



Boston University Institute for Sustainable Energy



Boston University Initiative on Cities



Innovation Network
for Communities

Climate of Crisis:

How Cities Can Use Climate Action to Close the Equity Gap, Drive Economic Recovery, and Improve Public Health

September • 2020



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This report is the second of three that provides community leaders, inside and outside of local government, with guidance about navigating their climate-action priorities through the gauntlet of challenges created by the COVID-19 pandemic and the ensuing economic crisis. Each report, based on a synthesis of peer-reviewed research, expert interviews, and the analysis of local climate action, address a different topic:

- **More Urgency, Not Less: The COVID-19 Pandemic’s Lessons for Local Climate Leadership** (Published June 2020)
- **Climate of Crisis: How Cities Can Use Climate Action to Close the Equity Gap, Drive Economic Recovery, and Improve Public Health** (Published September 2020)
- **A Survey of U.S. City Climate Leaders: The Prospects for Climate Action in the COVID-19 Era** (October 2020)

This work is supported by The Summit Foundation and The Grantham Foundation for the Protection of the Environment.

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Executive Summary

The purpose of the report is to support city and other local officials in their response to the events of 2020: the COVID-19 pandemic, a severe recession, a wave of social protest, and the ongoing imperative to respond to climate change. We provide new insight to the cause and confluence of these stressors, and suggest ways to blunt the short-term setbacks while simultaneously strengthening the foundation for sustained and equitable climate action that improves well-being for all. Our approach has a strong social equity component because the events of 2020 underscore that equitable life opportunities is a necessary condition for sustainability. Our intentional focus on equity reveals many “win-win” opportunities across the economic, social, and environmental landscapes of cities.

City governments can seize the moment by treating climate change with the same urgency and resolve as the pandemic. Delay today will substantially raise future costs. Like climate change, the pandemic illustrates the importance of decisions that are grounded in sound science and systems thinking. This approach will prioritize actions that generate simultaneous benefits across health, equity, the economy, and climate. Effective response may require adjustments that break down barriers across departments in government. The full complement of benefits from action on climate, health, and economic recovery come to fruition if decision making is transparent and inclusive. Government officials can lead by strengthening approaches that more deeply involve communities, and by making equity a key organizing principle.

COVID-19 has disproportionate health impacts on socially vulnerable populations that mirror longstanding disparities in American society, some of which are worsened by the pandemic. Families of color and low-income residents are experiencing higher job loss, slower job recovery, greater food insecurity, fewer opportunities to telework, and lower access to high-speed Internet, and they are more likely to be “essential” workers. These are deeply troubling outcomes, but city governments have the opportunity to respond in ways that dampen short-term pain while boosting long run recovery and resiliency. The elimination of food deserts and food swamps will shrink health disparities and lessen the impacts of future pandemics and heat stress caused by climate change. Closing the digital divide will shrink gaps in education and social connectivity while increasing access to information on clean energy and energy efficiency.

We provide compelling evidence that, contrary to some public opinion, the high concentration of people, economic activity, and social connectivity in cities confer benefits that far outweigh their costs. Infection and mortality due to COVID-19 are strongly related to the behavior of people and institutions, not to density per se. On average, urban residents have higher wages, lower death rates, and better access to emergency services compared to rural residents. Many of the attributes that make cities healthier and better prepared for emergencies also reduce energy use and greenhouse gas emissions per capita and per household. Those benefits are realized through compact cities that encourage cycling and walking, enhance public transport, mix land use, maintain accessibility to local services

and jobs, and build enough housing to give an affordable entry point to those who want access to the opportunities these places offer.

The transition to a low-carbon, energy-efficient way of life should not be derailed by the pandemic and ensuing recession. Prior to the pandemic, clean energy was on a roll and coal was in retreat. The economic shockwaves of the pandemic roiled the markets for clean energy, disrupted supply chains for wind and solar, and led to some project cancellations and delays. But there are other forces at work that are likely to maintain, and could substantially strengthen, the momentum behind clean energy and energy efficiency. Supply chains are quickly recovering, the cost advantage of wind and solar will widen, and the pandemic has motivated companies and governments from around the world and at every level to deepen their commitment to decarbonizing their energy systems as part of economic recovery. Clean energy and energy efficiency create substantial new opportunities for local workforce development.

The events of 2020 produced changes in some aspects of city life that demand urgent attention. The shutdown that accompanied the pandemic caused a precipitous decline in public transportation, and a commensurate fall in revenue. In addition to economic and social disruption, a long-term retrenchment in public transit will hamper efforts to reduce greenhouse gas emissions and improve public health if people revert to private vehicles. The momentum behind zero waste is retained by blunting the surge in plastic pollution and emphasizing the health, economic, climate, and environmental justice benefits of waste reduction, recycling, and composting.

The pandemic produced a renewed appreciation for green and open space in cities. People flocked to parks and plazas for mental, emotional, and physical relief when restrictions were lifted. Cities have an unprecedented opportunity to use this moment to make an investment in green space that will return a range of health, social, economic, and environmental benefits that also close the equity gap if properly implemented. In a similar vein, experiments with slow and shared streets reveal new potential for the vast amount of space devoted to private vehicle infrastructure. The deep and broad health benefits of walking and biking can dampen the potential health stress presented by pandemics and climate change.

Through this report we emphasize what cities can do to meet the challenges of accelerating climate action in ways that aid economic recovery, improve the foundation of public health, and improve the quality of life for socially vulnerable populations. The accompanying table summarizes those opportunities.

Table ES-1. Summary of What Cities Can Do

<p>Seize the Moment</p>	<ul style="list-style-type: none"> • Treat climate change with the same urgency and resolve as a pandemic; delay today will substantially raise future costs. • Communicate the imperative to use sound science in public health and climate action. • Prioritize actions that generate simultaneous gains across health, equity, the economy, and climate. • Adjust decision-making (including budgeting) to break down barriers across departments. • Implement transparent and inclusive decision making, including collaborative governance structures that bridge the divide between community and government. • Recognize that improved equity needs to be a key organizing principle in all decision-making.
<p>Close the Digital Divide</p>	<ul style="list-style-type: none"> • Improve access to information on clean energy, energy efficiency, transportation services, home energy use, waste reduction, health, and climate resiliency with: <ul style="list-style-type: none"> • Granular knowledge of internet access, cost, and utilization for socially vulnerable populations. • Pressure on federal regulators to eliminate digital redlining, and to cede more power to local governments. • Better, cheaper broadband access; more mobile hotspots and free public Wi-Fi. • Expanded partnerships to provide free or reduced cost devices, access, technical support, and digital literacy training. • Design climate action that does not rely exclusively on use of the Internet.
<p>Ensure Access to Healthy, Affordable Food for All</p>	<ul style="list-style-type: none"> • Eliminate food deserts and food swamps via zoning, real estate tax reductions, density bonuses, reduced parking requirements, and creation of mobile markets. • Limit or prohibit the sale and marketing of unhealthy food to children. • Expand public outreach and education on healthy eating. • License and provide public financial assistance for food retailers. • Expand urban food production. • Increase transportation access to supermarkets and farmer’s markets.
<p>Capture the Diverse Benefits of City Life</p>	<ul style="list-style-type: none"> • Assess the role of demographic factors (density, crowding) in COVID-19 infection and mortality. • Use the impact of and response to the pandemic as an opportunity to communicate the economic, social, and environmental benefits of cities. • Zone and invest in compact urban development that encourages cycling and walking; enhances public transport; mixes land use; maintains accessibility to local services and jobs; and increases affordable housing.

Drive the Clean Energy Transition	<ul style="list-style-type: none"> • Demonstrate that commitment to clean energy is not derailed by short term economic disruption. • Assess and communicate the health, workforce, and equity benefits of renewable energy and energy efficiency. • Increase investment in carbon-neutral and climate-resilient mobility (public transit, clean EVs, biking and walking). • Increase investment in building energy efficiency to generate jobs and reduce utility bills; couple with more affordable housing. • Invest in in-city solar PV; focus on low-income communities and building local workforce. • Lobby states and utilities to expand clean energy and energy efficiency programs. • Oppose the Federal bailout of oil and gas companies, and rollback of efficiency and pollution standards; support clean energy in recovery proposals. • Lobby for stable, supportive regulatory regimes for wind and solar.
Rejuvenate Public Transit and Expand Biking, Walking, and Slow/Shared Streets	<ul style="list-style-type: none"> • Pair city action with public behavior campaigns that raise awareness of the health, climate, economic, and equity benefits of public and active transport. • Assess and close equity gaps in quality, cost, and access to public transit, biking, and walking. • Assess and communicate experience of recent slow/shared streets pilots; expand scale and scope and make permanent. • Restore public trust in the safety of public transportation: increase cleaning, require face masks, reduce maximum passenger capacity, and accommodate shifting schedules, including essential workers. • Keep public transportation workers safe and equipped with proper PPE. • Assess and implement new revenue sources for transit (parking charges, congestion fees, real estate fees, tolls, business license taxes, registration fees, gasoline taxes). • Lobby for increased public transit funding at state and regional levels. • Combine GHG reduction and climate resiliency in all transportation planning. • Reduce transit cost to low-income residents. • Address the last mile problem via increased shuttles, biking, and micro mobility.
Reap More Benefits of Green Space	<ul style="list-style-type: none"> • Assess quality, quantity, and equity of access to all current green space. • Assess and communicate the health, economic, social, and climate resilience benefits of green space. • Assess new areas for conversion to green space (remediated industrial sites, etc.). • Avoid ecological gentrification with a deliberate commitment to equity; direct funds towards historically underinvested neighborhoods.
Maintain Momentum on Zero Waste	<ul style="list-style-type: none"> • Communicate the urgent need to reduce plastic pollution, and identify alternatives to plastic, including PPE in healthcare. • Drive retailers and residents back to the use of reusable bags and materials in a manner consistent with health science. • Communicate the public health risks and lifecycle assessment of the environmental impacts of disposal, recycling, composting, and waste to energy facilities. • Plan and implement a zero-waste initiative.
Prepare for More Telework	<ul style="list-style-type: none"> • Assess the extent to which a shift to teleworking can occur by sector, occupation, and number of jobs, including local government. • Reassess GHG reduction strategies based on shifts in energy end use and fuel shifting. • Assess the equity impacts of more telework and adopt measures to close equity gaps.

Navigating the Challenge of COVID-19, Climate, and Social Equity

The Year of Living Dangerously

In 2020, cities have been battered by simultaneous crises (Figure 1). The most obvious and most painful is the COVID-19 pandemic that has killed more than 200,000 Americans as of mid-September 2020, and left thousands more with ongoing health concerns. The economic shut down caused Gross Domestic Product to drop by one-third in the second quarter of 2020, the sharpest economic contraction in modern American history. Unemployment reached 15 percent in April 2020, five percentage points higher than the peak during the Great Recession of 2008-2009. The massive economic downturn was accompanied by an equivalent historic decline in the demand for the liquid fuels that power most of our cars and planes. The pandemic roiled energy markets. The price of oil—the lifeblood of the global economy—dropped by a factor of four from January to April, 2020. Supply chains were severely disrupted for goods ranging from solar panels to basic foodstuffs.

In the spring of 2020 America's streets and social media filled with protests over the death of George Floyd at the knee of a Minneapolis police officer. Floyd's death—the latest in a lengthy list of Black Americans killed by police¹—brought to a boil people's anger over the persistent, deep inequities in life experience and opportunity. The 15 million to 26 million people who participated in the Black Lives Matter protests in June were the largest protest movement in the country's history.² While protests filled the streets, Black Americans were dying from COVID-19 at 2.4 times the rate of White Americans.³

Laser-like focus on the health and economic impacts of the pandemic may seem at odds with climate action because we have mistakenly put the pandemic and climate change in different categories: one is urgent and short term, the other is less urgent and long-term. Most people and institutions tend to discount the well-being of future generations, so in both our thinking and in our budgeting, we place climate action as a lower priority. A death from the coronavirus and a job lost due to recession are tangible and measurable. Worse inequity between rich and poor and Black and White Americans due to extreme heat and coastal flooding from climate change is more difficult to measure and is less tangible.

Here are three considerations that might improve how we approach these problems.

First, climate change and the pandemic share many of the same threat attributes: they are global; vulnerable populations bear more of the burden of their impacts; they cause widespread economic disruption; they diminish public health; they are threat multipliers; and their mitigation requires sound science to inform decision making. Such similarities mean that we should think about them in a similar manner.

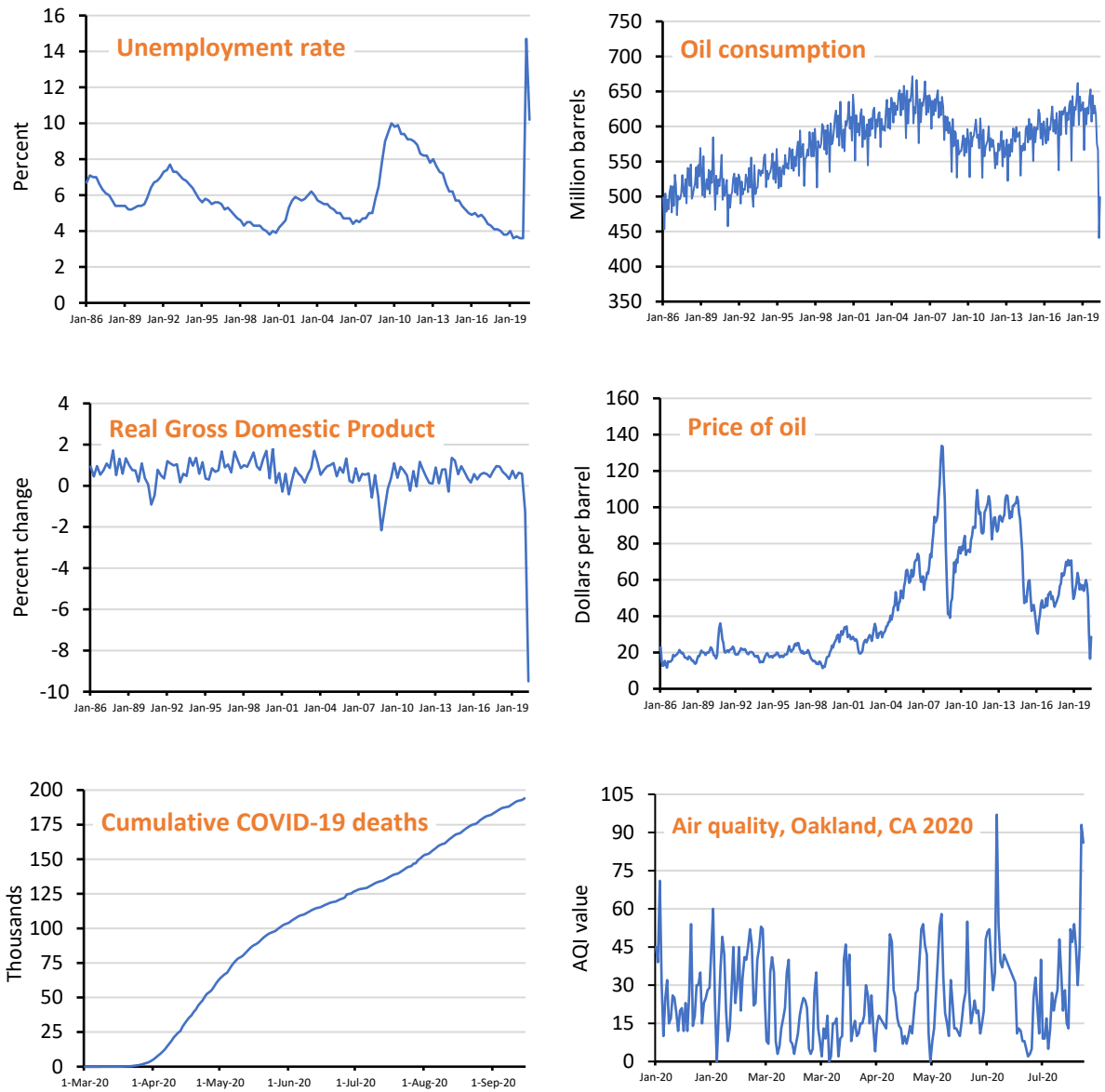


Figure 1. Economic, energy, health, and air quality impacts of the COVID-19 pandemic. Note that the times scales for the COVID-19 and air quality charts are different than the others. *Sources:* Bureau of Economic Analysis, Department of Commerce; Energy Information Administration; Department of Energy; Environmental Protection Agency; USA Facts

Second, researchers in attribution science⁴ provide compelling evidence that anthropogenic climate change inflicts serious harm on people *today*. Consider these events in 2018:

- Temperatures reached 41.1 degrees Celsius (106 °F) in the 2018 Japan heat wave, the hottest temperature ever recorded in the country. The heat wave killed more than 1,000 people and hospitalized tens of thousands. Scientists concluded that the heat wave would never have happened without anthropogenic global warming.⁵
- The fire season of 2018 was the most extreme on record in Northern California in terms of the number of fatalities (95), over 22,000 structures destroyed, and over 600,000 hectares burned.⁶ Attribution research concluded that anthropogenic warming is a major cause of the longer and more extreme fire seasons in California.⁷ The catastrophic fires in the Northwest in 2020 were due in part to the ongoing aridification (drying out) of North America.⁸
- A persistent heavy rainfall event in the summer of 2018 in central western China caused floods, landslides, and house collapses, affecting 2.9 million people and resulting an economic loss of over 8.9 billion Yuan (1.3 billion U.S. dollars). Attribution research concluded that anthropogenic warming has caused a 50 percent increase in the likelihood of extreme rainfall events in that region of China.⁹



Burnt out vehicles abandoned along the evacuation route from the Camp Fire near Paradise, CA in 2018. *Credit:* The National Guard

The science urges to us to move climate impacts from the “long-term” list of priorities to the “short-term” list. Walking away from or delaying crucial climate actions risks disastrous and inequitable local consequences because what are now considered “extreme” events will increasingly be the new normal, and because delay will cause the human and environmental costs to pile up in the future.

The third motivation for a new way of thinking has to do with interconnections. Climate change, public health, and equity are tightly linked. One can plausibly construct a pessimistic scenario of how these forces play out. The pandemic has worsened inequity and could increase greenhouse gas emissions if a fear of public transportation causes people to drive more personal vehicles. More traffic increases harmful emissions, intensifying the effects of climate change and disproportionately harms socially vulnerable populations. Poor underlying health conditions set the stage for a future pandemic. At the same time, climate change already has an inequitable impact on public health via compromised air quality,

increased heat waves, flooding, and other impacts. Climate change will worsen some vector-borne diseases, and environmental degradation will increase the incidence of zoonotic diseases such as COVID-19, Ebola, Lyme and HIV.¹⁰ These interconnections could form a downward spiral in the quality of life.

But one can plausibly envision a much more desirable future, one in which these interconnections are steered in a positive direction that expands life possibilities for all and improves environmental quality. Investment in green space reduces inequity, improves public health, increases active transport, creates jobs, and reduces flood risk associated with climate change. The same series of outcomes can be produced with investment in energy efficient affordable housing, public transport, zero waste initiatives, rooftop solar and other climate actions.

A city that achieves these positive outcomes and is resilient in the face of such threats is realized via action that makes equity an explicit, central organizing principle; that is based on sound science; that is capable of overcoming entrenched ways of thinking and powerful special interests; and that effectively engages and communicates with all constituencies.

Who, Why, and How?

The primary audience for this report is city and other local government officials with responsibility for climate action plans and, more generally, for any action related to sustainability. We hope it will reach people outside the Office of Sustainability in city halls because effective, equitable action requires new levels of cooperation across every department. Action that effectively reduces greenhouse gas emissions and bolsters resilience against flooding and extreme heat requires input on housing, streets, waste management, finance, and parks and recreation, among others. We expect that the report will also be useful for the constellation of people and organizations that work with cities and towns every day to improve the quality of life for residents.

The purpose of the report is simple. We hope to help city and other local officials understand and respond to the events of 2020: the COVID-19 pandemic, a severe recession, a wave of social protest, and the ongoing imperative to respond to climate change. We provide new insight to the cause and confluence of these stressors, and we suggest ways to blunt the short-term setbacks while simultaneously strengthening the foundation for sustained and equitable climate action that improves well-being for all. Our approach has a strong social equity component because the events of 2020 underscore that equality of life opportunities is a necessary condition for sustainability. Our intentional focus on equity reveals many “win-win” opportunities across the economic, social, and environmental landscapes of cities.

The roadmap to this report is as follows. We begin by describing the interconnections among climate change, the COVID-19 pandemic, the economy, and social equity, and how the pandemic has worsened inequity. We tackle an age-old debate that has renewed importance: is the density of people and economic activity good or bad for quality of life? We then turn to an analysis of what the recession and the disruption of energy markets means for clean

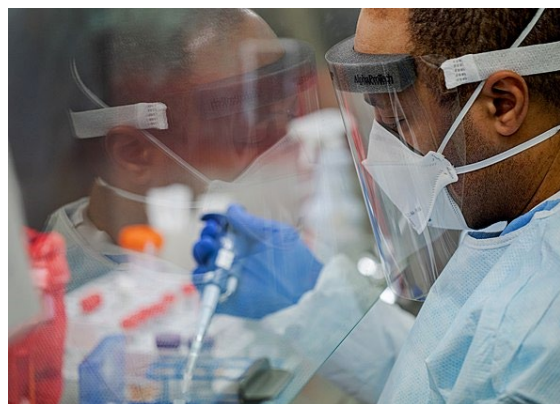
energy and energy efficiency, which were on a roll prior to the pandemic. We discuss specific positive and negative impacts of the pandemic related to mobility and streets, the appreciation for clean air and green space, and on waste management. We close with final thoughts on how all this can be tied together into climate action that is equitable and synergistic. In each chapter we include a “What Cities Can Do” section that provides concrete suggestions.

What Makes a City Resilient?

The pandemic and racial turmoil of 2020 have severely tested the resilience of the country’s families, cities, health care system, economy, and political system. The events of 2020 have also tested the resilience of the social relationships that are key to our sense of community. We hear the term “resiliency” a lot, and generally assume that it is a good thing to possess. But what does resilience actually mean, and can we use it in a practical way to recover from the pandemic, strengthen our social relations, while at the same time making rapid, substantive and equitable progress on addressing climate change?

Resilience is used in many fields, from ecology to economics to community development. There are three fundamental principles that underpin all uses of the term.

The first principle is that every system faces unexpected crises. A forest will burn or be infested with a pest. A public health system will face a pandemic. A water supply system will face drought or contamination. A coastal city will face recessions, social unrest, and sea level rise.



Extraction of the coronavirus at a public health lab in Pennsylvania in March, 2020. *Credit:* flickr user [governortomwolf](#)

The second principle is that a resilient system can absorb, adapt to, and recover from a crisis. A resilient electric grid has power quickly restored after a lightning strike causes a blackout. A resilient public health system has the staff, hospital space, equipment, medicines, communications and management plans to implement when a pandemic strikes, thereby minimizing harm. A resilient health care system is not surprised by or unable to adequately respond to an improbable, unpredictable, and high impact event.

Third, a resilient system learns from a crisis, and is better prepared to anticipate and possibly avoid similar future crises. Surviving a crisis is one thing; learning from it is another. The resiliency of our healthcare system improves if we use the painful experience of the COVID-19 pandemic to eliminate or tamp down the root causes of pandemics. The resiliency of a city to extreme heat improves if it intelligently and equitably expands greenspace, carefully plans the design and location of buildings, provides the elderly with air conditioning, and has sufficient public cooling facilities in a heat wave. Resiliency also requires that those actions are adequately funded.

Resilience: Concepts and Definitions¹¹

Origins: from Latin *resiliens*, "to rebound, recoil;" from *re-* "back" + *salire* "to jump, leap"

General and Simple: "the ability to recover from or adjust easily to misfortune or change."

General and Less Simple: "...the capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity, and structure, while also maintaining the capacity for adaptation, learning, and transformation."

Resilience in Context

Public Health: "...the capacity of health actors, institutions, and populations to prepare for and effectively respond to crises; maintain core functions when a crisis hits; and, informed by lessons learned during the crisis, reorganize if conditions require it."

Climate Change: ...the capacity for a society to absorb stresses and maintain function in the face of external stresses imposed upon it by climate change, and to emerge better prepared for future climate change impacts.

Ecology: "...the capacity of a system to absorb disturbance (fire, pest outbreak, invasive species, pollution) and reorganize while undergoing change so as to still retain essentially the same function, structure, identity, and feedbacks."

Critical Infrastructure (Internet, electric grids, railways, pipelines): "Ability to withstand within acceptable degradation parameters and to recover within an acceptable time and costs."

Transportation: "...a (transportation) system's vulnerability against potential disruption, and its adaptive capacity in recovering to an acceptable level of service within a reasonable timeframe after being affected."

Community: "the existence, development and engagement of community resources by community members to thrive in an environment characterized by change, uncertainty, unpredictability and surprise."

Individual: "... the process of adapting well in the face of adversity, trauma, tragedy, threats or significant sources of stress — such as family and relationship problems, serious health problems, or workplace and financial stressors."

Economics: Macro: "...the ability to limit the magnitude of the immediate loss of income for a given amount of capital losses, and...the ability to reconstruct and recover quickly..."
Micro: "...the ability of an economy and society to minimize household welfare losses for a given level of aggregate consumption losses."

Decision-Making for Resilient Cities

Resilient, prosperous, and sustainable cities result from a particular way that city governments conceive their mission and understand the aspirations of the people they serve, the means to reach their goals, and the barriers to their achievement. This is a challenging responsibility even under tranquil conditions. The impacts of climate change and the need to eliminate fossil fuels have elevated the stakes and the urgency to act. The pandemic and widespread social unrest add an additional element of urgency and difficulty. A successful response includes the following:

- 1. Equity should be a leading priority, not a “co-benefit.”** We tend to think of resilience in economic, technical, and scientific terms. But a city with deep inequity is not resilient in any sense of the term, and it certainly will suffer from climate change and a pandemic far more than a city in which everyone enjoys similar life opportunities. This perspective turns climate action on its head. If we maximize greenhouse gas (GHG) reduction in buildings via residential energy efficiency programs (primary goal), we may ask, what are the savings to households of color and low income (co-benefit)? Instead we should ask, how can we use energy efficiency programs to reduce utility bills and improve indoor air quality for households of color and low-income (primary goal), and then assess the GHG reduction (co-benefit). This approach requires a city to have an “equity action plan,” and it reinforces the aforementioned need for coordination across all “action plans.”
- 2. Systems Thinking.** Carbon neutrality, preparedness for extreme heat and flooding, a healthy population, and a high degree of economic and social opportunity are attributes of a resilient city, and each one is connected to all the others. A single action therefore ripples through every domain of city life. Some consequences are intended, others are unintended, and often times the unintended consequences are negative and fall on socially vulnerable populations. Consequences may be delayed in time and be experienced far away from where an action is taken. Decision making should be based on an understanding of the interconnections, it should avoid negative, unintended consequences, and it should activate potential synergies. This requires new modes of communication, planning, and budgeting across traditional silos in city hall (streets, waste, racial equity, budget and finance, housing, climate, emergency management, parks, transportation, etc.)
- 3. Communication and Engagement.** Community engagement and participation is an established component of municipal planning processes, but results are mixed. Communities often feel that government does not fully understand their day-to-day life experiences, leading to distrust and disengagement. Ineffective community engagement and limited pathways for underrepresented groups to gain formal power has helped propagate energy, environmental, and climate injustices. The Urban Sustainability Directors Network describes ways to move from community engagement to community ownership, with an emphasis on collaborative governance.¹² We now see cities producing “climate justice plans” that go beyond technical, sector-based approaches to reducing GHG emissions.¹³ Community

ownership coupled with government accountability can reduce societal inequity and help reduce climate vulnerability, build public support for innovative practices, minimize unintended consequences, and can complement government resources by increasing community-led action.¹⁴

- 4. Sound Science and the Communication of Risk.** The pandemic revealed how vital sound medical information is for good public health. In the early days of the pandemic, uncertainty swirled around the mode of transmission and protective measures. But medical research and learning-by-doing in hospitals quickly established the facts: transmission is airborne and simple preventive measures such as wearing masks, social distancing, and avoiding large crowds will effectively slow transmission when adopted at scale. Large numbers of lives were saved in cities and countries where policies were swiftly and forcefully aligned with science. The experience with COVID-19 can help cities elevate concern about the urgent risks of climate change to the level commensurate with the science of climate change.

Cities face the challenge of surmounting the obstacles and seizing the opportunities created by the pandemic, while pivoting to community ownership and collaborative governance of climate action. In the sections that follow we aim to support cities with deeper insights into the connections between social equity and climate action in the recovery from the COVID-19 pandemic. We pay particular attention to climate-related issues such as public health, food security, open space, transportation, waste, clean energy and energy efficiency. These issues present ample opportunities for cities to enhance overall resilience with systems-thinking based on sound science, with equity in the lead, and with effective community participation.

