

Heat and Justice: Assessing Urban Vulnerability and Climate Adaptation in Los Angeles

Ian Kalaokalani Rivera
Student ID #5471931

Supervisor: Ethemcan Turhan,
Ph. D.

Master Of Science
Society, Sustainability and
Planning
Faculty of Spatial Sciences
Rijksuniversiteit Groningen
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Abstract

This thesis investigates the intraurban vulnerability to extreme heat in Los Angeles, focusing on the San Fernando Valley. Examining two areas, Arleta – Pacoima and Encino – Tarzana to understand how historical, socio-economic, and biophysical factors influence vulnerability to extreme heat. To explore the situation theories of vulnerability, urban climate justice, and maladaptation are utilized as they each impact extreme heat. Using a triangulation approach by combining policy document analysis, GIS analysis, and semi-structured interviews to assess existing conditions and adaptation strategies.

The findings reveal significant disparities between the two neighborhoods. Arleta – Pacoima, a predominantly minority and lower-income area, showed greater vulnerability due to historical redlining, disinvestment, and inadequate infrastructure. GIS analysis depicted higher rates of poverty, health conditions exacerbated by extreme heat, and lower educational attainment in this area compared to the Encino – Tarzana area. Encino – Tarzana, a more affluent and predominantly white area depicted lower vulnerability, better infrastructure, and more green spaces. Through policy analysis, gaps between legislative intentions and real-world outcomes were highlighted. Although policies like *Senate Bill 1000* and *CF 22-156: Climate Action and Adaptation Plan in the City's General Plan* stress equity and recognition justice, their implementation often does not address the needs of the most vulnerable communities. These gaps were emphasized by local government and community organizations, pointing to insufficient administrative support and the need for more inclusive adaptation strategies. This research concludes that intraurban vulnerability in Los Angeles is driven by governmental structure, historical redlining, and disinvestment in minority neighborhoods. Emphasizing that recognition justice is crucial in shaping equitable adaptation strategies to avoid recreating existing inequalities.

Keywords: Extreme Heat, Los Angeles, Vulnerability, Urban Climate Justice, Maladaptation

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List of Abbreviations

Abbreviation	Definition
A/C	Air Conditioning
GHG	Greenhouse Gas
GIS	Geographic Information System
HVI	Heat Vulnerability Index
IPCC	International Panel on Climate Change
LA	Los Angeles
LACVA	Los Angeles Climate Vulnerability Assessment
SB	Senate Bill
UCJ	Urban Climate Justice
UHI	Urban Heat Island

1. Introduction

If you arrived in the San Fernando Valley between August and September of 2020, your perceptions of Los Angeles as the city without seasons would take on a new meaning. During this time the San Fernando Valley was experiencing heat waves characterized by rolling blackouts in August and temperatures reaching 49,4°C, the current county record, in September (Miller et al., 2020; Los Angeles County, 2021). While Los Angeles is characterized by a hot, arid Mediterranean climate and the San Fernando Valley is especially prone to higher temperatures due to its surrounding geography; these temperatures signified the beginning of a dangerous reality for the urban metropolis. Although this was one of the most recent occurrences of extreme heat waves in Los Angeles, they are not unprecedented. In July 2006 the previous county temperature record was set at 48,3°C, with temperatures surpassing 38°C for 21 consecutive days resulting in a death toll of anywhere from 130 to 450 people (Duginski, 2020; Los Angeles County, 2021).

While not a new phenomenon, extreme heat is predicted to become increasingly common in Los Angeles and cities worldwide as climate change and the urban fabric of our metropolitan areas put an increasing amount of people and places at risk. Extreme heat within urban areas is a growing phenomenon worldwide, exacerbated by population projections that place 60% of the global population living in cities by 2030 and 70% by 2050 (IOP, 2015). According to data from 2016, 1.7 billion people, or 23% of the global population, are now exposed to extreme heat with rates of exposure 52% greater than rates of urban population growth (Tuholske et al., 2021). The Federal Emergency Management Agency, an agency of the United States government, defines extreme heat as periods of heat exceeding 32.2°C for at least two to three days (FEMA, 2023). The County of Los Angeles, rather, defines extreme heat as the temperature threshold at which 95% of all days in a year have cooler maximum temperatures (Los Angeles County, 2021). Extreme heat has the capability to overwhelm a person's ability to thermoregulate their body temperature, leading to physiologic heat stress, and even death in some cases (Reid et al., 2009).

With a GDP of \$790 billion, slightly less than that of Taiwan's \$800 billion, the Los Angeles area is one of the richest and most well-known places in the world. Its response to this deadly

phenomenon holds implications for responses globally (US Department of Commerce 2023; IMF, 2024). Los Angeles' diverse landscape has a long history of inequality but has announced its intention to place equity as a guiding principle for all the county's future plans (LA County, 2021; Davis, 1998).

With extreme heat exposure and its associated vulnerabilities expected to increase within the San Fernando Valley (Figure 1), Los Angeles County has set about enacting adaptations to mitigate the negative health and environmental effects equitably (Chu et al., 2021). Therefore, this master's thesis aims to understand how and why different neighborhoods within the San Fernando Valley are and will be impacted by extreme heat. By comparing the Arleta – Pacoima and Encino – Tarzana community planning areas, two distinct neighborhoods located on opposite sides of the San Fernando Valley, assessing the intentions of equity in adaptation becomes possible.

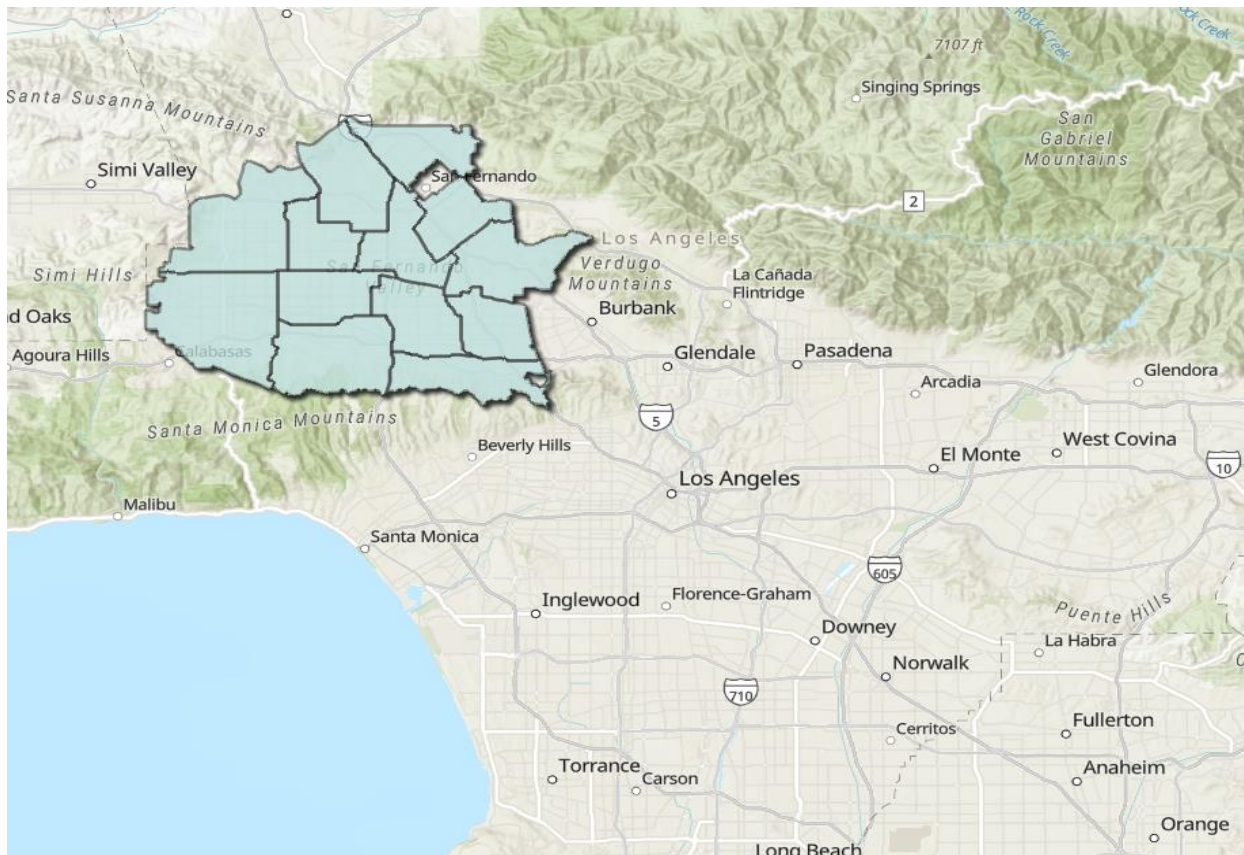


Figure 1: San Fernando Valley highlighted in light blue with community planning area boundaries outlined (Source: Author, 2024)

Based on this research objective, the following research question has been formulated:

What causes variation in vulnerability to extreme heat and how is this perceived by communities and governments in urban areas?

To provide structure to this research question and be able to answer the question comprehensively the following sub-questions are posed.

1. How do official documents from relevant government offices illustrate the existing circumstances of extreme heat risk and adaptation?
2. What does current vulnerability to extreme heat look like within the neighborhoods being compared in this study?
3. How do relevant stakeholders view the processes of adaptations in these neighborhoods?

This study is scientifically relevant given that extreme heat in urban areas is expected to affect an estimated 50%-75% of the world's population by 2100 (Mackres et al., 2023) making research on this topic and adaptation to it imperative. While extreme heat has been identified as affecting people of different socioeconomic backgrounds in distinct ways (Chakraborty et al., 2019; Feng et al., 2023) this research will address a gap in the literature by conducting an in-depth, mixed-methods, comparative analysis between two Los Angeles neighborhoods labeled among the most vulnerable to extreme heat (Los Angeles County, 2021). An approach of this nature aims to address possible overlooked aspects not covered by works that focus solely on either quantitative or qualitative data.

Although extreme heat and adaptation planning, in general, are problems unsuitable for a one-size-fits-all solution (Chakraborty et al., 2019), this research will be useful for gaining insights into existing vulnerabilities, current and future adaptation planning, and overarching policy that affect both areas. The results of this study could be especially valuable in highlighting the climate injustices that exist in urban areas across the Global North. Additionally, this study could add to the growing body of literature on the varied impacts of extreme heat on different populations within cities, similar to research by Amorim-Maia et al. (2021) and Chakraborty et al. (2019).

This study is societally relevant as urban areas now encompass more than half of the global population and are expected to house to an additional 2.5 billion people by 2050 (Mishra et al.,

2015; Mackres et al., 2023). The need to address the risks that these urban populations will encounter as a result of climate change is rapidly growing (ibid). With this exposure to extreme heat comes the risk of double-disadvantaging historically marginalized people within urban areas such as the poor or minority groups (Hamstead, 2023). As these groups are typically those who experience the effects of climate change in urban areas first and most intensely, they also have the least means to adapt to these rising temperatures (Goh, 2020; Environmental Protection Agency, 2021). Although extreme heat is a global threat, this thesis focuses on cases from one of the wealthiest cities in the Global North, where data on existing and projected vulnerabilities is relatively easily accessible. As a result, applying the findings and lessons from this research to the Global South may be challenging due to limited data availability and scientific research on climate change, primarily caused by funding constraints (Singh and Hopton, 2021; Mehmood, 2021). This discrepancy highlights a critical issue in climate adaptation: while countries in the Global South experience higher levels of physical vulnerability due to disproportionate exposure to climate impacts, they also face higher levels of social vulnerability. Variables impacting social vulnerability are understood as basic health care, livability, accessibility to basic services, political representation, overall indicators of quality of life, etc. (Cutter, 2006). The lack of comprehensive data on social vulnerabilities can lead to misallocation of funds and adaptation efforts, potentially directing resources away from areas most in need (Singh and Hopton, 2021).

The exposure of a growing population to extreme temperatures generates not only social and health concerns but economic problems as well (Santamouris & Vasilakopoulou, 2021). With heat-induced productivity losses and occupational injuries expected to cost an estimated 1% (\$2,5 trillion) of the global gross domestic product by 2030 (Feng et al., 2023). In the United States, the economic impacts of extreme heat-related productivity loss are currently \$100 billion a year and are expected to rise to \$500 billion a year by mid-century (United States Joint Economic Committee, 2023). While this thesis will not investigate the economics of extreme heat, it is worth mentioning as economics is at the forefront of policy and decision-making, with implications that are felt throughout society. As extreme heat poses a large threat to urban areas, planning practices should establish equity-focused adaptations (helping those who are most disadvantaged) as a guiding principle for urban areas threatened by extreme heat, which could save lives and prevent the worsening of inequality, a recurring issue worldwide.

The next section introduces the theoretical framework that constructs the foundation of this study and consists of vulnerability, urban climate justice, and maladaptation. Section three includes an explanation of the methodology used in this study which consists of qualitative policy analysis, GIS analysis, and semi-structured interviews. The results and findings of this study are found in section four. The final section, section five, includes reflective discussion points, policy recommendations, possible limitations, areas of interest that will require further research and the conclusion.

2. Theoretical Framework

To establish an understanding of the theories used in this master's thesis I define and provide examples of the following: vulnerability, urban climate justice, and maladaptation. These are all aspects that play an important role in understanding risk to all climate-related hazards, including extreme heat.

2.1 Aspects of Vulnerability in Climate Change and Extreme Heat

Vulnerability, as an area of study, has roots in the fields of hazards geography, sociology, political economy, and political ecology and is a continuously evolving concept that cannot be directly measured (Watkins et al., 2021; Cutter and Finch, 2008). Vulnerability's integration to climate change has been defined, per the International Panel of Climate Change's (IPCC) sixth assessment report, as "the propensity or predisposition to be adversely affected. Vulnerability encompasses a variety of concepts and elements, including sensitivity or susceptibility to harm and lack of capacity to cope and adapt" (IPCC, 2022, p. 2927). This report further elaborates that exposure, in addition to sensitivity and adaptive capacity, is an important principle when defining the term concerning climate change (ibid). In a topical review of the dynamics within vulnerability assessments, Jurgilevich et al. (2017) found that these three components were often used as conceptual starting points, having been established as principles of vulnerability by the IPCC as early as 2001 in the third assessment report.

While the three components are broadly agreed upon, their definitions are fluid as understandings and information evolve, allowing for refinement and adaptation to new contexts. Conceptually,

sensitivity is understood “the amount of transformation of a system per unit of the change in a given factor”, or in its simplest state, if a system does or does not respond to a specific stressor (Rafael et al, 2015, pg. 3). This understanding is flexible, accommodating varying scopes and parameters. For instance, in Xiu et al.’s (2011) quantitative, large-scale study of Chinese cities’ vulnerability to climate hazards, sensitivity was defined as a formula based on a city’s size, density, and spatial form. Finding cities with more concentrated layouts to be more sensitive to climate hazards (ibid). While this may work for inter-city, ranking-based research, it risks overlooking smaller-scale qualitative differences within cities where sensitivity is influenced more by social factors than by physical ones. Wilhelmi & Hayden (2010, p.3) define sensitivity rather as “the extent to which a system or population can absorb impact without suffering long term harm”, encompassing a temporal and coping aspect that may provide a more focused perspective. The authors, expanding on this definition, argue that socio-economic factors such as age, health, wealth, and occupation may further impact sensitivity at disproportionate levels (ibid).

Like sensitivity, as well as exposure and vulnerability itself, definitions of adaptive capacity are constantly evolving, and build off each other. Wilhelmi and Hayden (2010, p. 4) view adaptive capacity as “the potential of a system or population to modify its features and behavior so as to better cope with existing and anticipated stresses”. Specifying that local knowledge systems composed of knowledge, attitudes, and practices are critical in understanding the different scales of adaptive capacity (ibid). This definition remains far-reaching while allowing for interpretation at the individual level, an important nuance in the evolving concept that is vulnerability and the principles that define it. A nuance echoed by Romero-Lankao and Qin (2011) who stress that the geographic and temporal scales of adaptation’s intersections with individual, social, and governmental strategies can create environmental and socio-economic uncertainties if not directly suitable to a specific location. A concern shared by Rafael et al. (2015) who emphasize that without being tailored to local contexts, and accounting for equity, adaptations can diminish a community’s adaptive capacity.

Exposure largely dictates an area’s or individual’s level of vulnerability. For this study, I utilize the definition by Modica et al. (2019) who define exposure as everything that could be impacted by a shock, including people when evaluating socio-economic exposure and buildings and

infrastructure when considering physical exposure. This definition highlights a demarcation between types of exposure, a relevant insight when assessing vulnerability to climate hazards at the urban scale as both populations and the built environment are affected.

The importance of local contexts concerning a community's capacity to adapt is highlighted in a recent study on cross-organizational engagement for urban heat resilience in Los Angeles County from Mosleh et al. (2024). The authors found that for both communities and organizations that financial resources frequently dictate their adaptive capacity with organizations further impacted by their levels of influence and relationships with each other (ibid). They recommended that organizations involved in urban heat resilience follow a partnered approach as more than 15 governmental organizations and several non-governmental organizations focus on overlapping aspects of extreme heat, but communication remains inadequate for the problems at hand (ibid).

Mitchell and Chakraborty (2018) explored the relationship between residential segregation and thermal inequity in American cities by focusing on social and infrastructural aspects of exposure. The authors found that communities with higher minority populations, lower incomes, and lower rates of high school graduation were disproportionately exposed to the effects of extreme heat (ibid). With infrastructure associated with extreme heat (high rates of impermeable surfaces) also being more prevalent in neighborhoods with significant minority populations, highlighting how both socio-economic and infrastructural factors affect exposure in American cities (ibid).

