EQUITABLE ADAPTATION TO EXTREME HEAT IMPACTS OF CLIMATE CHANGE

Monica Heger

Abstract

Climate change has, and will continue to have, a disproportionate impact on communities of color. Already, it is clear that systemic racism has led to increased temperatures in predominantly Black neighborhoods as compared to white neighborhoods in the same cities. A legacy of discriminatory housing policies in California is correlated with worse air quality and health disparities, both of which could be further exacerbated as temperatures rise. As cities and states begin developing climate change adaptation plans, it is imperative that they develop equity-based solutions that take into account how discriminatory practices are leading to disproportionate climate impacts. If such impacts are not accounted for, they will be exacerbated in the future. This paper analyzes equity-based climate adaptation strategies for heat, which is already the deadliest weather-related disaster in the U.S., and how they could be applied to Los Angeles.

About the Author

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She would like to thank Professor Sean Hecht, Lydia Heye, Andy Su, and Sunjana Supekar for their thoughtful comments.

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Introduction

The world's five hottest years have all occurred since 2015, with 2020 going down as the second hottest year recorded since the National Oceanic and Atmospheric Administration (NOAA) first started recording global temperatures 141 years ago.[1] Future years will only be hotter: in February 2020, NOAA estimated that there is a 99 percent chance that the years 2019 to 2028 will be the ten hottest years to date.[2] If we continue on this trajectory, global temperatures are forecasted to increase more than 4 degrees Celsius by 2100. There is no question about it; our world is getting hotter.

In a blistering report published in October, the UN Office on Disaster Risk Reduction said a "staggering" increase in climate-related disasters over the last 20 years has been largely due to industrialized countries' failures to reduce their greenhouse gas emissions.[3] The UN researchers found that in the

1. *2020 Was Earth's 2nd-hottest Year, Just Behind 2016*, Nat'l Oceanic & Atmospheric Admin. (Jan 14, 2021), https://www.noaa.gov/news/2020-was-earth-s-2nd-hottest-year-just-behind-2016 [https://perma.cc/T6AQ-DZCC] (last updated Jan. 14, 2021); *More Near-Record Warm Years Are Likely on Horizon*, Nat'l Ctrs. for Env't. Info. (Feb. 14, 2020), https://www.ncei.noaa.gov/news/projected-ranks#:~:text=The%20warmest%20years%20globally%20have,Courtesy%20of%20NOAA%20NCEI [https://perma.cc/5A4N-9NEF] (last updated Jan. 29, 2021).

2. *Id.*

3. U.N. Office for Disaster Risk Reduction & Ctr. for Research on the Epidemiology of Disasters, Human Cost of Disasters: An Overview of the Last 20 Years 2000–2019, at 3 (2020) [https://perma.cc/U8GV-QFQK].

last 20 years, there have been 6,681 climate disasters—a more than 80 percent increase from the 20 years prior.[4] Extreme temperatures have caused 13 percent of all known disaster-related deaths, including a 2003 heatwave in Europe that killed more than 70,000 people and a 2010 heatwave in Russia that killed an estimated 55,000 people.[5] Two 2019 summer heatwaves in France killed more than 1,400 people, and a 2015 heat wave in India and Pakistan killed 2,248 and 1,229, respectively. What's more, these numbers are nearly certain to be an undercount because data on human impacts are only available for one-third of all the extreme temperature events.[6]

Climate change is upon us, and while it is necessary for the world to reduce its greenhouse gas emissions to mitigate the most severe climate change impacts, adaptation measures are also needed.

In this comment, I explore equitable strategies for adapting to heat and how they can be applied to Los Angeles. Like many climate change impacts, the effects of higher temperatures will not be borne equally. Cities are doubly impacted by both climate change and the urban heat island effect, which makes cities hotter than the surrounding rural areas. Even within a city, heat impacts are unevenly distributed, and researchers have recently been tracing heat disparities within cities to historic discriminatory housing and land use policies.[7]

Although higher temperatures can lead to increased wildfires and more strain on the electrical grid,[8] the consequences of higher temperatures are not always visible. Therefore, identifying the populations most at risk is critically important.

The impacts of heat are already upon us and so, while mitigation against further temperature rise is incredibly important, strategies for adapting to our new, hotter world are needed now. Given the disproportionate impacts of heat that are already being felt in our cities, equitable adaptation strategies are needed.

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4. *Id.* at 6.

5. *Id.* at 18. *See also* Jean-Marie Robine, et al., *Death Toll Exceeded 70,000 in Europe During the Summer of 2003.* 331 Comptes Rendus Biologies 171, 171 (2008) [*https://perma.cc/YPM3-VHH6*] ("More than 70,000 additional deaths occurred in Europe during the summer 2003").

6. U.N. Office for Disaster Risk Reduction & Ctr. for Research on the Epidemiology of Disasters, *supra* note 3, at 18.

7. Jeremy S. Hoffman et al., *The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 U.S. Urban Areas*, 8 Climate 1, 11–12 (2020), [https://perma.cc/9ZPE-CRZS]. *See also* Brad Plumer & Nadja Popovich, *How Decades of Racist Housing Policy Left Neighborhoods Sweltering*, N.Y. Times (Aug. 24, 2020), https://www.nytimes.com/interactive/2020/08/24/climate/racism-redlining-cities-global-warming.html [https://perma.cc/NMY8-C43T] (arguing that redlining in the U.S. housing industry contributed to disparities in urban heat environments).

8. Ann E. Carlson, *Heat Waves, Global Warming, and Mitigation*, 26 UCLA J. Env't L. & Pol'y 169, 173 (2008).

In Part I, I lay out the scope of the problem, discussing heat predictions in the face of climate change. I illustrate why hotter temperatures are a problem, including by showing how heat impacts learning, exacerbates underlying health conditions, increases the chances of premature birth, and increases mortality. In addition, I discuss the unequal impacts of heat. I also look at how those disparities can be traced to discriminatory land use policies. In this Part, I focus on Los Angeles. It is the nation's ninth most diverse large city, and it is already heating up due to climate change.[9]

In Part II, I lay out the existing frameworks of equitable adaptation. Equitable adaptation is necessary when thinking about the heat impacts of climate change because they are felt disproportionately, and those disproportionate impacts can be directly traced to racially discriminatory land use policies.

Finally, in Part III, I discuss how equitable adaptation to heat can be applied to Los Angeles. Residents living in neighborhoods that were historically redlined already experience temperatures that are two degrees hotter than the citywide average temperature. Those neighborhoods, which are still predominantly Black and Latinx, also have higher levels of air pollution due, in part, to their proximity to freeways. Air pollution and heat create a positive feedback loop, amplifying the health impacts of both. Equitable adaptation strategies that look at the problem holistically are necessary to adequately address how prior discriminatory land use policies continue to impact residents today. At the same time, it is important to recognize and plan for the fact that the very strategies known to be effective to adapt to hotter climates are often the same ones that can lead to displacement and gentrification.

Understanding the legacies of discriminatory land use policies is essential for developing equitable climate change adaptation policies. While I explore several equitable frameworks and how they can be applied specifically to Los Angeles, I think the frameworks will have broader applicability to cities throughout the U.S.

I. Climate Change Impacts of Heat are Already Being Felt Disproportionately and those Disparities are Tied to Discriminatory Land Use Policies

A. *Heat Kills*

Heat is already the leading cause of weather-related deaths in the United States, with more than 3,400 deaths reported between 1999 and 2003. Moreover, according to projections, annual heat-related deaths in the U.S. could increase five to seven times by the 2090s.[10]

9. PolicyLink & Program for Envtl. & Reg'l Equity at Univ. of S. Cal., An Equity Profile of the Los Angeles Region 17–18 (2017) [https://perma.cc/28GW-CFY2].

10. Thomas R. Karl, et al., U.S. Global Change Research Program, Global Climate

"Of all the climate change exposures we study, heat is the No. 1 killer," Rupa Basu, chief of air and climate epidemiology for the California Office of Environmental Health Hazard Assessment, said in an interview with the Los Angeles Times.[11]

By the end of the century, without a reduction in emissions, downtown L.A.'s number of extreme heat days will rise from six to fifty-four per year according to researchers at UCLA, who have developed a model to forecast temperature changes in Los Angeles.[12] The researchers found that inland areas in L.A. could experience between sixty and ninety additional days per year of temperatures above 95 degrees, "effectively adding a new season of extreme heat."[13]

Heat has numerous indirect health impacts aside from the direct impacts of heat exhaustion or heat stroke, including the exacerbation of existing health conditions like heart disease and asthma. Extreme heat has been associated with preterm birth and low birthweight.[14] Heat worsens the impact of ozone pollution by speeding up the chemical reaction of two precursor chemicals emitted from car exhaust and other sources. Thus, heat and air pollution work together to aggravate underlying respiratory and cardiovascular problems.[15]

Heat can negatively impact peoples' abilities to work and kids' abilities to learn in school. And, these impacts are not felt equally: when it is hotter, Black and Latinx kids' school test performances suffer compared to their white counterparts.[16]

These issues are not something to worry about in the future; they are upon us now. In California, heat-related emergency room visits increased 35

Change Impacts in the United States, at 91 (2009).

11. Tony Barboza, *As Second Heat Wave Sears California, Experts Say Impacts Will Worsen with Climate* Change, L.A. Times (Sept. 5, 2020), https://www.latimes.com/california/story/2020–09–05/heat-health-risks [https://perma.cc/5LV2–7VRK].