Maintain Gains and Reverse Pandemic-Induced Losses

The pandemic and its economic and social fallout caused enormous, rapid changes in city life. From a climate perspective, several notable changes were undesirable, such as a decrease in the use of (and confidence in) public transportation and a surge in plastic waste. Changes also occurred that are desirable from a climate perspective, such as a renewed appreciation for clean air, open space, and active transport; heightened attention towards personal and public health; and the use of streets by pedestrians, cyclists, and restaurant diners.

The economic and public health recovery provides an opportunity for cities to maintain gains and reverse losses related to climate action, and in doing so make continued progress towards climate goals while simultaneously improving social equity and economic recovery. We summarize the opportunities in the accompanying dashboard, derived from our analysis of the events of 2020, research in universities and think tanks, city programs, and interviews with city climate and sustainability officials. The results of a survey with city climate leaders will be published in separate report.

Maintain Gains, Reduce Losses <i>Assumptions based on projections at the city level in the next 2 years</i> ● Positive ● Neutral ● Negative	Expected net effect on GHG emission reductions	Expected net effect on climate resiliency	Expected net effect on health outcomes related to climate change	Expected net effect on the city's economy
Environmental Quality & Community Engagement				
Deeper understanding of connections between climate change, health, economic stability, and equity (including climate justice)	●	●	●	●
Increased awareness that climate resiliency and disaster preparedness is as important as GHG emission reduction	●	●	●	●
Increased focus on equitable community engagement and participation vs. top-down planning (e.g. closing the digital divide)	●	●	●	●
Appreciation for and value of open space and green space	●	●	●	●
Appreciation of clean air	●	●	●	●
Mobility				
Enhanced support for electric vehicle infrastructure, vehicles, and smart grid	●	●	●	●
Appreciation for and access to safer, quieter streets, and increase in active modes of transport	●	●	●	●
Decrease in demand for public transport	●	●	●	●
A shift in micromobility from private vehicle use	●	●	●	●
Energy				
Enhanced support for renewable energy, energy storage, and rooftop solar	●	●	●	●
Delay of clean energy, energy efficiency, and resiliency projects	●	●	●	●
Food & Waste				
Increased focus on local food and healthy diets	●	●	●	●
More people without access to reliable sources of food	●	●	●	●
Increase in household and medical waste, especially single use plastic	●	●	●	●
Buildings				
Increased focus on indoor air quality	●	●	●	●
Enhanced support for energy efficiency for residential and commercial buildings	●	●	●	●
High energy burden for low to middle income residents	●	●	●	●
Workforce				
Increase in telecommuting	●	●	●	●
Increased focus on innovation in clean energy and health	●	●	●	●
Increased focus on creating green jobs	●	●	●	●

Equity Unites Health, the Economy, and Climate Action

Introduction

A disturbing feature of COVID-19 is its disparate impacts among different groups of people. As of September 22, 2020, there were about 6.8 million COVID-19 cases and about 200,000 deaths in the U.S.¹⁵ Relative to white people, the death rates of Black people (2.4), American Indians or Alaska natives (1.5), and Hispanics or Latinos (1.5) are strikingly higher (Figure 2).¹⁶ Additionally, four of the top five counties with the highest death rates in the U.S. are predominantly Black. On top of these disparities, Black and Hispanic populations are experiencing longer wait times and understaffed COVID-19 testing centers,¹⁷ and they were underrepresented in early vaccine trials.¹⁸ Coupled with the Black Lives Matter protests, these health disparities have propelled race relations to the forefront of American consciousness once again.

Prior to 2020, some cities were attempting to integrate equity into climate action, frequently due to pressure from citizens and NGOs.¹⁹ Social equity is tied to the fate of cities, and the elimination of racial, ethnic, income, gender, and age disparities in public health, environmental quality, and every other aspect of human well-being should be front and center in every action taken by cities. Effective and lasting action begins with an understanding of the new challenges posed by the intersection of COVID-19, climate change, social equity, and city climate action (Figure 3).

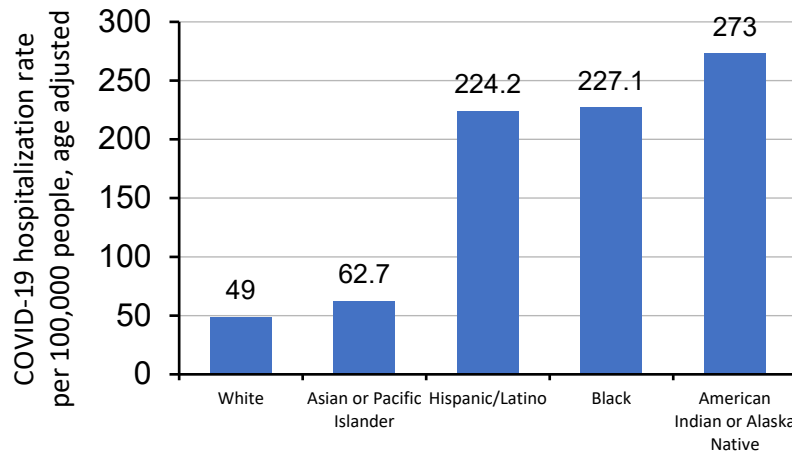


Figure 2. COVID-19 hospitalization rates by race and deaths by age group. *Source:* Centers for Disease Control and Protection.

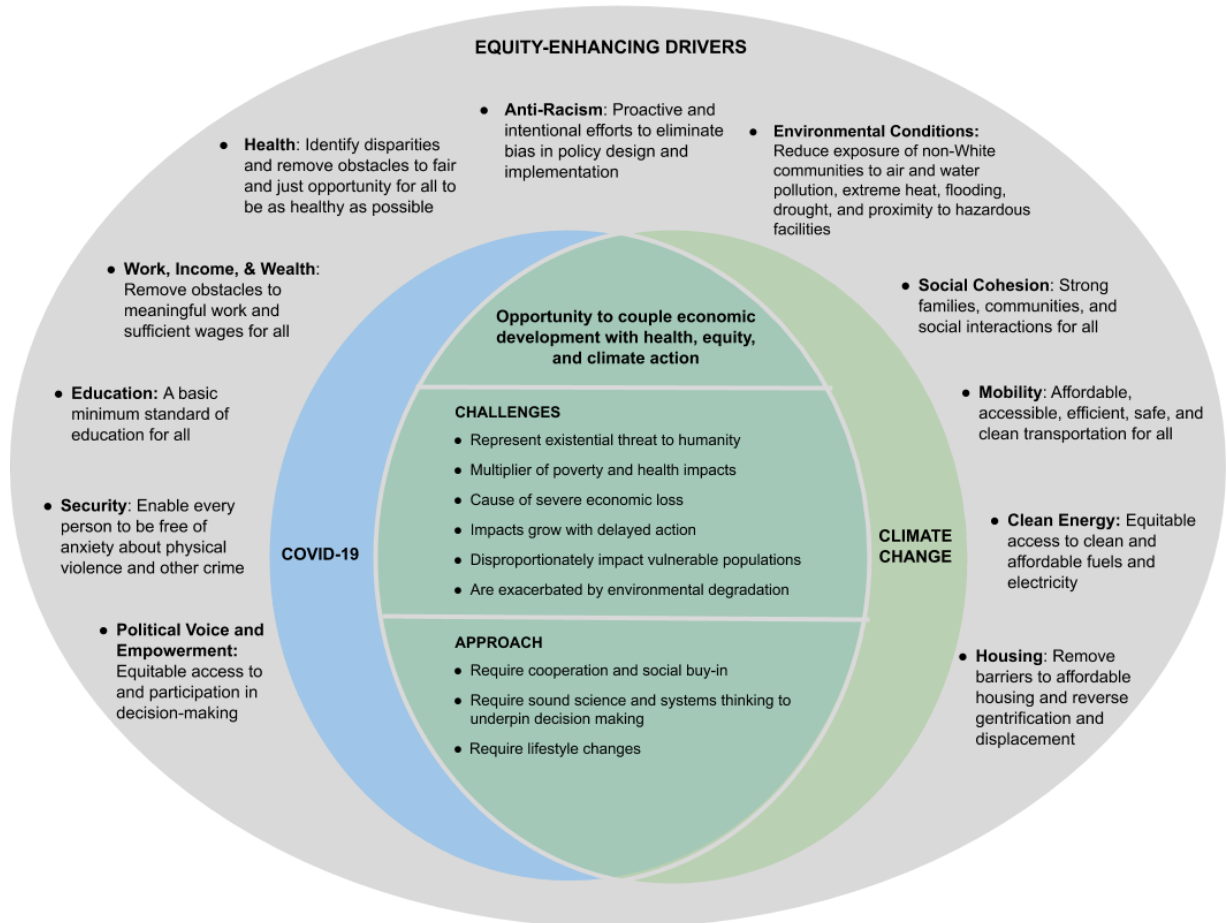


Figure 3. The interconnections among the COVID-19 pandemic, climate change, and the mechanisms to enhance social equity.

Why Is Social Equity Important?

Social equity is rooted in the idea that each person is equal and has inalienable rights, that each person should have equal opportunities, and that society should elevate the interests of the least advantaged members of society. In the context of governance, the National Academy of Public Administration defines social equity as

The fair, just, and equitable management of all institutions serving the public directly or by contract, and the fair, just, and equitable distribution of public services, and implementation of public policy, and the commitment to promote fairness, justice, and equity in the formation of public policy.²⁰

Why is social equity important, why should we spend our time and energy understanding it, and why should we spend scarce public resources to address it? The moral or social justice argument contends that each person's contribution to society is valuable, and that we must address barriers and historical factors that have led to unfair conditions and opportunities for marginalized populations.

Equity Compared to Equality

“The difference is one of nuance: while equality can be converted into a mathematical measure in which equal parts are identical in size or number, equity is a more flexible measure allowing for equivalency while not demanding exact sameness. For example, a child entering school who does not speak English is at a substantive disadvantage compared to her native English-speaking classmates. Though the entire class may receive equal instruction in language, the non-English-speaking student requires additional tutoring if her training is to be equitable with that of her classmates.” *Source: Guy, M.E. and McCandless, S.A. (2012), Social Equity: Its Legacy, Its Promise. Public Admin Rev, 72: S5-S13.*

But inequity is much more than an ethical issue because regardless of one’s moral stance, inequity touches us all. Inequity raises the prevalence of poor health, mental illness, crime, violence, and other societal ills.²¹ Equity-enhancing policies, particularly investment in human capital such as education, can boost economic growth which, in turn, alleviates poverty under the right conditions. Equity enhances social cohesion, reduces corruption,²² reduces political and violent conflict,²³ and retains cultural diversity through the empowerment of local communities.²⁴ Inequity promotes lifestyles that degrade the Earth’s natural systems.²⁵ In short, inequity is associated with reduced human well-being in just about every dimension, meaning everyone experiences its impacts.

Whether stated or unstated, every public action has an equity impact, and every action should purposefully avoid unintended consequences, be intentionally designed with a clear focus on equity outcomes, and have inclusive practices in all decision making.²⁶ Every public decision maker faces the challenge of how to incorporate these equity principles in complex challenges such as public health and climate action.

Social Vulnerability and Racism

Social vulnerability is the sensitivity of social groups to the impacts of hazards, disproportionate illness or death, disruption of livelihood, and the general capacity to withstand hardships of economic, health, physical, or environmental nature.²⁷ Examples include a high utility bill, a missed paycheck, residential damage due to flooding, or illness caused by air pollution. Characteristics of vulnerable social groups include age (children and older adults), limited English proficiency, low to no income, race and ethnicity, and people with disabilities.

Cities are starting to use vulnerability frameworks to implement equity goals in climate action. *Carbon Free Boston*²⁸ employed a social vulnerability framework to identify how equity can be prioritized to reduce greenhouse gas emissions from buildings, transportation, energy supply, and waste management. Harris County, Texas, which manages flood control in and around Houston, recently adopted the Social Vulnerability Index²⁹ developed by the Centers for Disease Control and Prevention to prioritize public spending on flood protection (Figure 4).³⁰

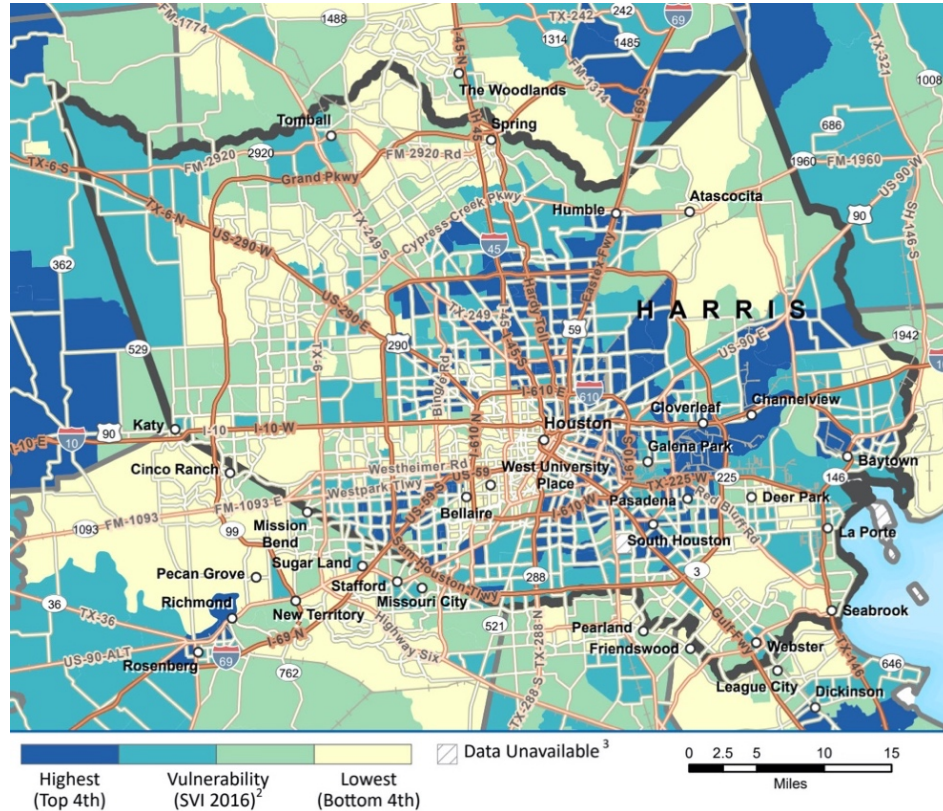


Figure 4. Social Vulnerability Index (SVI) 2016 for Harris County, Texas. The SVI groups fifteen census-derived factors into four themes that summarize the extent to which the area is socially vulnerable to disaster. The factors include economic data as well as data regarding education, family characteristics, housing, language ability, ethnicity, and vehicle access. The most vulnerable areas map closely to those with low incomes and/or a high percentage of Black and Hispanic households. *Source:* Centers for Disease Control and Protection.

For some people, vulnerability is rooted in, and/or exacerbated, by racism. As described by Ibram Kendi, a leading scholar of race and discriminatory policy in America:

“A racist policy is any measure that produces or sustains racial inequity between racial groups. An antiracist policy is any measure that produces or sustains racial equity between racial groups. By policy, I mean written and unwritten laws, rules, procedures, processes, regulations, and guidelines that govern people. There is no such thing as a nonracist or race-neutral policy. Every policy in every institution in every community in every nation is producing or sustaining either racial inequity or equity between racial groups.”³¹

Social vulnerability and racism stem from the deficiencies, policy failures, and historical disparities in our social, economic, and political systems that have made communities vulnerable. These inequities are amplified by COVID-19 and the effects of climate change. Their redress requires that equity be used as an organizing principal in every city action.

The Roots of Inequity

COVID-19 is a jarring current example of the historical absence of health equity in the U.S. Disparities in key health outcomes, such as infant mortality, age-adjusted death rates, and life expectancy, frequently align with race, ethnicity, and income groups.³² Many health outcomes stem from so-called *social determinants of health*. These include education; employment; health systems and services; housing; income and wealth; the physical environment; public safety; the social environment; and transportation. Inequities in social determinants ultimately stem from *structural inequities*, namely the systemic disadvantage of one social group compared to other groups with whom they coexist (Figure 5). Disadvantages span policy, law, governance, and culture. Social groups include race, ethnicity, gender or gender identity, class, sexual orientation, and other domains. Examples of structural inequities include racism, sexism, classism, ableism, xenophobia, and homophobia.

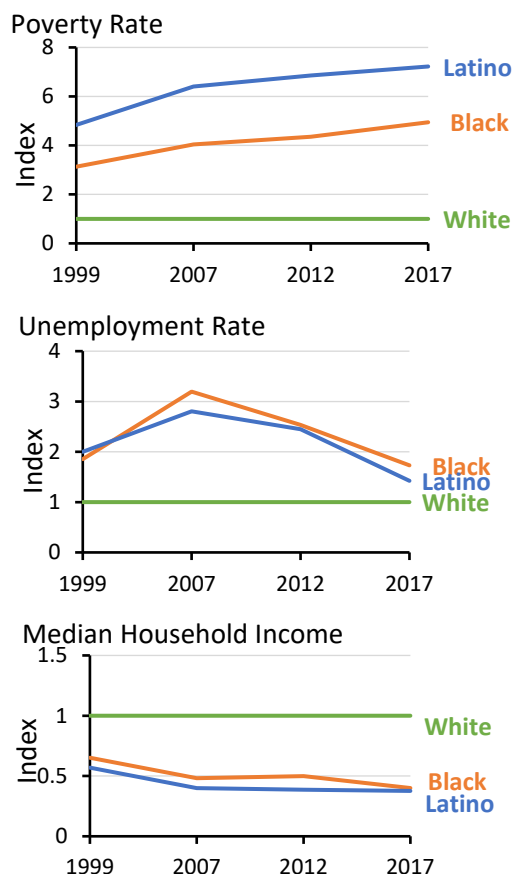


Figure 5. Racial Equity across Income, Unemployment, and Poverty. Black and Latino populations compared to White populations, where data is indexed to White population equal to 1.0. *Source:* Data from US Census Bureau, 1999/2000 Census Data: Profile of Selected Economic Characteristics and 2007, 2012 and 2017 American Community Survey Data: 1-Year Estimates, Selected Population Profile in the United States.

Climate, Energy, and Environmental Justice

COVID-19 challenge adds a new element to the climate, energy and environmental justice movements, which share a common theme of fairness and equity throughout the transition away from fossil fuels. In their own ways, these movements identify widespread injustices associated with fracking³³, indigenous communities³⁴, health outcomes³⁵, poverty³⁶, siting of public infrastructure³⁷, urban green space³⁸, light pollution³⁹, noise pollution⁴⁰, air pollution⁴¹, waste management⁴², flooding, water management⁴³, trade unions⁴⁴, fossil fuel supply chains⁴⁵, and exposure to toxic and hazardous wastes.⁴⁶

Environmental, Climate, and Energy Justice

Environmental Justice: "... the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."⁴⁷

Climate Justice: "... links human rights and development to achieve a human centered approach, safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and it's impacts equitably and fairly. Climate justice is informed by science, responds to science and acknowledges the need for equitable stewardship of the worlds resources."⁴⁸

Energy Justice: "...a global energy system that fairly disseminate costs of energy services, and one that has representative and impartial energy decision making."⁴⁹

This extensive body of work reveals that race and ethnicity are consistent features of inequity. Two examples are especially important for this study: air pollution and exposure to the impacts of climate change. Air pollution disparities are striking. On average, people of color in the U.S. breathe air 38 percent more nitrogen oxide than White people, and live with more air pollution in 46 states.⁵⁰ The impact on Black Americans is especially pernicious: they are far more likely to live near a coal-fired power plant,⁵¹ a hazardous waste facility,⁵² a municipal solid waste incinerator,⁵³ and oil and gas facilities;⁵⁴ breath air with more particulate⁵⁵ and ozone pollution;⁵⁶ and have elevated blood lead levels.⁵⁷

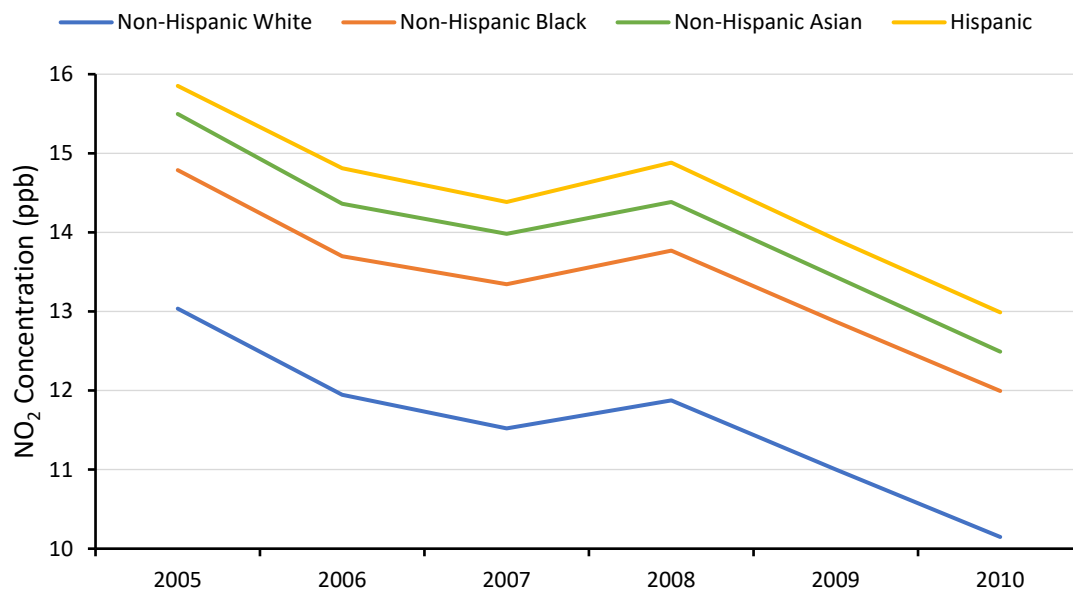


Figure 6. Annual average NO₂ concentrations in urban areas greater than 50,000 people in Massachusetts by Census 2010 and ACS 2006–2010 demographic subpopulations. *Source:* Rosofsky, Anna, Jonathan I. Levy, Antonella Zanobetti, Patricia Janulewicz, and M. Patricia Fabian. 2018. "Temporal Trends in Air Pollution Exposure Inequality in Massachusetts." *Environmental Research* 161 (February): 76–86. <https://doi.org/10.1016/j.envres.2017.10.028>.

These inequitable exposures have a perverse twist to them: a very large disparity between how much people consume, and thus how much pollution they generate, and how much polluted air they breathe. Just 10 percent of the world’s population is responsible for 50 percent of greenhouse gas emissions.⁵⁸ Black Americans are exposed to 21 percent *greater* particulate pollution than the overall population, but their consumption causes 23 percent *less* population-wide exposure than average.⁵⁹

Long term exposure to air pollution impairs lung function and reduces resistance to viral infection.⁶⁰ Short term exposure increases transmission because a virus can attach to particulate matter which then acts as a carrier.⁶¹ Regions with higher concentrations of air pollutants, especially PM_{2.5} and NO₂, have higher infection rates and higher mortality rates from COVID-19.⁶² A Harvard study concluded that an increase of only 1 µg/m³ in PM_{2.5} is associated with an eight percent increase in the COVID-19 death rate.⁶³ Patients in polluted areas have the same rates of admission to intensive care units compared to less-polluted areas, but they have double the mortality rate.⁶⁴

The effects of climate change mirror those of pollution. Socially vulnerable populations are disproportionately at risk from rising sea levels, droughts, climate related disasters, and extreme heat.⁶⁵ These risks manifest themselves at local to global scales. The impacts diminish well-being via reduced physical and mental health, reduced livelihoods, forced migration, and reduced food and water availability, among other impacts.⁶⁶

Access to Affordable Clean Energy

Decarbonization has a strong equity component. Access to clean, affordable energy is a fundamental component of well-being, and energy inequities align with income, race, and type of housing (Figure 7). Households that spend a large fraction of their monthly income on energy—i.e., have a high energy burden—are more likely to live in older homes, live in rented, multifamily units, and have children.⁶⁷ Their homes are often less energy efficient and more challenging to retrofit. Black/Latinx/Hispanic, and Native American households are about twice as likely to experience a high energy burden compared to White households.⁶⁸

The American Council for an Energy-Efficient Economy conducted an energy burden review in 48 major U.S.

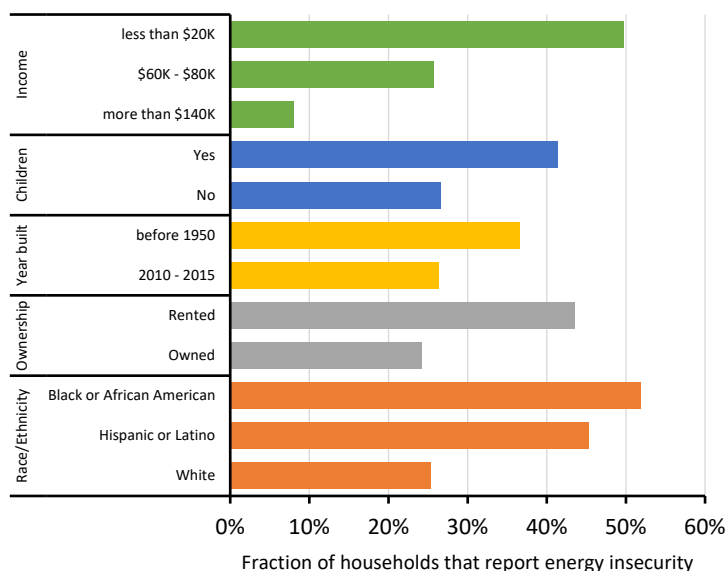


Figure 7. Energy Insecurity in the U.S. Source: Data from US Energy Information Administration, Residential Energy Consumption Survey. Source: Adapted from Cleveland, et al. 2019. Carbon Free Boston: Social Equity Report (Boston Green Ribbon Commission and the Boston University Institute for Sustainable Energy, Boston, MA, USA). <https://hdl.handle.net/2144/39229>.

cities and found that low-income populations paid up to three times as much of their income to energy costs compared to higher-income households.⁶⁹ Households of color and low income are also disproportionately affected by utility shut-off policies, exposing them to extreme heat or cold weather.⁷⁰ Solutions that may save these households money in the long run such as rooftop solar and energy efficient upgrades are inaccessible due to high upfront costs or limited access to capital.⁷¹

The economic impacts of energy insecurity impact health outcomes. The Department of Energy's Residential Energy Consumption Survey identified 25 million households that failed to buy food or medicine in order to pay their energy bill.⁷² The strong connection between energy insecurity and food insecurity means that people who cannot pay their energy bill have a higher chance of experiencing poor health, hospitalization, depression, and other negative health outcomes.⁷³

How the Pandemic Has Worsened Inequity

Exposure to Job and Income Loss

The COVID-19 pandemic has disrupted supply chains, consumer spending and new investment, resulting in extreme unemployment. The overall civilian unemployment rate peaked at 14.7 percent in April 2020 (Figure 8).⁷⁴ But job loss has been more severe for families of color and low-income residents. The peak unemployment rate for Hispanic or Latinx workers was 33 percent higher than White workers; Black workers experienced an 18 percent higher rate than White workers. In the top fifth of income earners, about one in nine workers lost their job. In the bottom fifth of income earners more than one in three workers lost their job, and they were more likely to be Black and Latino.⁷⁵



People wait in line for assistance with their unemployment benefits in Frankfort, KY., on Wednesday, June 17, 2020.
Credit: Ryan C. Hermens, Lexington Herald Leader

Black workers are regaining employment at a far slower rate than others. By August 1, 2020, the Black unemployment was still close to 15 percent, which translates to 13 percent improvement from the peak in May. In contrast, the unemployment rates for White and Hispanic or Latinx workers had fallen by more than 30 percent from their spring peaks.

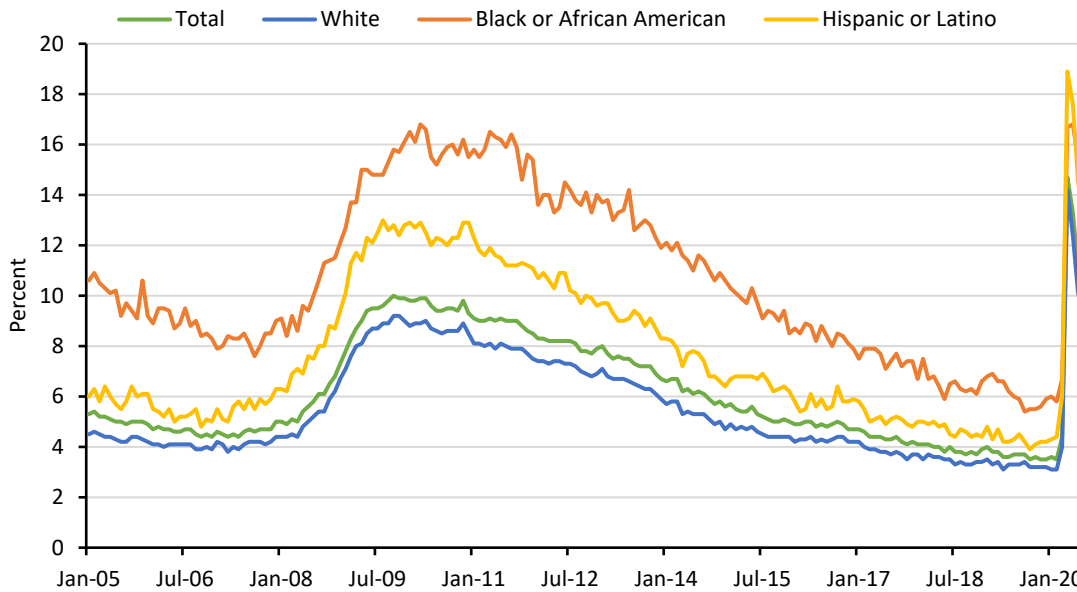


Figure 8. Civilian unemployment rate, seasonally adjusted. Gray rectangles are periods of recession. Persons whose ethnicity is identified as Hispanic or Latino may be of any race. *Source:* U.S. Bureau of Labor Statistics.