Cities in general find themselves particularly vulnerable to extreme heat. This is exemplified by the IPCC's 6th assessment report which stated that by coupling climate change and urban growth projections, cities will face local air temperature increases comparable to those produced by global warming (Dodman et al., 2022). With the most economically and socially marginalized groups in cities, including the poor and ethnic-racial minorities, being disproportionately affected due to their residence in hazard-prone areas (Reckien et al., 2018). As an increasingly large proportion of the world's population reside in urban areas, cities have found themselves in a unique situation, in which they cause a majority of anthropogenic climate change while simultaneously facing the greatest risks (UNEP, 2017; Florez Bossio et al., 2019; European Environmental Agency, n.d.). This situation, along with the disproportionate effects on inhabitants within different parts of the

city, has given rise to a focus on climate vulnerability on the urban scale (Romero-Lankao & Qin, 2011).

Urban vulnerability's differentiation from peri-urban or rural vulnerability is important to understand for creating effective, context-specific strategies and indices (Thomas, 2018). Urban vulnerability's distinction is shaped by, but not limited to, their larger populations with rays of diversity, urban fabric, and phenomena such as urban heat islands (UHIs) (Dodman et al., 2022; European Environmental Agency, n.d.; Zeleňáková et al., 2015). For example, as a growing number of refugees and internally displaced individuals are settling in urban areas, characteristics like language barriers or familiarity with an area make them vulnerable to various shocks and stresses (Earle, 2016). Urban fabric, or the build-up of urban areas, also creates distinct vulnerabilities for those that inhabit them, as the extensive infrastructure and impermeable surfaces that characterize these spaces reduce ecosystem services (Dodman et al., 2022). Services such as evapotranspiration that provide much-needed cooling in a heating world (ibid). This build-up and resulting heat exhaust give rise to UHIs, in which urban areas are documented as being hotter compared to rural surroundings, as heat is retained in the built environment and released at night (Feng et al., 2023). The elevated temperatures throughout the day and night inhibit the body's ability to recover and have the potential to worsen health problems associated with extreme heat such as cardiovascular diseases, respiratory diseases, and diabetes (Sarofim et al., 2016). Although these three are not the only factors distinguishing urban vulnerability from that of less populated areas, they underscore the need for differentiation.

While urban vulnerability should be recognized as a distinct concept, it faces challenges in capturing the unique differences within and between various urban areas due to their specific characteristics and dimensions, while also identifying common factors of adaptive capacity and resilience across all urban settings (Romero-Lankao & Qin, 2011). As cities in different continents, countries, and regions of the world will face different pressures in their specific vulnerabilities to climate change, one general definition will prove to be inadequate (Bulkeley and Tuts, 2013). Understanding this, I decided to use Rafael et al.'s (2015) definition, as it is overarching while allowing for specific adaptation, viewing urban vulnerability as the extent to which an urban system, its population, or its infrastructure, is susceptible to and able to effectively address the

negative impacts of one or more stressors. This stems from the interplay of factors (exposure, sensitivity, and adaptive capacity), the characteristics that define them, and make the area unique. This dynamic, shown in their framework (Figure 1), labels socio-economic and institutional capacity as well as the desire for adaptation of its citizens as important for understanding urban areas' adaptive capacity; with the specifics of an area's climate change hazards directly influencing its exposure (Rafael et al., 2015). This definition is similar to that of Romero-Lankao and Qin (2011) who understood urban vulnerability to be a fluid process, resulting from the decreasing ability of an urban area or its citizens to cope with societal and environmental stressors, including but not limited to climate change. This accompanying definition is important to include as Rafael et al. (2015) adapted their framework from Romero-Lankao & Qin (2011) and highlighted the importance of intra-city discrepancies.

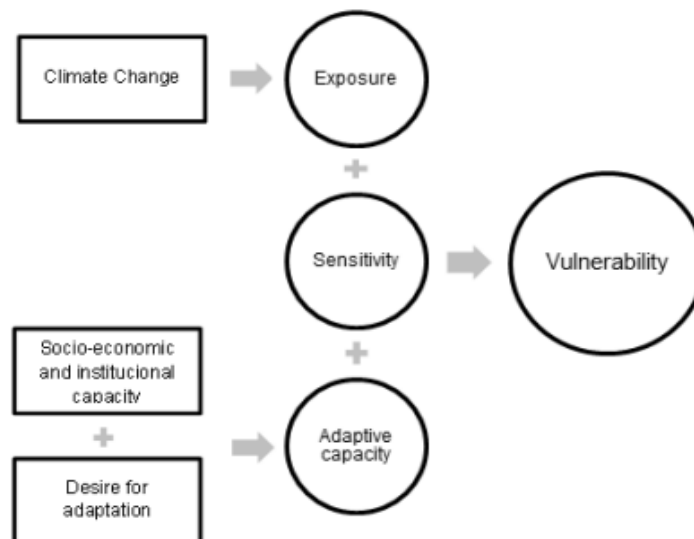


Figure 2: A conceptual framework of urban vulnerability to global climate and environmental change (Source: Rafael et al., 2015 adapted from Romero-Lankao & Qin, 2011)

Rafael et al.'s (2015) inclusion of socio-economic and institutional capacity and desire for adaptation, allow for a more localized, comprehensive view of urban vulnerability that may highlight or expose discrepancies. This is important, as a study by Turner et al. (2022) examining U.S. municipal climate hazard plans discovered that most cities have not developed effective heat governance despite the growing risk. In California, where the perceived risk of extreme heat is high due to elevated temperatures and a significant proportion of poor and minority populations, heat is rarely prioritized in state-level policies, resulting in a considerable gap in heat governance

(Howe et al., 2019; Turner et al., 2022). The desire for adaptation of a population may also prove to be an important distinction as factors like politics or economics could be components that affect different communities unevenly. In line with this framework, a neighborhood's socioeconomic and institutional capacity may dictate how or if they can address the threat of extreme heat and consequently their vulnerability. In the following section, I investigate how notions of justice are important in understanding urban areas' adaptations to extreme heat.

2.2 Notions of Justice in the Environment

Climate justice has its roots in environmental justice (Goh, 2020), making it essential to understand their interconnected evolution. The environmental justice movement is often traced back to Warren County, South Carolina in 1982, where protests opposed hazardous waste dumping in predominantly Black communities (Schlosberg & Collins, 2014; Bullard, 2001). Initial research into the issue by the US General Accounting Office and the United Church of Christ found race was a significant predictor of proximity to toxic waste sites both regionally and nationally (Schlosberg & Collins, 2014; Hamstead, 2023).

The environmental justice movement diverged from traditional environmentalism by redefining the environment as people's daily activity space, rather than untouched wilderness (Wright, 2011). The movement formalized its principles in 1991, crafting the 17 Principles of Environmental Justice, later mirrored in the 2002 Bali Principles of Climate Justice (ICJN, 2003; Edwards, 2020). Both emphasized equity, recognition, and rights for marginalized groups. A pivotal event highlighting the shift from environmental to climate justice was Hurricane Katrina. As its initial impacts and lingering damage exemplified the unequal distribution of climate risks among minority and poor communities (Bullard, 2009; Schlosberg, 2013; Harlan, 2015).

Despite these concepts existing for over 25 years, climate justice was only acknowledged in a global climate regime with the 2015 Paris Agreement (Onifade, 2021). The non-binding agreement recognized its importance but did not provide a clear definition, merely stating that it was to be noted as important (UNFCCC, 2015). While lacking a formal definition it generally emphasizes "putting equity and human rights at the core of decision-making and action on climate change"

considering the "unequal historical responsibility that countries and communities bear in relation to the climate crisis" (UNDP Climate Promise, 2023).

While in the past, most literature and interpretations of climate justice have been on an international scale, focusing on the discrepancies between the Global North and South, more recently a smaller-scale approach to climate justice has emerged. The growing realization that urban areas play a significant role in climate change and are increasingly vulnerable to its impacts has shifted research priorities (UNEP, 2017 & UN-HABITAT, 2022). This shift began in 2008, leading to research on urban design and climate adaptive spaces through a socio-economic disparity lens that has been expanding upon ever since (Mohtat and Khirfan, 2021). Urban climate justice (UCJ) literature builds on principles of climate and environmental justice, applying Schlosberg's (2004) dimensions of distributive, procedural, and recognitional justice (Bulkeley et al., 2014). These dimensions, explained by Mohtat and Khirfan (2021, p. 2) in a literature review of the topic are as follows:

“Distributive justice addresses the spatial scales across which the adaptive urban form interventions are spatially distributed...Procedural justice considers the various governance levels (scales) through which decisions on adaptive urban form interventions are made... recognitional justice argues that the scales across which people and their associated urban spaces are recognized in adaptation decisions and/or their outcomes.”

Of the three, recognitional justice has been found by climate justice scholars to be the least represented and in need of elevation to the level of its counterparts (Edwards, 2020; Schlosberg, 2007). This is problematic as recognitional justice represents the ‘who’ in this framework. Meaning when actions go through political processes and encounter inequalities these will likely affect marginalized communities that are the least recognized and already most disadvantaged (Edwards, 2020).

These three dimensions, along with the inclusion of citizens' rights and government responsibilities, are included in the definition that I find most applicable to the context at hand. Bulkeley et al. (2014) define urban climate justice as the pursuit of equitable responses to climate

change within cities, focusing on the fair distribution of responsibilities, rights, and adaptation resources among all residents. Recognition is an integral part of their definition, with an emphasis placed on addressing existing social and economic inequalities to ensure that vulnerable communities are protected and included in climate adaptation decision-making.

For this reason, I argue Bulkeley et al. (2014) offer the best approach for examining how urban adaptation processes contribute to creating various forms of social, political, and economic disparities. To better understand their approach, the authors created a conceptual model (Figure 3) in which the two different views provide “the conventional, international approach to climate justice” when viewed from above, but when viewed as a prism, “each facet of justice in the pyramid is filtered through the others, refracting the reconfiguring what it is that justice entails in any one context” (2014, p. 34). Edwards (2020) provides a theoretical example of what this would look like in the form of a project aimed at enhancing the energy efficiency of a city neighborhood to lower greenhouse gas emissions or make living areas more comfortable. Utilizing this recognition-based approach compels us to identify who may be excluded from these efforts, thereby acknowledging their right to enjoy these benefits and placing responsibility on the government to see that these rights are upheld (ibid). The local government then employs a mix of distributional and procedural strategies to ensure these rights, found through a focus on recognition (Edwards, 2020).

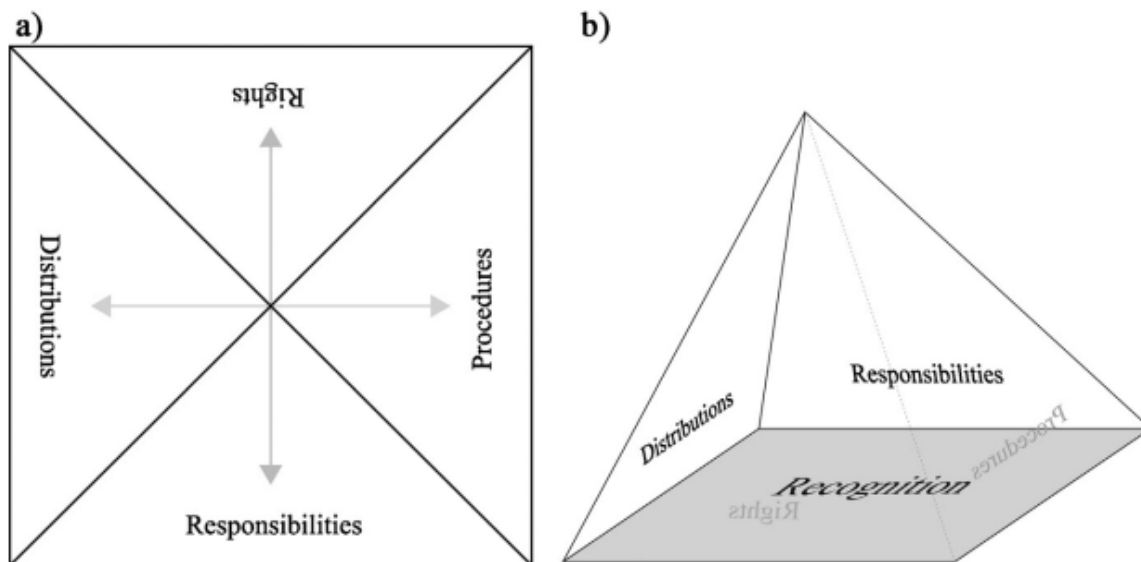


Figure 3: The three-dimensional climate justice pyramid (a) directly above; and (b) obliquely below (Source: Bulkeley et al., 2014)

The authors argue that when climate justice is viewed through the classic tri-dimensional approach, which puts greater emphasis on procedures and distributions (Mohtat and Khirfan, 2021), and achieved through the establishment of rights and responsibilities, the structural patterns of inequality within nations tend to be overlooked (Bulkeley et al. 2014). This is important to recognize as any effort at redistribution aiming to balance the rights and responsibilities among different actors via distributional or procedural means will inevitably recreate structural injustices within our society if recognition is not properly considered (Edwards, 2020). Goh (2020) suggests that urban-scale inequality patterns lead to concepts of urban justice, revealing how environmental challenges underscore specific struggles within broader urban processes and highlight cultural injustices and inequalities. Therefore, the use of this definition of UCJ was appropriate in this research, as I aimed to uncover potential discrepancies in neighborhoods' vulnerabilities and adaptations in Los Angeles.

Examples of UCJ and its use to analyze cities' adaptations to extreme heat are prevalent in the literature. One such example is Amorim-Maia et al.'s (2023) piece analyzing Barcelona's La Prosperitat neighborhood and its susceptibility to intersecting vulnerabilities in light of urban climate shelters. Using Schlosberg's tridimensional view of justice in their research to "theorize which groups benefit, participate, and are recognized (or not) in climate-adaptive interventions" within the area (Amorim-Maia et al., 2023, p. 3). Their study identified uneven experiences of thermal discomfort, risks of extreme temperatures, and abilities to adapt due to socio-economic factors. These findings back their use of such a guiding framework. They found that immigrants from the Global South were less likely to know about and use climate shelters, low-income residents were less likely to have heating or cooling systems compared to wealthier residents, and women were significantly more impacted by climate change issues relating to health and costs of living than men (Amorim-Maia et al., 2023). These findings highlight why recognition is a vital part of this justice view and mirror what Edwards (2020) said regarding inequalities affecting marginalized communities if the focus is solely on procedural and distributive aspects.

The need for an UCJ approach that focuses on recognition is exemplified by results in the literature that focus on the inequalities that exist within urban areas. For example, in a multi-city study of the correlation between urban heat island (UHI) exposure and lower-income neighborhoods,

Chakraborty et al. (2019) classified Los Angeles as a city characterized by high-income inequality and inequality in exposure to UHI that burdened the less affluent. Highlighting that the intra-city distribution of income, green space, and risks connected to climate change compound and affect marginalized neighborhoods at unequal rates (ibid) requiring solutions with a focus on equity. Other works like that of Schrock et al. (2015) who assessed the climate and sustainability plans of cities in the U.S. found that equity goals were largely ignored or treated as secondary to those focusing on economics or the environment. This blindness to equity shows a lack of recognitional justice as it aims to rectify existing inequities and inequality (Chu & Michael, 2019). Schrock et al. (2015) state that achieving equitable development to climate change and sustainability issues will rely on the ability of community-based actors, particularly from communities of color and other marginalized groups, to actively engage and participate in local sustainability initiatives. Reflecting what Edwards (2020) said about the definition, that to avoid worsening inequity there must be representation of marginalized interests to ensure their rights are recognized. While these studies did not utilize the specific definition of UCJ that I am using, I argue their findings highlight why an emphasis on recognition is imperative, and how doing so through the filter of other aspects of UCJ reveals insights and implications otherwise overlooked or ignored. Adapting to extreme heat is an integral part of urban areas' responses to climate change but, if done without proper foresight they can increase vulnerability, the focus of the following section.

2.3 Maladaptation

Maladaptation's integration into climate change occurred in the 1990s, with its first adopters commonly identified as Smit (1993), Burton (1997), and Scheraga & Grambsch (1998), using the term to demarcate adaptation measures that had negative outcomes (Schipper, 2020; Barrett & O'Neill, 2010; Magnan et al., 2016; Juhola et al., 2016). Since its adoption in climate change literature, the concept of maladaptation has evolved and been included in International Panel on Climate Change (IPCC) reports beginning with the 3rd Assessment Report (IPCC, 2001). In the latest 6th Assessment Report, maladaptation is defined as "actions that may lead to increased risk of adverse climate-related outcomes, including via increased greenhouse gas (GHG) emissions, increased or shifted vulnerability to climate change, more inequitable outcomes, or diminished welfare, now or in the future" (IPCC, 2022, p. 2915). This updated definition is comparatively

comprehensive, incorporating temporal and spatial aspects, emphasizing equity and welfare, and expanding its relationship with vulnerability compared to earlier definitions.

The IPCC's continued and expanded inclusion of vulnerability within the definition of maladaptation aligns with academia's understanding of the concept. From its inaugural sources in the context of climate change, maladaptation has been defined by its unintentional increases in vulnerability, whether that be of the natural environment or people (Burton 1997; Scheraga & Grambsch, 1998). These adverse effects are recognized as occurring as a result of adaptive measures that were taken without regard for interconnected systems that may be sensitive to climate change (Scheraga & Grambsch, 1998). This is still echoed in sources such as Barnett and O'Neill (2010) who define maladaptation as actions aimed at reducing vulnerability to climate change that actually, negatively affect or heighten the vulnerability of other systems, sectors, or social groups; or by Schipper (2020) who defines it as a process in which people who are already vulnerable to climate change become increasingly vulnerable, whether it be those who the adaptation was originally intended for or another group not in the initial scope of the project. Atteridge & Remling (2018) expand on this, pointing out that the increases in vulnerability that stem from maladaptive practices will likely end up affecting communities that are already disproportionately vulnerable due to their minimal involvement and representation in planning processes.