12. Fengpeng Sun, Daniel B. Walton, & Alex Hall, *A Hybrid Dynamical-Statistical Downscaling Technique. Part II: End-of-Century Warming Projections Predict a New Climate State in the Los Angeles Region*, 28 J. Climate, 4618, 4626 (2015) [*https://perma.cc/RP3M-NBDP*].

13. *Id.* at 4362.

14. Bruce Bekkar et al., *Association of Air Pollution and Heat Exposure with Preterm Birth, Low Birth Weight, and Stillbirth in the U.S.*, 3 JAMA Network Open e8243, at 6 (2020) [*https://perma.cc/B8JL-NXBK*]. *See also* Leann Kuehn & Sabrina McCormick, *Heat Exposure and Maternal Health in the Face of Climate Change*, 14 Int'l J. Env't Res. & Pub. Health 853 (2017), https://pubmed.ncbi.nlm.nih.gov/28758917 [*https://perma.cc/UQY8-JGU4*].

15. Ethan D. Coffel et al., *The Science of Adaptation to Extreme Heat, in Resilience* 89, 94 (Zinta Zommers & Keith Alverson eds., 2018).

16. Christopher Flavelle, *Hotter Days Widen Racial Gap in U.S. Schools, Data Shows*, N.Y. Times (Oct. 5, 2020), https://www.nytimes.com/2020/10/05/climate/heat-minority-school-performance.html [https://perma.cc/X6VX-63PE].

percent between 2005 to 2015, with disproportionate increases among Black, Asian Americans, and Latinx residents.[17]

B. *A Warming Climate is Further Exacerbated by the Urban Heat Island Effect*

Cities in particular are vulnerable to higher temperatures because of the urban heat island effect. The urban heat island effect results in daytime city temperatures that are 1 to 4 degrees Celsius higher than the areas outside the city and nighttime temperatures that can be 10 degrees Celsius warmer. Five key factors cause the phenomenon.[18] The primary cause is that cities are less efficient than surrounding rural areas at cycling out hot air.[19] Smooth city buildings and pavement slow air turbulence, which keeps hot air trapped at the ground. In addition, fewer trees and vegetation in cities reduce shade and evaporative cooling. Additionally, dark buildings and pavement absorb heat, which especially impacts night-time temperatures. Buildings, industrial activities, and cars also release heat.[20]

Urban heat goes hand in hand with poor air quality. Heat is a key ingredient in ozone, speeding up the photochemical reaction between the nitrogen oxides and volatile organic compounds that car exhaust emits into the atmosphere. Ozone pollution, like heat, can cause both acute respiratory and cardiovascular issues, and also amplify existing health problems.[21] As the world heats up due to climate change, these problems are compounded.

C. *Heat Disparities and Demographics*

Understanding who is at risk for increased heat is necessary for determining effective heat adaptation policies. For instance, cooling centers will not be effective if they are inaccessible to those who need them. Understanding how certain populations are disproportionately burdened by excess heat will help ensure that adaptation measures are equitable.

The Congressional Black Caucus reported in 2004 that Black people were, "already disproportionately burdened by the health effects of climate change, including deaths during heat waves and from worsened air pollution," with over 70 percent of Black people living in counties that are violating federal air pollution standards.[22]

Research also shows that socio-demographics correlate with disparities in exposure to higher temperatures. For instance, a study that examined heat

17. Barboza, *supra* note 11.

18. Coffel et al., *supra* note 15, at 91.

19. Lei Zhao, et al., *Strong Contributions of Local Background Climate to Urban Heat Islands*, 511 Nature, 216, 216 (2014).

20. Coffel et al., *supra* note 15, at 91.

21. *Id.* at 94.

22. Cong. Black Caucus Found., African Americans and Climate Change: An Unequal Burden 2, 10 (2004) [*https://perma.cc/Y436-KVS8*].

impacts in Portland, Oregon found that the eastern part of the city was significantly hotter than the western half.[23] And, by overlaying temperature data with census block group data on race and socioeconomics, the study found that higher heat exposure was correlated with households that were low-income and non-white.[24]

Similarly, other researchers have found that Black individuals are 52 percent more likely to live in an area at risk for extreme heat compared to white individuals, while Asian and Latinx individuals are 32 percent and 21 percent more likely to live in areas at risk for extreme heat.[25]

In another study, researchers looked at the relationship between heat, mortality, and race in four cities: Chicago, Detroit, Minneapolis, and Pittsburgh.[26] They compared the mortality rate on days when average temperatures were 59 degrees Fahrenheit to the mortality rate on days with an average temperature of 85 degrees Fahrenheit. They found that mortality increased 4.6 percent on the hotter days compared to the cooler ones.[27] But for Black individuals, daily mortality increased 9 percent, while for white individuals, the daily mortality increase was 3.7 percent.[28]

The researchers also analyzed air conditioning prevalence and found that in each city, air conditioning prevalence in Black households was about half what it was for white households.[29] However, the researchers calculated that air conditioning prevalence explained no more than 64 percent of the disparities in mortality,[30] suggesting that ensuring access to air conditioning will not be sufficient.

Socio-economic status can compound heat disparities since low-income populations are less likely to have air conditioning, making their exposure to higher temperatures even more pronounced.

Heat has disproportionate impacts. Identifying who will be vulnerable to heat is an important first step in determining adaptation policies. In the next Part, I discuss how the heat disparities described above can be tied to discriminatory land use policies.

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23. Jackson Voelkel, et al., *Assessing Vulnerability to Urban Heat: A Study of Disproportionate Heat Exposure and Access to Refuge by Socio-Demographic Status in Portland, Oregon*, 15 Int'l J. Envtl. Res.& Pub. Health 640, at 6 (2018) [*https://perma.cc/9WLP-BMQ7*].

24. *Id.*

25. Bill Jesdale, et al., *The Racial/Ethnic Distribution of Heat Risk-Related Land Cover in Relation to Residential Segregation*, 121 Envtl. Health Perspectives, 811 (2013).

26. Marie S. O'Neill et al., *Disparities by Race in Heat-Related Mortality in Four U.S. Cities: The Role of Air Conditioning Prevalence*, 82 J. Urban Health, 191 (2005).

27. *Id.* at 194.

28. *Id.*

29. *Id.* at 193.

30. *Id.* at 194.

D. *Heat Disparities in U.S. Cities Can be Linked to Land Use Policies that Were and Still Are Often Discriminatory*

Numerous factors impact heat exposure disparities. A higher income allows a household to purchase central air conditioning or may enable a family to buy a home nearer the coast, where air temperatures are cooler.[31] It could also enable a household to live in a newly constructed condo on a tree-lined street as opposed to in an older building with poor insulation and no air conditioning in a dense urban core. Individuals who work outdoors in agriculture or the construction industry will be more exposed to heat than those who work in office buildings. Access to health care can influence outcomes to heat-related health problems, such as heat exhaustion, and an individual's underlying health can increase their vulnerability to heat. Race intersects with all of these factors.

For the purposes of this article, I will focus on how land use policies have contributed to differences in temperature and disparities in heat exposure vulnerability within the same city. Understanding how land use decisions impact heat is important because more than half the world's population already lives in metropolitan areas and, by 2050, nearly two-thirds are expected to live in urban areas.[32] Cities will need to plan for that growing population while also grappling with the effects of climate change.

In addition, land use policies related to housing, transportation, and access to parks and open space have contributed to racial segregation and disparate heat impacts in cities.

Those policies have helped contribute to communities most vulnerable to heat being less able to escape urban heat islands. As cities and states begin adopting climate adaptation plans, understanding the role of land use in alleviating or aggravating heat impacts can help guide those plans.

1. Housing Policies

It is well documented that prior discriminatory housing policies, including redlining, restrictive covenants, and zoning, helped implement racial segregation, the effects of which are still observed today.[33] But more recently, researchers are finding that modern disparities in both heat vulnerability and air pollution, which can exacerbate heat impacts, correlate with the country's history of discriminatory housing policies.[34] Understanding how discriminatory housing policies shape cities' and communities' vulnerability to heat is important in determining what adaptation strategies will be effective.

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31. However, there is evidence that coastal communities are also susceptible to heat waves because fewer coastal households have air conditioning. *See* Rupa Basu & Bart D. Ostro, *A Multicounty Analysis Identifying the Populations Vulnerable to Mortality Associated with High Ambient Temperature in California*, 168 Am. J. Epidemiology 632, 636 (2008).

32. Voelkel et al., *supra* note 23, at 1.

33. *See, e.g.,* Richard Rothstein, The Color of Law (2017).

34. *See, e.g.,* Plumer & Popovich, *supra* note 7.

