

The Paradox of Change in the American West: Global Climate Destruction and the Reallocation of Urban Space and Priorities

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I

BACKGROUND

In 2019, the authors published an article that surveyed the response of six urban areas in the western United States to global climate destruction (GCD).¹ Our approach was primarily positive. We selected four markers—transportation, land use planning, infrastructure, and water and energy supply—to measure adaptation to the expected adverse impacts of GCD and to suggest best practices in each area. This Article complements the 2019 article by taking a normative approach. It asks the following question: given the magnitude of the expected adverse impacts, what *should* urban areas (i.e., states, regions, and cities) be doing to mitigate and adapt themselves to GCD? This Article focuses almost exclusively on urban areas in the American West, realizing that GCD will affect that region more severely than many other areas of the country, particularly with respect to the allocation of water resources. As the distinguished environmental law scholar Daniel Farber reminds us: “[T]he modern west is a human construct dependent on a massive rearrangement of water across large areas . . . geared toward a certain climate.”²

¹ Edward Sullivan & A. Dan Tarlock, *The Western Urban Landscape and Climate Change*, 49 ENV'T L. 931 (2019). The terminology to describe the unprecedented climatic impacts that we are now experiencing is both evolving and contested. Global warming was initially used to describe the observed temperature rises associated with greenhouse gas emissions. Scientists then added climate change to describe the consequences of warming, but opponents of action to slow warming preferred the catchall term “change” because it was less alarmist compared to warming. More recently scientists are using the term climate emergency. We prefer the term “global climate disruption” (GCD) first used by James Holdren, a Harvard University Professor of Environmental Policy, in 2007 and again when he served as President Barack Obama’s Science Advisor. The term has not yet displaced “climate change,” but we believe GCD is more descriptive of world climate phenomena and stresses the critical juncture we face.

² As this Article reports, that a “certain” climate has been replaced by an uncertain and erratic one. See Ronald Brownstein, *The Unbearable Summer: Disastrous Environmental Events Are Converging like Never Before*, THE ATLANTIC (Aug. 26, 2021), <https://www.theatlantic.com/politics/archive/2021/08/summer-2021-climate-change-records/619887/> [<https://perma.cc/CFT7-X8N7>].

A. GCD and the Challenge for Urbanized Western America

In the third decade of the twenty-first century, there is virtually a uniform scientific consensus that the earth's climate is warming due to anthropocentric causes, primarily the continuing emission of greenhouse gasses and large-scale forest clearing.³ We are simultaneously heating the earth's atmosphere and burning our natural carbon sinks and climate moderators. There is also a growing recognition that the long-hoped-for goal of rolling back greenhouse gas emissions and rainforest clearing to mitigate temperature rise is not happening and that tree plantings cannot keep pace with those clearings.

The international community has been unable to agree on an effective regulatory regime for mitigation or a scheme to equitably distribute, between developed and less-developed countries, the pain of transitioning to a non- or low-carbon economy. The United States' 2017 decision to withdraw from the 2015 Paris Agreement (although reversed by the Biden administration), as well as any international leadership on the issue, has served as an effective green light for inaction on a global scale.⁴ This leaves all countries with no choice but to try to adapt to GCD; that is, to accept the reality of adverse impacts and to attempt to avoid as many of them as possible. However, the line between mitigation and adaptation is not clear. Though it may be too late to avoid a warmer climate, many nations, states, regions, and cities are still taking steps to reduce greenhouse gas emissions. Regardless of any impacts on rising temperatures, there are immediate public health benefits to doing so.⁵

³ *Scientific Consensus: Earth's Climate Is Warming*, NASA, <https://climate.nasa.gov/scientific-consensus/> [<https://perma.cc/L8AY-SP9N>] (last visited Feb. 11, 2022).

⁴ See President Donald J. Trump, President of the U.S., Statement by President Trump on the Paris Climate Accord (June 1, 2017), <https://trumpwhitehouse.archives.gov/briefings-statements/statement-president-trump-paris-climate-accord/> [<https://perma.cc/6F8E-62FA>]; President Joseph R. Biden, Jr., President of the U.S., Paris Climate Agreement: Acceptance on Behalf of the United State of America (Jan. 20, 2021), <https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/20/paris-climate-agreement> [<https://perma.cc/B9VS-T8JZ>]. See also Coral Davenport & Lisa Friedman, *Biden Cancels Keystone XL Pipeline and Rejoins Paris Climate Agreement*, N.Y. TIMES (Jan. 20, 2021), <https://www.nytimes.com/2021/01/20/climate/biden-paris-climateagreement.html> [<https://perma.cc/YEG6-BMKP>] (describing the reversal of position on the Paris Climate Accords by the Biden Administration).

⁵ WHO COP 24 Report: *Health Benefits Outweigh Costs of Meeting Paris Agreement Goals*, INT'L INST. FOR SUSTAINABLE DEV. (Jan. 10, 2019), <https://sdg.iisd.org/news/who-cop-24-report-health-benefits-outweigh-costs-of-meeting-paris-agreement-goals/> [<https://perma.cc/3L8N-SKK9>]. The immediacy and seriousness of climate destruction are sharply emphasized in the 2021 Report of the Intergovernmental Panel on Climate Change. *Climate*

B. Urban Areas on the Firing Line

Over fifty percent of the world's population lives in urban areas, and that figure is expected to rise to two-thirds by 2050.⁶ Cities around the world are taking steps to make themselves more resilient to the adverse impacts of GCD. GCD adaptation is imperative for the three principal regions of the American West—the Great Plains, the Pacific Northwest, and the Southwest—for two reasons.⁷ First, the election of President Trump in 2016 ushered in a complete withdrawal of the federal government from support for climate adaptation and a further devolution of that adaptation to states and urban areas.⁸ Despite the Biden administration's efforts to change this outcome, little has occurred on this score as of September 2021. Second, although GCD's adverse impacts vary across and within these regions, the economic and public health risks of GCD are substantial, and, as we shall demonstrate, western cities are especially vulnerable.

The expected adverse climate impacts of GCD include, at one end of the spectrum, coastal and inland flooding from sea level rise and increased rainfall, and at the other end of the spectrum increased heat and water stress.⁹ Rapidly growing western cities do not have the water supply advantages that shrinking cities in the Midwest and East claim.¹⁰ In a ranking of fifty U.S. cities for resilience based on water supply disruption, natural disasters, and heat stress, Seattle is the only western

Change 2021: The Physical Science Basis, INT'L UNION OF PURE & APPLIED CHEMISTRY (Aug. 19, 2021), <https://iupac.org/climate-change-2021-the-physical-science-basis/> [<https://perma.cc/F773-H843>].

⁶ Hannah Ritchie & Max Roser, *Urbanization*, OUR WORLD IN DATA, <https://ourworldindata.org/urbanization> [<https://perma.cc/7S6N-XSEQ>] (last revised Nov. 2019).

⁷ See THE RISKY BUS. PROJECT, *RISKY BUSINESS: THE ECONOMIC RISKS OF CLIMATE CHANGE IN THE UNITED STATES* (2014), https://riskybusiness.org/site/assets/uploads/2015/09/RiskyBusiness_Report_WEB_09_08_14.pdf [<https://perma.cc/NLG9-UH46>].

⁸ "Absent any realistic prospects for federal action on climate change in the near term, state and local policies are the only game in town." Cary Coglianese & Shana Starobin, *After a Federal Climate Policy Retreat, States Should Proceed with Caution*, THE REGUL. REV. (Feb. 22, 2018), <https://www.theregreview.org/2018/02/22/coglianese-starobin-federal-climate-policy-retreat-caution/> [<https://perma.cc/93V9-CWAM>].

⁹ FOUR TWENTY SEVEN, *ASSESSING EXPOSURE TO CLIMATE CHANGE IN U.S. MUNICIPALITIES 5–12* (2018), <http://427mt.com/wp-content/uploads/2018/05/427-Muni-Risk-Paper-May-2018-1.pdf> [<https://perma.cc/8BDK-5VCE>].

¹⁰ For example, recent studies of the impact of climate change on the Great Lakes now estimate smaller decreases in lake levels than previously predicted. ENV'T L. & POL'Y CTR., *AN ASSESSMENT OF THE IMPACTS OF CLIMATE CHANGE ON THE GREAT LAKES* 21 (2019).

city recognized as one of the top ten least vulnerable to these risks.¹¹ Heat stress will only become worse for the American West, meaning less water for the region.¹² A 2019 study projects that Portland will have a climate similar to Sacramento's by the end of this century.¹³ The ability of governments to take steps to mitigate these adverse impacts varies across the region.¹⁴ Western cities face the additional problem that they are continuing to grow rapidly,¹⁵ forcing them to simultaneously meet increased demand for new housing stock, adapt to GCD, and address social equity issues such as affordable housing, access to decent-paying employment opportunities, and homelessness.

A warmer climate means more dangerous air pollution and greater water stress for the American West. The number of stagnant air days per year in U.S. cities is expected to increase by forty by the end of this century.¹⁶ The root cause of rising carbon dioxide emissions in urban and suburban areas is automobile use.¹⁷ Emission rates are increasing. The only question is how much? In many western cities, such as Las Vegas, Los Angeles, Portland, Sacramento, and San

¹¹ Jeff Opperman, *Which Cities Can Best Adapt to Climate Change?*, GRIST (June 23, 2011), <https://grist.org/climate-change/2011-06-23-which-cities-adapt-most-resilient-to-global-warming> [<https://perma.cc/9XNV-J7HM>]. Colorado Springs, San Francisco-Oakland, and Long Beach make the next twenty, but the bottom ten are all western or southwestern cities except for Miami, which is dead last.

¹² *Summer Temperature Trends in the Contiguous U.S.*, CLIMATE CENT. (June 5, 2019), <https://www.climatecentral.org/gallery/graphics/summer-temperature-trends-in-the-contiguous-us> [<https://perma.cc/YT2Q-D4TL>] (“In the past half-century, summer temperatures have risen 2.0°F on average in the contiguous U.S. Among the 244 cities analyzed, nearly 95% have recorded an increase in average summer temperatures since 1970. The eight largest increases have occurred in Texas and the West, led by Boise, Idaho (5.3°F); Las Vegas, Nevada (5.3°F); and McAllen, Texas (5.1°F).”).

¹³ Matthew C. Fitzpatrick & Robert R. Dunn, *Contemporary Climatic Analogs for 540 North American Urban Areas in the Late 21st Century*, 10 NATURE COMM'NS 614, 617 (2019).

¹⁴ J. KEVIN SUMMERS ET AL., EPA, DEVELOPMENT OF A CLIMATE RESILIENCE SCREENING INDEX (CRSI): AN ASSESSMENT OF RESILIENCE TO ACUTE METEOROLOGICAL EVENTS AND SELECTED NATURAL HAZARDS (2017), <https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P100SSN6.txt> [<https://perma.cc/2LUD-5LE6>].

¹⁵ Cities in the Texas and the U.S. West make up eleven of the fifteen fastest-growing large U.S. cities. Press Release, U.S. Census Bureau, Census Bureau Reveals Fastest-Growing Large Cities (May 24, 2018), <https://www.census.gov/newsroom/press-releases/2018/estimates-cities.html> [<https://perma.cc/2QRC-DF7F>].

¹⁶ CLIMATE CENT., CLIMATE CHANGE IS THREATENING AIR QUALITY ACROSS THE COUNTRY 6 (2019), <https://ccimsgs-2019.s3.amazonaws.com/2019AirQuality2/2019AirQuality.pdf> [<https://perma.cc/C5MZ-KQQF>].

¹⁷ See C. Gately, L.R. Hutyra & I.S. Wing, *DARTE Annual On-Road CO₂ Emissions on a 1-km Grid, Conterminous USA, V2, 1980-2017*, ORNL DAAC (2019), <https://doi.org/10.3334/ORNLDAAC/1735> [<https://perma.cc/NAF5-UWHE>].

Francisco, emissions have increased at rates below population growth.¹⁸ In other cities, such as Boise, Phoenix, Tucson, Salt Lake City, and Seattle, emission rates have exceeded population growth.¹⁹ A wetter, warmer climate means that precipitation patterns will become less predictable as we enter the era of non-stationarity.²⁰ Warmer air holds more moisture, but the benefits of increased rainfall may be offset by more frequent droughts in the “central and southern Great Plains, the Southwest and central Rocky Mountain States, and California.”²¹

C. The American West’s Changing Landscape: Population Concentration, Rural Retreat, and Contested Ecosystems

The West’s population is concentrated in urban areas. This reflects the distribution of population in the West. The West is the most urbanized region of the country. It now consists of two urban trends. Along the Pacific Coast, there are only three mega-regions: San Diego-Santa Barbara, the San Francisco Bay Area, and the Cascadia Corridor.²² The last of these may become the “Cascadia” corridor if plans materialize to move passengers from Portland to Vancouver in two hours via high-speed rail.²³ The West is now made up of a number

¹⁸ *Global Gridded Model of Carbon Footprints (GGMCF)*, CITY CARBON FOOTPRINTS, <http://citycarbonfootprints.info> [<https://perma.cc/J2E3-27VH>] (last visited Feb. 11, 2022).

¹⁹ *Id.*

²⁰ According to Sara Tessoroff, who writes for the Globe Program Scientists’ Blog: Non-stationarity means that what used to be normal is not normal anymore. It means that our climate system can no longer be considered stationary. The extremes in our climate system of the past, can no longer be considered the outer limits of what our current and future climate system can exceed. For example, a 100-year flood could now be expected to happen more frequently than once in a 100-year period; thus it may become a 50-year flood, or less.

Sarah Tessoroff, *Non-Stationarity: New Vocabulary for a Changing Climate*, GLOBE SCIENTISTS’ BLOG (Nov. 8, 2012), https://www.globe.gov/explore-science/scientists-blog/archived-posts/sciblog/index.html_p=1471.html [<https://perma.cc/DAV4-BHQ7>].

²¹ Thomas C. Brown, Vinod Mahat & Jorge A. Ramirez, *Adaptation to Future Water Shortages in the United States Caused by Population Growth and Climate Change*, 7 EARTH’S FUTURE 219, 232 (2019), <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1029/2018EF001091> [<https://perma.cc/H7XN-38GN>].

²² See C.L. Illsley, *What Are the Megaregions of the United States?*, WORLDATLAS (Apr. 12, 2019), <https://www.worldatlas.com/articles/what-are-the-megaregions-of-the-united-states.html> [<https://perma.cc/ZTU2-4KEC>].

²³ Jack Forrest, *Connecting Cascadia: Regional High-Speed Rail Plans on Track*, DAILY EMERALD (Oct. 31, 2019), https://www.dailyemerald.com/news/connecting-cascadia-regional-high-speed-rail-plans-on-track/article_939b7cb4-fb86-11e9-ad1f-076bb8c21a17.html [<https://perma.cc/8A9M-PGYT>]. The original plan to make Eugene the southern terminus has been abandoned as of 2019.

of urban archipelagos, even in the most rural states. This includes the older, traditional cities; high-end recreation areas, such as Moab, Utah; retirement centers, such as Saint George, Utah; agro-processing centers, such as Twin Falls, Idaho; and Canadian medical tourism centers, such as Coeur d'Alene, Idaho. In most states, over eighty-five percent of the population lives in urban areas.²⁴ Even the three western states with the lowest populations—Montana, Wyoming, and Idaho—have relatively high percentages of urban dwellers—fifty-five, sixty-four, and seventy percent, respectively.²⁵ Idaho's seventy percent reflects the rapid growth of Boise and Twin Falls.²⁶

Many parts of the rural West are under stress from population retreat as traditional, commodity-based economies erode.²⁷ These stresses are driven by changes in the economies of the globe in general and the American West in particular, which seem futile to try to reverse. Four specific activities in the rural West that contribute to gross domestic product are agriculture, logging, mining, and recreation.²⁸ However, outdoor recreation is growing at a rate faster than the national economy.²⁹ The chief use of western public lands, to borrow an analogy

²⁴ Aaron O'Neill, *Degree of Urbanization in the United States 1970 to 2020*, STATISTA (July 21, 2021), <https://www.statista.com/statistics/269967/urbanization-in-the-united-states/> [<https://perma.cc/6H67-8HMN>] (Statista places the percentage of the American population living in cities or urban areas at 82.66%).

²⁵ *See id.*

²⁶ *See* PRISCILLA SALANT ET AL., IDAHO COM. & LAB., PROFILE OF RURAL IDAHO: A LOOK AT ECONOMIC AND SOCIAL TRENDS AFFECTING RURAL IDAHO, <https://www.uidaho.edu/-/media/UIIdaho-Responsive/Files/president/direct-reports/mcclure-center/Idaho-at-a-Glance/IDG-Profile-of-Rural-Idaho.pdf> [<https://perma.cc/4QR6-KGS7>].

²⁷ For a general review of rural population decline, see Kenneth M. Johnson & Daniel T. Lichter, *Rural Depopulation: Growth and Decline Processes over the Past Century*, 84 RURAL SOCIO. 3 (2019). The distinction between urban and rural used by the United States Census Bureau masks the changing nature of rural settlement. The trend toward outward urban development, which was stalled during the 2008 Great Recession and the recovery decade that followed, resumed around 2018 so that many areas that are rural and whose residents consider themselves rural are on the fringes of smaller more recently designated metropolitan areas. *Shifting Geography of Population Change*, USDA ECON. RSCH. SERV., <https://www.ers.usda.gov/topics/rural-economy-population/population-migration/shifting-geography-of-population-change/> [<https://perma.cc/NTV8-FFF7>] (last updated Aug. 20, 2019). For an early normative but prescient examination of this trend, which the author describes as a new removal policy, see James R. Rasband, *The Rise of Urban Archipelagos in the American West: A New Reservation Policy?*, 31 ENV'T L. 1 (2001).

²⁸ *Industries at a Glance: Agriculture, Forestry, Fishing and Hunting: NAICS 11*, U.S. BUREAU OF LAB. STAT., <https://www.bls.gov/iag/tgs/iag11.htm> [<https://perma.cc/WKE7-E9HD>] (last visited Dec. 10, 2021).

²⁹ Doug Farquhar, *The Biggest Growth Sector in the Rural Economy Is . . .*, NCLS: THE NCSL BLOG (May 21, 2018), <https://www.ncsl.org/blog/2018/05/21/biggest-growth-sector-in-the-rural-economy-is-.aspx> [<https://perma.cc/NY32-ABQN>]; *Outdoor Recreation*, U.S.

from water resources, is now the relatively nonconsumptive use of lands for recreation.³⁰ These changes present challenges for both ranching and irrigated agriculture.³¹ Nonetheless, they reflect the realities that the great experiment to settle the West as an irrigated agricultural and ranching society is no longer viable in many areas and that the most rational settlement pattern is the opposite of what John Wesley Powell envisioned in his iconic *Report on the Lands of the Arid Region of the United States*.³² To take the charged issue of public land grazing, the reality is that only four percent of cattle forage and nine percent of sheep forage comes from public land.³³ The sheep industry is in decline, both in terms of wool production and meat consumption.³⁴ The West still loves meat, but domestic and worldwide changes in diet preferences do not bode well for beef and lamb.³⁵

BUREAU OF ECON. ANALYSIS, <https://www.bea.gov/data/special-topics/outdoor-recreation> [<https://perma.cc/K698-MQ6J>] (last visited Nov. 8, 2021) (based on 2019 statistics).

³⁰ Intense recreation from cars in national parks to off-road vehicles can cause considerable environmental damage. DOUGLAS S. OUREN ET AL., U.S. DEP'T OF THE INTERIOR, U.S. GEOLOGICAL SURV., ENVIRONMENTAL EFFECTS OF OFF-HIGHWAY VEHICLES ON BUREAU OF LAND MANAGEMENT LANDS: A LITERATURE SYNTHESIS, ANNOTATED BIBLIOGRAPHIES, EXTENSIVE BIBLIOGRAPHIES, AND INTERNET RESOURCES (2007), <https://pubs.usgs.gov/of/2007/1353/report.pdf> [<https://perma.cc/LQ9E-WCSD>]; A. Dennis Lemly, Richard T. Kingsford & Julian R. Thompson, *Irrigated Agriculture and Wildlife Conservation: Conflict on a Global Scale*, 25 ENV'T MGMT. 485 (2000), <https://www.fs.usda.gov/treesearch/pubs/1618> [<https://perma.cc/KB3U-TXN5>].

³¹ See e.g., GLENN D. SCHAIBLE & MARCEL P. AILLERY, U.S. DEP'T OF AGRIC. ECON. RSCH. SERV., WATER CONSERVATION IN IRRIGATED AGRICULTURE: TRENDS AND CHALLENGES IN THE FACE OF EMERGING DEMANDS (2012), https://www.ers.usda.gov/webdocs/publications/44696/30956_eib99.pdf?v=0 [<https://perma.cc/8ZMU-AX4V>].

³² J.W. POWELL, REPORT ON THE LANDS OF THE ARID REGION OF THE UNITED STATES WITH A MORE DETAILED ACCOUNT OF THE LANDS OF UTAH (U.S. Gov't Printing Off., 2d ed. 1879), <https://pubs.usgs.gov/unnumbered/70039240/report.pdf> [<https://perma.cc/H6YR-9PCL>].

³³ Neil R. Rimbey, John A. Tanaka & L. Allen Torell, *Economic Considerations of Livestock Grazing on Public Lands in the United States of America*, 5 ANIMAL FRONTIERS 32, 32 (2015).

³⁴ RICHARD STILLMAN, TERRY CRAWFORD & LORNA ALDRICH, ECON. RSCH. SERV., U.S. DEP'T OF AGRIC., THE U.S. SHEEP INDUSTRY (1990), https://www.ers.usda.gov/webdocs/publications/41867/50709_ages9048fm.pdf?v=9064 [<https://perma.cc/J2UH-33GL>].

³⁵ The impact of beef production on greenhouse gas emissions is clear, Gidon Eshel et al., *Land, Irrigation Water, Greenhouse Gas, and Reactive Nitrogen Burdens of Meat, Eggs, and Dairy Production in the United States*, 111 PROC. NAT'L ACAD. SCIS. 11,996 (2014), but whether diets will change is unclear. See JONATHAN SAFRAN FOER, WE ARE THE WEATHER: SAVING THE PLANET BEGINS AT BREAKFAST (2019).

D. Toward Resilient Western Urban Areas: A Long Way to Go

The four markers of climate resilience used in this Article are interrelated. In this section, we present the major challenges of achieving resilience with respect to each of the markers and the obvious interrelationships. There is a vast amount of literature on climate-resilient cities.³⁶ Although there is no single definition of a resilient city, there is a consensus that no city is fully climate resilient.³⁷ The best that we can do is glean the major characteristics from the work of urbanists and best planning practices worldwide.

1. Spatial Planning

Spatial planning is a core, but not exclusive, component of GCD adaptation. The West's urban areas have their strengths, primarily their strong economies and attractive lifestyle options, but they are not climate resilient. The primary reason for this is that they have followed the dominant paradigm of U.S. urban development. This paradigm is characterized by the assumption that cities should expand outward in response to market demand, the preference for single-family homes over higher-density development and public open space, fragmented municipal governments that promote racial and social segregation, and little effort to coordinate work and living spaces.³⁸ Put differently, Americans have rejected the European model of urban development. There have been challenges to this paradigm, but past models that marry density and green space offer limited lessons for resilience. Specifically, Le Corbusier's *Ville Radieuse* and Frank Lloyd Wright's *Broadacre City* are more associated with the sterile and unfair post-World War II era, which married urban renewal and warehouse-style public housing and produced the bastard child of exclusionary land

³⁶ Among the more recent articles are the following: Vahid M. Nik, A.T.D. Perera & Deliang Chen, *Towards Climate Resilient Urban Energy Systems: A Review*, 8 NAT'L SCI. REV. (2021), <https://doi.org/10.1093/nstr/nwaa134>; Anastasia Nikologianni, Peter J. Larkham, & Kathryn Moore, *Built Environment and Landscape Design as Tools for Resilient Cities*, 7 ATHENS J. ARCHITECTURE 335 (2021); and Jeroen Kluck & Floris Boogaard, *Climate Resilient Urban Retrofit at Street Level*, in CLIMATE RESILIENT URBAN AREAS 45 (Rutger de Graaf-van Dinther ed., 2021).

³⁷ David Satterthwaite & David Dodman, *Towards Resilience and Transformation for Cities Within a Finite Planet*, 25 ENV'T & URBANIZATION 291 (2013).

³⁸ *APA Policy Guide on Smart Growth*, AM. PLAN. ASS'N, <https://www.planning.org/policy/guides/adopted/smartgrowth.htm> [<https://perma.cc/PNT3-N6UF>] (last updated Apr. 14, 2012).

use.³⁹ Ebenezer Howard's garden cities offer some lessons,⁴⁰ but they too have degenerated into the theoretical underpinning of the gated community.⁴¹ The net result is that, despite the efforts the authors chronicled in their 2019 article,⁴² the United States is lagging behind other countries in urban adaptation. It ranks relatively low in local government spending for resilience-related services, such as health and environmental protection.⁴³

Cities must be greener, denser, less private and, thus, more public, with transportation options that provide a closer link between work and home. Greener cities are a given with respect to climate adaptation. Increased density is equally imperative but less understood and more controversial. Increased density is not an end in itself but a means to achieve a variety of linked goals, including greater spatial integration of work and residence; less general dependence on the automobile; more open, tree-covered space to reduce urban heat islands; and more affordable housing. Jane Jacobs's *The Death and Life of Great American Cities*,⁴⁴ a vision of denser urban living, has become a reality for millions of urban residents from hip Portland, Oregon, to Marfa, Texas.⁴⁵ However, a vibrant urban core is only one component of GCD

³⁹ E.g., Teresa Almeida, *Le Corbusier: How a Utopian Vision Became Pathological in Practice*, ORANGE TICKER (Mar. 5, 2013), <https://orangeticker.wordpress.com/2013/03/05/le-corbusier-how-a-utopic-vision-became-pathological-in-practic/> [https://perma.cc/6GTA-K3BF]; Kathrine Don, *Frank Lloyd Wright's Utopian Dystopia*, NEXT CITY (Apr. 8, 2010), <https://nextcity.org/daily/entry/frank-lloyd-wrights-utopian-dystopia> [https://perma.cc/ZQ9H-M5P2].

⁴⁰ EBENEZER HOWARD, GARDEN CITIES OF TO-MORROW (1902). See also Tommy O'Donnell, *Ebenezer Howard and Letchworth: The First Garden City*, URB. UTOPIAS (Nov. 1, 2018), <https://urbanutopias.net/2018/11/01/lethworth/> [https://perma.cc/FM89-K6ML].

⁴¹ EDWARD J. BLAKELY & MARY G. SNYDER, FORTRESS AMERICA: GATED COMMUNITIES IN THE UNITED STATES (1997); William Siembieda & Jerry Sturmer, *Contemporary Master Planned Community Practice*, 2 FOCUS 31 (2005), <https://digitalcommons.calpoly.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1034&context=focus> [https://perma.cc/JLW9-J5SX].

⁴² See Sullivan & Tarlock, *supra* note 1.

⁴³ UNITED CITIES & LOC. GOV'TS, ORG. FOR ECON. COOP. & DEV., SUBNATIONAL GOVERNMENTS AROUND THE WORLD: STRUCTURE AND FINANCE 26 (2016), <https://www.oecd.org/regional/regional-policy/Subnational-Governments-Around-the-World-%20Part-I.pdf> [https://perma.cc/WSL3-YGZW]. In nine resilience-related expenditures, the United States is eleventh in the world behind the obvious northern European countries but also behind China and Russia. Its ranking drops to eighteenth when the nine categories are compared to total local government expenditures. *Id.* at 28.

⁴⁴ JANE JACOBS, THE DEATH AND LIFE OF GREAT AMERICAN CITIES (1961).

⁴⁵ Density and livability are not necessarily related. *Density – A Livability Fact Sheet*, AM. ASS'N OF RETIRED PERSONS, <https://www.aarp.org/content/dam/aarp/livable-communities>

adaptation since large amounts of urban open space are needed, but entrenched zoning policies such as single-family zoning districts, and the continuing displacement of low-income residents and minorities, prevent its realization.⁴⁶ This displacement and the unabated outward growth of cities have led to the separation of work and residence, which is a major social equity issue because lower-income workers spend a greater percentage of their income on commuting.⁴⁷ Although transportation-oriented development (TOD) has increased housing options for larger cities and their older suburbs, connected via commuter rail networks,⁴⁸ more must be done to ensure that TOD actually works for those with long automobile commutes and that it actually reduces automobile use.

2. Transportation

The United States remains an automobile-driven society. Transportation continues to be the largest source of American and

/livable-documents/documents-2014/Livability%20Fact%20Sheets/Density%20Fact%20Sheet.pdf [https://perma.cc/4375-5EFF] (last visited Feb. 11, 2022); David D. Dixon, *Density*, in LIVABILITY 101, 18 (2005), https://www.aia-mn.org/wp-content/uploads/Livability101.pdf [https://perma.cc/AFN6-KTM5].

