# Temporary Tactics for Radical Shade:

# Catalyzing Rapid Interventions for Extreme Urban Heat in Seattle

Clelie Ada Fielding

A thesis

submitted in partial fulfillment of the

requirements for the degree of

Master of Landscape Architecture

Master of Urban Design and Planning

University of Washington

2025

Committee:

Lynne Manzo

Dylan Stevenson

Program Authorized to Offer Degree:

Landscape Architecture, Urban Design and Planning

University of Washington

**Abstract**

Temporary Tactics for Radical Shade:

Catalyzing Rapid Interventions for Extreme Urban Heat in Seattle

Clelie Ada Fielding

Chairs of the Committee:

Lynne Manzo

Department of Landscape Architecture

Dylan Stevenson

Department of Urban Design and Planning

One of the clearest signs of human-caused climate change is rising summer temperatures, resulting in more frequent and longer-lasting heat waves. There is an urgent need for shapers of the built environment to respond with rapid solutions. This thesis explores the concept of radical shade, where shade is understood as a civic resource that should be equitably distributed, and investigates tactical urbanism as a method to create rapid design interventions for heat relief. A city-wide site suitability analysis leads to the selection of three sites in Seattle, where the design proposals explore how tactical and temporary intervention can create invaluable shade. A series of three design interventions is proposed at each site through a phased design framework which emphasizes action in the next 0-3 years. Finally, sun/shade studies are conducted on the design interventions to demonstrate that the proposals do in fact increase the shaded area on site. The thesis calls on community organizers, design activists, and governmental agencies to act urgently and collaboratively to create temporary shade structures, which have the ability to provide opportunities for radical shade.

# TEMPORARY TACTICS FOR RADICAL SHADE

## CATALYZING RAPID INTERVENTIONS FOR EXTREME URBAN HEAT IN SEATTLE

CLELIE FIELDING
UNIVERSITY OF WASHINGTON | LANDSCAPE ARCHITECTURE | URBAN DESIGN AND PLANNING

# CONTENTS

# LIST OF FIGURES

# 01

# INTRODUCTION

*"A new urban forest is theoretically possible a decade from now. But what about all the people who need shade today? Why not do something simpler and faster, like promoting sidewalk canopies or specialized street furniture?"*

– Claire Bowin, City Planner in Los Angeles, as quoted in "Shade" by Sam Bloch

# OVERVIEW

Extreme urban heat is one of the most rapidly intensifying consequences of climate change. It poses a serious threat to public health, as well as a climate emergency and should prompt an urgent response. While long-term, city-scale planning efforts for heat mitigation are essential, they are often slow to materialize and challenging to implement at the site scale, making them insufficient for addressing immediate needs. This thesis argues that an effective response to extreme heat must be multi-scaled, combining long-term planning with immediate, localized interventions that can deliver radical shade where it is needed most.

Rather than relying solely on large-scale infrastructure or delayed policy implementation, this research focuses on the potential of rapid, tactical design interventions to provide short-term cooling relief, particularly in communities most vulnerable to heat exposure. Through a series of phased design proposals, this thesis explores what these nimble, low-cost, and community-driven solutions can look like, and how they might catalyze broader, long-term strategies for urban heat resilience.


# EXTREME HEAT

One of the clearest signs of human-caused climate change is rising summer temperatures, creating more frequent and longer-lasting heat waves (Thompson 2024). Extreme heat is “the deadliest extreme climate hazard in the U.S.,” causing more fatalities than hurricanes, tornadoes, and floods combined (Meerow and Keith 2022; Thompson 2024). As the climate crisis continues to intensify, all climate scenarios point to increasing summer temperatures, with urban areas experiencing the most hazardous effects (Calvin et al. 2023). Cities already experience increased heat due to the urban heat island (UHI) effect – where urban areas are significantly warmer than surrounding areas because of the density of heat-generating processes and surfaces that trap and retain heat – which renders cities highly vulnerable to extreme heat events (King County 2024). However, in many cities, urban planning efforts to address extreme heat are often underfunded and slow to be implemented. According to a national survey of U.S. planners, city planners are concerned about the threats of extreme heat, noting impacts related to energy and water use, vegetation and wildlife, public health, and quality of life (Meerow and Keith 2022). However, planners report several barriers to responding to extreme heat with urgency, such as a lack of human and financial resources, and lack of political will, leaving cities largely unprepared to address extreme heat events in the near future or to develop long-term strategies for mitigating the effects of extreme heat (Meerow and Keith 2022). Areas vulnerable to extreme urban heat need quick, low-cost response tactics that can be implemented independently of policy approval processes or bureaucratic delays.

# TACTICAL URBANISM

To address the lack of urgency in response to increasing urban heat, this thesis investigates tactical urbanism as a method to create rapid design interventions for heat relief. Tactical urbanism describes temporary, nimble, inexpensive, and small-scale interventions aimed at transforming public spaces that can either be driven by or engage community members (Lydon and Garcia 2015). Tactical urbanism is typically used by community activists to address critical gaps in public infrastructure, but it can also be used as a method to test different design or planning interventions, or attract broad public engagement. While the actions of tactical urbanism are short-term, the vision and the change that they intend to bring about are often long-term (Lydon and Garcia 2015). That is why this thesis explores tactical interventions that can be made now to reduce the burden of urban heat, and examines how these interventions influence long term heat resilience strategies.

Projects that use tactical urbanism can be initiated from the bottom-up, taking a community or grassroots approach, or from the top down, serving a regulatory or government agency approach (Lydon and Garcia 2015). To the advocacy groups of community organizers and government agencies, this thesis adds design activists as key players. These are design professionals working on the ground with communities to see their needs met through a tactical approach. The addition of design activists to the advocacy groups of community organizers and government agencies aims to bridge that gap between bottom-up and top-down actions, envisioning a third approach that highlights collaborative design strategies for place-making through instances of tactical urbanism. To that end, this thesis has three user groups in mind: community organizers, government agencies, and design activists.

# RADICAL SHADE

Generally, exposure to extreme heat is not evenly distributed across cities. Historically under-served populations and low-income neighborhoods can experience temperatures up to 7° C greater than other areas (Hoffman, Shandas, and Pendleton 2020). One of the reasons for the disproportionate impact of urban heat is the lack of shade, typically tree canopy. This absence of shade is often concentrated in neighborhoods that have a legacy of redlining, exclusionary zoning, or historic segregation (Hoffman, Shandas, and Pendleton 2020). Neighborhoods that have mature tree canopy cover are located in areas of historic wealth, higher social class, and greater civic investment. Shade has become a commodity, a monetized luxury, when it should be a fundamental civic resource for all (Bloch 2019). Increasing shade through vegetation and built structures is one of the most effective and immediate methods to reduce urban heat, and can significantly reduce temperatures. By blocking sunlight, shade can decrease the radiant temperature (what humans feel) by up to 30° F, and decrease surface temperature by up to 20° F (City of Phoenix 2024). This thesis explores a concept of radical shade, where 1) shade is understood as a civic resource that should be equitably distributed, and 2) the process of establishing shade is reimagined in its ability to combat the pressing issue of intense urban heat.

# CONCEPTUAL FRAMEWORK

Tactical urbanism can offer a new perspective on addressing shade inequities and responding to extreme urban heat through rapid solutions. The conceptual framework I have developed for this research includes three interrelated concepts: extreme heat, tactical urbanism, and radical shade (see Figure 1.1). These lay the foundation for this research and provide the organizational framework for the literature review. Extreme heat is centered between the other two triangles, and points down as it is the issue that the other two concepts, tactical urbanism and radical shade, aim to support and address. Figure 1.1 provides a visual key for how these concepts are defined individually, and how they relate to one another. Additionally, each concept has certain objectives that relate to how it might be expressed through short- and long-term objectives that address heat. For example, the short-term objectives include reducing heat exhaustion, demonstrating an urgent need for shade structures, and community participation in creating the short-term solution. The conceptual framework is revisited in depth at the end of the literature review.

# CRITICAL STANCE

As a concurrent master's degree student in Landscape Architecture and Urban Design and Planning, I am interested in how design in the public realm and public policy can respond to a dynamic issue like extreme urban heat. I am motivated by the increasing frequency of extreme heat events, and consider how shapers of the built environment (including community members, activists, and professionals) may respond to this intensifying issue with rapid solutions in the short-term.

Conducting this thesis research allows time to explore, analyze, and even plan how a tactical urbanism strategy might address extreme urban heat. The time allowed for this level of analysis and strategy is uncommon for tactical urbanism projects, which are often somewhat spontaneous. However, the nature of the thesis process allows time to research precedents and design proposals for future work.

As a design activist, and researcher, I am using this design research study to understand what areas of Seattle are in greatest need of temporary shade structure interventions. The goal of this project is to communicate the urgency and importance of this issue to two groups: 1) the Seattle government, who should understand the value and urgency for funding and implementation, and 2) to individuals and community groups. I wish to convey that action in their neighborhoods can be impactful to shaping and altering public spaces to fit their needs. This thesis seeks to answer the following research questions:

*1) What are the actions that landscape architects, urban designers, and city planners can take to respond in the short term to extreme urban heat and shade inequity in Seattle?*

*2) How can temporary installations in the public realm be employed to accelerate the response to mitigate extreme urban heat?*

*3) What kinds of structures can be easily crafted or assembled by community organizers or design activists to increase shade and provide relief from intense heat?*

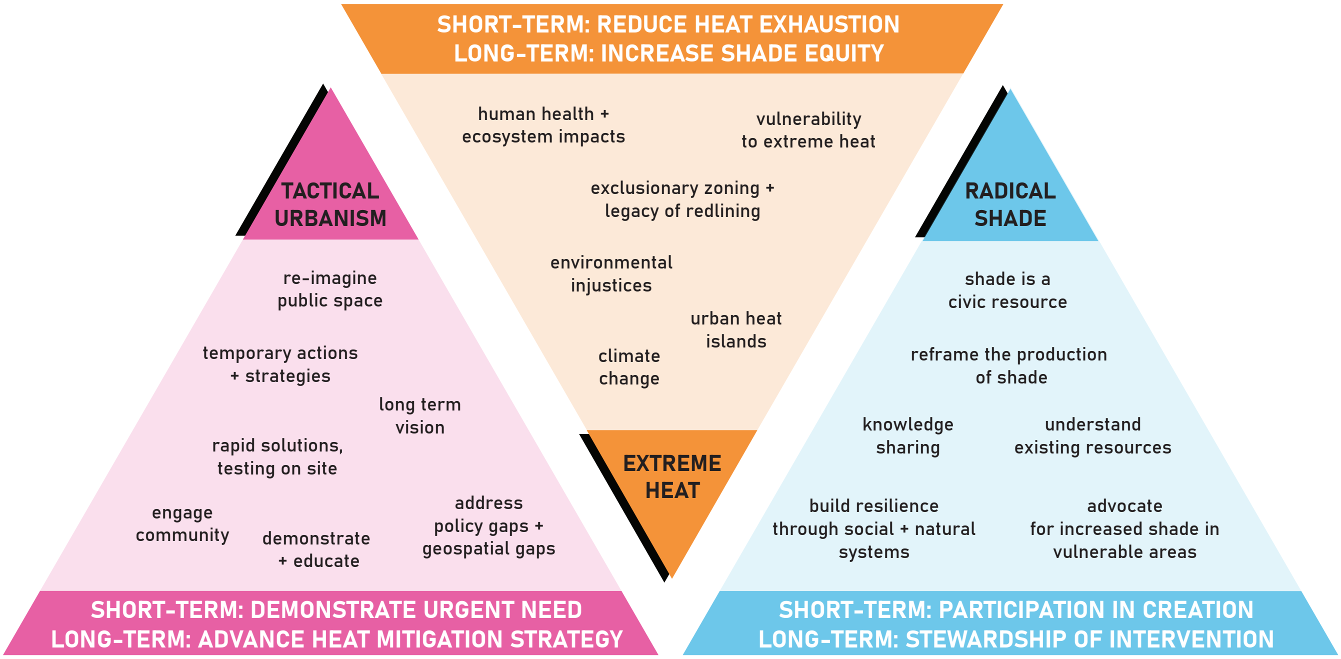



Figure 1.1: Conceptual Framework of Extreme Heat, Tactical Urbanism, and Radical Shade
Conceptual Framework by author

# DESIGN PHASING FRAMEWORK

To answer these questions, this project explores three different sites in Seattle that experience a significant burden of heat, and therefore are in the greatest need for increased shade. I chose these sites, located within the neighborhoods of Georgetown, New Holly, and SoDo, based on a series of mapped data. Both spatial and observational data of the site's existing conditions and context lead to a design proposal for each site. The site designs use a phasing approach for the tactical interventions, considering three time horizons (0-1 years, 1-3 years, and 3-5 years), with distinct interventions that correspond to the site and the temporality of each phase (see Figure 1.2). The design phasing strategy will be explored in-depth in the Design Proposals chapter, along with the site design proposals and design thinking approach, referencing built precedent projects and related policies and programs. Ultimately, the proposals are analyzed for their ability to create shade in public spaces, and recommendations are provided for how this work could be carried out further and supported by municipalities.

# RELEVANCE TO THE FIELD

To address the lack of urgency in response to This thesis communicates the need for a rapid response to urban heat, and underscores how the professional urban planners and landscape architects are poised to act swiftly through design responses in the built environment. It provides designers with resources such as international precedents of tactical urbanism, stories of organizations and programs addressing urban heat, and strategies for cities working to establish radical shade. It demonstrates the viability for a tactical response to extreme urban heat; showing that temporary shade structures can provide critical heat relief. Temporary, nimble, and inexpensive interventions can impact the experience of urban heat in the short-term; long-term planning is also important but can be inhibited by a slow, bureaucratic process. Municipalities, designers, and residents alike could use this research and the design proposals and iterations to create their own temporary shade installations for heat relief in hot areas. The site designs, site typologies, materials, and material assemblies outlined in this thesis, in accordance with the phasing approach, provide a framework for other sites in Seattle or other cities to use as a guide to using tactical urbanism in response to extreme heat.

| | PHASE 1 | PHASE 2 | PHASE 3 |
|---|---|---|---|
| PHASE | **PHASE 1** tactical urbanism | **PHASE 2** temporary urbanism | **PHASE 3** transformative urbanism |
| TIME | as needed in response to heat waves | seasonal: summer (1-2 years) | year round (2-5 years and beyond) |
| ACTORS | *community organizers<br>design activists<br>government agencies | *design activists<br>community organizers<br>government agencies | *government agencies<br>design activists<br>community organizers |
| DESIGN | functional<br>quick response<br>advocate + demonstrate | experimental<br>engage + activate<br>plan + strategize | systematic<br>implement + operate<br>repurpose + practice |

Figure 1.2: Design Phasing Framework
Framework by author

# 02

# LITERATURE REVIEW

*“Extreme heat is more than a public health issue; it is a question of environmental justice.”*

– Bev Wilson 2020

# PART 1: EXTREME URBAN HEAT

## CLIMATE CHANGE AND URBAN HEAT

As the human-driven climate crisis accelerates, extreme heat events are becoming more frequent, impacting regions and ecosystems worldwide (Day-Melgar 2023). Extreme urban heat is defined by “days with maximum temperatures over a certain threshold, seasons with temperatures well above average, heat waves, or multiple days with temperature above a certain threshold” (Day-Melgar 2023, 6). In the contiguous United States (U.S.), annual average temperatures have already risen by 1.8° F (1° C) since 1900, with projections indicating potential increases of up to 12° F (6.7° C  by 2100 (Meerow and Keith 2022). Urban areas are particularly vulnerable to extreme heat, as they are dominated by gray infrastructure – roads, buildings, and dark roofs – that absorb and retain heat. These environments often lack vegetation due to development, tree removal, and altered waterways, exacerbating the heat (Day-Melgar 2023). This anthropogenic transformation of the environment has caused a phenomenon referred to as the urban heat island (UHI) effect, which causes cities to experience temperatures as much as 7.2° F hotter than their rural counterparts (see Figure 2.1) (Gibbons and Lindquist, 2024; Keith and Meerow 2022).

The temperature difference is especially noticeable at night, because of human activity and the high density of buildings, roads, and infrastructure that absorb and store heat throughout the day (Gibbons and Lindquist 2024). This is due to the physical characteristics of urban areas, including material construction (e.g. buildings that accumulate heat), lack of green and blue spaces which reduce temperature through evapotranspiration, dense urban form which inhibits wind patterns, and general heat accumulation through anthropogenic activity, all of which slows and restricts the natural atmospheric cooling process (Rosso, Pioppi, and Pisello 2024; Meerow and Keith 2022).

The UHI effect not only contributes to intense heat in cities, but also “exacerbates the impact of heatwaves in cities, contributing to higher energy consumption, elevated emissions of air pollutants and greenhouse gases, and adverse health outcomes, particularly for vulnerable populations” (Gibbons and Lindquist 2024, 14). The 2022 Intergovernmental Panel on Climate Change (IPCC) report estimates that urban areas are responsible for approximately 67–72% of global greenhouse gas emissions, with the top 100

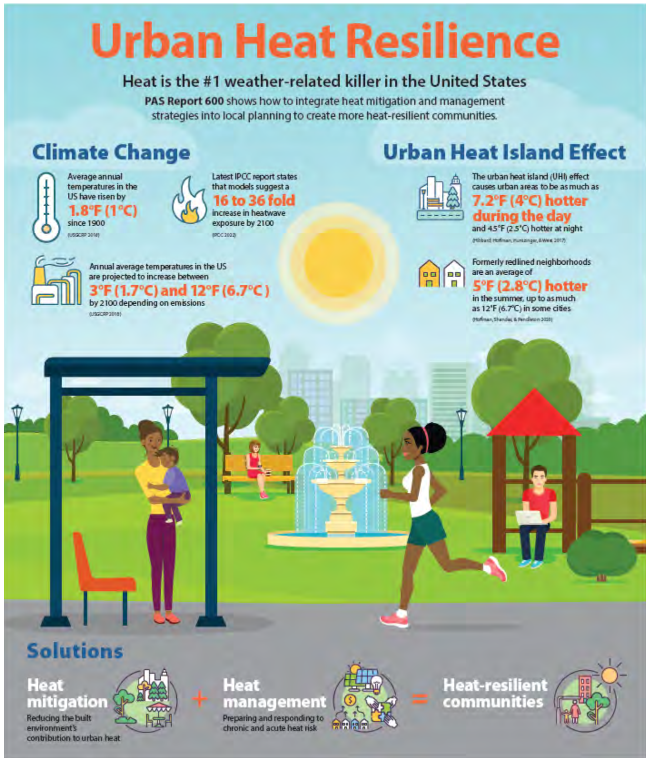



Figure 2.1: Infographic on increasing temperatures relating to climate change and the urban heat island effect
Source: Keith and Meerow, Planning for Urban Heat Resilience 2022

highest-emitting cities contributing around 18% of the world's total carbon footprint (Portmer et al. 2022). As the largest contributors to carbon emissions, cities must become the focal point for heat mitigation and adaptation efforts (Day-Melgar 2023).

The design of cities has long prioritized production, development, transportation, and density – often at the expense of natural systems – which has contributed to widening the disconnect between people and ecosystems. It is fitting, therefore, that one of the most commonly cited heat resilience strategies is to increase vegetation (Keith and Meerow 2022). Urban greening, referring to the network of both planned and unplanned vegetated spaces, is essential for managing heat in urban environments by increasing vegetation coverage. Meerow and Keith (2022) state that a "holistic system of vegetated parks and open spaces is an essential heat mitigation strategy because of the multiple benefits urban greening provides to the community and local ecosystems" (56). There are several co-benefits of increasing green spaces, ranging from UHI reduction, psychological benefits, providing habitat, and reducing flood risk, but it should be noted that the trade off with increased vegetation are the demands of significant watering and maintenance.

Urbanization is accelerating globally, as reflected in the rapid growth of urban populations. Currently, over 50% of the world's population resides in urban areas; a figure that is projected to increase to 66% by 2050 (Day-Melgar 2023). This trend underscores the urgent need to address rising urban air temperatures and mitigate extreme heat, which poses a significant threat to public health. Heat is the deadliest weather-related hazard, capable of elevating body temperatures and leading to heat stroke or heat strain; conditions which, if left untreated, can cause organ failure or death, particularly among vulnerable populations (Keith and Meerow 2022). Vulnerable populations include "the elderly and children; those who have chronic health conditions and lower incomes; those who lack air conditioners or cannot pay to cool their home; those experiencing homelessness or who are institutionalized; and those who work outside" (8). Studies report that the current average annual heat-related deaths in the U.S. is between 8,750-12,000, with rates predicted to increase alongside intensifying climate scenarios (Meerow and Keith 2022). As cities continue to grow, cooling efforts should be concentrated in urban areas, while rural areas and natural landscapes should be protected and preserved from development.

Cities with more density often have a higher UHI effect, which can lead to the misinterpretation that less dense, sprawling urban areas are the solution to reduce UHI effect. However, research has proven that the total urban area, including areas that are not as building-dense, "contributes to the UHI effect, and that sprawling low-density metropolitan areas often have a higher UHI effect than compact and denser metropolitan areas" (Keith and Meerow 2022, 22). The research shows that urban sprawl establishes greater expanses of impervious surfaces, resulting in significant vegetation loss and greater "heat waste generation per capita compared to compact development" (22). Therefore, thoughtfully planned, compact development can meet urban density targets while also contributing less to the UHI effect than sprawling developments.

# ENVIRONMENTAL JUSTICE AND THERMAL INEQUITY

Extreme heat affects all people, but it does not affect all urban populations equally. In an American Planning Association (APA) report titled *Urban Heat Management and the Legacy of Redlining*, the author states, “Extreme heat is more than a public health issue; it is a question of environmental justice” (Wilson 2020 451). The research for this report investigated the correlation between Home Owners’ Loan Corporation (HOLC) redlining maps and satellite-derived land surface temperature (LST) data across the cities of Baltimore, Dallas, and Kansas City. The researchers found that formerly redlined areas had “higher poverty rates and lower vegetative cover and exhibited higher land surface temperatures than other areas of the city” (451). This report confirmed that the city-scale patterns such as the spread of tree canopy cover, reveal the echoes of redlining and restrictive housing policies and consistently correlate to areas that experience higher vulnerabilities to extreme urban heat. Authors writing about heat inequities in the broader scope of environmental inequities often use the term “thermal inequity” to refer to these “systematic disparities in exposure to extreme heat” (446). A similar report explored the effects of historical housing policies on resident’s exposure to heat by studying 108 urban areas for patterns of urban heat vulnerabilities (Hoffman, Shandas, and Pendleton 2020). This study found that “in nearly all cases, those neighborhoods located in formerly redlined areas – that remain predominantly lower income and communities of color – are at present hotter than their non-redlined counterparts,” (6) in some cases by as much as 7° C. Extreme urban heat amplifies existing inequities; formerly redlined and historically under-served areas also face greater financial strain and more serious health consequences as a result of extreme urban heat.

These two studies underscore the link between historical federal housing policy and the “creation (or at least the exacerbation) of a climate stressor and potential variability in resident exposure to it” (Hoffman, Shandas, and Pendleton 2020, 11). The findings from these two studies emphasize the importance of focusing on urban areas that have experienced sustained disinvestment, and of leveraging the spatial data to inform heat mitigation strategies. Addressing extreme heat requires recognizing the legacy of restrictive policies that created thermal inequities over time, as well as understanding that communities have distinct needs to achieve heat equity (Keith and Meerow 2022). Hoffman et al. (2020) conclude that an awareness of environmental injustices may even speed up equity-seeking responses, stating that “crafting climate equity-centered policies that recognize decades of disproportionate exposure to environmental stressors can help any new discoveries in urban design get implemented with focus and rapidity” (Hoffman, Shandas, and Pendleton 2020, 12). Recognizing inequities, both current and historic, are important for responsive, community-centered and climate-informed designs that may even advance the implementation process.

# HEAT RESILIENCE PLANNING

Planning for how to address and respond to extreme urban heat events is critical for public health and heat resilient cities. A report titled *Planning for Extreme Heat: A National Survey of U.S. Planners,* published by the APA, analyzed how concerned planning professionals are about extreme heat, and to what extent U.S. cities are prepared to address it (Meerow and Keith 2022). The study surveyed about 100 planning professionals nationwide, finding that 30% of planning professionals were "very concerned" about extreme heat, and 73% were at least "somewhat concerned" (323). The responses showed that more planners were "concerned about environmental outcomes (43%) than health (36%) and economic (13%) outcomes" (Meerow and Keith 2022, 323). While the response to urban heat is typically driven by environmental and health impacts, heat also has negative impacts on the economy and economic productivity; an estimated 153 billion labor-hours were lost due to heat (Meerow and Keith 2022). This survey highlights the growing concern amongst planners for extreme heat, and reports that most communities are addressing heat through other plans related to sustainability, climate change, or resilience plans, but very few addressed heat in any single plan.

Although extreme urban heat poses a serious and potentially deadly threat to vulnerable populations, its health and economic impacts remain under-recognized by both insurance agencies and municipal authorities. In a 1997 paper titled *The Radical Politics of Shade,* Mike Davis wrote that heat waves "do not produce mega-billion-dollar property damage and economic disruption like hurricanes, floods and great winter storms. They are thus of minimal concern to the insurance industry, the decisive shaper of federal and state natural disaster policy" (Davis 1997). In 2021, Theodore Lamm's report concurred with Davis, stating that because the impacts of extreme heat are not as visually drastic as other natural disasters like wildfires or floods, heat is an under-recognized risk (Lamm 2021). Although there is significant loss of life, there is minimal loss of infrastructure compared to other natural disasters, and because of this, there is an absence of insurance or legal mandates to address extreme heat risk. Lamm states that insurance would help encourage heat-resilient infrastructure investments, especially where public funding is limited, but other limitations likely include political will and a policy gap. Because the human health impacts of urban heat is difficult to measure and often goes unnoticed, local governments may feel less urgency to address the issue. Cities are beginning to develop heat mitigation strategies, yet most cities lack any form of comprehensive policies or legal requirements for extreme heat. Lamm suggests that appropriate policies may include enacting legal protections for outdoor workers, mandating access to cool spaces in schools, workplaces, and residential buildings, integrating extreme heat into building codes, zoning, and planning, and lastly collaborating with insurers to integrate risk management into comprehensive local heat response plans.

# STRATEGIES FOR URBAN HEAT PLANNING

There are many strategies that professionals in urban design, planning, and landscape architecture can utilize to reduce urban heat. Heat resilience strategies are typically categorized into either heat mitigation or heat management strategies. Mitigation strategies involve design and planning interventions that reduce the built environment's contribution to extreme heat, including land use policies, urban greening, urban design, and the reduction of waste heat. Heat management strategies are "efforts to prepare for and respond to heat events," which relate to public health, emergency management, personal exposure, and energy (Meerow and Keith 2022, 321).

This thesis focuses on extreme heat response as 'heat mitigation,' yet both mitigation and management (or adaptation) are necessary for a comprehensive response. Relatedly, the thesis prioritizes short-term or temporary installations for heat relief, with the understanding that both short-term and long-term strategies are essential for establishing heat resilient cities. The key criteria for this research is the amount of time needed to implement a heat relief strategy, and the ability for strategies to reduce heat thermal discomfort, specifically outdoors. Therefore, I created a matrix in which I locate each heat resilient strategy on a horizontal axis of short- to long-term implementation strategies, and a vertical axis of the strategy's ability to provide outdoor thermal comfort (see Figure 2.2). The strategies are further distinguished by color to indicate which built environment category they relate to, such as architecture, energy, vegetation, or water. The strategies that have a gray circle backdrop highlight those that provide shade, which is the intent of this research. The positioning of the strategies within this matrix were based on their implementation time and heat reduction ability, and are placed as a best educated guess in relation to one other, and therefore should be interpreted with some flexibility.

The organization of the strategies in this visual matrix (Figure 2.2) helps to clarify which heat resilient strategies are most important to this thesis.

All of the shade-related strategies are located on the upper half, demonstrating that shade in general is one of the most effective methods for reducing outdoor temperatures.

All of the water-related strategies also bubble to the top, providing cooling capabilities through hydration, misting, and swimming access.

The vegetation strategies are mostly located in the upper half, providing air cooling through evapotranspiration in the short-term, shade canopy in the long-term, and green roofs + green walls as a strategy that provides heat mitigative effects for buildings but does not directly support outdoor thermal comfort at pedestrian level.

The architecture strategies span the gamut, from temporary shade structures and exterior building shades in the short-term, to expanding resilience hubs and community centers in the interim, to transforming building standards and practices for heat resiliency in the long-term.

The planning strategies are also spread widely throughout the matrix, including emergency response strategies in the short-term, planning in the interim, and implementing policies in the long-term.

The surfaces category involves reducing paved and impervious surfaces, which can greatly reduce urban heat island effects, but is not as closely related to outdoor thermal comfort as other strategies.

Lastly, energy is a complex category that involves both reducing heat waste through short- and long-term strategies, and increasing air-conditioning capacity. Although air conditioning is essential for protecting people from extreme heat and preventing heat-related illness, it also releases warm exhaust air, which directly contributes to the urban heat island effect. While air-conditioning is a necessary short-term solution, implementing district cooling on a larger scale would be a more climate resilient option in the long-term.

It is important to make the connection between short- and long-term strategies, and consider what short term actions can make the long-term strategies possible. For example, trees and vegetation need time to grow to have effective shade canopies and provide evapotranspiration benefits; therefore, programs that plant and maintain existing trees are critical for long-term heat resilience. Additionally, community involvement in heat awareness campaigns and the design and placement of cooling infrastructure are critical in the short-term for a more informed public and more socially responsive solutions. In turn, such approaches are  beneficial for implementing thermal comfort policies and shade master plans that can establish radical shade in the long-term.

At the national level, U.S. Environmental Protection Agency (EPA) provides a “Heat Island Community Actions Database,” where one can search by region, state, and locality to find existing state and local voluntary initiatives, and mandatory policies for supporting heat island cooling strategies (U.S. Environmental Protection Agency 2023). There are two entries listed for Washington State. One is the Seattle Green Factor code which was adopted in 2007 to provide a minimum of 30% vegetative cover for new developments in neighborhood business districts, which can be achieved through green roofs or trees and vegetation. The second is House Bill 1114, which incentivizes electric utilities to conduct shade tree planting. These are two high-level policies that are recognized as important factors for urban heat mitigation, yet this thesis argues that there should be more that can be done by cities as small-scale, low-cost, and temporary design approaches to secure heat relief for people in outdoor urban areas.

Of all the strategies located within the matrix, the most relevant to this thesis are those that create opportunities for shade. With temporary shade structures as the main strategic proposal, the implementation of the structures may relate to or influence other strategies such as building public awareness and education around extreme urban heat, reducing paved surfaces, increasing tree canopy, or developing policies that contribute to heat resilient practices. The objective of this design research is to explore ways in which the temporary installations could prompt or accelerate long-term changes through short-term interventions. The process for how temporary shade structures are developed and implemented is explored in the next two sections of the literature review.

