



# Centering Equity to Address Extreme Heat

## Preparing Communities for Hotter Days

*Rebecca Marx and Jorge Morales-Burnett*

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**Extreme heat cannot be addressed without considering equity. Its impact is not felt equally across communities. The legacy of racist housing policies and historic disinvestment in low-income neighborhoods and communities of color leaves low-income populations and people of color both more likely to live in hotter neighborhoods and less likely to have access to resources to cope with extreme temperatures. Recognizing this reality, President Biden is committed to working with states and local communities to deliver 40 percent of overall benefits of federal investment in climate and clean energy to communities that have been historically marginalized and underserved through the Justice40 Initiative.<sup>1</sup> But even as new investments are made, they may not be the ones residents want or result in intended outcomes. Equity must be central to the whole process of addressing extreme heat to ensure desired and equitable outcomes.**

Extreme heat is the number one most deadly weather-related event in the United States and, until now, has been one of the least talked about. In September 2021, President Biden recognized the seriousness of the threat by launching the Interagency Working Group on Extreme Heat to support the Build Back Better agenda.<sup>2</sup> Meanwhile, heat has gained wide media attention and dedicated discussions at COP26.<sup>3</sup> Heat waves are not named and ranked like other less deadly but more visible natural disasters, such as hurricanes, but there is a movement to start doing so. Advocates say naming heat waves could raise awareness of their danger.<sup>4</sup>

Although extreme heat has tremendous implications for people everywhere, including outdoor workers in rural areas, the focus of this brief is on its impacts in urban areas—both small and large—where denser concentrations of pavement, buildings, and other materials retain heat. In many communities, heat risk is not widely understood. It differs from place to place, city to city, and neighborhood to neighborhood. People in regions that have not historically experienced extreme heat might not even think it’s a problem, but it’s going to be.

As urban communities of all sizes in all geographies grapple with extreme heat challenges, policy makers, local government managers and staff, nonprofit organizations, community-based organizations, and institutions such as universities can glean lessons from communities that are already taking an equity lens to the extreme heat issue.

In this brief we consider the following questions:

- Why do local governments and their partners need to think about equity in the context of extreme heat?
- What are local governments and their partners doing to prepare for extreme heat?
- How do local governments and their partners center equity in their approaches to addressing extreme heat?
- How are communities funding extreme heat–related interventions?

We looked across three possible workstreams that communities can undertake to address extreme urban heat. Table 1 lists examples of how cities and counties are working across the three interconnected workstreams and highlights approaches communities have taken to planning, implementing, and funding their heat equity work. These examples are expanded throughout the brief.

**TABLE 1**  
**Urban Heat Workstreams**

*Community-level approaches to addressing extreme heat*

<b>Assess community vulnerabilities</b>	<b>Build emergency preparedness capacity</b>	<b>Adapt and mitigate through planning and design</b>
<ul style="list-style-type: none"> <li>▪ Mapping the problem</li> <li>▪ Listening to community members</li> </ul>	<ul style="list-style-type: none"> <li>▪ Raising public awareness</li> <li>▪ Preparing warning systems and emergency responses</li> <li>▪ Building cooling infrastructure</li> <li>▪ Providing utility assistance</li> </ul>	<ul style="list-style-type: none"> <li>▪ Greening buildings and cooling infrastructure</li> <li>▪ Financing weatherization</li> <li>▪ Forming urban forestry and tree canopy goals</li> <li>▪ Upgrading energy infrastructure</li> <li>▪ Changing land use and development practices</li> </ul>

**Source:** Authors’ analysis.

In addition to academic literature, media releases, practitioner websites, and city planning documents, the brief is based on eight semistructured interviews of city, county, and federal

government officials as well as representatives from the academic and not-for-profit field. It specifically draws on lessons learned from heat resilience efforts in Baltimore, MD; Boston, MA; Clarksville, IN; Miami-Dade County, FL; Phoenix, AZ; and Richmond, IN.

## Extreme Heat Trends

The risk from extreme heat is growing. Climate change has raised average temperatures as well as the frequency, intensity, and duration of extreme heat events (IPCC 2021a; Perkins-Kirkpatrick and Lewis 2020). Heat is also increasingly an urban problem. The urban heat island (UHI) effect traps heat in urban centers, making them considerably warmer than surrounding rural areas. This effect occurs for multiple reasons, including the dense concentration of tall buildings; a high prevalence of materials that absorb heat, such as concrete; and low vegetation (IPCC 2021b).<sup>5</sup> The growth of global urbanization is also expected to make heat waves more frequent in certain conditions (Liao et al. 2018; Wu et al. 2020).