Aspects brought up by Barnett and O'Neill (2010), Schipper (2020), and Magnan et al. (2016) emphasize that the delayed effects and shifting vulnerabilities encompass what could be termed the temporal and spatial aspects of maladaptation. The temporal aspect involves the uncertainty surrounding adaptation projects due to extended timescales beyond their implementation (Juhola et al., 2016). Unintended impacts can surface after a project's completion, potentially rendering it maladaptive even if initially considered beneficial (Atteridge & Remling, 2018; Schipper, 2020). An example of this comes from Ho Chi Minh City's flood risk reduction project, designed based on the best available predictions of climate change impacts and urbanization at the time (Hallegatte et al., 2012). After the project's completion, a combination of worsening climate impacts and a false sense of security led to increased development in low-density areas. As a result, vulnerability

grew because more people were exposed, and the flood control system, now inadequate, risked exacerbating flooding in certain parts of the city (ibid).

The spatial aspect of maladaptation is important to note as it refers to how certain adaptations may prove successful in their implementation areas but increase vulnerability in another (Chi et al., 2021). Sometimes referred to as the geographic aspect or spatial spillover, attention to this is crucial as when the impacts of an adaptation project are further away, those implementing them are less likely to have the ability to predict its effects or to care (Atteridge & Remling, 2018). A theoretical example of this is the creation of flood embankments on a river, which decrease the vulnerability of those on location but often have the exact opposite effect downstream, increasing flood risks and vulnerability (Adger et al., 2005).

In addition to the temporal and spatial aspects of maladaptation, various frameworks exist within the literature that describe how adaptations may become maladaptive or how to classify them. Arguably the most common, likely due to its advocacy in the IPCC's 5th assessment report, is Barnett and O'Neil's (2010) Pathways Framework (Chi et al., 2021; Magnan et al., 2016). These pathways in which a program could become maladaptive were labeled as: A) increasing GHG emissions, B) disproportionately burdening the most vulnerable, C) high opportunity costs, D) reducing incentives to adapt, and E) path dependency (Barnett & O'Neill, 2010). Their use received advocacy to inform decision-makers on best practices (Magnan et al., 2016; Juhola & Käyhkö, 2023).

The Feedback Framework introduced by Juhola et al. (2016) expands on Barnett & O'Neill's definition by focusing on the spatial and temporal aspects of negative feedback loops within maladaptive practices. Categorizing maladaptation within 3 fields being: A) rebounding vulnerability B) shifting vulnerability, and C) eroding sustainable development (ibid). Explained simply, rebounding vulnerability refers to adaptations that increase the vulnerability to the implementing party either currently or in the future, shifting vulnerability refers to adaptations that increase vulnerability at the time of implementation or in the future to outside actors, and eroding sustainability refers to maladaptive practices that increase GHG emissions and/or adversely affect environmental conditions and social and economic values, compromising conditions for

sustainable development globally (Juhola et al., 2016). Magnan et al. (2016) found this definition to be in line with their findings on a study of maladaptive practices around the world in that maladaptation is a process influenced by various actors across temporal and spatial scales. Juhola & Käyhkö (2023) argue that some sort of framework, not, in particular, these, should be used to assess maladaptive practices on the national policy level as they often have negative consequences on the community scale. Due to its greater specificity, this thesis utilized the Feedback Framework in an assessment of regional plans and policies to gauge potential for maladaptive practices regarding extreme heat.

An example of maladaptation especially relevant to urban areas, like Los Angeles, is the increasing prevalence of air conditioning (A/C) systems in Paris, where heat waves are increasing in frequency (Vigue et al., 2020). Following a series of hot summers, A/C installation nearly tripled between 2006 and 2016 (ibid). Studying the impacts of this, coupled with projected increases in heat waves and population through 2100, Vigue et al. (2020) found that the energy demanded would account for 81% of the daily average consumed by housing and office spaces with associated heat exhaust increasing high heat stress conditions by 20 minutes daily. I argue this type of adaptation is palliative, initially providing relief but ultimately worsening conditions (UNICEF Office of Research, 2014). As Paris' Metropolitan Area and Los Angeles County are quite similar: Paris having a GDP of \$830 billion to Los Angeles' \$770 billion, 12.4 million inhabitants to Los Angeles' ~10 million, and both cities hosting the Olympic Games this decade amidst concerns regarding extreme heat, paying attention to Paris' situation regarding extreme heat can provide valuable lessons for Los Angeles' response to the issue (European Commission, 2022; European Commission, 2024). This example highlights the importance of the temporal aspect of maladaptation, where short-term measures can reduce vulnerability but exacerbate future risks.

In addition, it is important to consider that A/C units can account for up to 20% of nighttime UHI intensity in large built-up urban areas (Masson et al., 2020). A worrying figure, especially when combined with previously mentioned Sarofim et al.'s (2016) findings on nighttime UHI effects on health, and Huang et al.'s (2019) projections that UHI can increase temperatures by up to twice as much as those caused by GHG emissions. Not only does this represent a problem on the temporal scale of maladaptation, as it has the potential to increase vulnerability to extreme heat because of

increased UHI intensity but on the spatial scale as well. Zooming out, the effect of a large urban area's constant electricity demand for A/C around the clock will lead to increased levels of GHG emissions, worsening anthropogenic climate change. This, in turn, is likely to increase the vulnerability of marginalized populations globally before affecting the groups that caused the increase. Quezada et al. (2013) raise another important point regarding the use of A/C in times of extreme heat, in their study of the topic in Queensland, Australia. Stating that the growing demand during peak times increases operating costs and as a result drives up electricity prices, an impact that disproportionately affects poorer populations (ibid). Hence, Los Angeles' adaptations must be well thought out prior to implementation or risk rebounding vulnerability, shifting vulnerability, and eroding sustainable development simultaneously.

2.4 Conceptual Model

In the previous sections, the concepts of vulnerability, urban climate justice, and maladaptation were discussed in the context of extreme heat and climate change. These concepts were discussed with an attention to notions of equality and equity. With this in mind, the conceptual model below (Figure 4) has been established.

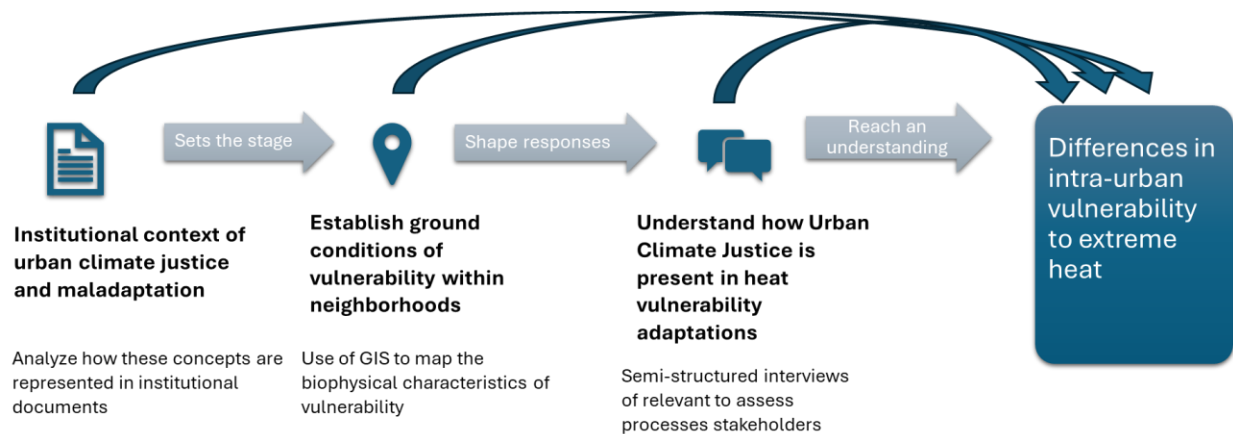


Figure 4: Conceptual Model (Source: Author, 2024)

To understand how these concepts interact with each other and contribute individually it is important to see them in real-world contexts. Each of these concepts can be represented in multiple ways, have impacts on one another, and define an area's vulnerability to extreme heat. To represent this dynamic this conceptual model was created to show these relationships and how they unfold.

To understand the ‘rules of the game’ and understand the baseline this thesis firstly looks into policy documents to understand how urban climate justice and maladaptation are represented in the institutional context. Going a step further, vulnerability is assessed and portrayed with the use of GIS. Maps were created of the two areas studied in this thesis to portray the realities of vulnerability and examine patterns that may give insight into how vulnerability is shaped. Finally, urban climate justice is revisited in semi-structured interviews to reach a well-rounded understanding of what shapes the differences in intra-urban vulnerability to extreme heat in the context of Los Angeles. By analyzing these three concepts, through three distinct but interconnected methods a deeper set of information is revealed. While each concept and method could independently address the question, triangulation ensures the most thorough understanding.

3. Methodology

This research paper used three methods to triangulate the concepts outlined above from both a quantitative and qualitative viewpoint. These methods consisted of policy document analysis, GIS analysis, and semi-structured interviews. Policy document analysis was used to set the stage of current and planned realities pertaining to maladaptation and urban climate justice (UCJ). GIS analysis was used to map the biophysical landscapes of the two neighborhoods, providing a realistic assessment of their vulnerability to extreme heat. In semi-structured interviews, relevant stakeholders from local government offices and community-based organizations were interviewed to understand how or if current adaptations and planning practices reflected themes of UCJ. This thesis employed a mixed methods approach to data collection to achieve triangulation and minimize potential gaps in understanding the problem.

3.1 Policy Document Analysis

This research analyzes four policy documents regarding extreme heat developed in the past six years by the County of Los Angeles and the State of California. These documents, enacted between 2018-2023 (Table 1), were chosen for their focus on climate change adaptation and/or vulnerability. Selected at the county and state levels for their direct effects on both areas studied, offering a specialized, region-specific approach. The plans were examined through the lens of climate justice and maladaptation. UCJ aspects were identified as distributive, procedural, and

recognitional justice, incorporating citizens' rights and government responsibilities. Maladaptation was defined as an unintentional increase in vulnerability from failed adaptations. I developed an analytical framework presented in Table 2 and Table 3 by adapting Strange et al.'s (2023) approach regarding urban climate justice and Juhola et al.'s (2016) Feedback Framework approach regarding maladaptation.

Document	Year	Governing Body	Jurisdiction
Senate Bill 1000: The Planning for Healthy Communities Act	2018	California State Senate	Sets guidelines for all cities of the state to follow
LA Climate Vulnerability Assessment	2021	LA County Chief Sustainability Office	A department of Los Angeles County, with jurisdiction over those living within the city of Los Angeles
Protecting Californians from Extreme Heat: A State Action Plan to Build Community Resilience	2022	Governor of California's Office	Sets guidelines for all cities of the state to follow
CF 22-1566: Climate Action and Adaptation Plan in the City's General Plan	2023	City of Los Angeles: Department of City Planning	A department of the City of Los Angeles, with jurisdiction over those living within the city of Los Angeles

Table 1: Policy Documents Analyzed (Source: Author, 2024)

Type of Maladaptation **Indicators**

<p>Rebounding Vulnerability Increasing the present or future vulnerability of those that implemented the adaptation.</p>	<ul style="list-style-type: none"> • Hard infrastructure adaptations reducing future flexibility. • Adaptations worsening future vulnerability in the implementation space.
<p>Shifting Vulnerability Increasing the present or future vulnerability of communities outside of the scope of implemented adaptation.</p>	<ul style="list-style-type: none"> • Costly technologies which increase adaptation difficulty for disadvantaged communities. • Adaptations which are unattainable to people of lower-income communities but which they help pay for through taxes.
<p>Eroding Sustainable Development Creation or worsening of common pool problems that degrade the potential for future sustainable development</p>	<ul style="list-style-type: none"> • Technologies/adaptations that increase rates of GHG emissions. • Technologies/adaptations that might disincentivize continued adaptation/sustainability. • Adaptations that negatively affect the natural environment, damaging ecosystem services

Table 2: Types of maladaptation with indicators for policy analysis. (Source: adapted from Juhola et al., 2016)

Justice Dimension	Indicators
<p>Distributive Recognizes the uneven impact of extreme heat and commits to the fair distribution of adaptations and resources across spatial scales.</p>	<ul style="list-style-type: none"> • Identifies how extreme heat affects groups in different ways. • Evaluates equitable resource distributions (e.g., cooling centers) • Plans to improve access to heat relief infrastructure in underserved areas.
<p>Procedural Establishes methods that promote inclusive decision-making through the integration of a range of voices,</p>	<ul style="list-style-type: none"> • Community involvement in planning and decision-making processes. • Trust-building and enhanced community participation. • Inclusive participation strategies (e.g., town halls, workshops).

values, and perspectives.

Recognitional

Acknowledge that some groups and places face historic and institutional vulnerability as a result of socioeconomic status, race, or culture.

- Addresses historic and institutional discrimination.
- Implements anti-racist, transformative, and socioeconomically empowering policies that enhance heat resilience for all.
- Identifies and avoids excluding vulnerable communities and people in adaptations.

Table 3: Dimensions of justice and their indicators for policy analysis (Source: Adapted from Strange et al., 2023)

Each plan was scored based on indicators of UCJ and maladaptation. Distributive justice focused on resource distribution, procedural justice examined community involvement, and recognitional justice assessed attention to historical discrimination. Maladaptation was evaluated based on whether plans could lead to rebounding vulnerability (harming intended beneficiaries), shifting vulnerability (passing the problem to other groups), or eroding sustainable development (increased greenhouse gas emissions (GHG), degradation, or negative social and economic effects). Themes were analyzed using Atlas.ti and coded deductively using the frameworks found in Tables 2 and 3.

Qualitative policy analysis was chosen for its ability to capture nuanced themes often missed in quantitative approaches. This approach allows for a comprehensive understanding of complex issues within policy, especially for evolving concepts like vulnerability and justice, where context is critical to human experiences.

3.2 GIS Analysis

Geographic Information System (GIS) analysis was utilized to portray vulnerability in the areas of study as maps paint an easy-to-understand picture of patterns and relationships (ESRI, n.d.). GIS is a commonly used tool to understand and detail vulnerability to various environmental hazards ranging from earthquakes to wildfires (McMaster et al., 1997). Its continued use in the environmental hazard field has resulted in the creation of various indices with a focus on specific

risks (Watkins et al., 2021). This research used the Heat Vulnerability Index (HVI) created by Reid et al. (2009) which is made up of 10 factors found to be particularly relevant to heat vulnerability. These 10 factors can be broken down into 4 categories including demographic variables, land cover, diabetes prevalence, and air conditioning (A/C) (ibid) and are defined in Table 4. HVI is a hazard-specific vulnerability index meant to incorporate “social variables that indicate susceptibility to heat, such as age or pre-existing disease prevalence, as well as variables reflecting the magnitude of heat, such as land surface temperature and vegetated land cover, while excluding variables that have shown small or null effects in existing heat-health epidemiological studies” (Watkins et al., 2021, p. 3). HVI has been used in similar studies regarding extreme urban heat in the U.S. and has been regarded as a useful tool for visualizing vulnerability to heat at the local scale and having the potential to direct funding and resources to communities with the most need (ibid; Harlan et al., 2021; Reid et al., 2009).

Category	Data source	Variable definition
Demographic variable	US Census Bureau, American Community Survey 2018 5-Year Estimates	Percent population below the poverty line Percent population with less than a high school diploma Percent population of race other than white Percent population \geq 65 years old living alone
Land cover	Healthy Places Index, NLCD 2011	Percent census tract not covered in vegetation
Impacted Health Conditions	California Environmental Health Tracking Program (CEHTP) and Office of Statewide Health Planning and Development (OSHPD)	Visits to Emergency Room per 10,000 as a result of health conditions impacted by extreme heat

Table 4: Heat Vulnerability Index (Source: Adapted from Reid et al., 2009)

The mapping of HVI used GIS layers sourced from the Los Angeles County Planning Office, who provide downloadable data from the county-operated website: geohub.lacity.org. Some variables were omitted or substituted from Reid et al.’s (2009) index as they were not available (diabetes) or seemed redundant (65+ population and 65+ population living alone). One notable omission is the prevalence of A/C. After having reached out to scholars who have conducted similar studies

in the area and asking interviewees of such information, it appears that data on A/C prevalence either does not exist or is not available at the same detailed level as the other variables.

3.3 Semi-Structured Interviews

In addition to GIS and policy analysis, this study is backed by 5 semi-structured interviews conducted between February and June of 2024. These interviews were conducted with representatives at various levels of local government and grassroots organizations, both of which focused on issues relating to climate change risks, vulnerability, and adaptations (sample questions and areas of focus in these conversations can be found in Appendices 1 and 2).

To understand the County of Los Angeles' and the studied neighborhoods' approach to UCJ, I interviewed representatives from the county and city level (n = 3). To find these interviewees I reached out to the Los Angeles County Planning Office and the Offices of the District Council of Los Angeles which represent the studied neighborhoods. On the county level, I was connected with a representative from the LA County Chief Sustainability Office, the same office responsible for conducting the LA County Vulnerability Assessment. On the city level, I was connected with a Field Deputy (a representative of an individual city as each district represents multiple cities) and a City Councilmember (the elected official overseeing an entire district). These interviews helped me understand whether themes of UCJ were at play in planned or current adaptations, and in which ways.