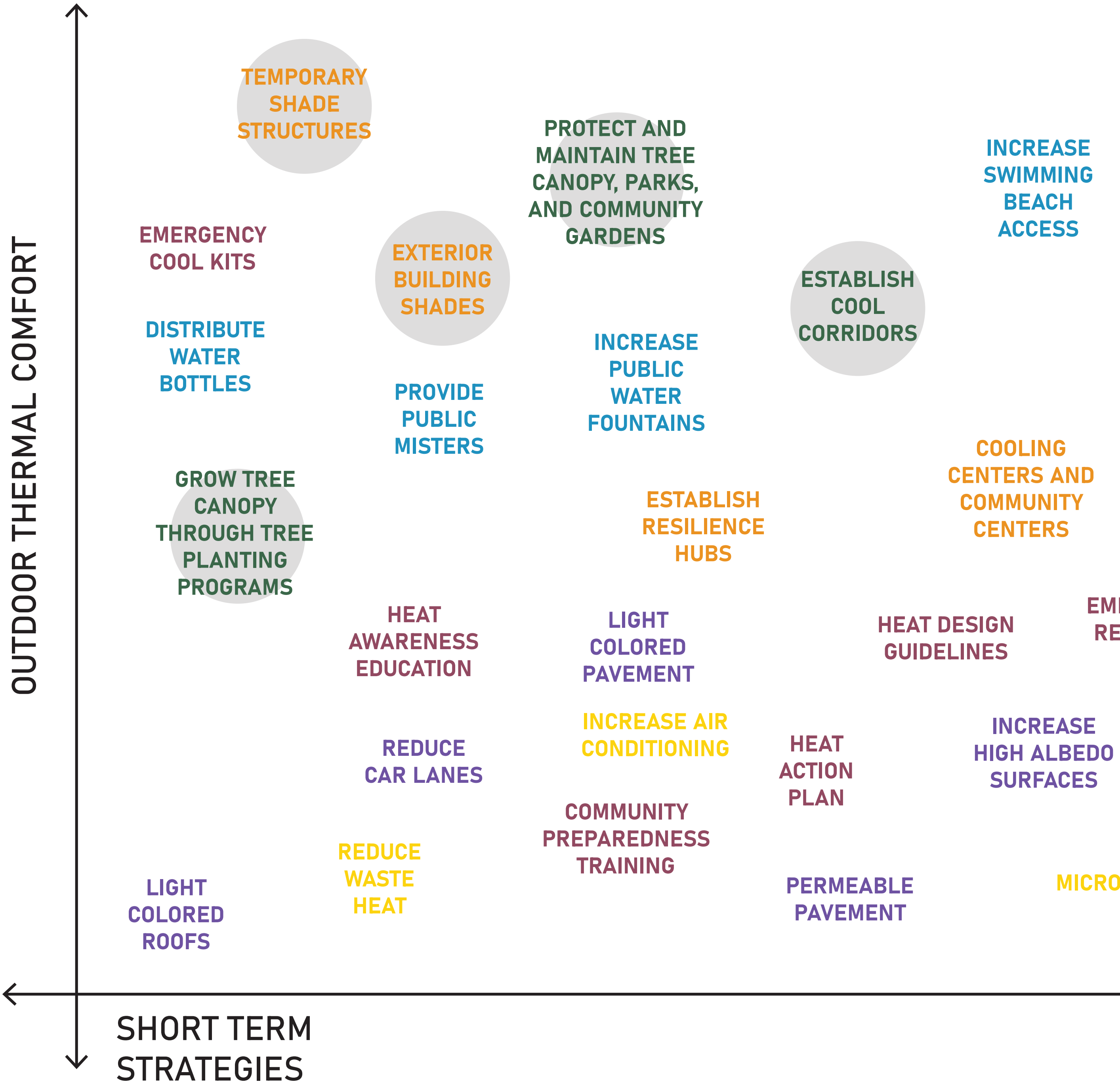
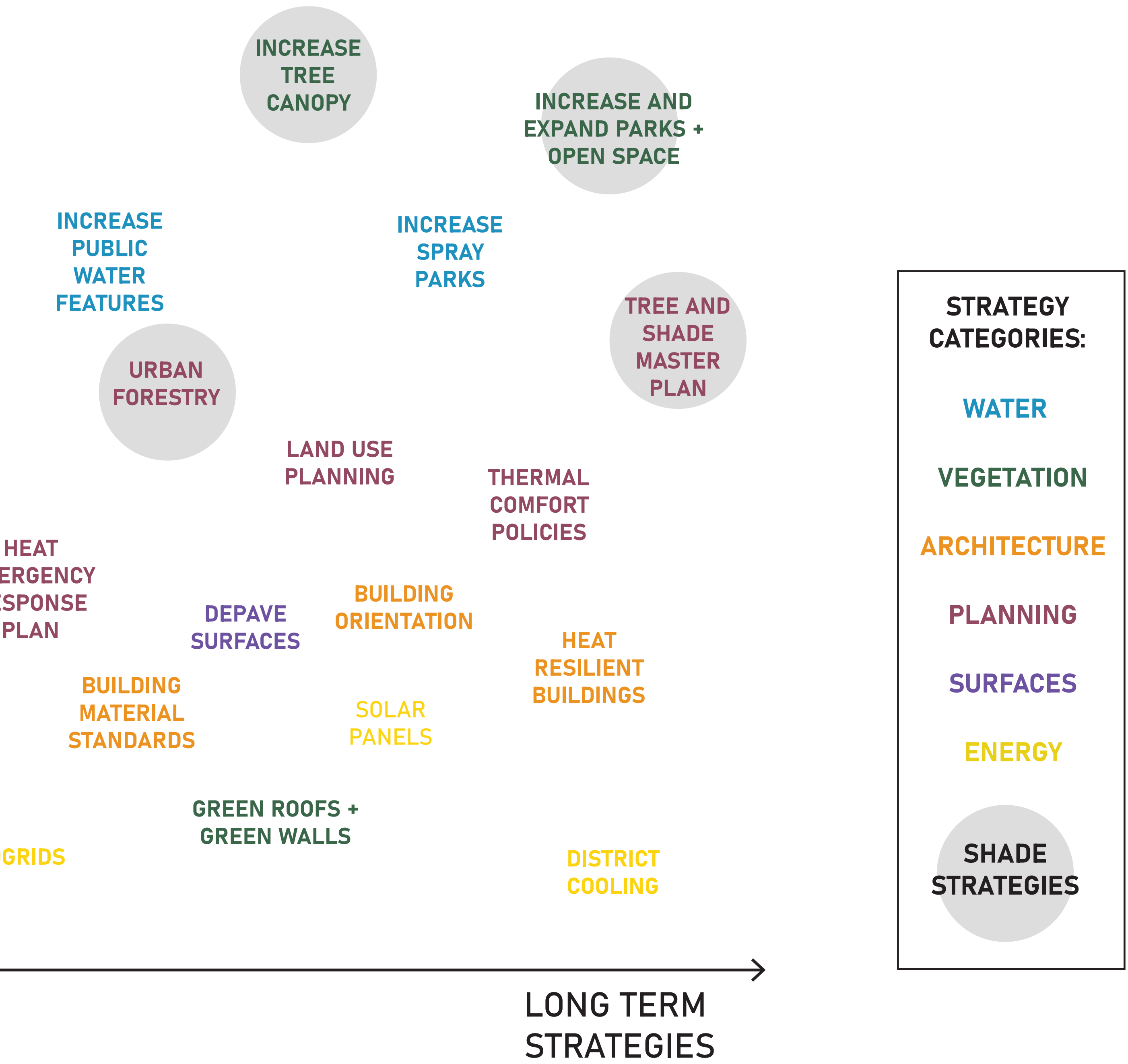



Figure 2.2: Matrix of Heat Resilient Strategies
Matrix by author



INCREASE TREE CANOPY
INCREASE AND EXPAND PARKS + OPEN SPACE
INCREASE PUBLIC WATER FEATURES
INCREASE SPRAY PARKS
TREE AND SHADE MASTER PLAN
URBAN FORESTRY
LAND USE PLANNING
THERMAL COMFORT POLICIES
HEAT ERGENCY SPONSE PLAN
DEPAVE SURFACES
BUILDING ORIENTATION
HEAT RESILIENT BUILDINGS
BUILDING MATERIAL STANDARDS
SOLAR PANELS
GREEN ROOFS + GREEN WALLS
GRIDS
DISTRICT COOLING
LONG TERM STRATEGIES
STRATEGY CATEGORIES:
WATER
VEGETATION
ARCHITECTURE
PLANNING
SURFACES
ENERGY
SHADE STRATEGIES

# PART 2: TACTICAL URBANISM

As mentioned in the previous section, my aim in this thesis is to consider low-cost, temporary interventions as a method to provide shade in areas of the city where there are significant urban heat island effects. Such nimble strategies align well with tactical urbanism, an insurgent approach to transforming public spaces. This section explores the broad topic of tactical urbanism, how it applies to this research, and several built tactical urbanism examples that relate to extreme urban heat.

## DEFINING TACTICAL URBANISM

Tactical urbanism is an approach to improving the design or function of public spaces through short-term interventions that have a vision for long-term change (Lydon and Garcia 2015). It typically involves reimagining underutilized urban spaces through temporary, small-scale, inexpensive, and flexible installations. Through either sanctioned or unsanctioned activities, tactical urbanism projects often reveal where public spaces or systems fall short of meeting user needs, and seek to meet those needs in the absence of more formal, longer-term solutions. In their book, *Tactical Urbanism: Short Term Action for Long Term Change*, Lydon and Garcia (2015) explain, tactical urbanism is “an approach to neighborhood building and activation using short-term, low-cost, and scalable interventions and policies… [which] makes use of the open and iterative development processes, the efficient use of resources, and the creative potential unleashed by social interaction”(2). These interventions are often community-driven and advocate for more equitable and sustainable use of public space. Through on-site design thinking, tactical urbanism allows for real-time experimentation and provides insights into how public infrastructure might be improved.

Tactical urbanism encompasses a wide range of applications, from guerrilla gardening and pop-up parks to temporary plazas, painted intersection interventions, and public art installations. These projects invite users to engage with spaces in ways that differ from conventional urban design, offering alternative experiences of place. Hadj and Kilani (2024) point out that the diversity of terms for tactical urbanism – such as “guerrilla,” DIY,” “spontaneous,” “insurgent,” “makeshift,” “pop-up,” “everyday,” and “temporary” urbanism – reflects the variety and adaptability of its practices (see also Stevens and Dovey 2022). Highlighting the wide-ranging approaches of tactical urbanism, the authors write that it is “both filling gaps and driven by new markets… [it] is geared to the failures of market capitalism; particularly high rates of vacancy and dereliction” (Stevens and Dovey 2022). These perspectives underscore the multitude of factors that motivate individuals and communities to reimagine and intervene in public space through tactical urbanism.

The most widely cited and earliest example of tactical urbanism is Park(ing) Day, which has become an international movement and annual event. The tactic, implemented by the design firm Rebar, was to install simple park furniture in a curbside parking space while paying the meter as a commentary about how much of the public realm is allocated to motor vehicles. This demonstration was successful in its mission to “reclaim the city from cars, undermine the car parking strategies of local governance and play on the double meaning of ’park’” (Stevens and Dovey 2022, 22). Though temporary, the installation advocates for lasting change: reduced car parking and increased space for pedestrians and green space. In fact, it was Park(ing) Day that catalyzed the development of San Francisco’s ‘Pavement to Parks’ program, which also became an established program in Seattle’s Department of Transportation (SDOT) for pedestrian street activation (Seattle Department of Transportation 2017).

*Tactical urbanism acts as both a design intervention and a form of public advocacy, where citizens and communities can shape the spaces they inhabit.*

Tactical urbanism is commonly initiated by grassroots groups to demonstrate a different use of space than has been designated by developers or city officials. Lydon and Garcia (2015) note, "These projects often result from the direct participation of citizens in the creation and activation of their neighborhood…. They demonstrate time and again that short-term action can create long-term change" (6). In this way, tactical urbanism acts as both a design intervention and a form of public advocacy, where citizens and communities can shape the spaces they inhabit.

However, projects such as Park(ing) Day that have become more formalized and grown to a global scale lose some of their original spark and spontaneity for local implementation. Hadj Kilani and Dhaher (2024) state that because Park(ing) Day has transformed from "grassroots activism to an institutionalized educational tool, this evolution challenges the notion of ephemerality associated with tactical urbanism" (16). Rather than citizen-led activism, the event has become institutionalized to a degree where cities, including Seattle, require participants to fill out permits that designate where and when certain parking spaces will be occupied. The event has been reduced to a bureaucratic process, resulting in rules for an event that was initiated to do the exact opposite – skirting regulations and temporarily transforming urban space. However, Hadj Kilani and Dhaher (2024) also observe that the institutionalization of Park(ing) Day "marks a shift in how tactical urbanism is perceived and integrated into formal urban planning practices… [and] challenges the traditional view of tactical interventions as mere experiments, suggesting that they can significantly contribute to shaping the urban landscape" (5). By increasing public awareness of a lack of pedestrian spaces in relation to the dominant car infrastructure in the urban environment, the Park(ing) Day demonstration instigated enough public awareness of the issue that it prompted the local government to create plans and programs for long-term change. Similarly, the tactical strategies proposed in this thesis to address extreme heat and heat inequities can begin as flexible, temporary interventions with the goal that longer-term solutions can be implemented.

Scholars have written on the ability for tactical urbanism projects to "influence perceptions, policies, and educational programs" which counters the "dichotomy between permanence and impermanence, suggesting that tactical urbanism can have lasting effects on the urban fabric" (Hadj Kilani and Dhaher 2024, 5). Although temporary in the installation period, tactical urbanism can have lasting ripple effects that permeate beyond the physical area where the installation took place. Stevens and Dovey (2022) write that temporary installations can "fire the urban imagination and become an impulse for other uses that utilize similar sites or tactics. If the temporary use is successful, it may be permitted to coexist with its replacement and operate in synergy with the long-term use. In some cases, the temporary use displaces the existing use and becomes permanent" (Stevens and Dovey 2022, 29). This kind of tactical action and temporary installation, which can become significant components of public space or propel long-term change in the public realm, is what is needed to establish shade infrastructure in hot, urban environments.

In this thesis I use both "tactical urbanism" and "temporary urbanism" to refer to similar instances of short-term design installations in the public realm that advocate for change (see the Design Phasing Framework, Figure 1.2). I use "tactical" to describe a more immediate, demonstrative, and impermanent action, whereas "temporary" refers to a slightly more prolonged, but still nimble and low-cost intervention. "Temporary urbanism" is the more commonly used term in the UK for tactical urbanism. Stevens and Dovey (2022) explain that temporary urbanism centers on "time horizons and rhythms of change; on physical transformations and 'meanwhile' or 'interim' uses of spaces that are not intended to last more than a few years" (19). In contrast, the more commonly used term in North America, "tactical urbanism" involves "a focus on self-organized spatial practices and social needs that are not well served by governments or the market, and a political orientation toward new forms of social agency in public spaces" (Stevens and Dovey 2022, 19). While tactical urbanism is typically enacted to provoke a specific response or engage a target audience, temporary urbanism can be used to occupy or repurpose spaces during an opportune in-between period, prior to a planned long-term use.

# ACTORS AND APPLICATIONS OF TACTICAL URBANISM

Tactical urbanism can be initiated by anyone, which brings a variety of motivations and values to tactical interventions. Tactical urbanism is often initiated by individual citizens or grassroots community organizers to target the redesign of public space, yet it can also be utilized by government agencies, municipal departments, developers, and planning and design firms to engage the public in the design development process. Lydon and Garcia (2015) advocate for governments to "work more tactically, just as citizens can learn to work more strategically. Strategies and tactics are therefore of equal value and should be used in concert with each other" (10). They argue that government and other regulatory agencies should use tactical urbanism more than they currently do, to test ideas and learn from people about how to design better cities for people. Tactical urbanism provides a method to bring a wider audience into the public participation process, whether it is grassroots or government led.

Lydon and Garcia created a diagram (see Figure 2.3) that locates where various tacticians are found if they operate from a top-down or bottom-up perspective, or somewhere in between. From this diagram, the authors enumerate three different applications of tactical urbanism for various user group beneficiaries, noting that the processes are not mutually exclusive, and often bleed into each other (Lydon and Garcia 2015). The first application is initiated by citizens, with the goal to "bypass the conventional project delivery process and cut through municipal bureaucracy by protesting, prototyping, or visually demonstrating the possibility of change" (Lydon and Garcia 2015, 12). The immediate reclamation, redesign, and reprogramming of public space is a  powerful way for citizens and community groups to participate in the shaping of their environments. Findings from the Urban Living Lab, a center for researching and implementing innovative solutions for climate change, revealed that the temporary activation of public spaces can enhance social cohesion, foster a sense of belonging, provide platforms for activism, and empower residents to directly shape their environment (Robazza 2022). Jeff Hou, whose research focuses on community design, and design activism in place-making, would concur that the inclusive and participatory production of public space through tactical urbanism – or insurgent public spaces as he describes them – emboldens communities to voice concerns and democratize the creation of public space (Hou 2010). For citizens, tactical urbanism can serve as platforms for community activism, empowering them to advocate for their needs and create lasting change.

*Temporary activation of public spaces can enhance social cohesion, foster a sense of belonging, provide platforms for activism, and empower residents to directly shape their environment.*

The second application, as described by Lydon and Garcia (2015), is a "tool for city government, developers or nonprofits to more broadly engage the public during project planning, delivery and development processes" (12). These points highlight the great opportunity for engaging with the community, collecting design intelligence and user data, and iterating with a tactical approach. Temporary interventions offer valuable time for experimentation and testing design ideas in real-world settings, which also provides a great opportunity for advocacy organizations to demonstrate what is possible, and to garner public and political support (Lydon and Garcia 2015). Tactical and temporary projects encourage a more flexible, responsive approach to urban design, where adjustments can be made as new challenges and opportunities arise. Hadj Kilani and Dhaher (2024) explain that the adaptability of tactical urbanism is important for the resilience of neighborhoods that face socio-economic challenges, as "tactical interventions can serve as immediate and cost-effective solutions to urgent problems" (3). They also note that the iteration involved in tactical urbanism can support long-term decision making, which supports sustainable development. In summary, tactical urbanism allows for rapid iteration and refinement based on real-world feedback, which help city planners and designers hone their ideas and better understand how the ideas function in the context of a constantly evolving urban environment.

The third application of tactical urbanism describes tactical urbanism as an "early implementation tool used by cities or developers to test projects before a long-term investment is made" (Lydon and Garcia 2015, 12). For cities, temporary interventions offer a powerful proof-of-concept for new urban space proposals. These low-stakes interventions allow for testing new ideas and gauging public response without significant upfront investment. By implementing small-scale interventions, cities can gather valuable data that serves as evidence to secure funding for more permanent projects, accelerating the implementation of innovative and sustainable urban designs with minimal risk (Lydon and Garcia 2015). Additionally, temporary interventions provide cities with deeper insights into the evolving needs of their residents, ensuring that future urban developments are more inclusive, adaptive, and aligned with the specific contexts of local communities.

Within Lydon and Garcia's (2015) framework for tactical urbanism, this thesis aligns most closely with the group that includes advocacy organizations, artists, and planning and design firms. I refer to this group as "design activists" relating to both the top-down and bottom-up actors utilizing momentum from both governmental agencies and community stakeholder groups. Landscape architects and urban planners can implement temporary installations to reimagine how public spaces function and adapt to the constantly evolving news of users and unique urban design challenges. While regulatory, bureaucratic, and financial barriers often limit what can be done to alter the urban environment when change is necessary, design activists can be agents of change who craft spaces for public gathering, education, research, growth, and resilience through tactical urbanism. Temporary interventions offer the potential to test ideas without major cost or consequence, provide evidence to support future investments, and bring people together in the practice of urban design and community activism. Temporary and tactical interventions can be leveraged to test, refine, and even drive long-term change.


Figure 2.3: The spectrum tacticians of tactical urbanism
Source: Lydon and Garcia 2015.

# TACTICAL URBANISM IN RESPONSE TO EXTREME HEAT

This section catalogs precedents in tactical urbanism that are particularly informative to the topic of urban heat mitigation and the creation of temporary shade structures. It is noteworthy that the research on tactical urbanism precedents included very few that related to the production of shade, which underscores a gap in the application of tactical urbanism. Shade is often an afterthought or an additional amenity of activating a space for some other alternate use, when in some areas, shade should be the primary design concern or objective. The precedents are international, and range from temporary installations, to annual events, to phased experiments, and engage a host of different stakeholders in the process.

## Tactical Urbanism Pocket Parks; New York City

This study, conducted in New York City (NYC), examined the ability for small pocket parks (simpler, less curated, sometimes temporary parks) to reduce urban heat stress for both objective and subjective thermal comfort (Rosso, Pioppi, and Pisello 2024). The researchers use the term "Tactical Urban Pocket Parks" (TUPP) to indicate a wide sample of small urban parks based on characteristics, size, ability to take up leftover space, and exploit abandoned corners, infills or street extensions (Rosso et al. 2024). Pocket parks are defined by the inclusion of the following attributes: 1) greenery for evaporation and connection with nature, 2) a water body or fountain to block noise, 3) varied furniture for groups to relax and eat, 4) shade structures through furniture and trees, and 5) general separation from the street (Rosso et al. 2024, 349). The different typologies the researchers categorized as TUPPs were pocket parks, privately owned public spaces, and interim plazas. It is notable that "interim plazas" are part of NYC Department of Transportation's (DOT) plaza program, and can eventually be transformed into permanent plazas if the interim phase is successful. After a competitive review of proposals, the NYC DOT constructs interim plazas, and if they prove successful, they are maintained by local community groups, reflecting a grassroots strategy for enhancing public outdoor areas (Rosso et al 2024). This is a great example of how cities can expand programs and policies to support community-based design proposals and the stewardship of areas that may be overlooked by the city or lack the resources for proper maintenance. This framework involving different typologies with various attributes and programming is similar to the strategies I use in my series of phased site design proposals across three different site typologies.

The study found that all TUPPs improved subjective comfort of users in comparison to the surrounding streets without pocket parks (Rosso et al 2024). Yet the data collected for objective comfort (air temperature, relative humidity, solar radiation, and wind speed) did not demonstrate significant improvement by the TUPP interventions in relation to the surrounding streets. However, this study provides valuable information for urban designers and planners, with measured microclimate data and human perceived data on the ability for a variety of pocket parks to regulate thermal comfort (Rosso et al 2024). According to my research, this is the first study of its kind, and one that could be replicated with different variables in another city. At the very least, it is informative work for heat mitigation, and hopefully will draw more attention to the idea that small-scale, temporary installations could provide some thermal relief in the short term.

## Umbrella Shade in the City; Los Angeles

A community-based arts organization in Los Angeles called Arroyo Arts Collective, created an outdoor public art installation to "raise awareness of shade as an equity issue" ("Shade in the City" 2022). The installation, "Shade in LA," was located in the Los Angeles Highland Park neighborhood, and it brought together the work of 18 artists. Each artist was given the canvas of an umbrella to represent their thoughts on the related topics of heat, shade, nature, environmental equity, and climate change.

The piece titled "Trapped in an Oil Cobweb" (Figure 2.4) by Joe Bravo reads:

*"As we use up more fossil fuels such as oil and coal, the pollutants released into the atmosphere by our machines further destabilize our climate, causing the wildfires, extreme heat, and other environmental disasters we are now experiencing. The public is caught in a spider's cobweb of oil consumption that covers the world. We can throw some shade on our climate dilemma by conserving our natural resources and developing reusable energy alternatives sooner rather than later."*

This piece echoes layered concerns related to extreme heat, and ways in which humans can act now to mitigate the effects of the climate crisis. Installed outside a studio space and suspended above head height, the umbrellas were enjoyed by "train passengers who got a glance of a colorful and visually impactful installation; and visitors and pedestrians who interacted with the umbrellas by walking or sitting under the installation" ("Shade in the City" 2022).

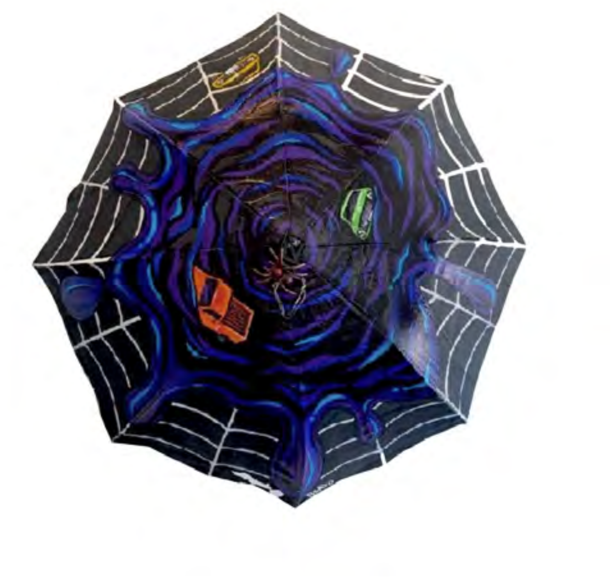


Figure 2.4: "Trapped in an Oil Cobweb" umbrella art
Source: Joe Bravo 2022, "Shade in the City "

Another umbrella artwork is called "Redlined, No Shade," by Chantée Benefield, which highlights existing neighborhood heat inequities as the result of historic housing policies (Figure 2.5). Vivek Shandas, Professor of Urban Studies and Planning commented the following about the umbrella:

*"It speaks directly to one of the major reasons we see shade inequity in US cities, it also contains an accurate representation about how these areas were geographically distributed with the center of the umbrella representing the center of an urban area, and progressively moving to green and blue colors towards the edges. The colors are remarkably close to the actual colors of these maps, and they provoke a series of questions for me, including: How might a museum in the 1950s have responded to this umbrella and the message it is sending about the inequities that current policies are generating? How might shade reflect the differences in color that we see on the maps and on people's faces — red as hot and blue as cool?"*

Although the umbrellas were only installed temporarily in the spring of 2022, the work was documented as an interactive virtual exhibit on The Nature of Cities  website, where anyone can view the umbrella artwork and the paired poems. This installation communicates the need for swift climate action, and by engaging people through the outdoor public exhibit, it spreads awareness for shade as a necessary resource in urban design. The project is a reminder of the power of art in communicating with and relating communities, which is critical for top-down and non-community based groups in general to utilize in tactical urbanism and design advocacy.

Within my design phase framework, this example relates most closely to Phase 1: Tactical Urbanism. The installation is temporary, initiated by community organizers and design activists, and its main objective is to communicate a pointed message of heat inequity through multidisciplinary art. While the umbrellas within the art installation provide some shade, the focus is on how they communicate stories of climate change, human reliance on fossil fuels, and the historic and present inequality in urban tree canopy cover; all relating to the issue of extreme heat and illustrating the need for increased shade. The installation's online presence furthers its educational impact with a wider audience, and extends the life of the tactical intervention.

Figure 2.5: "Redlined, No Shade" umbrella art
Source: Chantée Benefield 2022, "Shade in the City"

## Crochet Grannies; Madrid, Spain

The self-proclaimed “Crochet Grannies” are credited with creating a unique shade strategy for a bustling shopping street in Alhaurín de la Torre, Madrid. Recognizing the intense heat on this street, the city had previously installed a plastic shade cover which acted like a greenhouse and actually increased temperature on the street. With this failed attempt, it was time to test a new material. A local crochet club, made up of mostly older women, were contacted to see if their work could be transformed into textile blocks that could shade the street (Figure 2.6). The crocheted textile blocks have become a tremendous success, reducing the ambient temperature by five degrees, and incorporating an innovative, local craft. The “Crochet Grannies” were featured in a YouTube video that has given international recognition to their craft (Great Big Story 2024).

Figure 2.6: Crocheted squares create a shade canopy over Alhaurín de la Torre, Madrid
Source: Great Big Story 2024

This project highlights the ability for tactical urbanism to test different materials and design assemblies. Had the city chosen to test the plastic material before installing it on the whole street, they would have avoided spending valuable time and energy on the full installation. This precedent further emphasizes the importance of art in temporary installations to gain local support and connection to the design. The artistic shade installation adds value and cultural identity to the streetscape, in addition to cooling the street’s microclimate.

The Crochet Grannies precedent is best aligned with Phase 2: Temporary Urbanism, because of the intervention’s extended and seasonal nature, and the various actors involved in the strategy. The local government, design activists, and community organizers came together to make this installation a reality that proved successful for the people spending time on the street. The fact that there was some experimentation involved in finding a solution that was successful, is what defines Phase 2. This on-site iterative process – through material experimentation or citizen-led design – is how temporary and tactical urbanism can be most effective.

## Wanderbaumallee; Stuttgart, Germany

Wanderbaumallee, which translates to “Wandering Tree Avenue,” is a tactical urbanism project that was born from a desire to enhance neighborhood public spaces by increasing greenery and providing opportunities for community interaction (Wanderbaumallee Stuttgart 2025). The neighborhood organizers built the “wandering tree modules” (planter boxes with wheels and benches) to be mobile places of rest, meeting, and contemplation (Figures 2.7). On certain days throughout the summer, the boxes are paraded through the inner-city streets of Stuttgart, temporarily transforming the street into a “green oasis” and inviting people to experience the street in a new way. The organizers describe it as an experiment that “provides a tangible experience of how public spaces can be enlivened by people and plants” (Wanderbaumallee Stuttgart 2025.

In the fall, the trees find permanent homes in the neighborhood streets, school yards, and other publicly accessible spaces, where they are planted by volunteers. The work is “implemented in coordination with the city administration and supported by Stuttgart's district councils," and has garnered such success that it has been repeated annually since it began in 2019 (Wanderbaumallee Stuttgart 2025).

The success of this project proves that a community initiative, which began with a simple idea to activate and increase vegetation, can, in fact, transform and re-shape neighborhood public spaces. This tactical approach was ultimately successful in increasing green space and spaces for people to gather in their inner-city neighborhoods. The community organizers saw a human and ecological need that was not being met by existing infrastructure and urban spaces. It is a strategy that several cities have since replicated, and one that is useful to my design research because of the modules that are flexible, movable, encourage participation, and increase the prevalence of shade in urban neighborhoods.

Figure 2.7: People parade down a street and dance in a public square with the Wanderbaumallee tree modules
Source: Wanderbaumallee Stuttgart

Within my design phasing framework, this example is most reminiscent of Phase 3, because it has developed from Phases 1 and 2. In this framework, a design begins as either a Phase 1: Tactical Urbanism, or a Phase 2: Temporary Urbanism  strategy, and then from either of these, it may elevate to a Phase 3: Transformed Urbanism. Transformed urbanism relates to a nearly resolved design intervention, one that might look similar to a typical designed or planned urban landscape; however, because this thesis advocates for radical shade, I propose a preliminary tactical or temporary phase to understand existing site conditions, iterate options, and generate community participation and stewardship. Wanderbaumallee has become an annual event and project, but before it was formally recognized and funded, or supported by the local municipality, it was a group of people coming together to initiate steps toward radical shade. The wandering tree forest combines both advocacy for increased public resources in urban residential areas, as well as community cohesion and coalition building through the execution of the extensive tree installations and planting sessions. This approach of using tactical urbanism techniques to also build social connections and create transformative change in the built environment epitomizes what the design proposals in this thesis seek to accomplish.

# PART 3: RADICAL SHADE

## SHADE FOR HEALTH AND WELL-BEING

Weather related environmental conditions significantly influence how people enjoy and occupy urban spaces. In his seminal work, *The Social Life of Small Urban Spaces*, William Whyte found that people chose to sit in the sun during their lunch breaks in pleasant weather (Whyte 1980). Whyte observed that, if given the option, people would choose chairs in the sun, and even move their chairs into the sun. This work demonstrated that people are sensitive to urban microclimates – including sun, wind, trees and water – and will flock to the areas that are most inviting depending on the time of day and weather. On hot summer days, people will typically gather in the shaded areas of a park or open space, or "shade hop" between shaded areas to extend the amount of time they can spend outside. Shade is essential to providing comfort and respite on hot days.

In hot climates, shade has a significant impact on public health, which is the greatest reason for why it should be considered a civic resource. Spending time in the shade on a hot day helps people see and think more clearly, improves blood circulation, and can even make the difference between life and death for vulnerable populations like outdoor workers, the elderly, and the homeless (Bloch 2019). A seasonal field study from Tempe Arizona, conducted by climate scientist Ariane Middel and others, showed that shade improved thermal comfort in spring, summer, and fall (Middel et al. 2016). The researchers surveyed people about their perception of heat and preferred shaded areas, finding that the type of shade (either from photovoltaics or tree canopy) did not make a difference on thermal comfort, but the simple presence of shade increased thermal comfort. The study further found that shade – not wind speed, air humidity, or air temperature – was the most important factor for thermal comfort.

Another study on playground surface temperatures found that shaded asphalt was up to 40 degrees cooler than unshaded asphalt, with an even greater difference on metal jungle gyms (Middel 2016, as cited in Bloch 2019). The study effectively reported that "shade stops skin burns," which helps prevent skin cancer, in addition to a host of other health benefits. In 2002, a Shade Policy Committee was formed in the City of Toronto, Canada, with the objective to increase protection from ultraviolet radiation (UVR) for children, ultimately preventing skin cancer by increasing shade. In 2007, the committee produced a Shade Policy that explained how "increasing shade in Toronto contributes to a healthier and more sustainable City" (Toronto Cancer Prevention Coalition 2010, 7). The policy stated that "The provision of shade, either natural or constructed, should be an essential element when planning for and developing new city facilities such as parks or public spaces, and in refurbishing existing City-owned and operated facilities and sites" (15). All three of these studies contribute to the growing narrative that shade is an invaluable resource, and as global temperatures continue to rise, the benefits of shade need to be valued, understood, and acted upon.

## THE POLITICS OF SHADE: LOS ANGELES

As summer temperatures steadily increase and heat waves continue to intensify, shade is becoming recognized as critical infrastructure in mitigating dangerous public health scenarios and managing thermal discomfort. In his groundbreaking article simply titled *Shade*, Bloch persuasively states that "shade is often understood as a luxury amenity. But as deadly heat waves become commonplace, we have to see it as a civic resource shared by all" (Bloch 2019). Shade is not considered a civic resource because it has been politicized in cities, such as LA, to the extent where it is reduced to a luxury amenity that is not equally shared by all. Bloch laments, "To the list of environmental injustices in this country, we can add the unequal distribution of shade.... If you see a mature shade tree today [in Los Angeles], you can assume that a private citizen paid for it and maintained it. Canopy inequality thus follows lines of wealth" (Bloch 2019).

*"shade is often understood as a luxury amenity. But as deadly heat waves become commonplace, we have to see it as a civic resource shared by all"*

In addition to the historic and ongoing environmental injustices and thermal inequities discussed in the Urban Heat section of this chapter, there are also political and regulatory barriers to increasing shade in certain areas. The list of concerns for planting trees in LA specifically run the gamut from disrupting underground and aboveground utilities, violating the ADA, blocking driveway sightlines, and creating the appearance of shelter which may invite homeless people. These barriers and restrictions in certain LA blocks and neighborhoods effectively outlaw and "zone shade out of many poor neighborhoods," further amplifying subsequent disparities (Bloch 2019). In this in-depth article, Bloch draws on numerous interviews he conducted with urban heat researchers, public health experts, and LA city planners, crafting a compelling narrative about the history, politics, and planning shade in the city. This section reviews some of the highlights from those interview conversations, as they portray critical insights into how professionals are addressing extreme urban heat, and are essential to this thesis.