The greatest risk from extreme heat is to public health, because extreme heat is the deadliest of all weather-related hazards and can also contribute to health issues such as respiratory difficulties, heat cramps, heat exhaustion, and nonfatal heat stroke (Hondula et al. 2015).<sup>6</sup> Heat can have detrimental impacts on people's mental health and increase violence and crime (Anderson 2001; Hansen et al. 2008; Heilmann, Kahn, and Tang 2021; Thompson et al. 2018). Heat has also had negative implications for the economy by reducing productivity (Watts et al. 2018); for infrastructure by increasing the risk of power outages due to increased energy consumption (Stone et al. 2021); and for the environment by increasing energy consumption (and thereby increasing greenhouse gas emissions) and increasing water temperature, which can be fatal for aquatic life (Santamouris 2020; Somers et al. 2016). Further, because of global warming, regions that are not used to experiencing extreme heat and lack the infrastructure to cope with it will now become particularly vulnerable, as shown by the recent experience of extreme temperatures in the Pacific Northwest (Philip et al. 2021). These risks could be made worse by overlapping hazardous events, such as a storm that knocks out power followed by a heat wave.

In 2021, most cities surveyed said heat is not specifically addressed in their sustainability, resilience, or climate action plans (Meerow and Keith 2021). Heat is not an issue that has historically been owned by anyone: no local government departments such as health, emergency, planning, or parks and recreation have been tasked to address heat. That situation is beginning to change with more local governments dedicating resources to staff to focus on heat and bridge department efforts. Heat is a pernicious, crosscutting issue, yet many local government departments do not understand how their work relates to heat. Although heat resilience is a growing field, other risks or needs often get prioritized for limited resilience funding.

# Why Communities Need to Focus on Equity When Addressing Extreme Heat

Heat risk is not experienced equally within communities. Structural racism, income inequality, occupations, and health conditions influence city residents' abilities to cope with heat risks. Historic practices such as segregation and redlining, which led to underinvestment in neighborhoods of color, led to communities of color and low-income populations living in neighborhoods with less green space and higher concentrations of large building complexes made of dense, heat-absorbing materials. These practices resulted in higher temperatures but lower access to cooling (Hoffman, Shandas, and Pendleton 2020; Jesdale, Morello-Frosch, and Cushing 2013). Populations with low incomes are also more likely to live in lower-quality housing and are less likely to be able to afford air conditioning without public assistance (Chen, Ban-Weiss, and Sanders 2020; Farbotko and Waitt 2011). Paying for air conditioning can be a financial burden for populations that are already cash strapped. Regardless of spatial differences in temperatures, populations that are particularly vulnerable to the health impacts from heat include the elderly, children, outdoor workers, people with existing medical conditions, and people experiencing homelessness.<sup>7</sup>

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*It is hard to effectively plan to mitigate heat without planning for equity because it so disproportionately affects people with lower incomes.—A local stakeholder*

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Equity is a primary principle of heat governance (Keith et al. 2021). Interviewees stressed that heat strategies should target the neighborhoods that are the hottest and are home to vulnerable populations, particularly low-income communities of color. They emphasized the need to incorporate community voices in planning and implementation processes and to be mindful of the unintended impacts of certain interventions. Centering equity in climate or hazard mitigation plans is a relatively new approach, but it is gaining traction. Meanwhile, national funders have incorporated equity and environmental justice considerations in their grant applications. The appendix collects the equity suggestions offered throughout this brief that practitioners, academics, and funders can consider as they develop and implement extreme heat interventions.

Given that it is impossible to separate equity from addressing extreme heat, in this brief we outline how equity can be at the center of the three workstreams communities are undertaking to address extreme heat. We consider equity through its multiple dimensions, as other researchers have done (Junod et al. 2021). These dimensions respond to the following questions:

- **Recognition equity:** Are historical inequities being addressed and the views of marginalized populations being respected? (McCauley et al. 2013)

- **Reparative equity:** Are the conditions of a specific group being improved? (Palmer, McShane, and Sandler 2014)
- **Procedural equity:** Who is involved in the process of decisionmaking? Are such processes representative and transparent? (Bullard 2005)
- **Distributive equity:** Who is benefitting? How disparate are the benefits and harms? (Martín and Lewis 2019; Svava and Brunet 2005; Taylor 2000)

## Planning and Implementing Your Heat Equity Work

Choosing the right approach to address extreme heat takes time and effort. To arrive at crucial decisions, local governments are reconfiguring how heat resilience efforts are governed and are developing plans to carry them out. As local governments begin to address extreme heat, some communities are hiring dedicated staff to support plan development and help ensure an equitable approach.