The socioeconomic conditions faced by Black households create a much steeper climb to economic recovery compared to other households. Black workers have lower incomes, fewer household earners, and less accessible wealth than White workers.⁷⁶ On average, Black workers are paid 73 cents for every dollar earned by White workers, and Black women are 3.6 times as likely as White women to be single heads of households with children under 18 years old.⁷⁷

Wealth in the form of personal property, monetary savings, and income-generating capital assets is critical to the economic resiliency of a household. Keeping food on the table and the lights on during a crisis requires an adequate wealth safety net. Black Americans constitute 13 percent of the population but hold less than three percent of the nation's wealth.⁷⁸ At \$171,000, the net worth of a typical White family is nearly ten times greater than that of a Black family (\$17,150) in 2016.⁷⁹ This wealth gap has not appreciably changed in 50 years.⁸⁰

The communities where Black Americans live and work have suffered excessively from the pandemic. Black workers are twice as likely to live in counties and work in jobs that are at the highest risk of immediate and long-term economic disruption,⁸¹ black-owned small businesses are disproportionately being shut down,⁸² and Black and Latino business owners are less likely to receive federal pandemic assistance.⁸³ Large financial institutions prioritized the relief fund applications of their wealthier clients over smaller businesses.⁸⁴

We have heard a lot about “essential” and “frontline” workers during the pandemic. Definitions vary, but essentially the terms refer to workers who have to show up for work during a crisis while others work from home. Essential sectors include health care, emergency services, food and agriculture, energy supply, and transportation, among others. Many frontline workers are working without basic health and safety protections, paid leave,

or hazard pay, and some face higher risk to infection by the coronavirus. Some have to choose between risking their own health and continuing to get paid.⁸⁵

About 45 percent of essential workers are Black, Hispanic, or other non-White ethnicities, yet they account for just 36 of the country’s total workforce. Hispanic workers are especially overrepresented in Building Cleaning Services (40.2 percent of workers). Black workers are most overrepresented in Child Care and Social Services (19.3 percent of workers).⁸⁶

There also is a strong gender component to the essential workforce. About one-half of all workers are women, but nearly two-thirds (64.4 percent) of frontline workers are women. Women are particularly overrepresented in the frontline industries of Health Care (76.8 percent of workers) and Child Care and Social Services (85.2 percent).⁸⁷

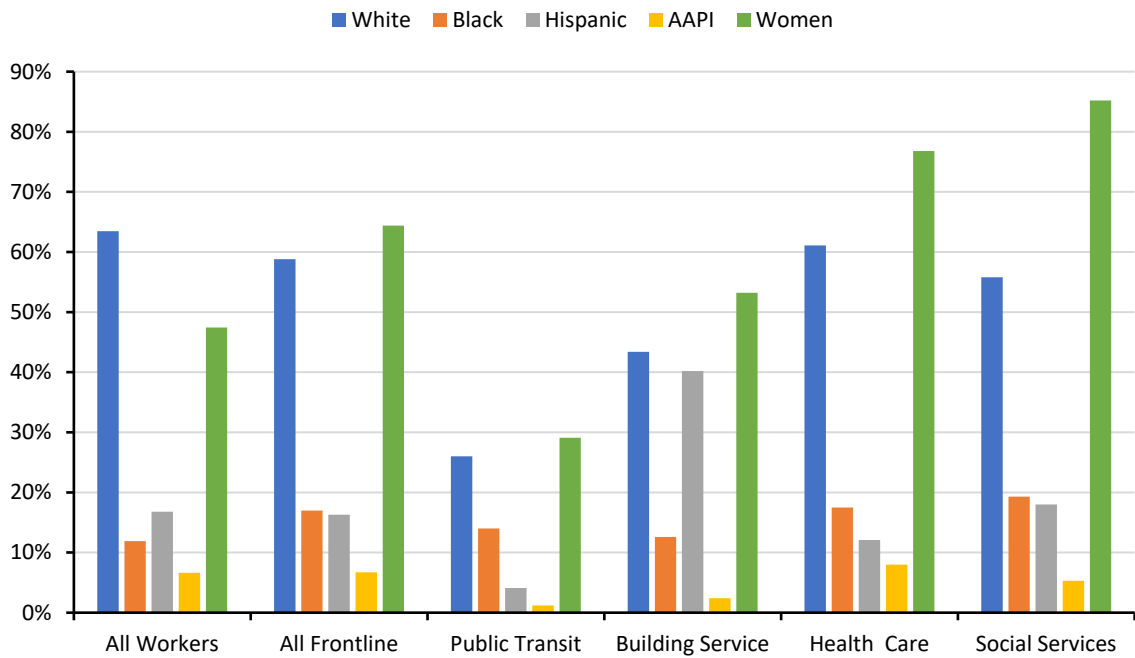


Figure 9. Employment characteristics of frontline (essential) workers. AAPI = Asian American and Pacific Islander. Source: Rho, Hye Jin, Hayley Brown, and Shawn Fremstad. April 7, 2020. “A Basic Demographic Profile of Workers in Frontline Industries.” Center for Economic and Policy Research.

The economic story line is clear. The pandemic has imposed tremendous economic hardship on millions of Americans. But the economic costs have been distributed inequitably by race, ethnicity, and gender, thus widening historical gaps in income and wealth.

Telework

In 2018, about 5.2% of employed Americans entirely teleworked from home.⁸⁸ By May 2020, at least 35 percent of employed Americans were working from home due to the pandemic. Some of the increase in teleworking is likely be made permanent. Tech giants Google, Facebook, Microsoft, Amazon, and Twitter announced plans to extend teleworking well into

the fall and possibly beyond. Such a change in the nature of work suggests potential benefits in the form of improved productivity, lower costs for employers, greater flexibility for workers, less congestion, and lower emissions, especially greenhouse gases.

A rush to embrace teleworking should be tempered with the reality that under current socioeconomic conditions, more teleworking will worsen inequity. To understand this one must start with the recognition that telework, and other aspects of a “flexible workplace,” are viewed favorably by most workers in the U.S. because control over work–life flexibility is an important component of well-being.⁸⁹ People report that commuting is one of daily life’s least enjoyable activities,⁹⁰ and home-based teleworkers report greater levels of life satisfaction than other workers.⁹¹ It is not surprising, therefore, that some workers prefer the opportunity to telework over a pay raise.⁹² The Bureau of Labor Statistics includes flexible workplace among other quality of life benefits such as childcare, subsidized commuting, wellness programs, and other employee assistance programs.

The potential for telework is unevenly distributed across occupation, income, and race. Only seven percent of civilian workers in the U.S. currently have access to a teleworking benefit according to the 2019 National Compensation Survey (NCS) from the Bureau of Labor Statistics. But the potential for teleworking is much higher than that. A recent study from the National Bureau of Economic Research concluded that 37 percent of jobs in the U.S. could be performed entirely at home, with significant variation across cities and industries (Figure 14).

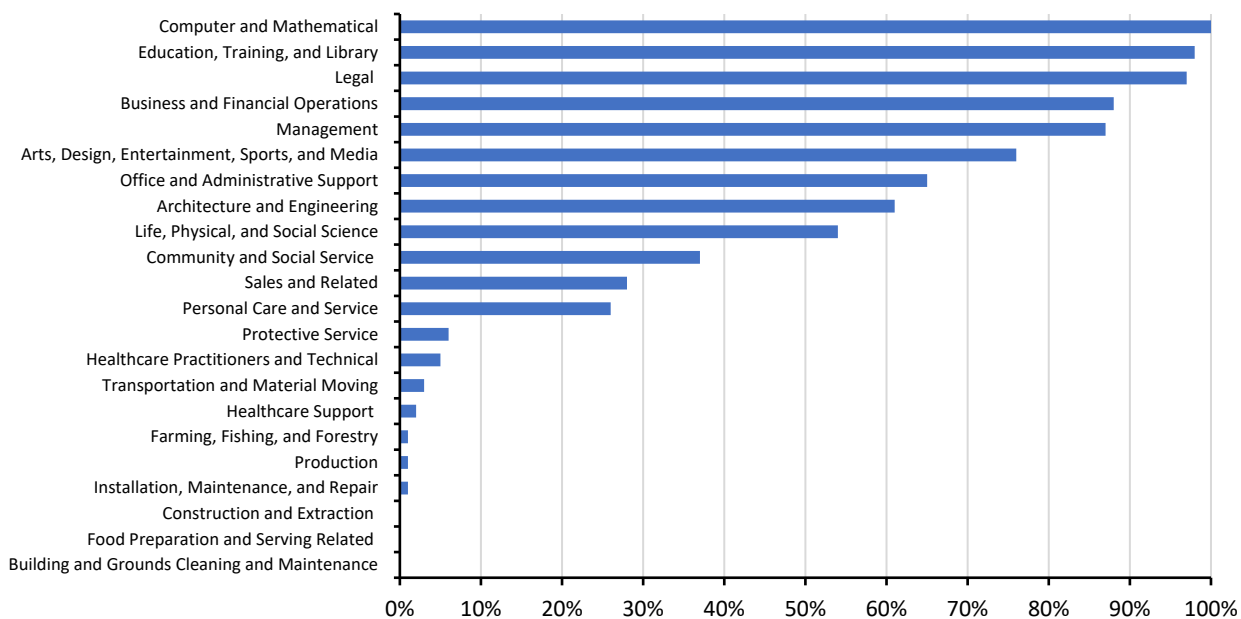


Figure 14. Share of jobs that can be done at home, by occupation’s major group. *Source:* Dingel, Jonathan, and Brent Neiman. 2020. “How Many Jobs Can Be Done at Home?” Cambridge, MA: National Bureau of Economic Research. <https://doi.org/10.3386/w26948>.

What types of occupations are these, and who holds them? In short, workers in low work-from-home occupations are less likely to be white, have a college degree, or have employer provided healthcare, more likely to be in the bottom half of the income distribution, and more

likely to rent their homes.⁹³ These are some of the defining attributes of socially vulnerable populations.

This outcome stems from the types of occupations that are most amenable to teleworking: Educational Services; Professional, Scientific, and Technical Services; Management of Companies and Enterprises; Finance and Insurance; and Information. Those jobs are overwhelmingly held by White Americans. As one example, Black professionals in 2018 held 3.3 percent of all executive or senior leadership roles in the private sector reference. Sectors in which the teleworking opportunity is low or nonexistent are some of the largest employers of people of color (Table 1). The service sector exemplifies this problem. Just one in a hundred service-sector workers have the opportunity to telecommute,⁹⁴ but one in five Black and Hispanic males work in service occupations.⁹⁵ Teleworking is simply not an option for many people of color in the U.S., which places them at higher health risk during a pandemic.

Disparities in access to the teleworking benefit also track income and educational disparities. One in five workers in the highest income decile could work at home, but that opportunity for the lowest income decile is one in 100 workers.⁹⁶ Thirty seven percent of workers with a bachelor’s degree or higher reported working from home at least part of the time in 2019. Just 16 percent of those holding a high school diploma reported some work at home.⁹⁷

Table 1. Employed persons by detailed industry, sex, race, and Hispanic or Latino ethnicity in 2019 (Numbers in thousands)

	Total Employed	Percent Employed			
		White	Black	Asian	Hispanic or Latino
Total, 16 years and over	157,538	77.7	12.3	6.5	17.6
Bus service and urban transit	492	59.1	31.4	7.2	18.7
Home health care services	1,412	59.7	30.5	6.1	18.4
Animal slaughtering and processing	585	66.4	21.9	5.6	35.3
Taxi and limousine service	703	52.5	29.9	15.6	23.5
Barber shops	150	62.5	29.0	6.0	28.4
Nursing care facilities	1,663	64.4	27.6	4.3	12.6
Couriers and messengers	938	66.6	25.1	4.1	19.5
Landscaping services	1,408	87.5	7.4	1.0	42.7
Services to buildings and dwellings	1,603	80.1	12.8	1.9	41.3
Construction	11,373	88.1	6.4	1.9	30.4
Food manufacturing	1,834	76.0	14.3	5.7	29.7
Food services and drinking places	9,711	73.9	13.2	7.5	26.8

Source: U.S. Bureau of Labor Statistics, Labor Force Statistics from the Current Population Survey, Table 18

Telework undoubtedly confers benefits to some companies and to workers with access to that benefit. But where does it leave cities? As centers of economic activity, cities stand to gain from higher wages and enhanced productivity that teleworking may generate. Under certain conditions, teleworking will reduce congestion and in doing so reduce its many social costs (fuel consumption and emissions are more complicated; we discuss that in detail below). But indirect effects from more telework could be quite severe. What if large commercial office space is scaled back or completely abandoned? Economic life in many cities is powered by commuters, from the rush-hour schedules of subways, buses and commuter rails to the construction of new buildings to the survival of corner bodegas. Restaurants, cafes, bars, grocery stores and shops depend on workers for their survival.⁹⁸ Real estate tax revenue could fall and thus hinder recovery efforts.

What Cities Can Do to Prepare for More Telework. Cities can prepare for a permanent and possibly significant shift to teleworking by understanding the occupational structure of their local and regional economies. This includes granular information on the potential number of jobs by sector and occupation that could be done at home. That information can be coupled with information from major employers to gauge the magnitude of the potential shift. In turn, that information can feed more detailed analysis of the impacts on congestion, transit use, tax revenue, real estate, the use of open space, and other aspects of city life.

Plans to reduce GHG emissions will need reassessment if there is a major shift to teleworking. Large urban centers that draw a lot of commuters will experience reduced transportation use in private vehicles and reduced building energy use in the commercial sector. Smaller cities and towns that are the sources of those commuters will see an increase in the demand for local transportation on workdays. Residential energy use may rise everywhere. Teleworking could cause a relative shift away from motor gasoline to electricity in some city GHG inventories. These and other changes caused by more teleworking may require cities to shift priorities for GHG reduction.

The inequities associated with teleworking are much more challenging. Obviously, a city government cannot convert landscaping a lawn, driving a city bus, cleaning an office building, or welding a steel girder into jobs that can be done at home. Many jobs require an in-person presence. Thus, greater access to the teleworking benefit requires greater access to the types of occupations for which telework is suited.

Cities can approach the issue with the understanding that telework is an employer-supplied benefit similar to childcare, subsidized commuting, wellness programs, and other employee assistance programs. Jobs that carry such benefits typically pay more and require more education. There is no single policy lever available to cities to reduce those large and longstanding gaps. The solution is similar to other forms of inequity: intentional policies that level the playing field in regards to education and income. This includes the turnaround of historical racial bias in housing, hiring, education, and health care that helped generate the current workforce composition. Climate action—from seawalls to rooftop solar—can help if policies are co-designed with benefits flowing to socially vulnerable groups and if the associated green jobs are accessible to all.

A good first step for cities is a self-check. What was the status of telework prior to the pandemic, and what proportion of the pandemic-induced shift to telework could/should be made permanent? How is that potential benefit distributed across departments, types of jobs, pay grade, gender, age, race, and ethnicity? Can the city take action that improves productivity and efficiency while closing any existing gaps in access to telework?

Digital Divide

The pandemic demonstrated clearly nearly overnight that access to the Internet and Information and Communication Technologies (ICT) are essential to meaningfully participate in everyday life.⁹⁹ This was true before the pandemic, but in 2020 people relied more heavily on digital communication services for telework, telehealth, grocery shopping, remote learning, and critical connections with friends and family. A lack of access to the Internet, digital devices, and software translates to reduced education, recreation, economic, health, and social opportunities. Most Americans are “connected” in some fashion, yet digital inequity persists and it aligns with race, income, education, age and geography.

Digital Equity and Inclusion

Digital Equity: A condition in which all individuals and communities have the information technology capacity needed for full participation in our society. Digital equity is necessary for civic and cultural participation, employment, lifelong learning, and access to essential services.

Digital Inclusion: The activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of information and communication technologies. This includes: affordable, robust broadband Internet services; Internet enabled devices; access to digital literacy training; quality technical support; and applications and online content that enable and encourage self-sufficiency, participation and collaboration. Digital inclusion requires intentional strategies to reduce and eliminate historical, institutional and structural barriers to access and use.

Digital Redlining: Creating, perpetuating, and enhancing inequities among socially vulnerable populations specifically via the use of digital technologies, digital content, and the Internet.

Sources: National Digital Inclusion Alliance; Gilliard, Christopher. Prepared Testimony and Statement for the Record: *Banking on Your Data: The Role of Big Data in Financial Services*, U.S. House of Representatives Financial Services Committee, November 21, 2019.

Features of the Digital Divide. The “digital divide” is the common term for digital inequity. How big is the divide? The Federal Communications Commission (FCC) reported that 21.3 million Americans, or 6.5 percent of the population, lacked access to broadband internet in 2017. But an independent analysis estimates that 42 million Americans (12.8 percent of the population) don’t have the ability to purchase broadband, and almost half of the country can’t

access the internet at broadband speeds.¹⁰⁰ And even that estimate may be too low because the current metric for broadband speed equates DSL lines, and other slower connection modes, with much faster cable and fiber optic connections. Video conferencing, cloud computing, and other major applications and services need robust upload speeds that only cable and especially fiber can provide.¹⁰¹

Five conspicuous features characterize the digital divide:¹⁰²

1. Race and Ethnicity: A 2016 report by *Free Press* documented how communities of color find themselves on the bad side of the digital divide for home internet access.¹⁰³ While 81 percent of Whites and 83 percent of Asians have home internet, only 70 percent of Hispanics, 68 percent of Blacks, 72 percent of American Indian/Alaska Natives, and 68 percent of Native Hawaiian/Pacific Islanders are connected at home. The disparity widens when the metric is wired (high speed) adoption (Figure 15). Nearly half of all people in the country without home internet access are people of color, and many are in cities with well-known environmental injustices, e.g., Flint, MI (Figure 16).¹⁰⁴ These differences remain even after accounting for differences in income.

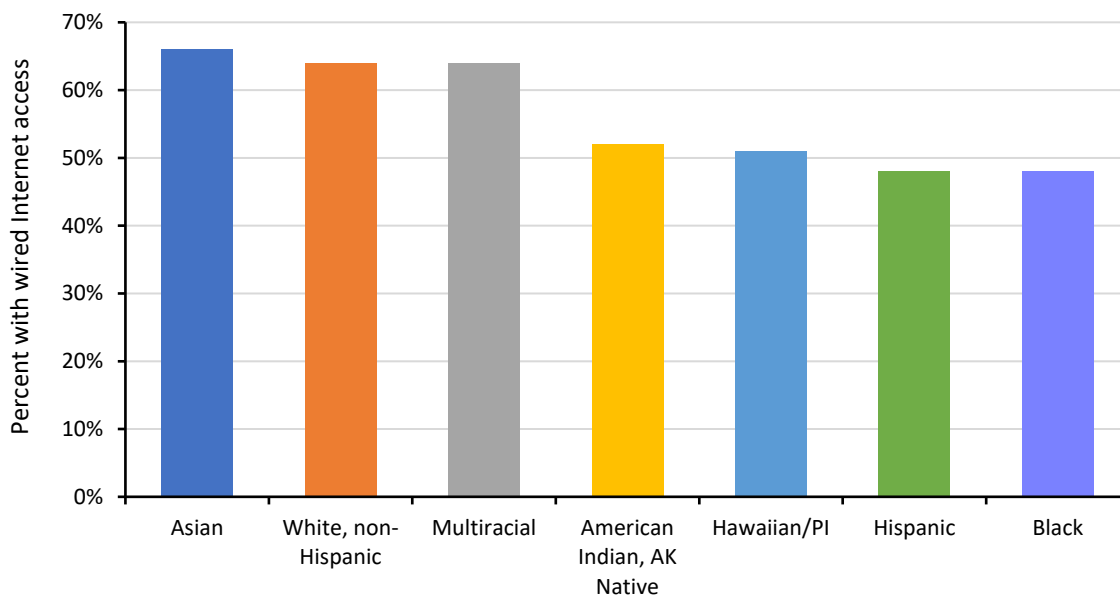


Figure 15. Household access to wired Internet in 2016. *Source:* Turner, S. Derek. 2016. "Digital Denied: The Impact of Systemic Racism on Internet Adoption." *Free Press*. <https://www.freepress.net/news/press-releases/digital-denied-free-press-report-exposes-impact-systemic-racism-internet>.

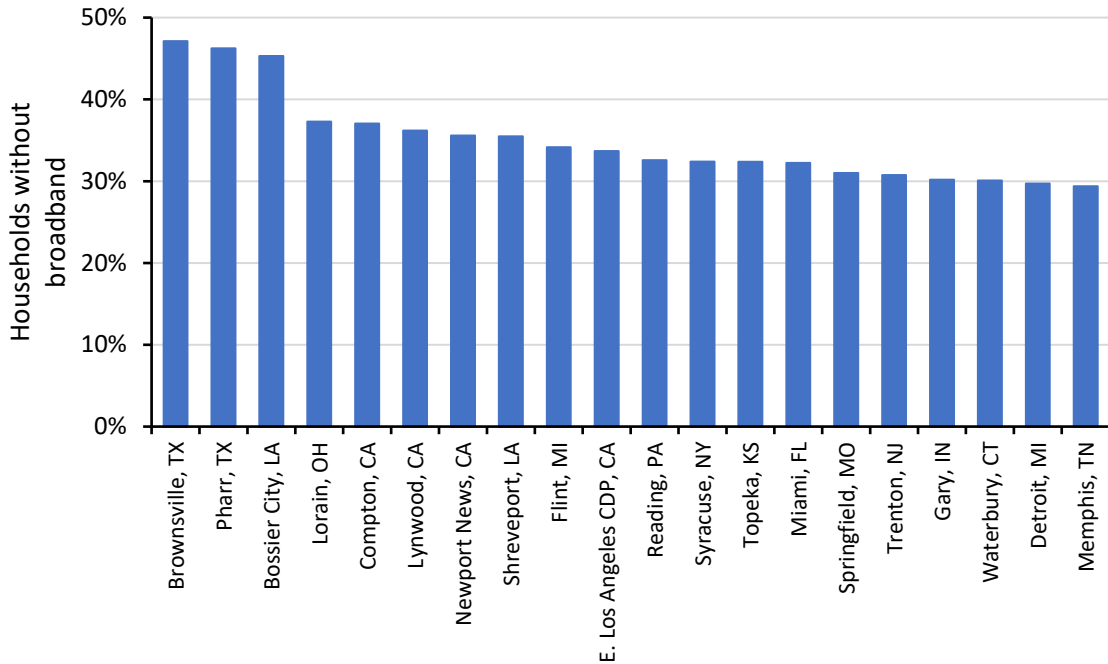


Figure 16. Twenty cities with the worst Internet connections in 2018. *Source:* Callahan, Bill. 2019. “Worst Connected Cities of 2018.” National Digital Inclusion Alliance. <https://tinyurl.com/t2mgcr2>.

2. Income: A 2019 report by the Pew Research Center describes how income differences contribute to the digital divide.¹⁰⁵ Twenty-nine percent of adults with household incomes below \$30,000 a year don’t own a smartphone; 44 percent do not have home broadband services; and 46 percent do not own a computer. By comparison, each of these technologies is nearly ubiquitous among adults in households earning \$100,000 or more a year.

3. Geography: In the average “mostly urban” county, over 75 percent of households have a subscription to broadband internet, while the average “completely rural” county has a subscription rate of 65 percent.¹⁰⁶ Within this aggregate geographic divide there are more extreme disparities. Some urban areas have access rates approaching 90 percent, while in some rural regions just one in three households have broadband access (Figure 17).

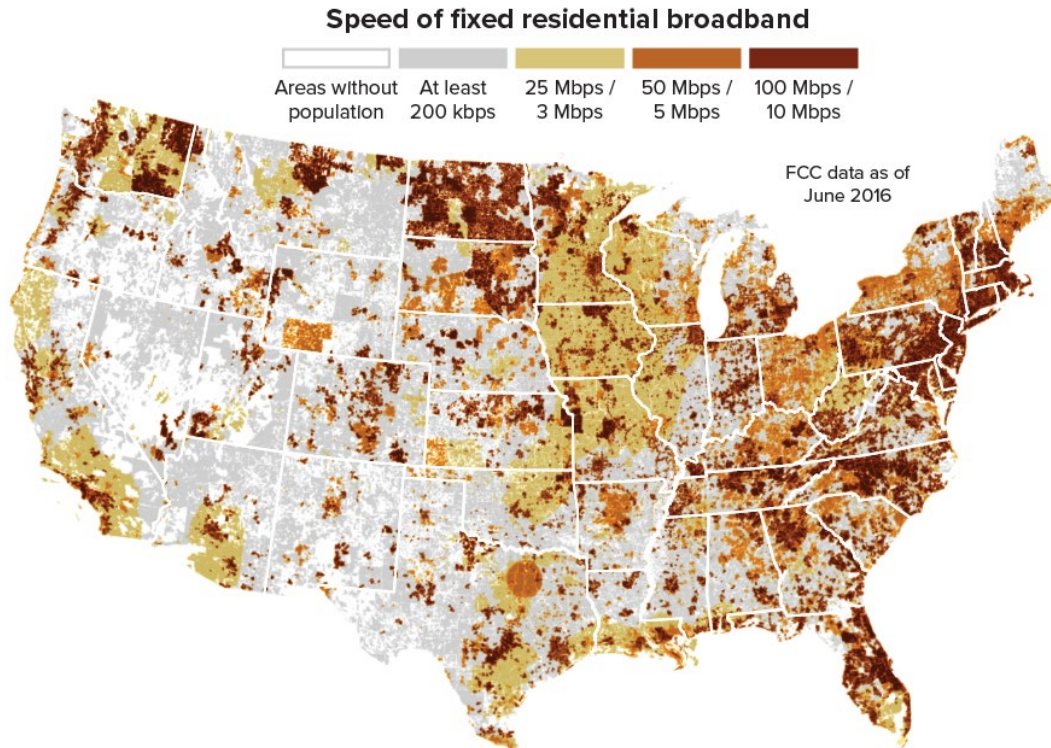


Figure 17. Estimated Internet access speeds. The Federal Communications Commission standard for broadband qualification is 25 megabits per second (Mbps). *Source:* Hendel, John, and Tucker Doherty. 2018. “America’s Digital Divide, in 2 Maps.” *The Agenda*. February 7, 2018. <http://politi.co/2E6OsUv>.

4. Disability: Compared with those who do not have a disability, disabled adults are about 20 percent less likely to subscribe to home broadband and own a computer, smartphone, or tablet.¹⁰⁷

5. Age: Adults ages 50 and older adopt devices such as smartphones, smart speakers, and wearables at rates comparable to younger generations.¹⁰⁸ Device adoption begins to drop rapidly at ages above 70. But broadband access is a different story. Close to 90 percent of households headed by persons through age 44 have a broadband subscription, but that drops to 68 for households headed by persons older than 65.¹⁰⁹ A significant percentage of older adults connect to the internet on a computer at a senior center, library or community center, many of which were shuttered by the pandemic. For an older individual, life without the internet in normal times is isolating; during the pandemic it could be life-threatening due heightened isolation and reduced access to food and health care.¹¹⁰

Digital Redlining. Detailed analysis of broadband access in the U.S. reveals systematic digital redlining: the purposeful discrimination against residents of lower-income, urban neighborhoods in the types of broadband service offered, and in ongoing investment in improved service. The name references the original term redlining, which was the practice of outlining areas with sizable Black populations in red ink on maps as a warning to mortgage lenders, effectively isolating Black people in areas that would suffer lower levels of investment than their white counterparts.¹¹¹ Higher speed technologies simply are not available to many urban households of color and low income. In the case of Dallas, Cleveland,

and Detroit, service providers have not made fiber-enhanced broadband improvements in many neighborhoods with high poverty rates, relegating them to Internet access services that are vastly inferior to the services enjoyed by their counterparts nearby in the higher-income suburbs.¹¹² (Figure 18).