Urban heat island impacts can vary even within the same metropolitan area and they appear to be more pronounced in areas that were historically redlined. Researchers analyzed maps created by the Home Owners' Loan Corporation (HOLC) in the 1930s when it was charged with refinancing mortgages at low interest rates to prevent foreclosures during a recession. HOLC created color-coded residential maps of 239 US cities, ranking neighborhoods on a scale from best (A rating) to hazardous (D rating) in terms of the investment risk, with its rankings largely based on the neighborhood's racial makeup.[35] The areas with a D rating, were outlined in red, hence the term redlining. Those rankings ended up blocking Black and other people of color from receiving low-interest mortgages that white people were able to access. That led to wealth gaps, lower levels of homeownership, and disinvestment from predominantly Black and Latinx neighborhoods, effects that continue to persist today.[36]

The research team wanted to see whether those housing policies resulted in environmental disparities from a temperature standpoint. By comparing the HOLC maps with temperature data, the researchers found that in 94 percent of the 109 cities they analyzed, the formerly redlined neighborhoods were hotter than those that were not redlined.[37] In the aggregate, the D-rated areas are now, on average, 4.7 degrees F warmer than A-rated areas in the same city. The biggest discrepancy was seen in Portland, Oregon, where D-rated neighborhoods are on average 12.8 degrees F warmer. In Los Angeles, formerly redlined neighborhoods are 2.1 degrees F warmer than the average citywide temperature, while A-rated neighborhoods are 5.5 degrees F cooler than the average.[38]

The researchers noted that even as cities start to grapple with planning for climate change and adapting to a hotter world, "without further understanding about the historic and present-day drivers that generate these asphalt-rich and tree canopy-poor land uses on intra-urban heat, and local communities, progress will be slow."[39]

Access to low interest mortgages is not the only reason for modern-day discrepancies. Taller buildings in city centers as compared to other neighborhoods play a role in temperature differences, for example. Regardless, the redlining policy, coupled with restrictive covenants and other discriminatory

35. Hoffman et al., *supra* note 7, at 2.

36. In L.A., for instance, white households have a median net worth of $355,000, while Mexican and Black households have median wealth of $3,500 and $4,000, respectively. Fed. Reserve Bank of S.F., The Color of Wealth in Los Angeles, 5 (2016) [*https://perma.cc/QZG5-Z8K7*].

37. Hoffman et al., *supra* note 7, at 9.

38. *Id.* at Table S1.

39. *Id.* at 10.

housing policies that were common for decades, spearheaded a cascading effect that has caused significant temperature differences within cities today.[40]

Discriminatory housing policies also correlate with disparate pollution impacts that further exacerbate heat. Researchers at the University of California, Berkeley applied the California Environmental Protection Agency's (CalEPA) CalEnviroScreen 3.0 tool, which analyzes pollution burdens, to track asthma-related emergency department visits in eight California cities: Fresno, Los Angeles, Oakland, Sacramento, San Diego, San Jose, San Francisco, and Stockton.[41] The team first analyzed the cities' demographics and compared them to the HOLC maps, finding that all of the cities still had high segregation rates, with Black and Latinx individuals disproportionately living in formerly redlined neighborhoods. Those neighborhoods had elevated levels of diesel-related air pollution, and rates of asthma ER visits were two to four times higher compared to non-redlined neighborhoods.[42] Those communities will be particularly vulnerable to a warmer future, as heat can aggravate respiratory conditions like asthma and intensify the effects of air pollution. What's more, the type of air pollution observed, diesel particulate matter, is predominately due to trucks on freeways. Locations close to freeways are also often associated with urban heat islands due to the large amounts of concrete and reduced tree canopy and green space. This demonstrates how intertwined land use policies can build upon one another.

These studies illustrate the connection between discriminatory housing policies and current vulnerabilities to heat. Understanding this connection is important for understanding what solutions will be effective. Of course, as mentioned above, housing is also related to transportation, and so it is necessary to further consider the relationship between transportation and heat vulnerability.

2. Transportation Policies

Transportation and transportation infrastructure relate to heat various ways. Transportation infrastructure, such as freeways, increases the urban heat island effect by adding to the amount of heat-absorbing pavement present in a city. Cars themselves are sources of heat and emit pollutants that contribute to ozone and smog, which in turn are worsened in hotter temperatures. And, transportation policies ensured that freeways were predominantly built in Black and Latinx communites in Los Angeles, but not white neighborhoods.

40. *See* Marlene Cimons, *How Redlining Makes Communities of Color More at Risk of Deadly Heatwaves*, PBS (Jan. 23, 2020), https://www.pbs.org/wnet/peril-and-promise/2020/01/redlined-neighborhoods [https://perma.cc/XXD5-BTBE].

41. Anthony Nardone et al., *Associations Between Historical Residential Redlining and Current Age-Adjusted Rates of Emergency Department Visits Due to Asthma Across Eight Cities in California: An Ecological Study*, 4 Lancet Planetary Health e24, e24 (2020).

42. *Id.* at e25.

Thus, those communities are disproportionately burdened by both freeway air pollution and the heat caused by freeways.

In Southern California, cars are responsible for 63 percent of nitrogen oxides, pollutants that are precursors to ozone, which can cause respiratory problems and other health effects.[43] Exposure to those vehicle emissions is disproportionate throughout Los Angeles, with non-white children three to four times more likely than white children to live in areas with high-density traffic.[44] High-poverty areas in Southern California have twice the traffic density of wealthier areas and communities of color have 2.5 times the traffic density as white areas.[45]

These disparities are not just happenstance. Race played a role in the decision-making process for where to build freeways. During the 1940s and 1950s, state and local governments across the country sited interstate highways directly through Black communities.[46] Federally funded highway construction destroyed Black communities in Orlando, Florida; Spokane, Washington; and Minneapolis–St. Paul, Minnesota.[47]

City officials in Los Angeles routed the Santa Monica Freeway directly through the affluent Black community of Sugar Hill.[48] The freeway destroyed homes and neighborhoods, displaced residents, and served as a dividing line in Santa Monica between the whiter neighborhoods to the north and the communities of color to the south.

Freeway projects in East L.A. tore through Mexican communities in Boyle Heights.[49] Today, four freeways intersect in Boyle Heights, and freeways now account for at least 19 percent of East L.A.'s land use.[50]

Freeway building and widening plans often went hand in hand with discriminatory restrictions on housing. As Los Angeles cleared 210 families in East L.A. and destroyed an elementary school to make way for the I-5 Santa Ana Freeway, surrounding neighborhood groups, including the Los Feliz Improvement Association and the University District Property Owners

43. Douglas Houston et al., *Structural Disparities of Urban Traffic in Southern California: Implications for Vehicle-Related Air Pollution Exposure in Minority and High-Poverty Neighborhoods*, 26 J. Urb. Affs. 565, 566 (2004).

44. *Id.* at 571.

45. *Id.* at 583.

46. Richard Rothstein, The Color of Law, 127–28 (2017).

47. Stephanie Gidigbi, *How Planes, Trains, and Automobiles Worsened America's Racial Divide*, Politico Mag. (June 26, 2020, 4:30 AM), https://www.politico.com/news/magazine/2020/06/26/the-racial-history-of-planes-trains-and-automobiles-340285 [https://perma.cc/QS9Y-UWJU]. *See also* Kristina Costa et al., *When Communities Didn't Have a Say: How Federal Infrastructure Dollars Were Used to Bulldoze Communities of Color*, Ctr. for Am. Progress (Apr. 24, 2018, 9:02 AM), https://www.americanprogress.org/issues/green/reports/2018/04/24/449961/communities-didnt-say [https://perma.cc/7B9Y-JQGN].

48. Rothstein, *supra* note 46, at 130–31.

49. Gilbert Estrada, *If You Build It, They Will Move: The Los Angeles Freeway System and the Displacement of Mexican East Los Angeles, 1944–1972*, 87 S. Cal. Q. 287, 294 (2005).

50. *Id.* at 289–90.

Association, established restrictions to prevent displaced families of color from moving into the adjacent predominantly white neighborhoods that were not being demolished by freeways.[51]

Destructive freeway building and widening are not relics of the past. The practices continue to this day, and East L.A. communities are still on the front-lines of those fights. In 2018, Caltrans scrapped a decades-long plan to extend the 710 freeway from the ports of L.A. and Long Beach through the East L.A. cities of El Sereno, Alhambra, and Pasadena.[52] Homes in El Sereno that were in the path of the proposed extension still remain at the center of community activism. Caltrans bought with taxpayer money, and, in some cases, used eminent domain to acquire more than 400 homes, many of which remain empty today.[53] Late last year, in response to the combined disasters of a housing crisis and global pandemic, houseless activists occupied some of the homes, seeking to force officials to house people in the vacant homes.[54]

In addition, L.A. Metro aims to widen a freeway that would destroy nearly 200 homes in Downey, a city southeast of downtown L.A., where around 72 percent of the population identifies as Latinx.[55]

At the same time, the communities burdened by freeways are less likely to benefit from them. While communities of color in Southern California have more traffic and roadways, 86 percent of households in those neighborhoods have a car, compared to 95 percent in predominantly white neighborhoods.[56] When looking at socio-economic status, the disparity is even stronger, with just 66 percent of households in low-income neighborhoods having a vehicle, compared to 96 percent of households in areas that are not low-income.[57]

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51. *Id.* at 295.

52. Carol Cormaci & Laura J. Nelson, *Caltrans Effectively Kills 710 Freeway Extension After Decades-long Battle*, L.A. Times (Nov. 29, 2018, 5:45 AM), https://www.latimes.com/local/lanow/la-me-ln-710-fwy-extension-alternative-20181129-story.html *[https://perma.cc/BW64-UVNA]*. For a timeline of the project, *see* Laura J. Nelson, *The Epic and Ugly Battle Over What to do About the 710 Freeway*, L.A. Times (May 24, 2017, 6:05 AM), https://www.latimes.com/local/california/la-me-ln-710-freeway-history-20170524-htmlstory.html [https://perma.cc/W3PA-Y7KV].