### Hiring Dedicated Staff

The existing literature on heat planning recognizes a shortfall of governance capacity as a main barrier to following through on local government strategies (Keith, Meerow, and Wagner 2020; Koop et al. 2017). Indeed, although planners from around the country indicate a multitude of barriers, they emphasize governance or institutional factors as most significant. In order of significance, these barriers include lack of funding and staff time; low prioritization relative to other issues; lack of leadership; lack of public support; lack of knowledge of existing information and heat strategies; and lack of coordination between agencies and jurisdictions (Meerow and Keith 2021). Perspectives from interviewees, including local actors, researchers, and funders, reflect the literature regarding key barriers. One interviewee explained that, without adequate staff capacity, it is hard for city leaders to be engaged with the extreme heat issue and with community members.

Dedicating staff to the heat issue can potentially improve coordination and accountability, as managing heat shocks and stressors generally does not entirely fall under one person's purview (Mees, Driessen, and Runhaar 2014). Given that the impacts from heat span multiple sectors, dedicated staff can help bridge a gap in coordination between city government departments, neighboring jurisdictions, and vertical levels of government, as well as with private-sector stakeholders (Keith et al. 2021). For example, dedicated staff can ensure synergy between emergency management, health and human services departments, planning departments, and nonprofits serving people experiencing homelessness during a heat wave. Local government heat staff interviewed tended to work frequently with planning departments, parks departments, emergency management departments, and public health departments, among others.

As with many issues, but particularly with climate action, large cities tend to have greater capacity than smaller cities to hire staff (Schilling and Velasco 2020). In fact, the survey from Meerow and Keith (2021) indicated that although only 8 percent of cities have dedicated staff for heat work, the rate is

20 percent for large cities, 6 percent for small cities, and 4 percent for medium cities. But interviews revealed that staff can be important in smaller cities, too, where some have been able to engage with community members on a personal level.

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*If you really want to say that something is important, you have to give someone that role and only that role.—A local stakeholder*

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Miami-Dade County became the first locality in the world to assign a Chief Heat Officer (box 1). The City of Phoenix later established the Office of Heat Response and Mitigation to develop a strategic action plan around heat. Smaller cities and towns like Clarksville and Richmond, Indiana, have also assigned heat coordinators thanks to the statewide Beat the Heat program, which offers two years of funding for the position and for the development of a heat relief strategy and response protocol (box 2).

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#### BOX 1

##### **The World's First Chief Heat Officer**

Miami-Dade County made news in 2021 by appointing the world's first Chief Heat Officer to expand and coordinate the county's efforts on extreme heat. The Chief Heat Officer is tasked with convening a climate and heat task force, developing a vulnerability analysis, and producing a framework for the county's heat interventions.

The task force will include municipal partners, key county departments, the National Weather Service, universities, community-based organizations, and people with lived experience. The purpose of the framework is to serve as a strategy that integrates the various actions across the county (and within its municipalities), monitors progress, and helps prioritize actions in the future. The goal is for the framework to be dynamic and adaptive to changing times.

Prior to this work, the county developed an Extreme Heat Toolkit to “provide a high-level briefing of various policy and project options identified by our community to adapt to and mitigate extreme heat.”<sup>a</sup>

<sup>a</sup> “Extreme Heat,” Miami-Dade County, accessed December 15, 2021, <https://www.miamidade.gov/global/economy/environment/heat.page>.

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## **Developing a Coordinated and Sustainable Plan**

Most cities address heat across multiple plans including climate action plans, emergency response plans, comprehensive plans, and hazard mitigation plans (Meerow and Keith 2021). That is, most cities do not address heat with a single plan. Some interviewees noted that heat is not included in their

communities' hazard mitigation plan, which limits their ability to request funding for emergency response. Some communities are now expanding heat elements within broader plans, and communities that did not previously have protocols to manage heat or implement projects are developing complementary strategic heat action plans. Community-wide heat plans, as one interviewee commented, should serve as an umbrella or guiding document to better coordinate efforts across jurisdictions and provide a system for tracking and measuring progress.