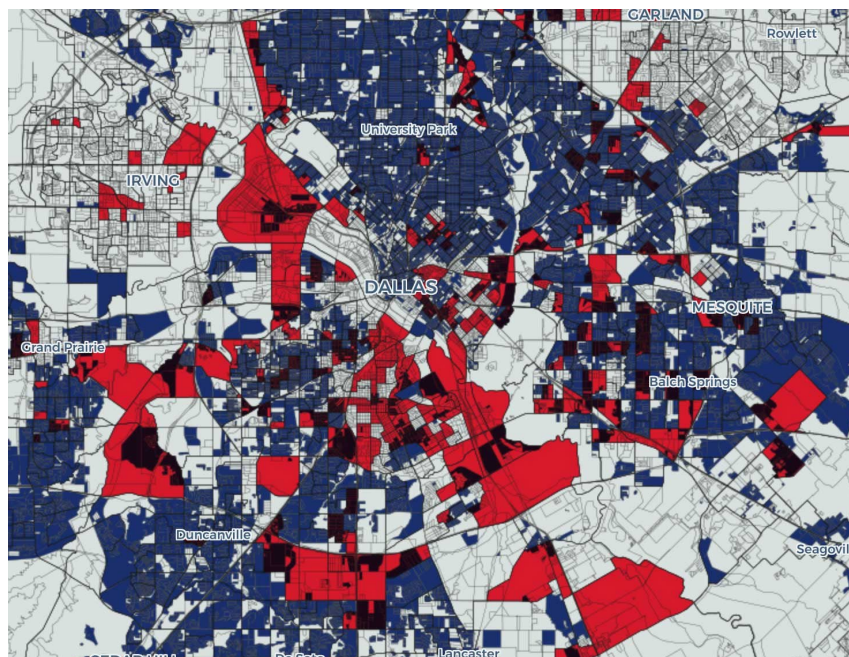


Figure 18. Digital redlining in Dallas, TX. The red areas are Census tracts that have poverty rates of 35 percent or more. The blue areas are Census tracts that are covered with high speed Internet access. The black areas are Census tracts where poverty and access overlap. *Source:* Callahan, Bill. 2019. “AT&T’s Digital Redlining of Dallas: New Research by Dr. Brian Whitacre.” <https://tinyurl.com/y647cge1>

The Digital Divide in Access to Clean Energy. A smartphone with cellular service provides access to much of the information required to participate in the clean energy revolution and to minimize utility bills. But access to the complete suite of information about rooftop solar, home energy audits, management of home energy use, EV charging, public bike share systems, weatherization, heat pumps, and financial assistance requires reliable and affordable high-speed access. Full benefit from these programs requires knowledge about, and use of, online calculator tools, instructional videos, buyer’s guides, FAQs, and other resources (Figure 19). Some of these resources do not have full functionality on a smartphone. Such information already is spread across unconnected federal, state, and local programs that exhibit a wide range of coverage, benefits, and outreach. The addition of poor ICT and Internet services compounds the problem.

An important example is the opportunity to live in a so-called “smart home,” i.e., a home in which appliances and devices are automatically controlled remotely from anywhere with an internet connection using a networked device. Smart homes provide secure access to door locks, televisions, thermostats, home monitors, cameras, lights, and appliances. In the case of energy, many low-income U.S. consumers lack a basic understanding of smart grid or smart

meter and the implications of these technologies, and they have much lower adoption rates of smart home technologies.¹¹³ Similarly, many low-income consumers are unaware of programs designed to help them pay for their household's electricity and fuel bills.¹¹⁴ Many renters who do not make efficiency related changes to their unit believe that they are not permitted to do so, or are unsure whether they can do so.¹¹⁵ A connection-to-the-grid alternatives such as rooftop solar power and energy storage systems requires good connectivity.¹¹⁶ These opportunities—all of which confer security, financial, health, and social benefits to the user—all depend in part on access to ICT and Internet services.



Figure 19. First Energy's online calculator enables the user to estimate savings from the installation of energy efficient heat pumps. *Source:* <https://energysavepa-home.com/hvac/hp-calculator/>

What Cities Can Do to Close the Divide. The pandemic has raised the stakes of the digital divide, prompting cities to take rapid action. A survey of city Chief Technology Officers in May 2020 revealed that some cities quickly expanded broadband access and lowered its price; increased mobile hotspots and free public Wi-Fi hotspots; and started to collect better user data.¹¹⁷ This work can be sustained in ways that close the digital divide and make progress on climate goals.

Cities can acquire real-time, granular knowledge of internet access, cost, and utilization for socially vulnerable populations. Cities and their partners can pressure the federal government to prevent carriers from practicing digital redlining; to provide subsidies that improve affordability; and to bolster the power of local governments to close the divide.

Cities can partner with service providers, city councils, unions, banks, foundations NGOs and others to provide free or reduced cost devices, access, and technical support. For example, the Baltimore Digital Equity Coalition (BDEC) was created to support a “rapid response” to digital access in the wake of COVID-19. The BDEC delivered home internet access to 2,000 disconnected homes, refurbished and distributed thousands of devices for students, and created a tech support hotline.¹¹⁸ In Kansas City, MO, the Federal Reserve Bank of Kansas City teamed with both the city and the business community on a program called the Employer Laptop Challenge that created a free stream of refurbished devices.¹¹⁹

Cities can partner with the same organizations to provide free digital literacy training. For example, the Digital Literacy Alliance (DLA) in Philadelphia awarded grants to support the

creation of “Digital Navigators” that help residents access affordable internet and technology options during the pandemic.¹²⁰ Literacy training can target skills and knowledge needed to realize clean energy benefits.

Cities can evaluate the extent to which their existing programs and plans for decarbonization and climate resiliency implicitly or explicitly assume access to and use of the Internet and ICT. How is the efficacy of a program affected by poor or no access? For example, what type and level of knowledge does a household energy efficiency program assume of renters and homeowners, and does knowledge acquisition rely on connectivity?

Cities can identify neighborhoods with poor connectivity and design new climate actions whose outreach efforts do not presume high rates of online participation.

Housing

There is a housing affordability crisis in America. Nowhere in the U.S. can someone working a full-time minimum wage job afford to rent a modest two-bedroom apartment.¹²¹ Meanwhile, housing, health, and poverty are intrinsically interconnected and pre-existing problems have been further exacerbated by the COVID-19 pandemic, as well as the effects of climate change. According to the Surgeon General, “many of the disparities in health status among subpopulations may be linked to poor access to safe and healthy homes, which is most prevalent among lower income populations, populations with disabilities, and minority populations.”¹²² Historically, neighborhood segregation was driven by intentional government red-lining that suppressed loans to Black people. Today, housing insecurity is perpetuated for the same population through disproportionate income and wealth, land costs, housing market dynamics, and lack of political voice. The outcomes created by these conditions include health disparities, less green space, higher eviction rates, concentrated poverty, and more.

Housing disparities are tightly tied to the wealth gap. Only 47 percent of Latinxs and 45 percent of Blacks were homeowners in 2011, compared with 73 percent of white households.¹²³ Moreover, Black and Latinx homeowners received a lower return in wealth on their investment. For every \$1 in wealth accrued by Black households, White households accrued \$1.34.¹²⁴

Historical housing segregation has led to non-White neighborhoods bearing the brunt of highways, landfills, incinerators, bus depots, and other unwanted land-use projects.¹²⁵ The proximity to these projects results in exposure to higher pollution and higher temperatures, and less access to green space, which all lead to health issues.¹²⁶

Vulnerable populations often live in unsafe or crowded conditions and find it more challenging to follow COVID-19 prevention strategies (Figure 10). Overcrowding among the Non-Hispanic, White population is low compared to other ethnicities and races.

Overcrowding due to multi-generation cohabitation is common in many cultures as well as low income communities, making it difficult to socially distance.¹²⁸

Other aspects of housing quality besides space per individual include air quality, home safety, and presence of mold, asbestos, or lead that contribute to poor health conditions.¹²⁹ Table 2

summarizes associated exposures and hazards based on income category, showing higher exposure rates in every category for lower income households. Exposure to these conditions create a domino effect that increases the risks of COVID-19 infection and mortality.

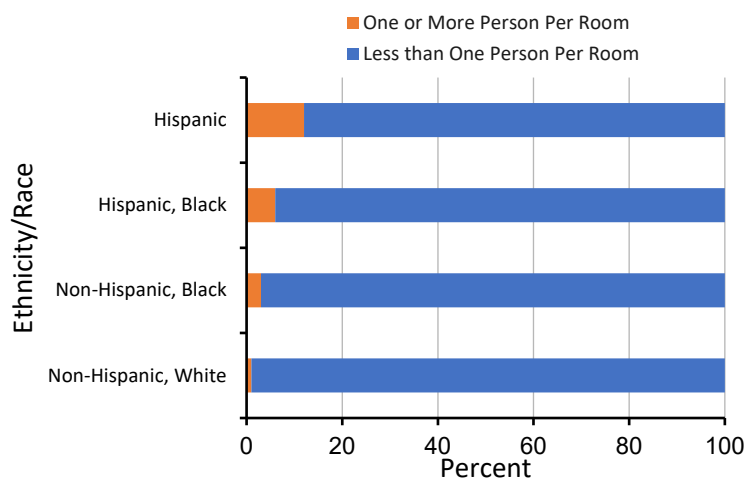


Figure 10. Overcrowding in housing by ethnicity/race. Source: ICF International analysis of AHS data¹²⁷

Table 2. Housing Variables Associated with Indoor Environmental Exposures, by Household Income

Housing Variable	Yearly Income Category				Associated Exposures and Hazards
	<\$30K	\$30K < \$60K	\$60K < \$100K	>\$100K	
Built before 1980, %	71.56	65.82	57.77	48.63	Lead paint; structural integrity
Area of peeling paint larger than 8x11 in, %	3.1	2.04	1.41	0.99	Lead paint
Any inside water leaks in past 12 months, %	9.14	8.67	8.24	7.98	Mold and moisture; structural integrity
Neighborhood with heavy street noise or traffic, %	28.19	25.42	21.95	16.69	Outdoor air sources - mobile
Industry or factory within half block, %	6.90	5.50	3.54	1.74	Outdoor air sources - stationary
Unit uncomfortably cold for >24 hours, %	10.70	9.67	7.33	6.71	Supplemental heating; comfort
Evidence of rodents in unit, %	17.77	16.81	16.98	16.26	Allergen exposure; pesticide exposure
Homes with cracks in floor, wall, or ceiling, %	7.13	5.10	3.88	3.31	Allergen exposure (pests)
Homes with holes in floor, %	1.85	1.03	0.58	0.37	Allergen exposure (pests)

Source: Adamkiewicz, Gary, Ami R. Zota, M. Patricia Fabian, Teresa Chahine, Rhona Julien, John D. Spengler, and Jonathan I. Levy. "Moving Environmental Justice Indoors: Understanding Structural Influences on Residential Exposure Patterns in Low-Income Communities." American Journal of Public Health 101, no. S1 (December 2011): S238-45. <https://doi.org/10.2105/AJPH.2011.300119>.

Access to nutritious food is a key social determinant of health.¹³⁰ Food insecurity can cause significant health problems including asthma, depression, cognitive problems in children, and hypertension, chronic kidney disease, diabetes, arthritis, and obesity in adults.¹³¹ It can significantly increase the cost of health care under conditions of heightened insecurity. Food insecurity is an intransigent problem in the U.S. It has trended slightly downwards over the past decade, but in 2018 one in nine households experienced food insecurity, roughly the same rate as a quarter century ago.¹³²

Concepts in Food Security

Food Security: “The right of every individual to have access to safe and nutritious food, consistent with the right to adequate food and the fundamental right of everyone to be free from hunger.”¹³³

Food Insecurity: “A household-level economic and social condition of limited or uncertain access to adequate food.”¹³⁴

Food Desert: “A low-income census tract with a substantial number or share of residents with low levels of access to retail outlets selling healthy and affordable foods.”¹³⁵

Food Apartheid: Residential areas that lack access to healthy food as a result of deliberate private and public decision making that produced structural social inequities by race, class, education, and geography.¹³⁶

Food Swamp: “Residential areas with a high-density of establishments selling high-calorie fast food and junk food, relative to healthier food options.”¹³⁷

The COVID-19 pandemic has exacerbated this gap. Prior to the pandemic, 35 percent of households with incomes below the federal poverty threshold experienced food insecurity, about seven times the rate of households with incomes at least 1.8 times above the poverty threshold (Figure 11). Black and Hispanic households were two to three times more likely to face food insecurity relative to White households. The presence of children increases the likelihood of food insecurity, and women living alone with children experience some of the highest rates of insecurity.

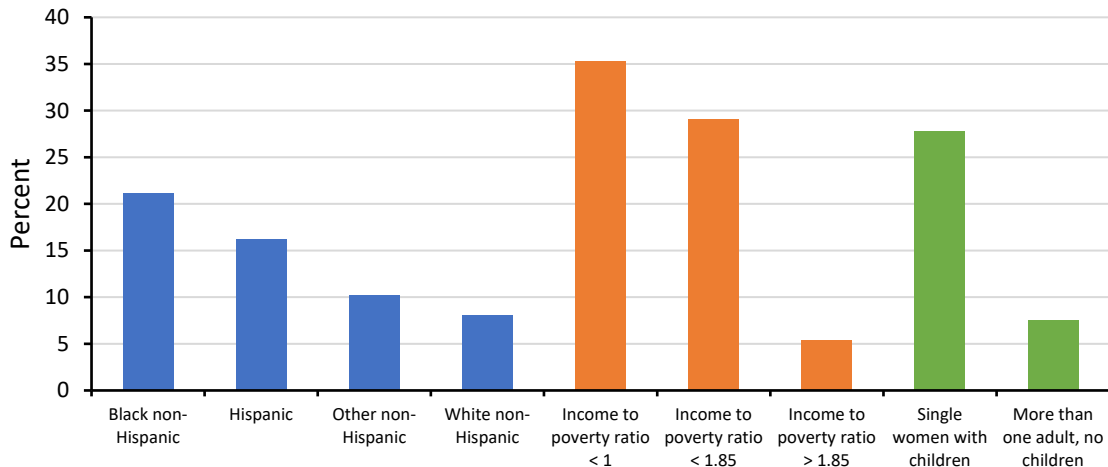


Figure 11. Percent of households that experienced food insecurity in 2018. The household income-to-poverty ratio is the total family income divided by the federally defined poverty threshold. A ratio less than 1 means that a household income is below the federal poverty line. In 2018 the poverty threshold was about \$26,000 for a family of four with two children under the age of 18. *Source:* Economic Research Service, U.S. Department of Agriculture.

Drivers of Food Insecurity. The proximate causes of food insecurity are low income and poor access to nutritious food. The ultimate causes run much deeper and they form a complex web of drivers, including poverty, unemployment, affordable housing, the status of women, household composition, level of education, residential segregation, and urban planning, among others.¹³⁸

The food insecurity problem for socially vulnerable populations, and especially for people of color and low income, exemplifies the confluence of forces that generate inequity in the U.S. that make them much more susceptible to COVID-19. Unemployment forces the choice to forgo some combination of food, rent, electricity, or transit fare. Poor nutrition exacerbates COVID-19 comorbidities such as obesity, diabetes, and hypertension. Behavioral coping responses to perceived racism produce psychological stress that also worsens some comorbidities.¹³⁹ At the same time that they are more likely to experience food insecurity, people of color are also more likely to work in low-wage, food processing jobs that are deemed essential during the pandemic, that carried higher risk of infection, and that are less likely to carry medical benefits.

Disruptions from the COVID-19 pandemic have exacerbated food insecurity problem in the U.S. More than 54 million people—one in six Americans—may experience food insecurity in 2020.¹⁴⁰ (Figure 12). Pre-pandemic racial disparities in food insecurity persist: in May 2020, about 14 percent of white adult households experienced food insecurity compared to 27 percent of Latinx and Black households.¹⁴¹ Critically, 16 percent of households with children reported not having enough to eat in June 2020,¹⁴² a number that may increase to 18 million children or one in four.¹⁴³ COVID-19 also caused an unprecedented disruption to schools, which typically take responsibility for serving free or reduced breakfast and lunch to millions of food insecure children every day. Across the country, school districts have been scrambling for months to get meals and financial resources to needy families.

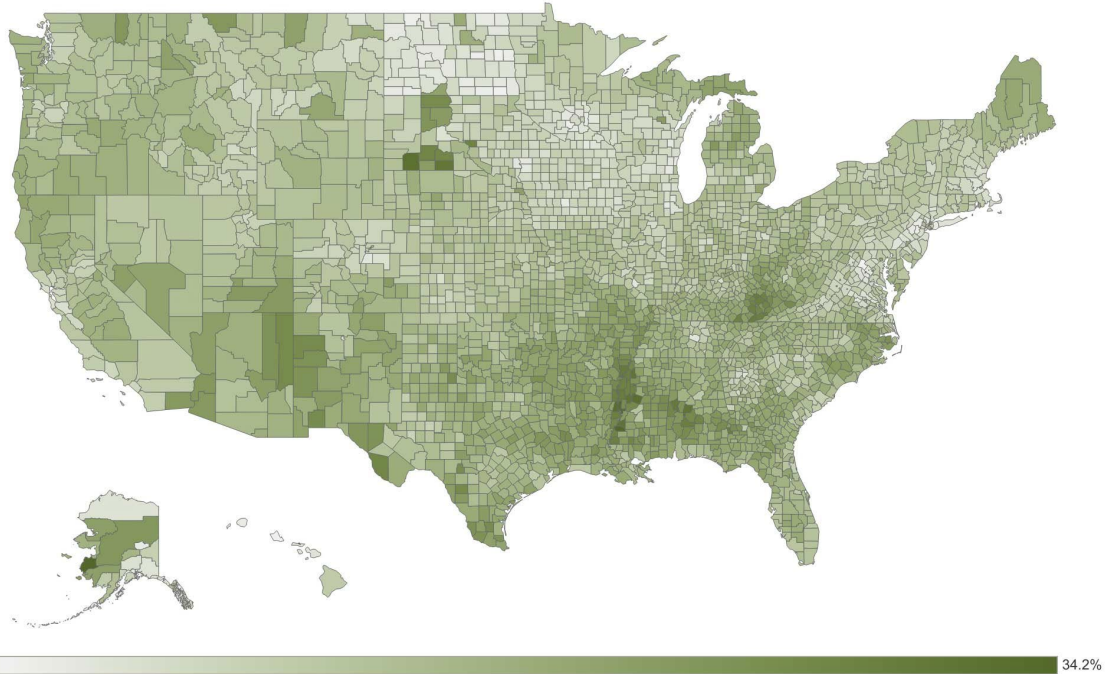


Figure 12. Projected rates of food insecurity by state in 2020. *Source:* The Impact of Coronavirus on Food Insecurity, Feeding America, Accessed September 6, 2020. <https://tinyurl.com/yykhj7gw>

Racial residential segregation created by strategic laws, policies, and restrictive covenants created food deserts in urban areas, especially between 1970 and 1988¹⁴⁴ (Figure 13). During this period, economic segregation became more prominent with more affluent, mostly white, households moving from urban to suburban areas. Supermarkets followed the suburban trend, leaving urban areas. This shift caused the median income in urban areas to decrease and forced nearly one-half of the supermarkets in the three largest U.S. cities to close, disproportionately decreasing access to fresh foods in Black communities. Residents in these communities must travel outside of their neighborhood and spend more time and money to feed their families.

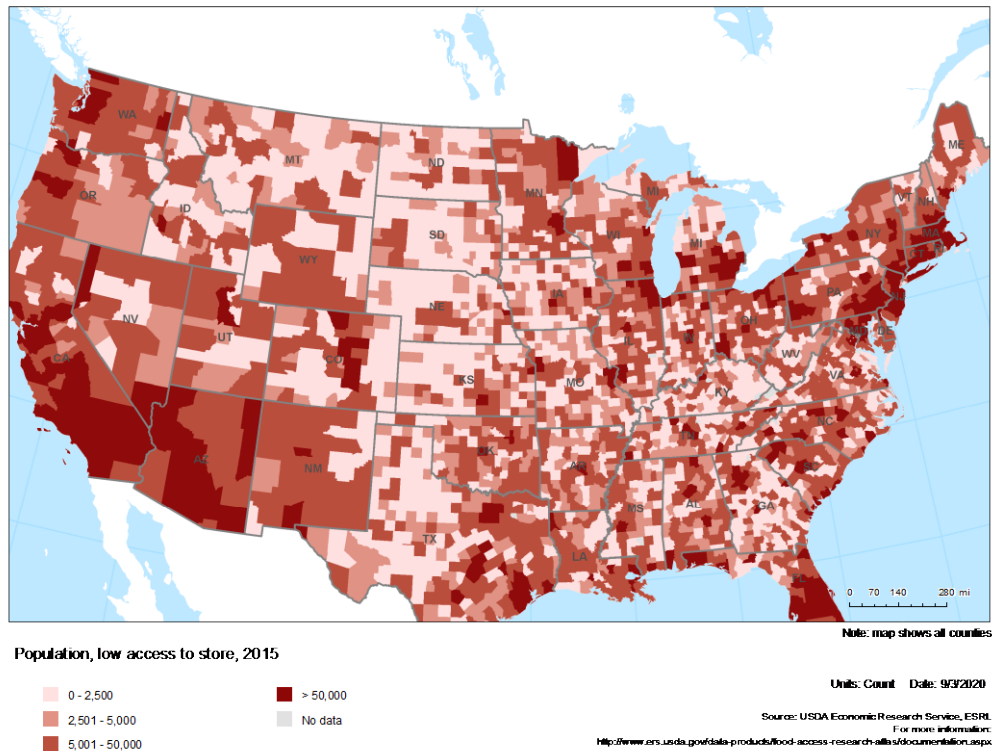


Figure 13. The number of people with low access to a grocery store in 2015. *Source:* Economic Research Service, U.S. Department of Agriculture, Food Access Research Atlas, Accessed September 6, 2020. <https://tinyurl.com/yacxt5zn>

Some argue that “food desert” is too antiseptic a term to describe this phenomenon because it typically is defined in geographic terms—distance to a market—and because “desert” implies that it is a “natural” occurrence.¹⁴⁵ The term *food apartheid* reflects the conscious decision making by public officials and private firms that generate the patterns we observe in Figure 13. Residential segregation caused by public policy and deliberative choices made by firms regarding where to build food stores have excluded many Black communities from access to healthy food.

The same set of discriminatory policies simultaneously created food swamps: neighborhoods where high calorie fast food and junk food inundate healthy alternatives.¹⁴⁶ While accounting for income effects, fast food restaurants and convenience stores are disproportionately located in Black neighborhoods.¹⁴⁷ In turn, proximity to fast food restaurants and convenience stores is a strong predictor of obesity rates.¹⁴⁸ In fact, it appears that living in a food swamp is worse for one’s health than living in a food desert (of course the two can occur together).

Food Assistance Programs. As minimum wages plateaued and housing costs soared in many cities, food banks doubled their distribution from 2009 to 2019 to serve 40 million people.¹⁴⁹ In spring 2020, higher unemployment quickly and dramatically forced more people to rely on food banks and local food pantries. Lines at some local food banks stretched over a mile long. The shutdown of public transportation worsened the problem, especially for those living in food deserts. Cities, states, and charitable organizations stepped up with more funding and

creative solutions. As the food service industry collapsed, farmers suddenly faced a collapse in demand for their crops. The Farm to Family program, run by the California Association of Food Banks and supported by the state's Department of Food and Agriculture, paid farmers to send surplus produce to food banks.¹⁵⁰



Food being delivered a one-day food drive event on Thursday, August 27, 2020, held at the Evergreen State Fair Park. The drive was sponsored by Snohomish County Parks in Washington. *Credit:* snohomishcountywa.gov

Food supplies in most grocery stores across the U.S. are trending back towards their pre-pandemic levels, a testament to resiliency in some aspects of the country's food distribution system. But the recovery of employment will take years. Thus, the end of enhanced unemployment benefits means that some states are experiencing a new peak in food insecurity. In Washington state, for example, 2.2 million people, or a quarter of the state's population, are projected to depend on visits to a food bank in 2020.¹⁵¹

Food banks, much like schools, are an important and critical safety net during crises that worsen food insecurity. But universal access to nutritious, affordable food requires deeper action to address the root causes of food insecurity.

What Cities Can Do to Improve Food Security. Cities can catalyze the effort to eliminate food deserts and food swamps. Zoning, real estate tax reductions, density bonuses, and reduced parking requirements are examples of existing tools cities can employ to drive grocery store attraction and corner-store conversion initiatives at the neighborhood level.¹⁵² For example, New York City provides real estate tax reductions, density bonuses and reduced parking requirements through its Food Retail Expansion to Support Health (FRESH) program.¹⁵³ In San Francisco, the Southeast Food Access Working Group's Food Guardians partnered with three corner-store owners to increase their healthy food items. In 2012, the City of

Philadelphia changed zoning regulations that “made gardening and farming permissible activities on most land with the city.” Many community gardens sprang up on abandoned lots. The City’s Urban Agriculture Plan guarantees that the land remains available for agriculture, that it meets food safety standards, and that coordination is established across city network of community gardens.¹⁵⁴

Cities have additional leverage via their ability to license and to provide public financial assistance for food retailers. In San Francisco, food retailers who receive loans and technical assistance must agree to dedicate at least 35 percent of their shelf space to “fresh produce, whole grains, lean proteins and low-fat dairy products.”¹⁵⁵ They can also limit or prohibit the sales and marketing of unhealthy food in environments frequented by children, especially at facilities that receive government funding.¹⁵⁶

Some cities are actively supporting urban food production through the conversion of vacant land and other means. The city of Cleveland could grow from 46 to 100 percent of its fresh produce needs, 25 percent of its poultry and eggs, and 100 percent of its honey by aggressive utilization of vacant land and industrial and commercial rooftops. Milwaukee is now experimenting with urban farming as a way to replenish food deserts in low-income neighborhoods.¹⁵⁷



Mobile grocery store converted from a retired transit bus in Toronto, Canada. Credit: Hunter College, NYC Food Policy Center, nycfoodpolicy.org.

Public transportation

planning can increase access to supermarkets and farmer’s markets in ways that connect food-stressed households to denser parts of cities. This action includes route planning and the expansion of service hours to accommodate workers with two and three jobs. This type of integrated planning can be achieved with a dedicated organizational infrastructure that joins transit authorities, community food providers and city officials.¹⁵⁸

Cities are creating mobile markets that serve urban deserts with fresh food and new job opportunities created with food delivery. The Urban Growers Collective on the South Side of Chicago uses refurbished, retired public buses to deliver fresh produce to residents, farmers markets, senior and health centers. The collective manages seven farms on 11 acres of land throughout the South Side and is farmed by residents.¹⁵⁹

Cities have also helped low income residents further stretch government food assistance like SNAP (Supplemental Nutrition Assistance Program), while also supporting local farmers. New York's Health Bucks program provided an extra \$2 for every \$5 spent on an EBT card at farmer's markets, resulting in increased farmer's market usage and self-reported fruit and vegetable consumption among recipients.¹⁶⁰ Rebates for fruit and vegetable purchases have also been shown to impact healthy food consumption among SNAP participants.

Cities can partner with academic institutions to evaluate programs and support new ways to improve access to affordable healthy food. Ohio State University is developing a model micro farm system to demonstrate how to maximize the number of crops grown in small spaces (one-third of an acre).¹⁶¹ Micro farms use a whole food system approach to be cost-competitive by training, growing the same food items in the same way, and marketing and selling all the produce before it's harvested. The micro farm system tracks GHG reductions through the avoidance of chemicals, soil conservation, and reduced supply chains for food distribution.



Chicago teenagers on the Grant Park Potager Farm that is located in downtown Chicago. *Credit:* Urban Growers Collective

Debunking Myths about Density

A New Round of Debate

During crises people rely more heavily on anecdotal evidence that often reflects their personal and professional biases to “make sense of things”. Everything becomes local and personal. Nowhere is that more evident than in the debate regarding the connection between the pandemic and population density. We intuitively connect proximity to others with heightened risk to an airborne virus. Isn't the public health recommendation for “social distancing” all the evidence we need to confirm that density is a health risk?



Street parties like this one in 2011 in the Soho district of London are a benefit of urban life enabled by high population densities. The COVID-19 pandemic has focused attention on the benefits and costs of density. *Credit:* Fæ / CC BY-SA, Wikimedia Commons.

Some observers then make what seems to be a short leap and deduce that densely populated hotspots such as Wuhan, China and New York City are evidence that urban density is bad. A New York Times headline declared that “Density Is New York City’s Big ‘Enemy’ in the Coronavirus Fight.”¹⁶² New York Governor Mario Cuomo—generally lauded for his leadership during the pandemic—tweeted “There is a density level in NYC that is destructive. It has to stop and it has to stop now. NYC must develop an immediate plan to reduce density.”¹⁶³ Similarly, an article in the Los Angeles Times opined: “Angelenos like their single-family sprawl. The coronavirus proves them right.”¹⁶⁴

The belief that density increases health risk have led some to conclude that the pandemic will accelerate the ongoing growth slowdown in major U.S. metropolitan areas.¹⁶⁵ A Harris Poll survey in April reported that nearly 40 percent of U.S. adults living in urban areas indicated they would consider moving “out of populated areas and toward rural areas.”¹⁶⁶ Some observers conclude that “the thrill of city living is gone,”¹⁶⁷ and that increasing the density of human populations “is not the answer to our environmental problems.”¹⁶⁸

Density vs. Crowding

Density: the average number of people, households, floor space, or housing units on one unit of land. Population density is the number of persons living in any given area (e.g., per square mile or per square kilometer). Residential density is the number of dwelling units per unit area.