53. Liam Dillon, *Activists Wield Bolt Cutters in a Tense L.A. Neighborhood as Poor Families Seize Empty Homes*, L.A. Times (Dec. 23, 2020, 6:00 AM), https://www.latimes.com/homeless-housing/story/2020–12–23/la-homeless-house-seizures *[https://perma.cc/K3FF-REGE]*; Donovan McCray, *Activists Issue Demands for Vacant Caltrans Houses*, Pasadena Now (Dec. 1, 2020, 12:07 PM), https://www.pasadenanow.com/main/activists-issue-demands-for-vacant-houses [https://perma.cc/STL8–6AYN].

54. Elina Shatkin, *CHP Removes Activists from Empty El Sereno Homes Owned by Caltrans*, LAist (Nov. 26, 2020, 1:00 PM), https://laist.com/2020/11/26/chp_removes_activists_from_empty_el_sereno_homes_owned_by_caltrans.php *[https://perma.cc/JJM9-DDJP]*; Dillon, *supra* note 53.

55. L.A. Cnty. Dep't of Pub. Health, City and Community Health Profiles: Downey 1 (2018) [https://perma.cc/3GQR-53YM].

56. Houston, *supra* note 43, at 583.

57. *Id.*

Transportation access is an important component of heat adaptation strategies because around 30 percent of households in the L.A. region lack air conditioning and will need to rely on transportation to get to cooling centers during heat waves.[58]

Black, Latinx, and Native American individuals in L.A. are the most likely to rely on public transportation.[59] However, many have criticized L.A.'s public transit system as focusing too heavily on building expensive light rails between predominantly white suburbs and downtown, at the expense of improving bus services in areas where ridership is the highest. As researchers at the University of Southern California note, a number of stakeholders did not support a 2016 transportation bond measure (that ultimately passed) because the measure included no assurances that the funding would improve equity.[60]

Transportation policies continue to contribute to disproportionate heat impacts. Freeways were and continue to be sited through communities of color, destroying homes, disrupting neighborhood connectivity, and increasing air pollution and urban heat island effects. Public transit has so far fallen short in improving equity, but has the potential to provide important links between peoples' homes and work. Public transit can also enable people to access cooler locations like mountains, beaches, and parks, which I will address in the following Part.

3. Access to Parks and Open Space

Parks and open spaces can have cooling effects on ambient temperatures and can also provide a shady respite on a hot day. Fewer parks and open spaces in a city contribute to the urban heat island effect. Park access also intersects with obesity and other health conditions that make one more vulnerable to extreme heat, although I will not address this connection.[61]

In Los Angeles, access to parks and open spaces is inequitably distributed. A 2016 assessment found that more than half of L.A. County was "park poor," with 82 percent of park-poor areas located in communities of color.[62]

58. Mo Chen et al., *A New Method Utilizing Smart Meter Data for Identifying the Existence of Air Conditioning in Residential Homes*, 14 Env't Rscj. Letters 1 (2019), https://iopscience.iop.org/article/10.1088/1748–9326/ab35a8/pdf [https://perma.cc/2PQ6-NLHU].

59. PolicyLink & Program for Env't & Reg'l Equity at Univ. of S. Cal., *supra* note 9, at 70.

60. Vanessa Carter et al., Univ. of S. Cal. Dornsife Program for Env't & Reg'l Equity, Measures Matter: Ensuring Equitable Implementation of Los Angeles County Measures M & A 25 (2018) [https://perma.cc/M3FD-GT75].

61. Robert García, Ctr. for L. in the Pub. Int., Equal Justice, Democracy & Livability: Lessons from the Urban Park Movement 3 (2006) [https://perma.cc/2BR7-RJKX].

62. Anisha Hingorani, *LA County Park Equity Groups Fight to Turn Park-Poor Communities 'Red to Green,'* Advancement Project Cal. (Jan. 22, 2019), https://www.advancementprojectca.org/blog/la-county-park-equity-groups-fight-to-turn-park-poor-communities-red-to-green [https://perma.cc/P8GZ-K5LF].

On average, across L.A. county, there were 3.3 acres of park land per 1,000 residents and less than half of residents lived within one-half mile of a park. L.A. County's park space per capita is less than half of what it is in other U.S. cities.

A 2005 Los Angeles City park assessment found that in neighborhoods that were more than three-fourths Black, park availability was 1.7 acres per 1,000 residents.[63] Predominantly Latinx neighborhoods had 0.6 park acres per 1,000 residents, and park availability dropped to 0.3 acres per 1,000 residents in predominantly Asian-Pacific Islander neighborhoods.[64] Meanwhile, predominantly white neighborhoods boasted 31.8 park acres per 1,000 residents.[65] What's more, just 29 percent of the city's population lived within a quarter mile of a park.[66]

Access to open spaces, including the Santa Monica Mountains, the Angeles National Forest, and the beach, is also disproportionate. The neighborhoods surrounding the Santa Monica Mountains tend to be low density and predominantly white, which limits easy access to the mountains for many. Only about 1 percent of visitors to the Angeles National Forest are Black despite Black individuals making up 10 percent of the regional population.[67]

The issue of disproportionate access to open spaces is interrelated with socioeconomics, and housing and transportation policies.[68] "The same children who do not have access to parks and schools in their neighborhoods lack access to cars and a decent transit system to reach parks and school fields in other neighborhoods."[69]

Socio-economic status plays a role in who can live near the beach or the mountains, yet the issues of access go beyond wealth. Discriminatory housing policies, in conjunction with freeway building, ensured that low-income households and people of color would not be able to access the suburban neighborhoods closer to the mountains, or the wealthy beach enclaves like Malibu.

Manhattan Beach, a wealthy coastal city in southwestern L.A., was once home to a thriving Black community centered around a popular beach resort and dance hall owned by Willa Bruce. Other Black families bought property in the area in the early 1900s, but soon, white neighbors began to harass the Bruces and other families. In 1924, city officials condemned the neighborhood

63. Jennifer Wolch et al., *Parks and Park Funding in Los Angeles: An Equity-Mapping Analysis*, 26 Urb. Geography, May 2013, at 4, 17 [https://perma.cc/NKA8-RQWW].

64. *Id.*

65. *Id.*

66. *Id.*

67. García, *supra* note 61, at 4.

68. The initial vision of L.A. as a low-density city of single-family homes with private yards is part of what led to fewer city parks, and even when developers built denser, multi-family units in central neighborhoods, very little land was designated for public park space. Wolch, *supra* note 63, at 4.

69. García, *supra* note 61, at 4.

and seized more than two dozen properties through eminent domain.[70] Today, less than 1 percent of Manhattan Beach's residents identify as Black.[71]

In the 1980s, white, affluent communities in L.A. lobbied the Southern California Rapid Transit District to end direct bus service to the beach from South Central L.A.[72] The Expo light-rail line in L.A., which travels from downtown L.A., through South L.A. neighborhoods, and into Santa Monica, stops short of the beach. It drops off riders about a half-mile from the coast, where they must then navigate to one of the handful of pedestrian bridges that cross Highway 1, a busy six-lane thoroughfare.

Currently, no public transit takes would-be visitors to Angeles National Forest, which is less than an hour's drive from downtown L.A. For just one month in 2016, a pilot program sponsored by the Angeles National Forest and funded through a one-time grant ran shuttles from the Gold Line light rail stop in Arcadia, to a popular trailhead at Chantry Flat.[73] A second shuttle service between the Gold Line station at Duarte to the trailhead at Fish Canyon ran on the weekends between April and June 2016, but ended due to a fire.[74]

Proximity to the beach and surrounding mountains are huge assets in the face of a hotter climate, since summer temperatures at the coast and in the higher elevations of the Angeles National Forest are significantly cooler than in downtown L.A. But, those most vulnerable to heat are currently not benefitting from this proximity. There are few public transit options to the mountains and the coast and lower car ownership rates among those most vulnerable to heat. Those with the greatest access tend to be higher income and predominantly white.

Discriminatory land use policies related to housing, transportation, and parks and open space have contributed to disparities in vulnerability to the heat impacts of climate change. In Los Angeles, the neighborhoods that are already hotter than average are neighborhoods whose residents are predominantly people of color. Understanding these disparities and the role that land use policies played in creating those disparities is important for designing solutions to adapt to a hotter world, otherwise we risk further exacerbating the problems.

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70. Rosanna Xia, *Manhattan Beach was Once Home to Black Beachgoers, but the City Ran Them Out. Now it Faces a Reckoning*, L.A. Times (Aug. 2, 2020, 6:00 AM), https://www.latimes.com/california/story/2020–08–02/bruces-beach-manhattan-beach [https://perma.cc/2ZEJ-TDNS].

71. U.S. Dep't of Com., *QuickFacts: Manhattan Beach City, California*, U.S. Census Bureau, https://www.census.gov/quickfacts/fact/table/manhattanbeachcitycalifornia/RHI125219 [https://perma.cc/HA2C-MEKT] (last visited Apr. 10, 2021).

72. Robert García & Erica Flores Baltodano, *Free the Beach! Public Access, Equal Justice, and the California Coast*, 2 Stan. J. Civ. Rts. & Civ. Liberties, 143, 165 (2005).

73. L.A. Metro, Transit to Parks Strategic Plan 1228 (2019) [https://perma.cc/8E9C-Z993].

74. *Id.* at 127.