In addition to representatives from the local government, I interviewed members of local community-based organizations (n = 2). This was done to understand their involvement with the community, immediate local government level (neighborhood/district), and county government. These interviews helped me understand the role that these organizations play in their communities as well as if or how themes of UCJ were included in these processes from a non-governmental perspective. As they are outside of government processes and built up of local community members, I felt they would more accurately represent the opinions and desires of the local communities. I chose to interview these organizations as they were some of the most involved within the local community, had previously done work in response to risks posed by extreme heat, and were either directly involved with the neighborhoods researched or served the San Fernando

Valley as a whole. The interviews were recorded, transcribed, and analyzed in Atlas.ti to perform a qualitative assessment of thematic codes and recurring themes (a coding tree is provided in Appendix 3).

Interviews were coded deductively, with Bulkeley et al.'s (2014) approach to urban climate justice being used as a start list. A start list was used to provide "initial focus in identifying certain key aspects of the data that directly relate to the research questions" (Azungah, 2018). This start list, and the proceeding codes that came as a result is visible in the coding tree of semi-structured interviews (Appendix 4). The second 'branch' of the coding tree is representative of frequent themes or talking points that came up when discussing topics of the start list either explicitly or implicitly, such as in the context of a larger conversation topic. The third 'branch' offered common reasons why or important outcomes of these talking points. Coding was done in this matter to create a structure in which hours of dialogue could be organized and simplified into subjects that could be analyzed for patterns and relationships (Cope, 2010). Quotes that were representative of prevalent codes and patterns were utilized in findings and discussion sections.

As Los Angeles County represents the largest county by population in the United States, and the neighborhoods compared make up roughly 175,000 people having only 5 interviewees may seem a low number. While many people, offices, and organizations were contacted for interviews, many did not respond, cited auditing/budgeting periods as reasons for inability to participate, or responded initially and then terminated communication. While more interviews may offer more perspectives, the interviewees involved in this thesis are influential people in key roles, both at the community-based organization and local government level. Additionally, this was not a study that relied primarily on interviews. To properly answer questions of this type, triangulation is necessary with interviews only representing one method and one type of data.

3.4 Ethical Considerations

When performing research, ethical behavior is important as the rights of people, communities, and societies are involved and potentially impacted by research. Hence, defining ethical guidelines and acting in an ethical manner is meant to improve the integrity and quality of the research at hand (Govil, 2013). To ensure ethical research, before conducting interviews, I sent out an agreement

to participate form (Appendix 4) to the interviewees. This consent form stated the purpose of the research in lay terms and outlined the way in which information would be used, collected, and stored. Additionally, at the beginning of the interview, I showed my university identification card to ensure that I was conducting interviews as part of university research and asked whether or not their identity could be used in my research as well as if the audio of the interview could be recorded. Interviewees were thanked for their willingness and time prior to and following the interview (Adams, 2015). After the interview was transcribed, I made the transcription available to interviewees so that they could verify information or check for possible inaccuracies. Maintaining accordance with the consent form, the information provided (interviews) was confidentially stored as a password-protected encrypted file on a password-protected computer.

4. Findings

To help make sense of the findings of this master's thesis, I first provide relevant background information on the area of the study and then go into the results in the following order: policy document analysis, Geographic Information System (GIS) analysis, and semi-structured interviews. Done in this order to give legislative context on the issue, followed by current realities of the issue, concluded with perceptions of the situation from relevant stakeholders.

4.1 The San Fernando Valley

This research investigated two community planning areas within the San Fernando Valley, which is located northwest of downtown Los Angeles and makes up about 20% of the entire official population of Los Angeles County (U.S. Census Bureau, 2022a). Geographically, the San Fernando Valley is surrounded by the San Gabriel, Santa Monica, and Santa Susanna Mountain Ranges as well as the Simi Hills (Britannica, 2023) which enhances the Mediterranean climatic conditions that characterize the area (Schiffman, 2019). These geographic features cause hot air to stagnate in the valley (Margolis, 2023) and create some of the hottest temperatures in the county (Los Angeles County, 2021). The overrepresentation of cities within this valley of the most vulnerable rankings by LA County was the reason for the selection of this area (Los Angeles County, 2021).

The two community areas that this investigated are the Encino – Tarzana and Arleta – Pacoima neighborhoods, which are outlined in Figure 5. These cities have been chosen as they highlight the variability in demographic makeups that characterize the San Fernando Valley while facing near-identical temperature increases and increases in the amount and intensity of extremely hot days by mid-century (Los Angeles County, 2021).

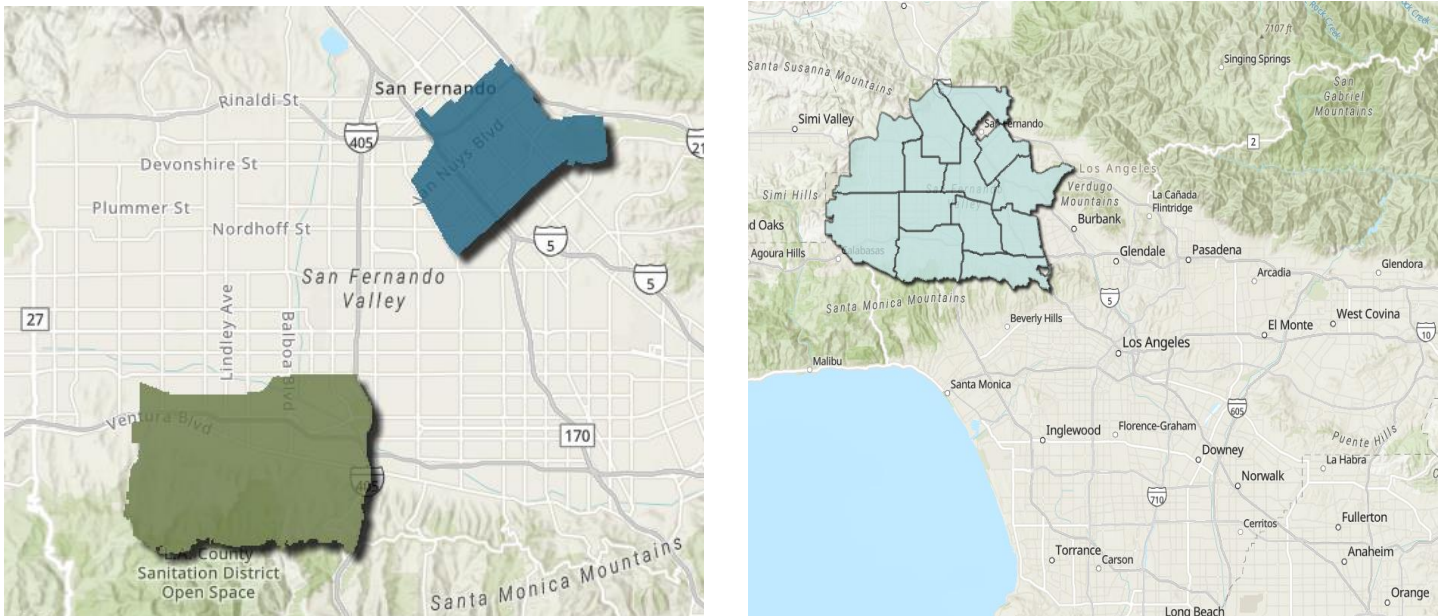


Figure 5: Encino - Tarzana (Green) and Arleta - Pacoima (Blue) Community Areas (Left) in reference to Greater Los Angeles (Right) (Source: Author, 2024)

The neighborhoods of Encino and Tarzana together make up the Encino – Tarzana , which is the metric used by the Los Angeles Department of City Planning and U.S. Census Data, is a predominantly white (80.4%), affluent, English-speaking neighborhood with a median household income of \$106,501 and population of 79,168 (Los Angeles Department of City Planning, 2024). The neighborhoods of Arleta and Pacoima together make up the Arleta – Pacoima area which is a minority-majority, (88% of the population identifies as Hispanic or Latino), Spanish-speaking, relatively low-income area with a median household income of \$73,167 and a population of 102,591 (Los Angeles Department of City Planning, 2023). For reference, the median household income in Los Angeles County is \$83,411 (U.S. Census Bureau, 2022b).

These two areas were selected as they represent two different faces of Los Angeles and the San Fernando Valley. The Arleta – Pacoima area has been selected for the Los Angeles Reforms for

Equity and Public Acknowledgement of Institutional Racism participatory budgeting program as a result of its experiences with historical and structural racism, redlining, the large population living below the poverty line, etc. (L.A. REPAIR, 2023). While the Encino – Tarzana area is characterized by multi-million-dollar homes, Ventura Boulevard - home to various luxury brands, local restaurants, yoga studios, and the Braemar Country Club in the hills of Tarzana. Considering the predicted increase in extreme heat intensity and frequency Pacoima and Tarzana were nearly identical, with an increase of 3.4°C above baseline extreme temperature for an additional 29.8 days per year and 3.3°C above baseline extreme temperature for an additional 27.9 days per year respectively (Los Angeles County, 2021). This presented a unique opportunity to assess intra-urban variance in vulnerability and potential adaptations.

4.2 Analyzing Relevant Government Policy

Since the turn of the century, the state of California has been at the forefront of including environmental justice into legislation. A true start can be seen in 1999, when then-governor Gray Davis signed Senate Bill 115, which saw California become the first state to legally define environmental justice, designated the Office of Planning and Research as the coordinating agency for environmental justice programs, and mandated the California Environmental Protection Agency to develop a model environmental justice mission statement for its boards, departments, and offices (Governor's Office of Planning and Research, 2013).

In recent years, California’s approach to environmental issues including extreme heat has resulted in the creation of various plans and policies aiming to understand and confront the problem. The first policy document that this research analyzed was *Senate Bill 1000: The Planning for Healthy Communities Act* which went into effect in 2018. For easier reading, *Senate Bill 1000: The Planning for Healthy Communities Act* will be referred to as *SB 1000* in this thesis. *SB 1000* requires cities and counties with ‘disadvantaged communities’ to incorporate principles of environmental justice into their general plans, which serve as blueprints for future development (Fallon, 2023). Specifically, the principles of environmental justice would need to be utilized “to reduce the unique or compounded health risks in disadvantaged communities, as specified, identify objectives and policies to promote civil engagement in the public decision-making process, and

identify objectives and policies that prioritize improvements and programs that address the needs of disadvantaged communities” (SB1000, 2016).

This piece of legislation’s focus on themes of environmental justice, and as a result urban climate justice (UCJ), hold major implications for neighborhoods in Los Angeles as ‘disadvantaged communities’ are widespread in the area. *SB 1000* paid equal attention to both procedural and distributive justice while, in line with findings from the literature, recognitional justice was present but to a lesser extent. Reflecting aspects of UCJ, *SB 1000* shows attentiveness to aspects of government’s responsibilities. Looking to examples from procedural justice within the legislation there was a focus on the incorporation of local governmental agencies and civil engagement in the minimization of climate change impacts in new land uses and decision-making process in areas of environmental risk respectively. Distributive justice’s representation in the legislation came through a focus on identifying and prioritizing programs, objectives, and policies that aim to reduce the unique or compounded risks that ‘disadvantaged communities’ face in terms of environmental hazards. In terms of recognitional justice, while represented in the definition of what ‘disadvantaged communities’ are as a result of being low-income and disproportionately susceptible to the impacts of environmental hazards and climate change, it does not acknowledge the processes that created these circumstances. Processes such as redlining, which would have put these “disadvantaged communities” in areas of greater risks for generations and put them in the situation they find themselves in now. *SB 1000*’s attention to the principle of responsibility was apparent, as it streamlined the reimbursement process for local agencies and school districts that incurred costs as a result of state mandates related to the bill.

In terms of maladaptive practices and potentials, the legislation seemed to be cognizant of risks as it advocated for new essential public facilities to be located outside of identified flood and fire risk areas. Additionally, its advocacy for nature-based solutions, in the form of tree planting and habitat restoration, to combat the impacts of high heat days and other environmental risks shows an awareness of the need to shift away from high-consumption adaptive practices, minimizing adaptations that would erode sustainable development.

The second policy document analyzed, the *Los Angeles Climate Vulnerability Assessment* (LACVA) was a report published by the LA County Chief Sustainability Office with the goal of identifying areas and communities at risk to various climate hazards including, but not limited to, extreme heat. As the document was not a piece of legislation, I argue that it offers a more transparent view of the situation, backed up by its seemingly disproportionate focus on principles of recognition justice. While the report focused on vulnerability, which I will examine with the use of GIS analysis in the next section, I found it important to understand and reveal the perceptions of these risks by the governmental bodies overseeing both neighborhoods. As per the nature of the report, aspects of procedural justice were very limited, confined to one mention that the goal of Los Angeles County is foster cooperation between the county, municipalities (individual cities/neighborhoods) and communities.

LACVA shows the most emphasis on recognition justice, highlighted by the emphasis it put on the role of institutionalized and historical racism in creation of areas of disproportionate vulnerability. Specific examples from the assessment pointed to overrepresentation of minority populations, especially Black and Latino, in underserved and hotter communities. Finding that Latino populations, while only making up 48.5% of the county's total population account for 66.9% of those vulnerable to extreme heat. Attributing this disparate vulnerability to historical practices of redlining which minimized access to green spaces and canopy cover and increased prevalence of impermeable surfaces in predominantly Latino communities. A community's environment is not the only feature that disproportionately impacts communities of color, as the report also cited that schools in these communities were less likely to have air-conditioning due to generational, nationwide racist practices against minority communities which exacerbate extreme heat's negative impacts on learning and cognitive functions.

In line with recognition, and the utilized definition of UCJ, the vulnerability assessment pointed out failures in responsibilities. Two points on this arose again from redlining practices or historical disinvestment such as the inadequate provision of public transportation in areas of disproportionate vulnerability that inhibit accessing cooling centers or increasing time spent waiting in high heat conditions. The second being the correlation between communities with low adaptive capacities and their proximity along major freeways as these areas often received little public investment and

their proximity made them susceptible to high levels of pollution and health complications. Another highlighted situation that can be seen as a failure of responsibilities is that 25% of workers whose occupation exposes them to extreme heat had been denied sick leave or extra break times in such conditions. This, in combination with other information brought up in the assessment which found that Latino populations were overly represented in outdoor-worker populations show how these conditions compound and create vulnerabilities in areas of residence and occupation. It is worth noting, and another example of recognition justice, that the report stressed that adaptations, in an attempt to prioritize equity, should be prioritized for communities at higher risk and limited access to cooled spaces.

The third policy document analyzed was *Protecting Californians from Extreme Heat: A State Action Plan to Build Community Resilience*, published by the Governor of California's Office. This action plan, the largest document analyzed, broke adaptation into four tracts: A) Build Community Awareness and Notification, B) Strengthen Community Services and Response, C) Increase Resilience of Our Built Environment, and D) Utilize Nature-based Solutions. Throughout these plans procedural justice was represented the most, followed by distributive justice, with recognition justice being the least represented. Regarding procedural justice, a majority of the plans put forward that related to the principle did so by incorporating Native American Tribal governments/offices, local government/jurisdictions, and community-based organizations into resilience planning and adaptations. These plans range from bolstering protections for unhoused populations during extreme heat events to creating and assisting in regional plans regarding health resilience associated with climate change and extreme heat.

Both awareness and risks of maladaptive potentials were present in the action plan, with overlap frequently occurring regarding plans involving increases in programs and technologies having to do with air conditioning (A/C) systems and their prevalence. While the plans repeatedly acknowledged the greenhouse gas (GHG) emissions resulting from A/C systems, hence how they were maladaptive, their continuous advocacy could prove to be detrimental if not carried out in an intentional manner. Plans which focus on adaptation that are heavily reliant on A/C systems risk falling into all categories of maladaptation. Continuing this trend, there were some plans put forth by the Governor's Office that I argue risk being categorized as shifting vulnerability. One of

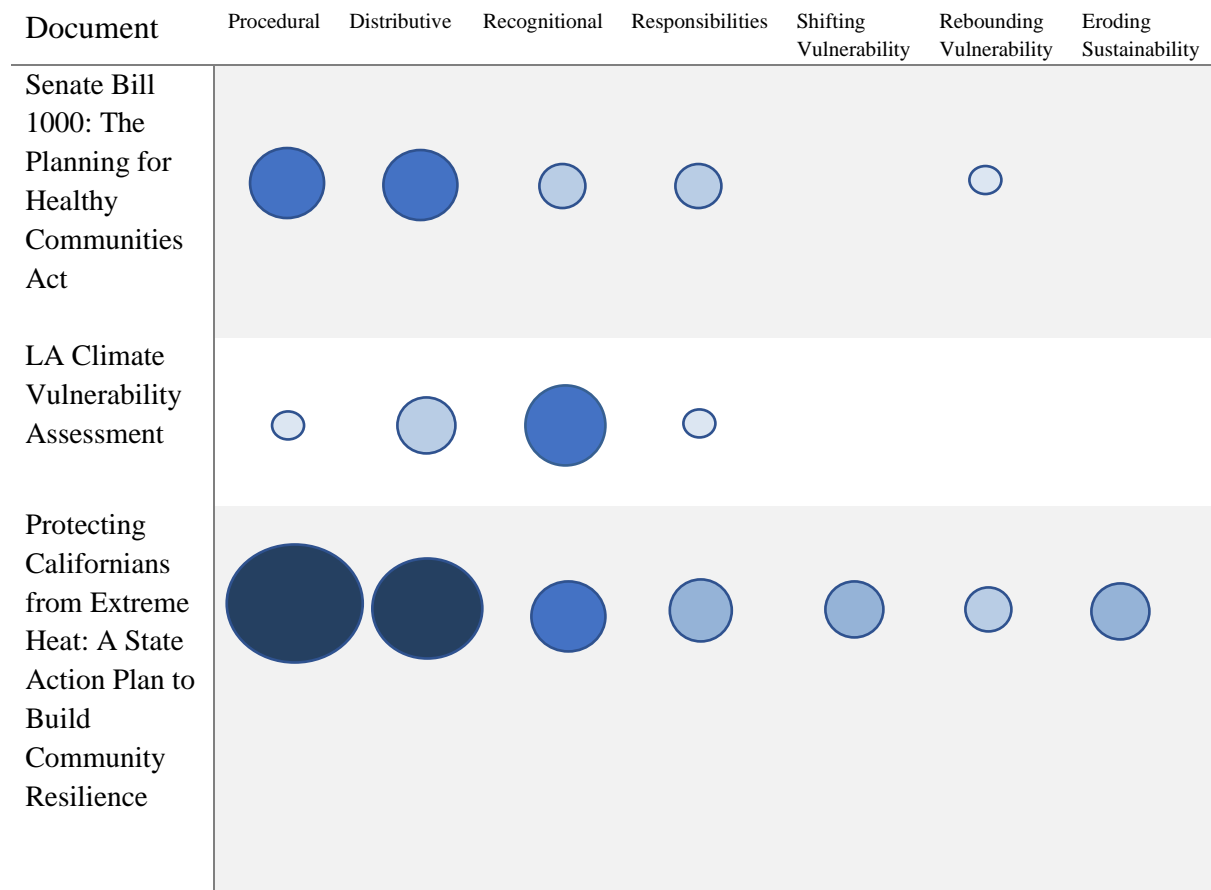
these programs was the provision of funds for external awnings as they reduce indoor air temperatures and reduce the need for A/C use resulting in emissions and peak demands. While a conscious effort to reduce known maladaptive practices, depending on the programs implementation it would risk benefitting only those that are private homeowners, as renters are typically not in the position to make decisions regarding the alteration of a household. This potentially leaves those that are less well-off to shoulder the cost, through taxes, of adaptations that they themselves cannot reap the benefits of.