(Household) Crowding: A condition where the number of occupants exceeds the capacity of the dwelling space available, whether measured as rooms, bedrooms or floor area, resulting in adverse physical and mental health outcomes. Crowding is often a marker of poverty, racism, and social deprivation. Most federal agencies in the U.S. define crowding in a dwelling unit as more than one person per room, excluding kitchens and bathrooms. Severe overcrowding occurs when there is more than 1.5 people per room.

Sources: WHO Housing and Health Guidelines, Geneva: World Health Organization; 2018. Chapter 3, Household Crowding; Lehmann S. (2019) Understanding the Benefits of Urban Density. In: Urban Regeneration. Palgrave Macmillan, Cham. https://doi.org/10.1007/978-3-030-04711-5_3

But anecdotal evidence abounds in the opposite direction, namely that the spread of virus has nothing to do with density. In mid-April, Albany Georgia, had the highest-per capita death rate from COVID-19 in the U.S. There is no subway in Albany and most people live in low-density housing. Hyper dense metropolitan regions such as Singapore, Hong Kong, Tokyo, and Seoul fared much better than many low-density regions. The outer boroughs of New York City had higher infection rates than much denser Manhattan. So, which condition is true?

Is the Pandemic Worse in the Densest Regions of the U.S.?

This may seem like a straightforward question but consider this: there is still debate about whether the 1918 influenza pandemic was worse in denser regions. We are in the first paragraph of the first page in the first chapter of the book on COVID-19, but here is what we currently know in regard to population density.

At the city level, three studies examine the pandemic in New York City.¹⁶⁹ They point in the same direction: the rates of infection and mortality are *not* related to population density, but instead tied to household crowding. In fact, one study found that ZIP Codes with a higher population density have some of the lowest rates of cases per 1,000 people (Figure 23). All three studies found that that measures of crowding, such as number of people per household, are strongly associated with the rate of infection and/or mortality.

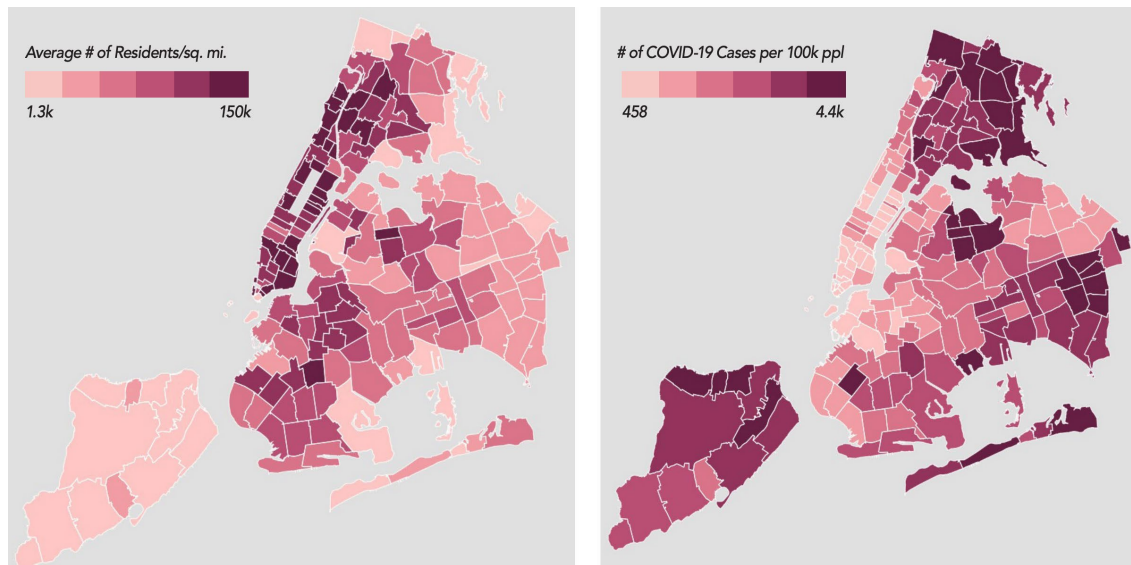


Figure 23. Population Density and COVID-19 Case Rate in New York City. *Source:* Citizens Housing and Planning Council of New York City. 2020. “Density and COVID-19 in New York City.” <https://chpcny.org/density-and-covid-19/>.

At the state level, there is one study of 351 cities and towns in Massachusetts, and it reported that municipalities with greater density have a significantly higher per capita incidence of the disease.¹⁷⁰

At the national level, most studies use county-level data for between 600 to 1800 municipal counties. County data is used because city-specific data on COVID-19 infection and fatality rates are less available and less likely to be reported in a consistent manner. Several studies find a strong connection between population density and infection and or mortality rates.¹⁷¹ One study of 351 cities and towns in Massachusetts also reported that municipalities with greater density have a significantly higher per capita incidence of the disease.¹⁷² Yet, one study found the opposite, namely that the densest counties in the US have the lowest rates of mortality.¹⁷³

We emphasize again that this is a very early snapshot. The initial work suggests no clear connection between population density *per se* and the infection and/or mortality rates from COVID-19. The city-level work points to a need to delve deeper into the possibility of crowding as an important health risk, in part because it has important equity impacts. The percentage of Black renter households that are crowded (more than two people per bedroom) is twice that of White renter households (Figure 24). Hispanic renter households are seven times more likely to be crowded compared to White renter households. Low income renter households are twice as likely to be crowded compared to high income households.

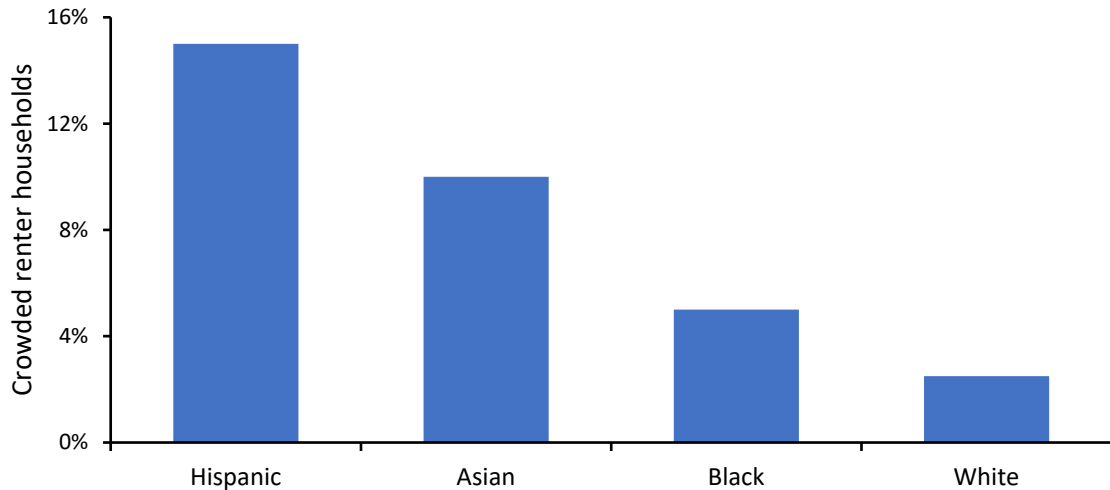
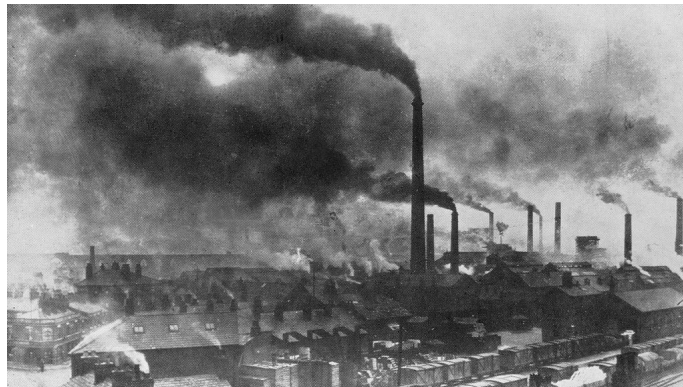


Figure 24. The percentage of renter households in the U.S. that are crowded (more than two people per bedroom).
Source: Government Accounting Office. 2020. “Rental Housing: As More Households Rent, the Poorest Face Affordability and Housing Quality Challenges.” Washington, D.C

Health Benefits of City Life

The benefits (higher productivity and wages, increased social connection) and the drawbacks (congestion, pollution, crime, greater inequality) of cities have been debated since they first emerged during the Neolithic Revolution that began some 12,000 years. Two aspects of that debate are highly relevant to our discussion: the connection between cities and health, and the connection among cities, energy use, and GHG emissions.

Thomas Jefferson famously wrote that the urban environment was “pestilential to the morals, the health, and the liberties of man.”¹⁷⁴ Through the 19th century cities were pretty unhealthy places to live compared to rural areas, at least in terms of infectious diseases and exposure to pollution. This was known as the “urban health penalty.” For example, the heights of servicemen recorded on enlistment in the British army during the First World War were found to be negatively correlated with the coal intensity of the districts in which the men were observed as children in the 1901 census.¹⁷⁵



Pollution in Widnes, England in the late 19th century caused by the combustion of wood and coal. *Credit:* Hardie, D. W. F., *A History of the Chemical Industry in Widnes*, Imperial Chemical Industries Limited, 1950 via Wikimedia Commons.

This began to change with the rise of the “Sanitary City”¹⁷⁶ that ultimately eliminated and then reversed the health penalty in many cities. Armed with new technologies and knowledge of the germ theory of disease, municipal governments began to build infrastructure that (i) delivered clean water, (ii) collected and treated sewage, and (iii) collected and treated solid waste. Cities also acted to reduce local air pollution by banning the use of wood and coal, and they invested in public health systems. Coupled with better nutrition and medical advances, these changes greatly improved health outcomes for city residents, although the benefits disproportionately accrued to wealthier white residents.

Public health scientists now refer to the “rural health penalty.”¹⁷⁷ Compared to rural residents, today’s urban residents have lower death rates due to lower rates of cardiovascular, respiratory and kidney diseases, stroke, unintentional injuries, lung and colorectal cancer, suicide, diabetes, Alzheimer’s disease and birth defects. These urban-rural differences are greatest for low income and people of color,¹⁷⁸ and they have widened over time (Figure 25). Life expectancy is three years higher in urban areas, compared just 0.4 years higher in 1971.¹⁷⁹

The mechanisms that underlie the health benefits of cities are relevant for the design of resilient and equitable responses to health crises such as pandemics, and emergencies such as extreme heat and flooding events brought by climate change. They also point the way to cost-effective, equitable, “win-win” actions to reduce GHG

emissions. Sprawl is linked to physical inactivity, obesity, traffic fatalities, poor air quality, higher residential energy use, greater emergency response times, reduced social capital, and longer private-vehicle commute distances and times.¹⁸⁰ Conversely, high density development in “compact cities” enhances urban vibrancy, increases physical activity and promotes the use of active transportation, resulting in improved health outcomes and reduced travel distance, minimizing the need for private automobiles.¹⁸¹ Emergency response times¹⁸² and hospital staffing¹⁸³ are both superior in cities.

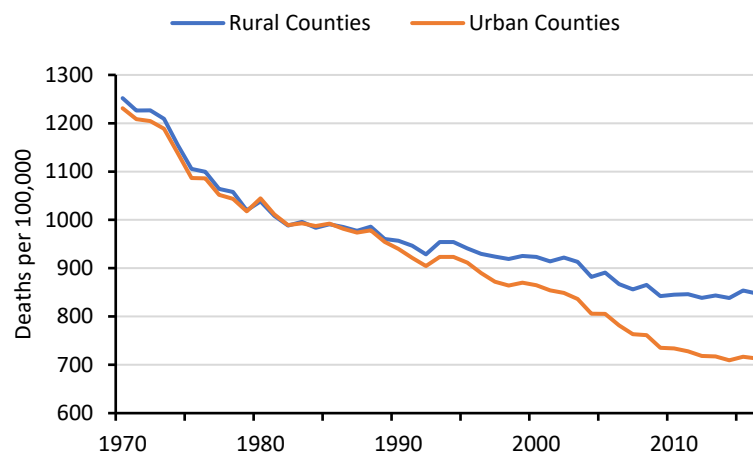


Figure 25. Trends in rural and urban age-adjusted (all-cause) mortality for the United States (1970–2016). *Source:* Cosby AG, McDoom-Echebiri MM, James W, Khandekar H, Brown W, Hanna HL. Growth and persistence of place-based mortality in the United States: the rural mortality penalty. *Am J Public Health.* 2019; 109:155–162. doi: 10.2105/AJPH.2018.304787

Energy and Emissions Benefits of Cities

Many of the attributes that make cities healthier and better prepared for emergencies also reduce GHG emissions per capita and per household. In many industrialized countries, per capita energy use of city dwellers is lower than the national average, which reflects the effects of compact urban form, settlement types (multi- versus single-family dwellings) and availability and/or practicability of public transport systems compared with those in the suburban or rural sprawl.¹⁸⁴

Consider non-transportation household energy use, i.e., the fuel and electricity used for heating and cooling, appliances, lighting, computers, etc. The average rural household uses more energy than its urban counterpart, and a household living in a single-family, detached home uses more energy than a household in an apartment building (Figure 26). Variations in lifestyle and the form of settlements explain these differences. Bigger houses require more energy than smaller ones because there is more space to heat and cool, and detached houses require more energy than attached houses or apartment buildings of comparable size because there is more exposed surface area.¹⁸⁵ Global models indicate that increasing urban population density is equally effective as improved energy efficiency as a means to reduce the future demand for building energy use.¹⁸⁶

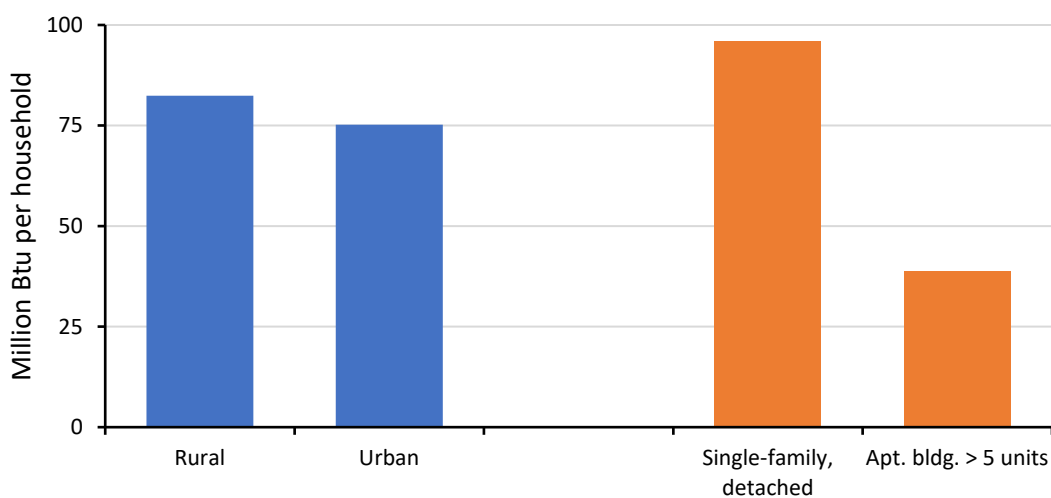


Figure 26. Household Energy Use in the U.S. in 2015. *Source:* U.S. Energy Information Administration, 2015 Residential Energy Consumption Survey.

In Peter Newman and Jeffrey Kenworthy's book *Cities and Automobile Dependence* the authors show that gasoline use per capita in cities declines as an exponential function of city population density (Figure 27). Their work has been replicated and cited by such a large number of researchers the curve is known as the "Newman and Kenworthy hyperbola." This relationship between density and transportation energy use became gospel because it seems consistent with a simple observation: people in dense cities own cars less, drive less, use more public transportation and walk and bike more compared to people in cities that are spread out.

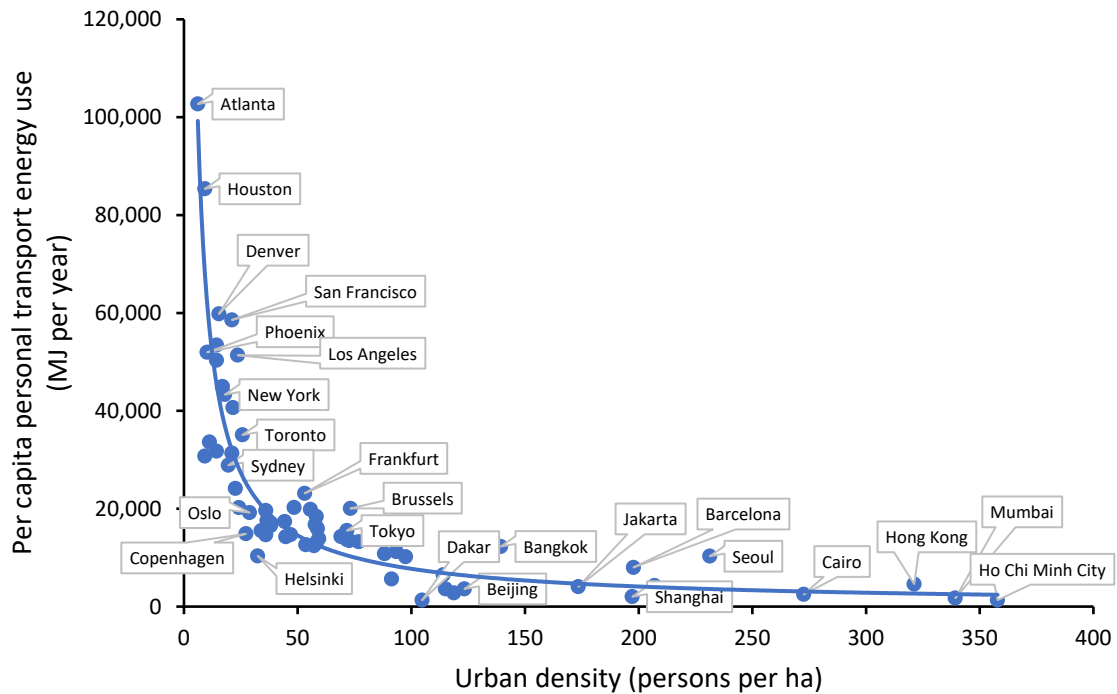


Figure 27. Per capita private passenger transport energy use and urban density in global cities. *Source:* Data from Newman, Peter. 2014. “Density, the Sustainability Multiplier: Some Myths and Truths with Application to Perth, Australia.” *Sustainability* 6 (9). <https://doi.org/10.3390/su6096467>.

Subsequent research shows that factors in addition to population density affect per capita energy use in transportation. Sprawl, or its opposite “compactness” of development, is a key determinant of energy use. Accessibility is the key. Sprawl is any development pattern in which related land uses have poor access to one another, leaving residents with no alternative to long distance trips by automobile.¹⁸⁷ Compact cities have patterns of connectivity, development, and other attributes in addition to high density that reduce per capita transportation energy use.¹⁸⁸

Atlanta illustrates the importance of compact development and density on the GHG emissions from household and transportation energy use. Researchers at the University of California at Berkeley calculated the “carbon footprint” for every zip code in the country.¹⁸⁹ Emissions were estimated from housing and transportation energy use, and from the energy used to produce the goods and services consumed by households. The Atlanta zip codes with the highest energy-related emissions are concentrated in a tight band of suburbs between 15 and 45 miles from the city center. Geographic differences are most pronounced for transportation-related emissions, which range from <10 tCO₂e per household in the urban core to >25 tCO₂e in the most distant suburbs. Income and household size contribute to larger consumption-related carbon footprints in suburbs. Most other major metropolitan areas mirror the Atlanta pattern.

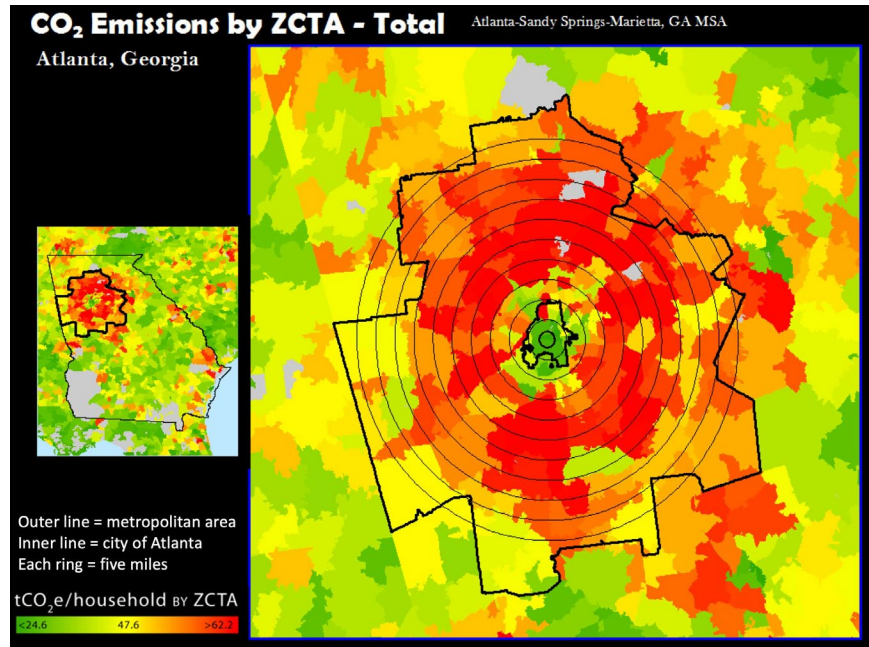


Figure 28. Household carbon footprints for Atlanta, GA based on for zip code tabulation areas (ZCTAs). Units are metric tons CO₂e per household. The maps demonstrate relatively low carbon urban cores and high carbon suburbs for all major sources of household carbon footprints. *Source:* Jones, Christopher, and Daniel M. Kammen. 2014. "Spatial Distribution of U.S. Household Carbon Footprints Reveals Suburbanization Undermines Greenhouse Gas Benefits of Urban Population Density." *Environmental Science & Technology* 48 (2): 895–902

The effect of population size and density on urban GHG emissions were summarized for 3285 urban areas in the U.S. (Figure 29).¹⁹⁰ The predominant relationship is clear. Larger urban areas as measured by total population size generate more emissions. A 10 percent increase in population size is associated with a 5 percent increase in total CO₂ emissions. An inverse relation exists between per capita emissions and population density. A 10 percent increase in population density is associated with an 8 percent decline in CO₂ emissions per person.

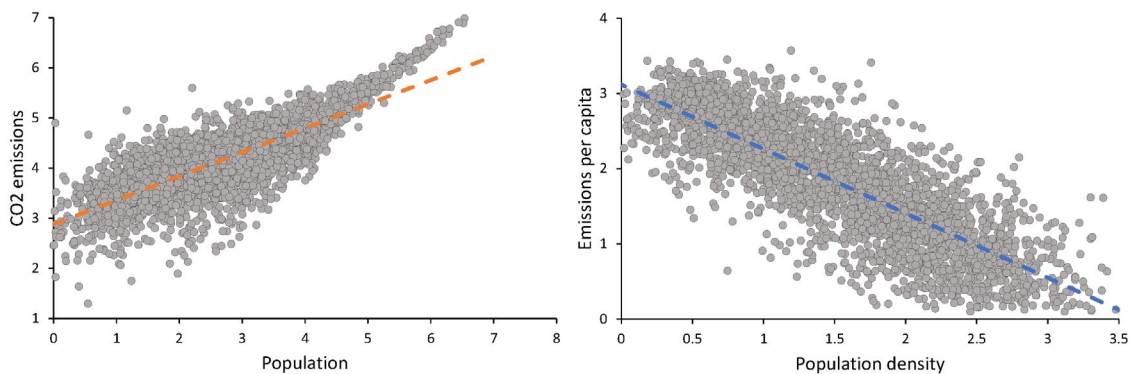


Figure 29. *Left:* The relationship between total CO₂ emissions and population size for 3285 urban regions in the U.S. *Right:* The relationship between total CO₂ emissions per capita and population density for those same regions. Units: population in raw counts, area in km², and emissions in tonnes of CO₂. In both plots, each dot is associated with a U.S. urban region, and all quantities are expressed in base-10 logarithmic scale. Emissions are from on-road transportation and buildings in the residential and commercial sectors. *Source:* Ribeiro, H.V., Rybski, D. & Kropp, J.P. Effects of changing population or density on urban carbon dioxide emissions. *Nature Communications* 10, 3204 (2019). <https://doi.org/10.1038/s41467-019-11184-y>

What Cities Can Do

The policy formula for a city that is carbon-neutral and resilient in the face of pandemics, flood, and heat waves is not a mystery. It is laid out in the "15-minute city" vision of Paris Mayor Anne Hidalgo where residents can meet all their work, shopping, and leisure needs within a short walk or bike ride.¹⁹¹ It is embodied in the notion of compact cities, an urban form that encourages cycling and walking, enhances public transport, mixes land use, maintains accessibility to local services and jobs, and builds enough housing to give an affordable toehold to those who want access to the opportunities these places offer.¹⁹² Portland's long range, comprehensive plan calls for "complete neighborhoods" with "multi-story buildings, well-scaled streets and businesses and shops and restaurants that meet the everyday needs of residents."¹⁹³

To reap the potential benefits offered by the dense arrangement of people and their economic and social activities, cities must sharply depart from business-as-usual decision making. We need policies that resist and reverse the inequitable and environmentally destructive outcomes from decades of market-driven decisions, that prioritize the needs of all socially vulnerable populations, and that leverage the enormous pent-up, potential synergy of actions that simultaneously reduce emissions, improve public health, expand economic and social opportunities, and close the equity gap.

The perception that population density drives the spread of the coronavirus poses a considerable communication challenge for cities. But the pandemic can also be used as a "teaching moment" in which action to improve public health, stimulate the economic recovery, and meet climate goals can be linked to the broader social, economic, cultural, and environmental benefits of city life. Cities can develop narratives and communication strategies that tell that story. But the credibility and effectiveness of that story depends on actual, visible actions that create healthy, livable, equitable, and climate resilient cities.

Affordable, Clean Energy and Energy Efficiency

The Clean Energy Transition

Prior to the pandemic, clean energy was advancing and coal was in retreat. In 2019, the country's total renewable energy consumption surpassed that of coal for the first time. Solar and wind were the fastest growing sources of new generation capacity from the mid-2000s through January 2020. The U.S. Energy Information Administration projected that solar and wind would account for 76 percent of this year's new generation capacity. Sales of electric vehicles doubled from 2017 to 2019,¹⁹⁴ and utility scale battery storage more than doubled from 2015 to 2018.¹⁹⁵ State energy efficiency programs continued to expand.¹⁹⁶ These trends were good news for cities because most climate action plans rely heavily on clean sources of electricity, the electrification of transport and heating, and more energy-efficient buildings.

The economic shockwaves of the pandemic roiled the markets for clean energy. The spot price of a barrel of oil dropped from about \$60 in early January 2020 to *minus* \$37 for one day in April, before partially recovering by the end of May (Figure 20). The price collapse was due in large part to an

historic drop in demand for gasoline as travel and shipping were sharply curtailed. In April 2020, the consumption of liquid fuels in the U.S. reached its all-time monthly low since the early 1980s.¹⁹⁷ Volatility in the price and demand for energy has raised serious questions about the recent momentum of clean

energy and energy efficiency. Will electricity generators continue to expand their investment in wind, energy, and storage? When vehicle sales rebound, will consumers continue to shift towards EVs? Will the rooftop solar industry recover quickly?

The response to many of these questions rests squarely in the hands policy makers at the federal, state, and local levels. Cities can take strong action that will enable clean energy to come out the other side of the pandemic in a stronger position. Two fundamentals are important here. First, historical price and demand shocks left indelible marks on the evolution of the global energy system, and the current crisis is no different.¹⁹⁸ This provides a

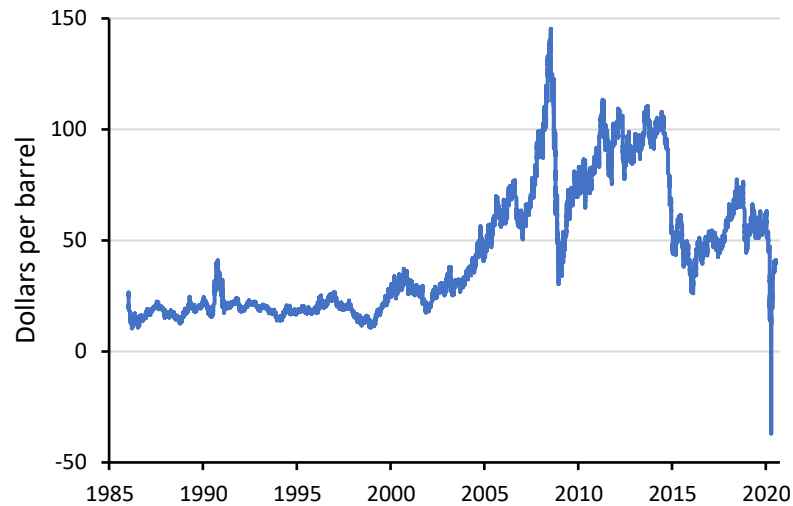


Figure 20. Spot price of oil in Cushing, OK, January 2, 1986 to August 24, 2020. Source: U.S. Energy Information Administration

rare opportunity for decision makers to effect rapid and transformative change, including the use of clean energy action to reduce inequity. Second, forceful and positive messaging and outreach is more important than ever, not only to mitigate the short run slow down caused by the pandemic, but also to capitalize on the once-in-a-generation opportunity at hand to accelerate progress towards carbon-neutral cities.