To mitigate heat, cities typically initiate climate goals such as Los Angeles' pledge to reduce the city's temperature by three degrees by 2050 (Bloch 2019). Yet, this broad goal to reduce the entirety of the city's temperature by just three degrees Fahrenheit does not make an impactful difference for people suffering from health consequences from exposure to extreme heat at a micro-scale. Bloch remarks that solutions to heat mitigation and management have to respond to neighborhood conditions and geographic contexts, "Neighborhoods with wide sidewalks and parkways will get the best street trees, while areas with compromised infrastructure may be targeted for green roofs and cool pavements, which can lower the heat island effect without actually increasing comfort for people on the street" (Bloch 2019). At the street level, it is clear to see the distinction between the different options that exist for shade improvements; many depend on the existing conditions and right-of-way space available that was predetermined by other planning objectives. Because of this, there is a need for site specific design strategies that relate to the immediate context and existing physical site conditions. A tactical approach for shade improvements in this case might involve site typologies with a toolbox of materials, assemblies, or strategies that fit each typology. These are examples that the results of my design research process seek to provide. With thoughtful material selection and material assemblies (shade structures) that address the lack of shade at each site, the design proposals supply community organizers and urban designers with ideas for what might be fitting at a few typologies of urban sites. These design proposals can then be further adapted and tailored to other site conditions and users.

Lauren Faber, the Chief Sustainability Officer coordinating Los Angeles' climate change response, was one of the people that Bloch interviewed for the article. She recognized that the city has a role to play in lowering the temperature, and stated that the city may need to "set additional goals, focusing on the creation of shade itself" (Bloch 2019). Faber acknowledged the fact that in the broad city effort to reduce overall temperature "nobody is really focused on shade disparities, and the need to provide shelter to those who need it most" (Bloch 2019). To address comprehensive urban issues, planners work at multiple scales such as neighborhood or master plan level to address issues for a single site. It can be difficult to maintain focus at both levels of planning simultaneously, with coordination between the master plan level and site-scale, on-the-ground strategies being a critical piece of realizing a comprehensive plan. Another challenge specifically for reducing urban temperatures is the benefits of shade and street trees are not widely understood or valued. Director Elizabeth Skrzat of City Plants, a tree planting organization in LA, calls shade trees a "'leafy, green utility' but the city doesn't care for them as it does other environmental infrastructure, like sewage or water pipes, or powerlines" (Bloch 2019). From an institutional planning perspective, shade is an undervalued resource that city planning departments do not prioritize their land use zoning, treating it more as open space rather than an alternative form of green infrastructure. Perhaps cities and developers would place a higher value on existing tree canopies, planting new trees, and increasing shade infrastructure if the benefits of shade were better understood.

Bloch also interviewed Claire Bowin, a planner for the City of Los Angeles, about the city's goals to increase tree canopy. Insightfully, Bowin mused that "A new urban forest is theoretically possible a decade from now. But what about all the people who need shade today? Why not do something simpler and faster, like promoting sidewalk canopies or specialized street furniture?" (Bowin, as quoted in Bloch 2019). The sense of urgency in this statement is exactly what this thesis strives to communicate, and proposes achieving through tactical design solutions. Certainly, there are plans in place to increase tree canopy and reduce the emission of greenhouse gases, both of which will reduce urban heat island effect in the long-term; but what happens in the short-term, during the next 0-10+ years when the "new urban forest" has grown and society is ideally less reliant on fossil fuels? Design activism through tactical urbanism, as this thesis suggests, can help raise awareness about the issue while also providing functional solutions, which the design proposals aim to achieve in a later chapter. Noting that street furniture projects can become expensive, Bowin tossed out ideas such as the city creating a single design that serves multiple purposes like shade, water, and wayfinding, and that vendors could be identified to construct the shade elements, and developers could be incentivized to incorporate shade elements. In this hypothetical process, she said the city would "have to go through a lot of testing of the different materials" (Bloch 2019). In trying something new, such as temporary shade structures for various street types and neighborhoods, it makes sense that the city would want to test different prototypes in scale, in place, and make adjustments based on observations of how people use the space and the quality and quantity of shade provided. This is exactly what the tactical urbanism approach I am proposing would involve, and a process that starts to land the idea of radical shade.

*Shade is an undervalued resource that city planning departments do not prioritize their land use zoning, treating it more as open space rather than an alternative form of green infrastructure.*

## DEFINING RADICAL SHADE

Before radical shade can be acted on, there are three components that must first be understood: 1) shade is a fundamental resource for all: it is valuable infrastructure, critical for human health and urban climate control, 2) shade has been unequally distributed, resulting in an environmental injustice and health disparities in areas that lack adequate shade, 3) shade is versatile: shade structures can have multiple uses, forms, and benefits to urban areas. These are the building blocks that make the case for why shade should be prioritized in city planning and "a mandate for urban designers" (Bloch 2019). The process of establishing shade should begin in neighborhoods that lack adequate canopy coverage in public spaces such as bus stops, playgrounds, sidewalks, and open areas: locations where people commonly spend time outdoors for commuting or recreation. Priority should be given to supporting vulnerable populations, including children, the elderly, unhoused individuals, and outdoor workers, who are more susceptible to the impacts of extreme heat. This effort requires a combination of geographic data analysis and community input. Understanding the lived experiences of residents in areas with higher heat exposure and limited shade is essential to developing effective, equitable solutions. Insights into how these communities currently use available resources and adapt to heat can inform both the placement and design of new shade infrastructure.

Much like on-site tabling as a means of community engagement, the conceptualization of "radical shade" in urban design may begin with the implementation of temporary shade structures. These installations can function as interactive tools, encouraging community members to identify and report locations where they experience thermal discomfort. Government agencies or design advocates would be responsible for creating and deploying these tactical shade prototypes in areas already recognized as deficient in canopy cover. The installations would provide shade while also communicating information about the public health risks of heat exposure, and climate projections indicating the intensification of urban heat island effect. Local residents encountering the shade structures would provide feedback on both the placement and performance of the structures, offering valuable insights into how and where more permanent shade structures would be most beneficial. This knowledge sharing between designers and community members not only enhances the quality and relevance of the research but also introduces greater flexibility into the design process and fosters meaningful public participation through tangible, site-specific experimentation. The necessary components for achieving "radical shade" are advocating for shade in vulnerable areas through interventions that provide temporary shade and educate people on the dangers of heat exposure, and reframing the production of shade through a community informed approach. It is through a small-scale, incremental and inclusive process that radical shade is built and informed by community voices at the microclimate level that provides data that cannot be gained through technological data. Radical shade is a call for the reframing of how shade is produced and distributed, which can also come from a bottom-up, community organized movement.

The objective of radical shade is to advocate for shade structures that build heat resilience through natural and social elements, which improve the health of residents and urban ecosystems. The key to incorporating social elements into this initiative is to locate the shade structures in areas where residents already spend time and may be interested in participating in the shade strategy. If the shade installations are initiated from a top-down or outside the community entity, the hope is to encourage community participation in and stewardship over the shade installation in the short-term, and promote community ownership over the long-term. There are multiple co-benefits to designing urban design systems with both climate mitigation strategies and social well-being infrastructure in concert, as described in *Climate Mitigation and Social Well-Being in Urban Design* (Fielding and Chinwalla 2025). One of the examples for social infrastructure in this guide is resilience hubs. Resilience hubs are "buildings which are trusted by the community, and support the neighborhood in everyday life and before, during, and after an emergency" (Fielding and Chinwalla 2025, 65). In a similar way, shade structures could provide heat relief to communities on a daily basis, and serve other purposes when heat is not a concern. If the shade structures become more permanent fixtures within the neighborhood, then they can be incorporated into the greater heat mitigation strategy. As Bowin said, growing the "new urban forest" is part of the solution to long-term heat mitigation, but there are other methods and processes that can be utilized in the meantime to achieve a transformation that defines "radical shade" (Bloch 2019).

*Radical shade is a call for the reframing of how shade is produced and distributed, which can also come from a bottom-up, community organized movement.*

# PROGRAMS AND POLICIES FOR RADICAL SHADE

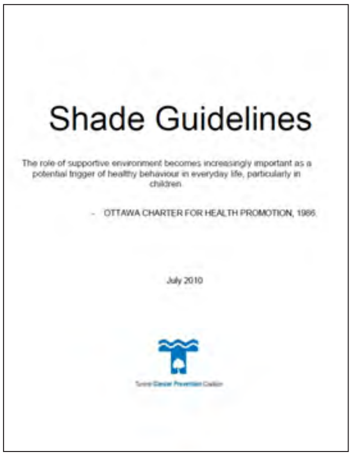
The following section describes strategies and actions that other international cities have taken that exemplify steps toward radical shade. In the U.S., as in many areas of the world, shade is not yet valued as a civic resource, nor is shade understood as a critical urban amenity that should be prioritized in urban design. Bloch (2019) goes as far to say that shade should be a mandate for urban designers and that shade guidelines should be written into urban policy. Similar to heat mitigation plans which adapt to the issue of urban heat, there should be shade master plans, which would help both to mitigate and to adapt to urban heat through a detailed focus on urban forestry and shade infrastructure. The examples below detail a variety of active plans, programs, and policies that relate to establishing shade in cities.

## Shade Guidelines, Toronto, Canada

The Toronto Cancer Prevention Coalition (TCPC) has a "Shade Policy Committee," which was formed to address excessive exposure to UVR (ultraviolet radiation) which can lead to skin cancer for vulnerable populations. The TCPC was established in 1998 to strengthen cancer prevention efforts in the city, and in 2002, the Toronto City Council endorsed the TCPC's Action Plan for cancer prevention (Toronto Cancer Prevention Coalition 2010). Most recently, in 2010, the City of Toronto adopted the TCPC's "Shade Guidelines" that includes tools and design examples for city planners and designers create shade structures. This work by the TCPC and the Shade Policy Committee, seem to be unprecedented for North America. Notably, the TCPC had the insight to suggest this fifteen years ago when the issue of extreme urban heat was not nearly as pressing as it is now. One of the most inventive and relevant parts of the report is its short-term and long-term objectives to increase shade. The report reads:

*Consider the rate of growth of new trees and existing trees on site. Consider augmenting with structures to provide shade until trees develop to provide more shade. Determine how interim solutions can address short-term needs and available budgets vs. long-term investment in significant structures and plantings. Interim and temporary solutions can be provided by demountable structures (i.e. shade sails). (64).*

Although written in a formal manner, the sentiment of this segment is earnest and direct in highlighting that we need short-term, inexpensive and easily assembled and disassembled solutions for shade structures while we plant trees and wait for the trees to grow and for high-cost structural solutions to be constructed. The guidelines state that shade structures should be portable, and that the shade structures at parks and recreation sites and facilities should be increased when feasible, and promoted through education for the general public when possible. Another short term goal was "to seek community advice and input to assist with planning of future shade creation activities" (Toronto Cancer Prevention Coalition 2010, 29), acknowledging the merit in consulting residents as to where and how shade should be created.


Shade Guidelines

The role of supportive environment becomes increasingly important as a potential trigger of healthy behaviour in everyday life, particularly in children

– OTTAWA CHARTER FOR HEALTH PROMOTION, 1986

July 2010

Figure 2.8: Cover image of the "Shade Guidelines" report for Toronto
Source: Toronto Cancer Prevention Coalition

The report suggests that the short-term shade structures be installed for up to 10 years to allow time for shade trees to grow, which will eventually replace the structures. Yet the authors note that the structures can be combined with natural vegetation to provide a hybrid solution that both blocks overhead sunlight in addition to reflection and absorption of indirect sunlight (Toronto Cancer Prevention Coalition 2010), 42). This mention of a vine covered pergola structure or lattice screen brings up the final point that the shade structures can provide other benefits besides shade. In the short-term they might provide cover from the rain, and in the long-term they might collect rainwater for irrigation or support solar panels to collect energy. The long-term goals of the Shade Guidelines included the implementation of UVR reduction strategies in future parks and recreation facilities planning, and to achieve continued and measurable growth in the number of shade structures available (29). Whether it is valued for the single use of shade provision, or multi-use benefits, the Shade Guidelines from TCPC are a forward-thinking set of objectives that should be noted and replicated by other cities that have a lack of shade and are facing a rise in extreme heat events.

## Shade Phoenix: An Action Plan for Trees and Built Shade, Phoenix, Arizona

As the hottest large city in the U.S. (City of Phoenix 2024), Phoenix, Arizona is leading the way for extreme heat planning. In November of 2024, the Phoenix City Council unanimously adopted the Shade Phoenix plan, which was presented by Phoenix's Office of Heat Response and Mitigation (see Figure 2.9). The plan is an update of the City's 2010 "Tree and Shade Master Plan," and includes the ambitious aims to plant 27,000 trees, and add 550 shade structures in the next five years (City of Phoenix 2024). The plan is guided by several key values, including 1) people first, targeting actions where shade can have the greatest impact on human health and wellbeing, 2) recognizing shade is a "critical resource provided to the community by public and private assets," and 3) leading with an environmental justice and equity lens to address inequities" (6). These values are very much aligned with how I have conducted this design research project for Seattle, especially by prioritizing areas where people are the most vulnerable to urban heat, focusing on areas of environmental injustice, and underscoring the reality that shade is a critical or civic resource for all.

The Shade Phoenix Plan includes a host of ongoing projects related to shade, including the Sidewalk Shade Project, Cool Corridors, Walkable Urban Code, T2050 Bus Shelter Shade Goals, and Sombra (City of Phoenix 2025). "¡Sombra! Experiments in Shade" is a program developed by the Office of Arts and Culture to engage the arts community in addressing extreme urban heat. The program is funded by a $1 million grant from Bloomberg Philanthropies' Public Art Challenge, bringing together artists, civic leaders, and residents to explore creative, community-driven solutions to extreme urban heat through temporary shade installations. From over 80 applicants, nine artists were selected to test and prototype shade structures with innovative materials, and develop community engagement activities around the temporary installations that will be debuted throughout the city beginning in Spring 2025. Depending on their impact, some temporary works may become permanent, as part of Phoenix's long-term investment in shade and heat mitigation through public art.

These efforts, which bring together government agencies, design activists, and community organizers illustrate the kind of programming that is essential to addressing the widespread issue of extreme heat. In this example, the city was able to resource the funding, and create a compelling event – almost like a design charrette – that citizens are excited about participating in. In the Sidewalk Shade Project, the City has designed small shade structures at junctures where pedestrians have to wait, but the Sombra program includes art and community in the design process of creating shade in parks. Both strategies are useful and valid in the short term, and can be treated as prototyping experiments that can be adjusted later for permanent installation.

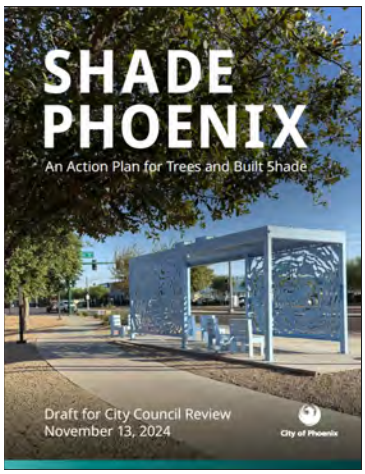



Figure 2.9: Cover image of the "Shade Phoenix" plan
Source: City of Phoenix

## Our Roots Chicago, Tree Ambassadors

Urban tree canopy stewardship and maintenance programs have become prevalent in many U.S. cities, and are instrumental to supporting the long-term health of the urban tree canopy. Trees serve multiple purposes of providing shade and cooling, improving air quality, mitigating heat, and supporting environmental justice, and therefore may relate to several climate action goals. The program called “Our Roots Chicago” with the slogan “Equitably Expanding Chicago’s Tree Canopy” is a tree ambassador program that works with community partners and volunteers to plant and maintain trees in neighborhoods that lack tree cover (see Figure 2.10). The program is commendable in terms of its community-driven nature, emphasis on education, and data-informed approach. In order to equitably expand the city’s tree canopy, the program uses geospatial analysis tools to identify “vulnerable neighborhoods,” similar to the methods approach used for a suitability selection in this thesis. Our Roots Chicago uses geospatial layers related to public health, environmental, social, and economic data, in order to identify neighborhoods that are more vulnerable to climate change impacts like extreme urban heat events, and to better understand tree canopies in these areas. This data and analysis helps inform where new trees can be the most impactful, and advances an equitable distribution of tree canopy. The program’s tree planting goal is to reach 75,000 planted trees by 2025 with the support of the Tree Equity Working Group and the Tree Ambassador Program. The tree ambassadors receive “training, funding, and priority status to request trees to be planted in parkways by the City of Chicago,” they help scout tree planting locations and inform property owners receiving trees on how to properly care for the new trees (The Morton Arboretum 2025). To highlight the program’s impact, they have video testimonials where the volunteers share their experience and the benefits they see now and for future generations.

## Speak for the Trees, Boston

Another tree planting program with a similar mission to increase urban tree canopy is “Speak for the Trees,” located in Boston (see Figure 2.11). The organization is funded by sponsors and community partners, and powered by community volunteers. Speak for the Trees aims to expand tree canopy in environmentally marginalized neighborhoods, including those that were formally redlined, by working together with community members to plant, preserve, care and advocate for trees (Speak for the Trees, Boston 2025). The “Adopt a Tree” program is a branch of Speak for the Trees that focuses on caring for the newly planted trees, offering online sign-ups for any local residents to adopt a tree. The website provides an interactive map that allows you to see where newly planted trees are located that need the most, older trees that don’t need as much help but could still be adopted trees,


Figure 2.10: “Our Roots Chicago” website home page
Source: City of Chicago


Figure 2.11: “Speak for the Trees” website home page
Source: Speak for the Trees, Boston

and empty sites where future trees can be planted. There is also guidance for how to properly water, mulch, and care for a tree once you adopt it. Although voluntary and self-motivated, the Adopt a Tree program aims to “build a sense of stewardship and connection between residents and trees,” as young trees need critical care and watering in the first three years of being planted (Speak for the Trees, Boston 2025).

## Trees for Neighborhoods, Seattle

Seattle’s Trees for Neighborhoods is an annual program that gives away free trees to local property owners. The program has been around since 2009, planting over 15,400 trees in residential yards and along property adjacent ROW strips. This program offers residents help selecting the right tree and location, assistance with planting, a watering bag, and mulch for each tree. Residents that receive a tree are required to attend a workshop on tree planting and care, and can receive up to 3 free trees per household. The application period for trees is open for a month, and applications are selected by a lottery system based on the number of trees available. While the program provides generous support from the city for individual residents for trees mainly on private property, this program does not incorporate the community interaction, stewardship, or tree equity prioritization that the examples from Chicago and Boston appear to foster. Pertinent to this research, the programs like Adopt a Tree and the Tree Ambassadors prioritize equitable tree canopy expansion through data-driven mapping and analysis, and foster environmental stewardship by empowering residents to actively support the health and longevity of their local urban forest.

# PART 4: SEATTLE CONTEXT

The following section describes strategies and Seattle is an intriguing location for the interventions I propose in this thesis because although it does not yet experience severe heat events every summer, now is the important time to start planning and implementing strategies before our summers become even hotter. The timing for this investigation in Seattle is key, because the King County Extreme Heat Mitigation Strategy was just published last summer (2024), indicating that the issue is locally relevant (see Figure 2.12). In addition, there are several local organizations and businesses working to bring change for improved social, active transit, and environmental connections to Seattleites through tactical, community engaged actions. These examples show that the City of Seattle is often supportive of initiatives that wish to test interventions throughout the city for human well-being and environmental sustainability. Lastly, the City of Seattle is involved in ongoing work focused on environmental justice and equitable development in the Duwamish Valley, dedicated to supporting and collaborating with existing community-led projects. This work relates to the idea of radical shade because it is community centered and explores new and innovative ways of approaching design for environmental equity. Based on this, Seattle is a terrific match for this design-research investigation into temporary tactics for radical shade.

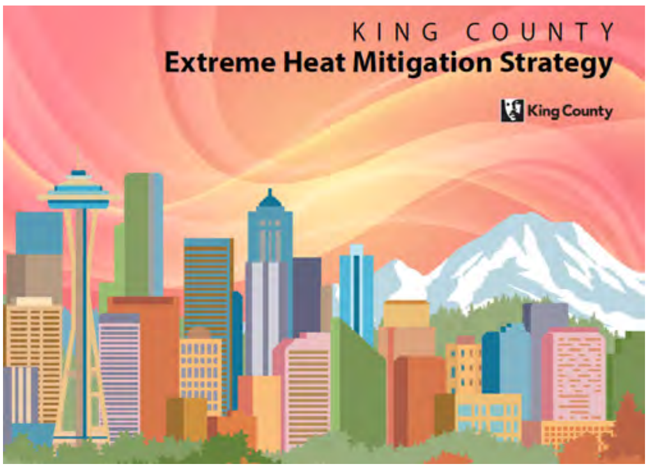


Figure 2.12: Cover of King County's Extreme Heat Mitigation Strategy
Source: King County 2024

## Seattle and Extreme Urban Heat

When considering U.S. cities that experience intense summer heat, one might think of Phoenix, Las Vegas, Los Angeles, or other cities in the Southwest. Seattle is likely not top of mind because Seattle's climate is mild, often described as a Mediterranean climate, with warm, dry summers and cool, wet winters. However, the city does record high to extreme heat in the summer and will continue to experience increasing heat as climate change continues to intensify. Our ecosystem regions are already adapting to changing weather patterns, with plant and animal species migrating further and further north for cooler summers and colder winters (Kubelka et al. 2022). Maximum summer temperatures in Seattle are expected to increase by 3.7° F by 2030, resulting in continually hotter summers and increased frequency of heat events like the deadly June 2021 Heat Dome, which reported 125 heat-related deaths in Washington State. The climate science data reveals that extreme heat events like the heat dome are 150 times more likely to occur because of climate change (King County 2024).

Largely in response to the effects of the 2021 Heat Dome, King County released its first Extreme Heat Mitigation Strategy in July, 2024. The strategy addresses the serious toll that heat events can have on human lives and on the economy, as well as exposing and exacerbating urban inequities. One example of such inequities was reported in a recent King County study on heat inequity. Researchers found that communities in two different parts of the county at the same day and time can experience as much as a 20° F temperature difference, with those experiencing extreme poverty also living in neighborhoods that are most affected by extreme heat (King County 2024, 4). Thus, the Seattle heat mitigation strategy focuses efforts in areas that are identified as heat islands, low-income communities, communities of color, and disproportionately affected communities (7-8). The strategy includes a five year plan (2024-2029) with 20 actions that invite collaboration from residents and community partner organizations, and which build on existing emergency management practices and heat responses. The actions are organized in six categories: 1) Help people stay cool and safe indoors, 2) Help people stay cool and safe outdoors, 3) Cool our neighborhoods, 4) Design for heat, 5) Increase heat safety awareness, and 6) Support heat action (King County 2024).

The action group that aligns best with my research is 2) Help people stay cool and safe outdoors, yet the actions in that group are limited to “drowning prevention, cool kits for unhoused people, and occupational heat safety” (10). While these are critically important actions, I was surprised not to see any mention of shade implementation within the category of keeping people cool and safe outdoors. Built shade does not appear anywhere in the actions, which is a missed opportunity. Other cities like Phoenix have recognized the importance of built shade elements as critical infrastructure for short-term relief and long-term resilience to urban heat.

The “Actions” section of King County’s heat mitigation report details each action with the implementation partners, implementation feasibility, timeline for community benefits, and alignment with community feedback (48). Given the urgency of addressing urban heat, I was most interested to learn which actions had the quickest implementation or “timeline for community benefits.” Some of the actions that only required 0-1 year timelines are the above-mentioned enhanced cooling centers, drowning prevention, cool kits for unhoused people, and multilingual communications. Overall, this is a comprehensive heat strategy, detailing how the county will take steps to reduce contributions to extreme heat and mitigate impacts to residents, yet I would argue that there is a lack of short-term actions that can truly benefit people and vulnerable populations at ground level.

## Seattle and Tactical Urbanism

There is a solid history of tactical urbanism in the city of Seattle. One of the older examples of tactical urbanism in Seattle is the P-Patch Program, which was established in 1973 and has become well renowned. It began with the creation of the city’s first community garden on a plot of land donated by the Picardo family, where the name ”P-Patch” originates. Recognizing the value of community gardening, the City of Seattle formally adopted the program to support urban agriculture, build community connections, and make gardening accessible to residents across neighborhoods. Over time, the program has expanded, growing into a network of community-managed garden spaces throughout the city. Today, the program encompasses 90 gardens across the city, collectively stewarding 33.7 acres of public land. These gardens serve as communal spaces where residents cultivate food, flowers, and herbs, fostering community engagement and environmental stewardship. The program emphasizes inclusivity, offering priority placement and financial assistance to low-income and historically under-served individuals. The P-Patch programs donate thousands of pounds of produce to local food banks annually, making the program a vital part of Seattle’s urban landscape by promoting sustainable living and community resilience.

The City of Seattle also has a history of supporting temporary installations in the public realm, and enacting “quick build” projects for improved bike and pedestrian activity (People For Bikes 2016). SDOT established the “Pavement to Parks” program in 2015, exploring a temporary and tactical approach to increasing public use of paved urban areas through activation and eventually transformation of these spaces into pocket parks. The program is still active today; projects are selected annually based on community-driven efforts to envision and locate a public plaza or pocket park site. Projects are typically operated and maintained by a neighborhood organization, Business Improvement District, non-profit, or private business (Seattle Department of Transportation 2017). SDOT also organizes Seattle’s Park(ing) Day event, as well as the “Healthy Streets” program. Originally named ‘Stay Healthy Streets,’ the program began during the COVID-19 lockdown as a temporary effort to reduce through traffic on neighborhood streets. The feedback from the program was so positive, reflecting increased quality of life and time spent outside for residents, that it led to the establishment of permanent ‘Healthy Streets.’ In 2022, the city committed to establishing 20 miles of city streets as permanent Healthy Streets. These are located in neighborhoods that have existing Neighborhood Greenways (bike and pedestrian friendly, safer streets), but lack open public space.

# SUMMARY

This literature review has explored the three foundational concepts of extreme heat, tactical urbanism, and radical shade that make up the conceptual framework for this design research project, and provided relevant context for Seattle. As the central issue, extreme heat sits at the center of the conceptual framework diagram (01 Introduction, Figure 1.1), supported on either side by tactical urbanism and radical shade, which are presented here as the strategies that address the urgent issue of extreme urban heat. Each of the concepts are briefly summarized by the key words and phrases that appear within the large triangles. For instance, Extreme Heat explores the climate science behind urban heat and the resulting effects of urban heat islands which harm people and ecosystems that are vulnerable to extreme temperatures. It also examines environmental injustices related to extreme heat and exclusionary zoning practices, concluding that not all urban neighborhoods are affected by heat waves to the same degree. On the left, Tactical Urbanism highlights the ability for community organizers to re-imagine public space through temporary actions that may address gaps in policy or public infrastructure. Through rapid implementations that are often tied to long-term visions, these temporary tactics can also contribute to demonstrating, educating, and engaging people in the transformation of a space. Lastly, Radical Shade reminds us that shade is a civic resource, which should be advocated for to increase shade cover in vulnerable areas. Establishing radical shade involves understanding existing resources, knowledge sharing with communities to build resilient systems, and ultimately reframing how shade is produced and distributed. These concepts are interrelated, and influence each other throughout the stages of site selection and design development in this project.

In reference to tactical urbanism being defined by "short term actions for long-term change" (Lydon and Garcia 2015), each of the concepts has a short-term and a long-term objective, which further unites them. The objectives for Extreme Heat are straightforward, directed at managing and reducing heat in the short-term and increasing shade equity in the long-term. The Tactical Urbanism objectives are aimed at speeding up the response to extreme heat, advocating and demonstrating an urgent need in the short term, and advancing heat mitigation and management strategies in the long-term. The objectives for Radical Shade are to center people in the production of shade (as a civic resource), by participating in the creation of shade structures in the short-term, and acting as stewards of shade infrastructure in the long-term. Together, this triad of concepts comprise a wide range of theories, strategies, and precedents that have informed this framework, and will continue to influence the design approach and proposals.

03

# METHODS

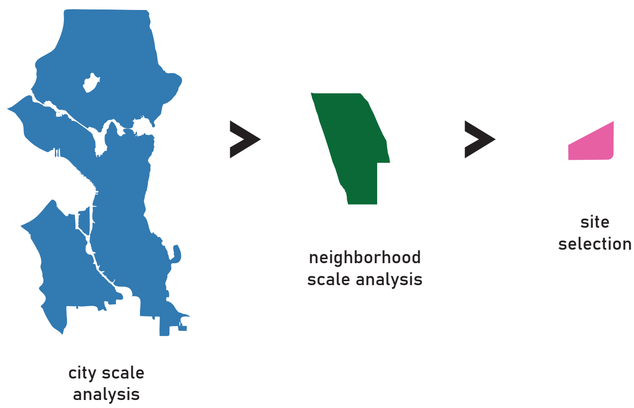
*“The provision of shade, either natural or constructed, should be an essential element when planning for and developing new city facilities such as parks or public spaces.”*

- Toronto Center for Cancer Prevention, 2010

# SCALING DOWN

## Determining Sites

To determine the sites in Seattle that are eligible for heat-related tactical urbanism interventions, I conducted a site suitability analysis using existing publicly available GIS data from Seattle OpenData, and King County GIS Open Data. This mapping research occurred at multiple scales: city, neighborhood, and site. I began at the city scale by mapping existing public facilities that provide cooling and heat relief – both in indoor and outdoor spaces – to understand where the most vulnerable populations are located in terms of urban heat islands, percentage of impervious paving, lack of urban tree canopy, and race and social equity. The results identified priority areas for shade interventions, which led to a study at neighborhood scale. There were a host of pertinent elements that were used for this intermediate scale analysis, including the current land use zoning detail from the Seattle Office of Planning and Development (OPCD), street classification from the Seattle Department of Transportation (SDOT), areas in the public right-of-way (ROW) also from SDOT, and property owner information from the King County Parcel Viewer. Through this intermediate neighborhood-level analysis, I found sites that met my criteria for tactical design interventions. The three sites I selected are within areas that are in what I have determined as priority areas for urgent heat relief and shade interventions. This chapter describes the site suitability assessment and analysis process from city scale, to neighborhood scale, and finally down to site scale.




## Locating Existing Cooling Facilities

Seattle's temperate climate has traditionally meant mild winters and moderate summers, with little cause for air-conditioned buildings. However, climate change is driving higher summer temperatures and more frequent heat waves, leading to a growing demand for air-conditioned buildings. Therefore, the first level of geospatial analysis included identifying existing public cooling facilities in Seattle and mapping their locations. The existing categories of cooling facilities I included were: public libraries with AC (5 out of 27 libraries do not have AC), community centers and "cooling centers" (designated public facilities with AC that provide relief during extreme heat events), spray parks, wading pools, swimming beaches, and swimming pools. I divided these categories into groups based on these variables: indoor air conditioning (Figure 3.1), park amenities (Figure 3.2), and open water (Figure 3.3), and created a map for each category to separate the data. The dots on all of the maps in this section illustrate a half-mile radius around where the existing facilities are located.

Figure 3.4 combines all of the data points from Figures 3.1 - 3.3. This includes all six layers that locate the existing cooling facilities throughout Seattle. From this map, it is clear that there is a plethora of air-conditioned buildings, spray parks, and public swimming areas, yet the distribution of these facilities is not equal. In addition to the heavy industrial areas of SoDo and Interbay, where there are significantly fewer residences, there are noticeable gaps in the distribution of cooling facilities in Georgetown, Columbia City, New Holly, and West Seattle areas of Seattle. While there may be less demand for cooling facilities in these neighborhoods, it is more likely that the limited public infrastructure results from their location in areas that have historically experienced disinvestment by the city. It is also important to note that there may be barriers to accessing these various cooling facilities based on urban design elements such as highways that require traveling by car or bus, and limit how a pedestrian or cyclist can travel from their home to a cooling facility. This initial investigation points to areas in Seattle that may have higher exposure to heat by virtue of having fewer cooling facilities.

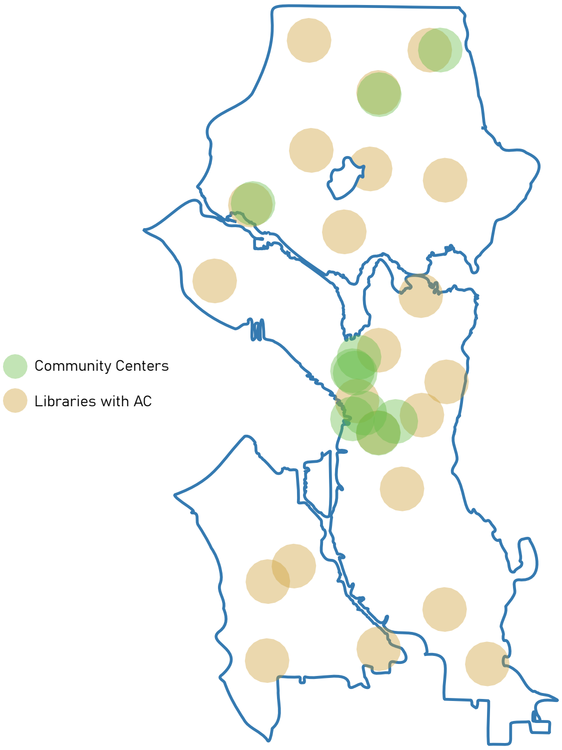



Figure 3.1: Map of Air Conditioning: Libraries and Community Centers. A critical mass of facilities are located near Downtown, with significant gaps in West Seattle, SoDo, Georgetown, and New Holly.