The fourth policy document analyzed in this study was *CF 22-1566 or the Climate Action and Adaptation Plan in the City's General Plan* published in April 2023. This piece of legislation focuses primarily on recognitional and distributive aspects of justice with procedural justice being the least represented of the three. Included in its background is the need to focus on creating plans in which climate equity is taken into consideration and that increase comprehension of how the most vulnerable populations will be impacted. Recognition and distributive justice often worked together in the plan, particularly in advocating for and supporting the *Climate Vulnerability Assessment*, as Los Angeles aimed to exceed state requirements. Their focus on vulnerability assessments resulting from the desire to incorporate the needs and voices of communities which have been historically marginalized and disproportionately burdened by climate hazards such as air pollution. Furthermore, in line with the three classic components of urban climate justice, the legislation detailed how a new department, the Climate Emergency Mobilization Office, would coordinate with community-based organizations and other key stakeholders to host a Climate Equity Series on extreme heat mitigation and adaptation. This series was created to advise the City Council, Mayor, and City Departments on how to shape equitable solutions and investments regarding the issue.

In an unprecedented manner, in the scope of this research, the legislation highlighted how the incorporation of the Climate Action and Adaptation Plan (CAAP) into the General Plan could prove to have negative impacts. As the CAAP's has strict requirements regarding development projects which increase GHG productions, this could conflict with current processes of streamlining approvals for affordable housing risking shifting vulnerability. As groups with

already heightened risk to the threats of extreme heat, those struggling with extreme poverty or homelessness, would find themselves worse off as a result of this adaptation.

To visualize the prevalence of topics in the analyzed documents Table 5 was created to illustrate the presence of aforementioned themes. The dots in the table darken and increase in size as their prevalence in the analyzed policy documents increases. In this style, a more comprehensive understanding of the policies can be provided without explaining the presence of each theme in detail. While *Protecting Californians from Extreme Heat: A State Action Plan to Build Community Resilience* showed the largest presence of almost all analyzed themes it was by far the longest document and as it only outlined plans this increased the likelihood for maladaptations.



CF 22-156:
Climate
Action and
Adaptation
Plan in the
City's General
Plan



Table 5: Prevalence of Justice Dimensions and Risk of Maladaptation. (Source: Author, 2024) Note: Circle sizes and color correspond to prevalence of the component in the corresponding document.

4.3 Mapping Existing Vulnerability to Extreme Heat

While policy analysis allows for a legislative understanding of the situation, to visualize the lived realities of vulnerability to extreme heat in the studied areas, GIS analysis was utilized. The differences between these neighborhoods, according to Reid et al.'s (2009) Heat Vulnerability Index, were stark. In every metric besides the percentage of population 65 or older living alone, the Arleta – Pacoima area fared worse than the Encino – Tarzana area. Looking first at the rates of poverty within the two areas (Figure 6), there are only two census tracts (the outlined polygons within the boundaries of the community) within the Arleta – Pacoima area that have poverty rates below 8,8%. With just as many census tracts characterized by poverty rates between 27,4% and 33,5%. In comparison, in the Encino – Tarzana area, more than half of the census tracts (10 out of 19) fall into the lowest field and only 3 census tracts land within the 15% - 21,1% field, being the highest rates represented in the area.

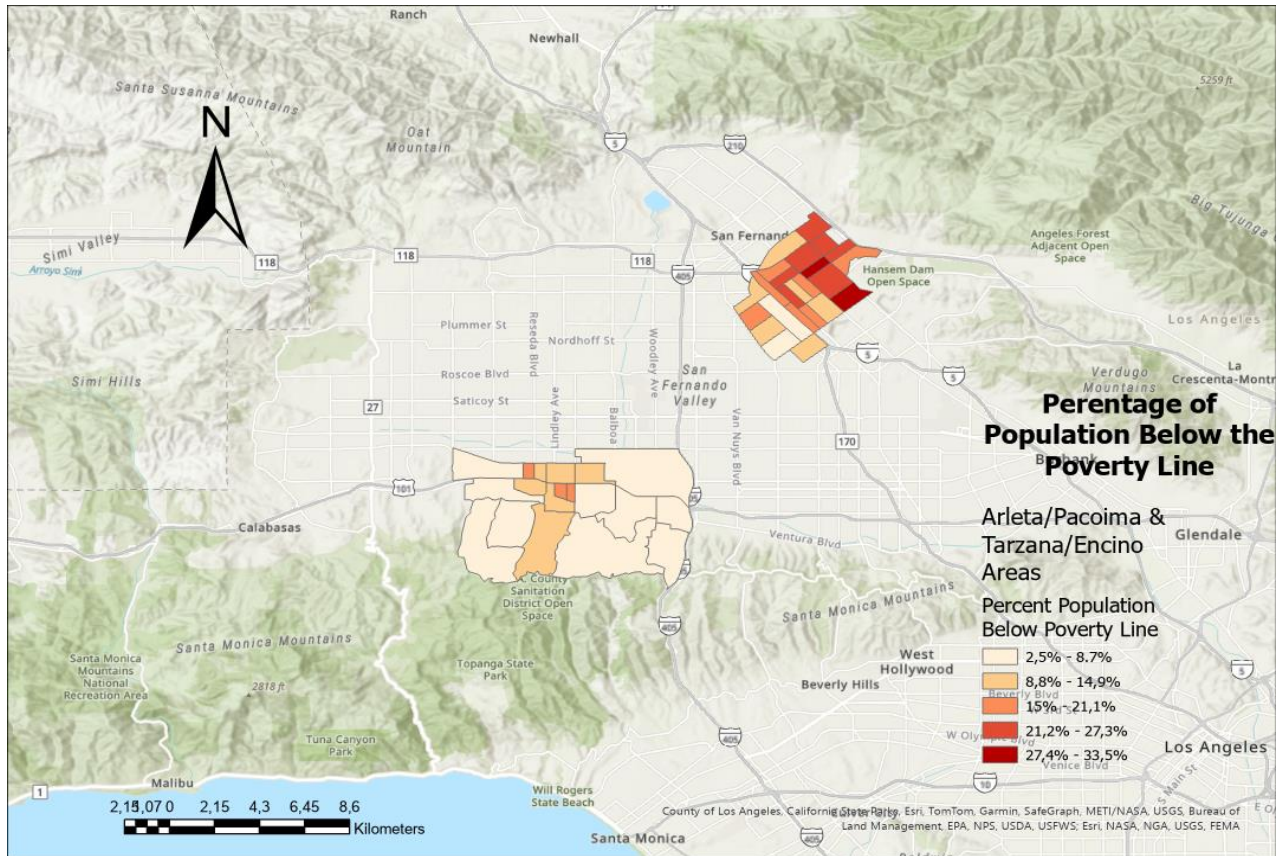


Figure 6: Percentage of population below the poverty line

When examining the map (Figure 7) of health conditions impacted by extreme heat, which combines the rates of emergency department visits (# per 10,000) for cardiovascular diseases and asthma the differences are less pronounced but still noticeable. In the Arleta – Pacoima area, 21 out of 24 of the area’s census tracts are represented in the highest field (between 61,5 and 81,5 visits per 10,000). Comparatively, the Encino – Tarzana area is significantly less affected, with no census tracts in the highest category. Instead, most of the population of the Encino – Tarzana area falls into the lower to middle ranges of emergency department visit rates. Examining this map reveals the important relationship between proximity to major freeways and health impacts. The Arleta – Pacoima area is dissected by the 118 and 5 Freeways, with the 5 intersecting the 170 at the southern border and the 118 connecting with the 210 at the northeast border. These freeways also intersect in the middle of the community. Additionally, the area is bordered by the 405 Freeway to the west and the 210 Freeway to the east.

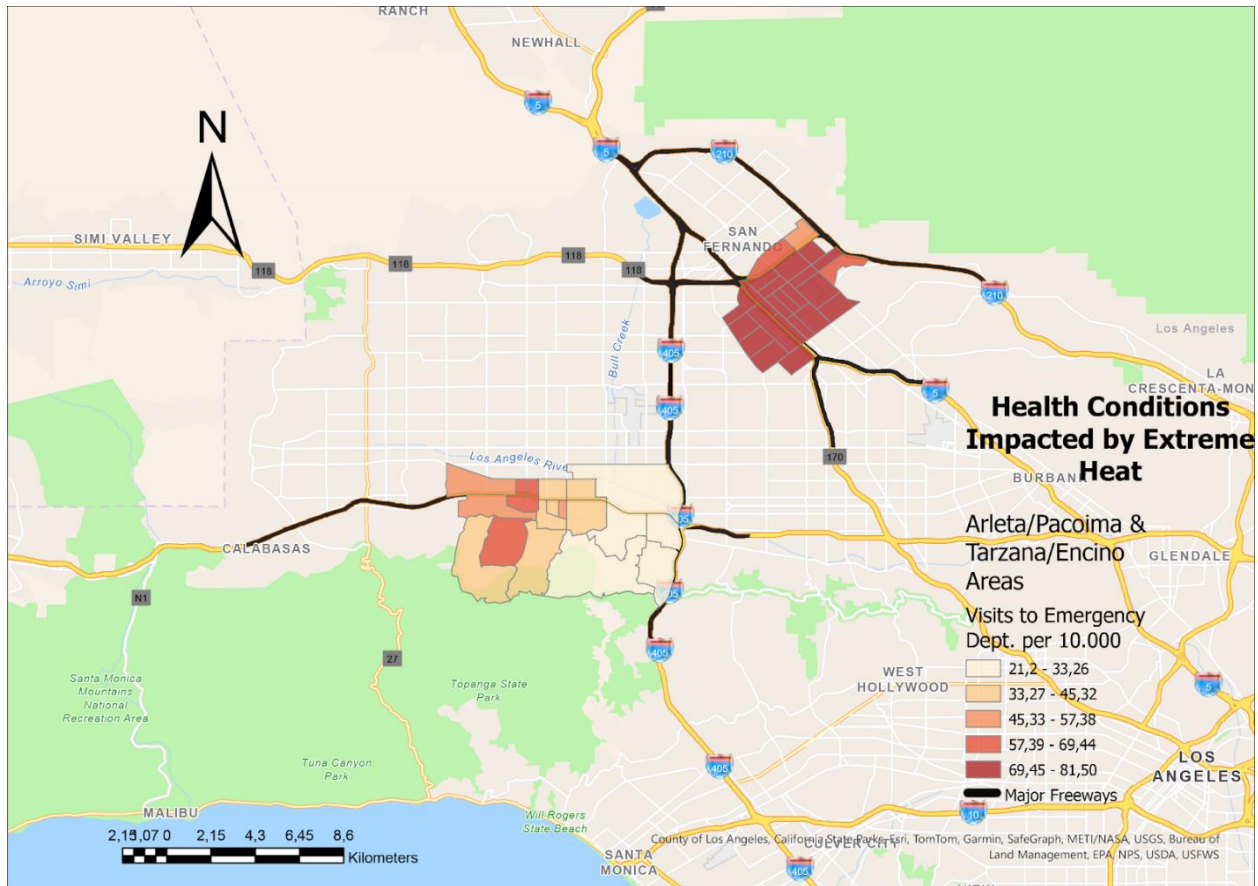


Figure 7: Health conditions impacted by extreme heat (Source: Author, 2024)

Ricky Angel, a field deputy representing the Encino area and a native to the City of San Fernando, a community bordering Arleta – Pacoima, highlights the impact of these freeways. According to Ricky, the freeways “created a huge disparity for people who grew up there. If you look at my neighborhood a lot of people in their late 20s to 40s have respiratory problems and that’s in large part due to the fact that we’re surrounded by freeways” (Interview #2, 22/04/2024).

In the Encino – Tarzana area, the difference between its East and West areas is drastic. However, examining data on land cover and elderly populations together can help explain this disparity. The northeast corner of this Encino – Tarzana is dominated by a recreational area, resulting in low population density whereas the areas to the west, specifically along the 101 Freeway corridor is characterized by townhomes and apartments (relatively high-density living spaces). The census tract in the southwest, characterized by the second highest field of health conditions might be explained by its large elderly population. As elderly people are more likely to suffer from

cardiovascular diseases this could explain the deviation from the apparent trend of freeway proximity correlating with health conditions (National Institute to Health, 2018).

Figure 8 depicts the racial/ethnic demographics of the studied areas and conveys a compelling illustration of the differences that characterize these areas. Every census tract within the Arleta – Pacoima area is part of the 82,2% - 100% field of population that identifies as a race other than white, with the largest group being Hispanic or Latino. While within Encino – Tarzana only 7 census tracts were outside of the lowest field, which is defined by 12,5% - 30%, 6 out of 7 of these were in the second field, defined by 30,1% - 47,3% of the population being a race other than white. An insight the Encino – Tarzana map illustrates that is worth pointing out is the concentration of these tracts that have higher rates of minorities on the north side of the 101 freeway. The demarcation between the sides of the 101-freeway where people or places are located is important, as the south side is often seen as a wealthier and more appealing place to live and do business.

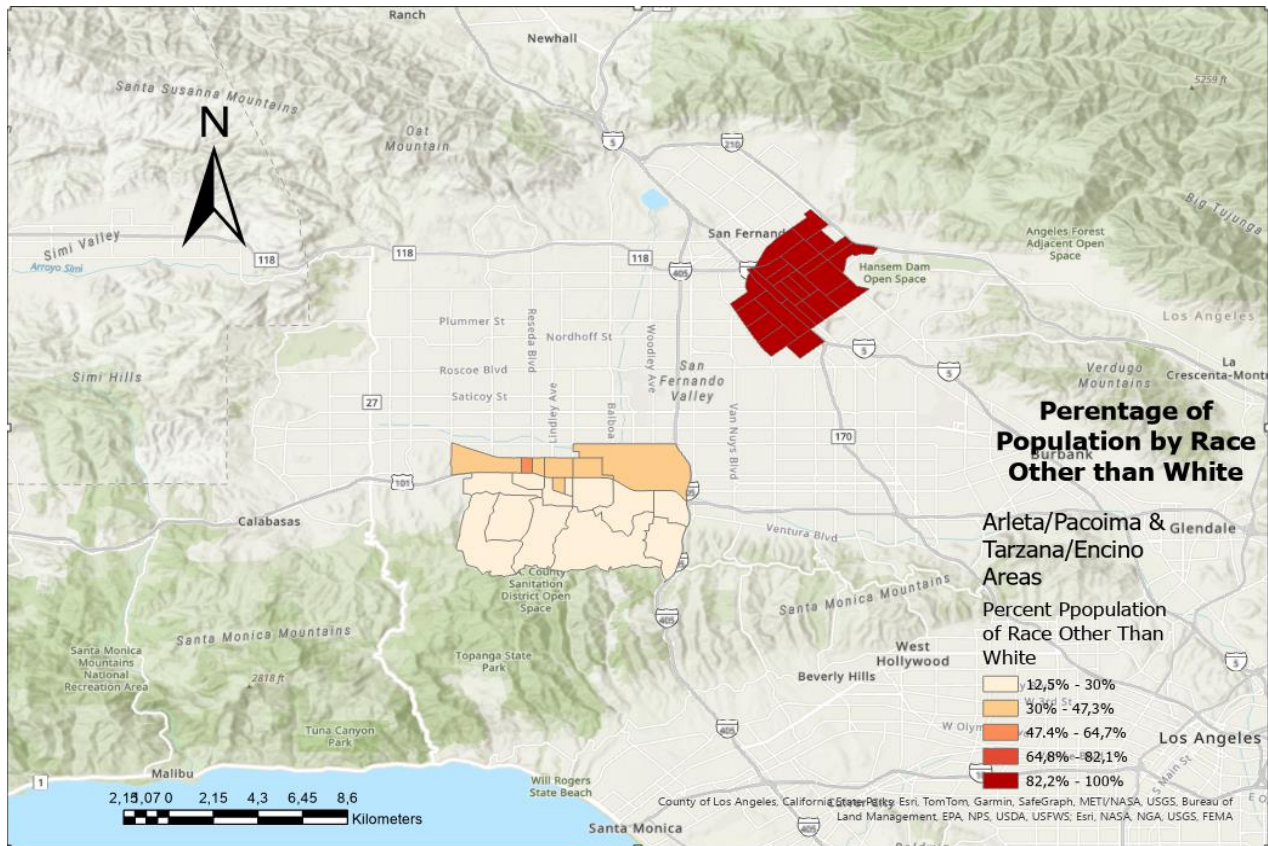


Figure 8: Percentage of population by race other than white (Source: Author, 2024)

Understanding the aforementioned differences vis a vis documents analyzed in this thesis, an important insight can be obtained. In its creation of a social sensitivity index, the LACVA highlighted race/ethnicity as an indicator representative of a “characteristic that increases a person’s sensitivity to climate hazards” (p. 36). Underscoring the earlier point that Black and Latino populations were found to be the most underserved and vulnerable communities. Moreover, the *Protecting Californians from Extreme Heat: A State Action Plan to Build Community Resilience* document reveals that formerly redlined or marginalized communities typically face hotter conditions than nearby wealthier areas. As Pacoima historically consisted of Black, Latino, and Japanese communities the area was redlined in the 1930s by a federal agency called the Home Owners Loan Corporation (Take Two, 2021). Exposing these populations to highly polluting infrastructure like freeways and landfills which have lasting implications regarding vulnerability to heat as well as other environmental hazards (ibid).