⁴⁶ Dan Bertolet, *Exclusionary Zoning Robs Our Cities of Their Best Qualities*, SIGHTLINE INST. (Apr. 20, 2016), https://www.sightline.org/2016/04/20/how-exclusionary-zoning-robs-our-cities-of-their-best-qualities/ [https://perma.cc/HB52-P675]; Bethany Y. Li, *Now Is the Time!: Challenging Resegregation and Displacement in the Age of Hypergentrification*, 85 FORDHAM L. REV. 1189, 1196–97 (2016); John Mangin, *The New Exclusionary Zoning*, 25 STAN. L. & POL. REV. 91, 91 (2014).

⁴⁷ E.g., ELIZABETH ROBERTO, BROOKINGS INST., COMMUTING TO OPPORTUNITY: THE WORKING POOR AND COMMUTING IN THE UNITED STATES (2008), https://www.brookings.edu/wp-content/uploads/2016/06/0314_transportation_puentes.pdf [https://perma.cc/G85G-5RB9]. For a history of urban commuting that supports the need for denser cities, see Jonathan English, *The Commuting Principle that Shaped Urban History*, BLOOMBERG CITYLAB (Aug. 29, 2019), https://www.bloomberg.com/news/features/2019-08-29/the-commuting-principle-that-shaped-urban-history [https://perma.cc/CXX7-7NH5].

⁴⁸ OFF. OF POL'Y DEV. & RSCH., U.S. DEP'T OF HOUSING & URB. DEV., CREATING CONNECTED COMMUNITIES (2014), https://www.huduser.gov/portal/publications/pdf/Creating_Cnnted_Comm.pdf [https://perma.cc/ES4R-UXNE]; DENA BELZER & GERALD AUTLER, BROOKINGS INST. CTR. ON URB. & METRO. POL'Y & THE GREAT AM. STATION FOUND., TRANSIT ORIENTED DEVELOPMENT: MOVING FROM RHETORIC TO REALITY (2002), https://www.brookings.edu/wp-content/uploads/2016/06/belzertod.pdf [https://perma.cc/2DTP-YB98]; ROBERT B. NOLAND ET AL., MINETA NAT'L TRANSIT RSCH. CONSORTIUM, MEASURING BENEFITS OF TRANSIT ORIENTED DEVELOPMENT (2014), https://transweb.sjsu.edu/sites/default/files/1142-measuring-TOD-benefits.pdf [https://perma.cc/Y9YZ-3Y28]; DOUGLAS SHINKLE, NAT'L CONF. OF STATE LEGISLATURES, TRANSIT-ORIENTED DEVELOPMENT IN THE STATES (2012), https://www.nsl.org/documents/transportation/TOD_final.pdf [https://perma.cc/VGX4-R5SG].

European greenhouse gas emissions.⁴⁹ This must change in order to adapt to GCD. Such change will be a three-pronged process: (1) development of new technologies, (2) spatial planning to reduce the disconnect between home and work, and (3) adoption of European public transportation policies. Electric cars and new battery technologies may reduce automobile greenhouse gas emissions, but the rate of adoption and technological innovation are unclear. In addition, electric vehicles require the increased generation of electrical power and will not solve congestion or the living-work disconnect. Sadly, spatial planning has done little to decrease automobile use. Public transportation had slowly increased ridership prospects⁵⁰ until the 2020 pandemic,⁵¹ overcoming the stigma associated with its use, but it is far from being an integral part of urban life in the American West. Commuter use of public transportation is over twenty percent in only three western cities: San Francisco, Seattle, and Oakland.⁵² Portland and Los Angeles come next at just over ten percent, followed by Denver and Salt Lake City at seven percent.⁵³ The comparison with Europe is striking. Forty-nine percent of all commuters in the large European cities use public transportation, with Vienna being the leader at seventy-four percent.⁵⁴ In the United States, retrenchment toward support of existing systems has all but precluded system expansion.

⁴⁹ Umair Irfan, *After Years of Decline, U.S. Carbon Emissions Are Rising Again*, VOX, <https://www.vox.com/2019/1/8/18174082/us-carbon-emissions-2018> [https://perma.cc/P2EM-42YB] (last updated Jan. 9, 2019).

⁵⁰ Laura Bliss, *Behind the Gains in U.S. Public Transit Ridership*, BLOOMBERG CITYLAB (Jan. 13, 2020), <https://www.bloomberg.com/news/articles/2020-01-13/behind-the-gains-in-u-s-public-transit-ridership> [https://perma.cc/VN2D-9EP5]; *Public Transportation Industry in the US*, IBIS WORLD, <https://www.ibisworld.com/united-states/market-research-reports/public-transportation-industry/> [https://perma.cc/E7NX-P8FV] (last updated Jan. 29, 2022).

⁵¹ *COVID-19 Trends Impacting the Future of Transportation Planning and Research*, NAT'L ACADS. SCI., ENG'G & MED., <https://www.nationalacademies.org/trb/blog/covid-19-trends-impacting-the-future-of-transportation-planning-and-research> [https://perma.cc/JDE6-3EFQ] (last updated Jan. 27, 2021).

⁵² Nick Wallace, *The Best Cities for Public Transportation in 2016*, SMARTASSET (June 17, 2019), <https://smartasset.com/mortgage/best-cities-for-public-transportation> [https://perma.cc/24ZT-SEVU]. The respective percentages are 34%, 21%, and 21%.

⁵³ *Id.*

⁵⁴ Feargus O'Sullivan, *Breaking Down the Many Ways Europe's City-Dwellers Get to Work*, BLOOMBERG CITYLAB (Oct. 18, 2017), <https://www.citylab.com/transportation/2017/10/riding-bikes-buses-trains-in-european-cities/543141/> [https://perma.cc/5PDQ-5A3N].

3. Infrastructure

Climate resiliency requires a complete rethinking of our urban infrastructure policies. We know that our current infrastructure is old and seldom serves any GCD adaptation objectives. We continue to build roads that simply increase congestion. We still think that we can solve sea level rise and urban flooding with large, hard infrastructure solutions in the face of growing consensus that climate-resilient infrastructure requires greater integration with natural features such as waterways and tree-covered open space.⁵⁵ The challenges are great. The problems start with the absence of any national standards to guide states and cities with respect to infrastructure, though the federal government is giving millions to vulnerable states⁵⁶ for flood mapping and infrastructure planning so long as the “C” words (i.e., climate change) are not used for justification.⁵⁷ The absence of such standards exacerbates the debate between hard and mixed, hard-soft solutions. Cities and landowners prefer hard solutions, but many engineers and other experts suggest that large projects are neither cost-effective nor effective at preventing damage.⁵⁸ New Orleans is the poster child for this problem. A fourteen-billion-dollar post-Hurricane Katrina flood protection system, including pumps and levees, was completed in 2018, but the levees are now sinking, and the system may not provide the promised protection.⁵⁹ Managed retreat from vulnerable areas may not be a complete solution to GCD, but it must become a more widely used regulatory tool. U.S. cities are just starting to conduct rigorous vulnerability assessments for current and planned hard infrastructure,

⁵⁵ DAVID SZÉSCILO, REGULATORY STRATEGIES FOR COOLING DOWN CITIES (2019).

⁵⁶ CONG. RSCH. SERV., FLOOD RESILIENCE AND RISK REDUCTION: FEDERAL ASSISTANCE AND PROGRAMS 10 (2019), <https://crsreports.congress.gov/product/pdf/R/R45017> [<https://perma.cc/BWX2-SD9B>].

⁵⁷ Jean Chemnick & Thomas Frank, *Climate Change Once Again Left Out of Trump's Federal Budget*, SCIENTIFIC AM. (Feb. 11, 2020), <https://www.scientificamerican.com/article/climate-change-once-again-left-out-of-trumps-federal-budget/> [<https://perma.cc/L89F-SQ72>].

⁵⁸ Jeroen C.J.H. Aerts, *A Review of Cost Estimates for Flood Adaptation*, 10 WATER 1646 (2018), <https://www.mdpi.com/2073-4441/10/11/1646/htm> [<https://perma.cc/3KGT-MS7Q>]; Thomas Frank, *FEMA Ends Policy Favoring Flood Walls Over Green Protections*, E&E NEWS (Oct. 15, 2020), <https://www.eenews.net/articles/fema-ends-policy-favoring-flood-walls-over-green-protections/> [<https://perma.cc/TQ43-AHMJ>].

⁵⁹ Thomas Frank, *After a \$14-Billion Upgrade, New Orleans' Levees Are Sinking*, SCIENTIFIC AM. (Apr. 11, 2019), <https://www.scientificamerican.com/article/after-a-14-billion-upgrade-new-orleans-levees-are-sinking/> [<https://perma.cc/3JLL-9FR3>]; Richard Campanella, *How Humans Sank New Orleans*, THE ATLANTIC (Feb. 6, 2018), <https://www.theatlantic.com/technology/archive/2018/02/how-humans-sank-new-orleans/552323/> [<https://perma.cc/8D9D-59LY>].

especially for increased flood and wildfire risks.⁶⁰ We cannot eliminate all flooding, but we continue to waste opportunities to make better use of stormwater runoff.

New infrastructure solutions pose a wide range of legal and political problems as well as psychological problems as landowners are faced with difficult adaptation choices. More sophisticated and accurate vulnerability assessments will affect real estate values. There will be political and legal pushback to more expensive solutions that do not follow the (failed) playbook now on offer. The traditional problem with flood protection has been to find the right balance between compensation and non-compensation for those properties destroyed or reduced in value by accelerated ocean or inland flooding.⁶¹ But as the ability to identify vulnerable areas increases, all levels of government face more exposure to liability for failing to adequately protect landowners from flood damages.⁶² At the same time, federal immunity from liability for decisions related to reservoir operation and project design is eroding.⁶³

⁶⁰ JOSEPH DEANGELIS, HALEY BRIEL & MICHAEL LAUER, AM. PLANNING ASS'N, PLANNING FOR INFRASTRUCTURE RESILIENCE (2019).

⁶¹ See ANNE SIDERS, COLUM. L. SCH. CTR. FOR CLIMATE CHANGE L., MANAGED COASTAL RETREAT: A LEGAL HANDBOOK ON SHIFTING DEVELOPMENT AWAY FROM VULNERABLE AREAS (2013), https://web.law.columbia.edu/sites/default/files/microsites/climate-change/files/Publications/ManagedCoastalRetreat_FINAL_Oct%2030.pdf [<https://perma.cc/3J2D-YUDE>]. Cal. Coastal Comm'n, *Adaption Strategies, in SEA LEVEL RISE POLICY GUIDANCE 121* (2015), https://documents.coastal.ca.gov/assets/slr/guidance/August2015/7_Ch7_Adopted_Sea_Level_Rise_Policy_Guidance.pdf [<https://perma.cc/ET9B-ZNH3>]. Market forces are already at work. First Street estimates that coastal properties along the Atlantic and Gulf Coasts lost sixteen billion dollars in value between 2005–2017. Press Release, First Street Found., Rising Seas Erode \$15.8 Billion in Home Value from Maine to Mississippi (Feb. 27, 2019), <https://assets.floodiq.com/2019/02/784113f9d16323db82f696b9c3b0874e-First-Street-Foundation-Mid-Atlantic-Press-Release-Immediate-Release.pdf> [<https://perma.cc/9PLW-84AC>].

⁶² JENNIFER KLEIN, COLUM. L. SCH. SABIN CTR. FOR CLIMATE CHANGE, POTENTIAL LIABILITY OF GOVERNMENTS FOR FAILURE TO PREPARE FOR CLIMATE CHANGE (2015), https://web.law.columbia.edu/sites/default/files/microsites/climate-change/klein_-_liability_of_governments_for_failure_to_prepare_for_climate_change.pdf [<https://perma.cc/PHX9-NUNY>].

⁶³ See, e.g., *United States v. James*, 478 U.S. 597 (1986); CONG. RSCH. SERV., FEDERAL LIABILITY FOR FLOOD DAMAGE RELATED TO ARMY CORPS OF ENGINEERS PROJECTS (2008), https://www.everycrsreport.com/files/20080711_RL34131_8cb989f06ad9a6258c7659bdc266526c60093923.pdf [<https://perma.cc/HBE3-4L3D>]; James C. Kozlowski, *Flood Control Immunity in Recreation Evaporating* (2011), <http://mason.gmu.edu/~jkozlow/s/lawarts/05MAY11.pdf> [<https://perma.cc/Y3L7-PA89>].

4. *Water and Energy*

Western cities have generally gone through three phases to supply their residents with needed water. The first is to rely on local supplies. The second is to dam the headwaters of streams and transport the water to the city. The third is to buy or lease water from farmers in the hinterland. San Francisco is a classic example of the second strategy.⁶⁴ Denver, Los Angeles, and Phoenix are classic examples of the evolution from the second strategy to the third.⁶⁵ As irrigated agriculture in the West shrinks, more water will become available for municipal use, but there are two possible constraints on continued agricultural-municipal transfers. First, environmental groups will increasingly bid to leave the water in place in order to conserve aquatic ecosystems.⁶⁶ Second, should the United States ever develop a coherent food security policy, transfers could be blocked for that reason.⁶⁷

GCD adaptation requires an energy grid that relies more on renewable sources of energy. Western states, along with New England, are well-poised to benefit from the generation of electricity from non-carbon sources. Four of the top seven states with the highest use of renewable energy are in the West.⁶⁸ This includes large hydroelectric projects that face challenges from GCD as less water may be available to meet peak summer demand.

II

REFORMS IN THE STATE AND LOCAL LAND USE REGIME

GCD will require a very different land use approach in the coming years. Allowing each local jurisdiction to chart its own land use vision is not sustainable. While most of the western states have already

⁶⁴ See *infra* notes 165, 169 and accompanying text.

⁶⁵ See *infra* notes 165, 300, 319 and accompanying text regarding Los Angeles and notes 171, 201, 319 and accompanying text about Phoenix.

⁶⁶ W. STATES WATER COUNCIL, WATER LAWS AND POLICIES FOR A SUSTAINABLE FUTURE: A WESTERN STATES' PERSPECTIVE 189 (2008), <https://www.westernstateswater.org/wp-content/uploads/2016/07/57-2008-Section-of-Water-Laws-and-Policies-for-a-Sustainable-Future.pdf> [<https://perma.cc/P8L5-9KWZ>]; Jesse A. Boyd, *Hip Deep: A Survey of State Instream Flow Law from the Rocky Mountains to the Pacific Ocean*, 43 NAT. RES. J. 1151, 1208 (2003); Sandi Zellmer, *Legal Tools for Instream Flow Protection*, U. NEB. LINCOLN (2008), <https://digitalcommons.unl.edu/lawfacpub/9> [<https://perma.cc/5KBY-JYXV>].

⁶⁷ Brown, Mahat & Ramirez, *supra* note 21, at 227.

⁶⁸ Zoe Chevalier, *These States Use the Most Renewable Energy*, U.S. NEWS (July 23, 2018), <https://www.usnews.com/news/best-states/slideshows/these-states-use-the-most-renewable-energy?slide=12> [<https://perma.cc/YZE6-VWS7>].

discarded the nearly century-old pattern of planning and zoning under the Standard Acts of the 1920s⁶⁹ through greater legislative oversight and direction,⁷⁰ that trend will grow more pronounced as competition over water, air quality, energy, and urban space intensifies. In addition to conflicts over dwindling gross amounts of water, there will be a sharp political divide between the needs of growing urban areas and the expectations of water rights holders and instream users.⁷¹ Moreover, we believe that dwindling water supply will have profound effects on urban land uses, from landscaping to trees, which will necessarily reduce the horizontal expansion of urban areas. Instead, these areas will become denser and their structures higher, not only as a product of planning laws but also the laws of market demand.⁷²

⁶⁹ About three-quarters of the states adopted the Standard Zoning Enabling Act (1926) and about half adopted the Standard City Planning Enabling Act (1928). Effectively, these Acts delegated virtually all powers over land use planning and regulation to local governments with limited judicial review. See Edward J. Sullivan, *Answered Prayers: The Dilemma of Binding Plans*, in *PLANNING REFORM IN THE NEW CENTURY* 137, 157–58 (Daniel R. Mandelker ed., 2005).

⁷⁰ For a discussion of various state land use programs, especially in the American West, see, inter alia, David L. Callies, *The Quiet Revolution Revisited: A Quarter Century of Progress*, 26 *URB. LAW.* 197 (1994); Patricia E. Salkin, *Statewide Comprehensive Planning: The Next Wave*, in *STATE AND REGIONAL COMPREHENSIVE PLANNING: IMPLEMENTING NEW METHODS OF GROWTH MANAGEMENT* (Peter A. Buchsbaum & Larry J. Smith eds., 1993); Daniel R. Mandelker, *Implementing State Growth Management Programs: Alternatives and Recommendations*, 45 *J. MARSHALL L. REV.* 307 (2012); Edward J. Sullivan & Jessica Yeh, *Smart Growth: State Strategies in Managing Sprawl*, 45 *URB. LAW.* 349 (2013); Jenna Nash & Ross Burkhart, *Sprawl in the Western United States: Do State Growth Management Programs Reduce Sprawl?*, 8 *MENAI SCHOLARS RSCH. J.* 53 (2012), https://scholarworks.boisestate.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1110&context=mcnair_journal [<https://perma.cc/JMK8-9V24>]. Oregon, California, Washington and Hawai'i have strong state programs.

⁷¹ See e.g., Matthew McKinney & John E. Thorson, *Resolving Water Conflicts in the American West*, 17 *WATER POL'Y* 679 (2015); Carl Boronkay and Warren J. Abbott, *Water Conflicts in the Western United States*, 20 *STUD. CONFLICT & TERRORISM* 137 (1997); Andrew Fahlund, Min L. Janny Choy & Leon Szeptycki, *Water in the West*, 6 *CAL. J. POL. POL'Y* 61 (2014), https://waterinthewest.stanford.edu/sites/default/files/Final_WaterintheWest_CJPP.pdf [<https://perma.cc/RGU7-QA6Z>]; Abraham Lustgarten, *Use It or Lose It Laws Worsen Western U.S. Water Woes*, *SCIENTIFIC AM.* (June 9, 2015), <https://www.scientificamerican.com/article/use-it-or-lose-it-laws-worsen-western-u-s-water-woes/> [<https://perma.cc/LR37-KCK3>]; U.S. ARMY CORP. OF ENG'RS, *CONSENSUS BUILDING INST., WATER IN THE U.S. AMERICAN WEST: 150 YEARS OF ADAPTIVE STRATEGIES* (2012), <http://naturalresourcespolicy.org/docs/water-in-the-west.pdf> [<https://perma.cc/7QT4-M5DX>].

⁷² The Economist newspaper has frequently noted the conflicts over land use and growth (with particular reference to water availability) in the American West. See e.g., *Caps on Groundwater Use Create a New Market in California*, *THE ECONOMIST* (Aug. 17, 2019), <https://www.economist.com/united-states/2019/08/17/caps-on-groundwater-use-create-a>

Many of the coming changes in land use patterns will be influenced by revolutionary changes in transportation policy, discussed in Part III below. The two areas are intertwined based on environmental and economic efficiency considerations. If we are to avoid the costs of choking on our own fossil fuel emissions, we must change our transportation habits and promote natural greenery. Similarly, to make transportation systems more efficient, we must have fewer vehicle miles traveled (especially for journeys between home and work), sufficient urban density, and housing equity. We do not know how the future will be disrupted by technological changes, such as the deployment of social media and artificial intelligence; social changes, such as the emergence of new health care regimes; lifestyle changes, such as the displacement of the nuclear family with alternatives, as has been done since 1960;⁷³ and the apparent cooling of America's twentieth-century love for the auto. However, we do know that the city of 2050 will be quite different from the city of 1950, and we hope that the necessities wrought by GCD will spur our creativity for the sake of our common survival.

The existential necessities of GCD and pure efficiency will require that urban areas plan and regulate land uses from a regional perspective. Let us begin with the structures of state and local governments, their coordination, and the allocation of their land use planning and regulatory powers. Efficiency considerations will likely pare down the number of public agencies and force them to coordinate their programs.⁷⁴ These considerations, along with political

-new-market-in-california [<https://perma.cc/H2FP-65Z2>]; *Irrigate and Die: Underpricing and Misallocating Water Carries a High Price*, THE ECONOMIST (Aug. 14, 2018), <https://www.economist.com/special-report/2018/08/14/irrigate-and-die> [<https://perma.cc/JYG4-X25T>]; *Liquid Assets: Where to Look for Sensible Water Policies*, THE ECONOMIST (Aug. 14, 2018), <https://www.economist.com/special-report/2018/08/14/liquid-assets> [<https://perma.cc/QM68-VZRP>]; *The Regulated West*, THE ECONOMIST (Apr. 25, 2015), <https://www.economist.com/united-states/2015/04/25/the-regulated-west> [<https://perma.cc/D8VN-NDV6>]; *The Drying of the West: Drought Is Forcing Westerners to Consider Wasting Less Water*, THE ECONOMIST (Feb. 22, 2014), <https://www.economist.com/united-states/2014/02/22/the-drying-of-the-west> [<https://perma.cc/8VYG-WUYJ>].

⁷³ *The American Family Today*, PEW RSCH. CTR. (Dec. 17, 2015), <https://www.pewsocialtrends.org/2015/12/17/1-the-american-family-today/> [<https://perma.cc/C26H-YB3W>].

⁷⁴ Bruce Chew & William D. Eggers, *Transforming the Cost Structure of Government*, DELOITTE INSIGHTS (Aug. 16, 2018), <https://www2.deloitte.com/us/en/insights/industry/public-sector/transforming-cost-management-for-government-agencies.html> [<https://perma.cc/PV7M-L63Z>]. The authors contend that traditional budget-cutting measures, such as hiring freezes, delaying payments to consultants, delaying expenditures, and redrawing organizational charts, which they call Act One, will be insufficient in the long term:

responsibility, will lead first to greater state control of land use powers and then to the delegation of such powers to regional agencies as state officials realize that statewide policies are not responsive to the needs of all parts of the state and that policy is more effectively realized at the regional level, especially in metropolitan areas.

Florida and Oregon provide models of this necessary restructuring. Prior to 2011, Florida had a system in place under which state policy, formulated by the Governor and Cabinet, guided binding and mandatory local plans and land use regulations; larger developments (i.e., Developments of Regional Impact) could be reviewed at the state level; and state agencies could review local plans for consistency with state policy.⁷⁵ All this changed in 2011, when Governor Rick Scott severely weakened the program by taking the state largely out of local planning and land use regulation.⁷⁶ Oregon has continued, with some variation, its 1973 program under which a state agency adopts binding planning policies called “goals,” reviews local plans that are mandatory and binding, and coordinates with other state agencies.⁷⁷ Planning in Oregon’s largest metropolitan area occurs on a regional basis,⁷⁸ and a

They may address the budget challenge but not the underlying economics of the enterprise. In the future, organizations will likely face significant, sustained budget constraints due to escalating costs in areas such as health care and education. When faced with these pressures, it will no longer be enough to massage the budget or make one-time cuts. Agency leaders should script an Act Two in which they *move beyond tweaking the budget to transform the economics of delivering on their missions*, creating a significant and lasting cost impact with the dollars they save.

Id. At the federal level, various advisory committees and commissions, most famously the Hoover Commissions, have sought to make government more efficient. *See Hoover Commissions Sought Government Reforms*, N.Y. TIMES (Oct. 21, 1964), <https://www.nytimes.com/1964/10/21/archives/hover-commissions-sought-government-reforms.html> [<https://perma.cc/482P-KT3H>]. Similarly, states frequently attempt to review their governmental structures from a fiscal and efficiency standpoint. *See California’s Independent State Oversight Agency*, THE LITTLE HOOVER COMM’N, <https://lhc.ca.gov> [<https://perma.cc/7UBV-E5LH>] (last visited Feb. 11, 2022). *See also* Steve Brawner, *Gov. Hutchinson Plans to Reduce Number of State Agencies by 50%*, TALK BUS. & POL. (Mar. 15, 2018), <https://talkbusiness.net/2018/03/gov-hutchinson-plans-to-reduce-number-of-state-agencies-by-50/> [<https://perma.cc/36WD-WFBZ>] (explaining Arkansas’s proposal to cut the number of state agencies).

⁷⁵ *The Governor and Cabinet*, MYFLORIDA, <https://www.myflorida.com/myflorida/cabinet/structurehistory.html> [<https://perma.cc/H7L4-JQ6K>] (last visited Oct. 31, 2021) (describing the structure and history of the Florida Cabinet).

⁷⁶ *See* Nancy Stroud, *A History and New Turns in Florida’s Growth Management Reform*, 45 J. MARSHALL L. REV. 397, 411 (2012).

⁷⁷ *See* Edward J. Sullivan, *The Quiet Revolution Goes West: The Oregon Planning Program 1961–2011*, 45 J. MARSHALL L. REV. 357 (2012) [hereinafter *Quiet Revolution*].

⁷⁸ *Id.* at 377–80.

unique administrative and judicial process ensures the consistent realization of state policy.⁷⁹ Washington has adopted a somewhat similar model;⁸⁰ however, in many other states, such as California,⁸¹ state intervention has been piecemeal.

Whichever of these models is used, the outcome will feature a state planning agency that coordinates state programs affecting land use, especially in metropolitan areas where the state will be a major contributor or administrator of transportation funding, and a special system for administrative or judicial review of local plans, regulations, and actions. However, the state will retain its core functions of administering its own property interests (i.e., in state-owned forests, riparian lands along rivers, and coastlines), setting policies on ports, transportation systems, the environment, economic development, housing, energy, and disaster preparedness. It seems apparent that citizens will demand services; developers will want an efficient, quick system for judicial review; and taxpayers will want procedural efficiency. All these demands will result in a coherent, efficient, and economical land use system that is far better than the multiple, incoherent systems that exist currently.⁸²

In addition to structural changes, the same constellation of economics, efficiency, and political responsibility will require a regionalization of

⁷⁹ *Id.* at 371–75.

⁸⁰ That system is described in *Washington Land Use Planning (1-WA-a)*, OPENEI, <https://openei.org/wiki/RAPID/Roadmap/1-WA-a> [<https://perma.cc/586U-ZKQS>] (last visited Feb. 11, 2022). Under the Washington Growth Management Act, there is a state role in setting plan standards, requiring plans and plan consistency for those areas covered by the legislation and providing a means of enforcement. *See also Growth Management Act*, MUN. RSCH. & SERVS. CTR. (last updated Jan. 6, 2022), <http://mrsc.org/Home/Explore-Topics/Planning/General-Planning-and-Growth-Management/Comprehensive-Planning-Growth-Management.aspx> [<https://perma.cc/BJ6D-D62H>].

⁸¹ *See Planning and Land Use Resources*, GOVERNOR'S OFF. OF PLAN. & RSCH., <http://opr.ca.gov/planning/> [<https://perma.cc/6KG4-ARWU>] (last visited Feb. 11, 2022) (describing the California planning and land use system).

⁸² Accompanying a revised land use system will be horizontal and vertical efforts to combine public agencies and to require intergovernmental agreements by which plans and land use regulatory tasks may be consolidated or allocated by consent. Moreover, the land use changes in land use structure and policy matters do not preclude other land use-related matters, such as changes to the interpretation of the Fifth Amendment Taking Clause (that are conceivable under the three-factor consideration of *Penn Cent. Transp. Co. v. New York City*, 438 U.S. 104, 124 (1978)), realignment of state property law to accommodate climate change (*see* Alan K. Brickley et al., *Climate Change and Oregon Law: What Is to Be Done?*, 33 J. ENV'T L. & LITIG. 235, 244–67 (2018)), or realignment of property rights in condominiums and other shared space (*see* Republic of Singapore Land Title (Strata) Act, sec. 84A (authorizes alienation of an occupied condominium property with the consent of a supermajority—eighty or ninety percent)).

the substantive programs performed by public agencies. For example, building codes will be adopted on a statewide basis,⁸³ and regional agencies will increasingly form to deal with large-scale public facilities and services, such as sewage collection and disposal, landfills, parks and open spaces, and water distribution. Several models exist for this regionalization, including regional agencies with planning powers, such as those in Minneapolis-St. Paul⁸⁴ and Portland.⁸⁵ Another model for this regionalization exists in the way that federal transportation funds are distributed to states, metropolitan planning organizations (MPOs),⁸⁶ and, indirectly, to nonmetropolitan regional transportation planning organizations.⁸⁷ These are organizations formed to plan for, receive, and distribute transportation funds, providing compelling examples of regional cooperation.

Since the beginning of the twentieth century—which saw the mass production of autos; the rise of urban transportation systems, such as roads and streetcars; and the closing of the frontier—cities have tended to proliferate within regions.⁸⁸ In the late nineteenth century, state laws that shifted the power to create cities from the state legislature to unincorporated areas allowed for the current pattern of central cities surrounded by more populous suburbs.⁸⁹ It was difficult to achieve

⁸³ For example, many states in the Southeast have statewide hurricane building codes, although they vary in their uniformity. Sarah Bobby, *Which Hurricane State's Best with Building Codes? One Guess!*, VERISK (Apr. 19, 2018), <https://www.air-worldwide.com/blog/posts/2018/4/which-hurricane-states-best-with-building-codes-one-guess/> [https://perma.cc/52Y9-KVRD].