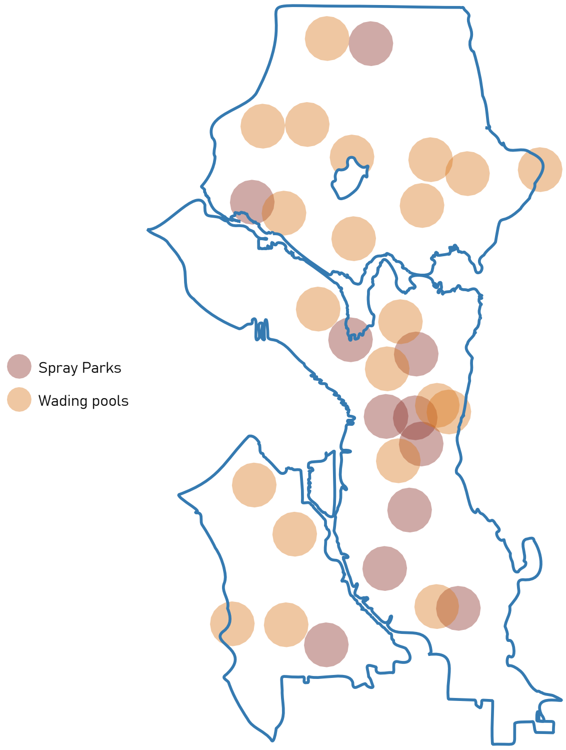



Figure 3.2: Map of Park Amenities: Spray Parks and Wading Pools. Fair dispersal throughout the city, with noticeable gaps in Lake City, Magnolia, Seward Park, SoDo, and Rainier Valley.

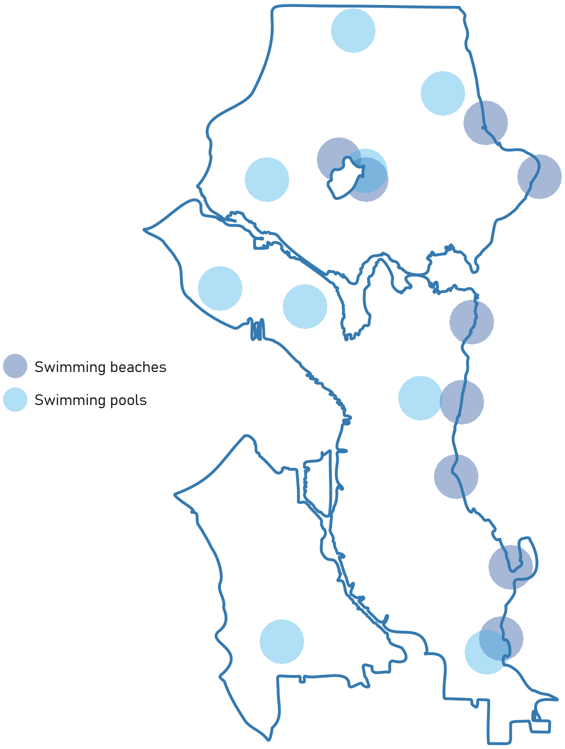



Figure 3.3: Map of Open Water: Swimming Pools, and Swimming Beaches. Neighborhoods in South Seattle that do not have easy access to public beaches are at a disadvantage.

Source: Seattle GeoData, maps by author

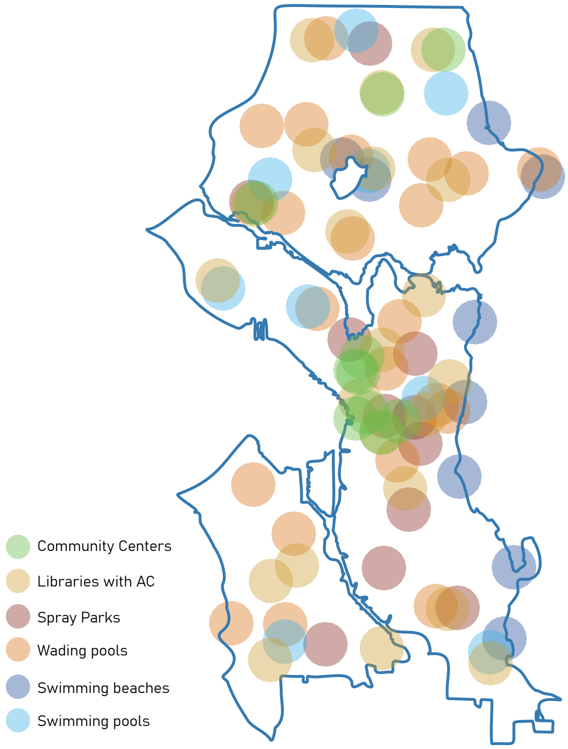



Figure 3.4: Composite Existing Cooling Facilities Map. Areas lacking access to public cooling facilities based on this map include: SoDo, Georgetown, Columbia City, New Holly, Interbay, and West Seattle.

# FINDING THE "HOT SPOTS"

Urban heat is a complex, layered issue that is informed by numerous urban conditions. It can be measured in many ways; for example, the City of Phoenix distinguishes between radiant, ambient, and surface temperatures. There are four layers of data that I have determined as key criteria to analyze at the city scale to contextualize neighborhood areas of highest concern for heat and therefore priorities for shade and cooling interventions. I begin by introducing how heat is measured, and then dive into the four criteria layers, which are: 1) Heat islands (King County GIS Open Data), 2) Race and Social Equity Index (Seattle OpenData), 3) Impervious surfaces (Seattle OpenData), 4) Tree canopy cover (Seattle OpenData).

## Measuring Urban Heat

To address heat mitigation and cooling strategies effectively, it is essential to understand how heat is measured within, and interacts with an urban environment. Heat is difficult to measure due to its transient quality throughout the day as it relates to the sun's path, especially in urban areas, heat can be absorbed, trapped, and radiated to different degrees by various materials. There are many ways in which heat can be measured, including radiant or ambient temperature (what we feel), air temperature, and surface temperature. For example, regarding radiant temperatures, a sidewalk in the direct sun may have a surface temperature of 130° F, and a person standing on the sidewalk may experience a radiant temperature of 145° F, and the air temperature is 110° F. However, if the same sidewalk were shaded from the direct sun, the surface temperature could be decreased to 110° F, the radiant temperature could be decreased to 115° F, and the air temperature could be decreased to 108° F (City of Phoenix 2024, 11). There are other conditions to consider, such as humidity, wind, and physical activity that have an effect on how the human body experiences temperature. Another way to measure heat is by "heat index," which combines air temperature with the relative humidity; high humidity makes it difficult for the human body to perspire or cool itself, causing the body to feel hotter (National Weather Service 2025). This thesis mainly discusses heat in terms of air temperature, unless otherwise specified. It is important to understand that there are multiple methods of measuring temperature.

# CITY SCALE ANALYSIS

## Heat Islands

The temperature maps (Figure 3.5) show which areas heat up faster than others and where heat lingers and is trapped throughout King County during extreme heat events. Areas where heat is concentrated and does not dissipate quickly are called "heat islands" (Gibbons and Lindquist 2024). These areas, especially where people are living and working, should be priorities for heat mitigation design. The temperature layers are the product of a model based on a community heat mapping campaign. The data were collected by volunteers on July 27, 2020, to better understand where the heat islands are in the county (ArcGIS Experience 2025). The temperature modeling data were separated by the researchers into three distinct times of day: Morning, Afternoon, and Evening (Figure 3.5). Note that the color keys have different temperatures for the same color blocks; the darkest red (highest temperature) in the Morning is 69° F, whereas the same red is 96° F in the Afternoon and Evening. Although the Morning map displays the most red, it shows lower temperatures overall. However, the Morning data is the most significant for heat islands because the data indicates places that retain heat and are unable to cool sufficiently over night.

As the sun and relative heat fluctuates throughout the day, different areas arise as the main "hot spots," making the analysis of which spots should be prioritized a challenge. To determine which areas are consistently the warmest, I first extracted the shapes of the highest recorded temperature during the Morning, Afternoon, and Evening into three separate maps (Figure 3.6). I then made each of the shapes partially transparent and overlaid them onto one map to see where the overlaps of highest temperature lie (Figure 3.7). The overlaid map illustrates the locations that frequently experience the highest temperatures, which created the first layer for areas in Seattle that should be a priority for this research proposal. It is important to note that the data is derived from a temperature model, and since heat is challenging to measure, the temperature ranges and boundaries should be interpreted with some flexibility.

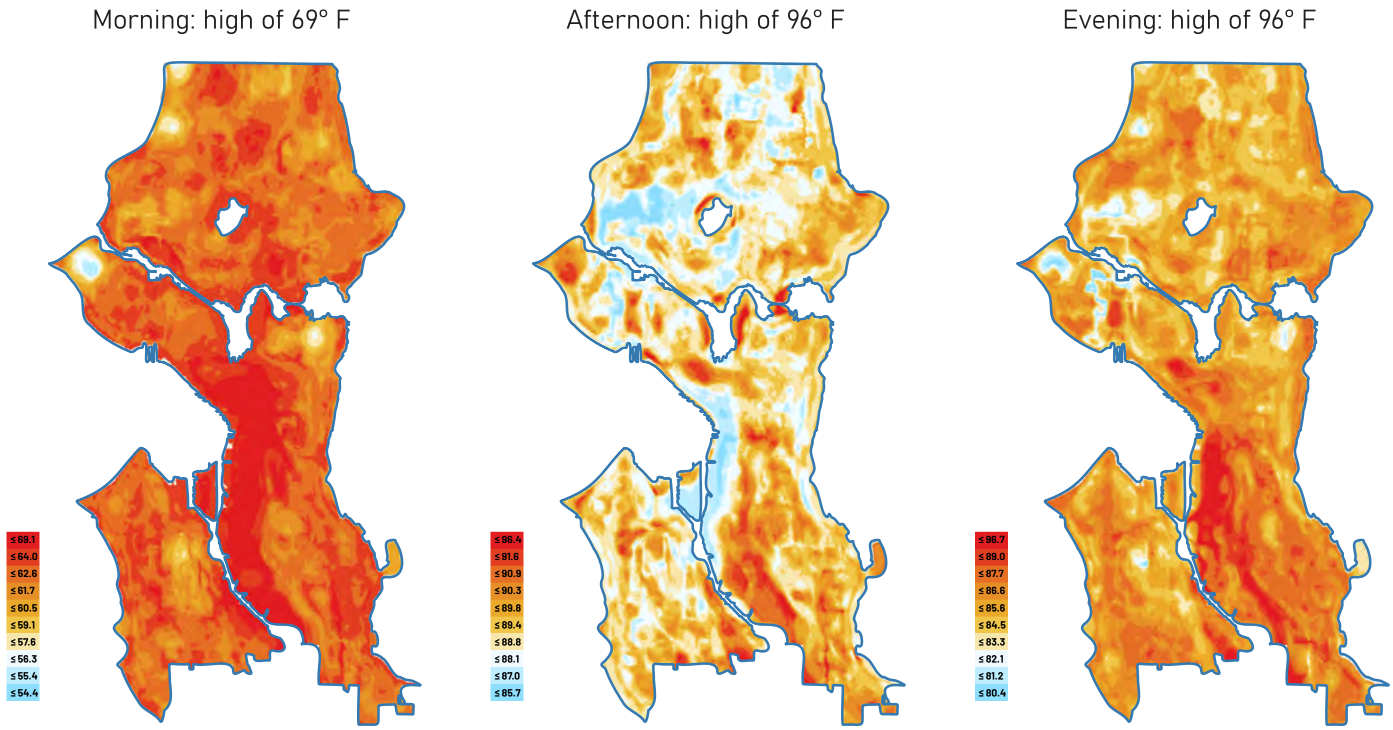



Figure 3.5: Heat Maps of Seattle, extracted and cropped from a heat mapping study of King County, with ambient temperature data collected by volunteers on July 27, 2020
Source: CAPA Strategies LLC 2020, Heat Watch Report for Seattle and King County

Figure 3.6: Highest Temperature Areas for Morning, Afternoon, Evening; adapted from CAPA Heat Mapping study for King County, July 27, 2020
Source: Adapted by author from original CAPA Heat Mapping study for King County on July 27, 2020

## Impervious Surfaces

Impervious surfaces include concrete, asphalt, and roofing materials that water cannot permeate. On these surfaces, heat is absorbed, retained, and radiated. An example of this is an asphalt parking lot; asphalt is excellent at absorbing heat and has no way to be cooled, due to the dark color and impermeability of the material. Exhaust from cars idling and moving in and out of the parking lot adds to the intense heat being absorbed from the sun. In contrast, pervious surfaces, such as mulch, aggregate, or soil, not only allow water to permeate through, they also do not retain, reflect, or radiate heat in the same way as impervious materials. The City of Seattle's map of impervious surfaces illustrates areas that are heavily paved and will likely retain the most heat throughout the day (Figure 3.8). The map provides the percentage of impervious surfaces of paved or impervious surfaces per total block surface area, which range from 0-28% at the least to 78-100% impervious surfaces.

The existing impervious surfaces map from the City of Seattle is a rasterized image that illustrates impervious surfaces. To make this data more flexible and editable, I brought the raster into Adobe Illustrator and used the image trace command to expand the raster image into editable shapes, and change the colors as seen in Figure 3.8. Urban heat islands often correspond to areas with excess impervious surfaces. Therefore, I extracted the categories with the highest percentage of impervious surfaces, 55-78% and 78-100% impervious surfaces as identified in Figure 3.8, and overlaid them with the Combined Highest Temperatures map as identified in Figure 3.7, to create Figure 3.9 which overlays these two mapped components. Notably, there is a strong correlation between the highest temperatures map layer and the highest impervious surfaces map layer, centered mainly around the industrial corridor, as well as other areas where there are significant concentrations of buildings, infrastructure, and impervious surfaces which retain heat.

Figure 3.7: Map of combined Highest Temperature Areas for the Morning, Afternoon, and Evening
Image created by author

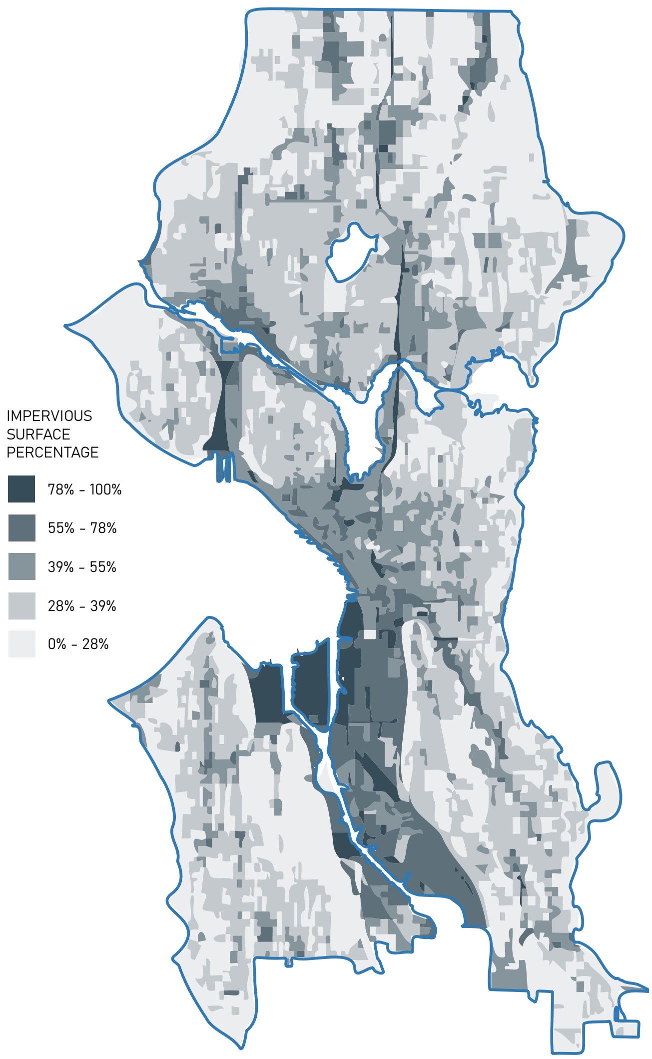



Figure 3.8: Map of percentage of impervious surface coverage
Source: Adapted by author from Seattle GeoData

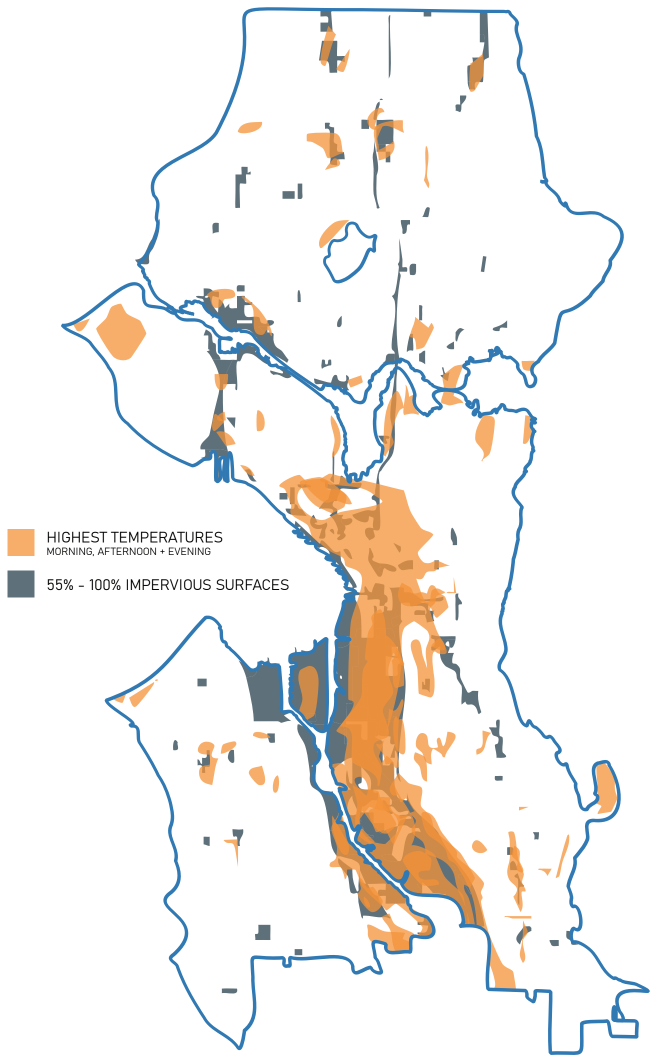



Figure 3.9: Map showing Impervious Surface coverage of 55-78% and 78-100% with combined highest temperatures
Map created by author

## Tree Canopy

Trees are essential for urban heat regulation. Not only do trees with sizable leaf canopies provide shade which cools surface temperatures, trees also reduce air temperature through evapotranspiration (Keith and Meerow 2022). Mature trees with canopies of 25 feet or greater in diameter are the most effective at mitigating the urban heat island effect (King County 2024). Rather than retaining and radiating heat like most fabricated materials, trees absorb heat and cool the air around them. Beyond cooling effects, trees provide numerous other benefits to urban areas, including improving air quality, helping to manage stormwater, reducing energy consumption, and enhancing mental and social well-being (Keith and Meerow 2022). The distribution of tree canopy in Seattle, similar to most U.S. cities, is lacking in neighborhoods that have a legacy of redlining and exclusionary zoning which Seattle now considers environmental justice priority areas. Increasing shade in environmental justice priority areas is one of the City of Seattle's goals for the city's canopy cover in the right-of-way (City of Seattle 2024). However, canopy cover gains and losses in the right-of-way fluctuate and do not occur equitably between all neighborhoods and street right-of-ways (City of Seattle 2021).

More generally, tree canopy in the public right-of-way is a critical piece of urban infrastructure and should be considered a basic component in design, rather than an amenity. Using data collected by the U.S. Census block group, tree canopy in the right-of-way is illustrated in Figure 3.10. I adapted the map from the City of Seattle's GIS data, which includes five percentage groups of tree canopy cover. I reduced the categories down to three groups: combining the two lowest percentages and the two highest percentages to simplify the visualization and to include more census block groups with less tree canopy cover into the next level of analysis. The tree canopy cover percentages resulted in the following categories, from lightest to darkest green: 5-24%, 24-31%, 31-64%, as seen in Figure 3.10.

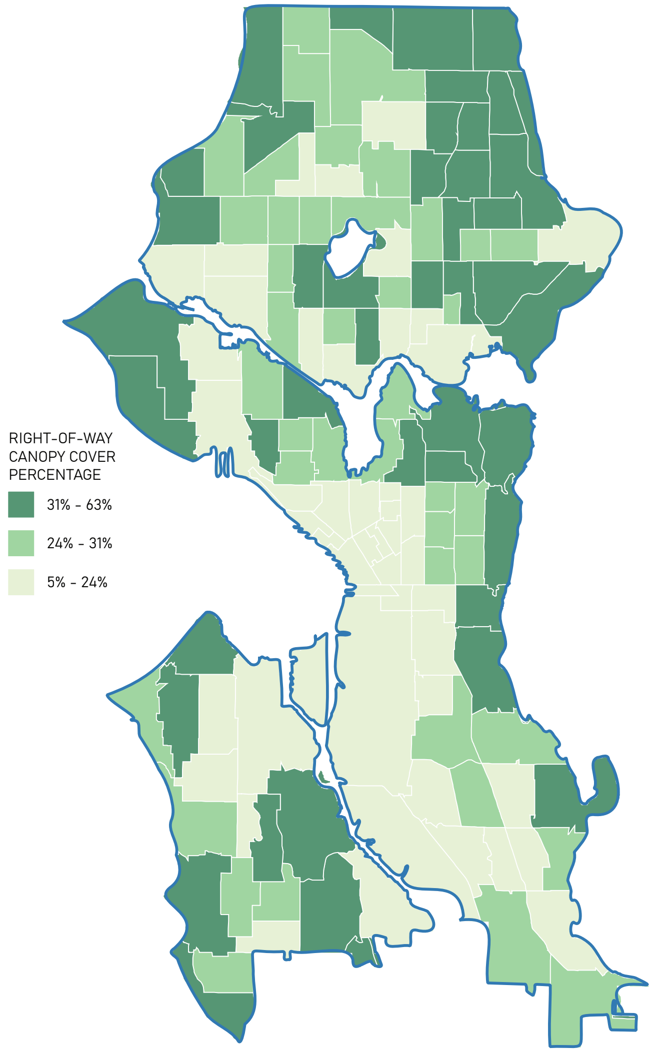



Figure 3.10: Map of Tree Canopy coverage in the right-of-way by U.S. Census block group
Source: Adapted by author from Seattle GeoData

## Race and Social Equity Index

To determine areas of demographic and social inequity, I use the Race and Social Equity (RSE) Index which is an existing map created by Seattle's Office of Planning and Community Development (OPCD). The RSE index includes information on race, ethnicity, and demographics such as data on socioeconomic and health disadvantages. This index was created to "identify where priority populations make up relatively large proportions of neighborhood residents" (Seattle Office of Planning and Community Development 2023). This index provides general trends across the city, illustrating the lowest to highest priority areas. As such, this Index is a tool for planning and investment prioritization that can be used by the city, developers and others. The City's original index map includes five

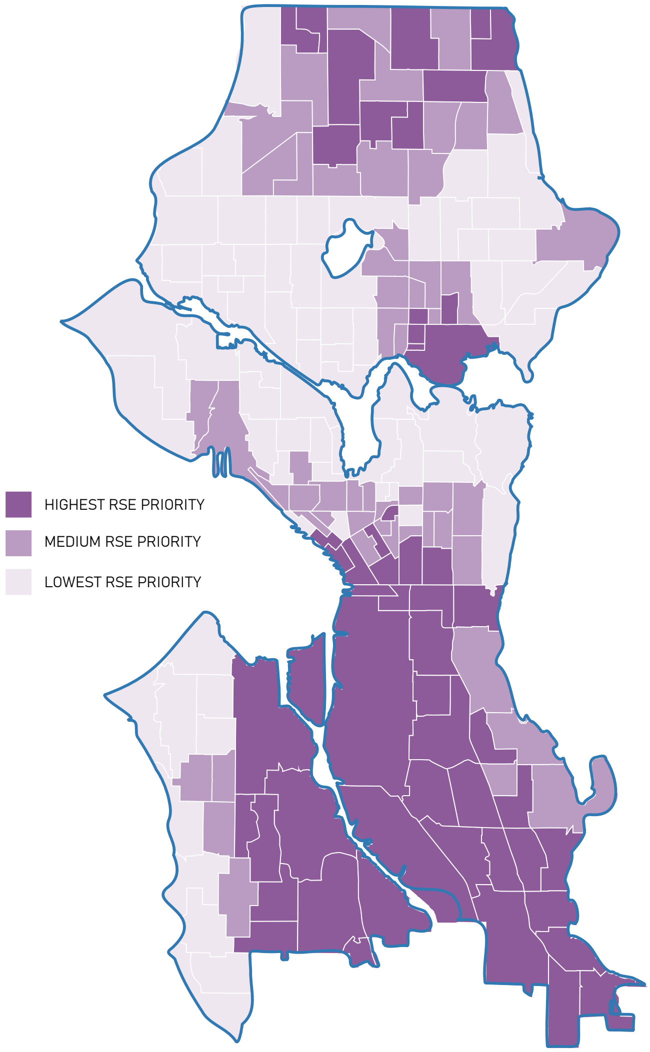



Figure 3.11: Map of Race and Social Equity Index, with darker purple indicating higher need/priority
Source: Adapted by author from Seattle GeoData.

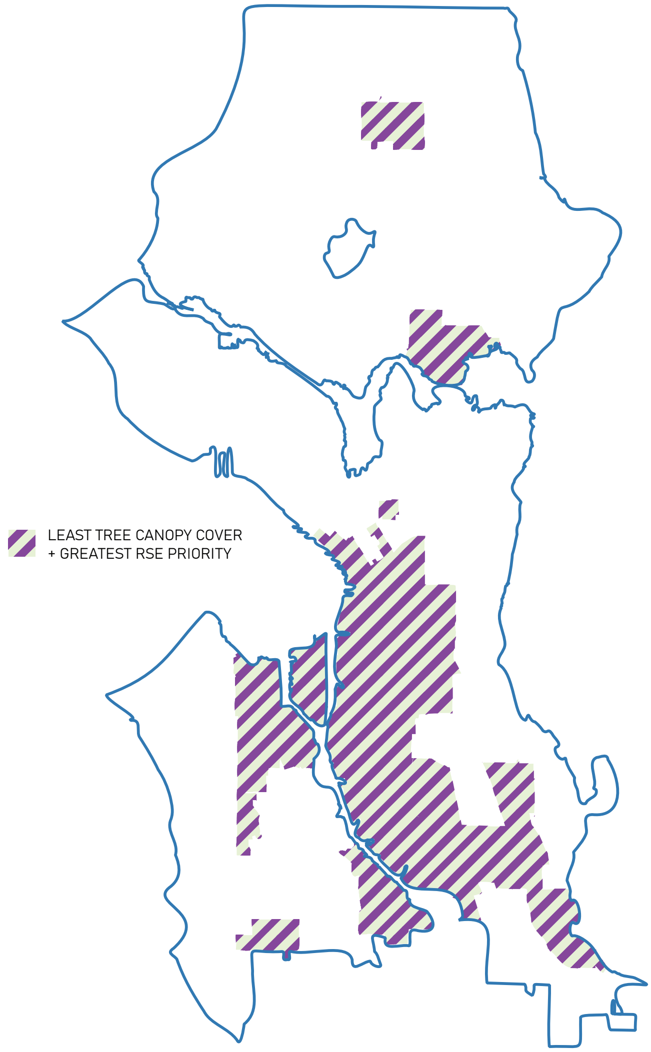



Figure 3.12: Map showing the intersection of highest RSE need and lowest tree canopy cover, revealing areas of highest priority for intervention for shade based on lack of canopy in the right-of-way. Map created by author

priority areas, but I adapted this map to only have three categories (see Figure 3.11) to match the tree canopy cover map. To do this, I combined the two categories of greatest need (dark purple) and the two categories of least need (light purple).

As discussed in the literature review, environmental, social, and health inequities in urban areas are related to tree canopy cover. Therefore, it made sense to combine the tree canopy cover data, using the lowest percentage of tree canopy cover, with the RSE map using the highest priority areas. The intersection outlines the areas in Seattle that are both deficient in tree canopy coverage and are in the greatest need of investment in public infrastructure such as more trees in the right-of-way (Figure 3.12). The spatial patterns revealed in this map are notably similar to the heat and impervious surface map overlay. They show that areas in south Seattle are in greater need of shade infrastructure, indicating that tactical shade interventions should begin in south Seattle to instigate more equitable distribution of shade across the city.

## Composite Heat Vulnerability Index

The last map used to determine areas of greatest heat vulnerability, Figure 3.13, combines to illustrate the overlaps of heat islands, impervious surfaces, tree canopy cover, and the RSE Index. This “Composite Heat Vulnerability” map outlines the zones throughout the city that experience the greatest impacts of extreme urban heat, indicating priority areas for shade interventions. Areas like SoDo, Georgetown, Harbor Island - with high industrial activity, the most impervious surfaces, least trees, and greatest presence of carbon exhaust from automobiles, semi-trucks, and other large industrial machinery – have the most significant concentration of the evaluation criteria. When examined more closely, there are several areas in more residential zones that have a significant overlap of the four criteria that warrant greater investigation. These areas included the following residential neighborhoods: New Holly, South Park, Beacon Hill, Chinatown International District (CID), University District, and Northgate. All of these zones have some overlap of all four key criteria – some to a higher degree – that appear to center around particularly developed areas with a plethora of parking lots or a portion of a highway or major transit route like Martin Luther King Jr Way. Any of these six zones would be excellent case studies for a tactical urbanism shade strategy, yet it was necessary to limit the number of case studies to three sites given the thesis timeline. This process of elimination was informed by the results of the Composite Heat Vulnerability map, and neighborhood scale analysis, which is detailed in the next section.

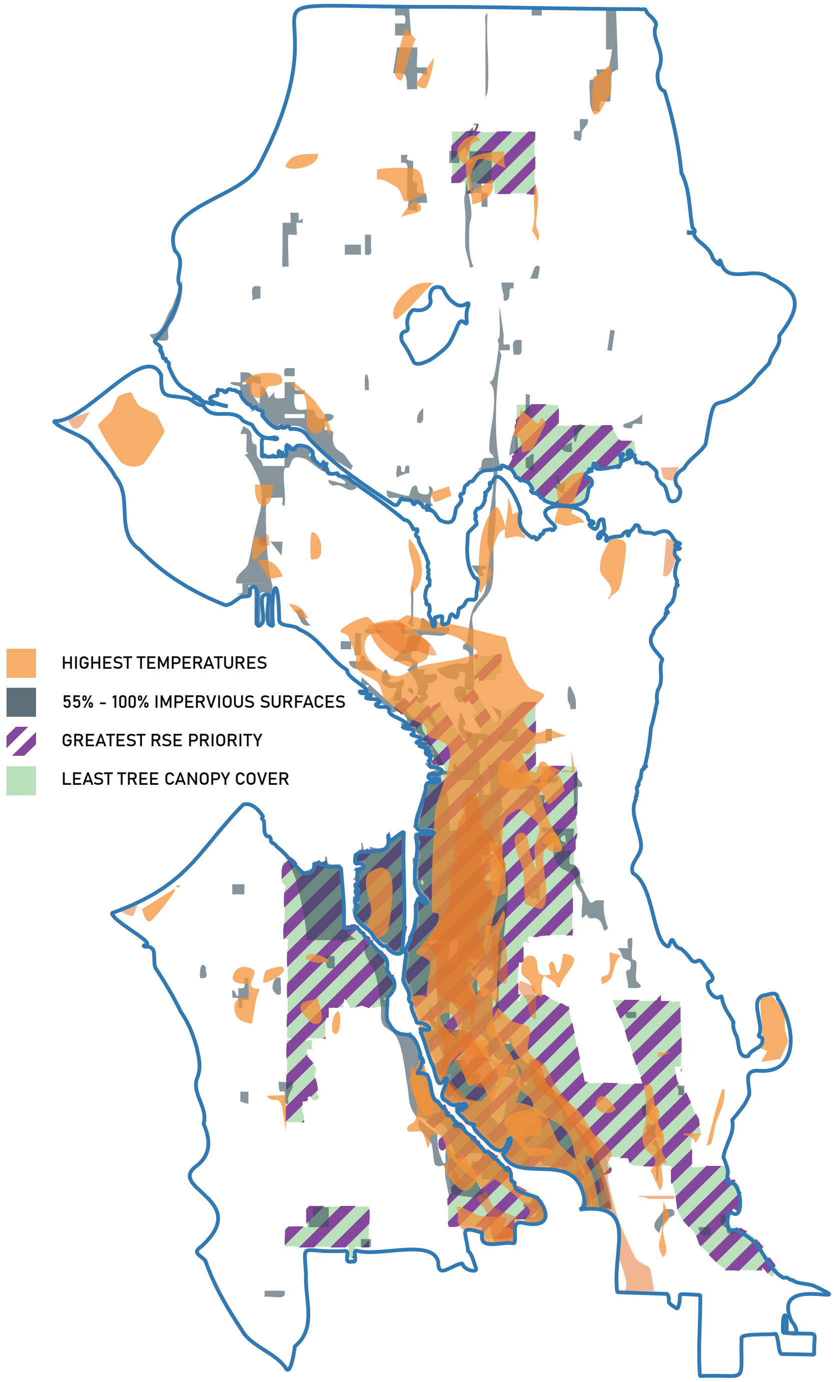



Figure 3.13: Composite Heat Vulnerability Map, showing priority areas for heat and shade interventions
Map created by author

# NEIGHBORHOOD SCALE ANALYSIS

Informed by the Composite Heat Vulnerability Map (Figure 3.13), and the Composite Existing Cooling Facilities Map (Figure 3.4), I studied the overlapping areas in New Holly, South Park, Beacon Hill, Chinatown International District (CID), University District, and Northgate at the neighborhood scale. Before zooming in to the neighborhood scale analysis with GIS software, I chose to eliminate several of the areas. I eliminated Northgate due to the fact that it is currently under major redevelopment and may look very different when that is completed. I eliminated the University District and Beacon Hill because they were not as high of RSE priorities. Lastly, I eliminated the CID because it had sufficient overlap and access to public cooling facilities. This left South Park, Georgetown, New Holly, and SoDo, all four of which I zoomed into for neighborhood scale analysis.