The map displaying the starkest contrast between the two areas is Figure 9, which depicts the percentage of the population with less than a high school diploma. In the Encino – Tarzana area every census tract is represented in the lowest field, defined by only 0,6% - 12,9% of the population not having a high school diploma. Whereas in the Arleta – Pacoima area not a single census tract is represented in the lowest two fields (between 0,6% and 25,4%), with a majority of the tracts (19 out of 24) being characterized by the highest two fields (between 37,8% and 62,5%). Unfortunately, the map with a pattern most similar to this is Figure 8, outlining the percentage of population by races other than white. This finding aligns with an earlier point made by the LACVA regarding schools without A/C being predominately located in communities of color; the impacts of this on learning and cognitive functions can provide important context in understanding this trend.

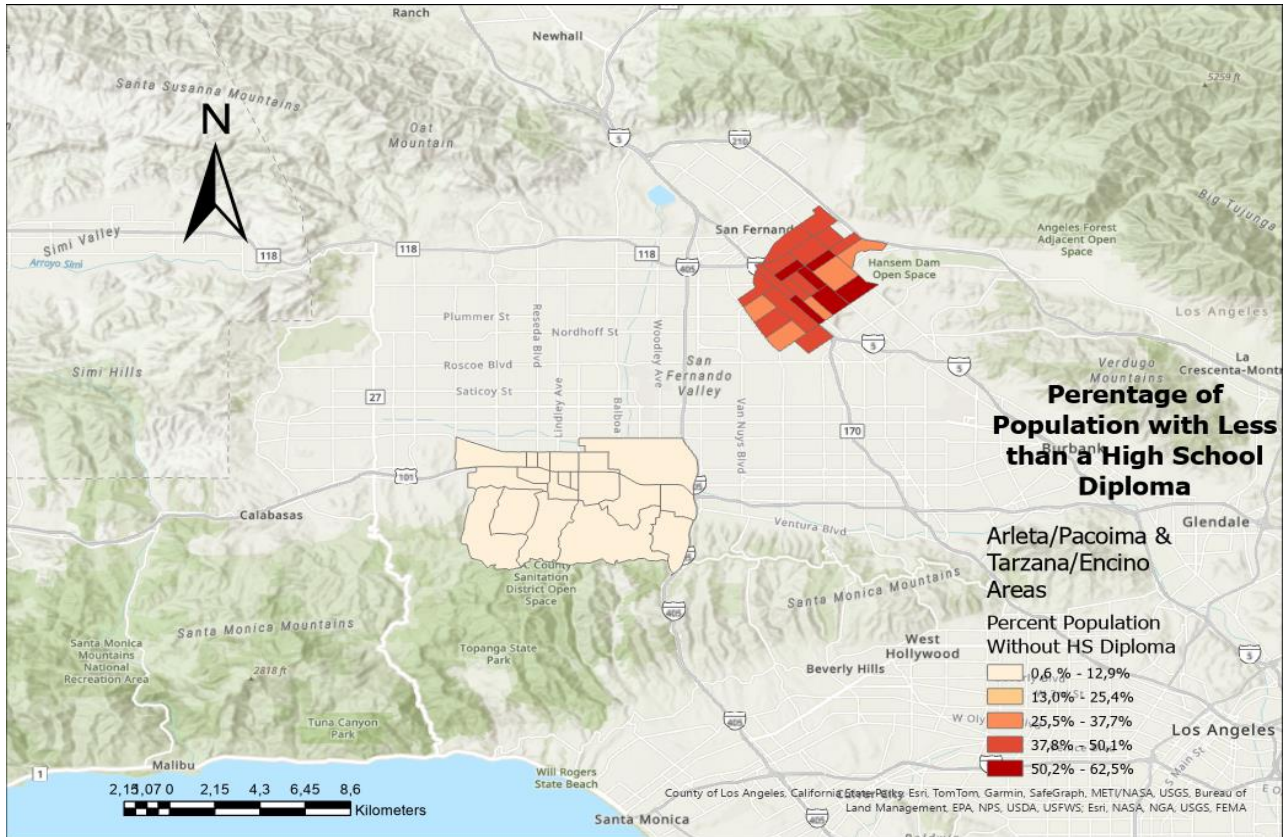


Figure 9: Percentage of population with less than a high school diploma (Source: Author, 2024)

Figure 10 is the only map that contradicts the trend of the Arleta – Pacoima area being more vulnerable compared to the Encino – Tarzana area. This map outlines the percentage of the population aged 65 or older that live alone. In the Arleta – Pacoima area a majority (14 out of 20) of the census tracts are represented in the lowest field (1,6% to 5,6%) with no census tracts in the highest two highest fields (13,6% to 21,5%). The Encino – Tarzana area finds itself at the opposite end of this metric, with no census tracts being represented within the lowest field. A majority of the census tracts (13 of 19) are characterized by three highest fields (between 9,7% and 21,5%) representing.

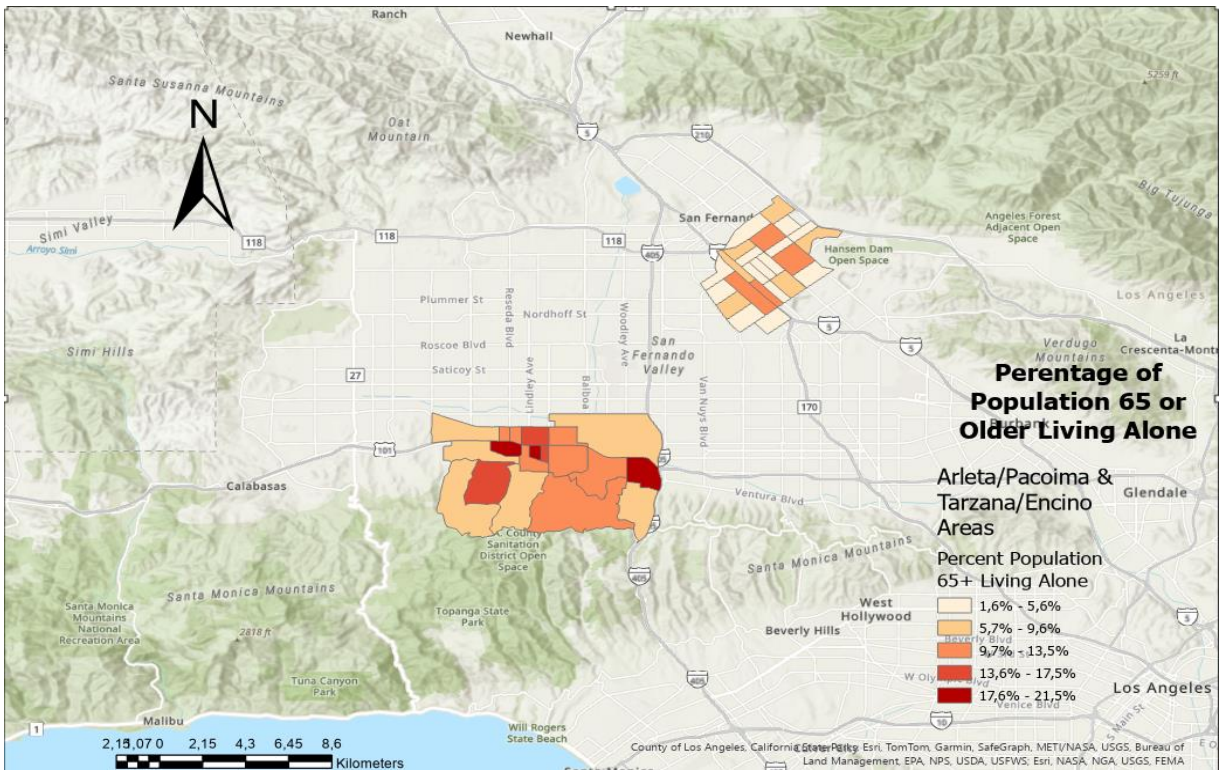


Figure 10: Percentage of population 65 or older living alone (Source: Author, 2024)

The final map (Figure 11) depicts the percentage of impermeable surfaces within the two communities (outlined in black). This map has a unique appearance as the dataset was not available for download and had to be made using geohub.lacity.org.’s Map Viewer tool, as opposed to being exported to ArcGIS Pro. Nevertheless, the trend of vulnerability continues with the Arleta – Pacoima area being more thoroughly covered by impermeable surfaces. While the areas that are covered with impermeable surfaces in the Encino – Tarzana areas are done so more thoroughly they represent a rather small proportion of the total area, with the mountainous backing providing a large amount of permeable surfaces. On average, 45,7% of the Encino/Tarzana area is covered by impermeable surfaces while in the Arleta - Pacoima area the average is 54,8%.¹

¹ However, this may be somewhat misleading, as this average was derived from census tracts, and the Encino/Tarzana areas have fewer tracts, with 3 outliers of more than 70% that represent very small areas.

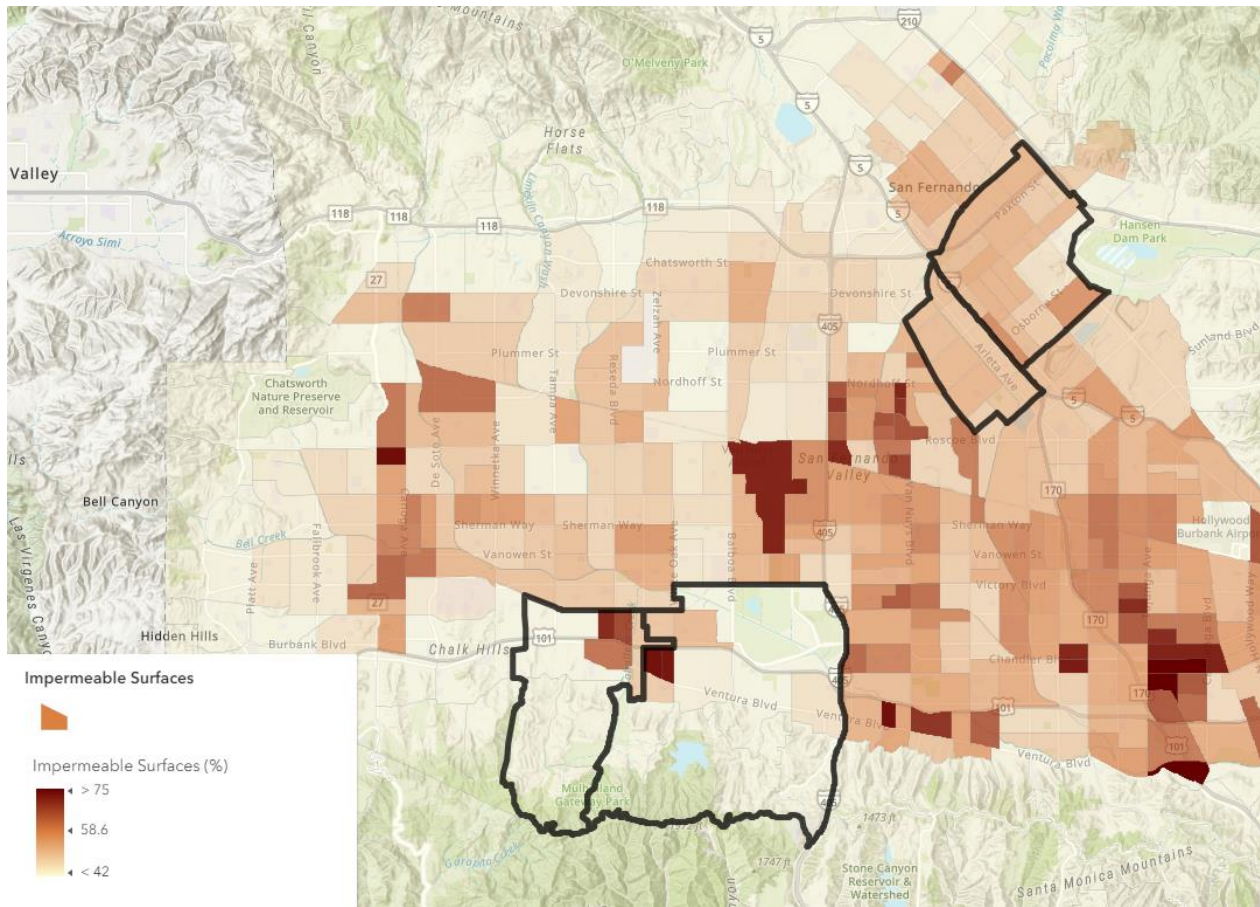


Figure 11: Percentage of land covered by impermeable surfaces (Source: Author, 2024)

The implications of impermeable surface rates go beyond susceptibility to phenomena like Urban Heat Islands; they also impact potential adaptation projects. Ali Frazzini, a Sustainable Policy Director at Los Angeles County’s Chief Sustainability Office stated that, “many of our most vulnerable neighborhoods are very dense, with a lot of people living in them and existing infrastructure under the street like water, gas, and sewage pipes. With this comes impermeable surfaces like wide streets, big parking lots, and other areas that are heavily paved over with little space for greening. So, to start planting more there we would have to dig up the pavement and factor in what’s underneath it as there are often concerns about trees growing around pipes and breaking them” (Interview #1, 21/02/2024).

The patterns and trends illustrated through GIS analysis paint a clear picture regarding the level of vulnerability faced by the studied areas concerning extreme heat. In 5 out of the 6 metrics of the HVI, the Arleta – Pacoima area exhibits higher levels of vulnerability to current to extreme heat

conditions. Without intervention, this trend is likely to worsen with projected increases in both the intensity and frequency of extreme heat.

4.4 Understanding Local Perspectives on the Issue

To obtain a varied and representative group of interviewees I reached out to representatives of local government and community-based organizations in the area. In the end, five interviewees from five different organizations involved in the studied areas were interviewed. Each neighborhood was represented by at least one member from both community-based organizations and local governments. These actors and the community which they represent are introduced in Table 6 to provide context and relevant background information. For context, Los Angeles' city governance structure includes a Mayor and City Council made up of 15 districts, each represented by an elected official overseeing approximately 260,000 constituents, reaching a total of about 4 million people (LA City, n.d.). Additionally, around 1 million residents of Los Angeles live within areas called unincorporated communities who are represented directly by the county's Board of Supervisors (LA County Planning, n.d.). The remaining ~5 million residents living in incorporated cities, such as Santa Monica or Beverly Hills, which have their own mayors and councils (Los Angeles County, n.d.). All these areas are part of Los Angeles County, resulting in a population of around 10 million.