⁸⁴ The Metropolitan Council has existed for nearly fifty years and has policy and planning powers, including parks, transportation, water, wastewater, and housing. *See Who We Are*, METRO. COUNCIL, <https://metro council.org/About-Us/Who-We-Are.aspx> [https://perma.cc/99SQ-QN3J] (last visited Feb. 11, 2022).

⁸⁵ The Metro Service District is unique in that its governing body is elected and has extensive statutory and charter powers. *See* OR. METRO., <https://www.oregonmetro.gov> [https://perma.cc/K8PE-RPH8] (last visited Feb. 11, 2022); *see also Quiet Revolution*, *supra* note 77.

⁸⁶ 23 U.S.C. § 134.

⁸⁷ 23 U.S.C. § 135. *See* U.S. DEP'T OF TRANSP., WHAT IS A REGIONAL TRANSPORTATION PLANNING ORGANIZATION?, https://www.planning.dot.gov/documents/RTPO_factsheet_master.pdf [https://perma.cc/H8A2-E4PC].

⁸⁸ It was no coincidence that the first pure zoning case before the Supreme Court, *Village of Euclid v. Ambler Realty Co.*, 272 U.S. 365 (1926), dealt with a suburb that asserted its separateness from the central city in the region, Cleveland.

⁸⁹ Maureen A. Flanagan, *Charters, Municipal*, ENCYC. OF CHI., <http://www.encyclopedia.chicagohistory.org/pages/231.html> [https://perma.cc/2T3R-EHVA] (last visited Feb. 11, 2022) (tracing the impact on the development of the greater Chicago metropolitan area of

cooperation between different municipal players within a region, given their desires to have separate identities. Urban areas will be required to think and act regionally, whether or not the constituent local governments merge or consolidate or form new regional agencies to address regional issues.

A significant factor in this regionalization will be the necessity to spend public funds wisely by allocating populations and land uses within a region through an urban growth boundary⁹⁰ or similar mechanism that will enable capital facilities planning to be more effective.⁹¹ That mechanism will require all parts of the region to bear their fair share of infrastructure costs and housing needs.⁹² In addition, the rigid separation of uses under existing zoning regulations will give way to mixed-use zoning through a performance-based approach. Inevitably, economics and efficiency will lead to smaller lots and smaller building footprints as well as more transit- and pedestrian-oriented residential development that cuts or eliminates personal auto use in the journey to work. Similarly, we expect that land use planning and regulation will become more intrusive—local regulations will not only be required to permit certain uses but also to site and limit them through conditions.⁹³ Even after public review, it is likely that human

the Illinois legislature's 1870 law, which ended legislative municipal charters in favor of allowing local areas to incorporate).

⁹⁰ We suggest that growth will be regulated by an urban growth that will limit growth to that which is necessary for the city or region over a fixed period and will generally prohibit the siting of urban uses outside that boundary. *See e.g.*, OR. ADMIN. R. 660-015-0000(14) (2021); Edward J. Sullivan, *Urbanization in Oregon: Goal 14 and the Urban Growth Boundary*, 47 URB. LAW. 165 (2015); Edward J. Sullivan, *Urban Growth Management in Portland, Oregon*, 93 OR. L. REV. 455 (2014).

⁹¹ Capital facilities planning enables public agencies to anticipate the nature, costs, and funding mechanisms for a given public improvement, such as sewer, water, or transportation facility. The State of Washington requires certain public facilities to be treated in this way as part of their comprehensive planning process and provides a good template for efficient governmental operations. *See Capital Facilities Planning*, MUN. RSCH. & SERVS. CTR., <https://mrsc.org/Home/Explore-Topics/Planning/General-Planning-and-Growth-Management/Capital-Facilities-Planning.aspx> [https://perma.cc/PWL8-2TFW] (last updated Apr. 2, 2021). Periodic replacement of existing infrastructure will allow these facilities to provide additional capacity to serve additional density requirements and be more resilient to climate change.

⁹² That mechanism will use a combination of taxes, fees, and subsidies to encourage and discourage land uses and use a “minimum density floor” to ensure sufficient density to support mass transit and efficient and sufficient public facilities and services.

⁹³ We expect that efficient planning will necessitate review of any significant change in the built environment to reflect state and regional environmental and economic values. Moreover, there will be “bumps in the road while we all slouch toward Nirvana” and short-term measures, such as rent control, will be popular, especially in larger cities where renters

dynamics in intentional⁹⁴ and conventional multifamily communities will create a need for dispute resolution methods on a scale not seen previously by the West or any other part of the United States for that matter.⁹⁵

The impacts of these new environmental, economic, and social necessities will be felt especially in the housing component of land use in the western United States, as single-family detached homes become less of an option for most Americans⁹⁶ and ways of making housing space more efficient and economical take hold. We will see more planned unit developments that mix uses and densities, accessory dwelling units,⁹⁷ and other forms of housing, such as condominiums,

form a significant portion of the voting population. WILLIAM A. FISCHER, *THE HOMEVOTER HYPOTHESIS* (2001).

⁹⁴ An intentional community is “a group of people who have chosen to live together or share resources on the basis of common values.” *About FIC*, FOUND. FOR INTENTIONAL CMTY, <https://www.ic.org/foundation-for-intentional-community/> [<https://perma.cc/AXC4-56FX>] (last visited Feb. 11, 2022). The most common example of an intentional community is a planned unit development, with or without a homeowner’s association.

⁹⁵ In addition to the problems of being a landowner (taxes, nuisances, maintenance, and the like) condominium owner associations have other difficulties that occur from owning this peculiar form of property interest and living in close proximity. These difficulties include board member conflicts of interest; disputes over the need for, cost of, and assessment of improvements; employment of management and staff; inter-owner disputes; insurance; fiscal management; and adherence to covenants and association rules as common issues. As this form of living becomes more used, multiple disputes and consequent litigation will occur.

⁹⁶ See e.g., Emily Badger & Quoc Trung Bui, *Cities Start to Question an American Ideal: A House with a Yard on Every Lot*, N.Y. TIMES (June 18, 2019), <https://www.nytimes.com/interactive/2019/06/18/upshot/cities-across-america-question-single-family-zoning.html> [<https://perma.cc/K7FX-AY78>]; Kate Wagner, *Should We Still Be Building Single-Family Homes?*, CURBED (Dec. 11, 2019), <https://www.curbed.com/2019/12/11/21003761/single-family-housing-debate-kate-wagner> [<https://perma.cc/HL8C-FXU3>]; Emily Badger, *The Missing Link of Climate Change: Single-Family Suburban Homes*, BLOOMBERG CITYLAB (Dec. 7, 2011), <https://www.citylab.com/equity/2011/12/missing-link-climate-change-single-family-suburban-homes/650/> [<https://perma.cc/83PQ-9FBA>]; Les Knapp, *States & Cities Ponder Ending Detached Single-Family Zoning*, MD. ASS’N OF CNTYS. (June 19, 2019), <https://conduitstreet.mdcounties.org/2019/06/19/states-cities-ponder-ending-detached-single-family-zoning/> [<https://perma.cc/Q5D2-DDFN>]. The 2017 tax law changes that limited mortgage interest deductions to \$750,000 may prove a template for further reductions as a means of responding to the need to increase revenues to respond to the budget deficit, particularly if homeownership continues to decrease.

⁹⁷ Local efforts to provide affordable units in existing housing through accessory dwelling units (ADUs, sometimes called “granny flats”) are often stymied by opportunistic conversion of those units to short-term rental use, with consequent effects on the inventory of affordable housing.

cooperatives, and cluster housing.⁹⁸ Similarly, we will see greater public participation in the housing field, with emphases on workforce housing to deal with the needs of teachers, police, fire personnel, and service workers, as well as affordable housing.⁹⁹

Heretofore, affordable housing has been dealt with through a combination of public and private incentives. On the public side, in the 1960s, after the failure of high-rise, government-funded apartment complexes, and as part of the war on poverty and the backlash to brutal urban renewal projects, we switched to direct and indirect subsidies in the form of tax credits, cash payments, zoning density bonuses, and fee credits for infrastructure and the like.¹⁰⁰ These efforts will continue and

⁹⁸ Kyle Barron, Edward Kung & Davide Proserpio, *Research: When Airbnb Listings in a City Increase, So Do Rent Prices*, HARV. BUS. REV. (Apr. 17, 2019), <https://hbr.org/2019/04/research-when-airbnb-listings-in-a-city-increase-so-do-rent-prices> [https://perma.cc/A77J-3A44]; Sarah Holder, *The Airbnb Effect: It's Not Just Rising Home Prices*, BLOOMBERG CITYLAB (Feb. 1, 2019), <https://www.citylab.com/equity/2019/02/study-airbnb-cities-rising-home-prices-tax/581590/> [https://perma.cc/3NZE-QCSK]; Josh Bivens, *The Economic Costs and Benefits of Airbnb*, ECON. POL'Y INST. (Jan. 30, 2019), <https://www.epi.org/publication/the-economic-costs-and-benefits-of-airbnb-no-reason-for-local-policymakers-to-let-airbnb-bypass-tax-or-regulatory-obligations/> [https://perma.cc/5NT8-2773]; Mike Sheridan, *Short-Term Rentals and the Effects on Housing Affordability*, URBAN LAND (Oct. 21, 2019), <https://urbanland.uli.org/economy-markets-trends/short-term-rentals-and-the-effects-on-housing-affordability/> [https://perma.cc/BJ38-4EA4]; Gary Barker, *The Airbnb Effect on Housing and Rent*, FORBES (Feb. 21, 2020), <https://www.forbes.com/sites/garybarker/2020/02/21/the-airbnb-effect-on-housing-and-rent/#5a1f30132226> [https://perma.cc/6N23-M5VG]; Trevor Bach, *Is Airbnb Ameliorating – or Exacerbating – Inequality in Cities*, U.S. NEWS & WORLD REP. (May 2, 2019), <https://www.usnews.com/news/cities/articles/2019-05-02/airbnbs-controversial-impact-on-cities>.

⁹⁹ Similarly, we expect planning to deal with myriads of social issues arising out of past planning patterns and practices, such as providing for more trees to avoid “heat islands,” and ensuring an adequate level of grocery availability to avoid “food deserts.” See *Heat Island Impacts*, EPA, <https://www.epa.gov/heat-islands/heat-island-impacts> [https://perma.cc/2MZQ-FVFK] (last visited Oct. 31, 2021); Alyson Kenward et al., *Hot and Getting Hotter: Heat Islands Cooking U.S. Cities*, CLIMATE CENT. (Aug. 20, 2014), <https://www.climatecentral.org/news/urban-heat-islands-threaten-us-health-17919> [https://perma.cc/2CG2-G6LX]; Walter Leal Filho, Leyre Echevarria Icaza, Victoria Omeche Emanche & Abul Quasem Al-Amin, *An Evidence-Based Review of Impacts, Strategies and Tools to Mitigate Urban Heat Islands*, 14 INT'L J. ENV'T RSCH. & PUB. HEALTH 1600 (2017) (regarding heat islands); Vmt Reisig & A. Hobbiss, *Food Deserts and How to Tackle Them: A Study of One City's Approach*, 59 HEALTH EDUC. J. 137 (2000); PAULA TARNAPOL WHITACRE ET AL., NAT'L ACAD. OF SCIS., THE PUBLIC HEALTH EFFECTS OF FOOD DESERTS: WORKSHOP SUMMARY (2009), <https://www.ncbi.nlm.nih.gov/books/NBK208027/> [https://perma.cc/8NJK-WYLR]; NAT'L POVERTY CTR., POLICY BRIEF: AN ECONOMIC VIEW OF FOOD DESERTS IN THE UNITED STATES (2010), http://www.npc.umich.edu/publications/policy_briefs/brief23/policybrief23.pdf [https://perma.cc/R3CY-YMUA].

¹⁰⁰ See, e.g., Tom Hanchett, *The Other “Subsidized Housing”: Federal Aid to Suburbanization, 1940s-1960s*, in FROM TENEMENTS TO TAYLOR HOMES: IN SEARCH OF URBAN HOUSING POLICY IN TWENTIETH CENTURY AMERICA (John Bauman, Roger Biles

may well intensify; however, there will also be increasing social and political pressure to do much more, perhaps due to the homelessness crisis felt especially strongly in the American West.¹⁰¹ It is likely that some of the funds for affordable housing at the local level will come from increases in taxation and the issuance of bonds to an unprecedented extent.¹⁰² State taxation and bonding capacities will also be called upon, and newer forms of taxation will add to whatever new federal resources may be available. Regarding land use regulation, even if the U.S. Supreme Court finds inclusionary zoning to constitute a

& Kristin Szylvian, eds., 2000), <https://www.historyouth.org/wp-content/uploads/2015/12/The-Other-22Subsidized-Housing22-Federal-Aid-To-Suburbanization-.pdf> [<https://perma.cc/GGR5-GDVA>]; *Federal Programs for Affordable Housing*, LOC. HOUSING SOLS., <https://www.localhousingolutions.org/fund/federal-funding-for-affordable-housing/> [<https://perma.cc/ZH3L-A5KE>] (last visited Feb. 11, 2022); *Multifamily Housing Program Financial Management Toolkit*, HUD EXCHANGE, <https://www.hudexchange.info/programs/multifamily-housing/financial-management-toolkit/11-allocating-indirect-costs/> [<https://perma.cc/6WFN-HKYT>] (last visited Feb. 11, 2022). These efforts include opening up those single-family zones that limit themselves to detached homes. See Robert Ellickson, *The Zoning Straitjacket: The Freezing of American Neighborhoods of Single-Family Houses*, 96 IND. L.J. 395 (2021) and the work of Professor John Nolon, especially JOHN R. NOLON, *CHOOSING TO SUCCEED: LAND USE LAW & CLIMATE CONTROL* (2021).

¹⁰¹ See, e.g., Margot Kushel, *Why There Are so Many Unsheltered Homeless People on the West Coast*, THE CONVERSATION (June 14, 2018), <https://theconversation.com/why-there-are-so-many-unsheltered-homeless-people-on-the-west-coast-96767> [<https://perma.cc/XPC7-EJRW>]; Gillian Flaccus & Geoff Mulvihill, *Amid Booming Economy, Homelessness Soars on US West Coast*, AP NEWS (Nov. 8, 2017), <https://apnews.com/article/us-news-ap-top-news-wa-state-wire-ca-state-wire-north-america-d480434bbacd4b028ff13cd1e7cea155> [<https://perma.cc/5NYH-GRTB>]; Anderson Cooper, “*Rent Is Obscene Here*”: *The Issues Forcing People in Seattle onto the Street*, CBS NEWS (Dec. 1, 2019), <https://www.cbsnews.com/news/homeless-in-america-the-issues-forcing-people-in-seattle-onto-the-street-60-minutes-2019-12-01/> [<https://perma.cc/CSBQ-ZLTK>].

¹⁰² See, e.g., *Low-Income Housing Tax Credit (LIHTC)*, OFF. OF POL’Y DEV. & RSCH., U.S. DEP’T OF HOUSING & URB. DEV., <https://www.huduser.gov/portal/datasets/lihtc.html> [<https://perma.cc/LD6U-XU45>] (last visited Feb. 11, 2022); *Low-Income Housing Tax Credits*, NAT’L HOUSING L. PROJECT, <https://www.nhlp.org/resource-center/low-income-housing-tax-credits/> [<https://perma.cc/XU9K-JWJT>] (last visited Feb. 11, 2022); OFF. OF THE COMPTROLLER OF THE CURRENCY, *LOW-INCOME HOUSING TAX CREDITS: AFFORDABLE HOUSING INVESTMENT OPPORTUNITIES FOR BANKS* (2014), <https://www.occ.gov/publications-and-resources/publications/community-affairs/community-developments-insights/ca-insights-mar-2014.html> [<https://perma.cc/373D-4NC6>] (regarding tax credits); *Housing Bonds: The Basics*, NAT’L HOUSING CONF. (Apr. 10, 2017), <https://www.nhc.org/policy-guide/housing-bonds-the-basics/> [<https://perma.cc/C37V-JZ6Y>]; Michael J. Novogradac, *Financing Affordable Housing*, CCIM INST., <https://www.ccim.com/cire-magazine/articles/financing-affordable-housing/?gmSsoPc=1> [<https://perma.cc/W2RG-UFAN>] (last visited Feb. 11, 2022); Michael Novogradac, *Tax Credits, Bonds Play Role in California’s Affordable Housing Strategy*, NOVOGRADAC (Sept. 3, 2019), <https://www.novoco.com/periodicals/articles/tax-credits-bonds-play-role-californias-affordable-housing-strategy> [<https://perma.cc/X7C8-LTMA>] (regarding bonds).

taking in some as-applied case, that would not be the end of the story—state and local governments could still induce developers to provide more affordable units through incentives or impose fees or taxes to offset the costs of constructing such developments themselves.¹⁰³

The federal government will also become more involved in dealing with housing discrimination so that the promise of the Fair Housing Act of 1968¹⁰⁴—enacted in the wake of Dr. Martin Luther King, Jr.'s death, and the currently delayed rules of the U.S. Department of Housing and Urban Development,¹⁰⁵ to “affirmatively further[] fair housing”¹⁰⁶—will break up white bastions of exclusion and ghettos of color alike. It would be a major tragedy if efforts to develop more GCD-adaptive land use policies further widened the economic and racial divides that cities have either aggressively or passively promoted.

¹⁰³ See, e.g., *Incentives*, INCLUSIONARY HOUSING, <https://inclusionaryhousing.org/designing-a-policy/land-dedication-incentives/> [<https://perma.cc/SXE5-CQQR>] (last visited Oct. 31, 2021); Kevin Brass, *Preserving and Incentivizing Affordable Housing for California*, URB. LAND INST. (Feb. 7, 2019), <https://urbanland.uli.org/industry-sectors/residential/revisiting-rent-control-preserving-affordable-housing-for-california/> [<https://perma.cc/4GBE-ZFR2>]; *Density Bonus Program*, CNTY. OF SONOMA CAL., <https://sonoma-county.ca.gov/PRMD/Regulations/Housing/Density-Bonus-Program/> [<https://perma.cc/9Q8B-SSBN>] (last visited Oct. 31, 2021). We also expect regulators to develop additional justifications for more of the stringent exactions and conditions for development approval. See James C. Nicholas & Julian C. Juergensmeyer, *A Rational Nexus Approach to Workforce Housing Land Development Conditions*, 52 UIC J. MARSHALL L. REV. 647 (2019) (suggests less rigorous scrutiny of workforce housing requirements in approval of significant industrial projects).

¹⁰⁴ The 1968 Act was extensively amended, particularly in 1988, and is codified at 42 U.S.C. §§ 3601–3619.

¹⁰⁵ Under the current administration, enforcement of federal fair housing laws has become a lower priority for the government. Lisa Rice, *Government Remains the Biggest Obstacle to Fair Housing*, THE AM. PROSPECT (May 8, 2018), <https://prospect.org/economy/government-remains-biggest-obstacle-fair-housing/> [<https://perma.cc/47SG-N2CK>]. In addition, the administration proposes to weaken a current rule regarding the statutory provision that requires that the government “affirmatively further fair housing.” *Affirmatively Furthering Fair Housing*, 85 Fed. Reg. 2041 (Jan. 14, 2020). Notwithstanding the direction for lower emphasis, the Act itself allows for state, local and individual remedies for enforcement of its prohibitions, inter alia, “to refuse to sell or rent . . . or otherwise make unavailable or deny, a dwelling to any person because of race, color, religion, sex, familial status, [] national origin [or disability], . . . to discriminate against any person in the terms, conditions, or privileges of sale or rental of a dwelling, or in the provision of services or facilities in connection therewith, because of race, color, religion, sex, familial status, [] national origin [or disability].” 42 U.S.C. § 3604. As competition for housing increases, we see an increase in the number of cases and resultant conformity with the Fair Housing Act.

¹⁰⁶ “Affirmatively furthering fair housing” was mandated by the 1968 Fair Housing Act for housing programs administered by the federal government. 42 U.S.C.A. § 3608(e)(5). As indicated in the previous note, the federal government has waxed and waned on this commitment.

In sum, the city of 2050 will have some of the physical features found in today's cities; however, its design and land use patterns, as well as its political, economic, and social features, will make it unrecognizable to the man or woman of today—assuming that we survive GCD.

III TRANSPORTATION

Transportation is a microcosm of the inadequate response thus far to the challenges of GCD in the American West. Transportation has been greatly influenced by choices made after World War II to prioritize the automobile and the airplane as the primary modes of transportation at the expense of long-distance and regional rail lines and the extensive network of interurban rail systems that once existed in the West.¹⁰⁷ Inertia and avoidance of the inconvenient scientific evidence of GCD is the order of the day. The convenience and autonomy of the car, and the relative inconvenience and expense of alternatives, delay the inevitable changes that must be made, raise their costs, and expose the contradictions in the American West between its love affair with the auto and its acknowledgment of the auto's baneful effects.¹⁰⁸ Because

¹⁰⁷ See, e.g., *Portland's Interurban Years*, TRI-MET, <https://trimet.org/history/newinterurban.htm> [<https://perma.cc/6EQD-QG87>] (last visited Feb. 11, 2022) (regarding rail lines in Portland, Oregon); Adam Burns, *Pacific Electric Railway: "Comfort, Speed, Safety,"* AMERICAN-RAILS.COM, <https://www.american-rails.com/pacific.html> [<https://perma.cc/FR4N-HYCJ>] (last updated Dec. 11, 2021) (regarding rail lines in the Los Angeles area); Walter Rice & Emiliano Echevarria, *San Francisco's 40-line: "San Mateo Interurban Car—Minimum Fare 10¢,"* THE MUSEUM OF THE CITY OF S.F., <http://www.sfmuseum.org/hist10/interurban.html> [<https://perma.cc/QD9J-G7ZC>] (last visited Feb. 11, 2022).

¹⁰⁸ See, e.g., Edward Humes, *The Absurd Primacy of the Automobile in American Life*, THE ATLANTIC (Apr. 12, 2016), <https://www.theatlantic.com/business/archive/2016/04/absurd-primacy-of-the-car-in-american-life/476346/> [<https://perma.cc/932H-DVL2>]. Humes scores the car economy on its waste of money and fuel, its toxic effect on human health, its role in climate change, its "quiet catastrophe" in loss of life and maiming in auto accidents and its lack of economic sense in being idle ninety-two percent of the time. The evidence is that it will take considerable effort to wean Americans away from the automobile. See, e.g., Ella Graham-Rowe et al., *Can We Reduce Car Use and, if so, How? A Review of Available Evidence*, 45 TRANSP. RSCH. PART A: POL'Y & PRAC. 401 (2011). Nevertheless, long-term auto projections reflect an auto industry more consistent with environmental ideals. David Zaroni, *Automotive Industry Current and Long-Term Future Outlook*, SEEKING ALPHA (Mar. 4, 2019), <https://seekingalpha.com/article/4246146-automotive-industry-current-and-long-term-future-outlook> [<https://perma.cc/2ZPU-W7JW>].

transportation is a major contributor to GCD,¹⁰⁹ because there are alternatives to the combustion engine auto,¹¹⁰ and because there are other alternatives to autos in general,¹¹¹ transportation must be addressed separately from other aspects of infrastructure.

If GCD is to be avoided, our transportation systems must employ policies and strategies that accomplish the following:

- (1) Work congruently with land use policies and regulations that reduce emissions, such as by increasing residential densities to support efficient transit alternatives to the single-occupancy auto; reduce congestion; and allow human activity to occur in closer proximity;¹¹²

¹⁰⁹ According to the EPA, motor vehicles collectively cause seventy-five percent of carbon monoxide pollution in the U.S. The Environmental Defense Fund (EDF) estimates that on-road vehicles cause one-third of the air pollution that produces smog in the U.S., and transportation causes twenty-seven percent of greenhouse gas emissions. The U.S. has thirty percent of the world's automobiles, yet it contributes about half of the world's emissions from cars. Linda C. Brinson & Francisco Guzman, *How Much Air Pollution Comes from Cars*, HOWSTUFFWORKS, <https://auto.howstuffworks.com/air-pollution-from-cars.htm> [https://perma.cc/6WUK-UN5D] (last updated July 7, 2021).

¹¹⁰ Deb Sanchari et al., *Review of Recent Trends in Charging Infrastructure Planning for Electric Vehicles*, 7 WIRE ENERGY & ENV'T (2018).

¹¹¹ See, e.g., Ralph Buehler, John Pucher & Alan Altshuler, *Vienna's Path to Sustainable Transport*, 11 INT'L J. SUSTAINABLE TRANSP. 257 (2017). Not all measures advanced to reduce auto dependence accomplish those objectives. For example, park and ride facilities may result in more dependence. Eric Jaffe, *How Park-and-Ride Encourages Car Use*, BLOOMBERG CITYLAB (Mar. 20, 2013), <https://www.citylab.com/transportation/2013/03/how-park-and-ride-encourages-car-use/5034/> [https://perma.cc/T6YF-4DS3].

¹¹² The crucial importance of land use planning to achieve climate goals is often met with averted eyes. Increased residential densities, promotion of fewer and shorter trips, and more absorption of carbon dioxide are all matters that planning and land use regulation can instigate to support transportation efforts to reduce GCD.

These land use planning efforts include an emphasis on pedestrian-oriented development that encourages walking and cycling (see e.g., Neil Takemoto, *The 13 Points of Pedestrian-Oriented Development*, COLLECTIVE IMPACT LAB (May 3, 2005), <https://collectiveimpactlab.com/2005/05/03/the-13-points-of-pedestrian-oriented-development/> [https://perma.cc/CZ2N-DWZD]) (using the work of the renowned design firm of Duany Plater-Zyberk & Company to lower carbon inputs), transit-oriented development for the same ends (see *Transit Oriented Development*, TRANSIT ORIENTED DEV. INST., <http://www.tod.org> [https://perma.cc/UQ7B-LYF7] (last visited Feb. 11, 2022)), and transportation demand management, defined as increasing transportation multi-modal choices by such techniques as ridesharing and development regulation to reduce trip generation and parking needs (see *Organizing and Planning for Operations: Transportation Demand Management*, FED. HIGHWAY ADMIN., https://ops.fhwa.dot.gov/plan4ops/trans_demand.htm [https://perma.cc/B6CK-A2B2] (last visited Feb. 11, 2022)).

Additional positive transportation measures include the encouragement of light rail, streetcar and bus rapid transit strategies. FED. TRANSIT ADMIN., U.S. DEP'T OF TRANSP., GREENHOUSE GAS EMISSIONS FROM TRANSIT PROJECTS: PROGRAMMATIC ASSESSMENT 1 (2017), https://www.transit.dot.gov/sites/fta.dot.gov/files/FTA_Report_No._0097.pdf

- (2) Provide a more efficient and cheaper means of propulsion than the internal combustion engine;¹¹³
- (3) Require payment of the full costs of transportation, particularly the costs of maintenance, and the full costs of parking;¹¹⁴ and
- (4) Ensure that the needs of the transportation disadvantaged and the less well-off are met.¹¹⁵

As suggested in Part II, any meaningful change in the current transportation regime in the American West must begin with an examination of the institutional structure providing those services¹¹⁶ and its potential mismatch with the costs of responding to GCD. Railroads and air transportation are regulated primarily by the federal government and, thus, less responsive to state, regional, and local controls.¹¹⁷ The transportation of oil and gas is more likely to be subject

[<https://perma.cc/GX2X-NLE8>]; FED. TRANSIT ADMIN., U.S. DEP'T OF TRANSP., PUBLIC TRANSPORTATION'S ROLE IN RESPONDING TO CLIMATE CHANGE (2010), <https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/PublicTransportationsRoleInRespondingToClimateChange2010.pdf> [<https://perma.cc/G2EC-3EVF>].

¹¹³ On the immediate horizon is the electric vehicle, though there are energy costs in supplying (and disposing of) batteries and in providing energy to other alternatives to the auto. Sanchari et al., *supra* note 110. A further emphasis on cycling would also significantly affect carbon emissions. Andre Neves & Christian Brand, *Assessing the Potential for Carbon Emissions Savings from Replacing Short Car Trips with Walking and Cycling Using a Mixed GPS-Travel Diary Approach*, 123 TRANSP. RSCH. PART A: POL'Y & PRAC. 130, 146 (2019), <https://www.sciencedirect.com/science/article/pii/S0965856417316117> [<https://perma.cc/EAV8-NFJC>]. These policies and strategies would include promoting bike parking especially near transit points and encouraging employers to make workplaces bike friendly.

¹¹⁴ Congestion pricing and renewed awareness of the true costs of parking are issues that must be addressed to realize an efficient and economically fair transportation system.