As depicted in the following neighborhood scale maps, this level of analysis included layers from the City of Seattle's ArcGIS Online data, including right-of-way, public parking lots and garages, zoning details, Healthy Streets, P-Patch gardens, People Streets and Public Space Investment areas (Seattle ArcGIS Online). These criteria, such right-of-way, parking lots, and zoning, were chosen because they identify characteristics of the area in more detail. Other criteria highlight certain existing areas that prioritize people and micro-mobility like Healthy Streets, include community-supported or maintained spaces such as P-Patches, or articulate plans for increased public and social spaces, like People Streets and Public Space Investment areas.

These criteria were used to further narrow potential sites for shade interventions, as they indicate where existing community energy and support for activating and maintaining public spaces could strengthen the impact of the design proposals. This does not suggest that areas lacking an adjacent P-Patch, for example, would be unfit for this work. However, given the experimental and at times unsanctioned nature of these interventions, it is important to locate them where they are more likely to be accepted, appreciated, and potentially stewarded into long-term interventions.

Due to the specific characteristics of each neighborhood, each of the neighborhood scale maps include a different group of the aforementioned additional layers. For example, some neighborhoods do not have a P-Patch garden or a Healthy Street designation so they are not included. The only layer retained from the City Scale Analysis was the heat islands, which are helpful to view in greater detail at this scale. To select the specific sites for design intervention within the neighborhood scope, I also used the King County Parcel Viewer, which provides detailed information on property ownership and other related records. With all of these components and data at play, this neighborhood scale analysis led to compelling site selections in Georgetown, New Holly, and SoDo (Figure 3.14). Therefore, I eliminated South Park at this stage. The three neighborhood analysis maps are introduced next, before moving into site-scale analysis.

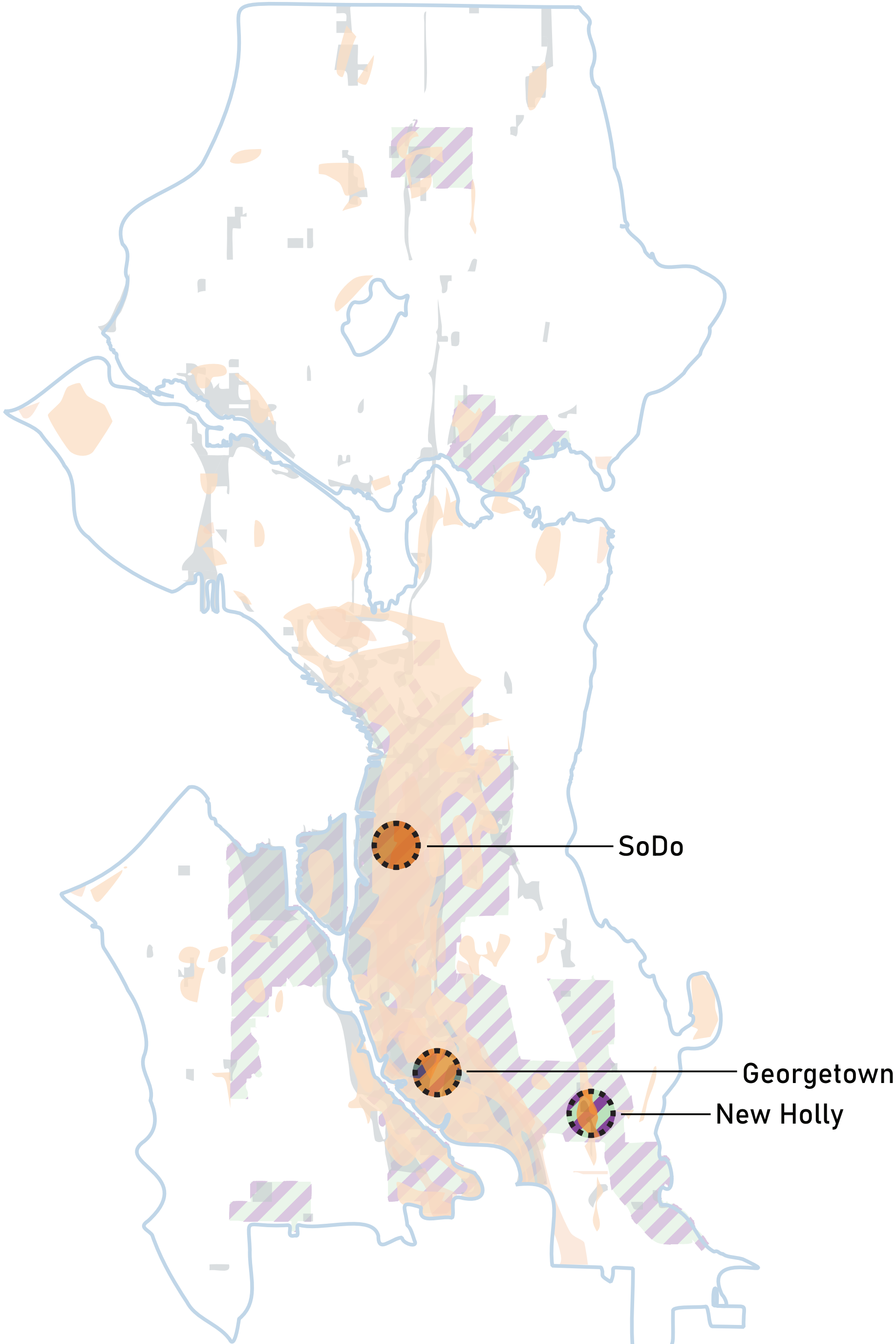


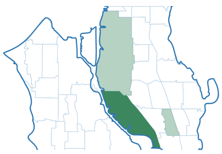

Figure 3.14: Composite Heat Vulnerability Map, highlighting the three neighborhood analysis areas.
Map created by author

# NEIGHBORHOOD SCALE ANALYSIS

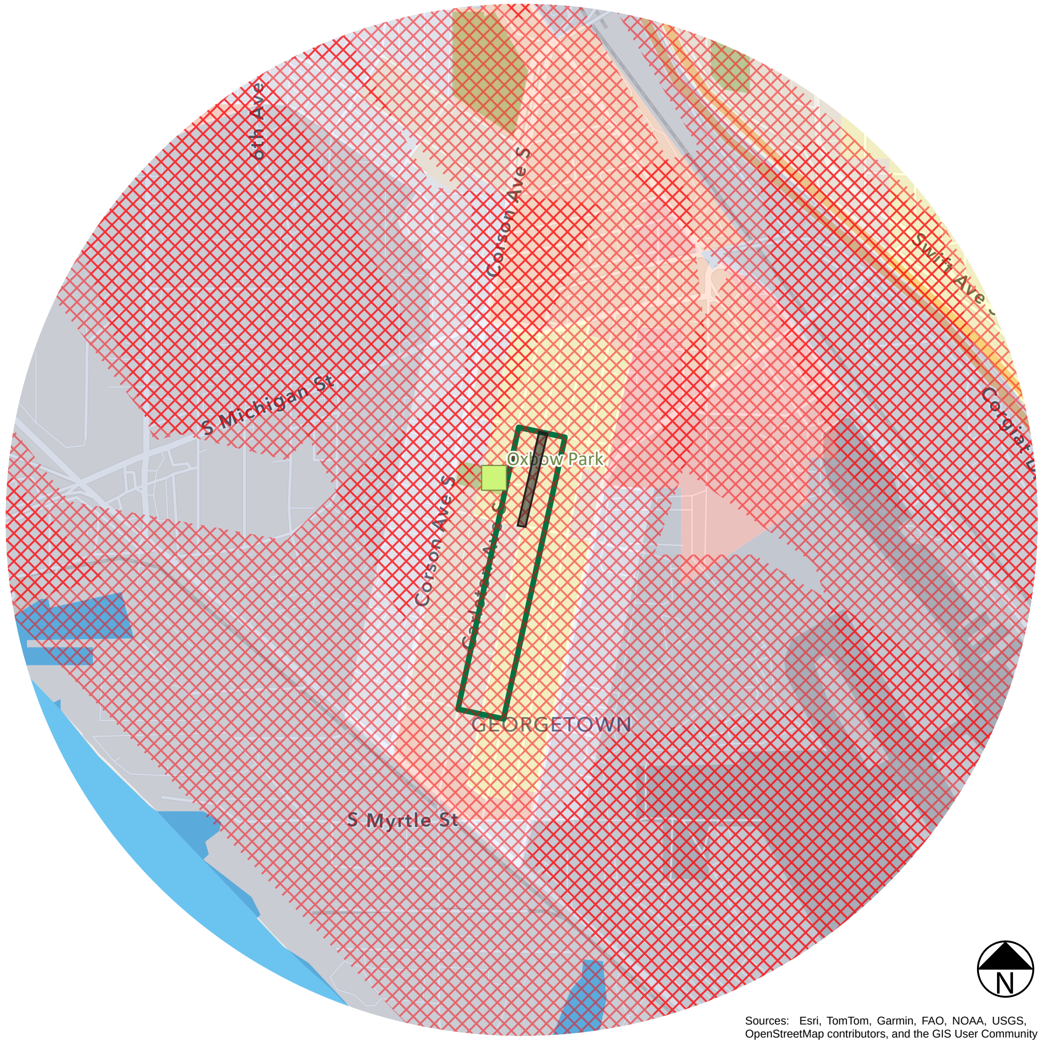
## Georgetown

The Georgetown neighborhood scale map (Figure 3.15) is unique because there are many overlapping heat islands, shown in crosshatched red lines, meaning that Georgetown is especially vulnerable to extreme urban heat. In fact, Georgetown has one of the highest heat disparities in the city, so locating shade structures almost anywhere in the neighborhood is in theory beneficial. Since most of Georgetown is zoned industrial and I was already considering the more accessible industrial area of SoDo, I chose not to explore Georgetown's industrial zones during my first site visit. Instead, I walked around the "Seattle Mixed" commercial and residential zone (in orange) and the "Residential Small Lot" zone (in yellow). I was most intrigued by the residential area because I discovered that there are already community-centered and -maintained spaces, such as the iconic Hat & Boots neighborhood park, and the Oxbow community P-Patch garden, as well as street signs designating "Healthy Streets."

Although it may seem counterintuitive from an equity standpoint to select a site that already has community support and public amenities, in this case, these features are the exact reason why this is a prime location for temporary tactics. Tactical urbanism projects, especially the kind that I am proposing, require a careful balance between visibility and durability: they must be placed in publicly active spaces to encourage interaction, yet also situated where nearby residents or businesses can help steward them over time. I believe that the intersection of activity with the park, and the P-Patch, and the recognized prioritization of people-centered spaces makes the case that this is an appropriate site.
There is good visibility with the people already using the space, and the potential for solid durability and community involvement because of the existing community networks and programs. In the design process, I pondered, how can a temporary installation for shade complement what is existing, and potentially add educational value or heat relief to the area?



Georgetown in context
to the other sites




## MAP KEY

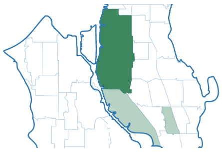
- HEAT ISLANDS
- P-PATCH GARDENS
- HEALTHY STREETS
- SEATTLE MIXED
- RESIDENTIAL SMALL LOT
- COMMERCIAL
- INDUSTRIAL
- SELECTED SITE

Figure 3.15: Georgetown Analysis, Neighborhood Scale with context key map
Source: Arc GIS Online, map created by author

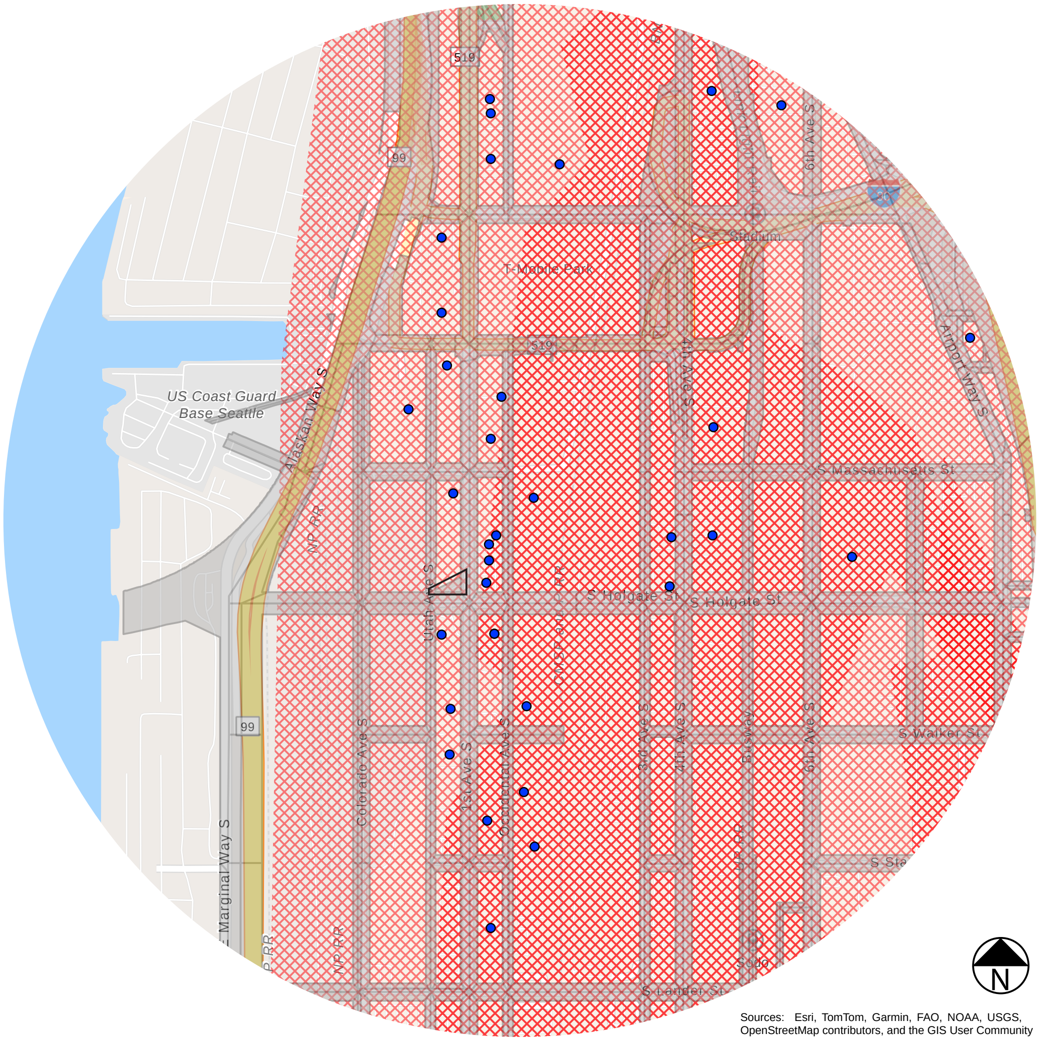
# NEIGHBORHOOD SCALE ANALYSIS

## SoDo

The SoDo neighborhood analysis shows another area dominated by heat islands, within a heavy industrial zone with many paved surfaces. Each of the dark blue dots is a public parking lot, yet there are many more private parking lots within this focus area as well which are not mapped with this data layer (Figure 3.16). This zone is further defined by wide right-of-way travel lanes where semi-trucks, shipping containers, and other large industrial equipment is transported. The whole area is zoned for industrial use, negating the need to include a zoning layer on this map. Although people do not live in this area, many people work here; in warehouses, factories, commercial offices and storefronts, stadium facilities, amongst others. The plethora of parking lots shows the demand for short-term parking in an area where people work and visit for entertainment (such as T-Mobile Park, and the ShowBox). One of the parking areas came to my attention here, because it is completely within the public right-of-way (see the "selected site" Figure 3.16). This led to the question that drove the design exploration: how can parking lots, especially those within the ROW, serve people instead of cars during days of high heat?



SoDo in context to the other sites




## MAP KEY

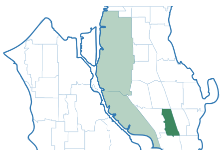
- HEAT ISLANDS
- PUBLIC PARKING
- PUBLIC RIGHT-OF-WAY
- SELECTED SITE

Figure 3.16: SoDo Analysis, Neighborhood Scale with context key map
Source: ArcGIS Online, map created by author

# NEIGHBORHOOD SCALE ANALYSIS

## New Holly

The New Holly neighborhood map displays the least prevalent heat islands, yet they are clearly concentrated around this portion of Martin Luther King Jr Way, which looks in some areas like a strip mall with many expansive parking lots. However, this area has been identified by SDOT as a “People Street and Public Space Investment” area, as shown by the pale pink circle in Figure 3.17. Both sides of MLK Jr Way are dominated by housing, with zoning for small lot residential and low rise multifamily. There is a Healthy Street that runs parallel to Othello Park, and three community P-Patch gardens included in the scope of this map. Within this area of intense combination of transit, commercial, and residential, there was a clear site that appeared to be calling out for a temporary design intervention. The site is a large vacant lot, currently owned by the Seattle Housing Authority (SHA), at the intersection of S Othello St and MLK Jr Way. When designing for this site, I wondered, is there a way for this temporarily vacant lot to provide shade for people passing through this busy area?



New Holly in context to
the other sites

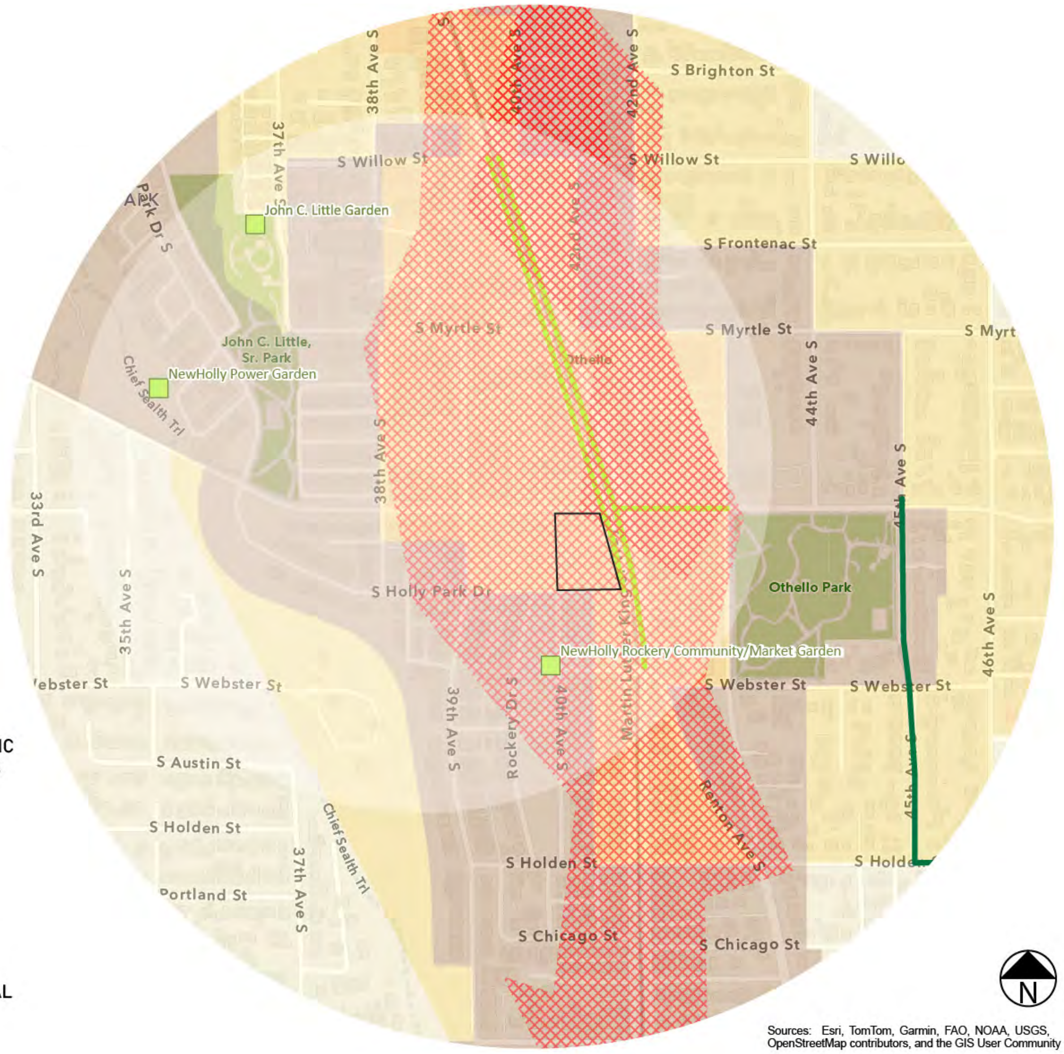



Figure 3.17: New Holly Analysis, Neighborhood Scale with context key map
Source: ArcGIS Online, map created by author

# SITE SCALE ANALYSIS

To introduce the three selected sites, I have organized them in a Site Descriptions chart (see Figure 3.18), which lists the zoning, owner, and type of site. The site types, or typologies, include a neighborhood street right-of-way, five adjacent parking spaces, and a vacant lot. The typology is important because it could help generalize what tactical design strategies are possible at each type of site, therefore informing any future tactical shade intervention work by community organizers, design advocates, or government officials. Paired with the typology, the site owners and zoning detail are useful information to be aware of when acting in a tactical, and possibly unsanctioned manner. This site chart is a useful guide for the following site scale analysis section, as well as the design and Analysis chapters to compare and contrast the different site typologies and how tactical urbanism approaches vary across the sites. The sites are located within their neighborhoods in south Seattle in Figure 3.19.

| | SITE 1 GEORGETOWN | SITE 2 SODO | SITE 3 NEW HOLLY |
|---|---|---|---|
| ZONING | neighborhood residential | mixed industrial commercial | mixed residential commercial |
| TYPE | street right of way + park entry | 5 adjacent parking spaces | vacant lot |
| OWNER | city of seattle + public right of way | public right of way + private property | Seattle Housing Authority + public right of way |

Figure 3.18: Site descriptions chart
Source: Google Street view, graphic created by author


Figure 3.19: Context map locating the three sites within their neighborhoods in Seattle
Graphic created by author

# SITE 1: CARLETON AVE S, GEORGETOWN

## Existing Conditions

This site is located within the main residential area of Georgetown, bordered to the east and west by industrial zoned land. I decided to focus in on the block of Carleton Ave between S Eddy St to the north and S Warsaw St to the south, where Carleton borders the east side of Georgetown's iconic Hat & Boots Park (also known as Oxbow Park) (Figure 3.20).

This side of the park is where the Oxbow P-Patch (community garden) is located, which could be a key partner in for the temporary design proposal. The Office of Emergency Management (OEM) recognizes P-Patches as community hubs, where people can gather during an emergency to share information and resources. During my site visits, I noted that the P-Patch appeared to be lively and active, but never saw people tending to it. On the first site visit I conducted, I observed that this block of Carleton Ave does not have any trees within the right-of-way. There are a significant number of trees on private property, and within the park, but the lack of trees and therefore shade on the street was notable. It was shocking, therefore, to walk Flora Ave S, one block to the east, to discover that there were 27 trees in the right-of-way. Both Carleton and Flora Ave have the same right-of-way distance of 60', and the same street classification type, therefore, it is curious that one would have a significant number of trees while the other has none in the right-of-way.

## Site Analysis

SDOT has designated both Carleton Ave and Flora Ave (to the immediate east of Carleton) as "Neighborhood Yield Streets." A Neighborhood Yield Street, as shown in Figure 3.17, includes 6' pedestrian zones (sidewalks), 6-8' landscape or green stormwater infrastructure (GSI) strips, 7' flex zones (parking in this case), and an 11' travel lane (City of Seattle, Streets Illustrated). While Flora Ave has approximately these divisions of use, Carleton Ave has only 6' sidewalks and 2' wide buffers between sidewalk and street, which does not appear to be formally planted or maintained. Therefore, with an extremely wide travel lane of approximately 30', vehicles are unhindered to drive fast without any indications to yield, as the street classification states.

There are, however, several signs that the City is working to reduce vehicular speeds, on and around Carleton Ave S. Both Carleton and Warsaw Ave are marked with signs and bollards for "Healthy Streets," limiting vehicle traffic to local access only (Figure 3.21). There are also painted traffic bulbs at some intersections, delineating a narrower street for vehicles (Figure 3.21). Lastly, on a later site visit, I observed that several speed bumps had been added within this block of Carleton and Flora Ave (Figure 3.21). These elements are clear signs that driving speed should be slowed down on Carleton Ave. One block to the west of the site is Corson Ave S, designated as an "Industrial Access" and minor arterial street, the street is designed for traffic to move more quickly, and it is used by a bus route (Seattle Department of Transportation n.d). Currently, the travel lane (for the portion of Carleton Ave that I am investigating) is wider than the travel lane on Corson Ave, which allows vehicles to travel faster than they should on the Neighborhood Yield Street. The elements such as the speed bumps, painted curb bulbs, and healthy street bollards do not appear to be as effective at slowing traffic as the neighborhood traffic circles, which create physical barriers that cars have to slow down to maneuver around.

While I was on site, I noted that there appeared to be a newly poured concrete platform with picnic tables adjacent to Carleton Ave. I used Google Street view to explore what the site looked like in previous years. I found that there used to be three mature honey locust trees planted, movable picnic tables, and crushed aggregate in the area that is now concrete with no shade. The change appears to have occurred between 2019 and 2023, when there are Google Street view images of the area. The three honey locust trees used to provide valuable shade and evaporative cooling to this section of the park. Now, the new seating area does not have any shade elements, and the tables are not able to be moved to the shade. Furthermore, the concrete is likely absorbing heat to a higher degree than the aggregate did.


Figure 3.20: Site 1: Carleton Ave Existing Conditions
Source: Google Earth, image by author


Figure 3.21: Site 1: Carleton Ave Site Analysis
Source: Images by author and Google Street view

# SITE 2: PARKING LOT 1000, SODO

## Existing Conditions

One of many in SoDo, this parking lot site was chosen because it is completely within the right-of-way. This means that the city or any interested citizen could theoretically activate the space through tactical means without any private property owner being contacted to negotiate a temporary use of their parking lot. In relation to the other corners of this intersection between 1st Ave S and S Holgate St, this corner is the only one without trees (see Figure 3.22).

The business that shares the space with the parking lot is a real estate consultancy, across the street to the east is Paseo Sodo, a Caribbean restaurant, diagonally across the intersection is a Krispy Kreme, and across the street to the south is a car accessories store. There are also two bus stops, just north and south of the site. For the tactical urbanism design proposal at this site, I use only five adjacent parking spaces that face 1st Ave.

To the west of the parking lot is Utah Ave S, which mainly provides alley-like access to the rear of buildings between 1st and Utah Ave. To the west of Utah Ave is where shipping containers are processed, which is completely fenced off. This essentially creates a dead-end zone on Holgate St between 1st and Utah Ave. Large trucks or buses often park temporarily on either side of this part of Holgate St, but this use prompts the notion that there could be other temporary uses for this space.

## Site Analysis

The parking lot offers 2-hour free parking, matching the on-street parking as both are city-owned and operated, in the public ROW. The lot has extremely faded parking lines, with a total of 30 parking spaces on three sides of the triangular shaped lot. Other physical items of note include a hawthorn shrub, complete with flowers and thorns at the southeast corner of the lot, and a double curb line bordering the 1st Ave sidewalk (see Figure 3.23). This double curb appears to denote a double-stop, dividing where parked cars meet the sidewalk. This creates about 2.5’ of paved void space, where cracks in the asphalt allow hearty plants to thrive (see Figure 3.23).

As previously established, impervious surfaces such as asphalt paving retains and radiates heat, and is one of the greatest contributors to urban heat islands. SoDo has the highest impervious surface coverage and the lowest tree canopy percentage of any neighborhood. Because the area is dominated by industrial use (with very few residential buildings), the Office of Planning and Community Development (OPCD) ranks SoDo as low priority for future parks and public space investment (Office of Planning and Community Development 2023). This is likely due to the challenges of protecting industrial zoning, which is very difficult to establish within a developed city. However, the northern portion of SoDo is outlined as “highest priority” for future park development, based on a 10 minute walking radius from the nearest neighborhood. The division between “highest priority” and “medium priority” is located at Holgate St, so this chosen site falls just within what the city considers high priority for park space, making this site a compelling space for tactical interventions.

Adding to the argument that SoDo is a viable place for parks and green infrastructure, the SoDo Business Improvement Area (BIA), in collaboration with the landscape architecture firm MxM, published the first Green Space Plan for SoDo in 2024 (SoDo BIA and MxM Landscape Architecture 2024). The vision of the plan simply states that “green infrastructure can be integrated into industrial spaces without disrupting freight and business operations” (7), and the community engagement proved that the workers, business owners, property owners, and people that eat/play/shop in SoDo want more green spaces. With data collected through an online survey, the most popular green infrastructure request was rain gardens, with street trees and parks tied as a close second. Although industrial areas like SoDo are often overlooked as a priority for green infrastructure, they remain a clear priority for the SoDo community.

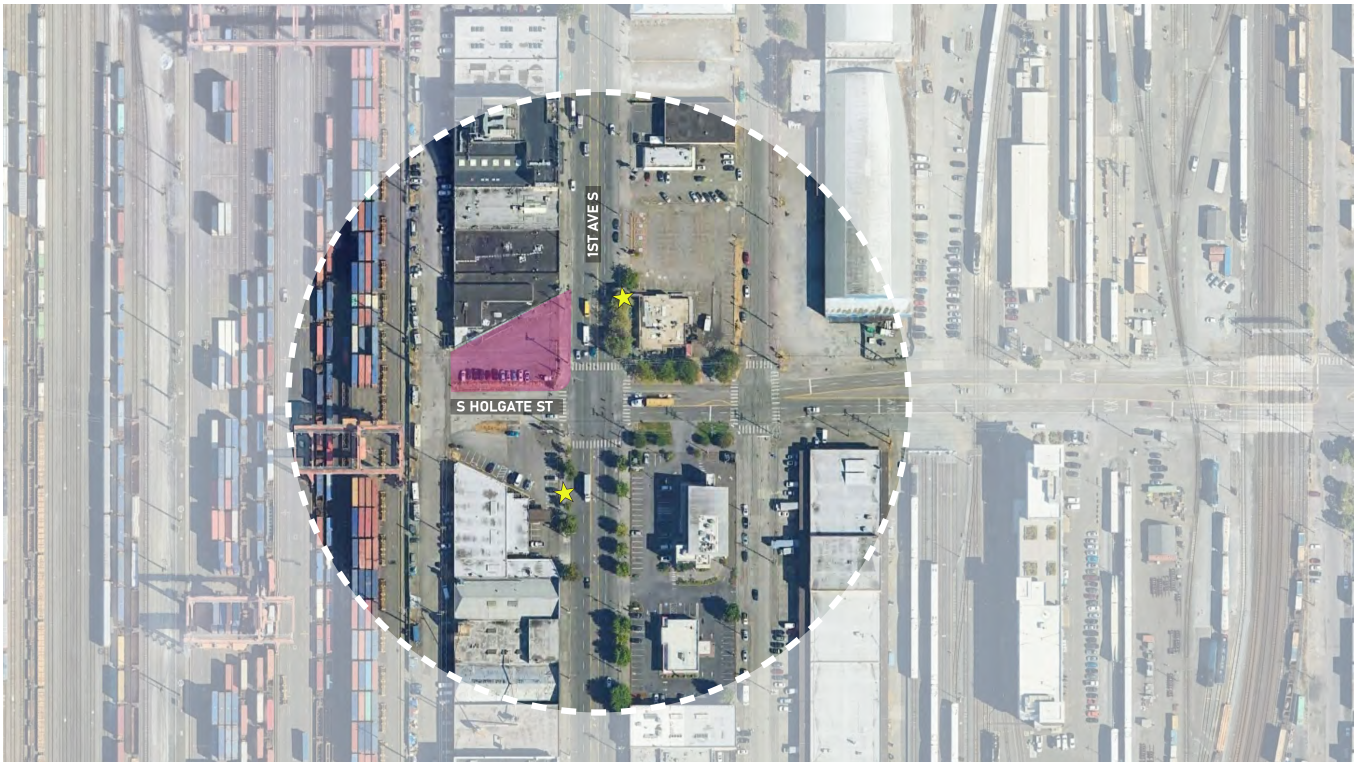



Figure 3.22: Site 2 Parking Lot 1000 Existing Conditions
Source: Google Earth, image by author


Figure 3.23: Site 2 Parking Lot 1000 Site Analysis
Source: Images by author and Google Street view

# SITE 3: OTHELLO SQUARE, NEW HOLLY

## Existing Conditions

This vacant lot site, which I am calling 'Othello Square,' is approximately 50,000 square feet, and is packed with action on all sides. It lies in the heart of a commercial/transit corridor, surrounded by residential buildings, where there are people constantly moving around and through the site. Over time, this has created noticeable desire-paths through the site that can be seen even in an aerial image (see Figure 3.24).