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## BOX 2

### Beat the Heat program in Clarksville and Richmond, Indiana

The State of Indiana's Office of Community and Rural Affairs and Indiana University's Environmental Resilience Institute launched the Beat the Heat program to support local governments in developing a strategy for extreme heat. The program is currently providing both Clarksville and Richmond two years of funding, primarily for the salary of a heat relief coordinator. The heat coordinator's role is to engage residents to assess their community's heat risk; develop educational materials; develop a heat relief strategy and response protocol; and consider the long-term sustainability of the heat management program so the work can continue after the two-year grant-funded position ends.<sup>a</sup>

The Beat the Heat program established the following phases:<sup>b</sup>

- **Phase 1:** Establish a community-led Heat Relief Task Force and hire a heat relief coordinator.
- **Phase 2:** Assess community needs through surveys, focus groups, and public observations; coordinate a Heat Watch Campaign to develop a community heat map by recording air temperatures; and develop a protocol for identifying high levels of heat.
- **Phase 3:** Develop a heat management strategy based on the information collected in phase 2; share findings from the heat map effort and collect input on the proposed strategy; and work with emergency management to develop a heat response protocol to prepare for and respond to extreme heat events.
- **Phase 4:** Implement the strategy; share educational materials with residents; and, because the program is temporary, develop a continuity plan.
- **Phase 5:** Survey residents to assess how effective the Beat the Heat program was in their community and finalize the continuity plan.

<sup>a</sup> "Helping Hoosiers Cope with Extreme Heat," Indiana University, Environmental Resilience Institute, accessed December 15, 2021, <https://eri.iu.edu/who-we-work-with/local-governments/beat-the-heat.html>.

<sup>b</sup> "Beat the Heat," Town of Clarksville, Indiana, accessed December 15, 2021, <https://www.townofclarksville.com/residents/beat-the-heat/>.

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To start the process of plan development, community leaders are undertaking vulnerability assessments consisting of community mapping campaigns, focus groups, and surveys to better understand the needs of their residents. In some places, this work is undertaken with the help of dedicated heat resilience staff. Plan development can be guided by task forces with representation from across sectors and people with lived experience coping with heat or with high vulnerability to extreme heat. Local governments are engaging subgroups that are particularly vulnerable to extreme

heat, such as outdoor workers and K-12 students participating in outdoor athletics, as well as government entities and nonprofit organizations that could help coordinate heat programs. Such engagement is expected to strengthen plans by grounding them in reality. Community engagement can also build awareness of the existence of plans, which could help residents access heat programs and their benefits once they are implemented.

## Developing an Approach to Extreme Heat

Local governments are at different stages of addressing extreme heat and are taking different approaches. Multiple interrelated workstreams in collaboration with local or regional partners are necessary to provide the fullest, most equitable approach. Historically, communities have not necessarily approached heat in the order of activities covered in this brief. For example, some cities that are developing urban forestry interventions have not developed vulnerability assessments (Meerow and Keith 2021). Furthermore, cities that have developed in heat, like Phoenix, may be further ahead in terms of cooler infrastructure, such as light-colored materials for streets and roofs, than other cities.

In developing their community-wide extreme heat strategy, communities should integrate the following three interdependent workstreams:



**Assess community vulnerabilities:** Cities need not only to understand where temperatures will be highest, but also what the experiences of vulnerable community members will be, and if they have access to cooling resources.



**Build emergency preparedness capacity:** Cities need to be prepared to support community members when it is deadly hot.



**Adapt and mitigate through planning and design:** Cities can do more to design housing, neighborhoods, and infrastructure in ways that will reduce UHI impacts.

In the following sections, we expand on each of these workstreams; summarize the types of heat interventions we are seeing across cities that fall into each stream; and recommend ways practitioners, policymakers, and funders can bring an equity lens to extreme heat interventions.



## Assess Community Vulnerabilities

As cities decide where to commit scarce resources, they will need to better understand how heat impacts their communities. Mapping heat, vulnerabilities to heat, and access to cooling resources can help cities decide which neighborhoods to target for interventions. Such studies can also help the urban resilience field by drawing attention to the nuances of how the UHI effect plays out in different climates and urban configurations.



## Mapping the Problem

Mapping is important because of the hyperlocal nature of heat risk, which has been shaped by past and current planning and development decisions. Heat risk varies from neighborhood to neighborhood, depending on factors such as building density, materials, and green space; and heat vulnerabilities tend to map closely to historic inequities in cities, like redlining (Hoffman, Shandas, and Pendleton 2020). For example, in Baltimore, researchers found that redlining policy influenced the location of investments in parks and the allocation of street tree plantings (Locke et al. 2021). In Boston, public presentations of the city-sponsored heat study have featured redlining maps and heat vulnerability maps side-by-side to demonstrate the correlation and the racial injustice. Boston is targeting its heat resilience work to historically underserved communities because, like many cities, its history of disinvestment and more crowded conditions in neighborhoods with a higher share of low-income populations mean those neighborhoods are dealing with worse conditions in extreme heat.