II. Equitably Adapting to a Hotter World

In order to develop adaptation policies that will address the heat-related disparities described in Part I, it is important to understand what equitable adaptation means. In Part II, I first describe some principles of equitable adaptation. Next, I discuss how equitable adaptation relates specifically to land use policies. Understanding what equitable adaptation is will be important for designing policies that alleviate the current disparities in vulnerability to climate change.

A. *What is Equitable Adaptation?*

Scholars have considered that our solutions to climate change adaptation risk exacerbating social inequity. That is why, when designing solutions, it is important to consider the impact a solution would have on equity. Scholars have developed several frameworks for understanding and evaluating how adaptation can succeed or fail at promoting equity.

For heat impacts, in particular, it will be important to pay attention to structural racism in our housing patterns, the design of our transportation system, and inequitable distribution of and access to parks and open spaces.

Understanding how past land use policies have contributed to existing disparities in climate change vulnerability is important for thinking about and designing solutions to mitigate and adapt to climate change in a way that does not further aggravate those disparities. But first, we must understand what equitable adaptation means. Alice Kaswan has described seven principles of equitable adaptation: (1) the government must play a role—solutions cannot be left to individuals or the market; (2) adaptation measures should address demographics and be targeted to serve the most vulnerable; (3) communication needs to be culturally sensitive and accessible; (4) the process should be participatory; (5) non-climate environmental stresses, like stormwater management and hazardous waste disposal, need to be considered; (6) policy makers should consider the interaction between mitigation and adaptation; and (7) policies should be cross-disciplinary and comprehensive, rather than siloed and piecemeal.[75]

This is a good jumping off point when thinking about how cities can adapt to heat, but it is also important to keep in mind the injustices that led to the disproportionate impacts of heat that are already seen today. If the government is to play a large role in equitable adaptation, as it should, then the government also needs to acknowledge its role in creating the disparity; otherwise, the solution could lead to an unjust adaptation plan.

Beverly Wright and Earthea Nance describe such an unjust governmental climate response in the aftermath of Hurricane Katrina.[76] Prior to

75. Alice Kaswan, *Seven Principles for Equitable Adaptation*, 13 Sustainable Dev. L. & Pol'y 41, 42–45 (2012).

76. Beverly Wright & Earthea Nance, *Toward Equity: Prioritizing Vulnerable*

Katrina, decades of "discriminatory public policies had created a concentration of racialized poverty" in New Orleans.[77] In 2000, the median household income for Black residents was half that of white residents. Nearly half of Black men were unemployed compared to less than one third of white men, and 41 percent of Black households owned their home compared to 56 percent of white households.[78] Katrina disproportionately impacted low-income households and communities of color, flooding thirty-eight of the region's forty-nine low-income neighborhoods.

Nevertheless, the recovery efforts focused disproportionately on wealthier, whiter neighborhoods. Ten months after Katrina, 80 percent of New Orleans' public housing remained closed. The federal government ultimately razed 4,500 public housing apartment units and replaced them with mixed-income developments, which included only a fraction of the public housing units formerly available.[79] A post-Katrina recovery plan allocated $208 million in redevelopment funds to four predominantly white planning districts and $204 million to eight predominantly Black planning districts.[80]

The federal government played a large role in the Katrina recovery, yet it was far from equitable. Thus, while the government will likely have an important role to play in climate adaptation strategies, it is critical that its role come with the other principles of equitable adaptation that Kaswan describes, and also that it come with a recognition of its own complicity in setting the stage for a climate disaster that will disproportionately affect communities of color, low-income households, and other vulnerable groups.

B. *Understanding the Impacts of Discriminatory Land Use Policies is Critical for Equitable Adaptation*

Robert Verchick wrote that it is important to distinguish between "misfortunes" and "injustice."[81] So-called "natural" disasters, like Katrina, can often be more accurately labeled injustices, which "can follow not only from bad intent and recklessness, but also from more ambiguous behavior, such as

Communities in Climate Change, 4 Duke F. For L. & Soc. Change 1, 7–9 (2012).

77. *Id.* at 7–8.

78. *Id.* at 8–9.

79. Before Katrina, the Housing Authority of New Orleans served 14,129 families, 5,148 of whom lived in public housing. After Katrina, the number of families who qualified for housing assistance grew to 19,175, but after demolishing the large public housing buildings, only 1,820 of those families lived in public housing, while the remainder received housing vouchers. Richard A. Webster, *New Orleans Public Housing Remade After Katrina. Is it Working?* NOLA.com (last updated July 18, 2019, 1:55 PM), https://www.nola.com/news/article_833cc3f5–2d6d-5edc-bc0f-ecd55ead7026.html [https://perma.cc/R3XQ-QLSD]. *See* Roberta Brandes Gratz, *Who Killed Public Housing in New Orleans?* The Nation (June 2, 2015), https://www.thenation.com/article/archive/requiem-bricks [https://perma.cc/4VGA-A6VY].

80. Wright & Nance, *supra* note 76, at 13.

81. Robert R.M. Verchick, *Disaster Justice: The Geography of Human Capability*, 23 Duke Env't L. & Pol'y F. 23, 27–28 (2012).

a government's failure to address an inequality or a foreseeable danger."[82] Verchick argues that the government's failure to address the underlying inequalities in New Orleans *before* Katrina hit led to the disproportionate impacts on lower-income and communities of color, which were compounded by the government's response.[83]

Similarly, in the face of climate change and the disproportionate impacts of extreme heat, if structural inequities are not addressed, then adaptation measures will be inequitable. It is also important to go further than Verchick and recognize that with regard to climate change, the inequities were the result of more than just a failure to address. Affirmative decisions restricted where people could live, determined exposures to pollution and vulnerability to heat, and limited access to parks and open space.

Another way of thinking about equitable adaptation is through Maxine Burkett's framework of climate reparations.[84] Climate reparations would involve a participatory process in which both those most responsible for emissions and those bearing the impacts of emissions collaborate on solutions.[85] The reparations framework would be both backward-looking—seeking to correct for past harms—and forward-looking—aiming to improve lives into the future.[86]

Burkett describes climate reparations on a global scale, but the framework could be implemented at the local level when thinking about how to equitably adapt to the heat impacts of climate change. A reparations framework would require the federal and local government to reckon with their complicity in creating inequitable cities. Such recogonition would help to avoid further disenfranchising vulnerable communities and help in designing equitable adaptation policies.

The forward-looking aspect of Burkett's climate reparations model is particularly important when considering how past discriminatory land use policies result in disparate heat impacts and reduce communities' abilities to withstand increased temperatures. "Forward-looking relief recognizes that past harm has current and continuing effect," which allows for "greater flexibility in choosing the type and size of the remedy, and is the best way to tailor a reparations program to the nature of the harm."[87]

The principles described by Kaswan, Verchick, and Burkett are all helpful for thinking about how to design equitable adaptation policies. The frameworks share some common elements—solutions should be participatory and address vulnerabilities. The checklist that Kaswan provides is particular helpful for evaluating specific policies, while the reparations framework described by Burkett both builds in accountability for past wrongs and also looks toward

82. *Id.* at 28.
83. *Id.* at 42–44.
84. Maxine Burkett, *Climate Reparations*, 10 Melbourne J. Int'l L. 509 (2009).
85. *Id.* at 522.
86. *Id.*
87. *Id.* at 523.

the future. In the next Part I will look at how these equitable adaptation principles can be applied to Los Angeles and its plans for addressing climate change.

III. Applying an Equitable Adaptation Strategy for Heat Impacts to Los Angeles

In this Part, I use the equitable adaptation principles described above to look at how they can be applied to Los Angeles. In 2020, Los Angeles County recorded its highest ever temperature of 121 degrees F over Labor Day weekend and its hottest ever month of September.[88] Those heat records were set amidst California's worst ever fire season, with more than 4.2 million acres burned.[89] Just a month after those record-breaking temperatures, Los Angeles was hit with another heat wave in October.

Los Angeles is only predicted to get hotter. By mid-century, average temperatures in L.A. are predicted to rise by 3 to 7 degrees F, with some cities in L.A. County experiencing five to six times the number of extreme heat days.[90]

Already, in L.A., all-cause mortality increases 8 percent during the hottest days. And when there are consecutive days of extreme heat, mortality rates increase as much as 30 percent.[91]

Increased heat and increased heat-related mortality will continue to rise and will disproportionately impact the most vulnerable communities. Researchers predict that under a business-as-usual scenario, neighborhoods near downtown L.A. will experience an average of 54 extreme heat days by the end of century, while communities closer to the coast will experience an average of three extreme heat days per year. Currently, downtown L.A. has an average of six extreme heat days per year. Even if emissions are reduced, extreme heat days in downtown L.A. are expected to more than double to fifteen.[92]

A. *Los Angeles' Existing Plans to Adapt to Heat*

Before applying the principles of equitable adaptation to Los Angeles, it is important to first look at Los Angeles' current plans. The city, county, and the state have all passed legislation and/or plans aimed at adapting to climate change. In Los Angeles, the mayor's office released L.A.'s Green New Deal in 2019, which includes as goals a 100 percent electric bus fleet by 2030; the

88. Matthew Fuhrman, *Los Angeles County Records its Highest Temperature on Record*, ABC News (Sept. 7, 2020), https://abc7ny.com/los-angeles-records-citys-highest-temperature-ever-on-record/6412050/#:~:text=Temperatures%20in%20one%20part%20of,with%20a%20dangerous%20heat%20wave [https://perma.cc/AH9X-9XP8].