Although the site is vacant, there is no fence around the perimeter. The ground material is a mix of aggregate, grass, huckleberry, and other volunteer vegetation. Because there are no paved surfaces, the site provides a wealth of opportunities for tactical interventions. Sharing the block with the vacant lot is a new apartment building (built 2021), a doctor's office, and a kindergarten and elementary school. Directly to the south is part of the Holly Park housing redevelopment built in the early 2000s, which centers a park, the New Holly Community Gardens, and an outpost of the Black Star Food Collective. The Othello Link Station is just north of the main intersection, and there are three bus stops around the intersection, with one on the northeast corner of the site.

## Site Analysis

The site has been vacant since at least 2011, if not since 2004, which is a significant amount of time whether it is going on 14 or 21 years of inactivity. However, browsing the Google street view images (which date back to 2011), the site appears to have had some minor activity as it has shifted ownership and responded to changes around the site, such as fencing around the site or temporary shelters within the site. On the northeast corner, at the bus stop, there is a 26' wide curb bulb (Figure 3.25), which appears to have been constructed around 2007 when the line of street trees on MLK Jr Way were planted. Exposed to the elements at this high-traffic intersection, this extremely wide sidewalk offers ample space for tactical shade interventions that could serve multiple purposes.


Figure 3.24: Site 3 Othello Square Existing Conditions
Source: Google Earth, image by author


Figure 3.25: Site 3 Othello Square Site Analysis
Source: Images by author and Google Street view

# SUMMARY

This site suitability assessment began at the city scale, by understanding the existing cooling facilities and contextualizing the conditions that contribute to urban heat islands in Seattle. From these data, summarized in Figures 3.4: Composite Existing Cooling Facilities Map and 3.13: Composite Heat Vulnerability Map, I selected three neighborhood areas that were high priority for further investigation. I explored the neighborhood areas within Georgetown, SoDo, and New Holly, including land use zoning, right-of-way, P-Patch locations, and several sublayers from the City of Seattle's People Streets and Public Space Investments GIS layer. This intermediate level of analysis guided where I continued to search for the "hot spots" that became the selected sites for tactical interventions.

In addition to the GIS data, I used the King County Parcel Viewer website to investigate property ownership, Google Earth and Google Street view to browse the landscapes virtually, and conducted in person site visits to find, and confirm the three chosen sites. These resources and data collection methods informed each other, with online data informing what to look for during site visits, and site visits sparking new questions and guiding how to analyze and depict the site. All of these research methods and data points were critical to determining that these sites were appropriate for this project and merited tactical design proposals for addressing extreme urban heat.

American Forests, a nonprofit working to ensure tree canopy equity, has an online interactive map called "Tree Equity Score" which is a resource with nationwide data. The interactive tree canopy explorer allows users to see the tree equity score in their neighborhood by U.S. Census block group. Recently, the UCLA Luskin Center for Innovation collaborated with American Forests to create a new National Shade mapping tool that adds a whole new layer of not only tree shade but built shade (Burstein 2025). This tool was published on June 2, 2025, which was during the final week of this thesis project, and was too late to be incorporated into the methods analysis. However, it serves as a strong point of validation for my findings on heat exposure in Seattle. Figure 3.26 shows a screen capture of the Shade Explorer with the "Heat Disparity" filter applied to Seattle. The data shows that there are significant hot spots in Georgetown, SoDo, and New Holly, which corroborates my findings.

Although the tool was not used in the methodology for this thesis, it is a valuable resource for those interested in understanding shade and tree coverage at a city or neighborhood level. More broadly, it offers critical data for ongoing heat mitigation planning and research, especially for U.S. cities developing heat resilience strategies and identifying zones of extreme heat vulnerability.

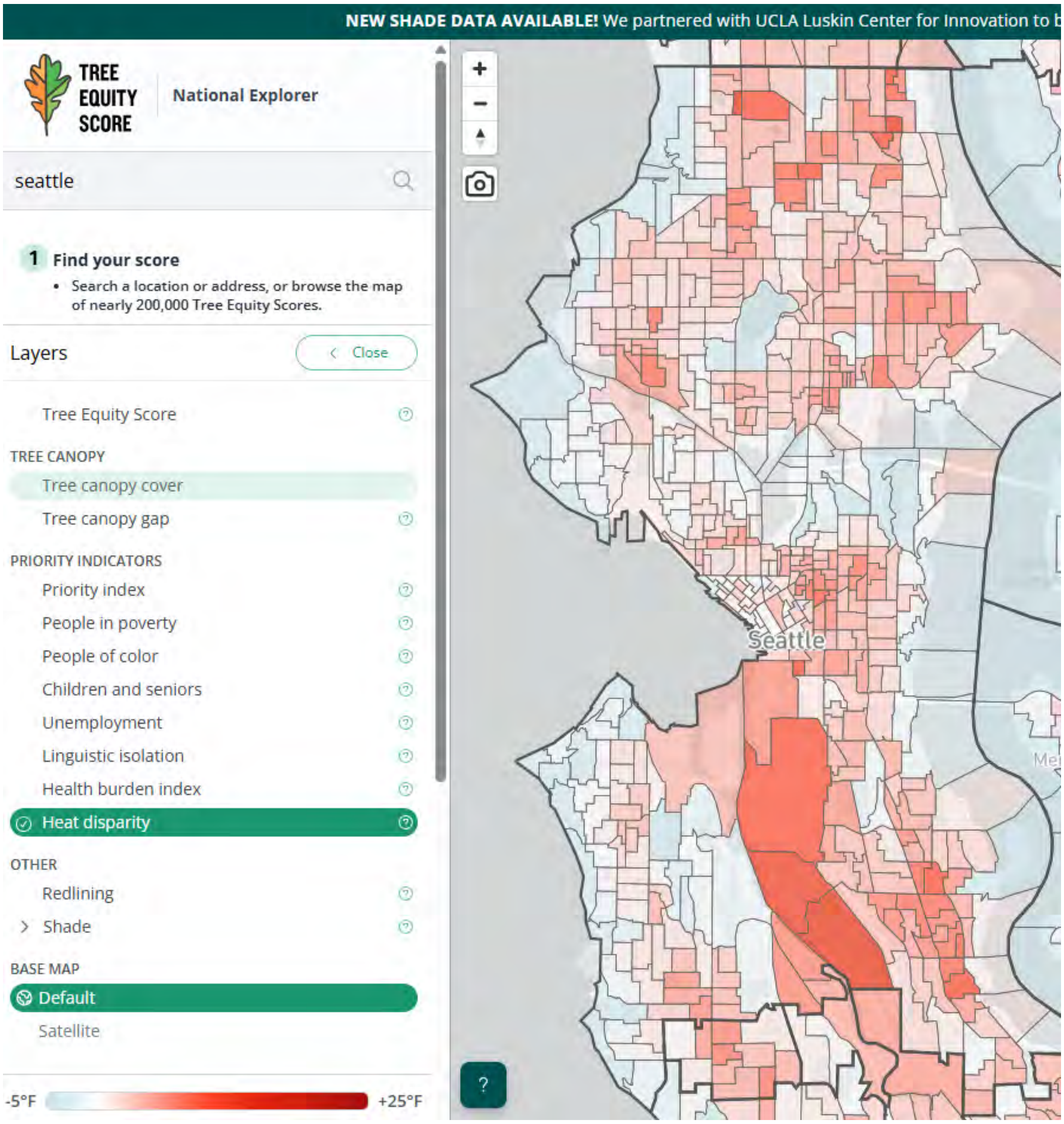



Figure 3.26: Map of heat disparity in Seattle
Source: UCLA Luskin Center for Innovation and American Forests

# 04
# DESIGN PROPOSALS

*"Consider the rate of growth of new trees and existing trees on site. Consider augmenting with structures to provide shade until trees develop to provide more shade. Determine how interim solutions can address short-term needs and available budgets vs. long-term investment in significant structures and plantings. Interim and temporary solutions can be provided by demountable structures."*

- Toronto Center for Cancer Prevention, 2010

# A PHASED DESIGN STRATEGY

Throughout the design process, it became clear that a phased approach was necessary. As detailed in previous chapters, tactical urbanism responds to existing conditions, instigating a change in the public realm. It is often temporary in nature, but operates with a long-term vision in mind. In this project, the immediate, tactical strategies create and advocate for simple shade structures, while the long-term vision is radical shade, establishing equitable shade distribution and reclaiming shade as a civic resource.

The Design Phasing Framework, as outlined in the introduction, is a framework for a series of design proposals at each of the three sites to advance actions and practice toward radical shade (see graphic on next page, repeated from 01 Introduction, Figure 1.2). The framework defines each of the phases by including a suggested time frame and actor groups, and describes the overall design objectives at each phase. All three of the actor groups are included in each of the phases as possible actors, but it is not necessary that each phase include participation from all of the actor groups. The first listed actor group, denoted with an * is the group that would most likely initiate that phase. For instance, Phase 1 is initiated by community organizers, Phase 2 is initiated by design activists, and Phase 3 is initiated by government agencies.

Phase 1, also known as "tactical urbanism," is an as-needed response to heat waves or high summer heat. It is initiated by community organizers, and could be supported by design activists or even government agencies. The design interventions provide a functional, quick response, and demonstrate a specific need or a call to action. These interventions could be installed for one day, a weekend, or a week of intense heat, and this could be repeated throughout the summer as often as desired. Any additional iterations could test different material assemblies, messaging or engagement around urban heat, or experiment with the same intervention at different sites. This phase has the most fleshed out designs of any of the three phases, as it relates most directly to tactical urbanism, and the question that this thesis aims to explore: How to address the urgent issue of extreme urban heat through small-scale, tactical shade structures in the built environment.

Phase 2, or "temporary urbanism," is a seasonal strategy, implemented throughout the summer, likely for one or two consecutive summers before a more permanent solution takes place. This phase is initiated by design activists and can be supported by community organizers or government agencies. The temporary urbanism phase is experimental; it engages and activates locals in the design creation process, inviting people to be agents of creating the space. Through this community- and user-engaged process, new information can be gained related to how the site could be transformed and planned in future phases or uses.

The last phase in this sequence, Phase 3, is called "transformative urbanism." It is a systematic approach for implementing, operating, and exercising shade structures as more permanent fixtures in public spaces. This phase would most likely be initiated by government agencies, and supported by design activists and community organizers. The designs would take up year-round residence at sites, repurposing and reimagining site use, and offering multiple purposes for users beyond shading. The transformative urbanism phase does not have to be the ultimate "end goal" for these three study sites or any sites. A site might not evolve to Phase 3, or the Phase 3 design intervention may become the desired end result for that site, or the Phase 3 design may just be one step of many toward achieving radical shade.

The following section includes a description of the site design proposals for each of the three sites, at each of the three phases. The design proposals for Phases 1 and 2 are the most thoroughly described, as they are more rapid in operation and duration, laying the groundwork for Phase 3 which truly begins to realize radical shade. The proposed designs for Phase 3 are the least resolved and more speculative at this phase, as they are meant to grow from the tactics used and lessons learned in the first two phases.

| | PHASE 1 | PHASE 2 | PHASE 3 |
|---|---|---|---|
| PHASE | tactical urbanism | temporary urbanism | transformative urbanism |
| TIME | as needed in response to heat waves | seasonal: summer (1-2 years) | year round (2-5 years and beyond) |
| ACTORS | *community organizers<br>design activists<br>government agencies | *design activists<br>community organizers<br>government agencies | *government agencies<br>design activists<br>community organizers |
| DESIGN | functional<br>quick response<br>advocate + demonstrate | experimental<br>engage + activate<br>plan + strategize | systematic<br>implement + operate<br>repurpose + practice |

Design Phasing Framework by author

# SITE 1: CARLETON AVE

## Phase 1: Tactical Urbanism

The tactical design proposal for Phase 1 at Carleton Ave (Figure 4.1) responds to considerable transformation in the last few years from removing three mature canopy trees. The removal of the trees appears to be in favor of creating a new concrete platform picnic table area, but it could also have been that the trees were diseased. Regardless, the new platform may provide better access to the picnic tables, but the picnic tables themselves are no longer mobile and do not add much aesthetically to the park. A concrete platform could have been poured in an artful way, installed around the existing trees and retaining the critical shade and cooling properties they provide. Because Georgetown has one of the lowest tree canopy cover percentages within Seattle (City of Seattle 2021), my design intervention proposes a commentary on both increasing temperatures and deforestation in the city.

I am proposing a painted bar chart that occupies the street parking lane, and extends into the travel lanes of Carleton Ave adjacent to Hat & Boots Park. Spanning the park's east boundary, this chart will read from north to south, illustrating the number of days per year that have recorded temperatures above 90 degrees since 1944 (see Figure 4.2). This plan drawing provides a bird's eye view of the chart, showing a notable trend of the annual number of days above 90 degrees steadily increasing to present day. To communicate that these are annual records, every decade beginning with 1944 and ending with 2024 will be painted horizontally on the sidewalk (see Figure 4.3). This draws the painted intervention into the park area itself, while also taking up space on the active street. Above the chart, in the middle of the street, bold block letter text would read "DAYS ABOVE 90 DEGREES."

By placing the paint on the street itself, there is another message or emphasis on the fact that if we continue to drive cars powered by fossil fuels, the climate disaster will continue to worsen. All of the paint would be in orange, relating to the topic of heat, and the paint might be left over from a P-Patch project, or perhaps even the orange paint needed to touch-up the Hat of the Hat & Boots sculptures. A single day of temperature recorded over 90 degrees is painted as a 1'x1' square. Therefore, the 13 days recorded above 90 in 2022 will total 13 linear feet of paint in the paved right-of-way. For about a week, while the paint is fresh, the chart will be blocked off from car traffic, yet people will be encouraged to occupy the space as they see fit, perhaps using the boxes as a hopscotch game.

The second piece of the intervention includes a shading element. As illustrated in Figures 4.2 and 4.3, umbrellas will be added to the four new picnic tables. This will be achieved through an act of guerrilla urbanism: drilling holes into the wooden surface boards to insert the umbrellas. At roughly 6' on each of the four sides of the umbrellas, they will provide significant shade for the picnic tables. This is a practical and useful intervention that adds a critical resource to an existing amenity for the local residents. In addition, the umbrellas and the shade they provide may remind residents of the three trees which used to stand there. The insurgent umbrellas make a commentary about the loss of shade-giving tree canopy and are a direct response to that counterproductive transformation of the space. That, paired with the bar chart illustration, communicates the threat of increasing heat and diminishing urban forests.


Figure 4.1: Aerial image of Site 1: Carleton Ave
Source: Google Earth

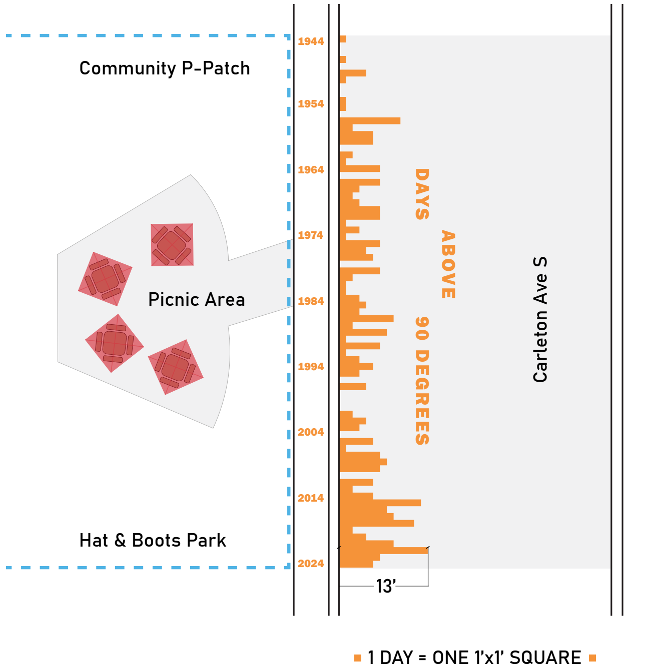



Figure 4.2: Days Above 90 Degrees painted chart, plan view
Graphic by author

Figure 4.3: Site 1: Tactical Urbanism intervention at Carleton Ave
Hand sketch by author

# SITE 1: CARLETON AVE

## Phase 2: Temporary Urbanism

The temporary urbanism strategy in Phase 2 would occupy the same space in the right-of-way (ROW), retaining and expanding upon the tactical interventions introduced in Phase 1. The umbrellas (assuming they are a welcome and useful addition), would remain on the new picnic tables and the bar chart would remain until the paint fades away. In conjunction with the community P-Patch garden, this design proposal adds planter boxes and picnic tables into the lane typically used for on-street parking. This type of intervention is similar to Park(ing) Day, where on-street parking spaces are replaced with amenities that people would find in a park. As Carleton Ave is directly adjacent to an existing park, this street intervention will act as an extension of the park itself. Therefore, the temporary installations would mimic the adjacent uses at this side of the park, which include a community P-Patch garden, and a picnic table area. The main difference in the two spaces is that the installations on the street would be covered by shade cloths, protecting people and plants from the hot summer sun. This design intervention could begin as a Park(ing) Day installation, and then grow from there if there is interest in maintaining and using the planter boxes as well as the shaded picnic tables.

The installation structures would alternate between two raised planting beds and two picnic benches, spanning the length of the eastern park boundary, and inviting people to grow food and enjoy each other's company in the space typically occupied by vehicles (see Figures 4.4 and 4.5). Shade cloths would play a key role in the installation, forming a continuous canopy over the picnic benches and planting beds. These shade cloths are cost-effective textile materials commonly used in formal shade structures and for protecting plants and vegetables, so they are well-suited for this installation. Extending the shade cloth over the planter boxes is a visual reminder that growing plants in summer can be challenging, especially in Seattle where summers are typically hot and dry. On the ground plane, between the footprints of three dimensional structures, there would be a visual remnant of the Days Above 90 Degrees chart. Built on top of in favor of the Phase 2 implementation, the faded orange paint alludes to the passage of time and the urgency to act on extreme heat in a subtle, poetic manner.

The picnic tables and raised planting beds would be made out of recycled or reclaimed wood. The planting beds could also be crafted out of recycled shipping pallets or other locally available lumber. The tables could be acquired from another site or previous use, or built specifically for this project. The framing for the shade canopy would be made out of wood, to continue with the theme of wood materials, and relate to the softer aesthetic of this neighborhood space. Although scaffolding could be used here for the shade canopy framing, as a material that is durable, easily available, and adaptable, it would not fit the feel of the site as well as a wood canopy. There could be a work party organized to build the new planting beds, which could potentially draw a significant amount of community support. Georgetown is known for its art community, especially industrial art, so there may be an interest in people wanting to build these structures and add their own artistic touch. If there is a considerable amount of artistic interest, there could be a competition held to construct shade structures out of local, and reused materials. There may also be the opportunity for other donated materials, such as steel or ceramics from local artists and makers.

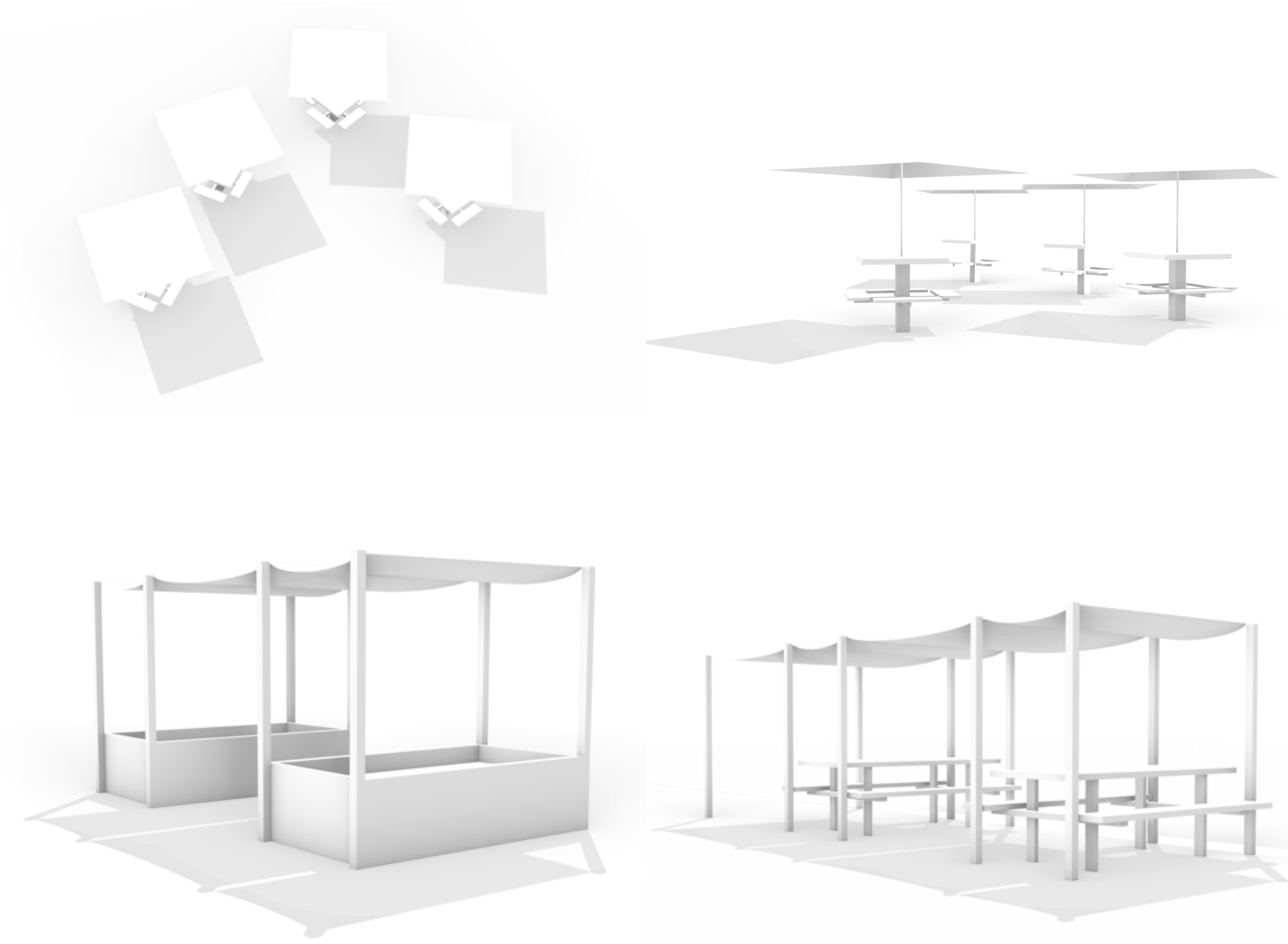


Figure 4.4: Shade illustrations of the umbrellas and picnic tables (above), and planter boxes and picnic tables (below)
Renderings by author

Figure 4.5: Site 1: Temporary Urbanism intervention at Carleton Ave
Rendering by author

# SITE 1: CARLETON AVE

## Phase 3: Transformative Urbanism

The Phase 3 proposal continues to work within the same 8' wide ROW zone as the previous phases. However, this phase introduces a significant alteration: the removal of asphalt to create a completely new landscape/GSI strip. This new strip would serve as a protective buffer between the sidewalk and the travel land (see Figure 4.5), and address multiple climate conditions such as extreme heat, stormwater, and air pollution (see Figure 4.5). This adjustment moves Carleton Ave closer to the dimensional standards outlined for a Neighborhood Yield Street (see Figure 3.21), as exemplified by nearby Flora Ave. Although improving the ROW to the prescribed street classifications may not appear radical, in this instance, because the specified standards are non-existent there is a clear need for intervention. What makes this proposal truly radical is not only the outcome but the process: a transformation initiated by  tactical and temporary strategies (Phases 1 and 2) focused on increasing shade, and shaped in part by community members.

The transformative urbanism intervention could be initiated by only converting the parking lane on the western side of Carleton Ave, and waiting to convert the second side after the first has been established and maintenance systems tested. However, from a construction standpoint, it would be most energy- and cost-efficient to construct both at the same time. It should be noted that the parking lanes would not be eliminated, but adjusted in toward the center of the road, creating a narrower travel lane. The existing ROW width (60 feet) is wide enough to accommodate two travel lanes, two parking lanes, two landscape/GSI strips, and two sidewalks. Reducing the size of the travel lane should reduce the speed of vehicles on the street, making it a safer street for bike and pedestrians and avoid the need for speed bumps.

Figure 4.6: Site 1: Transformative Urbanism intervention at Carleton Ave
Rendering by author

Within the landscape strip, tree saplings would be planted by local volunteers and community members in collaboration with the city. The trees would be provided in part by the city's Trees for Neighborhoods program, or supplied by the city, or perhaps donated by a local nursery. The trees and other vegetation in the new landscape strip would be stewarded by community members. Elements from the first two phases would be incorporated into this phase, such as raised planting beds, shaded seating areas, or art installations made by community members that relate to extreme heat or radical shade.

# SITE 2: PARKING LOT 1000

## Phase 1: Tactical Urbanism

The SoDo site is located within a parking lot at the intersection of 1st Ave and Holgate St (Figure 4.7). Catering to the industrial workers of SoDo, some of whom work in warehouses without AC, the tactical urbanism strategy at this site is designed primarily to provide a shaded outdoor space to take a lunch break. Besides local workers, this intervention could also be used by anyone visiting or spending time in the area. The design includes a long 40’ table with benches and a large overhead shade cover (Figure 4.8). The shade cover includes shade curtains on the west-facing side that can be adjusted by the users. The construction frame is built from scaffolding, plywood, standard sized wood boards, shade cloth, and string. Scaffolding is a material ubiquitous in urban areas where construction is constant. It is also relatively easy to assemble, and adjustable to be assembled in a variety of different shapes. The proposed framing of the scaffolding allows for a 4’ wide table, with a pair of scaffolding posts set 7’ apart, which should provide comfortable seating for about 36 adults. To further enhance the temporary intervention, plants in large plant pots would be placed in the “void” space between the double curb. These would ideally be loaned from a local nursery and provide some lively visual interest to the heavily paved site.

The Phase 1 proposal on this site includes the opportunity for related programming. This might include a food truck occupying the street parking on Holgate St, or an emergency response team handing out water bottles, emergency kits, and informational materials about preparing for extreme heat. In this case, if the first tactical installation at Parking Lot 1000 is well received, the operation could be expanded to occupy several parking lots along 1st Ave with tactical structures that pop up in preparation for or response to a heat wave.

The inspiration for this design comes from an installation in Brazil, where the architecture firm Estúdio Chão created a group of installations for a weekend event with programming related to cultural and educational activities. The installations included several types of scaffolding assemblies that provided various “rooms” throughout the square for lectures, concerts, gathering and eating; all of which also provided shade. The fact that these installations were created for a weekend festival indicates that they would be fitting for a short-term, functional intervention in response to a high heat event. The number of installations that were created for this short-term weekend event, the durability of the structures, and the rapidity with which they appear to be assembled, demonstrate that something similar would be viable to develop at a small scale for this SoDo parking lot site.


Figure 4.7: Aerial image of Site 2: Parking Lot 1000
Source: Google Earth

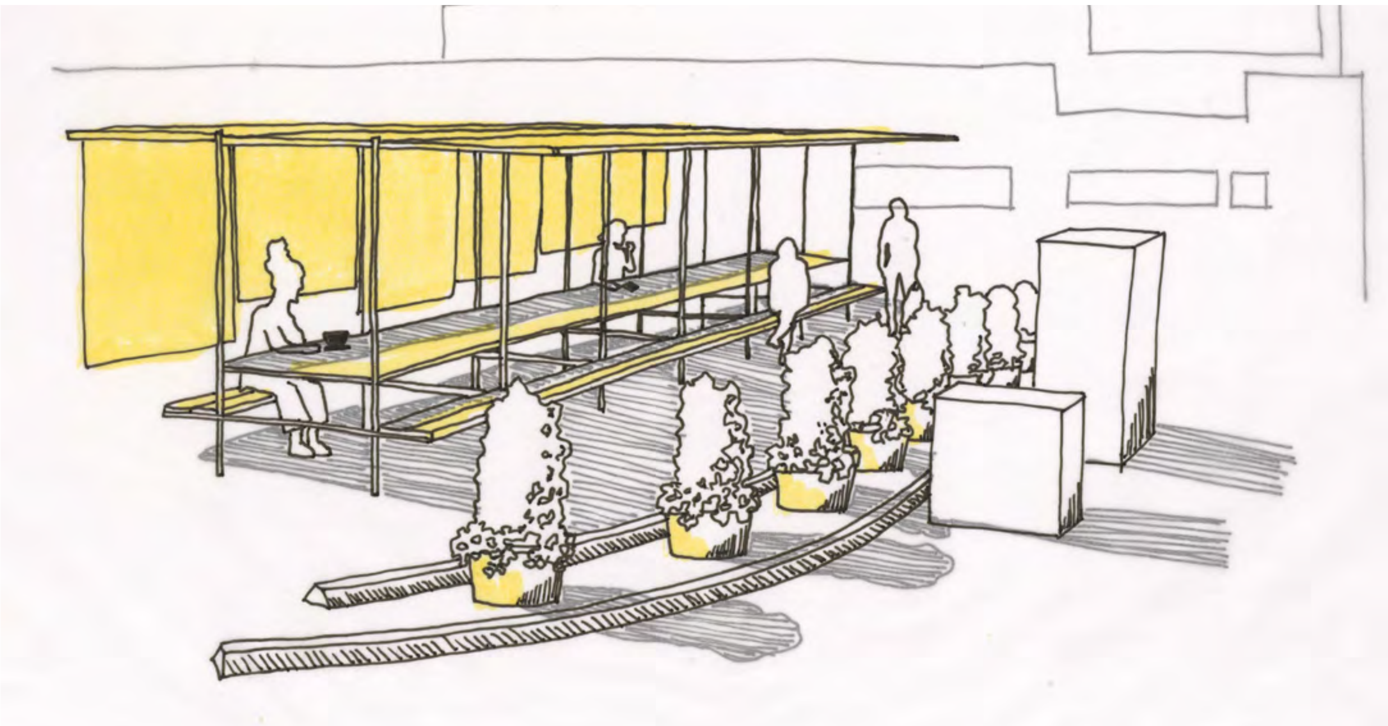


Figure 4.8: Site 2: Tactical Urbanism intervention at Parking Lot 1000
Hand sketch by author

# SITE 2: PARKING LOT 1000

## Phase 2: Temporary Urbanism

The temporary urbanism (Phase 2) strategy for what I am calling “Parking Lot 1000” would look similar to the tactical urbanism phase, but instead of one stationary shade structure, there would be a stationary structure with multiple mobile shade structures that users can move around to shape the space according to their needs. The site area would also be extended an additional 8 feet into the parking lot to the west. This creates space for the stationary shade structure, with a shade canopy spanning 8’ wide and 50’ from the north to the south end of the site. This structure would be framed with scaffolding, and include a vented and interactive “wall” like feature with manipulable slats on the western side, providing protection from the afternoon sun. This vertical element effectively divides the space between what will remain parking lot use, and the temporary urbanism site intervention while allowing shade and ventilation.

The wall would be constructed by a mix of wood boards and shade cloth material. Alternating between a cloth panel and a wood panel section, these sections would occupy the 8’ spaces between the scaffolding posts (see Figures 4.9 and 4.10). In the wood paneled sections, there would be thirteen 1”x6” vertical boards spaced evenly between the posts. These would be fastened to the scaffolding at the top and the bottom with two loop screws, allowing the board to be rotated by a user. This feature would not only provide shade, but also create an engaging element that allows users to rotate the panels, experimenting with changing the angle of the panels to allow more or less sun and wind into the site. The textile-based panels would be tightly fastened to the scaffolding (not adjustable), to provide continuous shade.

The mobile furnishings would include: Six mobile planter boxes with plants and one small tree in each, and six mobile benches, each with an umbrella installed in the center to provide shade (Figures 4.8 and 4.9). Ideally, there will be enough space within the site for users to move the elements around and create different arrangements for optimal shade coverage or simply gathering with friends. The tree boxes would be placed on moving dollies, theoretically readily available in the industrial area, and the boxes would be made out of reused shipping pallet wood, which can be acquired for free or purchased very cheaply. The umbrella benches would either be built out of shipping pallet wood or reused standard cut lumber. Inexpensive picnic table umbrellas would be installed at the center of the benches, with each of the four sides of an umbrella spanning roughly 7’ and casting significant shade. Two wheels would be attached to two of the four legs of the benches, to enable users to rearrange shade and seating elements as needed to provide shade.