Communities across the country are undertaking heat mapping campaigns to help them understand heat risks (box 3). Some are in the form of citizen science campaigns in which members of the community participate in measuring temperatures. This is the approach supported by the National Integrated Heat Health Information System's and Climate Adaptation Planning and Analytics' heat island mapping campaigns, which have supported mapping in more than 40 communities over the past five years.<sup>8</sup> In the past, vegetation maps were the most common form of heat information, but the most accurate measurement in terms of understanding how residents feel is air temperature (as opposed to surface temperature). According to interviewees, some methods also account for humidity, sunlight, and other factors that can affect how residents experience heat. Climate scientists continue to explore ways to measure air temperature more accurately (Conlon et al. 2020). Communities are now looking for creative ways to merge information to understand how residents feel during a heat wave.

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### BOX 3

#### **B'More Cool: Predicting Local Air Temperatures and Health Burdens**

In Baltimore, planners and community resilience experts in the city government, climate scientists and health experts from Johns Hopkins University, and designers from the Maryland Institute College of Art collaborated through the B'More Cool initiative to deploy low-cost temperature and humidity sensors across heat-affected neighborhoods. The temperature measurements were merged with other data sets, such as high-resolution satellite estimates of vegetation cover, albedo, and topography; skin temperature data from Landsat, ASTER and MODIS sensors; and GIS information on infrastructure and human demographics. The combined data were used to define regression models that predict local air temperature as a function of the natural and built environment. The measurements can also be combined with indoor air temperature measurements in homes of residents who suffer from chronic obstructive pulmonary disease or asthma to assess the health burden of localized heat.<sup>a</sup>

<sup>a</sup> "B'More Cool: Monitoring the Urban Heat Island at High Density for Health and Urban Design," IEEE Earthzine, February 23, 2016, <https://earthzine.org/bmore-cool-monitoring-the-urban-heat-island-at-high-density-for-health-and-urban-design/>.

Communities can map more than just temperature. They also need to have a clearer picture of the distribution of green amenities and opportunities for cooling across neighborhoods. For example, one interviewee mentioned that in Baltimore there is legwork to be done to identify what buildings could serve as cooling centers based on their frequency of availability and on being within walking distance of vulnerable populations. Similarly, knowing what populations have access to air conditioning and can stay cool at home will contribute to siting decisions for public cooling options. Other data are being tracked as well; for example, in Baltimore County, residents can report where they have planted trees.<sup>9</sup> Communities across the country are completing tree inventories in preparation for urban forestry plan updates or creations. For example, Boston's first citywide tree inventory launched in 2021.<sup>10</sup>

## Listening to Community Members

Beyond locational factors, cities are trying to better understand how residents experience heat. In some cases, this is done through community needs assessments or heat resilience studies. Inputs to these assessments may include focus groups, surveys, casual conversations with residents in public spaces, and other creative tools for attaining information from residents. Focus groups can help city staff understand the personal implications of extreme heat and how community members are struggling. Such efforts can be less centered on where efforts should be targeted and more focused on ensuring that the city is talking to the right people to decide how to support communities. Some cities, such as Clarksville and Richmond, Indiana, have designed focus groups for specific populations that are impacted by heat (box 4). In Miami-Dade County, government staff are leveraging interviews and focus groups already conducted by community-based organizations to understand community members' vulnerabilities and needs. Future focus groups will be held to ensure proper messaging.

Although focus groups and conversations have been helping cities decipher what residents do and do not want, some cities have come up with governance structures to ensure that the voices of community members are recognized and that there is follow-through on their input when it comes time to make decisions. For example, in Miami-Dade County, the Climate and Heat Health Task Force, which includes municipal partners and representatives from the National Weather Service, the Department of Health, universities, and community-based organizations, also has two spots for residents with lived experience. The task force has held talks in the community about inclusion.

Surveys can be made available in multiple languages and intentionally targeted to the most vulnerable subpopulations. In Clarksville, for instance, the city works with community organizations that serve specific populations, such as low-income residents, senior residents, and the Hispanic/Latino community. In Richmond, the city has reached out to the Hispanic/Latino populations to make sure messaging is inclusive, because some communities have not been addressed in ways they could understand in the past. City staff are trying to connect with as many individuals in as many sectors as possible. They are physically going to neighborhoods to make sure people know about the survey, are getting information, and are having their voices heard. Staff will talk to residents anywhere—at the farmer's market or a gas station—a benefit of being in a smaller city where staff might be able to connect with people on a personal level and ensure a community stake. Surveys can also be used to provide additional information, such as links to resources, as Boston did in its survey (box 5).