Short Run Causes for Concern

There is cause for concern (Table 3). The U.S. clean energy sector shed 620,000 jobs, or 18 percent of its work force, by the end of May 2020.¹⁹⁹ Major new clean energy projects were delayed or cancelled, and leading market analysts such as Bloomberg New Energy Finance and Wood Mackenzie substantially lowered their estimates of the demand for clean energy in 2020.²⁰⁰ Distributed solar and residential energy efficiency were especially hard hit due to the difficulty in reaching customers door to door, a cornerstone of the residential customer-acquisition process; installers facing work stoppages caused by lack of access to buildings; and consumers' heightened reluctance to make large capital expenditures.²⁰¹

Table 3. The Short and Long Run Prospects for Clean Energy in the U.S.

	Short run	Long run
Positive	<ul style="list-style-type: none"> • Public support for clean energy in economic recovery • Clean power weathered demand reduction better than fossil generation • “Safe Harbor” tax credits extended for solar and wind • Clean power stocks recovered faster than fossil fuel stocks 	<ul style="list-style-type: none"> • Growing cost advantage • Increasingly viewed as less risky investment than fossil fuels • Clean power targets codified in state laws and regulations. • Immense political and social pressure to retire coal plants • Utility and company buy-in is strong • Heightened concern about public health
Negative	<ul style="list-style-type: none"> • Reduced demand for electricity • Federal bailout of oil and gas • Supply chain disruptions • Unemployment of clean energy workers • Delays in permitting and public solicitations • Reduced capital for financing • Reduced major expenditures by households 	<ul style="list-style-type: none"> • Prolonged recession will reduce investment • Clean energy subsidies eliminated and regulatory uncertainty • Sustained rollback of energy efficiency and environmental quality regulations • Sustained and enhanced` subsidies for fossil fuels • Prolonged low oil and gas prices will extend their use

Wind turbines, PV modules and batteries are very material-intensive. The global supply chains that feed their construction were pummeled by the economic shutdown. Solar energy was especially hard hit because 70 percent of global PV module manufacture is in China, and in February, solar PV manufacturing facilities in China paused or reduced production because

of coronavirus-related lockdowns in several key provinces. Construction stalled for some wind and solar PV projects due to limited worker travel, changes in finances, and delays in onsite inspections and permits from local authorities.²⁰² For example developers scrapped plans to build at least 13 solar farms in Texas since crude prices began plummeting in March, creating a sharp downturn in the state's economy.²⁰³ Some states postponed solicitations for offshore wind projects, and financing for clean energy became more uncertain due to the increased cost of capital, concerns about tax equity financing, and heightened aversion to smaller projects.²⁰⁴

Energy politics is another source of concern. Lobbyists and lawmakers from oil and gas producing states found a sympathetic audience in Washington for their efforts to steer recovery stimulus funds towards the distressed industry. Changes to business tax provisions and rebates under the CARES Act favored oil and gas in light of its massive loss in revenue when oil prices cratered.²⁰⁵ The Federal Reserve expanded its "Main Street Lending Program" so that oil and gas companies received generous loan terms as they wait for prices to recover. The Fed also intervened in the bond market in a manner that disproportionately benefited fossil fuel companies despite their high credit risk.²⁰⁶ Finally, the Interior Department's Bureau of Land Management slashed royalty payments that oil and gas companies owe taxpayers from fuels extracted on public lands.²⁰⁷

Clean Energy Is Strengthened by the Pandemic

But there are other forces at work that are likely to maintain, and could substantially strengthen, the momentum behind clean energy and energy efficiency.²⁰⁸ As disruptive as it has been, the breakdown of supply chains for wind and solar will be temporary unless there is an especially protracted global recession. Indeed, PV and module production in China had recovered to their pre-pandemic levels by early April. While costly today, regulatory, construction, and financing delays are also likely to be temporary. Costs were substantially diminished on May 27, 2020, when the Internal Revenue Service extended the so-called "safe harbor rule" for the production tax credit (PTC) for wind energy and the energy investment tax credit (ITC) for solar energy from four years to five years for projects that started construction in 2016 or 2017. The safe harbor rule will help clean energy producers remain attractive to investors.

Developers can build wind and solar farms more quickly than natural gas, coal and nuclear plants, an attribute that is especially important during economic downturns. Investors are attracted to businesses that can quickly scale up and start earning money.²⁰⁹ Moreover, the clean energy sector has performed better than the fossil fuel sector during the pandemic. The stock prices of renewable "yieldcos"—companies formed to operate wind and solar farms—recovered faster than oil and gas due to their predictable cash flows that spin off generous dividends to investors.²¹⁰ Overall, clean power stocks in the U.S. increased 2.2 percent in the first four months of 2020,²¹¹ while fossil fuel stocks decreased 40.5 percent. The S&P 500 decreased 9.4 per cent over the same period. This resilience adds to a very strong recent performance: from 2015 to 2019 the average annual return for clean power stocks (10 percent) was substantially better than that for fossil fuel stocks (-3 percent).

The pandemic will hasten the demise of coal. After businesses, schools, and industrial facilities closed, there was an eight percent decline in the demand for electricity in May 2020 relative to one year ago.²¹² Electricity from coal is more expensive than from natural gas and renewable sources. When electricity demand dropped, coal plants ran for fewer higher hours, which in turn increased the unit cost of electricity from coal. This worsens coal's already poor cost position relative to natural gas and renewables. This dynamic explains why renewables generated more electricity than coal on every day in April 2020 in the U.S.²¹³

Many state responses to the pandemic include a reaffirmation of their commitment to clean energy and climate action.²¹⁴ Some have doubled down by explicitly linking recovery efforts to the expansion of clean energy. For example, New York passed the Accelerated Renewable Energy Growth and Community Benefit Act²¹⁵ that will streamline the process for the siting of large-scale renewable energy projects across the state, and in July the states issued the country's largest ever solicitation for new renewable energy generating capacity.²¹⁶ State support for a clean energy-led recovery reflects public opinion. A poll of registered voters in April 2020 found that 56 percent support federal government financial aid for the renewable energy industry during the pandemic.²¹⁷

The pandemic has not altered the long-term fundamentals that make clean energy increasingly attractive. First and foremost is a cost advantage. Technological and managerial advances have generated massive cost declines for wind and solar PV. From 2009 to 2019 the levelized cost of wind and utility-scale solar PV declined 70 and 89 percent, respectively.²¹⁸ In most regions of the country the cost of electricity from new onshore wind and utility-scale solar is far cheaper than a new coal plant, and is cost-competitive with a new combined cycle natural gas plant (Figure 21).

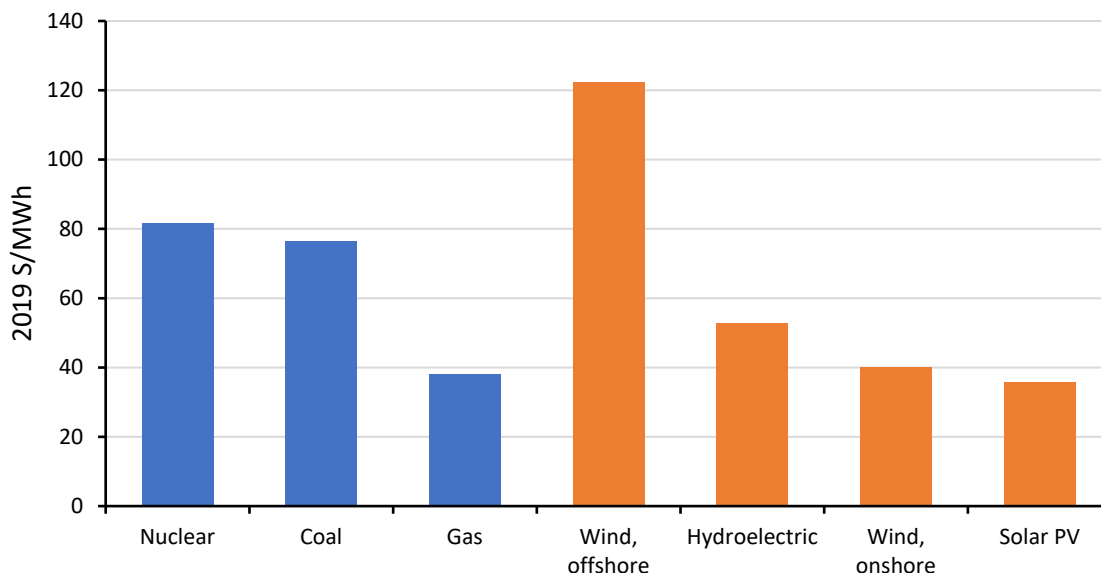


Figure 21. Levelized cost of new electricity generating capacity in the U.S. *Source:* U.S. Energy Information Administration

Utilities, investors, and governments view fossil fuels as an increasingly risky investment. Oil and gas are traded in very volatile markets that are impacted by unpredictable macroeconomic and geopolitical events. Wind and solar energy do not carry this type of risk. Fracking quickly expanded the production of oil and gas in the U.S.—itself a problem from a climate perspective—but it also enabled dozens of debt-ridden companies to expand on razor-thin margins that depend on high oil and gas prices. An analysis of 34 North American, shale-focused oil and gas producers revealed a disappointing \$2.1 billion negative free cash flows in 2019. The sudden and precipitous drop in oil and gas prices in produced a wave of companies “hurtling toward bankruptcy.”²¹⁹ Investors are more likely to ask the stranded asset question: will an investment in oil and gas with big upfront cost and a long payoff period make money? The answer increasingly is no. A Who’s Who of investors--Morgan Stanley, JPMorgan Chase, Wells Fargo, Goldman Sachs and Citibank-- decided not to lend to businesses drilling for oil in Alaska where payback periods are very long.²²⁰

Perhaps the most important impact of the pandemic is that has motivated companies and governments from around the world and at every level to deepen their commitment to decarbonizing their energy systems. The European Commission placed clean energy and energy efficiency at the center of its recovery plan.²²¹ In April, C40 mayors launched the Global Mayors COVID-19 Recovery Task Force to rebuild cities economies in a way that improves public health, reduces inequality and addresses the climate crisis.²²² A survey of 2,000 business leaders across the G20 bloc of nations found that 88 percent of companies have pivoted their investment strategies toward low-carbon energy.²²³ The International Renewable Energy Agency and the United Nations Development Programme point to investment in clean energy in developing nations as a principal means to prepare, respond, and recover from COVID-19 and similar shocks.²²⁴

Energy Burden in Cities

The affordability of energy is just as important as its carbon content. Energy insecurity refers to the inability to adequately and consistently meet basic household energy needs. In particular, paying a monthly utility bill is a significant challenge for many households in the U.S. This challenge is measured by what is known as the energy burden, which is the percentage of household income that is spent on fuel and electricity. High energy burdens can force households to make grim decisions about whether to keep the lights on or put food on the table. As discussed above, socially vulnerable populations disproportionately experience a high energy burden.²²⁵

The burden of energy costs has a distinct geographic component: when accounting for demographic and socioeconomic factors, urban households have a lower rate of energy burden compared to their rural counterparts (Figure 22). There are several reasons for the difference. First, the average city household has a higher income (\$59,358 in 2018)²²⁶ than the average rural household (\$49,867), which increases their capacity to pay their utility bills. Second, urban households have greater access to energy efficiency programs offered through utilities or other means. Third, rural households are more likely to live in detached, single-family residences such as manufactured homes that have low energy efficiency. Finally, rural household households rely more heavily on oil or propane for heating whose prices are more

volatile and often more expensive than other fuels. Thus, while vulnerable populations regardless of location tend to have a high energy burden, the characteristics of urban households provide a degree of protection that rural households do not enjoy.

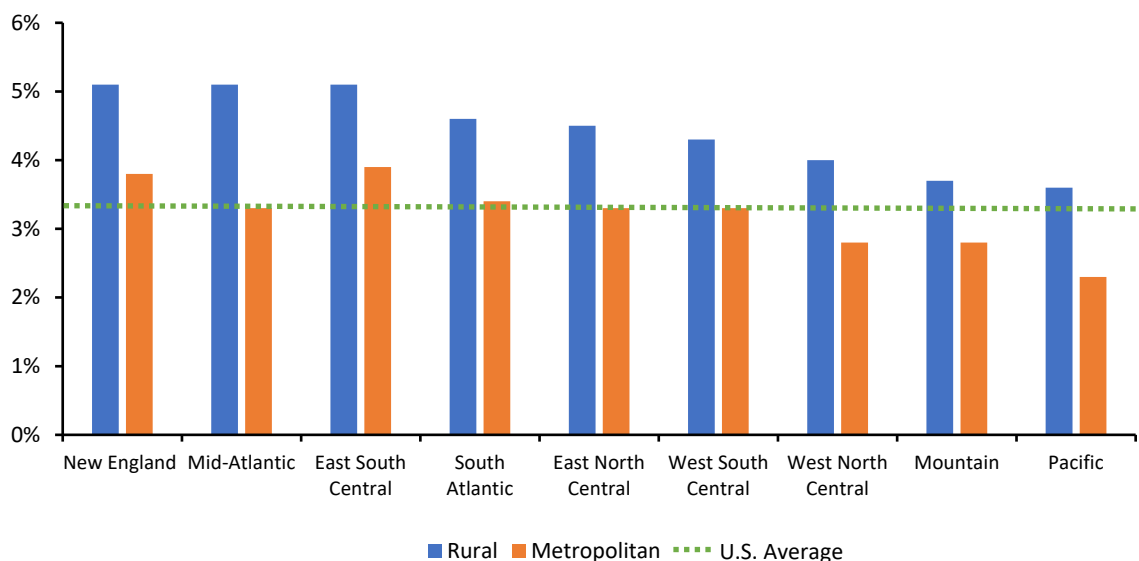


Figure 22. Rural and metropolitan energy burden in 2017. The vertical axis is the percent of median household income spent on household fuels and electricity (excluding transportation). *Source:* Ross, Lauren, Ariel Drehoobl, and Brian Stickles. 2018. “The High Cost of Energy in Rural America:” American Council for an Energy-Efficient Economy (ACEEE).

What Cities Can Do

Like every component of climate action, cities can use this moment to minimize damage from the economic effects of the pandemic, and to elevate the potential of clean energy in the minds and actions of people, businesses, municipal operations, and city networks.

With people’s attention on health, cities can demonstrate and emphasize the improvements in public health that will come when clean fuels and electricity replace fossil fuels. Public transportation and private vehicles powered by clean electricity reduce the particulate and ozone pollution that plague many cities. Vulnerable populations benefit the most from cleaner air because they have higher morbidity and mortality associated with exposure to every air pollutant, and because they are more likely to be located near noxious facilities.

With people’s attention on economic security, cities can demonstrate and emphasize the workforce development and equity-enhancing potential of investments in energy efficiency and clean energy. Investment in building energy efficiency, for example, is a potent means to generate jobs²²⁷ and reduce utility bills for everyone, most notably for low income households.²²⁸ In-city solar PV is an excellent workforce development tool to help low-income communities via intentional and targeted outreach to community colleges, job training organizations, housing authorities, and other entities that serve households of color and low income.²²⁹ Cities can act as a convening authority for workforce development-related community partners, and help collect, analyze and share labor market information.²³⁰

Cities have an opportunity to assess and strengthen their engagement with the states that they depend on for funding, outreach, and technical support. Examples here are funding for energy efficiency, support for rooftop and community solar energy, and fuel assistance programs for low-income households. Equity can be improved hand-in-hand with climate action. In the case of community solar energy, carve outs, specific projects, and participation incentives can be directed specifically to low income households, such as solar renewable energy certificate (SREC) programs. Cities can take more responsibility for the outreach and messaging needed for the programs to reach communities equitably.

Cities can also make their voices heard at the federal level. Cities can push back against the bailout of oil and gas companies with taxpayer funds, and support the clean energy initiatives that are at the core of nearly every green stimulus proposal. Cities can oppose proposed rollbacks of vehicle fuel efficiency standards, the opening of federal land for the development of fossil fuels that speed climate change, and the weakening of air and water quality standards and enforcement. They also can urge law makers to provide the stable, supportive regulatory regimes for wind and solar that investors seek and that the public increasingly demands.

Safe, Accessible, and Low-Carbon Mobility

Public Transit Takes a Big Hit

COVID-19 has dramatically transformed when we travel, why we travel, and how we travel. Daily routines of commuting to work, shopping, visiting friends and family, and flying for work and recreation slowed to a trickle, and travel was used to support what federal, state and local governments deemed essential for public health and security.

The shutdown that accompanied the pandemic caused a precipitous decline in public transportation, and a commensurate fall in revenue²³¹ (Figure 30). Nationwide urban regions experienced a 58% decline in public transit between March and July 2020.²³² Larger cities such as Boston saw an 80% reduction in ridership on buses and 92% reduction on subways, producing a \$231 million deficit by June 30.²³³ Metropolitan areas such as New York City were still experiencing prolonged reductions in ridership by up to 80% in August 2020,²³⁴ prompting budget cuts as a result of reduced revenue.²³⁵

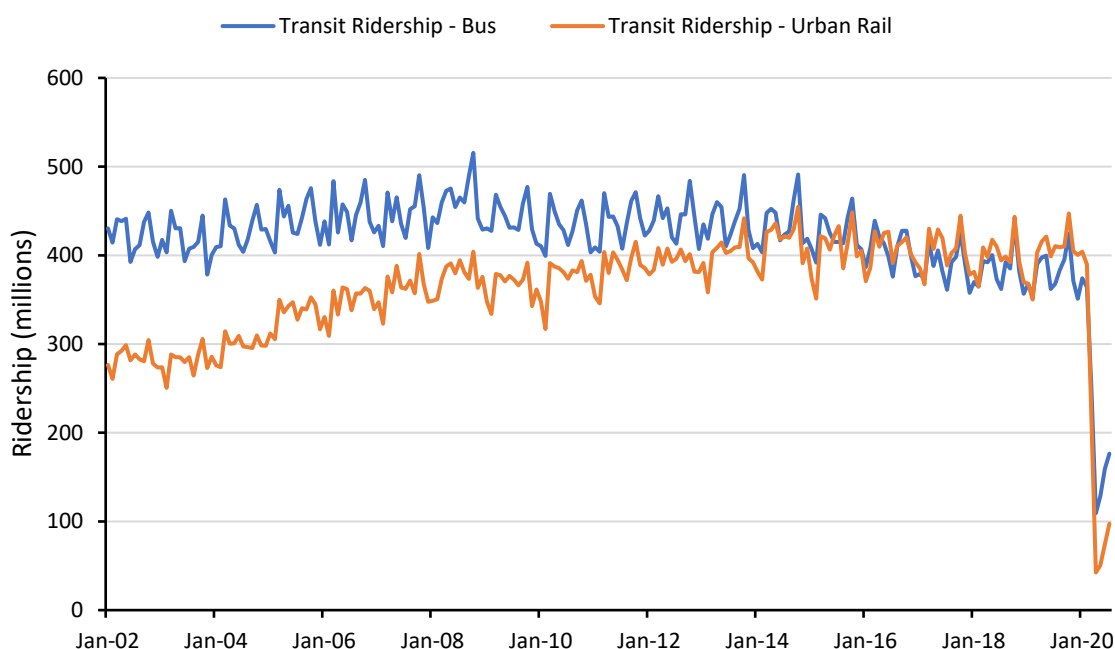


Figure 30. U.S. Monthly Urban Rail and Fixed Bus Route Ridership Trends annually through July 1, 2020. Urban rail includes heavy rail, commuter rail, light rail, streetcar rail, and hybrid rail. *Source:* DOT Bureau of Transportation Statistics. <https://data.bts.gov/stories/s/m9eb-yevh>

In the short run, revenue reductions will seriously hamper some plans to upgrade public transit, as evidenced by the MTA's decision in April to put New York City's congestion pricing plan "on ice." Congestion pricing was set to fund \$15 billion of the MTA's \$51.5 billion five-year capital plan, which includes the rapid modernization of delay-inducing subway signals and accessibility additions to 66 subway stations.²³⁶

The use of public transit was already trending downwards when the pandemic hit. Between 2015 and 2019 ridership dropped by about seven percent nationwide in response to aging infrastructure, crowded buses and trains, unreliable service, low gasoline prices and increased rideshare options.²³⁷

Cities that focused on improvements in infrastructure and service were able to maintain customers; ridership in Washington DC and Philadelphia rose by about two percent in 2019.²³⁸ Cities grappling with infrastructure concerns are exploring options to grow ridership, modernize the way commuters pay for



Repairs to the BART System in San Francisco Credit: Bay Area Rapid Transit

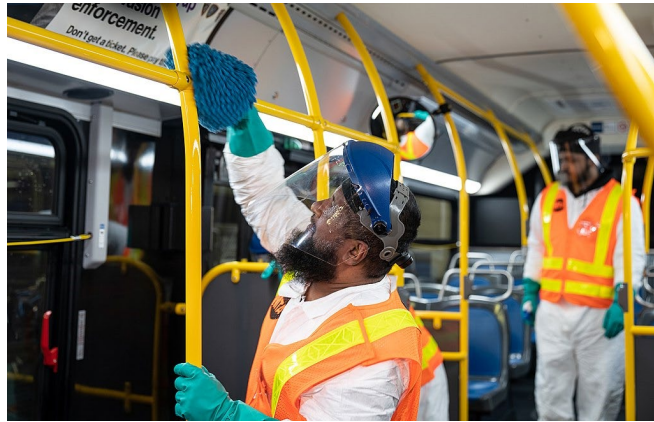
fares, and increase affordability and reliability.²³⁹ These kinds of investment in public transportation stimulate the economy: every dollar spent on infrastructure adds three dollars to GDP, and that multiplier may be larger in a recession.²⁴⁰

Public transportation is essential to everyday life in large urban areas. In cities with populations over 5 million, about 13 percent of commuters use public transportation; in New York City that dependence is 59 percent.²⁴¹ About three million essential workers in the U.S. rely on public transportation.²⁴² About one in five urban residents regularly use public transportation for household trips other than commuting to work. As the pandemic wreaks havoc on public transit systems across the country, transportation experts warn that low-income residents, people of color, and essential workers will bear the brunt of the impact.²⁴³

Black and Hispanic residents of urban areas report regular use of public transportation at twice the rate of White residents. A person earning less than \$30,000 per year is 50 percent more likely to regularly use public transportation compared to someone making more than \$75,000 per year.²⁴⁴ Reduced and slower transit thus compounds the challenges for these populations who depend on subways and buses for multiple trips to schools, stores, medical visits and work.²⁴⁵ The reliance on public transit also “plays a significant role in determining the spatial distribution of poverty in metropolitan areas” and expanding public transportation systems to low-income areas can help alleviate the “suburbanization” of poverty and contribute to more equitable and inclusive urban areas.²⁴⁶ In Boston, predominantly Black and Latinx communities of color spend 64 more hours per year in transit than other riders primarily due to “systemic difference in reliability and frequency of service.”²⁴⁷

Public Transportation and Public Health

Far fewer people are utilizing public transportation, a behavioral change imposed by social distancing rules and uncertainty about the safety of public transit during the pandemic. In response, transportation authorities have implemented rigorous internal cleaning and sanitation of public transportation vehicles. Public transit typically carries passengers beyond capacity at peak hours, and fear of virus



Sanitizing work on a New York City bus. Credit: Andrew Cashin / MTA New York City Transit

spread and the need for social distancing has kept ridership low. When facilities and vehicles are not properly cleaned on a regular basis they can contribute to virus spread, but recent studies show that the need for physical distancing can be reduced when enhanced hygiene (intensive cleaning, available hand sanitizer, proper ventilation), and where correct use and regulation of face masks are in place.²⁴⁸ Household exposure to COVID-19 puts more individuals at far greater risk than taking public transit when rigorous sanitation is in place. Thus, some health experts conclude that the suspension of public transit in urban areas may not be an effective countermeasure to the widespread dispersal of the virus.²⁴⁹

Restoring ridership in public transportation is a top priority for cities leaders who face two major hurdles: public confidence and funding. Ridership in public transit is recovering, but much more slowly than other modes. The American Public Transportation Association estimates that U.S. transit agencies will face a \$48 billion shortfall even after a federal aid investment of \$25 billion through the CARES Act in April 2020.²⁵⁰ Investment in roadway projects and upgrades have been canceled or delayed; up to \$8.5 billion worth of contracts in the U.S. have been impacted.²⁵¹

Air Quality Improves

The reduction in automobile travel had a direct effect on air quality during the initial weeks of the shutdown in the U.S. In the first two months of the pandemic, GHG emissions from transportation fell by 13 percent, a path that if maintained “puts the U.S. on track to exceed Paris Climate Accord targets for GHG emissions.”²⁵² NASA satellite data recorded a commensurate 30 percent drop in average concentrations of atmospheric nitrogen dioxide (NO₂) over the northeast²⁵³ (Figure 31).

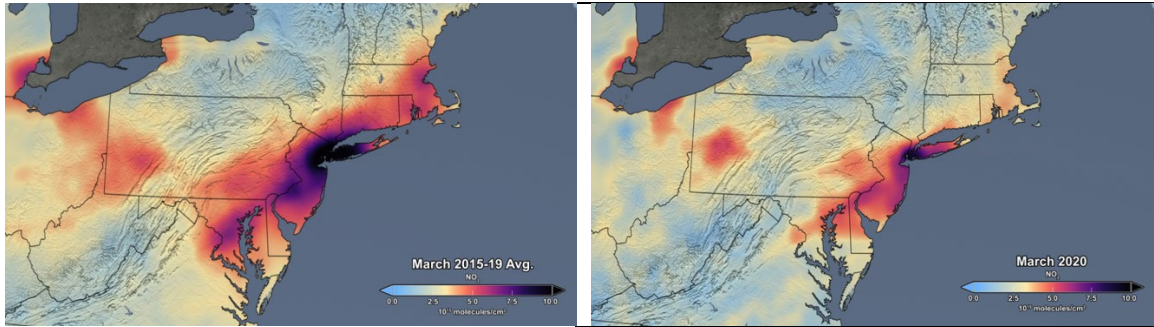


Figure 31. Average concentration of nitrogen dioxide (NO₂) in the atmosphere in March 2019 (left) and March 2020 (right). *Source:* NASA.

Cleaner air—and all its associated health and economic benefits—will be permanent only if individuals and the public and private sectors redouble their efforts to shift travel to public transit, walking, biking, and to vehicles powered by clean electricity and sustainably-sourced renewable fuels. The technical solution for a carbon neutral, climate resilient urban transportation system is straightforward in concept: shift people out of private vehicles to public transit, walking, and biking; reduce the overall demand for travel; power vehicles with clean electricity and sustainably-sourced renewable fuels; improve the energy efficiency of all modes; and manage ride-hailing and autonomous vehicles so that that they do not worsen inequity, congestion, and pollution. To be successful, technical solutions must be shaped with consideration of equity goals, economic and political constraints, and creative responses to the impacts of the pandemic

New Appreciation for Safe, Quiet Streets

In the first 6 months of 2020, people traveled less and trips were shorter. This opened an opportunity for biking and walking to flourish, especially since those modes of transportation are safer and more attractive when vehicle traffic is low (Figure 32). In urban areas the mode shift was largely from transit to walking, and not driving to walking. The rise of e-bikes opens up cycling to a larger section of the population; electric scooters are another option that expands the group of people taking advantage of non-vehicular modes. Active transport reduces GHG emissions and air pollution and in turn directly improves public health, including the comorbidities associated with viruses such as COVID-19.