The proposed construction materials were chosen specifically for the ease of sourcing and availability. Scaffolding is ubiquitous in cities, and can be easily acquired or borrowed, and the 1”x6” wood boards can be reused from another project or donated from a local builder. Similar to the tactical strategy in Phase 1, this Phase 2 intervention makes a statement about the lack of shade and shade structures in the area, and further layers on the ability for site users to be involved in the development of a parklet site. The intervention for this site is similar to Seattle’s Pavement to Parks program, with this phase being akin to a public engagement opportunity for users to help shape the more permanent Phase 3 strategy.

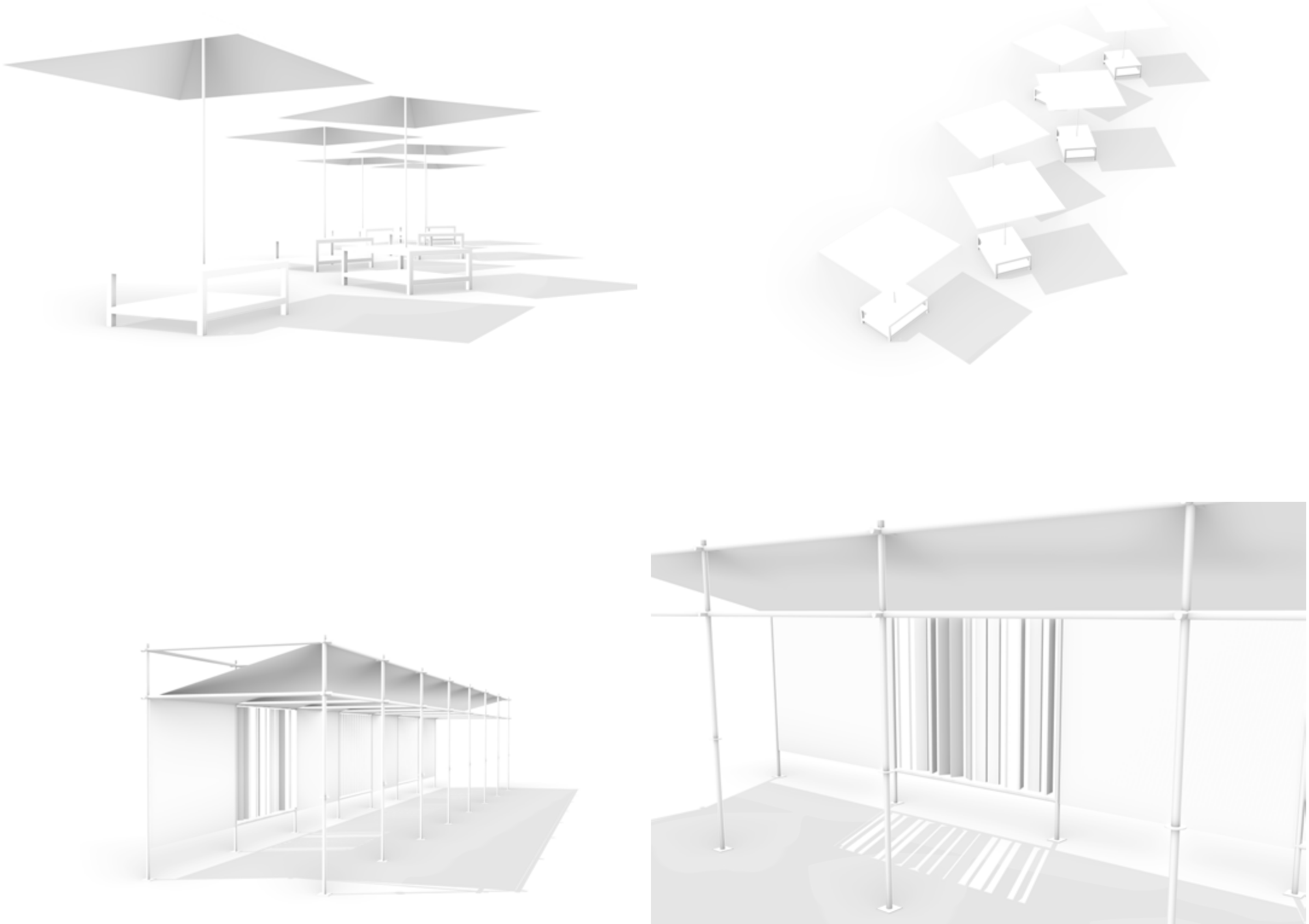


Figure 4.9: Shade illustrations of the umbrella benches (above) and the adjustable wood paneled shade wall (below)
Renderings by author


Figure 4.10: Site 2: Temporary Urbanism intervention at Parking Lot 1000
Rendering by author

# SITE 2: PARKING LOT 1000

## Phase 3: Transformative Urbanism

The transformative urbanism strategy for Phase 3 of Parking Lot 1000 is a depaving strategy. In this phase, asphalt is removed and replaced with soil, mulch, plants, or other softscape materials (see Figure 4.11). I envision this being implemented adjacent to the sidewalks on Holgate St and 1st Ave, but if the Phase 2 intervention is very popular, the Phase 3 intervention may be expanded to take up more of the parking lot.

Depaving several small portions of asphalt could be a useful strategy to enact in SoDo, demonstrating that trees can be incorporated into the landscape, and especially into parking spaces, without a significant amount of planning. This relates to ongoing policy conversations to reduce car dependency and carbon emissions by reducing or eliminating parking minimums for new constructions. However, I am proposing that replacing existing parking spaces with trees and vegetation can be a tactic to reduce parking spaces on built lots, rather than reducing parking spaces only through policy directed at new construction.

Another possible component for this phase would be a living shade wall, created by a fence where vines are trained to climb the fence. A narrow segment of asphalt would be removed, particularly the section along the void space between the double curb. A wire fence would be installed and hearty vine plant starts would be planted in the soil. This could be implemented at the interior corner of the parking lot where Holgate St and 1st Ave intersect (see Figure 4.11). This roughly 300 sq ft space is ripe for intervention because it currently cannot accommodate any parked cars because of the configuration of the parking stalls on the site. The vine wall would be placed on the western side of this area, similar to the placement of the wall structure in Phase 2.

This type of vine/fence was implemented by Terremoto landscape architects for an art gallery located in an industrial area of Los Angeles. The goals for that installation were to help block views, divide space, establish shade, and improve air quality. This precedent shows that phased design approaches do exist, and they can be more involved and include plants that require maintenance, given the right stewards. This is a relevant precedent for the SoDo site, as it has similar zoning and urban environment conditions, but finding a dedicated community partner would be necessary to maintain the plants.

Figure 4.11: Site 2: Transformative Urbanism intervention
Rendering by author


CC FILSON CO

# SITE 3: OTHELLO SQUARE

## Phase 1: Tactical Urbanism

At the third site, a large vacant lot sits at the intersection of MLK Jr Way and Othello St in New Holly (Figure 4.12). The tactical urbanism strategy for Phase 1 of this site would be to provide shade along the established desire path through the site. Trailing from the southwest corner, where there is a large residential development, the path leads to the northeast corner of the site where the major intersection lies, including a bus stop shelter on the sidewalk. According to my site observations and analysis, people travel both north and south through the site, mainly between transit and shopping destinations.

Portions of the path will be shaded by a series of seven canopy structures, spaced apart along the path. The canopies are framed by three pairs of scaffolding posts and two levels of horizontal scaffolding that create sturdy, wind-proof structures. The canopy segment structures range from 8'x16' to 10'x16', with the wider segments including two attached hammocks as well as wooden benches. The two canopies at the edges of the path include an extra frame with a total size of 8'x24', with the exterior shade covering raised higher at both entrances/exits to welcome people into the shaded pathway. The dispersed yet aligned canopy installations will create a patchwork of shade along the path that is visible at a distance from all edges of the site (see Figure 4.13). This tactical intervention alludes to the idea of "shade hopping," where people adapt their walking route to travel through pockets of shade, thereby increasing the amount of time they can spend outside. Theoretically, this will point to the idea that even more shade infrastructure would be beneficial at this site during hot summer months.

The structures will include shade cloth material for the overhead canopy, but the vertical drapes will be made out of recycled textile materials. This is inspired by one of the ¡Sombra! Experiments in Shade artist interventions called "Quilt Architecture," which uses recycled clothing material to create shade cloths. The recycled textile shade panels for the Othello site will be hung on some of the south- and west-facing "walls," located in relation to the side that received the most direct sunlight. The making of the recycled textile panels could be a volunteer effort, and perhaps even be assembled as a community event on-site, after the scaffolding frames are installed. Aligning with the textile theme, several of the canopy structures will include hammocks, made from textiles and rope. The hammocks will invite people to sit and rest, rather than only passing through the site, and they will be attached to horizontal cross bars where they join the vertical posts, ensuring a strong connection. Together, these tactical interventions offer not only practical pockets of shade, they also form an artistic and playful ensemble, to be constructed and enjoyed by members of the community.

Figure 4.12: Aerial image of Site 3: Othello Square
Source: Google Earth


Figure 4.13: Site 3: Tactical Urbanism intervention at Othello Square
Hand sketch by author

# SITE 3: OTHELLO SQUARE

## Phase 2: Temporary Urbanism

The temporary urbanism Phase 2 proposal expands on the path shading strategy by adding more shade structures as well as young trees to the site (see Figures 4.14 and 4.15). Given the vacant lot that has minimal paving coverage and the plethora of volunteer plants growing throughout the site, the opportunity to plant trees directly in the ground should be acted on. Trees could be temporarily planted in planter boxes and rest atop the soil, but trees cannot flourish as well in these cramped conditions. Planting them directly in the ground is a benefit to the long-term growth of the tree and would potentially contribute to healthier soil. Because there is minimal material that needs to be removed to plant the trees (soil, grass, crushed stones), it would be relatively straightforward to plant 25 saplings in the proposed locations. During their temporary stay, the trees would ideally be cared for by the local community garden members or other volunteers. In this temporary urbanism phase, the trees would live on site for at least the summer, and stay throughout the year if they are enjoyed and well cared for.

When a more permanent use of the site is decided upon, the trees would be delicately removed and replanted nearby, ideally in the public ROW. It is possible that people and children caring for the trees would be attached to them, and may want to continue stewarding or visiting the trees after they are removed from the site. Therefore, the goal is for the trees to remain in the area, either incorporated into the new development in a ROW planting strip or in a planted area on site property, as required by Seattle's Green Factor regulations. Some of the trees could also be planted at nearby parks or in existing ROW tree pits where a tree has been removed.
The effort to transplant the trees could be carried out by a mix of local volunteers and workers from the city's Urban Forestry team. The intention for continued stewardship of trees beyond the temporary installation relates to programs like Chicago's Tree Ambassador program, and the Adopt a Tree program in Boston, which build public awareness of and stewardship for urban tree canopies.

The other structures added to this site in Phase 2 would include another 16' long scaffolding canopy segment placed next to the bus stop (see Figures 4.14 and 4.15). This structure would provide more than twice the amount of shade as the bus stop shelter, while still allowing plenty of room to move about on the extensive, 24' wide sidewalk. There would be another canopy segment facing Othello Street, located right where the site boundary and sidewalk meet to invite people in to enjoy the temporary interventions. Taking advantage of the sheer size of this vacant lot, I propose a large tent-like structure occupying roughly 900 square feet (sq ft) in the center of the site and pathway. Matching the rest of the structures, this one would also be framed by scaffolding, and covered by shade cloths and recycled textile cloths. Additionally, there would be several hammocks installed that could be expanded and collapsed as needed, as well as the same style wooden benches that could be moved by site users. This tent would offer the opportunity to host gatherings or events, or simply a larger space for more people to get relief from the heat.

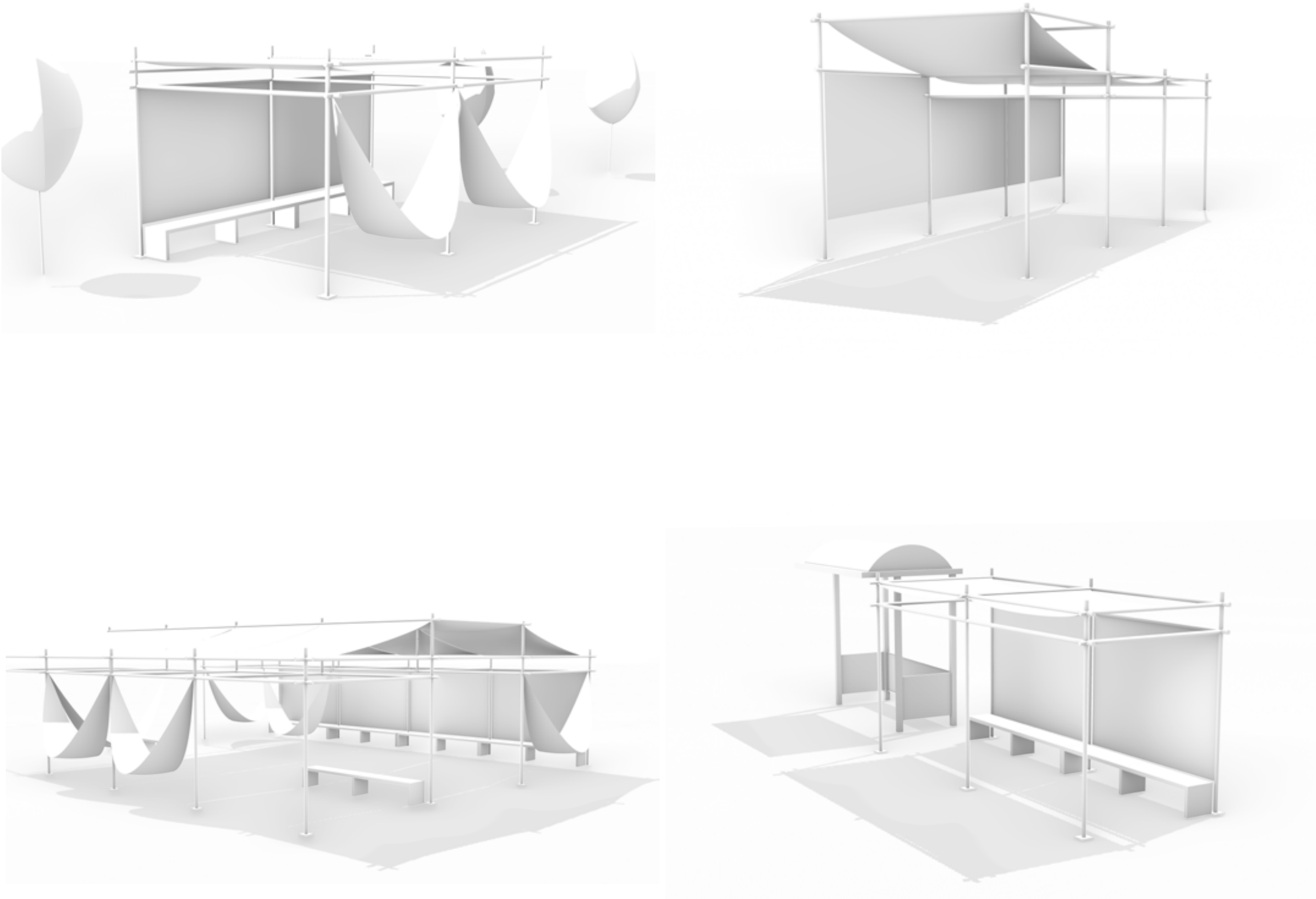


Figure 4.14: Shade illustrations of the structures, including scaffolding frames, shade cloths, benches and hammocks
Rendering by author

Figure 4.15: Site 3: Temporary Urbanism intervention at Othello Square
Rendering by author

# SITE 3: OTHELLO SQUARE

## Phase 3: Transformative Urbanism

The Phase 3 intervention for Othello Square once again builds on the first two phases of this site, both emphasizing the direct pathway connection and encouraging people to linger on site (see Figure 4.16). A shade covering would remain along the path, and extend along the entire pathway rather than only seven segments. This would be built out of new materials, perhaps finished wood that would communicate a sense of permanence, and be refreshed with new shade cloths. The large tent structure would remain at the center of the site, and could also be rebuilt with new materials. The trees that were previously planted would remain in place, and would be joined by a group of about 50-70 new trees and shrubs planted throughout the site. This dominant vegetated presence would communicate the reclamation of the landscape in an effort to provide a cool and shaded respite. The presence of so many trees – although small when first planted – located at the busy transit intersection of MLK Jr Way and Othello St would be eye-catching and stand out in high contrast to the large, treeless parking lot to the north of the site.

One of the objectives of planting so many trees on site is to establish a tree nursery, where the trees can grow and be enjoyed and cared for by the community. The nursery would be temporary in that the trees would remain on site only while the long-term building plans for the site are on hold. The landscape architecture firm Terremoto has piloted this work to actively plant on a vacant lot for the purposes of ecological restoration and community building. In their 7th Ave garden, located in LA, Terremoto made an agreement with the landowner to plant a garden on the site that would benefit the soil and the local community while there were no plans to build or develop the site. They hosted events including work parties to tend the land, and social gatherings that involved everything from recreation and education, to food and music. They cared for the space with care and diligence, making small and nimble adjustments that would serve people and plants in an unknown amount of time. This is along the lines of what I would hope for at the Othello Square site.

Consider if tree saplings had been planted at this lot when it first became vacant. Those saplings would have grown into trees providing significant shade canopies by this point roughly 14 years later. The property owners likely did not intend for the site to remain undeveloped for so many years, but it probably also did not occur to them that a temporary intervention could serve as a valuable public amenity. What if this kind of temporary urbanism – planting tree nurseries in vacant lots – was accepted or encouraged as part of a strategy for urban heat island mitigation and urban forest growth? This could be achieved while keeping the site fenced in if the landowner did not want it open to the public, but the

Figure 4.16: Site 3: Transformative Urbanism intervention at Othello Square
Rendering by author

strategy would be even more impactful if people were allowed to temporarily use the space. In terms of the Othello Square site, if the site is already open and actively used by locals, why not enhance the use of the site with elements that can be temporary and serve ecological and social benefits?

This Phase 3 site transformation of the Othello Square site essentially establishes a cool corridor, which by definition combines natural and engineered shade elements to provide enhanced shading and temperature-reducing solutions. With the seven-story apartment building directly to the west of the site creating considerable swaths of shade in the afternoon, and the tactical structures and trees contributing critical pockets of shade at ground level. The City of Phoenix defines cool corridors as "walkways or trails adjacent to an arterial street designed to keep pedestrians, bicyclists and transit users safe and provide relief from the high temperatures of our urban desert landscape," which typically span one-quarter to half-mile segments (Cool Corridors Program 2020). If implemented along the full desire path at Othello Square, this cool corridor would stretch less than one-tenth of a mile, but could connect to New Holly's "Central Park" at the center of the housing development.

# REFLECTION ON THE DESIGN PROPOSALS

These design proposals are one iteration of ideas that could be implemented at each site. The iterative design process, mainly executed through quick hand drawn sketches allowed me to experiment with different structural shapes and the general program or layout of a site. After the initial sketches, I modeled all of the designs in a 3D software, in which the designs were refined and scaled. The final renderings for each phase are intentionally communicated with different graphic styles. Phase 1 is illustrated with hand drawn graphics, communicating the unpolished and insurgent response defined by this phase. Phase 2 is digitally illustrated, communicating the design concepts through defined elements and some site context. Phase 3 builds naturally off of Phase 2, but adopts a less refined illustrative approach to invite greater imaginative interpretation, reflecting that its implementation would occur further in the future.

Through a careful site suitability assessment at multiple scales, and an iterative design process, this thesis has demonstrated one approach for site selection in the City of Seattle, and possible design responses at each of the three sites. The three sites for this project exemplify three distinct site typologies: Street ROW parking, five adjacent parking lot spaces, and a vacant lot. These three site typologies are an example of areas that may be easily replicable for temporary installations, given their ROW status and adjacent uses and users. The phased design explorations provide a practical guide for activating public space with temporary shade structures, demonstrating how rapid, low-cost interventions can catalyze systemic change in the built environment. The phases help to illustrate how tactical and temporary interventions can make incremental change in public spaces.

All together, the design proposals and iterations presented in this chapter seek to establish shade structures in places with an egregious lack of shade. They not only point out the lack of shade in these areas, they also spread awareness about extreme urban heat in Seattle. These designs are not meant to be perfect, fool-proof solutions, but rather tactical experiments related to how shade could be produced and implemented in a rapid fashion to respond to and help prepare for extreme heat events. There are countless different shade structures that could be crafted, and many design precedents for shading systems that already exist. The designs prioritized here feature low-cost, easily acquired and assembled materials, and designs that are the result of community collaboration, with design activists and municipal support.

It is notable that all of the Phase 2 proposals include some vegetation elements, and all of the Phase 3 proposals include planted trees. Trees (especially young saplings) and vegetation, need a significant amount of water to survive the summer heat in Seattle. Therefore, there will need to be a system for watering and maintaining the trees and vegetation at each site. Ideally, this will be community organized and led at least in the first two phases. SoDo is the only site with proposed vegetation in Phase 1, and because this site will be visited daily either by an emergency response team handing out water or heat relief kits, or a local food truck, it would fall upon those teams to water and care for the plants with their mobile supplies.

In Phase 2, the Georgetown site would be watered and cared for by the P-Patch community gardeners, and the same at the New Holly site with their P-Patch. At SoDo, the task again would likely fall on the food truck personnel, or the design activists that create the installation itself. For all sites in Phase 3, where the number of trees and vegetation grows significantly, the watering task would ideally be given to the City of Seattle tree watering team, as they are already watering the newer trees planted at Hat & Boots Park, and at New Holly's Central Park. There could be a condition where the city waters the trees in the summer months, when watering is most critical, and community members and local organizations take care of the trees during the rest of the year through a stewardship program.

# 05

# DESIGN ANALYSIS

*"It is more important than ever that we expand shade coverage from both trees and built structures. In the hottest months, shade can make up to a 30-degree difference."*

– Shade Phoenix, 2024

# SUN/SHADE STUDIES

## Overview

In this chapter, the design proposals are analyzed for their ability to create shade. I modeled the designs and shade structures in a 3D modeling software called Rhino to analyze the amount of shade provided in current conditions and as a result of my design interventions. In order to produce the sun/shade studies. To do this, I used Grasshopper, which is a visual programming software that plugs into Rhino. In Grasshopper, I used a script with geo-located sun data which creates a visualization of the sun's path throughout a full 24-hour period, and shows the subsequent shadows on the Rhino rendering. This method is an industry standard used by landscape architects, architects, urban planners, and other professionals to simulate and illustrate the sun's path and shadows, both for built structures and proposed designs. Sun/shade studies are typically conducted at the spring equinox, summer solstice, and fall equinox to show the seasonal range of sun and shadows at a given location. Because  this thesis focuses on summer heat, I chose to run the sun/shade study exclusively at the summer solstice, June 21st, to illustrate the maximum sun path and shadows.

To observe how the design proposals add shade to the site, I conducted the sun/shade studies on the site's existing conditions as well as the Phase 1 and Phase 2 design proposals. This allows one to easily compare the existing site conditions to the shade provided by the proposed design additions. Furthermore, using the same 24-hour period of analysis for each of the studies makes for a more valid and true comparison. It is important to note that these sun/shade studies in this analysis are based on the maximum sun path and corresponding shadows observed on the summer solstice. On any other day of the year, the shadows would be shorter. It is also important to note that I did not include sun/shade studies for Phase 3 because these designs are less defined, as they are expected to evolve from Phases 1 and 2. Therefore, it was not necessary to conduct sun/shade analysis on the design proposals that are less resolved. Consistent with the other phases, the objective for the Phase 3 is to increase the total shaded area from the previous phase using both built and natural shade elements.

In this series of sun/shade maps, there is a range of colors from yellow to orange to red and purple (see Figure 5.1). Although counterintuitive, the graphic convention for such studies uses oranges and reds to indicate shadows rather than heat, with the deeper color indicating more shade. This graphic style is an industry standard, where the light yellow indicates no shade throughout the full 24-hour period, and the darker the oranges and reds, indicate more hours of shade cover, not necessarily more impactful shade. The darker colors indicate areas that are in shadow at multiple hours of the day, literally illustrating where shade layers overlap and create darker colors. The inside the hatched blue shape indicates the "Area of Analysis," which illustrates the total area evaluated for shade across all four images.

The "existing conditions" renderings are a simplified representation of what actually exists on the sites. For this analysis, only the largest, most significant shadow-casting elements (i.e. buildings and trees, but not all curbs or planter boxes) are rendered to their approximate proportions with the use of on-site observation, Google Earth, and Google Street View. Some shade-casting features include elements that are permeable or transparent, such as shade cloth, which is a permeable textile, or the leaves of a tree canopy, which are transparent and not solid. But for the ease of rendering, these features are represented as solid objects in the digital model. Therefore, the shadows depicted are an approximation of shade, but do not accurately represent the full quality or exact quantity of shade. Additionally, the shadow-casting elements like buildings, trees, and shade cloth appear as white objects in the renderings, which obstruct the ground space that some elements like trees or structures may have underneath their canopy. The area underneath is assumed to be sufficiently shaded during the 24-hour analysis period, but not shaded throughout the entire period.

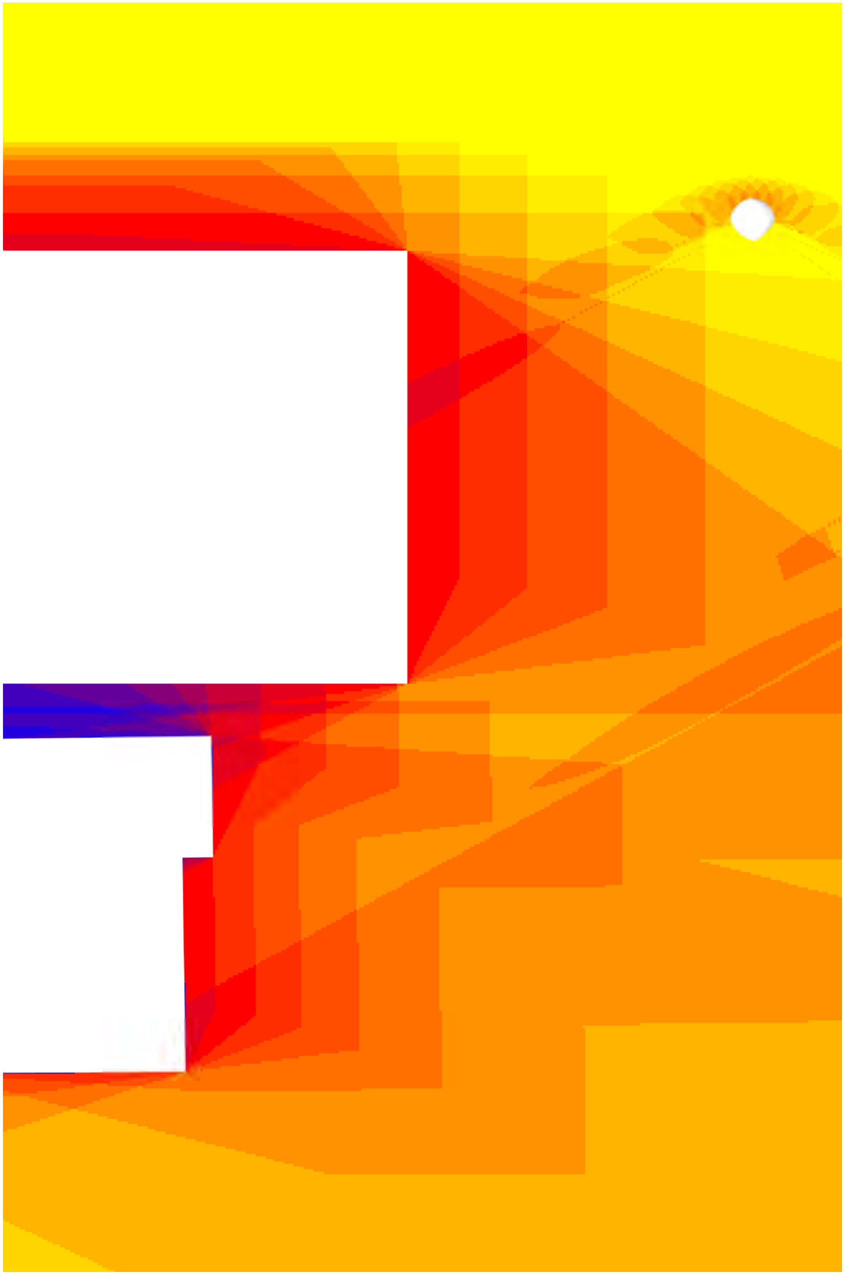


Figure 5.1: Sun/Shade study example graphic
Source: Google Earth, Climate.OneBuilding.com;
Image by author

# SITE 1: CARLETON AVE

## Existing Aerial and Area of Analysis

The area of analysis at the Carleton Ave site in Georgetown was chosen based on the Phase 2 intervention, which spans the length of this side of the park boundary. The area, inside the frame of the blue hatch, totals 12,500 sq ft and will be used to calculate and compare the amount of shade cast in the Existing Conditions, Phase 1, and Phase 2 sun/shade studies.

Figure 5.5 includes an aerial image of the area, the area of analysis and the basic linework used to create the digital renderings. This graphic provides a reference of the existing conditions that are rendered and referenced in the sun/shade studies (see Figures 5.3, 5.4, and 5.5).

## Existing Conditions

Figure 5.2, is a sun/shade study for the day of June 21, 2024. The estimated amount of shade currently cast in the area of analysis is 3,400 sq ft. The rendering shows that there is a fair amount of shade cast by houses and trees on private property, but little to no shade around the new picnic bench area in the park or on the sidewalk and on-street parking immediately adjacent to the picnic area and park boundary. This is edge of the ROW is where I am proposing a temporary shade intervention.

It should be noted that the northeast corner of the site (top left corner of these figures) is where the community P-Patch is located, which gets full sun, and should not be considered for increased shade.


Figure 5.2: Site 1: Existing Conditions Aerial
Source: Google Earth; Image by author

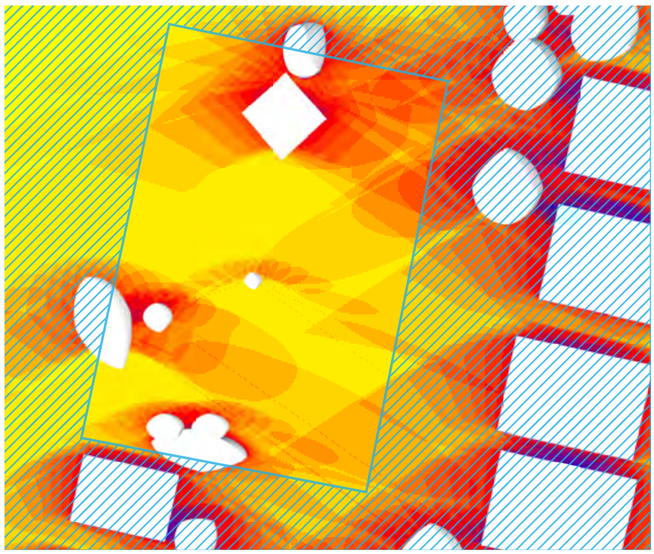


Figure 5.3: Site 1: Existing Conditions Shade Study
Sources: Google Earth, Climate.OneBuilding.com; Image by author

## Phase 1 Sun/Shade Study

The Phase 1 design proposal includes a non-shading element: the Days Above 90 Degrees painted bar chart, and a shading element: four umbrellas fixed to the new square picnic tables in the park. The umbrellas are designed to span roughly 7' on all four sides, with a total area of roughly 50 sq ft per umbrella. The sun/shade study for Phase 1 (see Figure 5.3) illustrates how the umbrellas contribute additional shade to the existing conditions, casting approximately 600 sq ft throughout the day. The shade cast by the umbrellas is critical in the gathering area, especially over the paved surface that retains heat, and in the late morning/early afternoon before the larger tree casts its shadow on the area. Had those three honeysuckle trees still been growing today, their shade would have covered the majority of the concrete area, providing the greatest relief in the afternoon, when the UVR and ambient temperature are most intense.

## Phase 2 Sun/Shade Study

The Phase 2 design proposal for this site includes a long banner of shade over picnic tables and vegetable planter boxes. This temporary intervention is analyzed for sun/shade in Figure 5.4, showing a significant increase in shade on the sidewalk and within the ROW intervention area. The total shaded area is approximately 1,750 sq ft, in addition to the 600 sq ft of shade that the umbrellas from Phase 1 cast. Due to the shape and positioning of the canopy structure, it would provide equal shade in the morning and afternoon, establishing this area as a comfortable place to spend time on a hot day. This analysis demonstrates that the design proposal is successful in adding shade to the site, and in fact, provides more shade than is currently available at the picnic area.