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## BOX 4

### Focus Groups with Heat-Vulnerable Populations in Clarksville and Richmond, Indiana

In Clarksville and Richmond, Indiana, the community needs assessments involve eight focus groups with different affected populations: (1) government employees who will plan and implement the heat response protocol, to understand how heat is currently addressed in the cities; (2) outdoor workers, mostly in construction; (3) senior residents living in assisted settings; (4) seniors not living in assisted settings; (5) parents, to see, for example, if parks can be improved to serve families better; (6) Hispanic and Latino community members who may be more impacted by heat, particularly in Clarksville, where this population predominantly lives in proximity to a highway and a commercial area; (7) mobile home park residents; and (8) high school athletes, to understand how they manage heat in practice and games.

The goal of the focus groups and other community engagement activities is to understand how the communities are being affected and to hear what resources community members would like to be made available. Local governments and their partners are asking residents questions such as, “Do you touch base with your neighbors during heat waves?” and “Do you have access to green space?” To try to make focus groups more accessible, the Beat the Heat program provides meals, Spanish translation, and child care for some focus group participants.

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## BOX 5

### Preparing for heat in Boston: Tools to Engage Residents

The City of Boston funded a heat resilience study that focused on the city’s most vulnerable neighborhoods. One data collection tool for this study, the Boston Heat Resilience Study survey, is available on the city’s website.<sup>a</sup> In addition to the survey, the city website hosts a tool that lets residents map their experience by marking hot spots and cool spots; in a separate tool, residents can create a comic of their experiences during very hot weather.

The survey includes questions such as the following:

- When it is very hot outside, how often do you use your air conditioning in your home?
- If you leave your home to stay cool, where do you go?
- What are your main sources of information in your community?
- Is there anything about your neighborhood (current or historic issues) that has made it hotter than other places you experience in the City of Boston?

Throughout the course of the heat resilience study, city representatives went to specific neighborhoods and asked residents to participate. They were mindful about hosting working sessions after business hours and providing translation services in multiple languages.

<sup>a</sup> “Preparing for Heat,” City of Boston, accessed December 15, 2021, <https://www.boston.gov/departments/environment/preparing-heat>.

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*We need to ensure we are talking to the right people—putting in effort to make sure people have the space to give us their voice. It's easy to talk to people who have air conditioning and are willing to take the survey, but they aren't the people who need to be heard.—A local stakeholder*

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#### **EQUITY CONSIDERATIONS: ASSESS COMMUNITY VULNERABILITIES**

Here is what practitioners, academics, and funders can keep in mind to center equity when considering the best course for assessing community vulnerabilities.

- **Recognitional equity: Are historical inequities being addressed?**
  - » Fully recognize and respect the views of populations that have suffered compounding disparities due to past policies, such as redlining.
  - » Make heat-related messaging available in multiple languages and appropriate for multiple cultures, recognizing that past messaging with inappropriate language may not have been interpreted as intended.
- **Reparative equity: Are the conditions of a specific group being improved?**
  - » Target the most heat-vulnerable communities for surveys, focus groups, casual conversations, and, ultimately, interventions.
- **Procedural equity: Who is involved in the process of decisionmaking? Are such processes representative and transparent?**
  - » Include community members in the citizen science campaigns.
  - » Actively engage community members and listen to their input when designing interventions.
  - » Make meetings and focus groups accessible to participants by providing services, such as translation, child care, and meals.
  - » Create structures, such as task forces and advisory groups, that allow local residents with lived experience to have a seat at the decisionmaking table.
- **Distributive equity: Who is benefitting? How disparate are the benefits and harms?**
  - » Assess the existing conditions and plans through mapping and conversation to understand who is bearing the cost of heat to ensure that intervention benefits reach vulnerable populations.
  - » Design processes that engage vulnerable community members to ensure that vulnerable populations are not excluded from the benefits of interventions.

- » Implement programs that use targeted focus groups to find out what community members do *not* want: listen for the unintended consequences of interventions that appear harmless at the surface.



## Build Emergency Preparedness Capacity

Communities need to be prepared to respond rapidly to an extreme heat event to keep residents, particularly vulnerable populations, adequately cool. There is also a need to be prepared for managing multiple simultaneous events; for example, the risk of a power outage during an extreme heat event is increasing and can hit vulnerable populations particularly hard (Stone et al. 2021). Heat emergency preparedness strategies include public awareness building, warning systems, emergency response procedures, cooling infrastructure, and utility assistance (Berisha et al. 2017). Recent efforts from the jurisdictions interviewed focused on the following actions: raising public awareness on heat risks; establishing warning systems to alert the public about excessive heat events; providing readily available cooling, such as cooling centers, fans, and water; and assistance to cover electricity costs during a heat event.