¹¹⁵ See Bob Wise, *Who Are the Transportation Disadvantaged?*, RESILIENCE (July 20, 2017), <https://www.resilience.org/stories/2017-07-20/who-are-the-transportation-disadvantaged/> [<https://perma.cc/HFD9-G7CC>]. If these groups get left behind, the wheelchair bound will be more easily isolated and the minimum wage single mother will more likely be stuck with an old car that must transport her to her job over long distances.

¹¹⁶ Oregon has planned and regulated more extensively at the intersection of planning and transportation and has multiple examples as to how a state and regional role in these fields may be undertaken. See Edward J. Sullivan, *The Connection Between Land Use and Transportation: The Oregon Experience*, 48 URB. LAW. 839 (2016).

¹¹⁷ The fact that these interstate methods of travel are neither easy to regulate nor tax for their emissions by state, regional or local governments is an ongoing problem; however, there is pressure on these industries to achieve significant reduction in emissions. Umair Irfan, *Air Travel Is a Huge Contributor to Climate Change. A New Global Movement Wants You to Be Ashamed to Fly*, VOX (Nov. 30, 2019), <https://www.vox.com/the-highlight/2019/7/25/8881364/greta-thunberg-climate-change-flying-airline> [<https://perma.cc/3YDQ-NYS8>]. The International Civil Aviation Organization has provided a means to measure air travel carbon emissions to use for carbon offset purposes. *ICAO Carbon Emissions*

to state or local regulation,¹¹⁸ but even that may be preempted if Congress or federal agencies are so directed. Ports and marine facilities are jointly regulated, so states and sub-state agencies have some influence over them.¹¹⁹ Finally, the diverse settlements in the American West and the long distances between them result in freight transportation equaling or exceeding the carbon emission impacts of other transportation modes.¹²⁰

Calculator, ICAO, <https://www.icao.int/environmental-protection/Carbonoffset/Pages/default.aspx> [<https://perma.cc/SKS3-QSW2>] (last visited Feb. 11, 2022). Freight use by railroads does reduce the carbon footprint of this transportation mode, as compared to freight sent by trucks. Shomik Mehndiratta & Tatiana Peralta Quiros, *Follow the Moving Carbon: A Strategy to Mitigate Emissions from Transport*, WORLD BANK BLOGS: TRANSPORT FOR DEV. (Jan. 10, 2017), <https://blogs.worldbank.org/transport/follow-moving-carbon-strategy-mitigate-emissions-transport> [<https://perma.cc/V4WK-RGAD>]. Although, the railroad industry had funded climate change deniers. Robinson Meyer, *A Major but Little-Known Supporter of Climate Denial: Freight Railroads*, THE ATLANTIC (Dec. 13, 2019), <https://www.theatlantic.com/science/archive/2019/12/freight-railroads-funded-climate-denial-decades/603559/> [<https://perma.cc/SFV7-QTR5>].

¹¹⁸ See *LNG Regulatory Documents*, U.S. DEP'T OF TRANSP., PIPELINE & HAZARDOUS MATERIALS SAFETY ADMIN., <https://www.phmsa.dot.gov/pipeline/liquified-natural-gas/lng-regulatory-documents> [<https://perma.cc/AF56-85W2>] (last visited Feb. 11, 2022).

¹¹⁹ Certainly, federal maritime agencies, the Coast Guard, and other federal agencies have a role in marine affairs; however, states and port authorities also play a significant role in regulating marine transportation facilities and terminals.

¹²⁰ The Intergovernmental Panel on Climate Change has documented the influence of transportation on carbon emissions and advanced a bold plan to meet this problem as it relates to freight. See RALPH SIMS & ROBERTO SCHAEFFER ET AL., *Freight and Passenger Transport (Land, Air, Sea and Water)*, in CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE, WORKING GROUP III CONTRIBUTION TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 605 (Elizabeth Deakin & Suzana Kahn Ribeiro eds., 2014), https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter8.pdf [<https://perma.cc/SN7R-YYJT>]; RALPH SIMS & ROBERTO SCHAEFFER ET AL., *Mitigation Technology Options, Practices and Behavioral Aspects*, in CLIMATE CHANGE 2014: MITIGATION OF CLIMATE CHANGE, WORKING GROUP III CONTRIBUTION TO THE FIFTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE 613 (Elizabeth Deakin & Suzana Kahn Ribeiro eds., 2014), https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter8.pdf. Much current concern relates to the "last mile" of freight delivery, which often increases carbon emissions. See Vishnu Rajamanickam, *Today's Pickup: Last-Mile Delivery Growth Will Increase Carbon Emissions by 30% by 2030*, FREIGHTWAVES (Jan. 16, 2020), <https://www.freightwaves.com/news/todays-pickup-last-mile-delivery-growth-will-increase-carbon-emissions-by-30-by-2030> [<https://perma.cc/C2DG-V4XU>]; Liying Song et al., *Quantifying the Greenhouse Gas Emissions of Local Collection-and-Delivery Points for Last-Mile Deliveries*, 2,340 TRANSP. RSCH. REC.: J. TRANSP. RSCH. BD. 66 (2013); Josué C. Velázquez-Martínez et al., *An Alternative Route to a Fuel-Efficient Last Mile*, MITSUPPLYCHAIN (Aug. 8, 2019), <https://medium.com/mitsupplychain/an-alternative-route-to-a-fuel-efficient-last-mile-1f06c32a4586> [<https://perma.cc/93R8-VL2S>]; Mohamed Awwad et al., *Sustainable Last-Mile Logistics Operation in the Era of E-Commerce*, in PROCEEDINGS OF THE INTERNATIONAL CONFERENCE ON INDUSTRIAL ENGINEERING

But it is in surface transportation that state and local governments have the greatest influence. For while the federal government funds a significant portion of the capital costs of these facilities,¹²¹ their planning and operational decisions are made elsewhere. The federal interstate system, begun in the 1950s, limits many state and local options. However, western American states have multiple road systems ranging from state highways to city and county roads.¹²² For more densely populated areas, the federal government has designated MPOs to plan and allocate federal funds for transportation projects.¹²³ Sometimes, these MPOs are regionally elected officials with a regional

AND OPERATIONS MANAGEMENT (2018), <http://ieomsociety.org/dc2018/papers/179.pdf> [<https://perma.cc/Q3A9-BKNP>].

¹²¹ In Fiscal 2018, the Highway Trust Fund, financed by fuel and other taxes and appropriations, received over \$41 billion to be distributed for highway construction and maintenance at the state and local level. *Briefing Book, What Is the Highway Trust Fund, and How Is It Financed?*, TAX POL'Y CTR., <https://www.taxpolicycenter.org/briefing-book/what-highway-trust-fund-and-how-it-financed> [<https://perma.cc/7ZGF-G7ZH>] (last updated May 2020). For certain highway projects, for example, the Federal share is eighty to ninety percent. *Fixing America's Surface Transportation Act or "FAST Act,"* FED. HIGHWAY ADMIN., <https://www.fhwa.dot.gov/fastact/factsheets/federalsharefs.cfm> [<https://perma.cc/N6LQ-AKLW>] (last updated Feb. 8, 2017); CONG. RSCH. SERV., FUNDING AND FINANCING HIGHWAYS AND PUBLIC TRANSPORTATION (2019), <https://crsreports.congress.gov/product/pdf/R/R45350> [<https://perma.cc/RXC8-439D>]; CONG. RSCH. SERV., FEDERAL-AID HIGHWAY PROGRAM (FAHP): IN BRIEF (2019), <https://fas.org/sgp/crs/misc/R44332.pdf> [<https://perma.cc/EUL3-J5QY>].

¹²² Each state has a state highway system that is the focus of federal highway planning and finances as a part of a national highway system. *See What Is the National Highway System?*, FED. HIGHWAY ADMIN., https://www.fhwa.dot.gov/planning/national_highway_system/ [<https://perma.cc/LG5F-AJQC>] (last updated June 29, 2017). However, city and county roads typically constitute a greater element of transportation than the state highway system. *See, e.g., State Highway System: State Highway System Is Only a Small Portion of All California Roads*, CAL. LEGIS. ANALYST'S OFF. (Jan. 1995), https://lao.ca.gov/1995/010195_calguide/cgtrans2.html [<https://perma.cc/7CMQ-RM78>].

¹²³ A Metropolitan Planning Organization (MPO) is an agency created by federal law to provide local elected officials input into the planning and implementation of federal transportation funds to metropolitan areas with populations of greater than 50,000. *What Is a Regional Council, COG, or MPO?*, NAT'L ASS'N OF REG'L COUNCILS, <https://narc.org/about/what-is-a-cog-or-mpo/> [<https://perma.cc/JWC2-HS45>] (last visited Feb. 11, 2022). *See also Metropolitan Planning Organization (MPO)*, FED. TRANSIT ADMIN. (Mar. 11, 2019), <https://www.transit.dot.gov/regulations-and-guidance/transportation-planning/metropolitan-planning-organization-mpo> [<https://perma.cc/4BV2-67EZ>] (last updated Mar. 11, 2019); U.S. DEP'T OF TRANSP., REVIEW OF STATE DOT APPROACHES TO DISTRIBUTE FEDERAL METROPOLITAN PLANNING (PL) FUNDS TO MPOS (2015), <https://rosap.ntl.bts.gov/view/dot/12218> [<https://perma.cc/Y5CE-XAQV>]. For a practical review of these organizations, see *About MPOs – A Brief History*, ASS'N OF METRO. PLAN. ORG.'S, <http://www.ampo.org/about-us/about-mpos/> [<https://perma.cc/UD5N-VCUW>] (last visited Feb. 11, 2022).

perspective,¹²⁴ but much more often they are locally elected or appointed officials that attempt to plan on a regional basis but also negotiate the allocation of funds for transportation projects in their own jurisdictions.¹²⁵ Just as mandatory planning, the binding nature of plans, and regionalization make policy instruments such as zoning more effective, so also may transportation policy be enhanced and more effectively realized through the adoption and effectuation of mandatory plans reflecting state and regional needs.¹²⁶

A second area for reconsideration is the incestuous relationship between the gas tax and ground transportation. At present, federal gas taxes are \$0.184 per gallon of gasoline and \$0.244 per gallon of diesel, and the average state taxes are \$0.2966 and \$0.3154, respectively.¹²⁷

¹²⁴ See, e.g., *What Is Metro?*, OR. METRO, <https://www.oregonmetro.gov/regional-leadership/what-metro> [<https://perma.cc/6YQ8-FTT8>] (last visited Oct. 31, 2021); *Programming for Operations: MPO Examples of Prioritizing and Funding Transportation Systems Management & Operations Strategies: Portland Metro (Portland, Oregon)*, FED. HIGHWAY ADMIN., <https://ops.fhwa.dot.gov/publications/fhwahop13050/s11.htm> [<https://perma.cc/6E22-BT2A>] (last modified May 29, 2020).

¹²⁵ Much of the recent discussion regarding the vast majority of the MPOs that are composed of unelected decision members (both appointed and elected local government officials of government entities that is composed of the MPO) deal with the strategies for that negotiation. See, e.g., U.S. GEN. ACCT. OFF., *MPOs Have Been Unable to Coordinate the Planning Process*, in STRONGER FEDERAL DIRECTION NEEDED TO PROMOTE BETTER USE OF PRESENT URBAN TRANSPORTATION SYSTEMS 23 (1979), <https://www.gao.gov/assets/ced-79-126.pdf> [<https://perma.cc/FLY3-QQBB>]; FED. TRANSIT ADMIN., U.S. DEP'T OF TRANSP., *TRANSIT AT THE TABLE: A GUIDE TO PARTICIPATION IN METROPOLITAN DECISIONMAKING*, <https://www.planning.dot.gov/Documents/TransitAtTable.pdf> [<https://perma.cc/VT9T-X6AC>].

¹²⁶ For example, plans can, and should, promote connectivity to reduce trip length and consequent carbon emissions. The Federal Highway Administration describes the connectivity rationale as follows:

A well-connected transportation network reduces the distances traveled to reach destinations, increases the options for routes of travel, and can facilitate walking and bicycling. Well-connected, multimodal networks are characterized by seamless bicycle and pedestrian infrastructure, direct routing, accessibility, few dead-ends, and few physical barriers.

Promoting Connectivity, U.S. DEP'T OF TRANSP., <https://www.transportation.gov/mission/health/promoting-connectivity> [<https://perma.cc/3MBU-HYUA>] (last updated Aug. 24, 2015).

¹²⁷ *Frequently Asked Questions (FAQs): How Much Tax Do We Pay on a Gallon of Gasoline and on a Gallon of Diesel Fuel?*, U.S. ENERGY INFO. ADMIN., <https://www.eia.gov/tools/faqs/faq.php?id=10&t=10> [<https://perma.cc/FQ73-NVY6>] (last updated Aug. 23, 2021). The Energy Information Administration adds:

Federal taxes include excises taxes of 18.3 cents per gallon on gasoline and 24.3 cents per gallon on diesel fuel, and a Leaking Underground Storage Tank fee of 0.1 cents per gallon on both fuels. State taxes include rates of general application including, but not limited to, excise taxes, environmental taxes, special taxes, and inspection

The federal taxes provide about \$41 billion annually to the Highway Trust Fund, which is distributed to the states for highway construction.¹²⁸ In addition, the states themselves raised about \$46.5 billion in gas tax revenues in 2017.¹²⁹ These are significant sums; however, they do not keep up with capital construction and maintenance costs, and, perversely, receipts are reduced as fuel efficiency rises and hybrid vehicles and fossil fuel alternatives are deployed. Tolling, an anathema in the West, is likely to have an increased role in transportation finance.¹³⁰

As it is, we are committing national suicide by fundraising off the poison that affects our health and our planet so adversely and by directing the use of those funds for much the same poison. Part of the resolution of this dilemma is switching away from fossil fuels (which, as long as we have roads, will cause fiscal problems) and improving intercity and rural transportation options. These issues can only be resolved by raising additional revenues to fund more energy-efficient vehicles and mass transit, as well as road construction and maintenance.¹³¹ One option is requiring those who opt for the single-

fees, but they exclude state taxes based on gross or net receipts. State taxes do not include county and local taxes.

Id. There remains concern over Congressional failure to raise these taxes to meet road needs. David Schaper, *It's Been 25 Years Since the Federal Gas Tax Went Up*, NPR (Oct. 5, 2018), <https://www.npr.org/2018/10/05/654670146/its-been-25-years-since-the-federal-gas-tax-went-up> [<https://perma.cc/PPA7-RM2R>].

¹²⁸ According to estimates by the Congressional Budget Office, Highway Trust Fund tax revenue totaled \$41 billion in fiscal year 2018. Revenue from the federal excise tax on gasoline (\$25.7 billion) and diesel fuel (\$9.9 billion) accounts for eighty-seven percent of that total. The remaining trust fund tax revenue comes from a sales tax on tractors and heavy trucks, an excise tax on tires for heavy vehicles, and an annual use tax on those vehicles. In addition to dedicated tax revenue, the trust fund receives a small amount of interest on trust fund reserves. However, Congress has added general revenues to these totals, as the amounts realized from transportation excise taxes have been inadequate for road needs. *Tax Policy Center Briefing Book: Key Elements of the U.S. Tax System*, TAX POL'Y CTR., <https://www.taxpolicycenter.org/briefing-book/what-highway-trust-fund-and-how-it-financed> [<https://perma.cc/G3R7-ZXLX>] (last updated May 2020).

¹²⁹ Erin Duffin, *State and Local Motor Fuel Tax Revenue in the United States from 1977 to 2018*, STATISTA (Sept. 23, 2020), <https://www.statista.com/statistics/249129/us-state-and-local-motor-fuel-tax-revenue/> [<https://perma.cc/Y5EU-EWHR>].

¹³⁰ Caroline Cournoyer, *With Gas Taxes in Peril, More States Study Alternatives*, GOVERNING (Jan. 12, 2018), <https://www.governing.com/topics/transportation-infrastructure/gov-gas-tax-oregon-california-mileage.html> [<https://perma.cc/4PLX-FDSP>].

¹³¹ Adam A. Millsap, *Gas Taxes Not Long-Term Answer for Infrastructure Funding*, FORBES (Apr. 29, 2019), <https://www.forbes.com/sites/adammillsap/2019/04/29/gas-taxes-not-long-term-answer-for-infrastructure-funding/#8e0a08c2ae82> [<https://perma.cc/AV6X>].

use auto to pay more of the costs of that mode through congestion pricing or similar means.¹³² With respect to mass transit, about eighty percent of federal public transportation funding currently comes from the mass transit account of the Highway Trust Fund and twenty percent comes from the general fund of the U.S. Treasury, which has been supported despite low levels of ridership.¹³³ However, mass transit has not been subsidized in the same way as the auto through the public highway program.¹³⁴ These priorities must change.

-MDP6]. Some have proposed that one of these alternatives is a per-mile charge, which would be possible with a significant expenditure to ensure its collection. CONG. RSCH. SERV., FUNDING AND FINANCING HIGHWAYS AND PUBLIC TRANSPORTATION 10–11 (2020), <https://fas.org/sgp/crs/misc/R45350.pdf> [<https://perma.cc/R6Z7-S42D>]; Nick Stockton, *To Save Our Infrastructure, Make Every Road a Toll Road*, WIRED (Feb. 11, 2018), <https://www.wired.com/story/gas-tax-vmt-toll-road/> [<https://perma.cc/GYJ5-URNQ>]. Another alternative proposed is to eliminate the Highway Trust Fund altogether, as Japan has done, as that fund must be refilled by general tax funds and is said to serve the interests of the construction industry and transportation bureaucracies, rather than the citizenry. See Tanya Snyder, *Eno: Stop Obsessing Over the Gas Tax and Change How We Fund Transpo*, STREETS BLOG USA (Dec. 4, 2014), <https://usa.streetsblog.org/2014/12/04/eno-stop-obsessing-over-the-gas-tax-and-change-how-we-fund-transpo/> [<https://perma.cc/9E7K-JEJE>]. The same author cites a 2011 article from *The Economist* to the effect that the gas tax system is wholly inadequate to meet highway needs, let alone those of mass transit. See Tanya Snyder, *The Economist: "Rock-Bottom" U.S. Gas Tax Makes Gas Cheaper than Water*, STREETS BLOG USA (Feb. 24, 2011), <https://usa.streetsblog.org/2011/02/24/the-economist-rock-bottom-u-s-gas-tax-makes-gas-cheaper-than-water/> [<https://perma.cc/8V8H-QQH3>].

¹³² The Federal Highway Administration describes this tool as using market power to reduce the waste caused by congestion and includes the use of variably priced express lanes separated from other highway lanes and costing more per trip; variable tolls that may rise in certain circumstances, such as rush hours; "cordon charges" that raise the price of driving into congested areas; and area-wide charges that impose fees on a per-mile basis, depending on the level of congestion. *Congestion Pricing: A Primer, What Is Congestion Pricing?*, FED. HIGHWAY ADMIN., <https://ops.fhwa.dot.gov/publications/congestionpricing/sec2.htm> [<https://perma.cc/T8MU-Z5GU>] (last updated Apr. 5, 2019).

¹³³ CONG. RSCH. SERV., FEDERAL PUBLIC TRANSPORTATION PROGRAM: IN BRIEF 1–2 (2021), <https://fas.org/sgp/crs/misc/R42706.pdf> [<https://perma.cc/8NML-9VE4>]; see also CONG. RSCH. SERV., HIGHWAY AND PUBLIC TRANSIT FUNDING ISSUES (2019), <https://fas.org/sgp/crs/misc/IF10495.pdf> [<https://perma.cc/N2NR-DNCK>].

¹³⁴ Jonathan English, *Why Did America Give Up on Mass Transit? (Don't Blame Cars.)*, BLOOMBERG CITYLAB (Aug. 31, 2018), <https://www.citylab.com/transportation/2018/08/how-america-killed-transit/568825/> [<https://perma.cc/WM99-MZYD>] (provides a fairly good history of public transportation in the United States, but notes that "[a]nnual per capita transit trips in the U.S. plummeted from 115.8 in 1950 to 36.1 in 1970, where they have roughly remained since, even as population has grown.").

IV

**CLIMATE-RESILIENT INFRASTRUCTURE:
A BETTER BALANCE BETWEEN CITIES AND NATURE*****A. Introduction: Planning and Building for the Unexpected***

Cities must ensure that both their existing and newly built infrastructure is climate resilient. This will require substantial retrofitting of existing infrastructure and the adoption of new standards for future construction and management. The need to rethink how we build, what we build, and how we use and manage infrastructure runs through all aspects of GCD adaptation. We address transportation infrastructure in the context of a broader discussion of how to encourage more adaptive transportation options. The need for more energy-efficient buildings is discussed Part IV. This section will concentrate primarily, but not exclusively, on the role of water-related infrastructure in GCD adaptation, particularly flood protection,¹³⁵ sustainable water supplies, and facilities for the absorption, drainage, and treatment of stormwater runoff. Our concept of infrastructure is, thus, a broad one.

We define climate-resilient infrastructure (CRI) to include both a built environment that is adapted to GCD and the increased use of nature to perform functions previously fulfilled by pouring concrete.¹³⁶ Thus, our broad view of infrastructure also addresses the need for additional parks and open space that can serve a variety of purposes, including biodiversity conservation,¹³⁷ recreation, and GCD affect mitigation. We begin with a brief discussion of CRI's essential characteristics and how they differ from what we have relied upon in the past.

The Organization for Economic Co-operation and Development (OECD) has defined CRI as an ongoing process:

The defining characteristic of [CRI] is that it is planned, designed, built and operated in a way that anticipates, prepares for, and adapts to changing climate conditions. It can also withstand, respond to, and recover rapidly from disruptions caused by these climate conditions.

¹³⁵ Patrick L. Barnard et al., *Dynamic Flood Modeling Essential to Assess the Coastal Impacts of Climate Change*, 9 SCI. REPS. 8 (2019).

¹³⁶ Resilience “needs to be part of any climate response. But, on its own, it represents an outdated way of thinking, the idea that we stop or contain the forces of nature.” Matt Shaw, *Adapt Architecture to Nature: Don't Fight It*, N.Y. TIMES (Apr. 30, 2020).

¹³⁷ See ROBERT BREARS, NATURE-BASED SOLUTIONS TO 21ST CENTURY CHALLENGES (2020).

Ensuring climate resilience is a continual process throughout the life of the asset.¹³⁸

Put differently, we can no longer plan projects under a set of assumptions based on past experience,¹³⁹ pour the concrete, and then set up an operating and maintenance regime. We need better management and maintenance regimes in place because CRI adds a new dimension to traditional infrastructure planning principles.

Infrastructure has traditionally been designed to meet three criteria: functionality, durability, and safety. These criteria, of course, must remain the foundation of project planning and operation, but they must be supplemented by a new, risk-based approach that recognizes infrastructure's vulnerabilities and the limitations of purely technological solutions. This approach has the greatest relevance for flood protection, water supply, and drainage,¹⁴⁰ but it is not limited to those categories. Water project planning and management have traditionally been based on a set of bounded assumptions about water supply and extreme weather events, but a paradigm shift has recently occurred in the water community's understanding of hydrology.¹⁴¹ We have moved from an era of stationary to nonstationary hydrology—past ranges of river flow variability are now less reliable than they once were.¹⁴² In short, we must expect the unexpected. The management of other types of infrastructure must also be based on risk. For example, because GCD will increase the risk of road buckling,¹⁴³ cities may have

¹³⁸ ORG. ECON. COOP. & DEV. CLIMATE-RESILIENT INFRASTRUCTURE: POLICY PERSPECTIVES 4 (2018), <http://www.oecd.org/environment/cc/policy-perspectives-climate-resilient-infrastructure.pdf> [<https://perma.cc/J79K-622Z>].

¹³⁹ CONSERVATION L. FOUND., CLIMATE ADAPTATION AND LIABILITY: A LEGAL PRIMER AND WORKSHOP SUMMARY REPORT 5 (2018), https://www.clf.org/wp-content/uploads/2018/01/GRC_CLF_Report_R8.pdf [<https://perma.cc/J2NR-D66B>] (a major barrier to climate change adaptation is continued reliance on past climate assumptions).

¹⁴⁰ AM. SOC'Y OF CIV. ENG'RS, CLIMATE-RESILIENT INFRASTRUCTURE ADAPTIVE DESIGN AND RISK MANAGEMENT (Bilal M. Ayyub ed., 2018).

¹⁴¹ *E.g.*, TRENDS AND CHANGES IN HYDROCLIMATIC VARIABLES (Ramesh Teegavarapu ed., 2018).

¹⁴² *See, e.g.*, Dimitri Koutsoyiannis, *Climate Change, the Hurst Phenomenon, and Hydrological Statistics*, 48 HYDROLOGICAL SCIS. J. 3 (2002); Tessendorf, *supra* note 20.

¹⁴³ MICHAEL MEYER ET AL., NAT'L COOP. HIGHWAY RSCH. PROGRAM, CLIMATE CHANGE, EXTREME WEATHER EVENTS AND THE HIGHWAY SYSTEM: A PRACTITIONER'S GUIDE 48, [http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-83\(05\)_AdaptationGuidanceDoc.pdf](http://onlinepubs.trb.org/onlinepubs/nchrp/docs/NCHRP20-83(05)_AdaptationGuidanceDoc.pdf) [<https://perma.cc/E7GU-3MET>].

to choose between funding expensive new paving technologies or rapid-response repair crews, depending on the level of risk.¹⁴⁴

CRI has four primary characteristics. The first is the increased use of green infrastructure (GI). Although there is no uniform definition of the term, the concept of GI has a long heritage and is gaining favor as a climate resilience strategy. In the United States, the core idea of working with nature can be traced to the pioneering geographer Gilbert White, who criticized the exclusive use of dams and levees to control flood damage because they promote moral hazard behavior in “protected” floodplains.¹⁴⁵ Ian McHarg developed a more comprehensive theory of working with, rather than against, nature.¹⁴⁶ The European Environmental Agency defines GI as “a strategically planned network of natural and semi-natural areas with other environmental features designed and managed to deliver a wide range of ecosystem services.”¹⁴⁷ Consistent with McHarg’s thinking, GI requires the integration of traditional hard or grey infrastructure with natural features, such as waterways and tree-covered open space.¹⁴⁸

The second characteristic of CRI is that it must be “smarter,” meaning that the chosen technologies must permit rapid behavior modifications. Those modifications must result in more measurable outcomes, including a shift toward greater use of flood and stormwater absorption strategies, less automobile use, and greater reliance on public transportation, as well as new technologies and strategies to reduce automobile congestion. We also need an energy grid that relies more on renewable sources of energy and gives consumers incentives

¹⁴⁴ *Planning for Systems Management & Operations as Part of Climate Change Adaptation*, FED. HIGHWAY ADMIN., <https://ops.fhwa.dot.gov/publications/fhwahop13030/chap3.htm> [<https://perma.cc/K4UJ-5UTP>] (last updated Feb. 2, 2022).

¹⁴⁵ See N. MacDonald et al., *The Significance of Gilbert F. White’s 1945 Paper ‘Human Adjustment to Floods’ in the Development of Risk and Hazard Management*, 36 *PROGRESS IN PHYSICAL GEOGRAPHY* 125, 126 (2011).

¹⁴⁶ IAN L. MCHARG, *DESIGN WITH NATURE* (1969).

¹⁴⁷ *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, Green Infrastructure (GI)—Enhancing Europe’s Natural Capital*, at 3, COM (2013) 249 final (June 5, 2013). For an effort to apply ecosystem theory to green infrastructure, see J.B. Ruhl, *Beyond Green Infrastructure—Integrating the Ecosystem Services Framework into Urban Planning Law and Policy*, 4 *J. COMPAR. URB. L. & POL’Y* 221 (2020).

¹⁴⁸ EPA, *REDUCING URBAN HEAT ISLANDS: COMPENDIUM OF STRATEGIES* 16 (2008), <https://www.epa.gov/sites/production/files/2014-06/documents/basicscompodium.pdf> [<https://perma.cc/8LYB-6TZV>].

to adjust their usage. Both transportation and energy are more extensively addressed in other Parts of this Article.

The third characteristic of CRI is that it must be sustainable. Our current infrastructure is not sustainable by any measure. Recently, the American Society of Civil Engineers gave the nation's infrastructure a grade of D.¹⁴⁹ This was only slightly higher than the D- of the previous year.¹⁵⁰ This translates into an estimated 374 billion dollars in lost jobs and gross domestic product.¹⁵¹ As a nation, we have underinvested in infrastructure for decades, and we are now playing catch-up by spending more on repair and replacement.

The final feature of CRI is that it must promote GCD adaptation justice. No one can hide from the adverse impacts of GCD, but both vulnerability and adaptive capacity can, and often do, vary by wealth. Poorer communities are more vulnerable to existing health problems caused by heat, inadequate sanitation, and automobile pollution, and they have less adaptive capacity, especially for natural disasters.¹⁵² The Fourth National Climate Assessment summarized how these communities are at risk for suffering the adverse impacts of GCD: "Populations including older adults, children, low-income communities, and some communities of color are often disproportionately affected by, and less resilient to, the health impacts of climate change."¹⁵³ These communities' rights are recognized in the

¹⁴⁹ AM. SOC'Y OF CIV. ENG'RS, 2021 REPORT CARD FOR AMERICA'S INFRASTRUCTURE (2021), https://infrastructurereportcard.org/wp-content/uploads/2020/12/National_IRC_2021-report.pdf [<https://perma.cc/F93E-FQB>]. The overall score was a "D." *Id.* at 2. The report provides desultory historic grades for each element. *Id.* at 168.

