freshwater supply is one of our most vulnerable resources in the United States. Drought is no longer just a problem for southwestern desert cities—communities in places like Texas, Georgia, and even New Jersey have recently had to contend with water shortages. As precipitation patterns become less reliable and underground aquifers dry up, more communities will need to significantly reduce water demand through efficiency, conservation, restrictions, and "tiered pricing" (which means a basic amount of water is available at a lower

price while above-average use becomes increasingly more expensive).

Global climate change is already known to be melting mountain snowpack much earlier than average in the spring, causing summer and fall water shortages. This has serious planning and design implications for many metro areas. For example, Lake Mead, which provides 90 percent of the water used by Las Vegas and is a major water source for Phoenix and other cities, has a projected 50 percent chance of drying up for water storage by 2021.[47] The days are likely numbered for having one's own swimming pool and a large, lush, ornamental lawn in the desert Southwest, unless new developments and urban growth are planned with water conservation having the highest design priority.

FOCUS ON FOOD

Urban areas need to think much bigger and plan systemically for significantly increased regional and local food production. Growing and processing more food for local consumption bolsters regional food security and provides jobs while generally reducing the energy, packaging, and storage needed to transport food to metro regions. In Asia and Latin America—even in big cities like Shanghai, China; Havana, Cuba; and Seoul, South Korea—there are thriving small farms interspersed within metro areas.[48] Gardens—whether in backyards, community parks, or in and on top of buildings—may supplement people's diets with fresh local produce. Suburbs around Denver, for instance, have organized to preserve and cultivate unsold tract-home lots for community garden food production.[49]

THINK IN TERMS OF COMBINED RISKS

The costs of energy from systems overly or solely dependent on fossil fuels, particularly coal-fired power plants, will be severely impacted by carbon-reduction regulations as well as the global decline of economically viable fossil-fuel resources. Petroleum supplies for transportation will also be at great risk of supply

Urban areas need to significantly increase regional and local food production.

disruptions, whether natural (hurricanes) or man-made (terrorism, warfare, political acts).

Communities and regions should decide for themselves which initiatives reduce their economic risks and provide the greatest "bang for the buck." As we learned with Wall Street's financial-derivatives crisis in 2007, we can't rely on government or conventional wisdom to identify all the big risks to our economy—and what we don't know *can* hurt us. Imagine if Las Vegas informed its residents and tourists on one 120-degree summer day that they would not be able to wash the dishes or take a shower, let alone golf, because there simply wasn't any water left. Whole regional economies will be threatened if we continue making decisions about how we use resources and energy without considering the risks of future energy and climate constraints.

THINK IN TERMS OF INTERRELATED SYSTEMS

If we think of our urban areas as living, breathing entities—each with a set of basic and more specialized requirements—we can better understand how to transform our communities from near-random configurations into dynamic, high-performance systems. In the same way that food, water, and oxygen make our own bodies run, we can think about the flows of resources that make urban systems run, and then con-

There is unprecedented opportunity to challenge and overcome the bankrupt status quo.

sider what we might do to improve the "metabolism" of that system.[50]

For example: More people living in southern California means more people wanting scarcer water. The conventional response might be to build more infrastructure to capture and pump more water from the Sierra Nevada to the cities and suburbs. A systems analysis, however, would note that water procurement over long distances and treatment can account for as much as 20 percent of electric power use (as is the case in California),[51] and that energy prices and supplies are only going to be more volatile in the future. Another energy-water nexus can be found in the solar-thermal power plants in the desert which happen to require large amounts of water for cooling, thus competing for scarce drinking-water supplies.[52] These accelerating system dependencies complicate management approaches for communities across the region.

By thinking of urban areas as interrelated systems economically dependent on water, energy, food, and vital material resources, communities can begin to prepare for a more secure future. Merely developing a list of topics that need to be addressed—the "sustainability checklist" approach—will not prepare regional economies for the complexity of new dynamics, such as energy- or water-supply shortages, rising population, extreme volatility in energy prices, and accelerating changes in regional climate influenced by global climate change.

Challenge and Opportunity

In the wake of global climate change, fossil-fuel depletion, water scarcity, and the worst economic crisis since the Great Depression, there is unprecedented opportunity to challenge and overcome the bankrupt status quo. Globally and nationally, large-scale research, planning, and management practices are just beginning to be mobilized in response to these threats to our civilization. Preparations at the regional to local level, however, are often more effective than national actions because they have the ability to be more nimble as they are based on local climate, cultural, and economic conditions and needs. The era of peak oil and climate change requires that communities determine how they can best prioritize building their own resilience for an uncertain future.

The world has moved rapidly toward an urban existence. We must immediately transform the way we plan and build our cities and suburbs so that resilience is an integral part of every community's design. We need to synthesize often fractured and specialized knowledge. Citizens, businesses, and elected officials will need to contribute their skills, creativity, leadership, and expertise to this massive effort. It is imperative that "know-

how" and state-of-the-art management and cultural practices are shared among our existing cities and even faster-urbanizing regions such as Asia.

Cities and suburbs have long been thought of as separate entities from nature or "the environment." That false dichotomy has come and gone: Both impact nature and are supported by it. The way we—and the rest of the world—redesign our communities for the energy and climate constraints of the twenty-first century will determine the fate not only of our nations but also of Earth's climate and the well-being of every species, humans included.

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Acknowledgments

Cover art by Mike King. Design by Sean McGuire. Layout by Clare Rhinelander.

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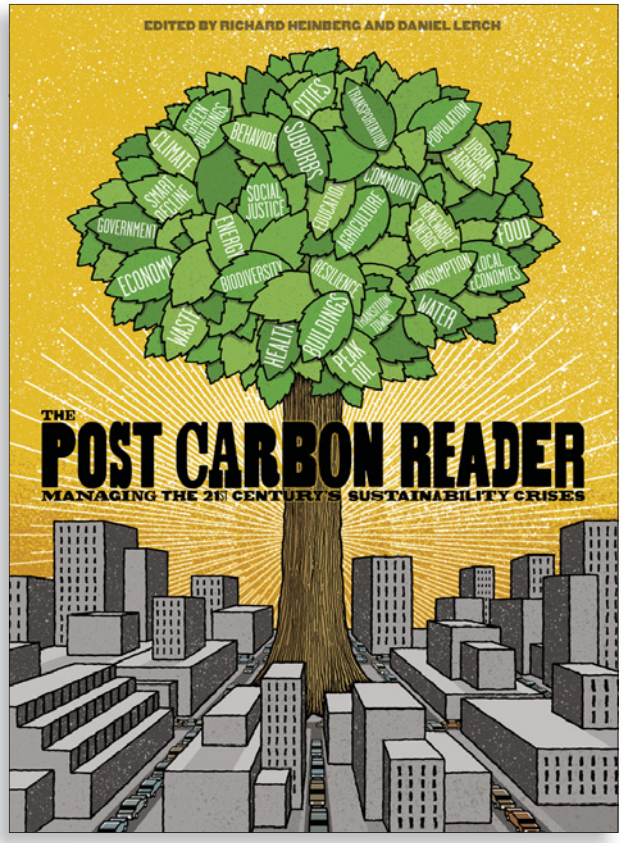

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