### Raising Public Awareness

The public should be informed about the risks from heat and the resources available in their community. Interviewees said that lack of public awareness of heat risks was a critical barrier to ensuring residents' safety during extreme heat events and that funding rarely existed for public education campaigns. With a changing climate, communities cannot assume that temperatures will be the same as in the past. It is important to make people aware of risks in places that are not traditionally thought of as hot and to anticipate where heat is going to become a bigger problem. Only 38 percent of cities reported using information and awareness as a strategy to address heat (Meerow and Keith 2021). In contrast, Boston offers extensive health guidance on its website on how to keep cool during heat events by posting fact sheets translated into different languages; tips on managing various heat-related challenges, such as keeping children safe; city resources; and the location of places to stay cool, such as cooling centers, pools and tot sprays, and community pools.<sup>11</sup>

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*The number one thing we hear from residents... is that they want to learn more. People want to understand why things are getting warmer, what is the UHI effect, how does it affect them, how can we mitigate it, how can we adapt to it.—A local stakeholder*

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Information campaigns should use multiple forms of communication, as well as careful messaging to best reach specific audiences. For example, one interviewee noted that outdoor workers were not receptive to being called a “vulnerable population,” and another interviewee said that some people may be more receptive to messaging around public health than messaging that emphasizes the climate crisis. Clarksville and Richmond, Indiana, have used their community mapping projects not only to collect data and better understand their local UHIs but also as an opportunity to draw attention to the heat vulnerabilities identified through conversations with community members. Richmond is reaching out to the members of its community most vulnerable to heat—including the elderly, youth, and communities of color—to ensure that its heat-related messaging is inclusive and in a language that is understandable.

## **Preparing Warning Systems and Emergency Responses**

The National Weather Service issues different forms of alerts, such as excessive heat warnings or heat advisories, to alert the public on potentially dangerous heat.<sup>12</sup> Baltimore established Code Red Extreme Heat as an emergency response protocol to alert the public about the danger.<sup>13</sup> However, as one interviewee noted, in urban contexts heat index readings by the National Weather Service to trigger a heat alert can be inaccurate because they occur in the periphery of the city, where the temperatures are cooler; these inaccurate representations of what heat is actually like within the city can be “a matter of life or death.”

Emergency response actions are one of the most common heat strategies implemented across cities (Meerow and Keith 2021). In the case of Code Red Extreme Heat, heat alerts trigger emergency responses, such as conversion of public facilities to cooling centers and protocols for transporting residents to such cooling centers. Information is also shared on how to stay cool. Miami-Dade County became the first local jurisdiction to announce a “Heat Season,” which will run from May 1 to October 31, 2022.<sup>14</sup>

## **Building Cooling Infrastructure**

Communities have established facilities with air conditioning for residents to go to during a heat emergency. Cooling centers can be set up in buildings like libraries, community centers, schools, and small businesses. Similarly, cities like Baltimore and Boston use pop-up cooling by incorporating coolers, fans, or shade at bus stops and social service lines. Some cities are also leveraging resilience hubs, neighborhood centers that provide various resources to residents to withstand a wide range of hazards, to incorporate cooling. Resilience hubs are established in partnership with organizations that are trusted in their communities and are typically located in communities that are considered to have high vulnerability to hazards. But some interviewees noted that not everyone wants to use cooling centers. Cooling centers can be limited in number and can therefore be too far away for use by many. Similarly, because of the COVID-19 pandemic or other reasons, some residents may prefer to have cooling services at home, such as air conditioning or fans.

Although no interviewees specifically mentioned the need for water fountains, they did mention the need for water generally. Residents in some communities indicated a preference for more water

access, such as splash pads, misting stations, and access to their local community pool. In Baltimore, resilience hubs that could accommodate social distancing were used to offer water to residents early in the pandemic.

## Providing Utility Assistance

In some places, residents have to think about the trade-off between running their air conditioning and paying the bill, according to an interviewee. Some programs exist to help residents cover the cost of energy. For example, the Low-Income Home Energy Assistance Program website is linked as a resource in the same portal where Boston's online heat survey is posted. But in Richmond, IN, an interviewee noted that although the Low-Income Home Energy Assistance Program provides energy support throughout the winter, it rarely extends into the summer. Similarly, the weatherization assistance program website linked in the Boston Heat Resilience Study survey mentions support for heat system repairs, but not air conditioning repairs.<sup>15</sup> Utility regulations can be used to protect residents from the potential financial burden of heat events. For example, Phoenix is trying to control for high energy bills through a state law that regulates when utilities can be shut off due to delinquent payments—protecting customers who have not paid their bills but only owe a few hundred dollars.<sup>16</sup> Some Boston stakeholders are thinking not about financial assistance to pay for cooling during emergencies but about building the physical capability to transfer cool air through a geothermal network.<sup>17</sup> Networked geothermal energy with microdistricts could allow different energy users to exchange hot and cool air in order to move cool air from members who can pay for it to those who cannot, according to an interviewee.