89. CalFire, https://www.fire.ca.gov/incidents/2020/.

90. Edith de Guzman et al.,Rx for Hot Cities: Climate Resilience Through Urban Greening and Cooling in Los Angeles 4 (2020) [https://perma.cc/EL8X-RF8F].

91. *Id.*

92. Fengpeng Sun, Daniel B. Walton, & Alex Hall, *A Hybrid Dynamical-Statistical Downscaling Technique. Part II: End-of-Century Warming Projections Predict a New Climate State in the Los Angeles Region*, 28 J. Climate 4618, 4629 (2015).

planting of 90,000 trees by 2021; the creation of 400,000 green new jobs by 2050; and the attainment 100 percent renewable energy by 2045.[93] The L.A. County Chief Sustainability Office, meanwhile, has published a county-wide sustainability plan that includes among its goals conducting a countywide climate vulnerability assessment. The assessment will be used to guide priorities in preparing for heat impacts of climate change, including developing a heat island mitigation strategy.[94]

Related to heat, specifically, L.A.'s Green New Deal had a 2020 goal for all new roofs to be cool roofs, defined as a roof that reflects heat or one that includes greenery, and 18,000 additional cool roofs to be installed by 2021.[95] In addition, between 2021 and 2025, it aims to develop pilot projects in six neighborhoods that include a mix of cool roofs; cool pavements, which have reflective or porous properties; and additional greening. By 2028, the plan calls for cool pavement on 250 lane miles of city streets, prioritizing those where the urban heat island effect is greatest. The city is also collaborating with the Los Angeles Urban Cooling Collaborative to identify the locations where increasing tree canopy and changing landcover will yield the most bang for the buck in reducing heat-related illness.[96] The city's goal is that these cooling projects will decrease the temperature gap between rural and urban areas by at least 1.7 degrees F by 2025 and by 3 degrees F by 2035. As of 2012, the urban-rural temperature differential in Los Angeles was 5.58 degrees F.[97]

In addition, the plan calls for the planting of 90,000 trees in the city by 2021, which, when the trees reach maturity, are projected to provide 61.3 million square feet of shade. The city plans to target the areas in greatest need of shade in order to increase tree canopy in those areas by 50 percent by 2028.[98]

Los Angeles intends to increase urban greenery by restoring portions of the Los Angeles River, which winds a 51-mile-long path from western San Fernando Valley, around Griffith Park and then heads south all the way to Long Beach. It also includes in its plan a goal for 65 percent of Angelenos to live within one-half mile of a park or open space by 2025 and 100 percent by 2050.[99]

The L.A. Green New Deal includes a number of measures designed to promote equity, including prioritizing neighborhoods with the fewest number of trees for initial cool pavement and tree planting projects. It also includes provisions for non-climate environmental stressors—one of Kaswan's

93. Eric Garcetti, L.A.'s Green New Deal: Sustainable City Plan, 38, 83, 120, 130 (2019) [https://perma.cc/K9S8–9FF3].

94. L.A. Cnty. Chief Sustainability Off., OurCounty: Los Angeles Countywide Sustainability Plan 49–50 (2019) https://perma.cc/7CZM-CXE4].

95. Eric Garcetti, *supra* note 93, at 122.

96. *Id.* at 126.

97. *Id.* at 122.

98. *Id.* at 120.

99. *Id.* at 124; Emily Guerin, *LA Explained: The Los Angeles River*, LAist (June 22, 2018, 1:00 PM), https://laist.com/2018/06/22/la_explained_the_la_river.php [https://perma.cc/4YU2-GYUL].

principles for equitable adaptation—like plans for stormwater management and water recycling. Stormwater projects often include the use of permeable pavement and strategically placed landscaping that slows rushing rainwater. Such stormwater projects have dual benefits of improving water quality and helping with urban heat.

The L.A. County plan also seeks to address equity issues. The OurCounty Sustainability Plan, which aims to make communities healthier, more equitable, and economically stronger, acknowledges the role that redlining and discriminatory housing policies have played in disproportionately burdening communities with pollution and limited access to transit and parks. This is a key first step in developing a plan rooted in equity.[100] One of its strategies, the Green Zones Program, aims to develop land use tools to address environmental justice issues in neighborhoods that have been disproportionately impacted by exposure to pollution.[101]

The OurCounty Plan addresses access to parks and open space as well as transportation issues. Again, the plan acknowledges that disparities in park and open space access can be directly linked to discriminatory land use practices.[102] By 2025, the County aims to increase the proportion of residents living within half a mile of a park or open space to 65 percent, up from 49 percent as of 2018. It also plans to focus first on those areas in which park access is the lowest—those with less than 1 acre to 1.3 acres of park land per 1,000 residents.[103]

The OurCounty Plan also recognizes increased park space and greener neighborhoods can lead to gentrification and displacement. It includes as a main goal, "equitable and sustainable land use and development without displacement."[104] It notes that as of 2018, 11,439 affordable housing units were at risk of converting to market rate, and the plan suggests implementing tenant protection measures and small business protection measures to help avoid displacement.[105] The County aims to promote transit-oriented development by first creating an inventory of all County-owned lands near existing and future transit and then seeking opportunities for development.[106]

In addition, L.A. County has adopted a Climate Action Plan (CAP), which focuses on reducing greenhouse gas emissions in the unincorporated portions of L.A. County in order to become carbon neutral by 2045.[107] The CAP is primarily focused on actions to mitigate climate change by reducing emissions, rather than on adaptation. But, it includes a few measures specifically aimed

100. L.A. Cnty. Chief Sustainability Office, *supra* note 94, at 17.
101. *Id.* at 32.
102. *Id.* at 94.
103. *Id.* at 96–98.
104. *Id.* at 62.
105. *Id.* at 70–71.
106. *Id.* at 67.
107. Cnty. of L. A., Dep't of Reg'l Plan., Los Angeles County Climate Action Plan 6 (2020) [https://perma.cc/N6VD-KH76].

at reducing the impacts of heat, including implementing shade corridors along areas with high public transit use and designing and refurbishing parks with cool pavement and vegetation.[108]

Finally, state legislation, like Senate Bill 1000, requires that counties' and cities' general plans take into account climate adaptation and resilience strategies.[109] The bill also requires cities to include an environmental justice element, which would aim to reduce the unique health risks faced by vulnerable communities. Cities and counties should also identify strategies to encourage public participation, another key principle of equitable adaptation. Another state bill that focuses on conserving land and ocean resources, includes a provision on ensuring equitable access to nature.[110]

Overall, the L.A. Green New Deal, OurCounty Sustainability Plan, and CAP include ambitious goals and incorporate many of the principles of equitable adaptation. The OurCounty Sustainability Plan, in particular, acknowledges and seeks to address the legacies of exclusion, directly linking disparities in park access and pollution burdens to discriminatory housing and land use policies. By contrast, The L.A. Green New Deal does not acknowledge that many of the vulnerabilities to heat impacts of climate change can be traced directly to discriminatory housing, transportation, and other land use policies. Thus, while a good step, these plans can and should go further.

B. *Recommendations to Adapt More Equitably*

Acknowledging past harms is critical for ensuring that policies repair and prevent them in the future, according to Burkett. Similarly, as Verchick notes, naming something as an injustice, as opposed to a misfortune, better ensures that the problem will be remedied:

> As long as our failure to adequately address social vulnerability is seen as a misfortune, fixing the problem will be framed as one of the many things we should do to help needy people, but because of other priorities, never get around to doing. But if our failure to protect the vulnerable is an injustice—a breach of democracy's fundamental obligation to its citizens—the mission takes on an urgency that can be trumpeted in the press, agency planning sessions, and perhaps the courtroom.[111]

Naming something an injustice is simply the first step, and the naming alone does not ensure that the problem will be remedied. There must also be a political will to address the injustice. But, reckoning with legacies enables a holistic understanding of the problem, which can lead to comprehensive

108. *Id.* at 26, 54.

109. S.B. 1000, 2015–2016 Cal. Leg., Reg. Sess. (2016).

110. A.B. 3030, 2019–2020 Cal. Leg., Reg. Sess. (2020). *See also* Drevet Hunt & Damon Nagami, *California Seeks to Reduce Inequity in Nature*, NRDC Expert Blog (July 22, 2020), https://www.nrdc.org/experts/drevet-hunt/california-seeks-reduce-inequity-access-nature [https://perma.cc/6CXQ-HQWX].

111. Robert R.M. Verchick, *Disaster Justice: The Geography of Human Capability*, 23 Duke Env't L. & Pol'y F. 23, 52 (2012) [*https://perma.cc/3EUH-ZAZZ]*.

and intersectional solutions, a key pillar of equitable adaptation according to Kaswan. Just as the land use decisions around housing, transportation, and parks that led to the modern disproportionate heat impacts were all interrelated, the solutions must also be intertwined.

It is important to point out that there are many more related problems and solutions that are beyond the scope of this paper. Income and wealth disparity is a particularly pernicious problem that makes developing equitable land-use solutions challenging. Wage gaps persist to this day: the median hourly wage in L.A. County for Black workers is 74 percent that of white workers, and for Latinx workers, it is half that of white workers.[112] These disparities play a huge role in housing, particularly in an astronomically high cost-of-living city such as Los Angeles. Income determines where people can live, including whether they live close to parks and open spaces or next to a freeway.