¹⁵⁰ The most recent Report Card concluded:

The 2021 grades range from a B in rail to a D- in transit. Five category grades—aviation, drinking water, energy, inland waterways, and ports—went up, while just one category—bridges—went down. And stormwater infrastructure received its first grade: a disappointing D. Overall, eleven category grades were stuck in the D range, a clear signal that our overdue bill on infrastructure is a long way from being paid off.

Id. at 2.

¹⁵¹ AM. SOC'Y OF CIV. ENG'RS, THE REGIONAL IMPACTS OF AMERICA'S DETERIORATING INFRASTRUCTURE ON FAMILIES, BUSINESS AND COMPETITIVENESS, https://www.politico.com/pdf/PPM156_asce_regional_impacts_white_paper_final.pdf [<https://perma.cc/PJ9J-8YRV>] (last visited Feb. 11, 2022).

¹⁵² See generally PETER FEIDEN, INT'L HOUSING COAL., ADAPTING TO CLIMATE CHANGE: CITIES AND THE URBAN POOR (2011), <https://ihcglobal.org/wp-content/uploads/2016/04/Climate-Change-and-the-Urban-Poor.pdf> [<https://perma.cc/HCY4-JCPZ>].

¹⁵³ U.S. GLOBAL CLIMATE CHANGE RSCH. PROGRAM, FOURTH NATIONAL CLIMATE ASSESSMENT, VOLUME II: IMPACTS, RISKS, AND ADAPTATION IN THE UNITED STATES 28 (2018), https://nca2018.globalchange.gov/downloads/NCA4_2018_FullReport.pdf [<https://perma.cc/5WVP-KL8M>].

International Covenant on Economic, Social and Cultural Rights, which has been adopted by the United Nations General Assembly, although it remains unratified by the United States.¹⁵⁴ The authors conclude that the COVID-19 pandemic only underscores the need to include the reduction of health risks to these communities in the goals for all infrastructure planning.¹⁵⁵

B. Water Infrastructure: Too Little, Too Much, and Too Dirty

Western cities face three water-related infrastructure challenges. Historically, especially since World War II, the most important challenge has been to secure a reliable supply of water for fast-growing urban areas. GCD presents new challenges for matching supply to growth. Urban areas also face the problem of too much water in the wrong places. The West's aridity reduces the risk of too much water, but by no means eliminates it. The relatively higher Pacific Coastline lowers the risks of sea level rise.¹⁵⁶ No western city appears on any list of the cities that will be most affected by these phenomena, although

¹⁵⁴ Article 12 provides, in part:

1. The States Parties to the present Covenant recognize the right of everyone to the enjoyment of the highest attainable standard of physical and mental health.
2. The steps to be taken by the States Parties to the present Covenant to achieve the full realization of this right shall include those necessary for:

. . . .

- (b) The improvement of all aspects of environmental and industrial hygiene;
- (c) The prevention, treatment and control of epidemic, endemic, occupational and other diseases;

International Covenant on Economic, Social and Cultural Rights art. 12, Dec. 16, 1966, 993 U.N.T.S. 3.

¹⁵⁵ See, e.g., Ayush Kumar Agrawal et al., *Assessment of Health Infrastructure in Tackling COVID-19: A Case Study of European and American Scenario*, 47 NAT'L INSTS. OF HEALTH 3716 (2021), <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7879103/> [<https://perma.cc/A6JQ-M5V4>]; Susan R. Bailey, *Pandemic Exposes Dire Need to Rebuild Public Health Infrastructure*, AM. MED. ASS'N (Feb. 10, 2021), <https://www.ama-assn.org/about/leadership/pandemic-exposes-dire-need-rebuild-public-health-infrastructure> [<https://perma.cc/ULU5-QVDN>]; Karen DeSalvo et al., *Public Health COVID-19 Impact Assessment: Lessons Learned and Compelling Needs*, NAT'L ACAD. OF MED. (Apr. 7, 2021), <https://nam.edu/public-health-covid-19-impact-assessment-lessons-learned-and-compelling-needs/> [<https://perma.cc/X8GE-V6YR>].

¹⁵⁶ A recent report in *Construction Coverage* concluded that, based on a report by Climate Central and Zillow, cities on the east coast of the United States are at greater risk than those on the west coast. Jonathan Jones, *These U.S. Cities Are the Most Threatened by Sea Level Rise*, CONSTRUCTION COVERAGE, <https://constructioncoverage.com/research/cities-most-impacted-by-sea-level-rise> [<https://perma.cc/J6NJ-8Z9C>] (last updated Dec. 2, 2021).

the San Francisco Bay Area and communities in southern California do face serious risks.¹⁵⁷ Some cities along major rivers, such as Portland¹⁵⁸ and Sacramento,¹⁵⁹ have experienced serious flooding, but those risks have been reduced by upstream dams and local levees and floodwalls.¹⁶⁰ Finally, there is the problem of too much dirty water from inadequate stormwater systems.

1. Too Little Water: Cities Have Adapted to Aridity but GCD Poses New Challenges

GCD poses a major threat to the availability of surface water and groundwater in both the rural and urban West.¹⁶¹ Although precipitation may increase, higher temperatures will mean less water from snowmelt.¹⁶² Scientists warn that we have entered another mega-drought period that will persist into the twenty-first century and be more severe than past mega-droughts.¹⁶³ Western cities have adapted the law of prior appropriation, originally designed for small-scale irrigated agriculture, to obtain the water necessary to sustain their

¹⁵⁷ Jeanine Jones, *Water Year 2021: How Are We Doing?*, CAL. DEP'T OF WATER RES. (Jan. 27, 2021), <https://water.ca.gov/News/Blog/2021/January/Water-Year-2021-How-Are-We-Doing> [<https://perma.cc/V8WS-7J44>]; Dale Kasler & Ryan Sabalow, *Red Alert Sounding on California Drought, as Valley Gets Grim News About Water Supply*, THE SACRAMENTO BEE (Feb. 23, 2021), <https://www.sacbee.com/news/california/water-and-drought/article249458755.html>.

¹⁵⁸ PORTLAND BUREAU OF EMERGENCY MGMT., FLOOD HAZARD-SPECIFIC APPENDIX TO THE BASIC EMERGENCY OPERATIONS PLAN 2 (2018), <https://www.portlandoregon.gov/pbem/article/352778> [<https://perma.cc/JR2P-K5XS>].

¹⁵⁹ See *Storm Ready: Region's Flooding History*, SACRAMENTO CNTY. WATER RES., <https://waterresources.saccounty.net/stormready/Pages/Region%27s-Flooding-History.aspx> [<https://perma.cc/2JE6-PG9V>] (last visited Feb. 11, 2022).

¹⁶⁰ Graham Bradner & Emilie Singleton, *The Origin and Evolution of the California State Plan of Flood Control Levee System*, GEI CONSULTANTS (2017), <https://www.geiconsultants.com/wp-content/uploads/2017/10/The-Origin-and-Evolution-of-the-California-State-Plan-of-Flood-Control-Levee-System.pdf> [<https://perma.cc/UWJ6-4RQ2>].

¹⁶¹ Urban water usage is a complex mix of available supply, population growth and demand management. For an effort to unpack these factors in the context of GCD, see Wondmagegn Yigzaw & Faisal Hossain, *Water Sustainability in Large Cities in the United States from the Perspectives of Population Increase, Anthropogenic Activities, and Climate Change*, 4 EARTH'S FUTURE 603 (2016), <https://agupubs.onlinelibrary.wiley.com/doi/full/10.1002/2016EF000393> [<https://perma.cc/DZJ7-54BV>].

¹⁶² P.C.D. Milly & K.A. Dunne, *Colorado River Flow Dwindles as Warming-Driven Loss of Reflective Snow Energizes Evaporation*, 367 SCI. 1252, 1252 (2020).

¹⁶³ A. Park Williams et al., *Large Contribution from Anthropogenic Warming to an Emerging North American Megadrought*, 368 SCI. 314, 314 (2020); Benjamin I. Cook et al., *Unprecedented 21st Century Drought Risk in the American Southwest and Central Plains*, 1 SCI. ADVANCES 1 (2015).

urbanization and growth.¹⁶⁴ Prior appropriation separates the right to use from the basin of origin, and thus allows cities to transport water long distances, as Los Angeles and San Francisco have done.¹⁶⁵ Prior appropriation has always had a strong anti-monopoly feature; rights cannot be acquired for speculative purposes.¹⁶⁶ However, courts created a “great and growing cities doctrine,” which allows cities to acquire water for projected future growth.¹⁶⁷ This doctrine and related legislation have created what is in effect a super preference for cities with respect to water rights.¹⁶⁸ Congress has also greatly aided many cities in terms of water rights. To the dismay of John Muir, Congress allowed San Francisco to build Hetch Hetchy Reservoir in Yosemite National Park.¹⁶⁹ In other cases, Congress has built projects to bail out cities that mined aquifers or exhausted local water supplies.¹⁷⁰ The Central Arizona Project, which brings the bulk of Arizona’s share of the Colorado River to Phoenix and Tucson, has enabled Phoenix to continue being the country’s most unsustainable city.¹⁷¹ The Central

¹⁶⁴ A. Dan Tarlock, *The Future of Prior Appropriation in the New West*, 41 NAT. RES. J. 769 (2001).

¹⁶⁵ Edward Sullivan & A. Dan Tarlock, *The Western Urban Landscape and Climate Change*, 49 ENV’T L. REV. 931, 951, 958 (2019).

¹⁶⁶ DAVID SCHORR, *THE COLORADO DOCTRINE: WATER RIGHTS, CORPORATIONS, AND DISTRIBUTIVE JUSTICE ON THE AMERICAN FRONTIER* (2012).

¹⁶⁷ See, e.g., PETER D. NICHOLS & MEGAN K. MURPHY ET AL., NATURAL RES. LAW CTR., UNIV. OF COLO. SCH. OF LAW, *WATER AND GROWTH IN COLORADO: A REVIEW OF LEGAL AND POLICY ISSUES* 29 (2001), https://scholar.law.colorado.edu/cgi/viewcontent.cgi?referer=&httpsredir=1&article=1029&context=books_reports_studies [<https://perma.cc/45DR-KN8L>]; Kate Mailliard, Court Report, *City of Helena v. Community of Rimini*, 397 P.3d 1 (Mont. 2017), 21 U. DENV. WATER L. REV. 130 (2017), <https://digitalcommons.du.edu/cgi/viewcontent.cgi?article=1023&context=wlr> [<https://perma.cc/4FGE-KXV8>].

¹⁶⁸ A. Dan Tarlock, *We Are All Water Lawyers Now: Water Law’s Potential but Limited Impact on Urban Growth Management*, in *WET GROWTH: SHOULD WATER LAW CONTROL LAND USE?* 57 (Craig Anthony Arnold ed., 2005).

¹⁶⁹ Environmentalists are still bitter over the fight to prevent the legislation, but political and legal efforts to dislodge the reservoir have so far proved futile. See also Paige Blankenbuehler, *Why Hetch Hetchy Is Staying Under Water*, HIGH COUNTRY NEWS (May 30, 2016), <https://www.hcn.org/issues/48.9/why-hetch-hetchy-is-staying-under-water> [<https://perma.cc/87SB-P5XG>]. In 2018, opponents lost a decisive court battle when an intermediate California appellate court held that efforts to argue that the dam and reservoir constituted an unreasonable use under California were preempted by federal legislation authorizing the dam. *Restore Hetch Hetchy v. City and Cnty. of S.F.*, 25 Cal. App. 5th 865 (2018).

¹⁷⁰ Andrew Ross, *Bird on Fire: Lessons from the World’s Least Sustainable City*, PLACES J. (Nov. 2011), <https://doi.org/10.22269/1111110> [<https://perma.cc/KSA2-BPYH>].

¹⁷¹ Jack L. August, Jr., *Water, Politics, and the Arizona Dream: Carl Hayden and the Modern Origins of the Central Arizona Project, 1922–1963*, 40 J. ARIZ. HIST. 391 (1999).

Utah Project moves a large portion of Utah's share of the Colorado River from the Uinta Basin to the Wasatch Front.¹⁷²

Until the 1980s, urban and agricultural areas were able to share their region's water. Cities and agricultural areas cooperated to support new storage and distribution projects.¹⁷³ But, as it became clear that the era of large, federal, multipurpose projects was ending, rapidly growing cities began to eye irrigated agriculture as a substitute. Starting in the 1960s, economists began to argue that the law of prior appropriation was inefficient because it locked too much water into low-value crops.¹⁷⁴ The proposed remedy was rural-to-urban water transfers. Water transfers—eventually renamed water markets—had long occurred,¹⁷⁵ but in the 1970s they began to increase in places such as Colorado.¹⁷⁶ For over fifty years, cities in the Front Range Urban Corridor have supplemented their reliance on local water supplies and western slope Colorado River water with water transfers.¹⁷⁷ They first purchased agricultural water rights from nearby farmers and then moved further into eastern Colorado, where seventy percent of the state's agriculture is located.¹⁷⁸

2. *Legal and Potential Political Constraints to Future Supply Acquisition*

GCD will make the aforementioned super preference a more difficult exercise for two reasons. First is the increasing reality of diminished supplies, and second is the legal allocation of major rivers such as the Colorado and Rio Grande placing national and international

¹⁷² Craig Fuller, *Central Utah Project*, UTAH HIST. ENCYCLOPEDIA, <https://historytogo.utah.gov/central-utah-project/> [https://perma.cc/VKG5-GHJK] (last visited Oct. 31, 2021).

¹⁷³ There are many histories of the Bureau of Reclamation dam-building programs, but MARC REISNER, *CADILLAC DESERT: THE AMERICAN WEST AND ITS DISAPPEARING WATER* (1986), remains relevant to understand the challenges that the West now faces from the era of large dams.

¹⁷⁴ Jedidiah Brewer et al., *Transferring Water in the American West: 1987-2005*, 40 U. MICH. J.L. REFORM 1021, 1022 (2007) (surveying the economic theory and the growth of water markets in the West).

¹⁷⁵ WATER MARKET INSIDER, *COLORADO'S SOUTH PLATTE BASIN WATER RIGHTS MARKET 1* (2016), <https://wingfootwater.com/wp-content/uploads/2017/03/16-0217-Q1-2016-WWInsider-LO-singles.pdf> [https://perma.cc/9ZQ4-9FRL].

¹⁷⁶ *Conflicting Values: Colorado, in WATER & AGRICULTURE IN THE WESTERN UNITED STATES: CONSERVATION, REALLOCATION, AND MARKETS* 233 (Gary Weatherford ed., 1982).

¹⁷⁷ *Id.*

¹⁷⁸ ENV'T DEF. FUND, *ALTERNATIVE WATER TRANSFERS IN COLORADO: A REVIEW OF ALTERNATIVE TRANSFER MECHANISMS FOR FRONT RANGE MUNICIPALITIES* (2016), <https://www.edf.org/sites/default/files/alternative-water-transfers-colorado.pdf> [https://perma.cc/C6M5-QQSL].

legal restraints on cities' use of those rivers. But regions such as the San Francisco Bay Area and Seattle, which are dependent on mountain snowpack for water, face similar risks.¹⁷⁹

Urban growth has often come at the expense of rural areas, especially in Colorado and Arizona. Water is power and identity, and rural resistance is hardening throughout the West. Prior appropriation has allowed water to be removed from its basins of origin or basins of use with little regard for the economic, social, and environmental impacts of those diversions and transfers.¹⁸⁰ Rural areas are fighting to stem the tide of this out-migration of water resources to urban areas through more efficient water use and a water transfer system that relies primarily on voluntary actions.¹⁸¹ Additionally, it appears that the COVID-19 pandemic will spur more urban-to-deep-rural migration of people putting more pressure on agricultural users.¹⁸² However, there are examples of rural efforts to successfully block rural to urban transfers. For example, Southwestern Nevada communities have been fighting before administrative agencies and courts for a rural to urban transfer of water.¹⁸³ For over thirty years, the Southern Nevada Water District sought to run a pipeline from White Pine County on the Nevada-Utah border to Las Vegas.¹⁸⁴ In 2010, Las Vegas's thirty-year war with rural eastern Nevada, Utah, and the Church of Jesus Christ of Latter-Day Saints ended with a decisive legal victory for the opponents of the transfer.¹⁸⁵

California cities face the risk of fewer groundwater transfer opportunities. In 2013, the state enacted a stringent groundwater

¹⁷⁹ Robert McClure, *Climate Change Is Darkening Seattle's Water Forecast*, INVESTIGATE W. (Sept. 9, 2015), <https://www.invw.org/2015/09/09/climate-change-is-darkening-seattles-water-forecast/> [<https://perma.cc/KD74-D5UG>].

¹⁸⁰ For an early analysis of this problem see COMM. ON W. WATER MGMT., NATIONAL RESEARCH COUNCIL, *WATER TRANSFERS IN THE WEST: EFFICIENCY, EQUITY, AND THE ENVIRONMENT* (1992). Professor Tarlock discloses that he was the chair of the Water, Science and Technology Board committee that produced the report.

¹⁸¹ See, e.g., W. GOVERNORS' ASS'N & W. STATES WATER COUNCIL, *WATER TRANSFERS IN THE WEST: PROJECTS, TRENDS, AND LEADING PRACTICES IN VOLUNTARY WATER TRADING* (2012), http://www.westernstateswater.org/wp-content/uploads/2012/12/Water_Transfers_in_the_West_2012.pdf [<https://perma.cc/KG9J-SPC9>].

¹⁸² See Ben Ryder Howe, *Wall Street Eyes Billions in the Colorado's Water*, N.Y. TIMES (Jan. 3, 2021), <https://www.nytimes.com/2021/01/03/business/colorado-river-water-rights.html> [<https://perma.cc/DF4S-WDAX>].

¹⁸³ See REED D. BENSON, BURKE W. GRIGGS & A. DAN TARLOCK, *WATER RESOURCES MANAGEMENT* 354–61, 930–31 (8th ed. 2021).

¹⁸⁴ *Id.*

¹⁸⁵ *Id.*

protection law that is now being implemented.¹⁸⁶ Critically over-drafted basins, many of which are in the San Joaquin Valley, submitted their sustainability plans in 2020.¹⁸⁷ A report by the University of California, Berkeley, estimates that up to one million acres of land may have to lie fallow (i.e., not planted) to meet the legislation's sustainability goals.¹⁸⁸

3. *The Special Case of Southwestern and Intermountain Western Cities*

Five major urban areas depend in whole or in part on the Colorado River: Albuquerque, Denver, Las Vegas, Los Angeles-San Diego, and Salt Lake City. All these cities face the risk of diminished water supplies due to GCD. The three cities in the Upper Basin—Albuquerque, Denver, and Salt Lake City—face additional risks due to the “Law of the River.”¹⁸⁹ Denver faces the greatest risk, followed by Salt Lake City, and then Albuquerque.¹⁹⁰ Per the 1922 Colorado River Compact, the river basin is allocated between an Upper Division and a Lower Division.¹⁹¹ The compact was premised on the assumption, long understood to be erroneous, that the average annual flow was 15.5 million acre-feet.¹⁹² The Upper Division states—Colorado, New Mexico, Utah, and Wyoming—are required to deliver 7.5 million acre-feet over a ten-year average to the Lower Division states (Arizona, California, and Nevada)—thus shifting the burden of shortage sharing

¹⁸⁶ CAL. WATER CODE § 10720 (2018).

¹⁸⁷ See JASON ANTHONY ROBISON & ANTHONY DAN TARLOCK, LAW OF WATER RIGHTS AND RESOURCES § 4:18 (2020).

¹⁸⁸ DAVID SUNDING & DAVID ROLAND-HOLST, BLUEPRINT ECONOMIC IMPACT ANALYSIS: PHASE ONE RESULTS 13 (2020), <https://www.restorethedelta.org/wp-content/uploads/SJV-Blueprint-for-Extinction-Economic-Study-2-15-2020.pdf> [<https://perma.cc/X5XY-X5M7>].

¹⁸⁹ The “Law of the River” is the sum of interstate compacts, Supreme Court decisions, federal legislation and agreements between the federal government and the states that determine the use of the Colorado River. See Lily Tomkovic, *A Brief History of Water Rights of the Colorado River*, CTR. FOR WATERSHED SCIS. (Feb. 14, 2016), <https://watershed.ucdavis.edu/education/classes/ecogeomorphology-grand-canyon-2016/flogs/brief-history-water-rights-colorado-river> [<https://perma.cc/SG74-M359>].

¹⁹⁰ The Compact may be found at COLO. REV. STAT. § 37-61-101 (2012).

¹⁹¹ COLO. REV. STAT. § 37-61-101 (2012). See also CONG. RSCH. SERV., MANAGEMENT OF THE COLORADO RIVER: WATER ALLOCATIONS, DROUGHT, AND THE FEDERAL ROLE (2021), <https://crsreports.congress.gov/product/pdf/R/R45546> [<https://perma.cc/T3LZ-SDM9>]; see also David H. Getches, *Competing Demands for the Colorado River*, 56 COLO. L. REV. 413, 419–20 (1985).

¹⁹² CONG. RSCH. SERV., *supra* note 191.

to the Upper Division states.¹⁹³ Additionally, the 1922 compact and a subsequent 1948 compact allocate the Upper Division's share among the Upper Division states.¹⁹⁴ The compact protects present perfected rights, almost all of which are held by farmers and rural water organizations.¹⁹⁵

The bottom line is that Denver and, to a lesser extent, the Wasatch Front face two related hydro-legal risks. Should the public entities in the Lower Division make a call for additional water and the Upper Division cannot meet its ten-year delivery obligation, each state will be limited to its share under the 1948 compact, and present perfected and other senior rights must be satisfied first. Albuquerque faces some amount of risk since it relies, in part, on 96,200 acre-feet of water per year being diverted from the Colorado River to the Rio Grande.¹⁹⁶ Use of the Rio Grande is limited by a Compact with Texas and a treaty with Mexico and is stressed by GCD.¹⁹⁷ Moreover, downstream agricultural use in New Mexico and the fast-growing Rio Grande Valley in Texas face similar shortages.¹⁹⁸

The Lower Division has the benefit of priority over the Upper Division, but the three major urban areas of Central Arizona (Phoenix and Tucson), Las Vegas, and Southern California (Greater Los Angeles and San Diego) face both the hydrological risks of less water and the consequent legal risks. For years, the Lower Division, especially

¹⁹³ Colorado River Compact, art. III(a) (1922), https://digitalrepository.unm.edu/cgi/viewcontent.cgi?article=1085&context=uc_rio_chama [<https://perma.cc/258J-LQW3>].

¹⁹⁴ *Id.*; Upper Colorado River Compact, art. III (1948), <https://www.usbr.gov/lc/region/g1000/pdfiles/ucbsnact.pdf> [<https://perma.cc/KG23-VDJW>].

¹⁹⁵ See BENSON, GRIGGS & TARLOCK, *supra* note 183, at 936–76, for a history and analysis of the “Law of the Colorado River.”

¹⁹⁶ *San Juan Chama Project*, BUCKMAN DIRECT DIVERSION, <https://bddproject.org/history/san-juan-chama-project/> [<https://perma.cc/HF9E-H96X>] (last visited Feb. 11, 2022).

¹⁹⁷ See BENSON, GRIGGS & TARLOCK, *supra* note 183, at 973–76.

¹⁹⁸ Tianshu Li, *Water Markets and Their Effects: Evidence from the Rio Grande*, UNIV. OF VA, DARDEN: GLOBAL WATER BLOG (Oct. 1, 2020), <https://blogs.darden.virginia.edu/globalwater/2020/10/01/water-markets-and-their-effects-evidence-from-the-rio-grande/> [<https://perma.cc/6PJS-XKDR>]; BUREAU OF RECLAMATION, U.S. DEP'T OF THE INTERIOR, LOWER RIO GRANDE BASIN STUDY (2013), <https://www.usbr.gov/watersmart/bsp/docs/finalreport/LowerRioGrande/LowerRioGrandeBasinStudy.pdf> [<https://perma.cc/9A92-NLNS>]; *Current U.S. Drought Monitor Conditions for New Mexico*, NAT'L ATMOSPHERIC & OCEANIC ADMIN., <https://www.drought.gov/states/new-mexico> [<https://perma.cc/8NMQ-RJ96>] (last visited Feb. 11, 2022).

California, enjoyed the surplus flows from the Upper Division.¹⁹⁹ This “structural deficit” flowed down to Lake Mead, but the recent long-term drought and dire GCD predictions suggest that this water will no longer be available to the Lower Division.²⁰⁰ Central Arizona faces the greatest risk because the price that Arizona paid for the Central Arizona Project was to subordinate its share of the Colorado River to California’s use.²⁰¹

Las Vegas’s risk comes from its rapid post-1922 Compact growth. The Las Vegas metropolitan area has a population of over two million, but its water supply is based on the modest growth of a city that had a population of around 2,500 when the Colorado River Compact was negotiated.²⁰² Nevada was then the least populous state in the nation, and most of its 77,000 residents were concentrated in the northern part of the state around Reno, the “biggest little city in the world.”²⁰³ Nevada’s situation had not changed much by 1928 when Congress passed the Boulder Canyon Project Act to authorize the construction of what is now the Hoover Dam,²⁰⁴ and its 300,000-acre allocation seemed more than sufficient for the state. As Las Vegas grew, the Southern Nevada Water District embraced a variety of strategies, including

¹⁹⁹ See Jason Anthony Robison, *The Colorado River Revisited*, 88 U. COLO. L. REV. 475, 495–500 (2017), for a discussion of studies that have warned against supply deficits, especially in the face of GCD.

²⁰⁰ *Id.*

²⁰¹ See BENSON, GRIGGS & TARLOCK, *supra* note 183, at 962–63; Colorado River Basin Project Act of 1968, 43 U.S.C. § 1521(b). In *Arizona v. California*, 376 U.S. 340 (1964), the Supreme Court awarded California 4.4 million acre-feet and Arizona 2.8 million. For a long time thereafter, California had “helped itself” to Arizona’s unused share, thereby increasing the shortage risks to Arizona. On August 16, 2021, for the first time since the Supreme Court gave the Secretary of the Interior the power to reduce Lower Basin entitlements in times of drought, or acidification (as water experts now prefer), the Secretary declared a Tier I emergency. Tier I is the first of three tiers and applies only to Nevada and Arizona, as those states had subordinated their water rights to California in exchange for the Central Arizona Project. The tier system, and the cuts for each tier, were negotiated by the Basin states in 2019. See Robison, *supra* note 199, at 495–500; *supra* notes 189–94.

²⁰² The 1920 census recorded 2,304 residents and an equal number in Clark County. *Timeline*, LAS VEGAS SUN, <https://lasvegassun.com/history/timeline/> [https://perma.cc/NZ6J-WB5S] (last visited Feb. 11, 2022). The current metropolitan area population can be found in *Las Vegas, Nevada Population 2021*, WORLD POPULATION REV., <https://worldpopulationreview.com/us-cities/las-vegas-nv-population> [https://perma.cc/35ZR-CSTY] (last visited Feb. 11, 2022).

²⁰³ *Las Vegas, Nevada Population 2021*, *supra* note 202; *Reno, Nevada Population 2021*, WORLD POPULATION REV., <https://worldpopulationreview.com/us-cities/reno-nv-population> [https://perma.cc/NBV5-23XD] (last visited Feb. 11, 2022).

²⁰⁴ 43 U.S.C. § 617.

aggressive conservation²⁰⁵ such as turf removal by paying single-family, multifamily, and commercial property owners to remove turf²⁰⁶ to secure additional water supplies, which we discuss below. Nevertheless, the shortage of water in this area creates a dire political and legal problem for southern Nevada.

4. Ways to Adapt: Best Practices

a. Conservation Works

Cities in the West have engaged in aggressive conservation efforts, and they work.²⁰⁷ A 2018 U.S. Geological Survey report found that municipal and industrial water supply withdrawals decreased seven percent from 2010 to 2015.²⁰⁸ During the drought from 2014 to 2016, California shifted the entire responsibility for reducing water use to urban water users, and those reduction targets were met.²⁰⁹ Technology

²⁰⁵ See DAVID OWEN, *WHERE THE WATER GOES: LIFE AND DEATH ALONG THE COLORADO RIVER* 93–120 (2017).