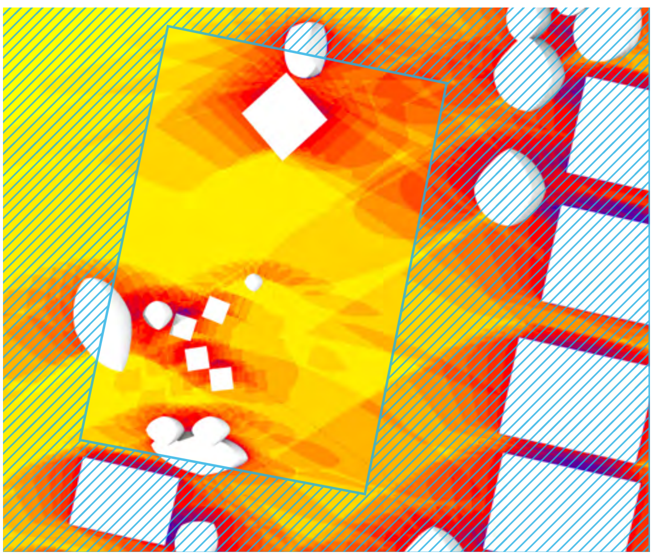


Figure 5.4: Site 1: Phase 1 Shade Study
Sources: Google Earth, Climate.OneBuilding.com;
Image by author

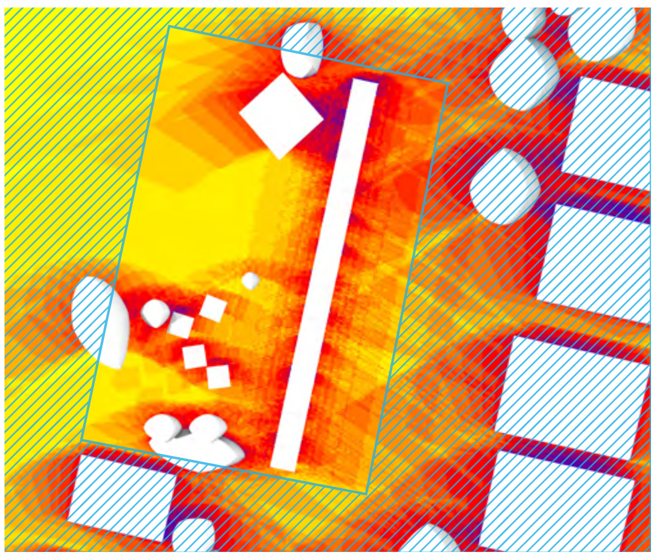


Figure 5.5: Site 1: Phase 2 Shade Study
Sources: Google Earth, Climate.OneBuilding.com;
Image by author

# SITE 2: PARKING LOT 1000

## Existing Aerial and Area of Analysis

The area of analysis at the Parking Lot 1000 site in SoDo includes the entire public parking lot and the two adjacent sidewalks to encapsulate an area of significance around the Phase 1 and Phase 2 intervention sites. This area, inside the frame of the blue hatch, totals 14,500 sq ft and will be used to calculate and compare the amount of shade cast in the Existing Conditions, Phase 1, and Phase 2 sun/shade studies.

Figure 5.5 includes an aerial image of the area and the basic linework used to create the digital renderings, which provides a reference of the existing conditions that are rendered and referenced in the sun/shade studies (see Figures 5.7, 5.8, and 5.9).

## Existing Conditions Shade Study

Figure 5.6, shows limited shade, exclusively cast by the one building shown within this zoomed-in view. Within the 14,500 sq ft area of analysis, there is only about 2,000 sq ft of shade cast by the one-story building in the late evening. The design proposals for Phase 1 and 2 aim to change that by increasing shade on the eastern side of the parking lot.

The thin white lines indicate the parking curbs, which are not a useful shade element, but is an important feature of the site for the design proposal. The two boxes to the right of the curbs are utility boxes, which were also included in the design renderings. The light poles and utility poles on the street were not included in the sun/shade analysis as they do not cast any significant shade.


Figure 5.6: Site 2: Existing Conditions Aerial
Source: Google Earth; Image by author

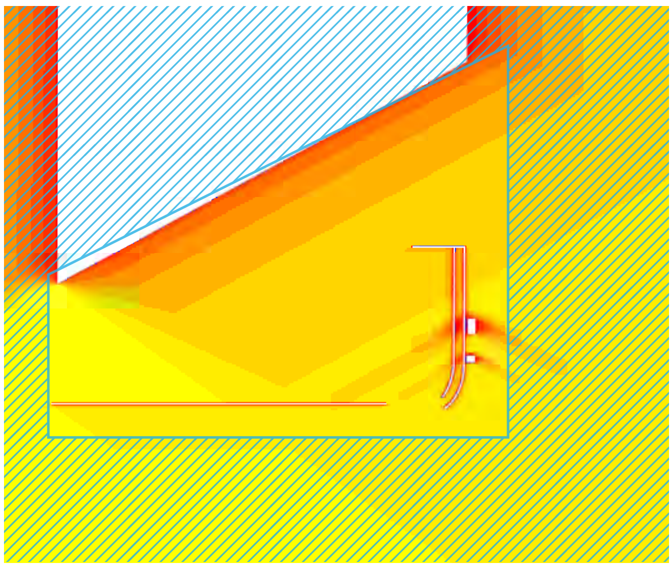


Figure 5.7: Site 2: Existing Conditions Shade Study
Sources: Google Earth, Climate.OneBuilding.com; Image by author

## Phase 1 Shade Study

The Phase 1 design proposal, analyzed for sun/shade in Figure 5.7, creates roughly 1,500 sq ft of valuable shade on site. This is a radical amount of shade in a parking lot that totals about 11,500 sq ft, and does not have any trees or vegetation to provide shade or cooling. Ideally, if the parking lot was retained long-term, the 1,500 sq ft of shade would eventually be a permanent installation, accomplished by several trees along the sidewalk edges of the lot. However, this tactical strategy, which occupies only five parking spaces of thirty total, could provide sufficient shade in the immediate future. Importantly, the structure would shade the 1st Ave sidewalk in the afternoon and evening, when the UVR is most intense.

## Phase 2 Shade Study

The design proposal for Phase 2 introduces a more playful, temporary intervention that also substantially increases shade on the site (see Figure 5.8). With a variety of shade-casting elements, this proposal expands the total area of shade to approximately 2,000 sq ft. The rendering shows that some areas are shaded more significantly by two overlapping shadows, and some areas are less intensely shaded where there are more gaps in the coverage. This mimics the design intent to provide some shade structures that are mobile and can be moved by site users to orchestrate intentional pockets of shade that meet their needs. Overall, it is clear that the design proposals for both Phase 1 and 2 significantly increase valuable shade on this site, temporarily making a portion of the parking lot a cool oasis for pedestrians.

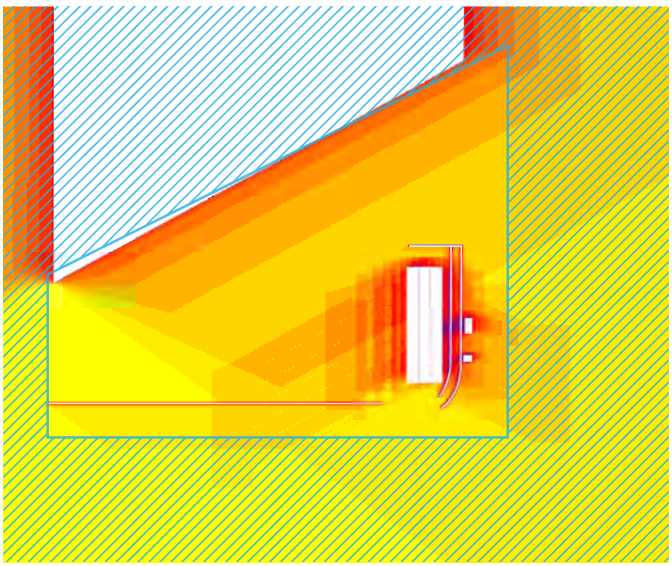


Figure 5.8: Site 2: Phase 1 Shade Study
Sources: Google Earth, Climate.OneBuilding.com;
Image by author

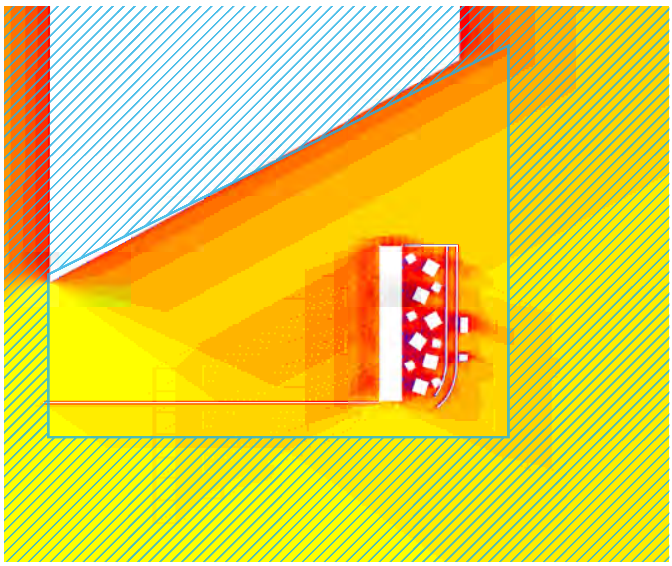


Figure 5.9: Site 2: Phase 2 Shade Study
Sources: Google Earth, Climate.OneBuilding.com;
Image by author

# SITE 3: OTHELLO SQUARE

## Existing Aerial and Area of Analysis

The area of analysis at the Othello Square site in New Holly includes the vacant lot site boundary as well as the sidewalks on three of the four sides of the site. This area totals 48,000 sq ft and will be used to calculate and compare the amount of shade cast in the Existing Conditions, Phase 1, and Phase 2 sun/shade studies.

Figure 5.9 includes an aerial image of the area, the area of analysis, and the basic linework used to create the digital renderings. This graphic provides a reference of the existing conditions that are rendered and referenced in the sun/shade studies (see Figures 5.11, 5.12, and 5.13).

It should be noted that the shadows cast by the buildings in this aerial are not intended: they originate from the Google Earth image and cannot be edited.

## Existing Conditions

The existing elements that cast shade on the vacant site in New Holly include a bus stop, seven street trees, and two six-story buildings to the east and west of the site, which cast large shadows on the vacant site for a considerable portion of the day (see Figures 5.9 and 5.10). The existing shade is approximately 34,000 sq ft within the total 48,000 sq ft area of analysis.

The sun/shade study indicates that the areas that would benefit most from shade implementation include the eastern half of the site, especially the corner closest to the bus stop sidewalk, where the site is least shaded by the buildings. The existing trees were planted around the same time the site became vacant, and have been growing for about 15 years, so the trees provide the MLK Jr Way sidewalk with significant shade.


Figure 5.10: Site 3: Existing Conditions Aerial
Source: Google Earth; Image by author

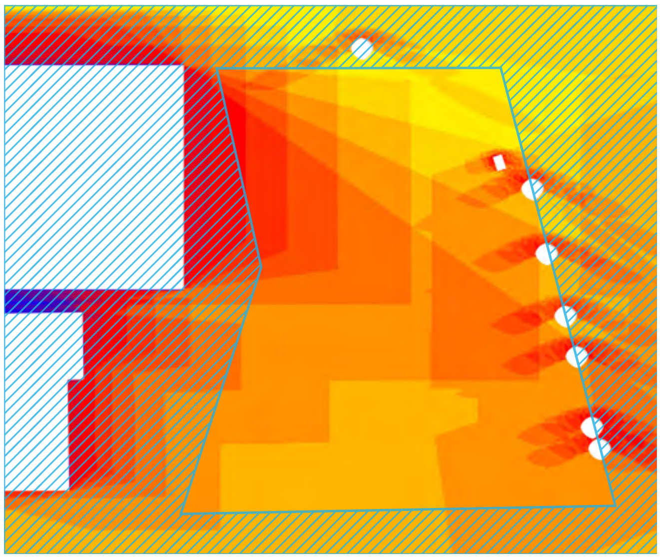


Figure 5.11: Site 3: Existing Conditions Shade Study
Sources: Google Earth, Climate.OneBuilding.com; Image by author

## Phase 1 Sun/Shade Study

The sun/shade study for the Phase 1 design proposal (see the lower left image in Figure 5.11) shows that the sections of constructed canopy increase the shade capacity on site. Due to the changing orientation of the canopy structures as they follow the curvilinear desire path, the structures to the north provide more impactful shade in the morning, while the structures to the south provide impactful shade in both the morning and afternoon. Because the existing buildings cast significant shade in the late afternoon and evening, the shade that the tactical structures provide in the morning and early afternoon is particularly impactful at this site. In total, the tactical shade structures establish and increase the shade on site by approximately 5,000 sq ft. It is important to note that most of the shade provided by Phase 1 overlaps with existing shade, but would still be complementary to reducing thermal discomfort on site.

## Phase 2 Sun/Shade Study

Phase 2 at this site builds on to Phase 1, maintaining the seven canopy structures and adding trees and three additional temporary structures of varying sizes. The sun/shade study (Figure 5.12) indicates the areas where shade has been increased, totaling approximately 3,800 sq ft of shade in Phase 2. The 25 saplings add minimal shade to the site, but they do add life to the vacant site, and demonstrate how the site could be used as a temporary plant nursery. The size and shape of the additional structures for this phase are not fully rendered, as the intention is to have volunteers design and construct them. The current site rendering includes five structures with 8'x12' shade canopies, which is an approximation of what may be constructed. In summary, the sun/shade studies indicate that the design proposals for both Phase 1 and 2 increase shade cover on this vacant lot.

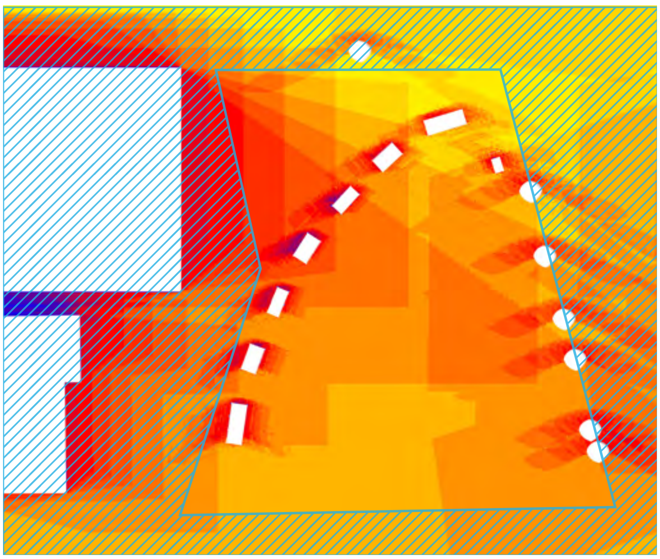


Figure 5.12: Site 3: Phase 1 Shade Study
Sources: Google Earth, Climate.OneBuilding.com; Image by author

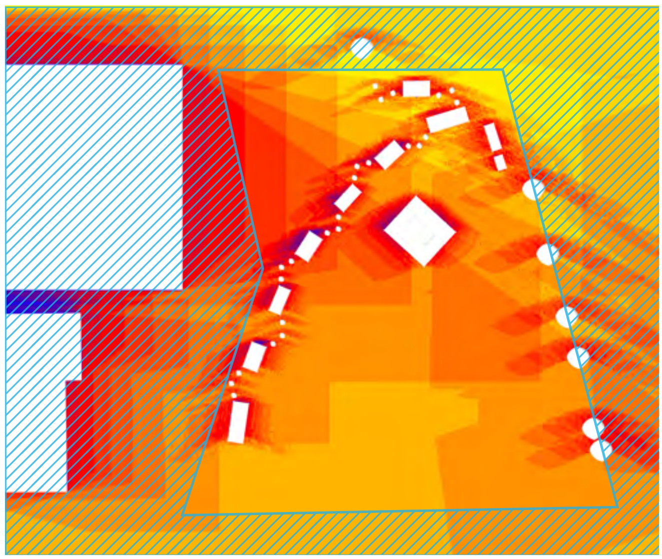


Figure 5.13: Site 3: Phase 2 Shade Study
Sources: Google Earth, Climate.OneBuilding.com; Image by author

# SUMMARY

This sun/shade study analysis has proved that the design proposals increase the amount of shade at all three sites and in all three phases. While Phase 1 at all sites provides the least amount of additional shade, the studies indicate that Phase 2 consistently builds on Phase 1, increasing the amount of shade provided as the phases advance in time. As mentioned in the overview, sun/shade studies were not conducted on the Phase 3 proposals, yet the goal would be for Phase 3 to further increase the amount of shade that Phase 2 provides. Thus, the phased approach demonstrates a sequence of steps toward transforming the built environment to increase shade opportunities and create greater shade equity in the public realm.

The analyses were conducted on the final design proposals as well as several iterations prior to the final designs. In earlier iterations of the sun/shade studies I was able to observe how my designs were performing with casting shade, which ultimately resulted in altering some of the design proposals. Upon seeing the existing shade cast by the tall buildings around the Othello Square site, I opted to shift the location of some of the shade structures to better account for the areas that receive the greatest amount of sunlight during the day. This is a natural element of an iterative process, where one must design then analyze, and adjust the design proposal as needed. In a typical tactical urbanism approach, the structures would have been built and set on-site to observe in context and in real time how the designs fit the space and where they might provide the most impactful shade. Time did not allow for 3-dimensional design prototypes as a part of this investigation. However, modern technology enables designers to digitally render and prototype proposals, which can later be tested with physical structures.

Another observation was that the orientation of any given structure does in fact make a difference as to how much shade it will cast. For example, a rectangular structure with the long end oriented east-west will cast less shade than if it is oriented north-south. The reason for this is related to the angle of the sun and the sun's path that casts less shade when it is at its peak. Therefore the taller a structure and greater its north-south length will cast more shade. All of this is to say that the orientation of the structures matter, and should be taken note of when placing structures to cast a maximum amount of shade.

The chart on the right provides a summary of the areas calculated for sun/shade. The sun/shade studies in this chapter demonstrate that increasing shade through temporary interventions at each of these sites is possible, and would contribute heat relief to site users.

# SUN/SHADE CALCULATIONS

## Site 1: Carleton Ave

| | |
|---|---|
| Area of analysis | = 12,500 sq ft |
| Existing shade | = 3,400 sq ft |
| Phase 1 proposal | + 600 sq ft |
| Phase 2 proposal | + 2,350 sq ft |

## Site 2: Parking Lot 1000

| | |
|---|---|
| Area of analysis | = 14,500 sq ft |
| Existing shade | = 2,000 sq ft |
| Phase 1 proposal | + 1,500 sq ft |
| Phase 2 proposal | + 2,000 sq ft |

## Site 3: Othello Square

| | |
|---|---|
| Area of analysis | = 48,000 sq ft |
| Existing shade | = 34,000 sq ft |
| Phase 1 proposal | + 5,000 sq ft |
| Phase 2 proposal | + 3,800 sq ft |

# 06

# CONCLUSIONS

*“It’s a civic resource, an index of inequality, and a requirement for public health. Shade should be a mandate for urban designers.”*

– Bloch, 2019

# SCALING UP

As extreme urban heat intensifies with climate change, it poses a profound threat to human health and the climate system, necessitating immediate intervention. Research shows that cities experience the most intense impacts of extreme heat, worsened by the urban heat island effect (Hoffman, Shandas, and Pendleton 2020). However, not all urban neighborhoods are affected equally. Low-income neighborhoods and communities of color often face a disproportionate burden. These disparities are frequently rooted in the legacy of discriminatory housing policies, which have shaped the physical landscape of these areas. These neighborhoods tend to lack equitable access to cooling resources and are characterized by a high concentration of impervious surfaces and heat-generating infrastructure, with few mitigating features like mature tree canopies or shaded outdoor spaces.

This thesis demonstrates that tactical urbanism offers a promising strategy to address shade inequity and provide short-term heat relief, while simultaneously laying the groundwork for comprehensive, long-term heat mitigation and adaptation efforts. Through the literature review and precedents, tactical urbanism is articulated as a stopgap measure to catalyze and develop small-scale, low-cost, and short-term design solutions which aim to reduce thermal discomfort in the built environment while advocating and anticipating the implementation of longer-term solutions.

Although extreme heat is the deadliest extreme weather event (Keith and Meerow 2022), there is a notable lack of funding and political will in most cities to take urgent action needed to develop short-term and long-term solutions to this issue. Unlike more visible dramatic climate events like hurricanes or wildfires, extreme urban heat is almost invisible, as it does not cause drastic infrastructure damage but presents severe threats to human health, ecosystems and even economies (Davis 1997; Meerow and Keith 2022). Certainly, heat poses a more significant threat in some cities over others, but climate science predicts that temperatures will continue to rise globally (Calvin et al. 2023), which substantiates that extreme heat will soon be an issue for most cities.

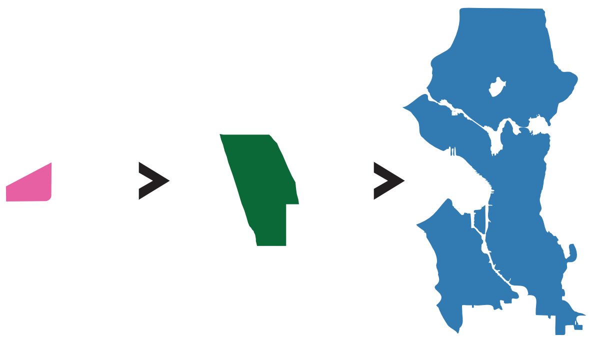
While a fair number of U.S. cities now have heat action plans or heat mitigation strategies, it is uncommon for cities to have short-term or seasonal infrastructure that provide immediate shade or cooling. Given the immense scale of the challenge, plans developed at the county or municipal level are often broad in scope and insufficient on their own. To effectively address extreme urban heat, these plans must be combined with localized solutions and heat relief programs implemented at the neighborhood scale or smaller. This thesis advocates for government agencies to allow and empower the public to implement tactical interventions in the public realm that increase shade and cooling, and for the government agencies to integrate short-term solutions into broader long-term planning efforts to more effectively respond to the urgency of the issue.

The City of Seattle should take note of the City of Phoenix's program to increase shade and transform the production of shade by encouraging artists and citizens to be a part of the shade creation and implementation strategy. This could easily be employed by Seattle, and would be well received by the artistic community. The annual Seattle Design Festival, which brings together designers, community members, and city officials through pop-up events and temporary outdoor structures would be an ideal opportunity to engage the public with shade structure prototypes (AIA Seattle 2025). Held in August, when local heat levels are typically at their highest, the festival provides a timely setting for demonstrating the need for shade interventions.

With the goal of establishing shade as a civic resource shared by all, this thesis argues that urban planners and landscape architects are not the only critical actors for this work. Community organizers, design activists, and government agencies are all called to take action individually and collectively to advance solutions for heat relief through temporary and tactical interventions in the built environment. I have posited that radical shade is achieved through a collaborative effort that brings together citizen tactics and municipal strategies to implement site-responsive and scalable solutions. The tactical and temporary shade structures proposed in this thesis provide uses beyond just a respite from the heat. Tactical installations in the public realm invite people to interact with one another and the space in a different manner, which may create new social connections or social capital amongst site users. With the integration of community organizations and volunteer stewards, the proposed designs offer the chance to build community capacity, and establish stronger social ties in resilience to climate disasters like extreme heat.

This thesis does not suggest that tactical urbanism alone can solve the challenges posed by extreme urban heat. Rather, tactical urbanism represents an initial step in building awareness around this urgent issue and enacting a rapid response that offers tangible shade relief in the public realm. The proposed tactical design interventions serve as catalysts; they spark conversations about extreme heat in our neighborhoods and provide functional heat relief. To support this innovative approach, this thesis includes a Design Phasing Framework (see 01 Introduction, Figure 1.2) which outlines three distinct phases: tactical, temporary, and transformative urbanism. This framework serves as a guide for designers, planners, and activists to build and establish shade as a civic resource. It is designed to shape urgent, short-term responses and to create site- and community-responsive strategies that inform long-term planning efforts aimed at expanding cooling infrastructure and expanding shade equity across neighborhoods.

Future work related to this research might involve a more advanced site suitability assessment, including comprehensive neighborhood-level analysis of existing shade cast at different times of day. This could be assisted by a new national shade mapping tool, published on June 2, 2025, by the UCLA Luskin Center for Innovation and American Forests. This is a groundbreaking new tool that allows anyone to see how much built and natural shade is present in their neighborhood. The tool itself was created to "help federal, state and local decision-makers identify existing "shade deserts" and prioritize investments to mitigate the impacts of extreme heat" (Burstein 2025). Another avenue of further study would be to build select design proposals and analyze their effectiveness in casting shade, including comparisons of temperature differences across various shading materials. While these represent valuable opportunities to scale up this thesis work, I argue that the most impactful next step is to build and test prototypes during the summer, specifically located at interstitial public spaces that lack shade. This active, hands-on approach would not only enable the collection of both measured and observed data, but also demonstrate the value and importance of shade as a civic resource. Through a phased progression of tactical, temporary, and transformative interventions, we can begin to realize the impacts of radical shade in real-world contexts.



# BIBLIOGRAPHY


AIA Seattle. 2025. “Seattle Design Festival.” https://aiaseattle.org/design-in-public-update/

ArcGIS Experience. 2025. “Hazard Explorer: Heat View.” https://experience.arcgis.com experience/2acb05d732134331bc05214740076373/page/Hazard-Explorer/?views=Heat.

Bloch, Sam. 2019. “Shade.” *Places Journal*, April. https://doi.org/10.22269/190423.

Burstein, Mara Elana. 2025. “National Shade Map from UCLA and American Forests Launched to Combat Deadly Urban Heat.” UCLA Newsroom, June 2, 2025. https://newsroom.ucla.edu/releases/national-shade-map-ucla-american-forests-combat-urban-heat.

Calvin, Katherine, Dipak Dasgupta, Gerhard Krinner, Aditi Mukherji, Peter W. Thorne, Christopher Trisos, José Romero, et al. 2023. “IPCC, 2023: Climate Change 2023: Synthesis Report. Contribution of Working Groups I, II and III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, H. Lee and J. Romero (Eds.)]. IPCC, Geneva, Switzerland.” First Intergovernmental Panel on Climate Change (IPCC). https://doi.org/10.59327 IPCC/AR6-9789291691647.

City of Phoenix. 2024. “Shade Phoenix: An Action Plan For Trees and Built Shade.”

City of Phoenix. 2025. “Tree Shade Programs.” https://www.phoenix.gov/administration/departments/heat/tree-shade programs.html.

City of Seattle. 2021. “2021 Tree Canopy Assessment Report. Prepared by the Office of Sustainability & Environment.” Analysis conducted by the University of Vermont Spatial Analysis Lab.

City of Seattle. 2024. “One Seattle Plan.” https://www.seattle.gov/opcd/one-seattle-plan.

City of Seattle. 2025. “Open Data Portal.” https://data-seattlecitygis.opendata.arcgis.com/.

Davis, Mike. 1997. “The Radical Politics of Shade.” *Capitalism Nature Socialism* 8 (3): 35–39. https://doi org/10.1080/10455759709358747.

Day-Melgar, Heather. 2023. “Radical Urban Natures: Mitigating Urban Heat with Nature-Based Techniques in Portland, Oregon.” Dissertations and Theses. https://doi.org/10.15760/etd.3610.

Fielding, Clelie, and Neha Chinwalla. 2024. “Climate Mitigation and Social Well-Being in Urban Design.” University of Washington Green Futures Research and Design Lab. https://greenfutures.be.uw.edu/2023/10/04/climate-responsible city/

Gibbons, Keenan, and Salvador Lindquist. 2024. “Thermal Toolkit: Technologies and Techniques for Visualizing Heat.” Landscape Architecture Foundation, Deb Mitchell Research Grant, 1 (1).

Great Big Story. 2024. “How Grannies Are Saving Spain From a Heat Wave.” YouTube, July 5, 2024. https://www.youtube.com watch?v=9WOeh-BErkw.

Hadj Kilani, Bochra, and Najem Dhaher. 2024. “Tactical Urbanism: From Temporary Action to Sustainable Urban Regeneration.” Qeios. https://doi.org/10.32388/3WQAT5.

Hoffman, Jeremy S., Vivek Shandas, and Nicholas Pendleton. 2020. “The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas.” Climate 8 (1): 12. https://doi.org/10.3390/cli8010012.

Hou, Jeffrey. 2010. “Insurgent Public Space: Guerrilla Urbanism and the Remaking of Contemporary Cities.” Abingdon, Oxon; Routledge.

Keith, Ladd, and Sara Meerow. 2022. “Planning for Urban Heat Resilience.” *Chicago, IL: American Planning Association.*

King County. 2024. “King County Extreme Heat Strategy.”

King County GIS Center. 2025. “King County GIS Open Data.” https://gis-kingcounty.opendata.arcgis.com/.

Kubelka, Vojtěch, Brett K. Sandercock, Tamás Székely, and Robert P. Freckleton. 2022. “Animal Migration to Northern Latitudes: Environmental Changes and Increasing Threats.” Trends in Ecology & Evolution 37 (1): 30–41. https://doi org/10.1016/j.tree.2021.08.010.

Lamm, Theodore E. 2021. “Insurance and Extreme Heat: The Policy Gap.”

Lydon, Mike, and Anthony Garcia. 2015. "Tactical Urbanism Short Term Action for Long Term Change." *Washington, DC: Island Press/Center for Resource Economics*. https://doi.org/10.5822/978-1-61091-567-0_1.

Meerow, Sara, and Ladd Keith. 2022. "Planning for Extreme Heat." *Journal of the American Planning Association* 88 (3): 319–34. https://doi.org/10.1080/01944363.2021.1977682.

Middel, Ariane, Nancy Selover, Björn Hagen, and Nalini Chhetri. 2016. "Impact of Shade on Outdoor Thermal Comfort—a Seasonal Field Study in Tempe, Arizona." *International Journal of Biometeorology* 60 (12): 1849–61. https://doi.org/10.1007 s00484-016-1172-5.

The Morton Arboretum. 2025. "Tree Ambassador Program." Chicago Region Trees Initiative. https://mortonarb.org/plant-and-protect/chicago-region-trees-initiative/tree-ambassador-program/.

National Weather Service. 2025. "What Is the Heat Index?" National Weather Service, May 9, 2025. https://www.weather.gov ama/heatindex.

The Nature of Cities. 2022. "Shade in the City: Rising Heat Inequity in a Sunburnt Era." *The Nature of Cities*, May 9, 2022. https:/ www.thenatureofcities.com/shade-in-the-city/.

People For Bikes. 2016. "Quick Builds for Better Streets."

Pörtner, Hans-Otto, Debra Roberts, Melinda Tignor, et al. 2022. "Climate Change 2022: Impacts, Adaptation and Vulnerability Working Group II Contribution to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change." 10.1017/9781009325844.

Robazza, Guido. 2022. "Temporary Urbanism: Innovative Tactics for the Co-Production of Social Resilience." ProQuest Dissertations & Theses. https://www.proquest.com/docview/2796749631.

Rosso, Federica, Benedetta Pioppi, and Anna Laura Pisello. 2024. "Tactical Urban Pocket Parks (TUPPs) for Subjective and Objective Multi-Domain Comfort Enhancement." *Journal of Environmental Management 349* (January):119447. https:/ doi.org/10.1016/j.jenvman.2023.119447.

Seattle Department of Transportation. 2017. "Pavement to Parks." *Streets Illustrated*. Last updated July 17, 2017. https:/ streetsillustrated.seattle.gov/urban-design/adaptive-design/pavement-to-parks/.

Seattle Department of Transportation n.d. "Seattle Streets Illustrated: Street Types Map." https://seattlecitygis.maps.arcgis.com/apps/webappviewer/index.html?id=dfeed51c66334b10a82e7a23dc42086f

Seattle Office of Planning and Community Development. 2023. "Outside Citywide Public Space Explorer."

Seattle Office of Planning and Community Development. 2023. Racial and Social Equity Composite Index (Current). https:/ data-seattlecitygis.opendata.arcgis.com/datasets/SeattleCityGIS::racial-and-social-equity-composite-index-current about. https://experience.arcgis.com/experience/0c24ee3cd61243c2b0bc35a853cf355f

SODO BIA and MxM Landscape Architecture. 2024. "SODO Green Space Plan." https://sodoseattle.org/greenspace-plan/.

Speak for the Trees, Boston. 2025. "Home." https://treeboston.org/.

Stevens, Quentin, and Kim Dovey. 2022. Temporary and Tactical Urbanism: (Re)Assembling Urban Space. 1st ed. New York: Routledge. https://doi.org/10.4324/9781003284390.

Thompson, Andrea. n.d. Scientific American. https://www.scientificamerican.com/article/summers-are-hotter-than-ever and-are-only-going-to-get-worse/.

Toronto Cancer Prevention Coalition. 2010. "Shade Guidelines."

U.S. Environmental Protection Agency. 2023. "Heat Island Community Actions Database." Last updated August 14, 2023. https://www.epa.gov/heatislands/heat-island-community-actions-database.

Wanderbaumallee Stuttgart. 2025. "Wanderbaumallee Stuttgart." https://www.wanderbaumallee-stuttgart.de/.

Whyte, William. 1980. "The Social Life of Small Urban Spaces."

Wilson, Bev. 2020. "Urban Heat Management and the Legacy of Redlining." *Journal of the American Planning Association* 86 (4): 443–57. https://doi.org/10.1080/01944363.2020.1759127.