Interviewee	Information	Date	Logo	#
Ali Frazzini	The Chief Sustainability Office of Los Angeles, part of the LA County Government, leads collaborative efforts to create a sustainable Los Angeles emphasizing equity, economic opportunity, and climate resilience (Chief Sustainability Office, n.d.). It offers policy guidance to the Board of supervisors, County departments, and regional partners to ensure a sustainable future for all residents (ibid). I spoke to Ali Frazzini, one of two Sustainable Policy Directors and the lead manager of the LACVA.	21/02/2024	 <p>LA County Chief Sustainability Office Environment • Economy • Equity</p>	1
Ricky Angel	The Encino – Tarzana community planning area falls under Los Angeles Council Districts 4 and 3. I spoke with Field Deputy of Encino, Ricky Angel, who represents the Encino area. As a Field Deputy, Ricky sees his role as acting as a relationship builder to get a sense of the community's desires and needs and on the other end allocating resources.	22/04/2024 and 06/05/2024	 <p>NITHYA RAMAN Los Angeles City Councilmember 4th District</p>	2
N/A	Pacoima Beautiful is a community-based organization located in Pacoima, founded in 1996 by five mothers who became distraught by the environmental condition of their neighborhood. Leading them to organize community-clean up and tree planting events, which evolved into the only environmental justice organization in the Northeast San Fernando Valley.	25/04/2024	 <p>Pacoima Beautiful</p>	3
Diana Weynand	San Fernando Valley Climate Reality is a local chapter of The Climate Reality Project, a non-for-profit organization founded by former U.S. Vice President Al Gore. Their mission is to educate the public, influence policy, and promote sustainable adaptations to address climate change. I spoke with Diana Weynand, the chapter's chair.	26/04/2024	 <p>The Climate Reality Project SAN FERNANDO VALLEY, CA CHAPTER</p>	4
N/A	The Arleta – Pacoima community planning area is also represented by two separate Los Angeles City Council Districts, being Districts 6 and 7 respectively. From Arleta – Pacoima I spoke with an elected official representing the area.	30/05/2024		5

Table 6: Interviewee Table (Source: Author, 2024)

Ali Frazzini, a Sustainable Policy Director from the county's Chief Sustainability Office, provided an understanding of the situation and contexts in which adaptations exist from the county level, the highest body of administration in the immediate area. Regarding the difficulties that some neighborhoods may face in formulating comprehensive adaptation plans, she revealed that "most of our small cities just don't have the time or capacity to think about this issue. So, they aren't, they aren't looking for the information and they have many other things that seem more urgent to them" (Interview #1, 21/02/2024). The lack of capacity, commonly understood as time, resources, and money, was echoed in interviews conducted with both community-based organizations and administrative bodies. According to Diana Weynand, the chair of San Fernando Valley Climate Reality, this sentiment is not reserved for just local governments, but extends to members of communities as well, especially those in areas that have been historically disinvested. Given that trees, canopy cover, and greenspace are commonly seen as effective adaptation measures to extreme heat in cities worldwide, Diana made the point that:

"It's all about taking care of the trees after they've been planted. And a lot of times these projects fail because the trees are not taken care of by the community. Again, we're back to Maslow and the hierarchy of needs. We're talking about where on their scale of importance five degrees cooler is and watering the trees in the middle of a busy day trying to make ends meet" (Interview 4, 26/04/2024). Expanding on a previous point made regarding Maslow's Hierarchy of Needs in that "if your base needs are not met, then a focus on climate change and on heat seems secondary to paying the bills and buying groceries" (Interview #4, 26/04/2024).

This point combines themes of distributive justice and maladaptation, particularly of shifting vulnerability. This effort to alleviate extreme heat through canopy cover and tree planting, if not done with intention and follow through on the government's part risks being a waste of funds that could have gone into other adaptation projects. Planting these trees in neighborhoods that undoubtedly need and deserve them, but leaving their upkeep to individual citizens or communities that may not have the time, expertise, or resources to care for them can prove to be shortsighted. This lack of foresight represents a major challenge to these neighborhoods. Particularly those that

have historically been left out of planning practices, resulting in their lack of canopy cover, demonstrating how distributive justice has not been realized in these areas and continues to be a struggle. While adaptation through tree implementation doesn't put direct financial burden on the community members like typical examples of shifting vulnerability, it puts the burden of time and responsibility on them, forcing them to make a decision regarding priorities in adaptations.

Returning to the abilities of local governments to respond and properly plan adaptations to extreme heat in an equitable way highlights the challenges that exist in achieving procedural justice. Speaking on enacting meaningful change at this level, Ricky Angel, the field deputy of Encino, stated that “in terms of the equity components it cannot be done at the neighborhood level. It has to be done at a systems level” (Interview #2, 22/04/2024). Even within this systems level, because of the government structure that Los Angeles has, attention to climate change and justice “depends on the councilmember and how much they want to dedicate towards addressing that... because it's up to each individual councilmember's discretion within their district” (Interview #2, 22/04/2024). The emphasis put on climate change and climate justice focus within the area is volatile, at the will of each new councilmember, who is up for election every four years. This point was echoed by an elected official from the Arleta – Pacoima area, who through a career of advocating for environmental justice in community-based organizations and government offices found that “the conversation related to the environment or environmental justice hasn't had a consistent flow of people that are in the field. People come into the field and then they realize that it's boring or they realize that it's too technical” (Interview #5, 30/05/2024).

This volatility is recognized at both the administration and community-based organization levels, especially in areas like Arleta – Pacoima that face substantial risks, as illustrated in the maps above, and cannot afford to wait for a string of environmental justice focused representatives. This train of thought was revealed in an interview with a representative from Pacoima Beautiful:

“We know as a community-based organization it's not going to be just up to the councilwoman or just up to the board of supervisors. It's not going to be just up to whatever level, and we can't just keep putting the blame on them. We really have to step up in our own way and say we can do something about it, too... We are not going to leave our fate

up to the elected officials or the city or the state. We have to do something about it ourselves, even if that means partnering with private partners, philanthropy, or whatever. We will do the work that needs to be done because there's just so much as a result of historical disinvestment" (Interview #3, 25/04/2024).

This reality reveals a systematic failure of the Los Angeles government's responsibilities in providing rights to its citizens of a healthy place to live and highlights how procedural justice has severely lacked in the past and still threatens this community. This 'taking into our own hands' approach is a common thread at Pacoima Beautiful, since its founding by concerned mothers. While explaining a neighborhood intervention that transformed a side street and back alley, previously hotspots for illegal dumping and speeding, into a plaza and green alley it was revealed that "we couldn't do grass or anything like that because the parks department wanted no part of it. Because it's owned by the department of transportation they didn't want to partner and create a parklet here, saying it was out of their scope. So, we said, we're going to take ownership over this space and we're going to maintain it" (Interview #3, 25/04/2024). In a neighborhood dominated by impermeable surfaces, as shown earlier, a project providing much needed green space was deemed out of scope by the parks and transportation departments. Leaving the community-based organization to do the work and implement their own planters as a substitute, highlighting the shortcomings of procedural practices and lack of focus and coordination in the area.

Inaction in the area is not unique to this situation, as there has been a history of neglect regarding the Arleta – Pacoima area, as well as other bordering communities of color. Speaking on this history, in the context of long-promised interventions on the part of the county the areas representative stated:

"Roy Shaw Wetlands Park is an example of the lack of prioritization of creating green space in a community of color that really needs it. Roy Shaw is a park that was supposed to be built by the county over 20 years ago by their Department of Public Works in a way that was supposed to help with flood mitigation...and the county completely neglected this community. The last two county supervisors just didn't care but I'm proud to say that by making noise with neighbors and counterparts the county has finally put together a motion

where they're instructed to find the funding to build it. But overall, it is an example of neglect and lack of equity for communities of color on behalf of the county...They tend to focus a lot of dollars for infrastructure in their unincorporated communities so when they're in charge of something related to infrastructure in the city of Los Angeles they tend to ignore us...In Pacoima that's the reason why the county never cared to put investment in the Whiteman airport" (Interview #5, 30/05/2024).

Whiteman airport, an airport located in Pacoima and owned by Los Angeles County, has faced over 60 years of backlash from the local community who have called for its closure citing noise and air pollution, risks of crashes (of which there have been 13 within the last decade), and its existence being attributed to redlining practices (Pacoima Beautiful, 2022; City News Service | Pacoima, 2022). As the airport is predominantly for private or recreational jets, they claim that it offers no economic benefit simply shifting the negatives that come with airports to an already historically disadvantaged community of color (ibid).

The views held on the situation regarding the processes and adaptations which shape the differing vulnerabilities that exist within the San Fernando Valley aid in creating a comprehensive view of the situation that faces this part of Los Angeles. Alongside the analysis of state and county documents that establish the legislative framework, and the fine grain statistical data provided by GIS which visually depict current biophysical characteristics, these interviews offer triangulation for understanding these differences. Even in the face of official legislation such as *SB1000* or the *Climate Action and Adaptation Plan in the City's General Plan* which mandates that environmental justice (this reflective of analyzed themes of urban climate justice) and equity be prioritized, the lived experiences and views of the situation seen through both GIS analysis and interviews reveal that significant further action is needed.

While the processes and conditions that shape intra urban vulnerability have been revealed and examined to paint a rather grim picture, there has been progress. On this progress the elected official from Arleta – Pacoima stated, “today there's definitely much more action to be intentional, the county out of their CEO's office have their Climate Resistance branch ... the City of Los Angeles also has the Climate Emergency Mobilization Office which is a space for them to go after

state and federal dollars specifically towards heat mitigation and that's a big deal because we didn't have that before" (Interview #5, 30/05/2024). Wrapping up the interview with a surge of optimism, reaffirming that "what we're realizing is that people with the rancho mentality know what's up and they're going to be the ones that actually save us from this climate disaster" (Interview #5, 30/05/2024). This rancho mentality refers to people and communities hailing from rural backgrounds in Latin America and the lifestyle and practices associated with them. This carries weight as, even though it is not legislation or a formal adaptation, it is someone from and representative of the community that believes even in the face of generations of discriminatory practices that these communities are catalysts for change. In the following section, I will put these findings into the greater context of the literature on adaptations to extreme heat and their application into scenarios in the Global North.

5. Discussion

The previous section exemplifies the differences in intraurban vulnerability to extreme heat in the case of Los Angeles' San Fernando Valley. While these circumstances are specific to a small area geographically, they are prevalent in the context of other major cities in the United States as well as worldwide. The problems that arise from the area's governance structure and processes as well as the implications that historical practices of disinvestment have are examined in this section.

5.1 Governance Structure and Capacities

The results shown in sections 4.3 and 4.4 call attention to the shortcomings of analyzed policy documents in section 4.2 and exemplify the gaps that exist between government ambitions and actions and adequate responses to extreme heat. One example of this can be seen in the context of *Senate Bill 1000* emphasis on environmental justice and the statements made by the Arleta – Pacoima area's elected official. *Senate Bill 1000* represented distributive and recognition justice by putting priority on plans that would aim to alleviate exasperatedly disadvantaged neighborhoods, such as the area that they represent. The two decades of inaction regarding the aforementioned Roy Shaw Wetlands Park show how these responses continue to significantly lag behind necessary adaptations. The interviewee from Pacoima Beautiful reiterated this point in their statement regarding the need for them to act themselves and their inability to wait for a government system that is properly focused on the topic.

This gap and inadequate action to respond to extreme heat is not unique to Los Angeles as Schrock et al. (2015) highlighted in their work regarding adequate planning and response to climate change in Boston, Philadelphia, and Portland. They found that in these cities, intentional action to guide distributive processes in planning efforts and public investment would be necessary to effectively achieve equitable outcomes (ibid). This need to focus on equity, which in part exists as a result of discriminatory planning, is expanded upon further in the next section. In Los Angeles, this insufficient focus on adaptation may be partly due to the structure and collaboration of the regional government and its departments. Mosleh et al.'s (2024) research on the topic found that there are as many as 27 different departments within the Los Angeles County and City governments that partly address aspects of extreme heat adaptation. These 27 departments only account for government offices, not other institutions such as community-based organizations and universities who also do work on the topic. Nonetheless, these departments and organizations follow a hierarchical system which they believe strains relations, communication, and action (ibid). Inadequate cooperation between various levels of governance and departments can lead to the burden for adaptation being placed on citizens or community-based organizations. For instance, in the case of Pacoima Beautiful being unable to implement necessary green space in their adaptation project as a result of two different departments not seeing eye to eye. Kotsila et al. (2023) similarly finding that the participation of different branches of government on one issue can lead to the pursuit of competing goals and that this bureaucracy often results in a failure to address the needs of vulnerable communities.

Schrock et al. (2015) also observed this phenomenon in their study, noting that the current reality often places the burden of local adaptive capacity on community-based representatives, particularly from communities of color or other marginalized groups, to be the difference makers. This trend exemplifies the need to critically assess and potentially overhaul the government structure regarding extreme heat or environmental hazard response in Los Angeles. Indicative of this problem are the findings of Nightingale (2017) and Dolšak and Prakash (2018) which found that in adaptive policy and decision making the involvement and cooperation of various bodies of government often lead to disputes and contested areas of focus. Dolšak and Prakash (2018) point out that, around the world, governance actors are involved in different policy games which may

reflect different policy priorities, institutional dynamics, and resource constraints. These findings, along with this study's findings from the Los Angeles area, support Mosleh's (2024) call for the formation of a Chief Heat Officer to preside over Los Angeles County and City. Calling for an overhaul of the area's current government structure is unrealistic at best and counterproductive at worst. However, if a single office were to serve as a centralized authority focused specifically on this threat, distinct from broader climate change issues, which might be perceived as political, it could ameliorate communication and organization of adaptive practices. Through this issue focused approach, a systems level approach to equity, as called for by Ricky Angel, could be easier to enact and maintain. Understanding the challenges that exist in properly defining what this means and how to achieve this has evidently challenged the area for decades. Hence a new approach to the issue is only fitting.

To avoid recreating patterns of disputes and non-shared areas of focus, citizen and community involvement would be necessary to assure accountability. I would advocate for the use of vulnerability assessments, as Prall et al. (2023) found that socio-economic projections such as these are ways to both include local communities and allow them to assess distributive justice processes and progress. As an increase in vulnerability assessments has already been advocated for in *CF 22-1566: Climate Action and Adaptation Plan in the City's General Plan* this is already within the scope of the regional government. While resources such as the US Census Bureau which gives fine grain zip code level data and open-access GIS platforms to citizens make this a relatively straightforward process for American cities, this would be significantly more difficult if not impossible in developing countries. Prall et al. (2023) understand this, noting that the use of socio-economic projections would be limited to areas which are data rich regarding these characteristics that impact vulnerability. While undoubtedly a challenge in developing nations, Birkmann et al. (2020) found, in a study on vulnerability to extreme heat, that even in Germany the sufficient data wouldn't be available at the city level. This underscores the importance, in both the Global South and North, of proper data collection and provision to relevant government bodies as well as their citizens. In order to ensure comprehensive adaptations that ensure equitable processes, extensive data regarding current and expected vulnerabilities to extreme heat are necessary.

While vulnerability assessments and other socio-economic projection-based tools represent important components of adequate responses to extreme heat, it still leaves communities reliant on governmental institutions. One way in which community and community-based organizations could seek to improve local adaptations and create further independence from these institutions is by focusing on education regarding extreme heat, the processes that cause it in their area, and its interrelations with other issues in the community. As found by Lim et al. (2022), if these education-based activities could incorporate all members, young and old, then awareness and understanding of the issue would improve; resulting in adults that are more cognizant of the systems that have caused them and their rights regarding healthy living environments and children that are aware that these processes are not natural, require action, and become increasingly involved in related processes. By having well-informed citizens in every age group both advocate for government led adaptations and advance community-based responses more attention and resources will be aimed at the solution. Additionally, communities and community-based organizations should aim to produce more place-based narratives as these draw local knowledge and desires for adaptation practices. These practices can supplement existing abilities and lead to more effective policies and practices (Singh, 2024).

This gap that exists between government response and necessary adaptation is indicative of why Rafael et al.'s (2015) definition of vulnerability is especially relevant for the context of Los Angeles, and likely for similar studies done on major urban areas. Their definition's inclusion of 'socioeconomic and institutional capacity' and 'desire for adaptation' proved beneficial in this context as it prompted investigation of what might shape these components. While assessing vulnerability was predominantly done using GIS, findings regarding these components largely came from interview data. As both components can be viewed from a resident's and government's perspective, they highlight how these two differ and why. When the two are understood in conjunction a more complete picture regarding the reasons for intra-urban vulnerability to extreme heat emerges.

While this study aimed to understand the variability in urban heat vulnerability through triangulation, future research on the topic could expand on the understanding of the issue by focusing on any one of the three methods used in this thesis. While using these methods helped

create an overall understanding, looking into legislation especially could uncover overlooked processes. This study was limited by a lack of knowledge of relevant governmental processes and legislation. While extreme heat is a risk that threatens many communities and cities in California there is not an abundance of governmental material that focuses primarily on the issue.

Additionally, whether in Los Angeles or in similar contexts around the world, future research should look into how community-based organizations or other non-governmental stakeholders can or would perform socio-economic projections. Having a metric for comparison between the public and governmental institutions could prove useful regarding accountability and progressing independent adaptations processes.

5.2 Historical Implications on Current Vulnerabilities

Mentioned in three out of the four documents analyzed and brought up in 3 out of 5 interviews, under the theme of “historical disinvestment” was the practice of redlining. Redlining was carried out by the federally backed Home Owners’ Loan Corporation with the intention of preventing homeowners from losing their homes as a result of the Great Depression (Schinasi et al., 2022). To assess the riskiness of borrowers and the government’s willingness to lend money to homeowners, neighborhoods were rated ‘A’ through ‘D’, with ‘A’ being the most desirable and labeled green whereas ‘D’ was the most undesirable and labeled red (ibid). Grades were allocated largely based on a community’s sociodemographic characteristics, resulting in areas with large black or immigrant populations receiving ‘D’ ratings. Living in a ‘D’ rated area greatly inhibited chances of obtaining a mortgage and creating generational wealth, creating a disproportionate number of minority renters in specific city districts (Schinasi et al., 2022; Nelson et al., 2023). This practice was rampant, occurring from 1933 thru 1968 when it was finally outlawed and affected almost every major American city, including Los Angeles (ibid). While it was outlawed nearly 60 years ago it has had lasting implications regarding the creation of ‘sacrifice zones’ and the aforementioned inability to build generational wealth in areas predominantly populated by people of color (An et al., 2019; Climate Reality Project, n.d.).