²⁰⁶ It should be noted that Las Vegas depended entirely on groundwater in 1922. Michael Arthur & Demian Saffer, *A Familiar History of Water and Population Growth*, PENN STATE UNIV., <https://www.e-education.psu.edu/earth111/node/950> [<https://perma.cc/M2NQ-H455>] (last visited Feb. 11, 2022). The turf removal program is described at S. NEV. WATER AUTH., https://www.snwa.com/rebates/wsl/index.html?gclid=Cj0KCCQjwjo2JBhCRARIsAFG667XjtmTD6Y6P8jb31lw4EBL7CG0C4oh_RZydyUy6NdtKBJZaUlufqYaAqKpEALw_wcB [<https://perma.cc/9HWS-2KRX>] (last visited Feb. 11, 2022). In 2021, Nevada's Colorado River allocation was reduced from 300,000 to 279 acre-feet. *Colorado River Compact Agreement*, LASVEGASNEVADA.GOV (Aug. 26, 2021), <https://www.lasvegasnevada.gov/News/Blog/Detail/colorado-river-compact-agreement> [<https://perma.cc/DEC6-RPTN>]. However, due to the Southern Nevada Water Authority's turf retirement program, the metro area had already reduced its withdrawals by 70,000 acre-feet over 2002 levels and currently withdraws only 256,000 acre-feet annually. Karin Brulliard & Joshua Partlow, *First-Ever Water Shortage Declared on the Colorado River, Triggering Water Cuts for Some States in the West*, WASH. POST (Aug. 16, 2021), <https://www.washingtonpost.com/nation/2021/08/16/colorado-river-water-cuts-drought/> [<https://perma.cc/XZ3E-5HCC>].

²⁰⁷ Jonathan M. Gilligan et al., *Urban Water Conservation Policies in the United States*, 6 *EARTH'S FUTURE* 955 (2018), <https://doi.org/10.1029/2017ef000797> [<https://perma.cc/A2MH-T5F6>] (applying the Vanderbilt Water Conservation Index to major urban areas in forty-nine states; if one were to include Texas, eighteen of the top twenty cities are in the West).

²⁰⁸ CHERYL A. DIETER ET AL., U.S. GEOLOGICAL SURV., *ESTIMATED USE OF WATER IN THE UNITED STATES IN 2015: CIRCULAR 1441* at 65 (2018), <https://doi.org/10.3133/cir1441> [<https://perma.cc/FD3K-MN4K>].

²⁰⁹ See Dan Tarlock, *California Adapts to Prolonged Drought: Any Lessons for the Humid Midwest?*, 51 *VALPARAISO U. L. REV.* 519, 529–34 (2018); Amy Talbot, *Urban Water Conservation in the Sacramento, California Region During the 2014-2016 Drought* (2019) (M.A. thesis, University of California, Davis), <https://watershed.ucdavis.edu/shed/lund/students/AmyTalbot2019.pdf> [<https://perma.cc/46BE-V2H5>]. California has since

has helped the United States to save a great deal of water. Low flush toilets and more efficient shower heads can cut water use in half compared to older plumbing.²¹⁰ Congress set specific usage standards for newly installed flush toilets and showerheads in the Energy Policy Act of 1992.²¹¹ States such as California,²¹² Colorado,²¹³ Nevada,²¹⁴ and Washington²¹⁵ have set stricter standards. California has gone further; in 2013, it required all pre-1994 homes to be retrofitted by 2017.²¹⁶ The validity of stricter state standards was clarified in 2010 when the U.S. Department of Energy waived federal preemption.²¹⁷

There is still more low-hanging fruit to be picked through water-saving technologies and climate-adapted landscaping. More and more cities in the arid Southwest and Intermountain West are giving up the Midwestern ideal of verdant lawns, but more semiarid cities, such as Denver, have to embrace xeriscaping (i.e., using landscaping that requires little or no water) or more climate-appropriate yards that require less water to maintain. With GCD, that strategy may now be appropriate even in the Pacific Northwest.

adopted more aggressive water conservation goals; Assemb. B. 1668, 2018 Reg. Sess. (Cal. 2018); S.B. 606, 2018 Reg. Sess. (Cal. 2018).

²¹⁰ JOANNA MAUER ET AL., APPLIANCE STANDARD AWARENESS PROJECT, STATES GO FIRST: HOW STATES CAN SAVE CONSUMERS MONEY, REDUCE ENERGY AND WATER WASTE, AND PROTECT THE ENVIRONMENT WITH NEW APPLIANCE STANDARDS (2017), <https://appliance-standards.org/sites/default/files/States%20Go%20First.pdf> [<https://perma.cc/NC5P-SZM8>]; TAL LINK ET AL., WATER CONSUMPTION EFFICIENCY OF TOILETS & SHOWER HEADS IN DAVIS: OLD DAVIS (CAMBRIDGE HOUSE) VS. NEW DAVIS (SYCAMORE LANE APARTMENTS), http://watermanagement.ucdavis.edu/files/6613/8255/4524/02_Group_Purewal_Purewal_Phung_Salmon_Link.pdf.

²¹¹ 42 U.S.C. §§ 6291–6309.

²¹² CAL. HEALTH & SAFETY CODE §17921.3; CAL. CIV. CODE §1101.3.

²¹³ COLO. REV. STAT. § 6-7.5-102.

²¹⁴ NEV. REV. STAT. § 278.582.

²¹⁵ WASH. REV. CODE § 19.27.170.

²¹⁶ CAL. CIV. CODE §1101.3-9.

²¹⁷ Energy Efficiency Program for Consumer Products: Waiver of Federal Preemption of State Regulations Concerning the Water Use or Water Efficiency of Showerheads, Faucets, Water Closets and Urinals, 75 Fed. Reg. 80,289 (Dec. 22, 2010). The Department of Energy was required to waive federal preemption under the Energy Policy Act of 1992. 42 U.S.C. §§ 6295(j)(3)(3), (k)(3). The Act required the Department to waive preemption if the American Society of Mechanical Engineers did not promulgate new toilet and showerhead standards by 2001. In December 2019, President Trump ordered an EPA review of the federal standards which was promptly terminated because they are not regulations but congressionally mandated ones.

b. Nontraditional Alternative Sources

Cities rely on treated sources of “natural” water—rivers and aquifers. However, water can have a second life, and salty water can be treated. Three of the major sources of nontraditional alternative potable water are reclaimed sewage, stormwater, and desalination.

Reclaimed sewage has long been used for non-potable uses, such as golf courses and fountains, but most people have resisted its integration into potable supplies. This is changing. Orange County has been using “indirect potable reuse,” i.e., the storage of treated wastewater in aquifers before distribution as drinking water, for over two decades with no adverse public health impacts.²¹⁸ Eleven states now authorize the process.²¹⁹

Desalination has a long history, but in the last two decades, its use worldwide and in the West, primarily California, is increasing. For decades, costs and environmental impacts retarded the growth of this area. Despite advances in technology, desalination is energy intensive and, thus, more expensive.²²⁰ Nonetheless, more cities are investing in the technology or exploring it. San Diego has invested in the technology even though the cost of an acre-foot of desalinated water is \$2,200,²²¹ whereas the cost for an acre-foot of Colorado River water is \$1,200.²²² San Diego has the lowest municipal priority for the use of Colorado River water and has foreseen that its supply will shrink in the future.²²³ Desalination is not restricted to oceanfront cities. The City of Antioch,

²¹⁸ Jacques Leslie, *Where Water Is Scarce, Communities Turn to Reusing Wastewater*, YALE ENV'T 360 (May 1, 2018), <https://e360.yale.edu/features/instead-of-more-dams-communities-turn-to-reusing-wastewater> [<https://perma.cc/ZXL7-LYHU>].

²¹⁹ *Id.*

²²⁰ See Jim Robbins, *As Water Scarcity Increases, Desalination Plants Are on the Rise*, YALE ENV'T 360 (June 11, 2019), <https://e360.yale.edu/features/as-water-scarcity-increases-desalination-plants-are-on-the-rise> [<https://perma.cc/GD4K-DF72>] [hereinafter *Desalination Plants*]; Jim Robbins, *Desalination Is Booming as Cities Run Out of Water*, WIRED (June 27, 2019), <https://www.wired.com/story/desalination-is-booming-as-cities-run-out-of-water/> [<https://perma.cc/63E9-7BVD>].

²²¹ *Desalination Plants*, *supra* note 220.

²²² *Id.*

²²³ Historically, San Diego was totally reliant on water purchases from the Metropolitan Water District of Los Angeles and was subject to delivery cuts. But, after severe cuts during a late 1990s drought, San Diego began to diversify its supplies and began a series of conservation programs. For example, it now leases water directly from the Imperial Irrigation District, which has one of the highest priorities on the Colorado River. See SAN DIEGO CNTY. WATER AUTH., 2020 URBAN WATER MANAGEMENT PLAN 4-3 to 4-4 (2021), <https://www.sdcwa.org/wp-content/uploads/2021/03/Draft-2020-UWMP.pdf> [<https://perma.cc/5WRN-ALH9>].

California, which has drawn water from the increasingly saline California Bay Delta, is planning to build a plant, and Arizona cities are looking at the desalination of brackish aquifers.²²⁴

Stormwater, as subsections 5 and 6 of this Section indicate, is generally considered unwanted water which must be treated or returned to the ground as soon as possible. However, stormwater can be a source of water for many other uses, including the augmentation of potable supplies. A 2016 National Academy of Sciences report explained:

Stormwater and graywater can serve a range of non-potable uses, including irrigation, toilet flushing, washing, and cooling, although treatment may be needed. Stormwater may also be used to recharge groundwater, which may ultimately be tapped for potable use. In addition to increasing of local water supply, harvesting stormwater has many potential benefits, including saving energy, preventing pollution, reducing the impacts of development on urban streams, and enhancing the livability of cities.²²⁵

c. Water Balance Accounting and Water Rights Risk Assessment

States have long tried to ensure that cities have enough water to meet population growth. States have imposed rigorous water supply planning mandates on cities,²²⁶ required cities to ensure that adequate supplies exist for large new developments,²²⁷ and linked the adequacy of such supplies to growth management programs.²²⁸ Except for a few instances in California, these laws have had a limited impact.²²⁹ Nonetheless,

²²⁴ See BENSON, GRIGGS & TARLOCK, *supra* note 183, at 627–31.

²²⁵ NAT'L ACADS. OF SCIS. ENG'G MED., USING GRAYWATER AND STORMWATER TO ENHANCE LOCAL WATER SUPPLIES: AN ASSESSMENT OF RISKS, COSTS, AND BENEFITS 1 (2016). As the Report explains, stormwater use in the West raises special legal challenges because all water is subject to appropriation and thus rights to use storm water must obtain a water right. Some states have created limited exceptions.

²²⁶ See, e.g., WASH. REV. CODE. § 90.03.105.

²²⁷ E.g., CAL. GOV. CODE § 10912. See *Real Water: California's Land Use-Water Law Turns Ten*, 4 GOLDEN GATE U. ENV'T L.J. 1 (2010).

²²⁸ E.g., WASH. REV. CODE. § 90.03.105. Two important state Supreme Court decisions have invalidated development approvals because the local government failed to consider the impact of exempt domestic wells on water quantity and quality. *Kittitas Cnty. v. E. Wash. Growth Mgmt. Hearings Bd.*, 256 P.3d 1193 (Wash. 2011); *Whatcom Cnty. v. Hirst*, 381 P.3d 1 (Wash. 2016). See generally Lincoln L. Davies, *Just a Big Hot Fuss? Assessing the Value of Connecting Suburban Sprawl, Land Use, and Water Rights Through Assured Supply Laws*, 34 ECOLOGY L.Q. 1217 (2007).

²²⁹ The most complete analysis remains. See Ellen Hanak, *Show Me the Water Plan: Urban Water Management Plans and California's Water Supply Adequacy Laws*, 4 GOLDEN GATE U. ENV'T L.J. 69 (2010). For example, the Act played almost no role in California's response to its last major drought. Tarlock, *supra* note 209. However, in 2021, the severe Western drought spurred two small towns east of Salt Lake City that had rapidly grown from

some cities have gone further and adopted their own water balance systems that link new development to water availability. Most of these municipal programs are in California due to its “show me the water” law.²³⁰ New Mexico has also been a leader in the development of water budgets to match growth to availability. For years, Albuquerque conditioned new municipal well permits on the retirement of surface rights.²³¹ Santa Fe has the most aggressive scheme, which requires that development projects with new water demand either (1) contract with the city to save water or retrofit older water fixtures with more efficient models through the Water Conservation Credit Program, (2) acquire water rights and transfer them to the city through the Water Rights Transfer Program, or (3) a combination of both.²³² There are efforts to apply this model elsewhere,²³³ but the social justice implications of these laws must be reevaluated, as they potentially exist in the NIMBY arsenal.

A better strategy might be for states to combine a water rights risk adjustment process with an environmental justice impact analysis.²³⁴

COVID-19 refugees from Salt Lake City to enact moratoria on new construction. It has also opened up a conversation about water and growth in central Arizona. Jack Healy & Sophie Kasakove, *A Drought So Dire that a Utah Town Pulled the Plug on Growth*, N.Y. TIMES, (July 20, 2021), <https://www.nytimes.com/2021/07/20/us/utah-water-drought-climate-change.html> [<https://perma.cc/8K5W-W2DP>].

²³⁰ BILL CHRISTIANSEN, ALL. FOR WATER EFFICIENCY, WATER OFFSET POLICIES FOR WATER-NEUTRAL COMMUNITY GROWTH: A LITERATURE REVIEW & CASE STUDY COMPILATION (2015), <https://www.allianceforwaterefficiency.org/sites/www.allianceforwaterefficiency.org/files/assets/Water-Offset-Policies-for-WaterNeutral-Community-Growth150126.pdf> [<https://perma.cc/PHN3-A84V>]. The Alliance has developed a model ordinance which is being implemented in Bozeman, Montana. E-Mail from Dwight Merriam, Fellow and Past President of the American Institute of Certified Planners, to author (June 30, 2020) (on file with author).

²³¹ See Charles T. DuMars & Jeffrie D. Minier, *The Evolution of Groundwater Rights and Groundwater Management in New Mexico and the Western United States*, 12 HYDROGEOLOGY J. 40, 44–46 (2004).

²³² CHRISTIANSEN, *supra* note 230, at 41–43.

²³³ See CHRISTIANSEN, *supra* note 230.

²³⁴ The environmental justice movement emerged in the 1990s over concerns that poor neighborhoods were being targeted for Superfund sites and other environmental hazards. An article written by a leading environmental scholar in 2016 points out the need, now more important than ever, to integrate social justice concerns into all aspects of environmental protection. Jedediah Purdy, *Environmentalism Was Once a Social-Justice Movement: It Can Be Again*, THE ATLANTIC (Dec. 2, 2016), <https://www.theatlantic.com/science/archive/2016/12/how-the-environmental-movement-can-recover-its-soul/509831/> [<https://perma.cc/8UUC-7VC8>]. For an analysis of why environmental justice has not had a major impact on environmental law and policy see the same author’s article, Jedediah Britton-Purdy, *The Long Environmental Justice Movement*, 44 ECOLOGY L.Q. 809 (2018).

On one level, the law of prior appropriation, which governs the use of water, is a complete adaptation system in the West, except for California.²³⁵ It assigns the risk of shortages by priority and leaves it up to water rights holders to plan for this contingency. The strategy of relying on large reservoirs with carryover storage capacity and water marketing to avoid invoking priority needs to be supplemented by water rights risk assessments. A hard look at how we assess the risks that GCD poses for large agricultural and urban entitlements, as well as which groups are most at risk if shortages occur and existing entitlements are curtailed, is a first step toward matching available supplies with growth projections.

5. *Too Much Water*

Urban areas in the West usually experience flooding from shorter-term extreme events that the areas' stormwater drainage systems cannot absorb.²³⁶ Thanks to its aridity, though, the West suffers less from riverine flooding than the rest of the United States.²³⁷ However, due to more GCD-induced frequent monsoon rains,²³⁸ the three Pacific Coast states and Arizona face substantially greater risks compared to the rest of the West. Sea level rise is concentrated along the Pacific Ocean. Urban areas in California and Washington face the greatest threat, but unlike low-lying Atlantic Coast cities, the areas at risk tend to be narrower coastal bands.

a. *The Hubris of Thinking that We Can Eliminate Flood Damage*

U.S. flood control policy moved from local to state and federal responsibility in the nineteenth and early twentieth centuries and is now moving back to the cities. Until 1968, federal flood control policy was

²³⁵ In *Lux v. Haggin*, 10 P. 674 (Cal. 1886), the California Supreme Court found that state to recognize both appropriative and riparian rights. Almost all other western states have eliminated unused riparian rights; however, California maintains a robust dual system.

²³⁶ UNIV. OF MD., COLLEGE PARK & TEX. A&M UNIV., GALVESTON CAMPUS, *THE GROWING THREAT OF URBAN FLOODING: A NATIONAL CHALLENGE* (2018), <https://today.tamu.edu/wp-content/uploads/sites/4/2018/11/Urban-flooding-report-online.pdf> [<https://perma.cc/5EZ6-Q773>].

²³⁷ Ranked by percentage of land in flood risk zones, most western states are at the bottom of the list. The highest at-risk states, Washington state and California, rank 33rd and 36th respectively. See Jennifer Billock, *States with the Highest Risk of Flooding*, STACKER (May 8, 2019), <https://stacker.com/stories/3037/states-highest-risk-flooding?page=6> [<https://perma.cc/57WB-A8QG>].

²³⁸ Frances V. Davenport et al., *Contribution of Historical Precipitation Change to U.S. Flood Damages*, PROC. OF THE NAT'L ACAD. OF SCIS. 1 (2021), <https://doi.org/10.1073/pnas.2017524118> [<https://perma.cc/AP22-T6NU>].

based on preventing floods and storm surges through levees, seawalls, and upstream dams. The great geographer Gilbert White had long argued that total prevention was an illusion²³⁹ and that the opening of federal floodplains to development created too much moral hazard behavior.²⁴⁰ His criticism is reflected in the National Flood Insurance Act of 1968, which combined federally subsidized flood insurance with efforts to limit development in high-risk areas.²⁴¹ The Act has been frequently amended, but White's criticism has remained constant: there is too much development in high-risk areas.²⁴² The root problems are twofold. Subsidized insurance creates moral hazard behavior, and the real estate industry has successfully pushed to limit the designation of at-risk areas, even as the risks posed by GCD become clearer.²⁴³ Despite recent efforts to update flood maps, most maps do not reflect GCD risks.²⁴⁴ By allowing buildings to be evaluated against outdated flood maps, or simply not enforcing the Act, cities have been unable to ensure that landowners qualify for insurance.²⁴⁵

²³⁹ See Debbie M. Chizewer & A. Dan Tarlock, *New Challenges for Urban Areas Facing Flood Risks*, 40 *FORDHAM URB. L.J.* 1739 (2013) (analyzing White's thinking on United States flood policy).

²⁴⁰ Mary McGee, *Moral Hazard and the National Flood Insurance Program* (Apr. 30, 2014) (ECON 490 class research paper, Colgate University), <http://blogs.colgate.edu/economics/files/2014/09/McGee-2014-Moral-Hazard-and-the-National-Flood-Insurance-Program.pdf> [<https://perma.cc/SKY7-QZLC>].

²⁴¹ Chizewer & Tarlock, *supra* note 239, at 1759.

²⁴² *Id.*

²⁴³ See Chizewer & Tarlock, *supra* note 239, at 1745–46.

²⁴⁴ A 2020 study by First Street Foundation, an independent group of experts, compared FEMA to maps they created which take into account sea level rise and increased rainfall. For almost all cities, the First Street maps showed more properties at risk from 100-year floods. For example, in Los Angeles, the percentage of properties at risk went from 0.7 to 12%, Fresno went from 0.5 to 19%, and Portland from 1.6 to 12%. Christopher Flavelle et al., *New Data Reveals Hidden Flood Risks Across America*, *N.Y. TIMES* (June 29, 2020), <https://www.nytimes.com/interactive/2020/06/29/climate/hidden-flood-risk-maps.html> [<https://perma.cc/2RFE-25C3>].

²⁴⁵ The Act is enforced by FEMA, but there are at least 112,480 post-Act noncompliant buildings in the country. The three Pacific Coast states and Arizona and Nevada are the worst offenders in the West. Christopher Flavelle & John Schwartz, *Cities Are Flaunting Flood Rules. The Cost: \$1 Billion*, *N.Y. TIMES* (Apr. 9, 2020), <https://www.nytimes.com/2020/04/09/climate/fema-flood-insurance.html?smid=nytcore-ios-share> [<https://perma.cc/7V69-J8JL>].

b. Reality Check: A Risk-Based Flood Management Policy that Works With, Not Against, Nature

A GCD-adaptive flood control policy has three primary elements. The first element is the recognition that flooding cannot be entirely prevented, but the risks of damage can be minimized. This is the cornerstone of the 2007 European Flood Directive.²⁴⁶ A risk-based policy requires that insurance rates reflect market rates and that more of the risk of property destruction be shifted to those who choose to locate in high-risk areas. Social justice, however, may require targeted subsidies for those who cannot easily adjust to risk. The second element is the recognition that floodplains are valuable biodiversity resources and that they reduce flood damage.²⁴⁷ In urban areas, this requires wide-open spaces where limited development occurs. The third element follows from retreat from high-risk areas.²⁴⁸ In our view, retreat is most applicable to areas that are at risk of inundation by extreme sea level rise, but it is also appropriate for low-lying urban areas that face repeated flooding. This element requires the generation and communication of accurate risk information to governments and the public so that appropriate risk adjustments can be made by governments and markets.

There are models of this policy in both Europe and the United States. Copenhagen's adaptation plan estimates that there will be more frequent downpours, and the city plans to convert twenty percent of its space to areas capable of absorbing, rather than redirecting, floodwaters.²⁴⁹ The

²⁴⁶ Directive 2007/60/EC of the European Parliament and of the Council of 23 October 2007 on the Assessment and Management of Flood Risks, 2007 O.J. (L 288) 27.

²⁴⁷ PATTY GLICK ET AL., NAT'L WILDLIFE FED'N., THE PROTECTIVE VALUE OF NATURE 10 (2020).

²⁴⁸ The ideal is to encourage "sponge cities," i.e., cities that allow rainwater to enter the ground, instead of using impermeable surfaces to divert the same. A "sponge city" is "a particular type of city that does not act like an impermeable system not allowing any water to filter through the ground but, more like a sponge, actually absorbs the rainwater, which is then naturally filtered by the soil and allowed to reach into the urban aquifers." *Sponge Cities: What Is It All About?*, WORLD FUTURE COUNCIL (Jan. 20, 2016), <https://www.worldfuturecouncil.org/sponge-cities-what-is-it-all-about/> [<https://perma.cc/LH8X-2HEW>]. There are no examples of a full "sponge city" yet in North America.

²⁴⁹ MILJO METROPOLEN, COPENHAGEN CLIMATE ADAPTATION PLAN, https://en.klimatilpasning.dk/media/568851/copenhagen_adaption_plan.pdf [<https://perma.cc/9AYH-9NEK>]. See also INS. BUREAU CAN., COMBATING CANADA'S RISING FLOOD COSTS (2018) (counsels (1) retain what you have, (2) restore what you lost, and (3) build what you must). The term "sponge city" has emerged to describe intensive efforts by cities to absorb more water from increased rainfall, but the idea remains mainly a theory except for cities in Asia and Europe. See Ali Hamidi, Bahman Ramavandi & George A. Sorial, *Sponge City—An Emerging Concept in Sustainable Water Resource Management: A Scientometric Analysis*, 5 RES., ENV'T & SUSTAINABILITY (2021).

elements of a GCD-adaptive flood control policy have now been widely accepted among flood professionals and some states.²⁵⁰ The federal government was slow to move in this direction under the Obama administration (2008–2016),²⁵¹ and what progress was made was reversed under the Trump administration (2017–2021).²⁵² Nevertheless, it is likely the Biden administration will pursue GCD adaptation policies.

6. *Too Much Dirty Water*

Many American cities were built over portions of larger watersheds, but urban growth obliterated the natural landscape, thus cutting off much of the landscape's natural capacity to absorb stormwater. Those cities have been trying to build themselves out of this mess until relatively recently. The Clean Water Act of 1972 (CWA), which imposed restrictions on many discharges into water bodies,²⁵³ has gradually forced cities to understand that they must manage the whole watershed in order to reduce harmful pollution levels from combined sanitary and storm sewers and to adapt to GCD.²⁵⁴ Nowhere is this more important than in the way that cities think about stormwater management, especially as many cities in the West will face increased rainfall.²⁵⁵

The CWA divided pollution into point and nonpoint sources.²⁵⁶ In brief, point sources, such as major end-of-pipe discharges, were subject to National Pollution Discharge Elimination System (NPDES) permit standards, which were technology-forcing.²⁵⁷ Nonpoint or diffuse sources of pollution, such as urban runoff, were exempt from the NPDES

²⁵⁰ A. Dan Tarlock & Deborah M. Chizewer, *Living with Water in a Climate-Changed World: Will Federal Flood Policy Sink or Swim?*, 46 ENV'T L. 491 (2016).

²⁵¹ *Id.*

²⁵² Early in his administration, President Trump rolled back an Executive Order issued by President Obama on flood standards. See Darryl Fears & Steven Mufson, *Trump to Reverse Obama-Era Order Aimed at Planning for Climate Change*, WASH. POST (Aug. 15, 2017), <https://www.washingtonpost.com/news/energy-environment/wp/2017/08/15/trump-to-reverse-obama-era-order-aimed-at-planning-for-climate-change/> [<https://perma.cc/M8QX-MY58>].

²⁵³ 33 U.S.C. §§ 1251–1388.

²⁵⁴ E.g., Rutherford H. Platt, *Urban Watershed Management: Sustainability, One Stream at a Time*, 48 ENV'T 26 (2006).

²⁵⁵ Kirsten M. Parris et al., *The Seven Lamps of Planning for Biodiversity in the City*, 83 CITIES 44 (2018).

²⁵⁶ 33 U.S.C. §§ 1251–1388.

²⁵⁷ 33 U.S.C. § 1342.

permit program and were largely left to the states for regulation.²⁵⁸ Stormwater runoff is at the intersection of these two categories because many cities either collect it through separate systems or through combined sanitary sewers. The Federal Environmental Protection Agency (EPA) issued a Combined Sewer Overflow (CSO) Policy in 1994 and subsequent guidance, which urged cities to plan, monitor, and regulate at the watershed level.²⁵⁹ The Wet Weather Water Quality Act of 2000 made compliance with the CSO Policy a mandatory NPDES permit condition.²⁶⁰

Despite years of efforts to address the problem, stormwater runoff continues to be a major source of pollution due to chronic underinvestment in the necessary infrastructure at all three levels of government, the difficulty of addressing diffuse sources of pollution such as fertilizer runoff from lawns, and GCD.²⁶¹ Even in cities that have invested in infrastructure, traditional solutions are not likely to be adequate. Chicago has invested in the Deep Tunnel Project, a series of underground conduits and reservoirs, but the region still floods, and GCD is projected to bring more rain to the already-wet area.²⁶² Many cities are adopting land use controls to limit nonpoint source pollution by creating more open space dedicated to runoff absorption.²⁶³

7. *The Legal Risks of Doing Too Little or Too Much*

Local infrastructure adaptation efforts may face a variety of legal challenges because they rely on a combination of natural and traditional sources, thus increasing the risk that flooding and pollution will still occur. There is a long history of lawsuits against government entities for constructing infrastructure or approving development plans that

²⁵⁸ Jan G. Laitos & Heidi Ruckriegle, *The Clean Water Act and the Challenge of Agricultural Pollution*, 37 VT. L.R. 1033, 1035 (2013).

²⁵⁹ Combined Sewer Overflow (CSO) Control Policy, 59 Fed. Reg. 18,688 (Apr. 19, 1994); EPA, COMBINED SEWER OVERFLOWS: GUIDANCE FOR LONG-TERM CONTROL PLAN (1995), <https://www3.epa.gov/npdes/pubs/owm0272.pdf> [<https://perma.cc/KS29-UGLH>].

²⁶⁰ 33 U.S.C. § 1342q.

²⁶¹ Alexandra Müller et al., *The Pollution Conveyed by Urban Runoff: A Review of Sources*, 709 SCI. TOTAL ENV'T 2 (2020).

²⁶² Henry Grabar, *Tunnel Vision*, SLATE (Jan. 2, 2019), <https://slate.com/business/2019/01/chicagos-deep-tunnel-is-it-the-solution-to-urban-flooding-or-a-cautionary-tale.html> [<https://perma.cc/VE2G-UE3N>].