In the following Part, I seek to apply the lessons of equitable adaptation to the land use issues (housing, transportation, and park access) that led to disparate heat vulnerability in L.A. in order to better understand what equitable solutions could look like. A number of organizations and researchers are already tackling these issues, and I have heavily drawn on their work. In addition, while the following policies embrace many of the principles of equitable adaptation, I recognize that even if they are implemented, there will still be ongoing challenges to ensuring they maintain proper funding and do not cause unanticipated adverse impacts. And, there will still be work to do to solve the underlying issues of income disparity and racial segregation and discrimination in L.A. But, focusing on land use is worthwhile since city planning agencies, local and state government officials, and legislation can significantly impact and guide land use decisions.

1. Target Green and Cooling Infrastructure in Hotter Neighborhoods that were Disproportionately Impacted by Discriminatory Housing Policies

As previously described, neighborhoods in Los Angeles that were redlined are already 2.1 degrees F hotter than non-redlined neighborhoods. Thus, land use changes that are known to be effective at reducing urban heat island effects, such as permeable pavement, increased tree canopy, and green or reflective roofs, should be targeted in those neighborhoods.

The Los Angeles Urban Cooling Collaborative (LAUCC) quantified how various combinations of increased solar reflectance on roofs and pavements and increased urban tree cover could reduce the number of extreme heat days in L.A. County.[113] Moreover, the group considered differences within neigh-

112. *See* Vanessa Carter et al., Univ. of S. Cal., Measures Matter: Ensuring Equitable Implementation of Los Angeles County Measures M & A 10 (2018) [https://perma.cc/M3FD-GT75].

113. Edith de Guzman et al, Rx for Hot Cities: Climate Resilience Through Urban Greening and Cooling in Los Angeles 1 (2020) [https://perma.cc/EL8X-RF8F].

borhoods from the perspective of socioeconomic status, ethnicity, population density, and the climate zone of the neighborhood. This holistic approach to the problem can help ensure that cooling strategies are implemented where they are most needed.

LAUCC also recognizes that assuming individuals will simply install air conditioning as the city gets hotter is an "inherently inequitable" solution that is both unavailable to many and "aggravates the problem by emitting climate-changing greenhouse gases."[114]

The collaborative found that tree canopies' cooling benefits increase exponentially for urban areas as the trees mature, making investing in planting more street trees a good long-term strategy.[115] The group also analyzed studies on the impact of urban structural improvements to increase solar reflectance of roofs, windows, walls, and pavements, finding that such changes could reduce average ambient temperatures by 0.54 degrees F per 0.10 increase in solar reflectance across the city. The collaborative developed a model that overlaid a combination of solar reflectance measures and tree canopy increases on historic heat waves to try to determine which combination of strategies would result in the greatest temperature decrease and reduction in mortality. In addition, they looked more granularly at specific communities, finding that lower-income communities, more densely populated communities, and communities of color were at the greatest risk during heat waves. Moreover, when the LAUCC's prescriptive approaches were implemented, they resulted in the most dramatic benefits in terms of temperature reductions and potential lives saved from heat-related mortality.[116] Overall, their model predicted that the benefits of implementing an aggressive urban cooling strategy could help delay the impacts of heat by fifty years.[117]

The LAUCC study embraces a key principle of equitable adaptation—addressing vulnerability. The researchers focused not on identifying the hottest areas, but on the most heat-vulnerable in the region, where their urban heat cooling strategies would make the biggest difference.[118]

2. Reckon with Freeway Construction's Racist Past and Prioritize Transit

Several environmental groups have criticized L.A.'s Green New Deal for not going far enough, particularly with regard to the lack of investment in public transit or focus on disincentivizing driving.[119] StreetsblogLA wrote that

114. *Id.* at 36.
115. *Id.* at 10.
116. *Id.* at 32.
117. *Id.* at 33.
118. *Id.* at 36.
119. Damien Newton, *Garcetti's Green New Deal for Los Angeles Under Attack for Being Too Car-Centric*, StreetsblogLA (Apr. 30, 2019), https://la.streetsblog.org/2019/04/30/garcettis-green-new-deal-for-los-angeles-under-attack-for-being-too-car-centric [*https://*

the plan failed to increase the city's bus network and the plan to install twenty new miles of bike lanes was a step backwards from the Bike Plan passed under the previous mayor's administration.[120]

Indeed, in 2020, the Los Angeles Metropolitan Transportation Authority (Metro) announced a $1.2 billion budget cut for fiscal year 2021, and reduced bus and rail service by 20 percent, through June 2021.[121] Directors had approved a temporary 20 percent service cut in April 2019 as ridership fell due to the stay-at-home order amidst the coronavirus pandemic, but September's vote made those service cuts permanent for nearly one year.[122] In addition, the agency scaled back plans to add new rail lines.[123]

At the same time, Metro has continued to move forward with freeway-widening plans in southeast L.A. that would potentially demolish more than 200 homes in the predominantly Latinx city of Downey.[124] Downey is already hemmed in on all four sides by freeways, and Metro's plans would push those freeways even closer to homes. Plans to widen freeways are inconsistent with any climate adaptation policy and are particularly anathema to equitable adaptation. Freeways contribute to urban heat, both in their structure and in their use—heat trapping pavement combined with increased car traffic means increased emissions, which creates smog and heat. The combination of emissions, heat, and sun create a feedback loop that worsens smog pollution and the respiratory, cardiovascular, and cognitive problems associated with smog.[125] Given the racist history of freeway construction in Los Angeles, as described in Part II,[126] any equitable heat adaptation plan cannot allow for continued expansion of freeways through neighborhoods. Instead, a transportation plan should focus on expanding access to public transit.

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perma.cc/77RR-GSRS].

120. *Id.*

121. Laura J. Nelson, *L.A. Metro Cuts Budget by $1.2 Billion, Locking in Steep Reductions to Bus, Rail Service*, L.A. Times, Sept. 24, 2020, https://www.latimes.com/california/story/2020–09–24/metro-bus-train-service-cuts-coronavirus-pandemic-budget [*https://perma.cc/YA8B-MMD6*].

122. *Id.*

123. *Id.*

124. Joe Linton, *Metro Plans to Take Out 200+ Downey Homes to Widen 5 and 605 Freeways*, StreetsblogLA (Oct. 2, 2020), https://la.streetsblog.org/2020/10/02/metro-plans-to-take-out-200-downey-homes-to-widen-5-and-605-freeways [*https://perma.cc/CWC2-GRR5*].

125. Downey is also plagued by the related problems of having little greenspace and higher than average rates of childhood asthma. Eight percent of children aged 17 or younger diagnosed with asthma, and it is in the bottom half of the California Healthy Places Index. L. A. Cty. Dep't of Pub. Health, Cty. and Cmty. Health Profiles: Downey 14, 25 (2018) [*https://perma.cc/FX5B-UVB5*].

126. *See also*, Matthew Fleischer, Opinion, *Want to Tear Down Insidious Monuments to Racism and Segregation? Bulldoze L.A. Freeways*, L.A. Times, June 24, 2020, https://www.latimes.com/opinion/story/2020–06–24/bulldoze-la-freeways-racism-monument *[https://perma.cc/7MKV-4PCH*].

Expanding public transit fits within Kaswan's equitable adaptation principle of addressing vulnerability. "To achieve equitable adaptation, adaptation policies must explicitly address the demographics of affected populations and target interventions to address the needs of the most vulnerable."[127] As previously discussed, Black, Native American, and Latinx individuals are more likely to bear the brunt of freeway emissions pollution, least likely to benefit from proximity to freeways, and most likely to rely on public transit.[128]

However, not all public transit in L.A. is created equally. As researchers at the University of Southern California (USC) note, a number of stakeholders did not support a 2016 transportation bond measure (Measure M) because the measure included no assurances that the funding would improve equity.[129] Transit advocates worried Measure M would repeat what they saw as the inequitable transit infrastructure funding previously noted, which focuses on light-rail at the expense of bus service, benefitting predominantly suburban commuters and furthering inequity.[130] The USC researchers recommend that equity guidelines be tied to all public investments and that Metro incorporate equity guidelines into its Multi-year Subregional Program to ensure that Measure M funding will advance equity.[131]

Developing an equitable transportation policy may be the biggest hurdle for car-centric Los Angeles. L.A.'s ever-clogged freeways have been rightfully described as racist monuments.[132] While L.A. is likely still a long ways from tearing down such monuments, at the very least officials must stop expanding the freeways at the expense of neighboring communities' homes and health. Funding should instead be prioritized for equitable public transit projects like expanding bus services.

3. Reduce Park and Open Space Access Disparities While Preventing Displacement

Park access in L.A. has been a concern since at least the 1930s. In the 1930s, a report by an architecture firm recognized that public beach access was

127. Alice Kaswan, *Seven Principles for Equitable Adaptation*, 13 Univ. Wash. Coll. of L. Sustainable Dev. L. & Pol'y 41, 43 (2013) [*https://perma.cc/6YML-CCY8*].