In the scope of this study Pacoima, which at the time encompassed Arleta, was redlined along with other nearby predominantly Latino communities (City District 6, n.d.). The Home Owners’ Loan Corporation assigned Pacoima a ‘D’, as the area was characterized by Mexican families who

worked as farm and orchard laborers and had no ‘residential value’ (Nelson et al., 2023). While this designation was nearly a century ago, these practices continue to impact the area and other cities within the United States. These impacts are exemplified through Wilson’s (2020) study on the relationship between heat management and redlined areas in Baltimore, Kansas City, and Dallas. The study found that land surface temperatures were higher in each city’s previously demarcated ‘D’ neighborhoods compared to ‘A’ neighborhoods, demonstrated by a finding that on a summer day in Baltimore the difference was as large as 5.5°C (ibid). Two influential factors which frequently appear in the literature relating to intraurban heat and the legacy of redlining that are evident in the context of this study are the prevalence of freeways and highways in and around these neighborhoods and rates of greenspace (Hoffman et al., 2020; Wilson, 2020; An et al., 2019)

Figure 7, which displays health conditions that are impacted by extreme heat and highlights the freeways that border and dissect the Arleta – Pacoima area, are patterns consistent with trends found in the literature. In a 2022 study of Detroit, Shkemi et al. found that new major roads and highways were typically constructed in ‘D rated’ neighborhoods while rarely even being found next to “A rated” neighborhoods; further finding that intersections of major highways were typically placed around black and immigrant neighborhoods (ibid). This phenomenon is easily visible when seen looking at the Arleta – Pacoima area that is surrounded and intersected by major local and regional freeways. While these two areas exemplify these processes, they are by no means unique. Hoffman et al. (2020) in a study of 108 American cities’ relationship between redlining and intra-urban heat found that across the United States major roadways and highway infrastructure projects were federally incentivized to go through low-income, redlined neighborhoods during the 1950s. While intra-urban heat was not a focus of the time, knowledge regarding the heat capturing properties of asphalt and concrete were (ibid), suggesting the intentional creation of sacrifice zones in communities dominated by people of color and/or poverty. This incentivization often came in the form of urban renewal where, country-wide, neighborhoods deemed blighted were selected for major road infrastructure (Kotsila et al., 2023). Not coincidentally, these neighborhoods were frequently those which had been redlined and were home to large minority populations (ibid).

In a study by Meng et al. (2006), on the relationship between traffic and asthma severity, it was revealed that medium to high traffic exposure increased the chances of chronic symptoms of asthma by 40-80% and even more significantly in children. Of a similar nature, but relating specifically to Los Angeles, Perez et al. (2012) found that 8% of all childhood asthma cases could be partly attributed to residing in close proximity to major roadways. When viewing the cases of Arleta – Pacoima and Tarzana – Encino in conjunction with these patterns it becomes apparent how and why current vulnerabilities exist and differ within these areas. This situation sustains a trend in Southern California in which disadvantaged, racialized or ethnically diverse neighborhoods are those most impacted by outdoor air toxins (Morello-Frosch et al., 2001).

In addition to the high concentration of freeways and major transportation infrastructure in this area, green space was found to be lacking in the Arleta – Pacoima area when compared to the Tarzana – Encino area and advocated for in various interviews. As greenspace is crucial for an area's adaptive capacity to extreme heat due to shading and evapotranspiration its prevalence is important in understanding what shapes an area's vulnerability to extreme heat (Gkatsopoulos, 2017). Similar trends are seen in studies focusing on Philadelphia, which found there to be a strong correlation between the grades designated by the Home Owner Loan Corporation and the prevalence of mature tree canopy cover (Schinasi et al., 2022). With areas previously ranked as 'D' having significantly less or no mature tree canopy cover which provide the greatest amount of shading, attributing this lack in part to the time needed to mature and how this would reflect intentional action (ibid). Their findings mirror a 2010 study by Nardone et al., on 102 municipal areas in the United States which found that D rated neighborhoods had on average ~19% less greenspace when compared to A rated neighborhoods. While the difference between the Arleta – Pacoima and Encino – Tarzana areas were not as drastic they still contribute to this trend.

While greenspace and canopy cover are often seen as preferable methods to reduce air temperature, as opposed to technology like air conditioning these are solutions that take years of planning and maintenance. Neighborhoods like Arleta – Pacoima, and others around the nation that have been historically disinvested in, do not have time to wait for this growth as extreme heat already threatens them disproportionately. Though A/C represents an important coping strategy, Romitti et al. (2022) found in a study of 115 U.S. metropolitan areas that the relationship between

prevalence of household A/C and minority or low socio-economic status was inversely related. While, on a much larger scale, Khosla et al. (2020) found that globally those most exposed to extreme heat typically had the least adaptive capacity regarding A/C systems. This pattern mirrors the previous findings regarding transportation infrastructure and green space rates in disadvantaged neighborhoods and demonstrate the lasting implications these racist practices continue to have on communities.

These trends echo what Wilson (2020) stated, in that extreme heat must be seen as an issue of environmental justice, not just an issue of public health and approached with recognitional equity. Recognitional equity means acknowledging that community identities are influenced by historical injustices and influence individual vulnerabilities in respect to environmental hazards such as extreme heat (Meerow et al., 2019). Hence, the use of Bulkeley et al.'s definition of urban climate justice is relevant in this context as combating these historically entrenched issues will undoubtedly require an emphasis on recognitional justice. This definition's expanded inclusion of rights and responsibilities allows for a more realistic understanding of how these processes interact and influence each other. Avoiding a common trend in practice where procedural justice is often seen as achieving recognitional justice by including a token representative of a group's interests during participatory processes (Swanson, 2023).

From these findings, one recommendation that could ameliorate both the exposure and proximity of these neighborhoods to major roadways and lack of green space in these neighborhoods is an increase in buffer zones consisting of trees. The U.S. Environmental Protection Agency (2020) found that tree coverage that borders these spaces is able to reduce the amount of air pollutants emitted by traffic, lower ambient air temperature, and can reduce the noise of traffic. However, in a study of the same topic in Detroit, Feinstein et al. (2018) found that the process would be complicated because of jurisdictional structure and continued maintenance. Citing Los Angeles as a city with similar characteristics that was also looking into the adaptation (ibid). Adaptations centered around nature-based solutions, such as this, are direly needed in the San Fernando Valley. As rates of central A/C units in the valley are relatively high, at around 60% of households, and recent programs like Cool L.A. from the local Department of Water and Power are providing rebates on portable or window-unit air conditioners (Fraser et al., 2016; Healy, 2023). While the

use of A/C is something that the County of Los Angeles recommends for staying safe during times of extreme heat (Ready LA County, 2018) Vigue et al.'s (2020) study on Paris evidence how this is maladaptive.

Moving forward, future research on extreme heat would benefit from incorporating quantitative land surface temperature studies. Studies of this type could prove particularly valuable as they more accurately reflect on-the-ground lived experiences compared to assessments like the LACVA which projected similar increases in both areas. Additionally, further research should be conducted on adaptive processes like greenspace buffers between major roadways and residential areas as it is a global risk. Research on both the effects and processes to get these types of adaptations are equally important as there is a large gap between theory and realistic implementation. While this study was only possible due to publicly available data from various offices of the Los Angeles government it also represents a limitation in that it relies on government-provided information. This dependence is problematic, as this thesis has found that the government has failed to implement adequate adaptive responses to extreme heat and these findings may reflect these shortcomings.

5.3 Conclusion

This thesis sought out to understand the variation in vulnerability to extreme heat that exists within the San Fernando Valley of Los Angeles. Using a triangulation approach consisting of qualitative document analysis, GIS mapping, and semi-structured interviews. The findings highlighted significant disparities of vulnerability to extreme heat between the Arleta – Pacoima and Encino – Tarzana areas, largely as a result of historical processes and socio-economic factors.

Through GIS analysis, a clear image emerged revealing that the Arleta – Pacoima area exhibited higher levels of vulnerability in part due to the prevalence of health conditions impacted by extreme heat, rates of poverty in the area, lower green space availability, amongst others. In contrast, the Encino – Tarzana area, with more affluent demographics, showed lower rates of vulnerability in all but one metric used by the study. This reflects the uneven distribution of extreme heat vulnerability in urban areas, especially across socio-economic borders. Through analysis of policy documents, significant gaps between policy intentions and real-world outcomes were identified. While various legislative documents such as *Senate Bill 1000: The Planning for*

Healthy Communities Act and *CF 22-1566: Climate Action and Adaptation Plan in the City's General Plan* emphasized equity and environmental justice as guiding principles, the lived realities of citizens, revealed through a combination of GIS analysis and semi-structured interviews found these to be inadequate. While these policy documents, contrary to the literature, saw a rather equal representation of each component of urban climate justice they still often failed to address the specific needs of the most vulnerable communities.

Interviews with members of local government offices and community-based organizations highlighted these shortcomings. From interviewees representative of the Arleta – Pacoima area expressing frustration over insufficient administrative support and inaction on adaptation projects, such as the seemingly forgotten Roy Shaw Wetlands Park; to the Encino – Tarzana area interviewees citing the need for a ‘systems-level approach’ to effectively incorporate themes of equity into the adaptation processes.

The culmination of these findings leads this study to state that the reasons for intraurban vulnerability to extreme heat in Los Angeles are threefold: A) the governmental structure of the region, B) the impacts of redlining, and C) the subsequent disinvestment in minority neighborhoods. Additionally, it emphasizes the importance of recognition justice in shaping and guiding equitable adaptation processes and strategies to avoid recreating these inequalities in future plans. Regarding planning theory and practice, this thesis’ findings highlight A) how the ethics that go into both must be scrutinized, as racist planning practices helped shape the discrepancies of vulnerability that still impact these areas and B) in order properly adapt our urban areas to the reality that is climate change cooperation between government offices, community-based organizations, private firms, etc. will be mandatory. As planning is about creating spaces for all there must be representation and meaningful consideration of everyone’s needs and desires, especially in a world increasingly defined by inequality.

6. Reflection

Upon completing this master’s thesis, I look back on it as a significant learning experience, particularly as I did not write a bachelor’s thesis. From the beginning, something that went well

for me was my desire to write on a topic that has impacted my life and the areas where I have lived previously. This focus sustained my interest throughout the process, especially as it focused on the area of Los Angeles where I was born and raised. That being said, one aspect that presented various challenges for me was the semi-structured interviews. While this research greatly benefits from their inclusion, the reliance on others for data and scheduling proved difficult. In multiple cases potential interviewees would stop communicating after initially responding positively, which created some worrying delays. Additionally, being located outside of the country made communication heavily reliant on phone calls which meant calling various times throughout the week hoping to be connected with someone.

In hindsight, I would reconsider the inclusion of maladaptation from my theoretical framework. While it is an important theory regarding all climate change risks, as extreme heat adaptations in Los Angeles are predominantly in the planning or early rollout stages it left me to speculate whether these potential projects could end up being maladaptive. Writing this same paper five years from now might provide a clearer answer but as it stands, I think trying to assess these hypothetical scenarios might have distracted me from findings regarding vulnerability or urban climate justice.

I find that the outcomes of this thesis are convincing, especially as the three methods used reflect each other in their individual findings. By pursuing triangulation, I aimed to provide an encompassing answer that did not rely on any one method to answer the question. Moreover, the points made in the discussion section reinforce why these findings and answers to the research questions are convincing. The systemic racist policies that created these inequalities hold implications for generations, as is the case in any context where segregation has occurred and Los Angeles' response to the issue in light of them has proven to be insufficient.

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Appendices

- Appendix 1 Interview Guide 1: Local Government
- Appendix 2 Interview Guide 2: Community-Based Organizations
- Appendix 3 Interviewee Consent Form
- Appendix 4 Coding Tree - Semi-structured Interviews

Appendix 1 - Interview Guide: Local Government

Interview Guide for Semi-Structured Interviews with Local Government Officials

Title: Urban Vulnerability and Justice in Climate Adaptation: A Comparative Analysis of Urban Heat In Los Angeles Neighborhoods

Description of Research Aim: By conducting semi-structured interviews, I aim to understand local perceptions of adaptations to extreme heat and how they might reflect concepts of urban climate justice.

Introduction: As a semi-structured interview there are no right or wrong answers, the point of this interview is to understand local perceptions of the topic at hand. Questions from this guide are meant to foster conversation and give information but are not mandatory talking points.

Sections

Personal Context:

- What is your role in the community/city?
- Do you think that aspects of climate justice (distributional, procedural, recognition) are recognized in adaptation plans?
- Do you think that planned or current adaptations are/will be effective?

Institutional Context:

- As a representative of the local government, how does this demarcation of vulnerability by the LA County Vulnerability Assessment present itself at this level? How is it received?
- In the case of _____ who are the relevant actors in adaptive planning to climate change, in particular extreme heat (if applicable)?
- Is there communication between the different levels of government (cities, districts, county?)
 - Is there support from the higher-up levels in terms of resources or expertise?
- Are aspects of urban climate justice taken into account when plans are being made? Or do processes reflect something similar?

Local Context:

- Are there any organizations that ____, or the district works with from the surrounding community (ex: grassroots organizations, neighborhood councils)?

- How does this materialize and what does it look like?
- Are adaptations catered to the specific needs of the community and in what ways?
- What are examples of current or planned adaptations?
- Do adaptations attempt to involve the local community and how are the rights of citizens accounted for?
 - How is information made available? Is this information made available in different languages

Appendix 2 - Interview Guide: Community-Based Organizations

Interview Guide for Semi-Structured Interviews with Community-Based Organizations

Title: Urban Vulnerability and Justice in Climate Adaptation: A Comparative Analysis of Urban Heat In Los Angeles Neighborhoods

Description of Research Aim: By conducting semi-structured interviews, I aim to understand local perceptions of adaptations to extreme heat and how they might reflect concepts of urban climate justice.

Introduction: As a semi-structured interview there are no right or wrong answers, the point of this interview is to understand local perceptions of the topic at hand. Questions from this guide are meant to foster conversation and give information but are not mandatory talking points.
Sections

Personal Context:

- What is your role in the community/organization?
- Do you think that aspects of urban climate justice (distributional, procedural, recognitional) are recognized in adaptation plans?
- Do you think that planned or current adaptations are/will be effective?

Institutional Context:

- As a representative of a local community-based organization, how does the demarcation of vulnerability by the LA County Vulnerability Assessment present itself at this level? How is it received?
- In the case of _____ who are the relevant actors in adaptive planning to climate change, in particular extreme heat (if applicable)?
- Is there communication between the organization that you represent and different levels of government (cities, districts, county?)
 - Is there support from the local government in terms of resources or expertise?
- Are aspects of urban climate justice taken into account when plans are being made? Or do processes reflect something similar?

Local Context:

- Are there any other organizations that _____, works with from the surrounding community (ex: community-based organizations, neighborhood councils)?
- How does this materialize and what does it look like?
- Are adaptations catered to the specific needs of the community and in what ways?

- Coming from a non-governmental organization, do you think that different areas within the county of Los Angeles, or within the San Fernando Valley receive different levels of support, recognition, or assistance in adaptation in light of extreme heat or climate change vulnerability?
- What are examples of current or planned adaptations?
- Do adaptations attempt to involve the local community and how are the rights of citizens accounted for?
 - How is information made available? Is this information made available in different languages

Appendix 3 - Coding Tree - Semi-structured Interviews

		Specialized Departments
	Distribution of Resources	Expertise
Distributive Justice	Representation	Community Based Organizations
	Difficulties	Funding
		Area of Focus
	Acknowledgement	Accounting for Those Typically Left Out
Recognitional Justice		Neighborhood Characteristics & Desires
	Difficulties	Inaction
		Historical Inequities
		Political Will
	Outreach	Community Canvassing
		Education on Science/Risks
		Neighborhood Council Involvement
Procedural Justice	Coordination	Inter-district Adaptation Measures
		CBO and Government Cooperation
	Difficulties	Regional Government Structure
		Areas of Focus
	Failure of Responsibilities	Inaction on County to Amend Systematic Inequities
		Burden of Adaptation on CBOs
Responsibilities		Communication Breakdown
	Realization	Provision of Information Regarding Heat & Health
		Those in need first approach
		Proactive Planning Regarding Community Needs
	Quality of Life	Rights to Green Space
		Rights to Clean Air and water
Rights		Rights to Representation
		Participation in Political Process
	Education Oriented	Rights and Processes of Planning Activities
		Provision of Information in Spanish

Appendix 4 – Interviewee Agreement to Participate Form

Agreement to participate - Research Ethics Committee (REC)

in master's research project:

Title: Urban Vulnerability and Justice in Climate Adaptation: A Comparative Analysis of Urban Heat in Los Angeles Neighborhoods

The purpose of the research is to understand how extreme heat affects people and communities differently on the intra-urban scale.

- I have read and I understand the information sheet of this present research project.
- I have had the opportunity to discuss this study. I am satisfied with the answers I have been given.
- I understand that taking part in this study is voluntary and that I have the right to withdraw from the study until the moment that the study has been published, and to decline to answer any individual questions in the study.
- I understand that my participation in this study is confidential. Without my prior consent, no material, which could identify me will be used in any reports generated from this study.
- I understand that this data may also be used in articles, book chapters, published and unpublished work and presentations.
- I understand that all information I provide will be kept confidentially either in a locked facility or as a password protected encrypted file on a password protected computer.

Please circle YES or NO to each of the following:

I consent to my interview being audio-recorded YES / NO

I wish to remain anonymous for this research YES / NO

If YES

My first name can be used for this research YES / NO

OR

A pseudonym of my own choosing can be used in this research YES / NO

“I agree to participate in this individual interview and acknowledge receipt of a copy of this consent form and the research project information sheet.”

Signature of participant: _____ Date: _____

“I agree to abide by the conditions set out in the information sheet and I ensure no harm will be done to any participant during this research.”

Signature of researcher: _____ Date: _____

Please fill in the following information. It will only be used in case you want to be sent a copy of interview notes so that you have the opportunity to make corrections.

Address:

Email:

Declaration by the Candidate

I hereby declare that this thesis “Heat and Justice: Assessing Urban Vulnerability and Climate Adaptation in Los Angeles” is my own work and by my own effort and that it has not been accepted anywhere else for the award of any other degree or diploma. Where sources of information have been used, they have been acknowledged.

Name: Ian Kalaōkalani Rivera

Date: 27/06/2024

Signature: 