²⁶³ John R. Nolon, *Calming Troubled Waters: Local Solutions*, 44 VT. L. REV. 1 (2019) (explores recent efforts, primarily in the East and Midwest, to use land use controls to control nonpoint sources of pollution).

cause flood damage.²⁶⁴ There has been little litigation expressly holding that GCD adds a new dimension to traditional liability rules and changes existing doctrines, but the lawsuits will continue to come.²⁶⁵ There are at least three scenarios in which our increasing ability to anticipate and map the risks of GCD may impose new duties on government entities to limit the moral hazard activities of private landowners: (1) failure to anticipate GCD and invest in infrastructure that would have prevented the damage, (2) approval of private developments with inadequate flood protection, and (3) enactment of land use regulations to minimize flood damage. These scenarios are not exclusive. For example, landowners may bring lawsuits arguing that new infrastructure such as raised roads will impair the value of their property or is not needed because GCD risks have been overestimated.²⁶⁶

a. Liability for Inadequately Planned or Maintained Infrastructure

All levels of government enjoy almost total immunity for the construction of flood control facilities, especially larger projects, or for the failure to construct them.²⁶⁷ Governments achieve this immunity by

²⁶⁴ After a severe flood in the Chicago metropolitan area caused flooding despite the construction of a major flood retention project, insurance companies sued the Metropolitan Water Reclamation District of Greater Chicago arguing that it failed to anticipate climate change when it built the Deep Tunnel Project, but the companies withdrew the suit. An earlier lawsuit against one suburban flood control district for not building adequate drainage was dismissed at the trial court on sovereign immunity grounds. Evan Lehmann, *Can Local Officials Who Ignore Climate Change Risks Be Sued?*, SCI. AM. (June 8, 2015), <https://www.scientificamerican.com/article/can-local-officials-who-ignore-climate-change-risks-be-sued/> [<https://perma.cc/R4WR-WU3E>].

²⁶⁵ See JON KUSLER, GOVERNMENT LIABILITY AND CLIMATE CHANGE: SELECTED ISSUES FOR WETLAND AND FLOODPLAIN MANAGERS (2016), https://www.aswm.org/pdf_lib/government_liability_and_climate_cahnge_kusler_0416.pdf [<https://perma.cc/9D35-Q9HM>]; KLEIN, *supra* note 62, at 2.

²⁶⁶ Alex Harris, *Can Raising Roads for Sea Rise Make a Home More Valuable? Miami Beach Report Says Yes*, MIAMI HERALD (Jan. 29, 2020), <https://www.miamiherald.com/news/local/environment/article239682778.html> (noting opposition by homeowners described in his earlier article); Alex Harris, *Lawsuits Could Spark 'Existential Crisis' in Cities Trying to Survive Climate Change*, MIAMI HERALD (Dec. 18, 2019), <https://www.miamiherald.com/news/local/environment/article239682778.html>.

²⁶⁷ Until relatively recently, it was commonly accepted that federal law provided immunity in the planning for, and placement of, flood control projects. Mary Jean Pederson, *Boudreau v. United States: Government Immunity Under the Flood Control Act of 1928 and the Effect of Outdated Legislation on Society*, 41 VILL. L. REV. 1487, 1489 (1996). This conclusion was questioned, if not overruled in *Ark. Game and Fish Comm'n v. United States*, 568 U.S. 23 (2012). However, discretionary immunity may be available to a public agency as a defense. CYNTHIA BROUGHER, CONG. RSCH. SERV., FLOOD DAMAGE RELATED TO ARMY CORPS OF ENGINEERS PROJECTS: SELECTED LEGAL ISSUES 2–5 (2011), <https://>

invoking either the doctrine of sovereign immunity itself or the discretionary exception to federal and state sovereign immunity waiver statutes.²⁶⁸ But there are limited exceptions. Liability is often based on local road or ditch projects where the likelihood of flooding was foreseeable at the time of construction or the government failed to adequately maintain the project.²⁶⁹ These suits face the frequently invoked Act of God defense.²⁷⁰ For example, this defense was applied in a takings case brought in the wake of Hurricane Harvey, which caused severe flooding downstream from two U.S. Army Corps of Engineers reservoirs in Texas.²⁷¹ The Court of Federal Claims held that

neither Texas law nor federal law provides [the downstream] plaintiffs with a cognizable property interest in perfect flood control in the wake of an Act of God. As the government cannot take a property interest that does not exist, and as the Corps cannot be held liable when an Act of God inundates a plaintiff's real property with flood waters that the government could not conceivably have controlled, plaintiffs have failed to state a claim upon which relief can be granted.²⁷²

The crucial element of an Act of God defense is that the disaster could not have been prevented or its buildup could not have been observed.²⁷³ Thus, the defense is not appropriate for sea level rise²⁷⁴ or perhaps GCD-induced flooding.²⁷⁵ The former is now observable thanks to the myriad of projected impact maps, making any damage foreseeable and preventable. The timing of local-scale GCD impacts remains difficult

nationalaglawcenter.org/wp-content/uploads/assets/crs/RL34131.pdf [https://perma.cc/P5T9-B3E3]. See e.g., *St. Bernard Parish v. United States*, 887 F.3d 1354 (Fed. Cir. 2018); *Tri-Chem, Inc. v. L.A. Cnty. Flood Control Dist.*, 60 Cal. App. 3d 306 (Cal. App. 1978).

²⁶⁸ *Id.*

²⁶⁹ E.g., *Valley Cattle Co. v. United States*, 258 F. Supp. 12 (D. Haw. 1966).

²⁷⁰ An "Act of God" is an affirmative defense to liability for injuries caused by an unforeseeable and preventable natural act, such as flooding. See Clifford J. Villa, *Is the "Act of God" Dead?*, 7 WASH. J. ENV'T L. & POL'Y 320 (2017) for a history of the doctrine and its application to modern environmental law.

²⁷¹ *In re Downstream Addicks and Barker (Texas) Flood Control Reservoirs*, 147 Fed. Cl. 566 (Feb. 18, 2020).

²⁷² *Id.* at 584. Moreover, a property owner may be liable for assessments for improvements to limit or prevent flooding and the value of that portion of unusable property acquired for purposes of these works will be valued as such, if acquired for that purpose. *Borough of Harvey Cedars v. Karan*, 70 A.3d 524 (N.J. 2013).

²⁷³ See *infra* note 275.

²⁷⁴ James Wilkins, *Is Sea Level Rise "Foreseeable"? Does It Matter?*, 26 J. LAND USE & ENV'T L. 437, 497 (2011).

²⁷⁵ TED STEINBERG, *ACTS OF GOD: THE UNNATURAL HISTORY OF NATURAL DISASTER IN AMERICA* (2006).

to predict with accuracy, but they are increasingly observable and no longer extraordinary or unexpected.

Lawsuits against government entities may become more successful as more accurate information about the likelihood, magnitude, and geographical scope of at-risk areas emerges. As this information strengthens the element of foreseeability, subsequent failure to act on that knowledge becomes more unreasonable. In a separate case concerning the Hurricane Harvey flooding mentioned in the previous paragraph, a different group of plaintiffs—these ones upstream from the reservoirs—prevailed on their takings claims.²⁷⁶ The court noted that the Corps had made a “calculated decision” for cost reasons not to require flood easements for land onto which it had planned for years to impound floodwaters.²⁷⁷

More accurate information may also increase local government liability for approving developments, such as subdivisions, with inadequate drainage facilities. Courts are split on such liability, and no consistent doctrines have emerged. As the leading expert on the issue has noted:

The decisions [imposing liability] turn upon a number of considerations: the water law rules in the state (e.g., common enemy, “reasonable use”), the degree of government involvement and control, and who owns the lands at the time of suit (e.g., government versus private). The decisions also turn upon statutory or regulatory provisions which may (or may not) create a regulatory duty to consider natural hazards in permitting and the precise language of the state tort claim act.²⁷⁸

To induce cities to invest in CRI, a balance must be struck between penalizing governments that ignore available science and underinvest in adaptation and recognizing that even adaptation carries with it the risks of damage. Thus, at a minimum, the risks of damages must be shared between governments and landowners. Ideally, states would adopt legislation that spells out municipal duties to move toward

²⁷⁶ *In Re Upstream Addicks and Barker (Texas) Flood-Control Reservoirs*, 146 Fed. Cl. 219 (2019).

²⁷⁷ *Id.* at 232.

²⁷⁸ JON A. KUSLER, ASS’N OF STATE FLOODPLAIN MANAGERS FOUND., *A COMPARATIVE LOOK AT PUBLIC LIABILITY FOR FLOOD HAZARD MITIGATION* 42. *See id.* at 44–46 for cases holding that local governments are not liable for approving developments that subsequent cause flooding.

CRI.²⁷⁹ Cities that use state-of-the-art hydrologic modeling, construct infrastructure using the best engineering practices, and accurately communicate risks to landowners should be presumed to have acted reasonably.²⁸⁰ The COVID-19 pandemic will strengthen the need for accurate and effective risk communication. State and local budgets will be stressed, and less funding will be available for GCD adaptation. Governments may lack the financial capacity to build the infrastructure that experts suggest. To compensate for this, landowners need full information about the increased risk of flooding so that they can make informed choices regarding how much compensated and uncompensated risk they want to assume.

b. Takings Liability for Regulation and Project Planning

State and local floodplain regulation has been almost universally upheld against regulatory takings challenges; however, takings law must be reformed, especially at the Supreme Court level, because it does not adequately take into account the moral hazard behavior of landowners. In holding that the U.S. Army Corps of Engineers had taken the upstream plaintiffs' property in the Hurricane Harvey litigation discussed above, the Court of Federal Claims rejected the government's argument that landowners around the reservoirs were on notice that they faced the risk of flooding, found that public meetings and other efforts to warn the landowners were ineffective, and found that the purchase of flood insurance by the landowners was irrelevant:

[I]t would take an uncommonly attentive eye to notice and comprehend the import of such a "disclosure." Moreover, the government's own witness, the Fort Bend County Drainage District's Chief Engineer, testified that the plat language was not successful in informing the public of the risks involved. Additionally, the fact that the Corps discussed the possibility of upstream flooding with developers is not evidence that anyone who subsequently purchased that property also should have been apprised of the information. The government further cites the high rate of flood-insurance purchases compared to the national average, concluding that this demonstrates that "the possibility of upstream flooding has long been knowable in this region." This argument also fails because no one disputes that the Houston region is, and long has been, especially flood prone.

²⁷⁹ For an extensive development of this argument using New York state as a case study, see Sarah J. Adams-Schoen, *Beyond Localism: Harnessing State Adaptation Lawmaking to Facilitate Local Climate Resilience*, 8 MICH. J. ENV'T & ADMIN. L. 185 (2018).

²⁸⁰ It is still difficult to scale GCD risk information to the local level, and existing risk maps, such as flood risk zones, still do not fully try to incorporate the risks of an altered climate. *Id.* at 222–27.

Because that general flood risk was well known, and because some residents purchased flood insurance to account for it, is simply not evidence that plaintiffs should have been aware of the specific risk associated with the very different type of flooding at issue here, namely, government-induced flooding.

Perhaps the government's strongest argument on the issue of notice is the fact that during the decades leading up to Harvey, both the Corps and local governments conducted public meetings, in which they disclosed information about the possibility of flooding. . . . But here, too, the government fails to show that plaintiffs should reasonably have known of the risk. The mere fact that meetings occurred does not mean they were effective at communicating the risk such that the public should have known about government-induced flooding; there is no evidence that these meetings were heavily attended or particularly well publicized in the community. And in rapidly developing suburbs of a large city like Houston, it is reasonable to expect a regular flow of people moving into and out of the area, further reducing the likelihood that new residents would know of the risk without an especially aggressive public campaign. That not one of the plaintiffs in this case was aware of the situation regarding government-induced flooding is also telling with respect to the effectiveness of these meetings, suggesting that it is quite reasonable to conclude that the average person in the community was likely unaware of the risk.²⁸¹

Coastal retreat raises important takings challenges and illustrates the need for reforms. In 2018, the California Coastal Commission published a revised draft of a guidance document that encourages local governments to adopt “managed retreat” policies for areas at risk from sea level rise.²⁸² This is complemented by provisions in the 1976 California Coastal Commission Act, which limit seawall construction to pre-1976 buildings.²⁸³ Nonetheless, considerable seawall construction has been allowed, despite efforts to limit approvals.²⁸⁴ The commission may limit the duration of seawall permits,²⁸⁵ and the California Court

²⁸¹ *In re* Downstream Addicks and Barker (Texas) Flood Control Reservoir, 146 Fed. Cl. 219 at 262–63.

²⁸² CAL. COASTAL COMM'N, RESIDENTIAL ADAPTATION POLICY GUIDANCE (2018), <https://documents.coastal.ca.gov/assets/climate/slr/vulnerability/residential/RevisedDraftResidentialAdaptationGuidance.pdf> [<https://perma.cc/C26V-TDF9>]. There is vast literature advocating retreat from at-risk areas. See e.g., Leah A. Dundon & Mark Abkowitz, *Climate-Induced Managed Retreat in the U.S.: A Review of Current Research*, 33 CLIMATE RISK MGMT. (2021).

²⁸³ CAL. PUB. RES. CODE § 30235.

²⁸⁴ Todd T. Cardiff, *Conflict in the California Coastal Act: Sand and Seawalls*, 38 CAL. W.L. REV. 255 (2001).

²⁸⁵ *Lynch v. Cal. Coastal Comm'n*, 396 P.3d 1085 (Cal. 2017) (20 years).

of Appeal has rejected a facial takings challenge to a city plan policy that limited new shoreline building.²⁸⁶ The pushback by southern California landowners has been intense,²⁸⁷ and any efforts to limit landowners' abilities to avoid property loss from erosion will likely be challenged as a taking.²⁸⁸ However, these lawsuits are unlikely to succeed. First, loss of title from sea level rise is more of a background limitation than an Act of God because it is observable and foreseeable.²⁸⁹ The boundary between public and private ownership of the coastline has always been a moving one—the mean high tide line in California²⁹⁰—and it can shift title from a private owner to the state.²⁹¹ Likewise, cities have wide discretion to respond to sea level rise. For example, North Carolina and Oregon have held that littoral owners have no common law right to build seawalls.

²⁸⁶ *Beach & Bluff Conservancy v. City of Solana Beach*, 28 Cal. App. 5th 244 (Oct. 17, 2018). Policy 4.19 states:

New shoreline or bluff protective devices that alter natural landforms along the bluffs or shoreline processes shall not be permitted to protect new development. A condition of the permit for all new development and blufftop redevelopment on bluff property shall require the property owner [to] record a deed restriction against the property that expressly waives any future right that may exist pursuant to Section 30235 of the Coastal Act.

Id. at 270.

²⁸⁷ See e.g., *Lindstrom v. Cal. Coastal Comm'n*, 40 Cal. App. 5th 73 (2019); De Vann Sago, *(Sea) Walling Off the Beach: The Future of California's Coastal Commons Remains Contested*, GEO. ENV'T L. REV. (Nov. 15, 2018), <https://www.law.georgetown.edu/environmental-law-review/blog/sea-walling-off-the-beach-the-future-of-californias-coastal-commons-remains-contested/> [<https://perma.cc/E5YV-QSYX>]; Jim Replogle, *5 Things to Know About California Supreme Court Case on Seawalls*, 89.3 KPCC (May 4, 2017), <https://www.scpr.org/news/2017/05/04/71491/5-things-to-know-about-california-supreme-court-ca/> [<https://perma.cc/WE2Q-QLDN>]. *11 Lagunita, LLC v. California Coastal Commission*, 58 Cal. App. 5th 904 (2021).

²⁸⁸ *Tag: Seawall* (Blog), PAC. LEGAL FOUND., <https://pacificlegal.org/tag/seawall/> [<https://perma.cc/9F4C-MNY8>] (last visited Feb. 11, 2022).

²⁸⁹ *McQueen v. S.C. Coastal Council*, 354 S.C. 142 (2003), *cert. denied* 540 U.S. 982 (2003).

²⁹⁰ *Borax Consol. v. City of L.A.*, 296 U.S. 10 (1935).

²⁹¹ *United States v. Milner*, 583 F.3d 1174 (9th Cir. 2009) (An owner of tidelands could require upland owners to remove portions of revetments that prevented inward movement of tides and because the actual property boundary was where the mean high tide line would have been if the revetments were not there.).

V
ENERGY

*A. From Local Provision to Large Scale Entities and Back to
“Distributed Generation”*

In the late nineteenth century, municipal residents obtained electricity and natural gas through a number of small entities. By the early twentieth century, however, these entities were consolidated into large public utilities.²⁹² Industrialists who wanted to consolidate energy production and distribution, such as Samuel Insull of Chicago, struck a bargain with the Progressive movement.²⁹³ In return for monopoly status, utilities would be subject to rate and service regulation by the state.²⁹⁴ Thus, until thirty years ago, cities played a relatively passive role in the use of energy. The availability of fuels to generate electricity and provide heating was largely determined by federal policies and state regulations. Until the 1970s, U.S. energy policy was an amalgam of separate federal policies and laws for each major fuel.²⁹⁵ This led to competition among fuels both in the market and for legislation that would give each fuel a comparative advantage over others.²⁹⁶ This legacy still confines local government power to influence energy use. Hydrocarbon fuels continue to fight federal and state efforts to promote

²⁹² HAROLD L. PLATT, *THE ELECTRIC CITY: ENERGY AND THE GROWTH OF THE CHICAGO AREA 1880-1930* (1991).

²⁹³ For an interesting study of the relationship between energy entrepreneurs and the progressive movement in America, see *Emergence of Electrical Utilities in America*, SMITHSONIAN INST., <https://americanhistory.si.edu/powering/past/h1main.htm> [<https://perma.cc/GHY7-ABKH>] (last visited Feb. 11, 2022); William D. Henderson & Richard D. Cudahy, *From Insull to Enron: Corporate (Re)Regulation After the Rise and Fall of Two Energy Icons*, 26 ENERGY L.J. 35 (2005). This bargain gave the appearance of a “tamed monopoly.”

²⁹⁴ Roger Lowenstein, *Before There Was Enron, There Was Insull*, N.Y. TIMES (Mar. 19, 2006), <https://www.nytimes.com/2006/03/19/business/yourmoney/before-there-was-enron-there-was-insull.html> [<https://perma.cc/78AV-9AKR>].

²⁹⁵ See Joseph P. Tomain, *The Dominant Model of United States Energy Policy*, 61 U. COLO. L. REV. 355, 356 (1990). The article also traces how federal and state regulation of different fuels moved energy policy away from local governments, which initially controlled electricity generation and fuel use to the states and the federal government.

²⁹⁶ See Kimberly Amadeo, *Comparative Advantage Theory and Examples*, THE BALANCE, <https://www.thebalance.com/comparative-advantage-3305915> [<https://perma.cc/NQX8-GDHJ>] (last updated Mar. 30, 2021).

the increased use of renewable energy, thus circumscribing local initiatives.²⁹⁷

All GCD adaptation scenarios are based on the increased use of electricity in sectors, such as transportation and heating, that have traditionally relied on oil and natural gas.²⁹⁸ Until forty years ago, electricity was almost exclusively generated by investor-owned utilities, which still serve 110 million customers; cooperatives, which serve 20 million; and publicly owned utilities, which serve 24 million.²⁹⁹ The Los Angeles Department of Water and Power, with 1.4 million customers, is the largest municipal utility.³⁰⁰ Likewise, natural gas was primarily delivered by investor-owned utilities that purchased it from interstate pipeline companies, which were monopolies regulated by the Federal Energy Regulatory Commission (FERC).³⁰¹ FERC sets rates for interstate sales,³⁰² and the state public utility commissions set

²⁹⁷ MEGHAN O'SULLIVAN, INDRA OVERLAND & DAVID SANDALOW, COLUM. UNIV. CTR. ON GLOBAL ENERGY POL'Y, *THE GEOPOLITICS OF RENEWABLE ENERGY* (2017), <https://energypolicy.columbia.edu/sites/default/files/CGEPTheGeopoliticsOfRenewables.pdf> [<https://perma.cc/AF8R-42UR>]; Sam Ricketts et al., *States Are Laying a Road Map for Climate Leadership*, CTR. FOR AM. PROGRESS (Apr. 30, 2020), <https://www.americanprogress.org/issues/green/reports/2020/04/30/484163/states-laying-road-map-climate-leadership/> [<https://perma.cc/ENF4-TYDD>].

²⁹⁸ This assertion assumes that a sustainable energy future requires the continuing shift from hydrocarbon to renewable sources of energy. It is subject to considerable uncertainty. At the present time, hydrocarbons supply approximately eighty percent of our energy needs, especially in heating and transportation.

²⁹⁹ *Investor-Owned Utilities Served 72% of U.S. Electricity Customers in 2017*, U.S. ENERGY INFO. ADMIN. (Aug. 15, 2019), <https://www.eia.gov/todayinenergy/detail.php?id=40913> [<https://perma.cc/3A7K-BAJQ>]. There is a relatively strong consensus that the use of electricity for heating and transportation will rise; the uncertainty is the balance between continued reliance on hydrocarbons, primarily natural gas, versus renewable sources. RICHARD G. NEWELL, DANIEL RAIMI & GLORIA ALDANA, RES. FOR THE FUTURE, *GLOBAL ENERGY OUTLOOK 2019: THE NEXT GENERATION OF ENERGY* (2019), <https://www.rff.org/publications/reports/global-energy-outlook-2019/> [<https://perma.cc/7SC8-45LL>].

³⁰⁰ *Who We Are*, LOS ANGELES DEP'T OF WATER & POWER, https://www.ladwp.com/ladwp/faces/ladwp/aboutus/a-whoweare?_afLoop=224350254936929&_afWindowMode=0&_afWindowId=2j2vhyb53_1#%40%3F_afWindowId%3D2j2vhyb53_1%26_afLoop%3D224350254936929%26_afWindowMode%3D0%26_adf.ctrl-state%3D2j2vhyb53_17 (last visited Oct. 31, 2021).

³⁰¹ FED. ENERGY REG. COMM'N, REPORT TO CONGRESS ON COMPETITION IN WHOLESALE AND RETAIL MARKETS FOR ELECTRIC ENERGY 10–43 (2007), https://www.ferc.gov/sites/default/files/2020-04/epact-final-rpt_0.pdf [<https://perma.cc/L9WU-3PXQ>].

³⁰² *Natural Gas: Cost-of-Service Rate Filings*, FED. ENERGY REG. COMM'N, <https://www.ferc.gov/industries-data/natural-gas/overview/general-information/cost-service-rate-filings> [<https://perma.cc/4797-NYT9>] (last updated Aug. 14, 2020).

rates for commercial and residential end-users.³⁰³ Both commercial and residential consumers could choose from among different fuels, and there were few incentives for customers to limit energy use, as rates often declined with increased use.³⁰⁴ This all changed in the wake of the 1973 oil embargo by the Organization of the Petroleum Exporting Countries, or OPEC,³⁰⁵ and natural gas shortages in the late 1970s caused by the overregulation of production.³⁰⁶ Energy independence became a national policy and concerns that oil and gas reserves were limited slowly led to the promotion of both small- and large-scale renewable sources, primarily wind and solar.³⁰⁷

The development of fracking technologies recently led to a boom in oil and gas production.³⁰⁸ In the drive for energy independence, the power to determine fuel choice and the level of energy use has slowly shifted downward to municipalities.³⁰⁹ That said, the United States still lacks a coherent energy policy, and interfuel competition, especially between coal and natural gas, continues. There are two primary reasons for this downward shift. The first is the partial deregulation of the

³⁰³ EPA, STATE CLIMATE AND ENERGY TECHNICAL FORUM BACKGROUND DOCUMENT, AN OVERVIEW OF PUCs FOR STATE ENVIRONMENT AND ENERGY OFFICIALS (2010), https://www.epa.gov/sites/production/files/2016-03/documents/background_paper.pdf [<https://perma.cc/2B3H-48A8>].

³⁰⁴ See SEVERIN BORENSTEIN, CTR. FOR THE STUDY OF ENERGY MARKETS, UNIV. OF CAL., BERKELEY, EQUITY EFFECTS OF INCREASING BLOCK-ELECTRICITY PRICING (2008), <https://escholarship.org/uc/item/3sr1h8nc> [<https://perma.cc/23MF-ZTS7>], for an analysis of the switch from declining block rates which rewarded electricity use to increasing block rates which penalized it.

³⁰⁵ *Oil Embargo, 1973–1974*, U.S. DEP'T OF STATE, OFF. OF THE HISTORIAN, <https://history.state.gov/milestones/1969-1976/oil-embargo> [<https://perma.cc/5PGB-MARP>] (last visited Feb. 11, 2022).

³⁰⁶ Stephen Breyer & Paul W. MacAvoy, *The Natural Gas Shortage and the Regulation of Natural Gas Producers*, 86 HARV. L. REV. 941, 943 (1973).

³⁰⁷ CONG. BUDGET OFF., ENERGY SECURITY IN THE UNITED STATES (2012), <https://www.cbo.gov/sites/default/files/cbofiles/attachments/05-09-EnergySecurity.pdf> [<https://perma.cc/527H-F9KY>].

³⁰⁸ Christina Nunez, *How Has Fracking Changed Our Future?*, NAT'L GEOGRAPHIC, <https://www.nationalgeographic.com/environment/article/how-has-fracking-changed-our-future> [<https://perma.cc/3CTB-BVWC>] (last visited Feb. 11, 2022).

³⁰⁹ *What Is Electricity Deregulation?*, ELECTRIC CHOICE, <https://www.electricchoice.com/blog/what-is-electricity-deregulation/> [<https://perma.cc/NGS8-KV7U>] (last visited Feb. 11, 2022) (explains deregulation and compares market prices). However, there are downsides to deregulation, as shown in the recent Texas retail price controversies. See, e.g., *The Ultimate Guide to Texas Electricity Deregulation*, ELECTRIC CHOICE, <https://www.electricchoice.com/blog/guide-texas-electricity-deregulation/> [<https://perma.cc/6C2W-DCHK>] (last updated Feb. 24, 2021).

wholesale electricity and natural gas industry.³¹⁰ Many public utilities have primarily become energy distributors, purchasing supplies from a variety of sources at market rates.³¹¹ Thus, public and private customers often have a choice between multiple sellers of gas and electricity. The second reason for this downward shift is the transition away from fossil fuels and toward renewable energy, primarily hydropower, wind, and solar.³¹² In 2019, sixty-three percent of the energy generated by utilities came from fossil fuels, another twenty percent from nuclear, and the remaining eighteen percent from renewable sources, primarily hydropower.³¹³ Electricity from small-scale photovoltaic systems (i.e., solar panels that convert sunlight into energy) is rising and now constitutes 35 billion kilowatt-hours as of 2019, but is still small compared to the 4,110 billion kilowatt-hours from utilities.³¹⁴

B. The New Local Government Role: Energy Policy Instead of Foreign Policy

1. Municipal Energy Policy Options in a Federal System

Despite the increase in locally produced energy, local governments have a limited role in energy and climate policy, which remains concentrated at the federal and state levels. Nonetheless, local governments are becoming more aggressive in encouraging the use of sustainable energy production and even going further, directly regulating property owners' fuel choices. Local government efforts to prohibit the use of natural gas is a case in point. Compared to local government efforts to enact their own foreign policies,³¹⁵ the lack of a

³¹⁰ Severin Borenstein & James Bushnell, *The U.S. Electricity Industry After 20 Years of Restructuring*, 7 ANNU. REV. ECON. 437 (2015).

³¹¹ *Id.*

³¹² See *What Are 100% Clean Energy Commitments?*, SIERRA CLUB, <https://www.sierraclub.org/ready-for-100/commitments> [<https://perma.cc/XHR2-HKKE>] (last visited Feb. 11, 2022) for a list of cities that are moving toward all renewable sources of energy.

³¹³ *Frequently Asked Questions (FAQs): What Is U.S. Electricity Generation by Energy Source?*, U.S. ENERGY INFO. ADMIN., <https://www.eia.gov/tools/faqs/faq.php?id=427&t=3> [<https://perma.cc/4T85-ZZUW>] (last visited Feb. 11, 2022) [hereinafter *Frequently Asked Questions (FAQs)*].

³¹⁴ *Electricity Explained*, U.S. ENERGY INFO. ADMIN., <https://www.eia.gov/energy-explained/electricity/electricity-in-the-us-generation-capacity-and-sales.php> [<https://perma.cc/QK5T-FTSG>] (last updated Mar. 18, 2021); *Frequently Asked Questions (FAQs)*, *supra* note 313.

³¹⁵ Cities and states have a long history of adopting foreign policy positions at odds with the federal government, Howard N. Fenton III, *The Fallacy of Federalism in Foreign Affairs: State and Local Foreign Policy Trade Restrictions*, 13 NW. J. INT'L L. & BUS. 563 (1993), but their authority is circumscribed by the foreign affairs power of the federal

coherent federal energy policy to address climate destruction provides regulatory space for local initiatives. This is especially true for Western cities in states that have adopted policies to transition to cleaner energy.³¹⁶ In addition, the lack of a coherent federal energy policy means that there is more room for municipalities to formulate their own, though that power is not unlimited.

From our review of the actions of Western American cities, we recommend a number of steps that may be taken to meet their energy needs. Many cities have taken the semi-aspirational step of committing to move to 100% renewable sources by a target date. Some 163 cities have set dates between 2030 and 2050.³¹⁷ Five western states—California, Hawaii, Nevada, New Mexico, and Washington—also have target dates, usually 2045 or 2050.³¹⁸ The second step for these cities is to decide how to acquire the needed renewable energy. The choice has long been between investor-owned utilities and publicly owned utilities. For example, some of the West’s largest cities—Los Angeles, Phoenix, San Francisco, and Seattle—are served by publicly owned

government. E.g., *Arizona v. United States*, 567 U.S. 387, 394 (2012) (“The Government of the United States has broad, undoubted power over the subject of immigration and status of aliens.”).