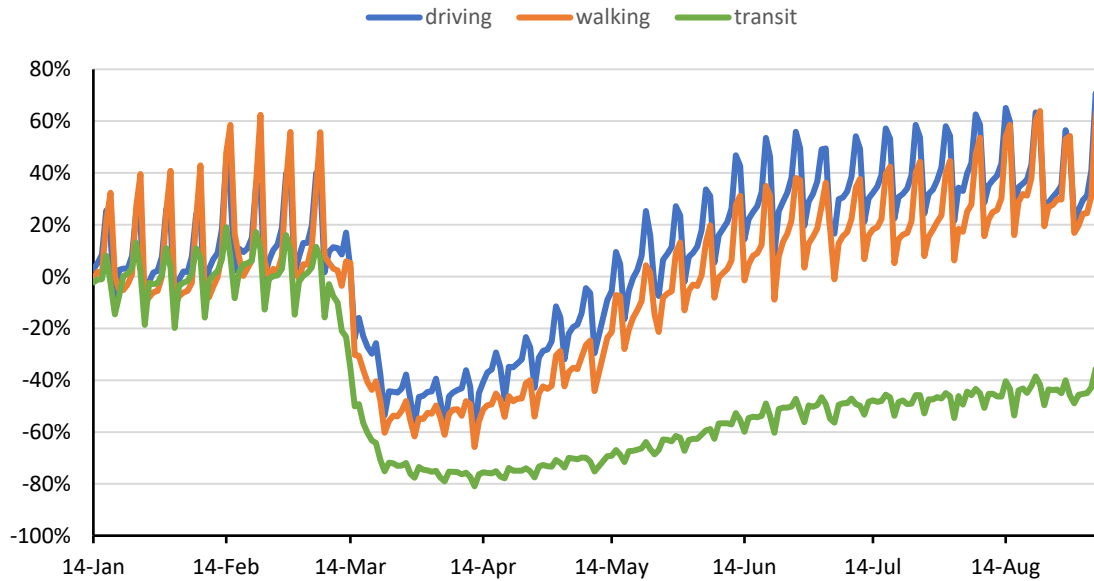


Figure 32. Changes in mobility in the U.S. between January 14, 2020 and September 5, 2020. The data reflect the daily volume of directions requests made to Apple Maps for each transportation type. *Source:* Apple Mobility Trends, <https://covid19.apple.com/mobility>

Cars consume voracious amounts of space for travel and parking compared to biking, walking and bus (Figure 33). A car traveling at 20 miles per hour in a city requires 400 square feet of space for street and parking space. A pedestrian or passenger on a bus needs one-tenth the amount of space. It is no wonder that in a typical American city, from 10 to 50 percent of the land area is covered by asphalt.

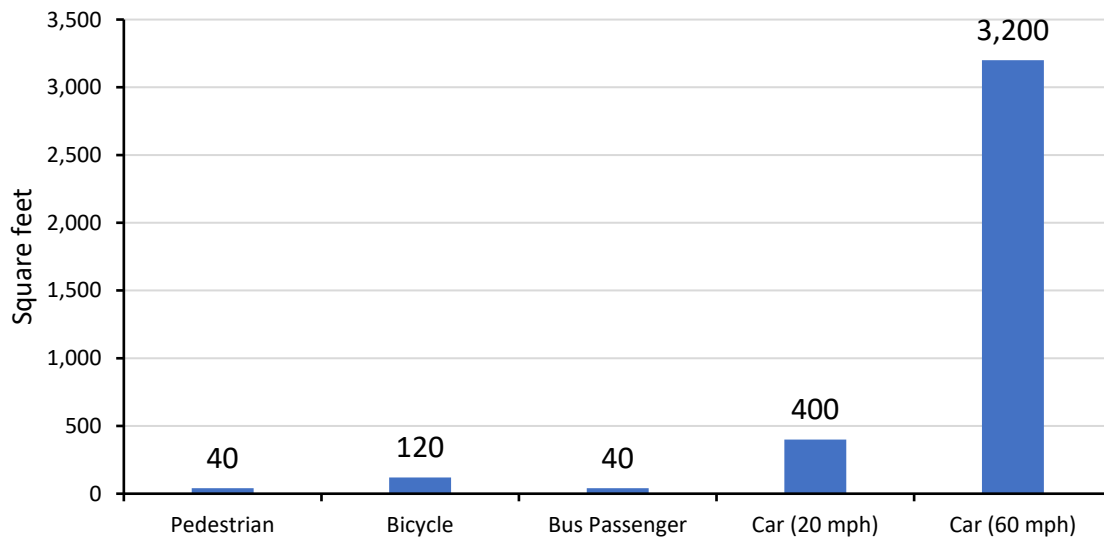


Figure 33. Land requirements (parking plus travel) per passenger for alternative modes. *Source:* Litman, Todd. 2020. "Transportation Land Valuation." Victoria Transport Policy Institute. <https://www.vtpi.org/land.pdf>

City streets suddenly devoid of cars in the pandemic raised an obvious question: can we use some of that space in other ways that raise quality of life? In some cities, the behavioral changes have driven or accelerated changes to alternative uses of streets expanded pedestrian walkways, expanded bike lanes, and in some cases closure of streets to vehicular traffic or at least to through traffic. Some of these changes are temporary; other measures will be permanent. Actions that cities have already taken to expand and improve cycling and pedestrian infrastructure and encourage local businesses since COVID-19 shutdown include the creation of shared streets (Table 4).

Table 4. City actions that encourage social distancing and regular exercise

Name	Location	Project	Outcomes
Slow Streets	Oakland, CA	74 Miles (10%) of neighborhood streets allocated for bikes, pedestrians, wheelchair users' and local vehicles only. Routes are aligned with existing bike routes.	<ul style="list-style-type: none"> • Safer streets for walking and biking in the city • Reduce foot traffic in high-use parks • Wider spaces for walking to comply with social distancing
Shared Streets	Chicago, IL	Streets closed, open to local vehicular traffic only. Streets are located in areas with existing pedestrian and biking routes and neighborhoods with high density and limited green space. Streets were chosen with community input.	<ul style="list-style-type: none"> • Improve safety in streets • Encourage walking, biking, running and rolling in the street. • Accommodate social distancing protocols • 30-day installation only, continuation dependent on community feedback.
Shared Streets	Denver, CO	18 miles of streets limited to local traffic only in residential areas and parks. 26 miles of pop-up bike and pedestrian infrastructure, roadways converted to mixed use.	<ul style="list-style-type: none"> • Safely walk, bike, stroll and roll while maintaining social distance. • These activities increased 4 times in some areas when they opened.
Shared Streets for Social Distancing	Burlington, VT	Shared streets, local traffic only streets and temporary parking restrictions and cone protected bike lanes. Community volunteers manage the street barriers.	<ul style="list-style-type: none"> • Safe, healthy recreation and ways to access essential services. • Designed for families with children working from home, first responders and essential workers access to recreation close to home, and residents without cars accessing groceries and pharmacies.

Sources: City of Oakland. "Oakland Slow Streets". <https://www.oaklandca.gov/projects/oakland-slow-streets>. Accessed September 10, 2020. City of Chicago. "Mobility During Covid-19. Shared Streets." https://www.chicago.gov/city/en/depts/cdot/supp_info/covid-mobility.html. Accessed September 10, 2020. Denver Streets Partnerships. "Shared & Open Streets". <https://denverstreetspartnership.org/what-we-do/shared-open-streets/>. Accessed September 10, 2020. The City of Burlington. "Shared Streets for Social Distancing." <https://www.burlingtonvt.gov/dpw/covid-19/shared-streets>. Accessed September 10, 2020.

“Streateries” are a variation of open streets and are open to restaurants, biking and walking and closed to most vehicular traffic. The Chatham neighborhood in Chicago converted parking spots along a city block into “parklets” along with hangout spaces, art installations and seating for eleven local restaurants. The project was low-cost and involved youth construction mentoring.²⁵⁴



A Chatham neighborhood parklet with outdoor restaurant seating located in an expanded sidewalk.
Source: *Streets Blog Chicago*. Sept. 10, 2020.

What Cities Can Do

Cities have an opportunity to invest in infrastructure and programs now that will not only support increased ridership in public transit and local economic development, but advance key outcomes related to health, equity and resilience. These are key actions that cities can take in the near-term to increase ridership and build resiliency in the transit system:

Restore Public Trust

A recent survey of 1,000 public transit users in the northeast found that that 9 in 10 riders will return if the following actions are in place: (i) increased cleaning; (ii) mandatory face masks; (iii) reduced maximum passenger capacity; (iv) social distancing; and (v) and more buses and trains to accommodate shifting schedules and the distancing requirements.²⁵⁵ Keeping workers safe and equipped with proper Personal Protective Equipment (PPE) will encourage people to keep working and reduce the incidence of infection amongst transit workers. Encouraging riders to shift their schedules for working, shopping and studying to distribute transit services over as much time as possible will reduce congestion.²⁵⁶ Effectively communicating on-going health interventions, science-based messaging, and emphasizing the importance of behavioral changes will build trust and ensure compliance with new guidelines.²⁵⁷

Build Local Fiscal Capacity

Cities and transit authorities will need creative new ways to finance public transit. Options include:

- Boost non-fare sources of revenue such as parking charges, real estate fees, business license taxes, and advertising²⁵⁸ realty transfer taxes, corporate franchise taxes, concession revenues and vehicle registration fees,²⁵⁹ and congestion pricing.²⁶⁰ Other options include greater allocation of transportation budgets towards transit, indexing gas taxes to inflation,²⁶¹ and higher tolls.²⁶²
- Transit-Oriented Development (TOD) optimizes development to take advantage of existing infrastructure. The City of Dallas has created TOD around mixed-use neighborhoods, and a portion of the incremental revenue generated in these zones goes toward public transportation infrastructure and affordable housing.²⁶³
- Match debt service, recovered through fares, tolls and tax subsidies, with effective spending cuts and new projects that support economic recovery.²⁶⁴
- Optimize public transit service to match ridership patterns and support critical needs of the economy, eliminating routes that result in empty vehicles.²⁶⁵ The City of Houston completely redesigned their metro system, “removing duplicate routes to low-ridership areas and creating a grid of high-frequency routes resulting in increased ridership with faster service for riders” yielding higher bus ridership and sustained improvements in light-rail ridership.²⁶⁶

Invest in Workforce

Public transit can be an engine of economic recovery because it supports 31 percent more jobs per dollar invested compared to bridges and roads.²⁶⁷ Public jobs are a critical component of stability in many communities and “preserving public jobs through job sharing, new revenue sources, borrowing and targeted salary reductions rather across the board cuts will boost economic recovery”.²⁶⁸

Prioritize for Climate Resiliency

Urban transportation systems are deeply exposed to climate change impacts of increased urban heat, excessive rainfall and flooding and extreme fire events. Properly conceived, new investment in transit can support the recovery while at the same time ensuring that services will remain functional under future extreme weather. These investments should include low-carbon and multi-modal transportation options, such as complete streets, that prioritize essential workers and help insulate low-income communities from climate shocks. A resilient transportation system is a lynchpin of overall urban resiliency.²⁶⁹

Prioritize for Vulnerable Populations

More so than ever, transportation planning in cities must prioritize the needs of vulnerable populations, especially communities of color and low income that are disproportionately impacted by the pandemic and that are more likely to be home to frontline workers.²⁷⁰

Transportation planning that improves connectedness and reliability, and scheduling that is oriented to serve these residents is essential to improve food security and economic opportunity. Reducing the share that lower-income households pay for transportation and placing a priority on expanding affordable modes of travel such as walking, cycling, rideshare and transit will improve equity outcomes in public transportation, improve food security and health, and reduce GHG emissions.²⁷¹

Promote Active Transport

Walking and biking are among the most potent activities that yield simultaneous social, economic, health, and climate benefits. The quality and quantity of the built environment for physical activity (e.g., infrastructure for walking and cycling, availability of public transit, street connectivity, housing density, and mixed land use) influence the likelihood that people will use active transport for their daily travel.^{xxvii} Cities can shift transit schedules to match the needs of potential riders and introduce mobile applications that improve predictability and reliability of public transit. Minimizing the last mile problem, the distance from a workplace or home to public transit station, through increased shuttles, bike racks, and restoring bike share programs will help to make a commute using public transit more manageable.²⁷²

Biking and walking are expanded when infrastructure, safety, and accessibility are expanded. The International Energy Agency (IEA) demonstrated this by examining what happened after the London terrorist attacks on underground trains and buses in July 2005.²⁷³ The IEA observed that clearly defined cycle paths and lanes and end-of-trip facilities that improved safety and convenience led to an increase the number of people who choose to cycle, including under-represented populations. Perceived safety is a very influential factor when considering urban cycling.



New uses for streets under the City of Oakland's Oakland Slow Street program. *Credit:* City of Oakland

Cities can encourage cycling and walking through public behavior campaigns.²⁷⁴ As a standalone measure this may not have a significant impact, but when paired with other actions – infrastructure improvements to increase safety and/or pricing and regulatory measures to encourage cycling and walking – it can have a notable effect. Successful campaigns rely on the population having trust in local government and emphasizing co-benefits that are appealing to the target audience, such as improvements in air quality and health.

Appreciation for Green Space

"The Power of Parks in a Pandemic" suggested a headline in Bloomberg's *CityLab* on April 9, 2020.²⁷⁵ Across the world we witnessed a recognition of how important green space—and open space more generally—is to city life. People flocked to parks and plazas for mental, emotional, and physical relief when restrictions were lifted. The sudden spotlight on "nature in the city" revealed not only its value, but also its deficiencies in many cities due to a lack of prioritization in city budgets, and to instances of bias in access and services for people of color and low income. Cities have an unprecedented opportunity to use this moment to make an investment in green space that will return a range of social, economic, and environmental benefits that close the equity gap.

The Benefits of Green Space

Public green space includes parks and reserves, sporting fields, riparian areas like stream and river banks, greenways and trails, community gardens, street trees, and nature conservation areas, as well as less conventional spaces such as green walls, green alleyways, and cemeteries.²⁷⁶ We focus on the public sphere, while acknowledging that private greenspaces—residential backyards, corporate campuses, etc.—provide some of the same benefits.

The contribution of green space to well-being is well-established (Table 5). Green space is what economists call an "environmental amenity," which is a natural system that provides a flow of perceived benefits to people and neighborhoods where it is found.²⁷⁷ The ecosystem services range from regulation of regional climate and water cycles to spiritual enrichment. Vegetation provides a GHG reduction benefit because plants uptake and store carbon, but the quantity of carbon stored is very small relative to the anthropogenic emissions from fossil fuel use in cities.²⁷⁸

Table 5. Ecosystem Services Provided by Urban Vegetation

Ecosystem Service	Description
Aesthetic benefits	Enhanced perception of beauty; increase in property values
Recreation	Walking, sports, relaxation
Physical health	Physical activity improves health, including reduced obesity.
Mental health	Interaction with nature decreases stress and increases focus.
Spiritual value and sense of place	Greenspace enhances people’s spiritual life and appreciation for their city.
Biodiversity	Habitat for biodiversity, including migrating birds.
Erosion prevention	Soil stabilization reduces erosion.
Stormwater mitigation	Increase infiltration of stormwater and filtration of pollutants.
Mitigating flood risk	Reduced movement of stormwater downstream.
Coastal protection	Natural habitats mitigate storm surges and flooding.
Air purification	Trees reduce air pollution concentrations (particulates, ozone).
Heat wave mitigation	Trees reduce ambient air temperatures.
Noise reduction	Trees act as natural "silencers" to limit the impact of noise from traffic.
Carbon sequestration	Trees absorb CO ₂ and store some of it in biomass.

Source: Adapted from McDonald, Rob, et al. 2016. "Planting Healthy Air: A Global Analysis of the Role of Urban Trees in Addressing Particulate Matter Pollution and Extreme Heat." The Nature Conservancy.

The pandemic highlights the health benefits of urban green spaces. As sites of physical activity, green spaces provide a wide range of health benefits for people of every age.²⁷⁹ An analysis of residents’ activity level in various types of built environments across 12 countries (before COVID-19) found that 57 percent of the study population had walked for leisure within the last week, and that the use of parks contributed physical health benefits such as reduction in the incidence of obesity.²⁸⁰ There also is a compelling link between physical activity and stronger immune system and inflammation responses against viral respiratory infections such as COVID-19.²⁸¹

Thus, living in a city that enables outdoor physical activity reduces residents’ vulnerability to both non-communicable diseases (including obesity, diabetes, and heart disease) *and* infectious diseases. The physical activity enabled by green spaces thus provides a compound benefit because COVID-19 mortality rates are significantly higher for people with underlying non-communicable conditions.

The pandemic has caused tremendous personal and social anxiety. The National Center for Health Statistics reports that 30 to 40 percent of adult Americans showed symptoms of an anxiety disorder during the spring and summer of 2020. The comparable figure for 2019 was about eight percent.²⁸² Green space can be an elixir for our moods and attitudes. One detailed study examined the relationship between neighborhood green space and mental health in a sample of Wisconsin residents across 229 disparate Census blocks. The results indicated that higher levels of neighborhood green space were associated with significantly lower levels

depression, anxiety, and stress.²⁸³ These results are consistent with other observed benefits of green space such as recovery from mental fatigue,²⁸⁴ stress reduction,²⁸⁵ improved worker attitude on the job,²⁸⁶ and social cohesion.²⁸⁷

Parks stimulate economic activity that contribute to the prosperity of cities. People go to parks to take an exercise class, read a book, meet friends, bird watch, attend a free concert or cultural event, work in a community garden, use a playground, or to enjoy many additional park services. In 2017 these activities generated more than \$166 billion in U.S. economic activity and supported 1.1 million jobs from their operations and capital



The Frog Pond spray pool in The Boston Common. *Source:* The Skating Club of Boston®

spending.²⁸⁸ These benefits include *direct effects* (spending by local park and recreation agencies); *indirect effects* (spending associated with park vendors, such as a landscaping company); and *induced effects* (spending from wages earned employees of park agencies and their vendors).

The Trust for Public Land uses a framework that digs deeper into the extensive economic benefits of parks.²⁸⁹ Their approach monetizes benefits such as the increase in property value due to park proximity, tourism, health benefits, "community cohesion" value of parks, and the benefits of the storm water reduction and the removal of air pollution. These benefits do not show up in market transactions, such as buying lunch at a food truck in a park, but nevertheless contribute to the economic well-being of a city. For example, being within 500 feet of a park adds an average of five percent to the value of a residence. Health benefits are estimated by the medical savings realized by city residents because of park exercise. Stormwater benefits are estimated by the costs savings of not having to pump and treat the water retained by vegetation. A study that employed this methodology to Philadelphia found that the park system provided the city with revenue of \$23.3 million, municipal savings of \$14.5 million, resident savings of \$1.28 billion and a collective increase of resident wealth of \$729 million (Table 6).²⁹⁰

Table 6. Estimated Annual Value of the Philadelphia Park and Recreation System	
Revenue Producing Factors for City Government	
Tax Receipts from Increased Property Value	\$18,129,000
Tax Receipts from Increased Tourism Value	\$5,177,000
Estimated Total, Municipal Revenue Producing Factors	\$23,306,000
Cost Saving Factors for City Government	
Stormwater Management Value	\$5,949,000
Air Pollution Mitigation Value	\$1,534,000
Community Cohesion Value	\$8,600,000
Estimated Total, Municipal Cost Saving Factors	\$16,083,000
Cost Saving Factors to Citizens	
Direct Use Value	\$1,076,303,000
Health Value	\$69,419,000
Estimated Total, Citizen Cost Saving Factors	\$1,145,722,000
Wealth Increasing Factors to Citizens	
Property Value from Park Proximity	\$688,849,000
Profit from Tourism	\$40,263,000
Estimated Total, Wealth Increasing Factors	\$729,112,000
<i>Source: The Trust for Public Land. 2008. "How Much Value Does the City of Philadelphia Receive from Its Park and Recreation System." https://www.tpl.org/philadelphia-park-value-report</i>	

Properly designed green space increases community safety (Figure 34). A review of studies performed in 24 U.S. cities concluded that the presence of parks and other green space reduces urban crime.²⁹¹ Green space appears to improve public safety because it increases social cohesion and civic pride; reduces anxiety and improves physical health; increases the perceived quality of life, including control; and it is a clear expression of territorial definition that improves maintenance and guardianship, as well as people’s perception of order. The effect on crime varies with the form of green space. Public parks are associated with reduced crime in some cities, but more crime in others. On the other hand, community gardens, vegetated streets and walkways, and trees and ground cover are strongly correlated with lower rates of crime.

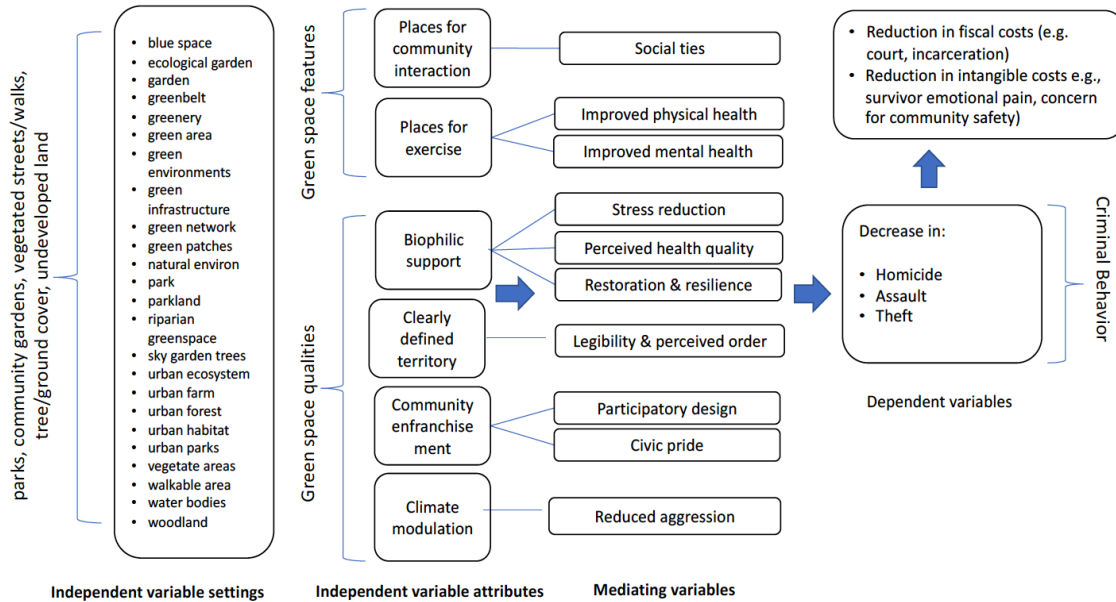


Figure 34. The relationships between green space and crime. *Source:* The Impact of Green Space on Violent Crime in Urban Environments: An Evidence Synthesis." Int. J. Environ. Res. Public Health 16, no. 24: 5119

Green Equity

Access to environmental amenities such as green space is an important component of environmental justice.²⁹² In the U.S., urban green space accessibility reflects persistent racial and socioeconomic hierarchies.²⁹³ The enduring influence of historical segregation and inequality is demonstrated by disparities in land development, financial status, and park design and administration.²⁹⁴ As a result, communities of color and low-income often face geographic, financial, and socio-cultural barriers that contribute to reduced green space accessibility in urban areas.²⁹⁵ Reduced access to green space for vulnerable populations limits their opportunities for social connection, accelerates poor health outcomes, and puts entire neighborhoods at greater risk of rising temperatures and severe weather.²⁹⁶

The distributional equity of green space is revealed by comparative studies across cities and by deep, single-city studies. A study of 10 U.S. metropolitan areas demonstrated a positive relationship between vegetation cover and both income and level of education, and a negative relationship between vegetation cover and the proportion of population that was Black, Latino and Native American.²⁹⁷ A study of the ten core counties in the Atlanta metropolitan area “reveals the deprivation of African Americans to access green spaces.”²⁹⁸ The Trust for Public Land found that many large parks New York City are heavily used by people of color, but that taken as a whole, parks in poor and nonwhite neighborhoods are smaller and have to serve far more people than in wealthy neighborhoods. The average park size is 7.9 acres in predominantly Black neighborhoods, compared with 29.8 acres in predominantly white neighborhoods.²⁹⁹

The Baltimore metropolitan region illustrates some important nuances of green equity.³⁰⁰ Black and low-income residents have greater access to parks compared to White and higher income residents, where access is measured by distance to the closest park. But a different pattern emerges when looking at park congestion, i.e., the acres of park accessible per person. White residents on average have access to larger parks than Black residents. As a result, the distribution of potential park pressure across the Baltimore metropolitan region has a distinct spatial pattern, with potentially more congested parks located in or close to the City of Baltimore. In contrast, parks with relatively low park pressure levels are located mainly in the predominantly white suburban counties outside the city (Figure 35).

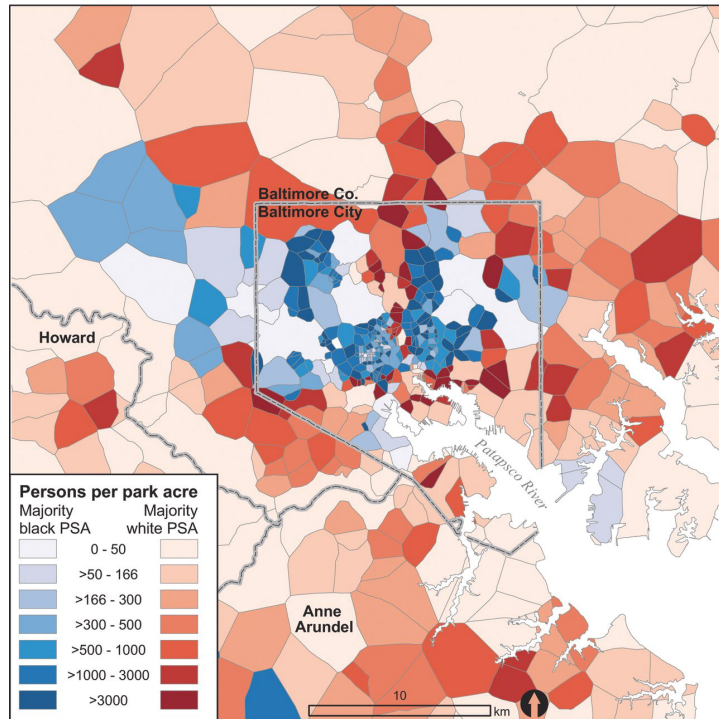


Figure 35. Park congestion levels in the greater Baltimore region, 2000. PSA = park service area. *Source:* Boone, Christopher G., Geoffrey L. Buckley, J. Morgan Grove, and Chona Sister. 2009. "Parks and People: An Environmental Justice Inquiry in Baltimore, Maryland." *Annals of the Association of American Geographers* 99 (4): 767–87.

Today's pattern of green inequity is the direct result of discriminatory policies such as redlining that was established by the federal Home Owners' Loan Corporation (HOLC) during the 1930s. In a study of 37 metropolitan areas in the U.S., current urban tree cover was mapped against the HOLC neighborhood grading system. Metropolitan areas formerly graded D, which were mostly inhabited by racial and ethnic minorities, have on average 23 percent tree canopy cover today. Areas formerly graded A, characterized by U.S.-born white populations living in newer housing stock, had nearly twice as much tree canopy (43 percent).³⁰¹

This pattern is mirrored by the effects of urban heat islands. Greenspace, trees, or water bodies within a city create lower land surface temperatures.³⁰² Lack of those amenities expose residents to higher temperature extremes. A study of 108 urban areas in the United States compared vegetation cover and land surface temperatures with each region's historic HOLC neighborhood grading system (A-"Best," B-"Still Desirable," C-"Definitely Declining," and D-"Hazardous"). The results revealed that 94 percent of areas have elevated land surface temperatures in formerly redlined areas relative to their non-redlined neighbors by as much as 7 °C.³⁰³ This is an ominous situation because the urban heating effect will cause extra warming in many cities, in addition to warming already caused by climate change.

One hot summer day in 2018 in Baltimore illustrates this pattern (Figure 36). A prominent expense of high heat stretched east of downtown, across residential neighborhoods made up of dense row houses, typically with no yards and little tree cover. Average temperatures in this area, which is majority African American and largely lower-income, hovered between 98 and 99 degrees, with hot spots reaching as high as 102 degrees. At the same time, average temperatures in the more affluent, tree-lined residential areas in the city's north, as well as those surrounding Leakin Park to the west, stayed in the low 90s.³⁰⁴

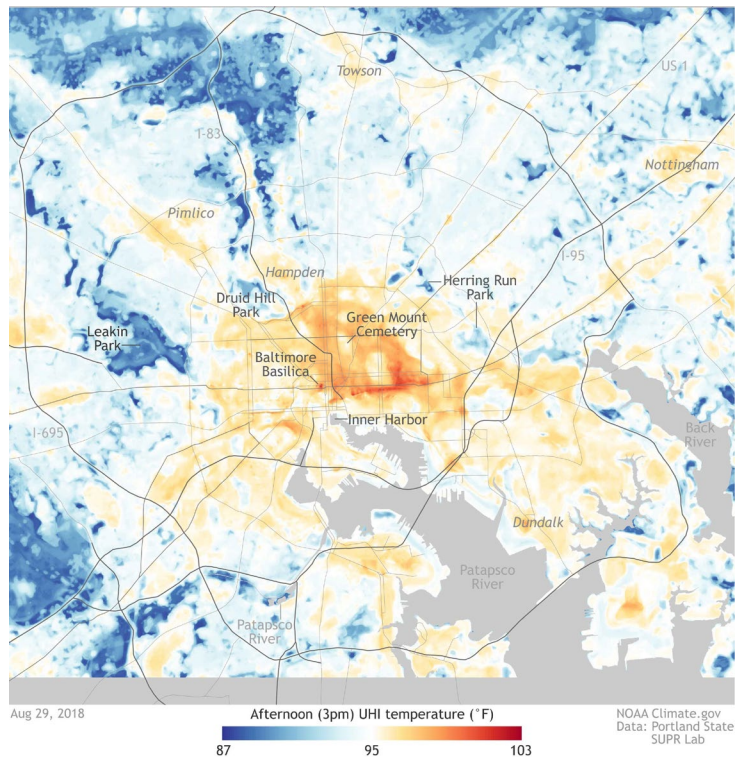


Figure 36. Temperature gradients across metro Baltimore on August 29, 2018. Source: SUPR Lab, Portland State University. <https://climatecope.research.pdx.edu/>

Avoiding Ecological Gentrification

Ecological or environmental gentrification refers to the influx of wealthy residents to historically disenfranchised neighborhoods due to new green spaces.³⁰⁵ It often results from a vicious cycle of economic disinvestment and environmental degradation that devalues urban space, followed by subsequent reinvestment and greening (parks, bike trails) that increase property values and displace existing residents.³⁰⁶ Well-intentioned green projects can worsen overall inequities if they are not transparently designed, implemented, and evaluated with equity as an explicit metric, and when city officials are accountable for their decisions.