128. The city does aim to have an all-electric bus fleet, which will reduce diesel particulate emissions, a particularly harmful air pollutant, the effects of which are exacerbated by heat and borne disproportionately by low-income and communities of color. Monica Anderson, *Who Relies on Public Transit in the U.S.*, Pew Research Center, (Apr. 7, 2016), https://www.pewresearch.org/fact-tank/2016/04/07/who-relies-on-public-transit-in-the-u-s. [https://perma.cc/PYT2-KWNR]; *Disparities in the Impact of Air Pollution*, American Lung Association, https://www.lung.org/clean-air/outdoors/who-is-at-risk/disparities (last visited Apr. 9, 2021). [https://perma.cc/WS3Y-PYQL].

129. Vanessa Carter et al., Univ. of S. Cal., Measures Matter: Ensuring Equitable Implementation of Los Angeles County Measures M & A, 25 (2018) [https://perma.cc/M3FD-GT75].

130. *Id.*

131. *Id.* at 34.

132. Fleischer, *supra* note 126.

"one of the prime needs" of the L.A. region.[133] The report called for a doubling of public beach frontage. It laid out a vision for L.A. in which 71,000 acres were dedicated to public parks, with another 91,000 acres in the areas surrounding L.A. The report was never implemented, and the lofty goals succumbed instead to private interests, which ultimately led to the continued park disparities seen today.

Parks are important for climate change adaptation. Trees provide shade and help cool the air through evapotranspiration, a process of evaporation and the release of water from trees. Urban trees can contribute up to an 11-degree F decrease in park air temperatures.[134] Shade is particularly helpful in reducing air temperatures, and in a city like L.A., which has 284 days of sun per year, more trees can be particularly helpful at reducing air temperatures.

The development of Los Angeles State Historic Park (also known as Cornfield Park) is one that is often thought of as equitable park development, in part because the process of developing the park was a community-driven, participatory process—checking one of Kaswan's boxes.[135] The site, a former railroad yard north of Chinatown, was originally slated to be turned into an industrial warehouse project with $80 million in federal subsidies. But a diverse coalition highlighted the history of discriminatory land use planning in the area and disparities in park funding, filed an administrative complaint that successfully cut off the federal subsidies for the warehouse, and ultimately spearheaded the development of the park.[136]

An equitable strategy to address park and open space disparities would not only aim to include more parks in neighborhoods that are considered park-poor, but would also look holistically at the problem. For instance, lack of parks often correlates with lower-income neighborhoods, and simply increasing the number of parks to address disparities without also implementing strategies to prevent displacement would defeat the purpose.

Climate adaptation strategies like increasing parks and open spaces in cities can lead to displacement and gentrification.[137] The nonprofit EcoAdapt

133. Robert García & Erica Flores Baltodano, *Free the Beach! Public Access, Equal Justice, and the California Coast*, 2 Stanford J. C.R. & C.L., 143, 147 (2005) [https://perma.cc/2BR7-RJKX].

134. Edith de Guzman et al., Rx for Hot Cities: Climate Resilience Through Urban Greening and Cooling in Los Angeles 10 (2020) [https://perma.cc/EL8X-RF8F].

135. *See* Kaswan, *supra* note 127, at 43. But, the reality is of course much more complex. The park was closed for renovations in 2014, but the discovery of contaminants at the site delayed its reopening for three years, highlighting another environmental justice issue of dealing with contaminated land. See Eddie Kim, Soil Contamination Delays Renovation at Los Angeles State Historic Park, L.A. Downtown News (Jan. 14, 2015), http://www.ladowntownnews.com/news/soil-contamination-delays-renovation-at-los-angeles-state-historic-park/article_0b972436–9c12–11e4-a315–9f8a303a5a22.html [https://perma.cc/P7PE-UJ5J].

136. García & Flores Baltodano, *supra* note 133, 4–6.

137. Daniel Cusick, *Resilience Can Harm Vulnerable Communities – Report*,

and the University of California, Berkeley's Urban Displacement Project have found that failing to balance climate adaptation measures with a focus on affordable housing and housing security can result in displacement.[138] Anti-displacement must be a core principle of any equitable adaptation plan. Applying this to Burkett's climate reparations theory, Los Angeles must reckon with its past discriminatory housing and planning policies that led to communities of color being disproportionately at risk to extreme heat from climate change. An equitable adaptation plan must repair those past harms by focusing adaptation on those communities. But, it must also be forward-looking, meaning that the solution must equip those same communities to thrive in the future. A plan that does nothing to ensure that the individuals living there today are able to continue living there is not equitable.

While L.A.'s Green New Deal does include anti-displacement as a goal, it is short on specifics for how to accomplish that. The OurCounty Sustainability Plan, meanwhile, does include specific plans for combatting displacement, including implementing stronger tenant protections and identifying County-owned lands for future transit-oriented development.[139]

Four years ago, L.A. voters passed Measure A, a bond measure to fund parks that includes a focus on park equity and anti-displacement. That is a good start, but one need only look to the conversations around the restoration of the L.A. River to see that displacement is a real, ongoing concern.[140] As the city and county look to restore the L.A. River, developers are also eyeing the riverbanks for housing and retail projects, which threaten to raise rents and property values and displace residents in the surrounding neighborhoods. L.A. renters are already feeling the squeeze; between 2000 and 2015, rents increased around 32 percent, while real renter income fell by 3 percent.[141]

The L.A. Regional Open Space and Affordable Housing Collaborative (LAROSAH) formed in 2016 to address this exact issue of park and nature access and displacement. "Displacement protections, affordable housing production

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Climatewire, April 27, 2020, https://www.eenews.net/climatewire/stories/1062980005 [*https://perma.cc/YLS6-AKNB*]. *See also* Emma Yudelevitch, Green Gentrification: A Study of Revitalized Parks in Los Angeles (2019) [*https://perma.cc/636U-B2VG*] (exploring the idea of green gentrification, where opening parks in cities can lead to displacement of low-income residents).

138. Rachel M. Gregg & Kathryn N. Braddock, Climate Change and Displacement in U.S. Communities (EcoAdapt & Nick Collins eds., 2020) [*https://perma.cc/4TAK-R2CM*].

139. Garcetti, *supra* note 93, at 70.

140. *See, e.g.,* Bianca Barragan, *Opposition Persists Against Plans for 420 Apartments, Beer Garden at L.A. River*, Curbed L.A. (Mar. 6, 2020), https://la.curbed.com/2020/3/6/21138251/casitas-avenue-lofts-panam-equities-bowtie-parcel [https://perma.cc/GZ5V-VWNE]; Jeff Terrentine, *Restoring the L.A. River for All Angelenos*, NRDC Western Dispatch (Dec. 26, 2019), https://www.nrdc.org/stories/restoring-river-all-angelenos [*https://perma.cc/LW52–8DQM]*.

141. Vanessa Carter et al, Univ. of S. Cal., Measures Matter: Ensuring Equitable Implementation of Los Angeles County Measures M & A, 10 (2018) [https://perma.cc/M3FD-GT75].

and preservation are all essential elements to be integrated in with park development infrastructure investments now, before it is too late." Neighborhoods adjacent to the river, which have been historically underinvested in, are now seeing "dramatic increases in the values of rental apartments, homes, and raw land . . . even before any infrastructure projects have even begun."[142]

To combat this problem, LAROSAH proposes a strategy similar to transit-oriented development, where a transit agency partners with a public or private developer to develop property owned by the transit agency.[143] The collaborative proposes that public park and conservation agencies can take a similar approach, partnering with developers to create affordable housing and mixed-use space on land owned by the park agency that is near a public park. Building affordable housing "can ease displacement pressure at twice the impact of new market rate housing units."[144]

Los Angeles officials and voters both appear eager to address the problem of park space in the city and county, as evidenced by a recent bond measure to provide funding for parks and the plans to restore the L.A. River. However, it will be important for planning agencies to focus on equitable development that has anti-displacement as a goal, otherwise the development will not alleviate heat vulnerabilities, but simply displace those who are vulnerable.

Overall, OurCounty Plan and the L.A. Green New Deal have ambitious goals to prepare for climate change. While the plans do incorporate some principles of equitable adaptation, they can and should go further. Equitable policies will be necessary to adapt to the impending increases in temperatures.

Conclusion

Climate change is one of the greatest environmental challenges of the century. While cutting global emissions is critical for staving off the most destructive impacts of climate change, there is no question that the climate has already changed. Thus, adaptation strategies are needed in conjunction with mitigation.

Increased urban heat has the potential to be an extremely deadly impact of climate change that will be disproportionately borne by communities of color and low-income communities. Climate change "looms as *the* global environmental justice issue of the twenty-first century," Robert Bullard and Beverly Wright wrote in 2012.[145] Without appropriate policies to mitigate and adapt to extreme heat, climate change will worsen existing equity issues in the United

142. Thomas Yee, Sissy Trinh, & Natalie Zappella, Pathway to Parks & Affordable Housing Joint Development 15 (LA THRIVES & Los Angeles Regional Open Space and Affordable Housing) (2018) [https://perma.cc/85GU-XVP3].

143. *Id.* at 10.

144. *Id.*

145. Robert D. Bullard & Beverly Wright, The Wrong Complexion for Protection: How the Government Response to Disaster Endangers African American Communities 51 (2012).

States.[146] But, by incorporating principles of equitable adaptation, cities and planning officials can develop holistic, participatory solutions that avoid some of the worst impacts of climate change-induced heat and create more equitable, resilient cities.

146. Cong. Black Caucus Found., African Americans and Climate Change: An Unequal Burden 2 (July 2004) [*https://perma.cc/Y436-KVS8*].