³¹⁶ *United States v. State of California*, Case 2:19-cv-02142-WBS-EFB (E.D. Cal. Oct. 23, 2019) (upholding California-Quebec greenhouse trading agreement). See Sharmila L. Murthy, *The Constitutionality of State and Local “Norm Sustaining” Actions on Global Climate Change: The Foreign Affairs Federalism Grey Zone*, U. PENN. J.L. & PUB. AFF. (2020).

³¹⁷ *Ready for 100*, SIERRA CLUB, <https://www.sierraclub.org/ready-for-100/commitments> [<https://perma.cc/FK7K-UXC7>] (last visited Feb. 11, 2022).

³¹⁸ Trevor Nace, *California Goes All In—100% Renewable Energy by 2045*, FORBES MAGAZINE (Aug. 1, 2017), <https://www.forbes.com/sites/trevornace/2017/08/01/california-goes-all-in-100-percent-renewable-energy-by-2045/?sh=66964453570f> [<https://perma.cc/E45N-6C4V>]; *Hawaii Clean Energy Initiative*, HAWAII.GOV, <http://energy.hawaii.gov/testbeds-initiatives/hcei> [<https://perma.cc/KWK5-8UUB>] (Hawaii’s target date is 2045); Sarah Spengeman, *Accelerating Its Clean Energy Revolution Would Add \$700 Million to Nevada’s Economy Per Year by 2030*, FORBES (Mar. 10, 2021), <https://www.forbes.com/sites/energyinnovation/2021/03/10/accelerating-its-clean-energy-revolution-would-add-700-million-to-nevadas-economy-per-year-by-2030/?sh=7d0ab2ab7063> [<https://perma.cc/E22U-TK9Y>] (Nevada’s target date is 2035); Catherine Morehouse, *Three’s Company: New Mexico Joins California, Hawaii in Approving 100% Clean Energy Mandate* (Mar. 13, 2019), <https://www.utilitydive.com/news/threes-company-new-mexico-joins-california-hawaii-in-approving-100-clea/550390/> [<https://perma.cc/4DS9-C24T>] (New Mexico’s target date is 2045); Wash. Governor’s Off., *Washington Enacts Strongest Clean Electricity Standard in the Nation* (May 2019), <https://www.governor.wa.gov/sites/default/files/documents/clean-electricity-policy-brief-bill-signing.pdf> [<https://perma.cc/68NG-ATFV>] (Washington’s target date is 2045).

utilities.³¹⁹ In states that have deregulated energy sales, cities now have the option of purchasing energy from different sources and distributing it through existing utility infrastructure.³²⁰ States also have more discretion to switch cities' energy use to renewable sources. Although renewable procurement is growing, it is currently used primarily in California and Texas.³²¹ The third step for these cities is to help organize local residents to install solar energy, as Portland has done by mobilizing neighborhood organizations.³²² A fourth step is to take advantage of federal and state incentives and regulations to promote renewable energy.

2. *Picking Winners: Local Governments and Solar and Wind Energy*

Solar and wind energy are different from coal, natural gas, and nuclear energy because they require greater amounts of land and, thus, can generate local opposition.³²³ This is especially true in rural areas,³²⁴ though residential solar has also engendered some opposition.³²⁵ Only a few states have protected access to the sun. Thus, the use of solar energy has proceeded without a clear property rights regime, and the task of protecting it has fallen largely to local governments. New Mexico's pioneering 1978 act applied the doctrine of prior appropriation to solar energy:

A. The legislature declares that the right to use the natural resource of solar energy is a property right, the exercise of which is to be encouraged and regulated by the laws of this state. Such property right shall be known as a solar right.

³¹⁹ *Public Power*, AM. PUB. POWER ASS'N, <https://www.publicpower.org/public-power> [<https://perma.cc/XT2E-GPLV>] (last visited Feb. 11, 2022).

³²⁰ JESSICA LEUNG & AMY BAILEY, CTR. FOR CLIMATE & ENERGY SOLS., *BUYING CLEAN ELECTRICITY: HOW CITIES BENEFIT FROM POWER PURCHASE AGREEMENTS* (2018), <https://www.c2es.org/site/assets/uploads/2018/09/how-cities-benefit-from-ppas.pdf> [<https://perma.cc/EB4J-KP4S>].

³²¹ Tatsatom Gonçalves & Yuning Liu, *How US Cities and Counties Are Getting Renewable Energy*, WORLD RES. INST. (June 24, 2020), <https://www.wri.org/blog/2020/06/renewable-energy-procurement-cities-counties> [<https://perma.cc/KR7R-7368>].

³²² *Solarize Projects*, SOLAR OR., <http://solaroregon.org/how-to-go-solar/solar-for-communities/solarize-projects/> [<https://perma.cc/PNB4-ZS7C>] (last visited Feb. 11, 2022).

³²³ SAMANTHA GROSS, BROOKINGS INST., *RENEWABLES, LAND USE, AND LOCAL OPPOSITION IN THE UNITED STATES 1* (2020), https://www.brookings.edu/wp-content/uploads/2020/01/FP_20200113_renewables_land_use_local_opposition_gross.pdf [<https://perma.cc/8TZU-NG8U>].

³²⁴ *Id.* at 11.

³²⁵ *Id.*

B. The following concepts shall be applicable to the regulation of disputes over the use of solar energy where practicable:

(1) “beneficial use.” Beneficial use shall be the basis, the measure and the limit of the solar right, except as otherwise provided by written contract. If the amount of solar energy which a solar collector user can beneficially use varies with the season of the year, then the extent of the solar right shall vary likewise;

(2) “prior appropriation.” In disputes involving solar rights, priority in time shall have the better right except that the state and its political subdivisions may legislate, or ordain that a solar collector user has a solar right even though a structure or building located on neighborhood property blocks the sunshine from the proposed solar collector site. Nothing in this paragraph shall be construed to diminish in any way the right of eminent domain of the state or any of its political subdivisions or any other entity that currently has such a right[.]³²⁶

Wyoming basically copied New Mexico’s law,³²⁷ and the California Solar Rights Act limits homeowner association restrictions on solar panels and allows for the creation of voluntary solar easements, removing the threat that courts would strike them down as novel.³²⁸ To fill the gap, many cities have effectively used their zoning power to protect solar access by creating solar envelopes and allowing a variety of technologies to be installed.³²⁹ Municipal solar access laws are an important component of promoting solar energy, but state policies on distributed generation play a large role.³³⁰

The lack of property rights for solar access has not substantially hampered investment in residential and commercial solar panels because federal and state policies have promoted distributed energy and

³²⁶ N.M. STAT. ANN. § 47-3-4.

³²⁷ WYO. STAT §§ 34-22-101 to -106.

³²⁸ CAL. CIV. CODE §§ 714, 714.1, 801, 801.5; CAL. GOV’T CODE §§ 65850.5, 66475.3, 66473.1; CAL. HEALTH & SAFETY CODE § 17959.1.

³²⁹ See Joshua B. Landis, *Sunny and Share: Balancing Airspace Entitlement Rights Between Solar Energy Adopters and Their Neighbors*, 72 VAND. L. REV. 1075, 1093–1102 (2019); Evan J. Rosenthal, *Letting the Sunshine In: Protecting Residential Access to Solar Energy in Common Interest Developments*, 40 FLA. ST. U. L. REV. 995 (2013); R. Lisle Baker, *My Tree Versus Your Solar Collector or Your Well Versus My Septic System?—Exploring Responses to Beneficial but Conflicting Neighboring Uses of Land*, 37 B.C. ENV’T AFFS. L. REV. 1 (2010).

³³⁰ GREER RYAN, CTR. FOR BIOLOGICAL DIVERSITY, THROWING SHADE: 10 SUNNY STATES BLOCKING DISTRIBUTED SOLAR DEVELOPMENT (2016), https://www.biologicaldiversity.org/programs/population_and_sustainability/energy/pdfs/ThrowingShade.pdf [<https://perma.cc/7TTH-GW4R>].

the return to small-scale electricity and heating and cooling.³³¹ The Energy Policy Act of 2005³³² established tax credits for the installation of solar and wind facilities; the twenty-six percent credit has been kept alive by a series of extensions.³³³ As of 2020, these extensions will remain until 2022 but drop to twenty-two percent in 2023.³³⁴ After that, the residential credit ends but commercial and utility projects will still be entitled to a ten percent credit.³³⁵ Many states have additional incentive programs, such as tax credits and rebates.³³⁶ The basis for state support of solar and wind energy is the adoption of renewable portfolio standards for major energy providers. All western states, with the exceptions of Idaho and Wyoming, have such programs, though Utah's is voluntary.³³⁷ Some targets are modest but, as noted, many western states have the goal of 100% renewable energy between 2045 and 2050.³³⁸

In addition to tax credits and rebates, a major incentive for increased renewable energy is mandatory utility purchase of excess electricity generated by solar or wind. With the exceptions of Arizona, Idaho, and Utah, all continental western states have net metering policies which require utilities to purchase surplus energy from individual buildings at retail rates.³³⁹ Public utilities and other large electricity providers face the same problem that cable companies face: cutters.³⁴⁰ These providers argue that they are in a death spiral and, thus, distributed generation

³³¹ *Id.*

³³² 42 U.S.C. §§ 13201–13574.

³³³ CONG. RSCH. SERV., RENEWABLE ENERGY AND ENERGY EFFICIENCY INCENTIVES: A SUMMARY OF FEDERAL PROGRAMS 30 (2021), <https://sgp.fas.org/crs/misc/R40913.pdf>.

³³⁴ *Id.*

³³⁵ Consolidated Appropriations Act, H.R. 113, 116th Cong. § 148 (2021), <https://www.congress.gov/116/bills/hr133/BILLS-116hr133enr.pdf>.

³³⁶ The status of each state program and the legislative or executive authority is available at Consolidated Appropriations Act of 2016, Pub. L. No. 113-114 § 303, 129 Stat. 2242 (2016), <https://www.congress.gov/114/plaws/publ113/PLAW-114publ113.pdf>.

³³⁷ *State Renewable Portfolio Standards and Goals*, NAT'L CONF. OF STATE LEGISLATURES (Aug. 13, 2021), <https://www.ncsl.org/research/energy/renewable-portfolio-standards.aspx> [<https://perma.cc/E9MA-XJZ5>].

³³⁸ *See supra* note 318 and accompanying text.

³³⁹ Kelly Pickerel, *Which States Offer Net Metering?*, SOLAR POWER WORLD (Mar. 27, 2020), <https://www.solarpowerworldonline.com/2020/03/which-states-offer-net-metering/> [<https://perma.cc/S9LR-WLR8>].

³⁴⁰ “Cord cutting, at its simplest, means breaking free from the long-term contracts of traditional pay TV such as cable TV.” Luke Bouma, *So What Does Cord Cutting Mean? We Define What It Means to Be a Cord Cutter*, CORD CUTTERS NEWS (May 13, 2017), <https://www.cordcuttersnews.com/cord-cutting-mean-define-means-cord-cutter/> [<https://perma.cc/U8YX-EQBQ>].

needs to be curbed. These arguments have resonated only in Arizona and Utah. In Arizona, net billing has been eliminated and, instead, solar and wind providers receive a credit for exported energy.³⁴¹ Utah capped net billing, and new customers are limited to an export credit which will expire in 2032.³⁴² The legal basis for mandatory utility purchases is the Public Utility Regulatory Policies Act, or PURPA, which mandates utility purchases from small qualifying facilities.³⁴³ In 2020, FERC gave utilities a boost in their battle against rooftop solar by allowing states to set the rates that utilities must pay qualifying facilities at a variable wholesale rate rather than a fixed cost.³⁴⁴ However, FERC also rejected a petition to make all rooftop rates subject to federal jurisdiction, which many believed would have led to lower rates.³⁴⁵

The promotion of wind energy has become a high priority for many states as wind now generates over seven percent of the nation's electricity.³⁴⁶ Residential wind generation exists,³⁴⁷ but most wind-generated electricity comes from large turbines.³⁴⁸ As with solar, there is no firmly established property right to wind that would protect one landowner from another's interference with their power generation;³⁴⁹

³⁴¹ *Id.*

³⁴² *Id.*

³⁴³ 16 U.S.C. §§ 2601–2645.

³⁴⁴ Qualifying Facility Rates and Requirements Implementation Issues Under the Public Utility Regulatory Policies Act of 1978, 172 FERC ¶ 61,041 (July 16, 2020).

³⁴⁵ Paul Ciampoli, *FERC Dismisses Net Metering Jurisdiction Petition on Procedural Grounds*, AM. PUB. POWER ASS'N (July 16, 2020), <https://www.publicpower.org/periodical/article/ferc-dismisses-net-metering-jurisdiction-petition-procedural-ground> [<https://perma.cc/NZG6-FLC8>].

³⁴⁶ *Wind Explained, Electricity Generation from Wind*, U.S. ENERGY INFO. ADMIN., <https://www.eia.gov/energyexplained/wind/electricity-generation-from-wind.php> [<https://perma.cc/KQ5P-5WSN>] (last updated Mar. 17, 2021).

³⁴⁷ A wind turbine requires at least one acre, thus limiting most residential options. *Residential Wind Energy*, OFF. OF ENERGY EFFICIENCY AND RENEWABLE ENERGY, <https://windexchange.energy.gov/markets/residential> [<https://perma.cc/HN39-GNBD>] (last visited Feb. 11, 2022).

³⁴⁸ *Wind Explained, Where Wind Power Is Harnessed*, U.S. ENERGY INFO. ADMIN., <https://www.eia.gov/energyexplained/wind/where-wind-power-is-harnessed.php> [<https://perma.cc/62Y4-XUEA>] (last visited Feb. 11, 2022).

³⁴⁹ Landowners are granting wind easement under the ad coelum doctrine and severing wind rights from the surface. An intermediate California appellate court has upheld a severance. *See Contra Costa Water Dist. v. Vaquero Farms, Inc.*, 58 Cal. App. 4th 883 (1997). Troy A. Rule, *Wind Rights Under Property Law: Answers Still Blowing in the Wind*, 26 PROBATE & PROP. 2 (2012), <https://ssrn.com/abstract=2178194> [<https://perma.cc/UA6A-3QA4>].

most of the conflicts between generators and neighbors, governments, or NGOs concern external costs, such as alteration of the landscape, noise, or bird kills.³⁵⁰ For this reason, the regulation of wind follows one of three patterns: (1) siting can be controlled exclusively by the state, but no western state follows this approach; (2) siting can be split between the state and local governments; or (3) siting can be left exclusively to local governments, which is the approach followed by Montana, Idaho, Utah, and Arizona.³⁵¹ Under the second model, there is often a generation threshold for state approval. Wyoming requires county approval of facilities over 500 megawatts, but the legislation specifies minimum conditions that the county must impose to minimize the impact of the facility on urban areas and rural subdivisions.³⁵² Local governments can impose traditional zoning requirements but, because local height limits can effectively block a project, Colorado, New Mexico, and Nevada forbid local governments from prohibiting the use of property for wind generation and preempt any regulation of 70-megawatt turbines and larger.³⁵³

3. *Direct Interference with Fuel Choice*

In 2020, California became the first state to mandate solar installation for new homes and low-rise apartment buildings.³⁵⁴ More recently, a few cities, led by Berkeley, have banned natural gas hookups for new construction, with very limited exceptions for some

³⁵⁰ Troy A. Rule, *Renewable Energy and the Neighbors*, 2010 UTAH L. REV. 1223, 1238–40 (2010).

³⁵¹ Jaclyn Kahn & Laura Shields, *State Approaches to Wind Facility Siting*, NAT'L CONF. OF STATE LEGISLATURES (Sept. 2, 2020), <https://www.ncsl.org/research/energy/state-wind-energy-siting.aspx> [<https://perma.cc/889R-PA4N>].

³⁵² WYO. STAT. §§ 18-5-501 to -504.

³⁵³ COLO. REV. STAT. §§ 30-28-106(3)(a)(VI), 40-5-101, 29-20-108(2); N.M. STAT. ANN. §§ 62-9-3, 3-21-1; NEV. REV. STAT. ANN. §§ 704.820–.900, 278.250(2)(n), 278.02077.

³⁵⁴ *Solar PV Systems and Solar Ready*, CAL. ENERGY COMM'N, <https://www.energy.ca.gov/programs-and-topics/programs/building-energy-efficiency-standards/online-resource-center/solar> [<https://perma.cc/57GW-NQ8N>] (last visited Jan. 29, 2021). The pandemic substantially reduced new residential construction and exceptions have developed. For example, builders in Sacramento obtained an exemption when the Sacramento Public Utility district was allowed to construct solar farms to supply to exempt homes. *See* Cuneyt Dil, *California's Solar Mandate to Allow Homes Without Solar*, U.S. NEWS & WORLD REP. (Feb. 20, 2020), <https://www.usnews.com/news/best-states/california/articles/2020-02-19/californias-solar-mandate-may-not-require-one-on-every-roof> [<https://perma.cc/5DTA-VJ4C>].

appliances.³⁵⁵ In other states, local governments are concerned about state preemption, and the Berkeley ordinance itself was immediately challenged as preempted by federal law.³⁵⁶ Because cities have no inherent powers, states may exercise their reserved Tenth Amendment police powers to preempt local ordinances.³⁵⁷ Arizona, Oklahoma, and Tennessee have already preempted hookup bans.³⁵⁸

4. Demand Management

Until the 1970s, the individual consumer of electricity and natural gas was a passive recipient of the service. As part of efforts to achieve energy independence and to move from nonrenewable sources of energy to renewable sources, the concept of demand management emerged.³⁵⁹ States began to reform energy rate structures that previously encouraged energy use.³⁶⁰ This was followed by efforts to involve both providers and consumers in real-time energy usage. The major technology accompanying these efforts was the smart meter. The Energy Policy Act of 2005 required utilities to offer smart meters.³⁶¹ By 2017, there were 88.6 million smart meters in use, and the number

³⁵⁵ Amy Turner, *Municipal Natural Gas Bans: Round 1*, COLUM. L. SCH., SABIN CTR. FOR CLIMATE CHANGE L.: CLIMATE LAW BLOG (Jan. 9, 2020), <http://blogs.law.columbia.edu/climatechange/2020/01/09/municipal-natural-gas-bans-round-1/> [<https://perma.cc/ED2D-P4EF>]. However, in 2021 a federal district court held that local regulation was not preempted primarily because the Federal Energy Policy Conservation Act was concerned only with energy efficiency, energy use, or water use of appliances as opposed to the regulation of fuel choice. *Cal. Restaurant Ass'n v. City of Berkeley*, 547 F. Supp. 3d 878 (N.D. Cal. 2021).

³⁵⁶ 42 U.S.C. §§ 6297(f)(3)(A)–(G) (only two subsections are relevant here: (B), which provides that the building code must not “require” the use of appliances with energy efficiencies exceeding the minimum efficiency set by DOE regulations, and (C), which provides that the building code must offer builders a “one-for-one credit” for alternative methods that reduce energy use.). Subsection (C) is designed to prevent state and local agencies from favoring particular products or methods. The Ninth Circuit has distinguished between requirements and incentives and held that the latter are not preempted. *Bldg. Indus. Ass'n of Wash. v. Wash. State Bldg. Code Council*, 683 F.3d 1144 (9th Cir. 2012).

³⁵⁷ See Emily S.P. Baxter, *Protecting Local Authority in State Constitutions and Challenging Intrastate Preemption*, 52 U. MICH. J.L. REFORM 947 (2019).

³⁵⁸ Amy Turner, *Municipal Natural Gas Bans: Round 2 (The Evolution of State Preemption Law)*, COLUM. L. SCH. CLIMATE L. BLOG (July 29, 2020), <http://blogs.law.columbia.edu/climatechange/2020/07/29/municipal-natural-gas-bans-round-2-the-evolution-of-state-preemption-law/> [<https://perma.cc/4C6C-MCUP>].

³⁵⁹ David S. Loughran & Jonathan Kulick, *Demand-Side Management and Energy Efficiency in the United States*, 25 ENERGY J. 19 (2005).

³⁶⁰ *Id.*

³⁶¹ 42 U.S.C. §. 15801.

is growing.³⁶² To date, the primary municipal role in this area has been the decision to allow or not allow the installation of smart meters. Smart meters only create a direct relationship between consumers and their energy provider. But the program has implications for local governments who want to promote the decreased use of carbon-intensive energy. Smart meters make it easier for local governments to convince residents that they can play a positive role in decreasing energy use.

a. Information Flow and Usage

Information from smart meters flows both to the energy provider and to the end user. Energy providers use the aggregated data to make adjustments in supply. The question of end use is more complicated. Smart meters can be linked to smart devices through readily available apps. The question is whether the information provided translates into individual energy-use decisions. In recent years, a great amount of attention has been devoted to the question of what combination of incentives and penalties might cause individuals to modify their behavior to use less energy, especially nonrenewable sources.³⁶³ Reducing energy consumption should be a relatively easy choice because the consumer saves money, and the sacrifice is minimal. Nonetheless, preliminary research suggests that users monitor their use but do not modify it accordingly.³⁶⁴

This may reflect the long history of relatively low energy prices in the United States, with spikes such as those that occurred in the 1970s.³⁶⁵ In recent years, consumers have benefitted from the fracking

³⁶² *Frequently Asked Questions (FAQs): How Many Smart Meters Are Installed in the United States, and Who Has Them?*, U.S. ENERGY INFO. ADMIN., <https://www.eia.gov/tools/faqs/faq.php?id=108&t=342> [<https://perma.cc/ZQM3-7366>] (last updated Nov. 2, 2021).

³⁶³ *The Benefits of Smart Meters*, CAL. PUB. UTIL. COMM'N, <https://www.cpuc.ca.gov/industries-and-topics/electrical-energy/infrastructure/the-benefits-of-smart-meters> [<https://perma.cc/GYH3-XZZX>] (last visited Feb. 11, 2022).

³⁶⁴ Daphne Geelen et al., *The Use of Apps to Promote Energy Saving: A Study of Smart Meter-Related Feedback in the Netherlands*, 12 ENERGY EFFICIENCY 1635 (2019), <https://doi.org/10.1007/s12053-019-09777-z> [<https://perma.cc/SKE6-3WUR>]. See also Chris Mooney, *Why 50 Million Smart Meters Still Haven't Fixed America's Energy Habits*, WASH. POST (Jan. 29, 2015), <https://www.washingtonpost.com/news/energy-environment/wp/2015/01/29/americans-are-this-close-to-finally-understanding-their-electricity-bills/> [<https://perma.cc/4568-TVSS>].

³⁶⁵ Professor Michael Vandenberg of Vanderbilt University Law School has been a leader in exploring this question. Thomas Dietz et al., *Household Actions Can Provide a Behavioral Wedge to Rapidly Reduce U.S. Carbon Emissions*, 106 PROC. NAT'L ACAD.

boom, which has produced low natural gas prices.³⁶⁶ Electricity rates have risen an average of fifteen percent since 2010,³⁶⁷ but we do not know what price change is necessary to trigger adjustments in energy consumption.

b. Opposition

Smart meters have faced opposition because of the electrons they omit and because of privacy concerns. In 2012, the Maine Supreme Court rejected a safety challenge.³⁶⁸ More recently, when an affluent suburb of Chicago allowed a utility to install smart meters, the decision was challenged as an unreasonable search and seizure.³⁶⁹ The Seventh Circuit upheld smart metering as a reasonable search because there was no prosecutorial intent in the data collection and because the government's interest in smart meters was substantial, but the court added a note of caution: "[O]ur holding depends on the particular circumstances of this case. Were a city to collect the data at shorter intervals, our conclusion could change. Likewise, our conclusion might change if the data was more easily accessible to law enforcement or other city officials outside the utility."³⁷⁰ Opponents have been more successful in convincing state public utility commissions to adopt opt-out programs.³⁷¹ However, the amount of opt-outs does not seem significant enough to alter provider use of smart meter data, and

SCIS. 18,452 (2009); Michael P. Vandenberg & Anne C. Steinemann, *The Carbon-Neutral Individual*, 82 N.Y.U. L. REV. 1673 (2007).

³⁶⁶ In 2015, the Brookings Institution in *The Economic Benefits of Fracking*, BROOKINGS INST. (Mar. 23, 2015), <https://www.brookings.edu/blog/brookings-now/2015/03/23/the-economic-benefits-of-fracking/> [<https://perma.cc/MS4H-Z7TR>], estimated that consumers saved 13 billion dollars per year because of the fall in natural gas prices. The industry apparently agrees. Ed Hirs, *The Arithmetic of Fracking*, FORBES (Feb. 21, 2020), <https://www.forbes.com/sites/edhirs/2020/02/21/the-arithmetic-of-fracking/?sh=5cdf72cd61d4> [<https://perma.cc/32QC-DNJ7>]; Jesse Empsak, *How Fracking Affects Natural Gas Prices*, INVESTOPEDIA, <https://www.investopedia.com/articles/markets/080814/how-fracking-affects-natural-gas-prices.asp> [<https://perma.cc/G2TT-3Z99>] (last updated June 25, 2019).

³⁶⁷ *Is Residential Electricity Price Going Up or Down?*, ENERGYSAGE, <https://news.energysage.com/residential-electricity-prices-going-up-or-down/> [<https://perma.cc/C43Z-EVB2>] (last visited Feb. 11, 2022).

³⁶⁸ *Friedman v. Pub. Util. Comm'n*, 48 A.3d 794 (Me. 2012).

³⁶⁹ *Naperville Smart Meter Awareness v. City of Naperville*, 900 F.3d 521 (7th Cir. 2018).

³⁷⁰ *Id.* at 529.

³⁷¹ Daniel Shea & Kate Bell, *Smart Meter Opt-Out Policies*, NAT'L CONF. OF STATE LEGISLATURES (Aug. 20, 2019), <https://www.ncsl.org/research/energy/smart-meter-opt-out-policies.aspx> [<https://perma.cc/TG7Z-JQAB>].

consumer use, as discussed in section V.B.4.a, is broader than the opt-out controversies.³⁷²

CONCLUSION

Pending the inevitable reentry of the federal government into the field, it remains the function of state and urban governments in the American West to respond to GCD. Due to their geography, as well as economic and social necessity, that response has been along the lines of ensuring resilience. Temperatures are rising, water is scarcer (in the absence of flooding), people are migrating, and forest fires are increasing. These events can only be mitigated, not changed. Despite their diverse political faiths, red and blue states and their urban areas face a common challenge. But what does their response indicate to the rest of the country?

First, necessity has caused these areas to respond to the challenge pragmatically, rather than dogmatically, and to do so regardless of federal action or inaction. Those responses—e.g., encouraging development within urban growth boundaries in Oregon,³⁷³ reallocating water in California,³⁷⁴ xeriscaping in Arizona³⁷⁵—have tested the opportunities and limits of political consensus but recognize that some action must occur. They also serve as experiments from which other states can learn.

Second, the four areas we have examined—land use, transportation, public facilities, and energy—are significant, quantifiable indicators of human interaction with the environment. As such, the reduction of harmful environmental effects in these fields is a measure by which our response to GCD may be evaluated. The methods that state and local governments employ in that response can be promoted only if they actually reduce the adverse impacts of GCD.

Third, political and legal reform is necessary to meet this challenge. States must retake some of the powers previously delegated to local

³⁷² See *supra* note 362 and accompanying text.

³⁷³ See Edward J. Sullivan, *Urbanization in Oregon: Goal 14 and the Urban Growth Boundary*, 47 URB. LAW. 165 (2015); Edward J. Sullivan, *Urban Growth Management in Portland, Oregon*, 93 OR. L. REV. 455 (2014).

³⁷⁴ A. DAN TARLOCK, WATER LAW'S CLIMATE DISRUPTION ADAPTATION POTENTIAL (2011), https://www.law.northwestern.edu/research-faculty/clbe/workingpapers/documents/Tarlock_Water.pdf [<https://perma.cc/C7SJ-7R2W>].

³⁷⁵ Ariz. Dep't of Water Res., *Conservation: Landscaping – Residential & Professional*, <https://new.azwater.gov/conservation/landscaping> [<https://perma.cc/F8U8-TBGN>] (last visited Nov. 11, 2021).

governments and either exercise them directly or actively supervise their exercise by other entities. This is true in all four of our marker areas, but especially land use and transportation. That reform must also include reallocating risks so that the real costs of constructing homes and businesses in floodplains are calculated and applied and ensuring that the impacts of speculative land uses are understood in takings analyses. Moreover, the costs of GCD must factor into both public and private financial priorities.

Finally, the response to GCD will require an alignment of human projects with the natural environment, as opposed to King Canute's lackeys, who foolishly attempted to convince him that he could hold back the tide.

The American West is a microcosm of the world, but it may be more agile in responding to the existential challenge of GCD. The responses outlined in this Article may give hope that mankind has not succumbed to that challenge.