The High Line is a 1.5-mile-long elevated linear park, greenway and rail trail created on a former New York Central Railroad spur on the west side of Manhattan in New York City. By many metrics the High Line is a huge success. It is green space with myriad recreational, cultural, and economic opportunities that was built from the ashes of a dilapidated infrastructure. Upwards of eight million people experience the High Line every year, driving new economic development and billions of dollars of tax revenue in the coming decades.



View of the High Line greenway in New York, looking south at 20th Street. *Source:* Wikimedia Commons user Dansnguyen /CC0

But the High Line has been called a “elevated cattle chute for tourists”³⁰⁷ because in 2019 more than half were international visitors and just one in five lived in the city. A 2019 survey revealed that just two percent of visitors identified as Black, far out of line with the racial demographics of its surrounding neighborhoods, the borough, and the city.³⁰⁸ In Chelsea, one of the High Line’s neighborhoods, about one in three residents are people of color. Critics also claim that the High Line is the latest symbol of the “new” New York, a city of profound inequality because expensive housing and retail stores have shuttered bodegas and caused considerable displacement anxiety.³⁰⁹

These outcomes led High Line park co-creator, Robert Hammond, to observe that that “ultimately, we failed” to build an urban park that serves the needs of local residents. Hammond offers sage advice for city officials: “Instead of asking what the design should look like, I wish we’d asked, ‘What can we do for you?’ People have bigger problems than design.”³¹⁰ Similar issues surround the equity impacts of other high-profile projects such as the Atlanta Beltline.³¹¹

What Cities Can Do

Green space is one the most powerful tools for cities to think and act with a systems perspective because every park, garden, or trail yields multiple benefits. Green space directly

contributes to well-being by improving public health via physical activity and reduced urban heat island effects, by stimulating active transport and access to public transit, and by reducing the risk of flooding and sea level rise. Green space indirectly improves well-being via the provision of ecosystem services that do not always appear in a spreadsheet in city hall, but which nonetheless have demonstrable impacts on people's physical, mental, and social well-being.

The design, financing, and administration of green spaces should be viewed through the lens of environmental justice. There is much work to be done here. Cities need to start with a deep empirical understanding how historical discriminatory policies have shaped the current quantity, distribution, access, quality, and administration of green space. Cities should also employ rigorous citywide park audits, to develop a baseline understanding of present conditions. The allocation of resources to green space should seek to remediate current conditions, but also remedy decades of neglect.

Resource allocation is just a lever to remedy historic inequities. Cities must also enable diverse voices to guide investment decisions and adapt greenspaces to changing needs and uses. Yet, just 45 percent of park agencies have a formal inclusion policy and one in five agencies report that insufficient community outreach and a lack of understanding of community needs is a barrier to inclusive use of public parks.³¹² Bottom-up engagement and communication is essential to equitable use of green space. Equity outcomes are enhanced when decision making is transparent and inclusive, and when community-specific characteristics are prioritized, such as how people use green space, what programming they want, what they experience in a heat wave, and so on.

Cities can be entrepreneurial by looking for underutilized urban spaces such as abandoned transportation corridors, empty alleyways, and remediated industrial sites whose conversion does not impose on existing communities.³¹³ Conversion of small, underutilized sites can democratize the spatial distribution of green space throughout a city, and potentially avoid the concentrated development magnet that one large space can promote.³¹⁴ Repurposing empty sites for green infrastructure can improve the attractiveness of communities, reduce residents' travel times to access green space, and disperse the ecosystem services of green space more.³¹⁵

At the same time, city officials will need a firm commitment to social equity to avoid ecological gentrification. Green space attracts people and resources. Proximity to parks raises the value of property and could thereby exacerbate gentrification and displacement. As the High Line project illustrates, market forces will meter the costs and benefits in line with existing economic and political power structures that are biased against people of color and low income. Cities will "walk the walk" when it comes to green equity when they muster the public support and political will to make equity a leading and actionable priority.

Staying on Track for Zero Waste

Cities made great strides in waste reduction since the 1970s when recycling programs were launched across the U.S.³¹⁶ The rate of recycling and composting of municipal solid waste increased from seven percent in 1970 to 35 percent in 2017.³¹⁷ More recently, cities tackled the plastic pollution problem by encouraging the use of reusable bags and containers by passing legislation banning single-use plastic bags. Zero waste and initiatives are now ubiquitous across municipalities.

Despite this success, recycling and waste reduction programs are hampered by volatility in the markets for recycled materials, contaminated recycling streams, and wide variability in participation across municipalities. The national rate of recycling and composting plateaued beginning in 2010. In 2018, China's refusal of contaminated recyclable material caused turmoil in scrap markets, resulting in reduced profits for recycling companies.³¹⁸ Consequently, many U.S. cities reduced or eliminated their recycling programs, and some chose to collect recyclables only to send them to landfills and waste-to-energy incinerators.

Such was the recycling scene when the pandemic hit. The sudden onset and rapid transmission of the virus, conflicting expert opinion about the handling of food and other consumer goods, and general panic and confusion among the public produced a spike in single-use plastic consumption and waste production. The surge in waste plastic combined with reduced waste diversion programs produced a corresponding surge in plastic in the environment that harms the health of people and marine ecosystems.³¹⁹

Use of Plastic in Medical Care

The most obvious area with an increase in use of plastic disposables is in medical facilities via personal protective equipment (PPE), such as protective medical suits and test kits.³²⁰ The proper disposal of medical waste from hospitals adds further complications to waste management, as medical waste has the potential to carry pathogens and must be carefully handled.³²¹ In addition, as public health guidelines trickled out in March, public demand skyrocketed for disposable masks, gloves, hand sanitizers bottles, and disinfectant wipes and sprays.

The COVID-19 pandemic caused plastic-intensive shifts in consumer behavior. The closure of restaurants produced a sudden increase in takeaway meals and their accompanying disposable container waste. Many food service businesses stopped allowing customers to bring in their own reusable containers.³²² People relied more heavily on purchasing products online that caused more delivery packaging waste.³²³

Municipalities now face an uncertain and tumultuous market for recycling and composting. The programs that did survive the 2018 crisis must now reconcile their zero waste plans with severely constrained budgets, at least for the short term. The collapse of oil and natural gas prices makes virgin plastics cheaper than recycled plastics.³²⁴ Additionally, as recycling

requires sorting done by on-site workers, recycling facilities face reduced operational capacity due to concerns about worker safety.³²⁵

Suspension of Plastic Bag Bans

The plastics pollution problem is exacerbated by the weakening of waste reduction action in many cities in response to the pandemic. After San Francisco became the first city to completely ban plastics bags in 2007, more than 400 cities followed suit³²⁶ and eight states imposed a statewide ban.³²⁷ In the early weeks of the pandemic, there was considerable uncertainty and confusion about the importance of surface-to-hand transmission of the virus. Some cities responded with extreme caution and suspended their bans on plastic bags while at the same time forbidding the use of reusable bags.

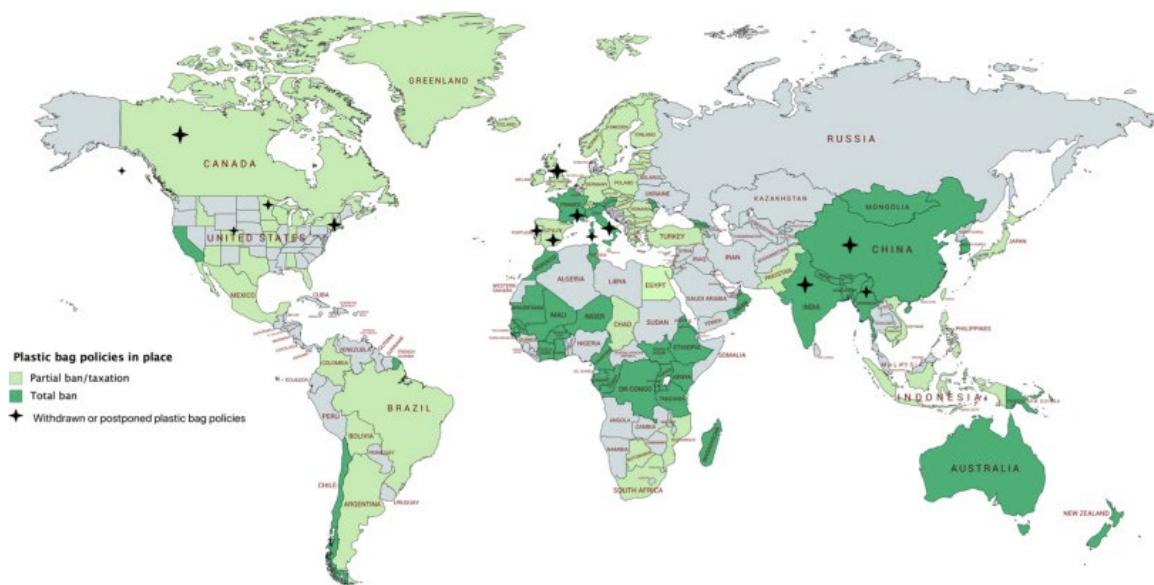


Figure 37. Global plastic bag policies in 2020. *Source:* Silva, Ana L. et al. 2020. “Rethinking and optimizing plastic waste management under COVID-19 pandemic: Policy solutions based on redesign and reduction of single-use plastics and personal protective equipment.” *Science of the Total Environment*, 742: 140565. <https://tinyurl.com/y5vm7yth>

The plastics industry and their lobbyists pounced on the uncertainty and public fear. A few days after the World Health Organization labeled COVID-19 a “pandemic,” a prominent plastics lobbying group sent a memo to Alex Azar, secretary of the Department of Health and Human Services (DHHS), and claimed that: “[...] single-use plastic products are the most sanitary choice when it comes to many applications, especially the consumption and transport of food, whether purchased at a restaurant or at a grocery store.” The memo urged the DHHS to “[...] speak out against bans on these products as a public safety risk and help stop the rush to ban these products by environmentalists and elected officials that puts consumers and workers at risk.”³²⁸

We now know that the type of virus transmission that panicked consumers and retailers is not a major health threat. In June 2020, the CDC reported that the COVID-19 virus spreads primarily through aerosolized droplets, rather than by touching surfaces.³²⁹ Although the

plastic industry claims that reusable bags are vectors for the virus, in actuality viruses last longer on plastic material compared to paper, glass, or cloth materials.³³⁰ In light of this new information, a team of more than 100 virologists, epidemiologists, health experts, and chemists from 18 different countries released a statement in June 2020 reporting that reusables are safe to use during the pandemic, as long as they are regularly sanitized.³³¹ Some cities recently reinstated their plastic bag ban, a first step back to plastic waste reduction. However, city officials will need to work on other opportunities for plastic waste reduction in areas that are compounded by other factors, such as plastic usage in takeaway containers and the increase of delivery packaging, by making in-person purchasing safe and accessible, when appropriate.

What Cities Can Do

A comprehensive zero waste program--waste reduction, recycling, and composting—is a prime example of where cities can use sound science, effective communication, and participatory decision making to link social, health, environmental, and climate objectives. Landfills and incinerators are often located near low-income communities and/or communities of color, increasing exposure to toxins, air pollutants, and putrid odors.³³² This exposure compounds the disproportionate health risk that communities of color face from COVID-19.

Full implementation of a zero waste initiative doubles as an effective strategy to reduce GHG emissions. The landfilling of solid waste and wastewater treatment generated 132 MtCO_{2e} in 2016, or about two percent of total national GHG emissions. The combustion of solid waste in waste-to-energy facilities contributed an additional 11.0 Mt CO_{2e}, over half of which is attributable to the combustion of plastic. Zero waste makes good climate sense in addition to all its other environmental, health, and equity benefits.³³³

Waste management is effective and equitable when sound science informs both decision-making and communication about the public health risks and lifecycle assessment of the environmental impacts of disposal, recycling, composting, and waste to energy facilities. The surge in single-use plastics and waste generation in light of the growing knowledge about risks of plastics pollution merits focused attention by cities. Cities would benefit from working with retailers and residents to encourage the hygienic use of reusable bags and materials, from protecting food service, retail, and recycling facility workers, and from supporting the waste reduction and diversion behavior that form the foundation of zero waste programs.

Climate Action that is Equitable and Synergistic

The actions we take on climate in the coming decade will determine whether or not we successfully meet the Paris climate goal of limiting global warming to substantially less than 2 degrees Celsius. City level action is key because cities use more than two-thirds of the world's energy and release over 70 percent of GHG emissions.³³⁴

But successful climate action is much more than swapping out a fossil fuel system for a clean energy system. Success requires that climate actions emerge from collaboration with leadership in communities who are historically disenfranchised from most public and private decision-making in cities, including climate action. Success requires that the cornerstone of climate action is meeting the needs of the most socially vulnerable community members.



Credit: Mayor's Office City of Boston; photo by Don Harney

Inclusive and equitable climate action not only improves a city's climate resilience, but also it strengthens the city's resilience to other stressors such as recessions, pandemics, natural hazards, pollution, and social unrest. Sufficient affordable housing with consistent access to healthy food improves the physical and mental health of the most vulnerable residents, which ultimately generates economic benefits through reduced healthcare costs.³³⁵ Transportation planning and infrastructure investment can simultaneously generate multiple benefits if they connect open space with bike lanes and key bus and subway stops, and if they prioritize improved access in neighborhoods of color and low-income. Such planning reduces congestion, improves air quality, enables more active lifestyles and increases social

connectivity, and thereby improves public health.³³⁶ It also supports the economy by growing the green jobs workforce, which in turn can improve social equity if intentional planning for equity guides economic decision-making.³³⁷

Systems Thinking and Integrated Planning

The infrastructure, economy, social interactions, and environments that define cities are highly interrelated, but they often are considered as singular problems or opportunities in climate action planning. The website for a city government typically reveals how staff, financial resources, and planning are organized around individual departments: streets, waste, racial equity, budget and finance, housing, emergency management, parks, transportation, etc. Public health and climate change are erroneously identified as singular challenges.

This way of thinking leads to missed opportunities and unintended consequences that disproportionately impact low income residents and people of color. For example, the historic focus on the ubiquitous provision of inexpensive energy to cities ignored the local environmental and equity impacts of increased air pollution and high energy burden. Renowned systems thinker Donella Meadows noted that “We need to more effectively address the challenges we face rather than the symptoms we experience.”³³⁸



Rooftop solar in Denver, CO. *Credit:* National Renewable Energy Laboratory

The COVID-19 pandemic and the Black Lives Matter movement highlight the urgent need for “systems thinking” and “integrated planning” in our cities. Achieving urban sustainability also requires understanding a complex and rapidly changing landscape, and effective, cost-efficient, and equitable action requires the identification of opportunities that generate simultaneous gains across multiple fronts over multiple time scales.

To illustrate this point, consider energy efficient buildings. Greenhouse gas emissions from buildings constitute one-half to two-thirds of total emissions in many cities’ community inventories. Deep energy retrofits are among the most cost-effective measures to reduce emissions. Energy efficient residences can reduce heat- and cold-related deaths; heart disease; asthma and other respiratory risks; reduce cancer risks due to radon and improve mental health.³³⁹ Many of these health benefits mitigate pre-existing health conditions that heighten people’s risk of infection from communicable diseases such as COVID-19. Energy efficiency lowers household utility bills, increases disposable income, stimulates the economy, and supports good jobs – and is a key aspect of making the transition to clean energy. If residential efficiency programs explicitly target multifamily rental units and affordable housing, then the benefits of energy efficiency are steered towards households of color and low income.³⁴⁰

Cities have three key, interconnected components: the physical/built system (roads, homes, bike paths, water supply); the social/economics system (commerce, finance, government, social networks), and the ecological system (rivers, urban forests, wetlands, community gardens) (Figure 38). A city includes diverse actors and constituents. Cities connect with other systems at the regional, national and global scales via exchanges of people, information, money, goods, waste, energy, water and pollution. The path towards a resilient, healthy, and prosperous city begins with this mindset.

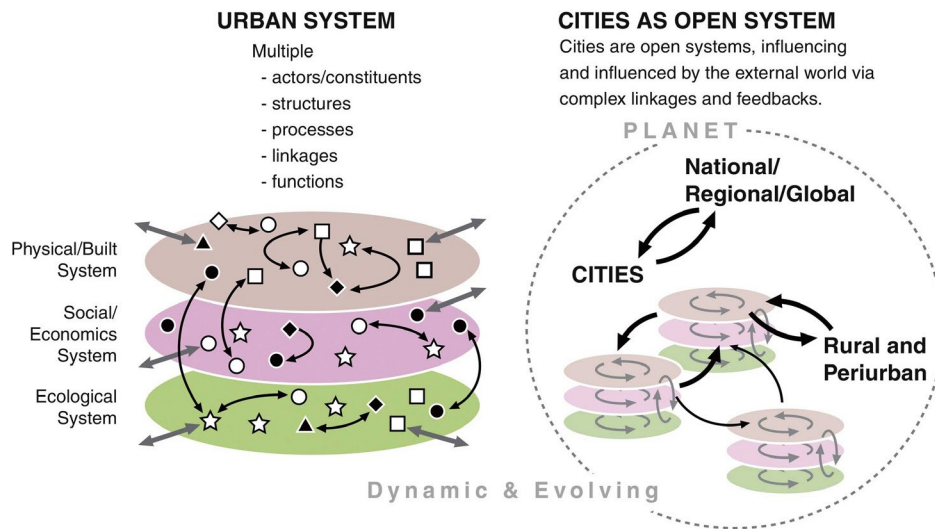


Figure 38. Urban system structure and interlinkages, with the left component focusing more on the internal structure, and the right one highlighting external linkages and interactions of cities. The symbols represent actors/constituents, structure, and processes across physical/built, social/economics, and ecological subsystems. The arrows represent complex processes and linkages within and between cities, and between cities and their hinterlands. *Source:* Bai, Xuemei, Alyson Surveyer, Thomas Elmqvist, Franz W Gatzweiler, Burak Güneralp, Susan Parnell, Anne-Hélène Prieur-Richard, et al. 2016. “Defining and Advancing a Systems Approach for Sustainable Cities.” *Open Issue, Part I* 23 (December): 69–78. <https://doi.org/10.1016/j.cosust.2016.11.010>.

Embedded in this perspective is the recognition that inequity makes a city unsustainable and more vulnerable, i.e., the opposite of resilient. Inequity results from the concentration of economic and political power in an elite that prioritizes its privileged place in society. Inequity makes a substantial part of a city’s population highly vulnerable to chronic risks, and also worsens the human toll of pandemics, heat waves, flooding, and other extreme events. It also inhibits the transition to a clean energy, zero waste city.

This systems-oriented, equity-focused way of thinking will include a bottom-up planning process that understands the needs of all residents and intentionally includes socially vulnerable populations in decision-making. Goals that effectively address equity, public health, climate change, and economic opportunity will emerge from inclusive engagement.

Inclusivity and cross-silo thinking are mutually reinforcing. If equity and inclusive decision making are prioritized, integrated action to tackle climate change will follow. Staffing, accountability, and budgeting need to be developed on a team basis, where the team is developing a solution that may benefit multiple city departments. The system planning lens also opens up opportunities to consider how to draw in other actors to support the solutions-

oriented plan, whether that is community groups supporting citizen science projects, local institutions of higher education, or non-government partners providing additional financial support.

Inclusive Community Engagement

Community engagement and participation is an established component of municipal planning processes. Yet there is now a new widespread awareness and understanding of the common community engagement processes being deeply inequitable in practice.³⁴¹ Ineffective inclusion has helped propagate energy, environmental and climate injustices. Poor and non-White people are concentrated in neighborhoods where the amenities are fewer and lower quality; where it is harder to complete everyday journeys to the grocery store, health care, and work; where there are fewer greenspaces and protected bike lanes; where individual safety and security is lower; and where air quality and extreme heat are worse.



The C40 Cities Climate Leadership Group identifies seven benefits of inclusive and equitable community engagement:³⁴²

1. Tackling intrinsic societal inequality can help to address climatic vulnerability
2. Building individual and social capital
3. Reducing unintended consequences and building community trust
4. Changing behavior
5. Building community capacity
6. Complementing government resources
7. Building public support for innovative practices.

Changing the process for community engagement requires highly deliberate action. Rather than equity considerations being “added in” to municipal planning processes, they must be the starting point. Increasingly cities are branding their plans “climate justice plans” instead of “climate action plans” to reflect this change in emphasis.³⁴³ Similarly, the Urban Sustainability Directors Network speaks of moving from community engagement to community ownership, and an emphasis on collaborative governance³⁴⁴ (Figure 39).

Stance towards community	0 IGNORE	1 INFORM	2 CONSULT	3 INVOLVE	4 COLLABORATE	5 DEFER TO
Impact	<i>Marginalization</i>	<i>Placation</i>	<i>Tokenization</i>	<i>Voice</i>	<i>Delegated Power</i>	<i>Community Ownership</i>
Community Engagement Goals	Deny access to decision-making processes	Provide the community with relevant information	Gather input from the community	Ensure community needs and assets are integrated into process and inform planning	Ensure community capacity to play a leadership role in implementation of decisions	Foster democratic participation and equity by placing full decision-making in the hands of the community; bridge divide between community and governance
Message to Community	<i>"Your voice, needs, and interests do not matter"</i>	<i>"We will keep you informed"</i>	<i>"We care what you think"</i>	<i>"You are making us think (and therefore act) differently about the issue"</i>	<i>"Your leadership and expertise are critical to how we address the issue"</i>	<i>"It's time to unlock collective power and capacity for transformative solutions"</i>
Activities	Closed-Door Meetings Misinformation Systematic Disenfranchisement Voter Suppression	Fact Sheets Open Houses Presentations Billboards Videos	Public Comment Focus Groups Community Forums Surveys	Community Organizing & Advocacy House Meetings Interactive Workshops Polling Community Forums	MOUs with Community-Based Organizations Community Organizing Citizen Advisory Committees Open Planning Forums with Citizen Polling	Community-Driven Planning Consensus Building Participatory Action Research Participatory Budgeting Cooperatives

Figure 39. The spectrum of community engagement to ownership. The spectrum is designed to acknowledge marginalization as the status quo; assert a clear vision; articulate a developmental process; and assess community participation efforts. *Source:* Urban Sustainability Directors Network (USDN). 2019. "From Community Engagement to Ownership." The USDN credits this tool to Rosa González of Facilitating Power, in collaboration with Movement Strategy Center.

Rather than emphasizing how *many* community members are engaged in the planning process, the focus must be on *which* community members are engaged. Those community members who have been disenfranchised will not necessarily respond to a general invitation; they must be found through community organizations and networks and personally invited to be part of the process. This is not an easy task: an analysis of neighborhoods in the City of Boston finds a strong link between social isolation and social vulnerability.³⁴⁵

It is important to acknowledge that the opportunities and challenges of community engagement have shifted during COVID-19, and generally not in a direction that improves equity. Community engagement is occurring online and people who may struggle to attend a meeting in person may find it easier to join a meeting virtually. Some households lack digital access and connectivity and may have limited capacity to participate in meetings or events if they are shouldering the burdens of addressing the epidemic as essential workers, are unemployed, or caring for an ailing family member or children. Engagement must adjust to these new conditions and ensure everyone has the ability to participate in local government at all times.

Sound Science and the Communication of Risk

The communication of risk is an important component of inclusive engagement. Risk communication is important in the context of *preparedness* (e.g., in defining challenges and in the co-production of solutions in the context of short- and long-term planning); in guiding the *response* to a threat (e.g., imposing stay-at-home orders in a pandemic or evacuation orders in response to flooding); in the *recovery* phase (e.g., in allowing people to return to their homes or to regular daily activities in a phased approach), and finally in the *hazard mitigation* phase (e.g., building new protective infrastructure).³⁴⁶



Damage from Hurricane Charley in Florida in 2004. Credit: needpix.com

In all contexts, careful communication rooted in scientific understanding of the threat and in articulation of the associated risk helps build trust between a city and its residents. One study examined the relative merits of three different communication methodologies to share public health risks with returning residents following the nuclear accident at Fukushima.³⁴⁷ The study identified four elements of successful communication: (i) direct communication, rather than indirect communication via the media; (ii) small meetings where communication was face-to-face were more successful than large group meetings; (iii) core messages that were communicated consistently, and broader messaging that was adapted to individual groups; and (iv) engaging a trusted communicator who was a physician to help convey public health messages, and partnering with local community leaders to facilitate dialogue.

Effective risk communication with socially vulnerable populations requires extra diligence. The credible and trusted messengers may be different for this population, who may not know or trust government figures as “the experts.” Content and style must adjust for language barriers, level of education, and the amount of time they have available to listen and learn as they juggle other daily tasks. Practical guidance of how a socially vulnerable population should respond to a risk may be different than for other populations, since they typically have more limited resources and so will need more support from the city. Overall, both messages and information pathways need to be tailored according to the population the communicators are trying to reach (Table 7).

Table 7. Principles for Risk Communication for Socially Vulnerable Populations

Underlying Concepts	Implications for Socially Vulnerable Populations
Credibility is essential if message recipients are to be receptive to risk communications, believe them, and take them seriously.	Careful planning and relationship-building are critical for risk communicators. Government actors and other officials may lack credibility with some communities due to pre-existing conflicts, historical injustices, or simple lack of familiarity. It is essential for risk communicators to understand how they are perceived and empathize with message recipients.
Risk communicators must be viewed as legitimate and trustworthy sources of information.	Working with credible, well-connected gatekeepers” or “cultural brokers” in target communities helps to ensure that messages are appropriately constructed and disseminated.
It is essential to find the right person or entity to deliver the message.	Expertise and rank alone do not automatically provide credibility or authority; this kind of influence is developed by building trusting and mutually respectful relationships with credible partners.
Messages should be designed and tested to ensure that they are clear, consistent, and comprehensible.	Risk communicators must consider how information will be interpreted by message recipients. Overly complicated messages can fail to adequately signal the risks people face or the steps to reduce it due language barriers, cognitive limitations, competition for attention, and other factors.
Knowledge alone is insufficient for prompting action. Instead, information about risk must be linked to actionable guidance.	Threat-related information can be frightening and overwhelming for some people. Pairing risk warnings with actionable information and examples can help mitigate these negative responses by empowering message recipients to take protective action within the constraints they face.

Source: Adapted from Natural Hazards Center, University of Colorado Boulder.2020. Principles of Risk Communication: A Guide to Communicating with Socially Vulnerable Populations Across the Disaster Lifecycle. <https://tinyurl.com/y29qgzoh>

What Cities Can Do

Effective, efficient, and equitable climate action requires new modes of thinking and engagement in city hall. The key to closing equity gaps and resolving climate vulnerability is the direct participation by impacted communities in the development and implementation of solutions and policy decisions that directly impact them.³⁴⁸

Building on this foundation, solutions that address multiple aspects of resilience may not be implemented within the existing siloes of city government, and different staffing and budget structures will be necessary to support projects that span different departments. Metrics for success and communication of benefits to residents and other stakeholders should span all

the aspects of resilience and should include measurement and communication of costs and benefits to socially vulnerable populations. Specifically, it is not just the impact that is important, but also the *distribution of the impact* across different populations within the city.³⁴⁹

Underlying all aspects of community engagement and planning is the importance of scientifically based risk assessment that is clearly communicated to stakeholders. This includes risk multipliers like climate change and a pandemic, but also the “benefits multiplier” of an equity and systems approach. Specifically, consideration of how the combined effects of access to healthy food, affordable housing, indoor and outdoor air quality, access to green space, and access to sustainable modes of transportation cumulatively impact socially vulnerable communities shines a spotlight on the multitude of risks those communities face and elevates the need for urgent action.

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