### EQUITY CONSIDERATIONS: BUILD EMERGENCY PREPAREDNESS CAPACITY

Here is what practitioners, academics, and funders can keep in mind to center equity when considering the best course for building emergency preparedness capacity to deal with extreme heat.

- **Recognitional equity: Are historical inequities being addressed?**
  - » Improve access to critical resources, acknowledging the ways historic policies like redlining and segregation continue to contribute to limited access for many residents, and the preferences of residents who currently lack cooling.
  - » Create educational and emergency-related messaging that historically misinformed or underinformed populations will be receptive to, being sensitive to language barriers, culture, and circumstances.
- **Reparative equity: Are the conditions of a specific group being improved?**
  - » Target public communications campaigns to vulnerable communities using careful framing and multiple languages.
  - » Train emergency management technicians, particularly frontline staff, to help vulnerable populations, such as elderly individuals living alone or limited English speakers, during heat events.
  - » Target utility assistance to cost-burdened households.

- **Procedural equity: Who is involved in the process of decisionmaking? Are such processes representative and transparent?**
  - » Seek public input about whether residents would use cooling centers or would prefer cooling interventions at their homes.
  - » Evaluate the quality of resilience hubs and whether the resources offered address critical needs and the multiple simultaneous hazards a community might face.
- **Distributive equity: Who is benefitting? How disparate are the benefits and harms?**
  - » Establish cooling centers and water access points in locations where all community members can access them, including those with a legacy of redlining and extreme heat.



## Adapt and Mitigate through Planning and Design

Although it is important to prepare and support the community during extreme heat events, cities must also think about the long term and take initial actions now that can reduce the future heat burden for the most vulnerable urban residents through both adaptation and mitigation. Urban planning and design can have integral roles in this effort, ranging from building and infrastructure design and materials choices to siting of cooling resources, adopting tree ordinances, and zoning reforms. As cities develop and retrofit their built environments to make them more resilient and equitable, policymakers and local leaders must consider how they can plan and design the built environment to mitigate the UHI effect.

The Environmental Protection Agency's *Reducing Urban Heat Islands: Compendium of Strategies* offers many options for infrastructure-related interventions, with dedicated chapters for trees and vegetation; green roofs; cool roofs; cool pavements; and other UHI-reduction activities (EPA 2008). Although *Reducing Urban Heat Islands* was published 14 years ago, planning and implementation in these areas remain nascent for many local jurisdictions. Even in Miami-Dade County, infrastructure enhancements are still in early stages. Further along in some cities are urban forestry plans. Many organizations, including Vibrant Cities Lab and American Forests, are working to make the equity case for more trees in urban areas, while simultaneously highlighting the importance of not letting well-intentioned urban forestry strategies exacerbate inequities.<sup>18</sup> These and other strategies are being considered by urban heat practitioners, as highlighted in the next subsections.

### Greening Buildings and Cooling Infrastructure

Communities are considering how infrastructure can be updated to reduce the retention of heat in urban environments, but efforts are only in conceptual or early stages in many places. Interventions include greening and cooling existing infrastructure, for example, by replacing hardscapes with greener infrastructure, such as vegetated green roofs. Mitigating the UHI effect is just one of many benefits of green space listed in the Baltimore Green Network Plan that was released by the Baltimore Office of Sustainability in 2018 to improve and increase the green space in long-neglected neighborhoods (City of Baltimore Department of Planning 2018). Cities are also working on making surfaces lighter. Roads,



for example, can be paved with more reflective surfaces to make people in the area more comfortable. Many cities are thinking about cool pavement: according to interviewees, conversations are started in Baltimore, Boston, and Clarksville; planning is underway for cool pavement installation in Miami-Dade County; and Phoenix is on the second phase of its Cool Pavement Program (box 6). In a similar vein, some cities are looking at ways to design cooler roofs. For instance, one interviewee suggested that Miami-Dade County should have a white roof ordinance; provide grants for reflective paint; and acknowledge the potential cobenefits of such a heat resilience investment, such as improving the environment, increasing residents' health, and lowering energy bills. Cities like Baltimore are exploring greening options, such as green roofs or green walls.

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#### BOX 6

##### **Cool Pavement Program in Phoenix**

Phoenix launched a Cool Pavement Program in 2020. Following the first phase, Phoenix's Street Transportation Department initiated a joint study with city officials and Arizona State University scientists. The study found that when compared to streets made of conventional asphalt, streets sealed with a cool pavement treatment were cooler by 10.5 to 12 degrees Fahrenheit at noon and during the afternoon hours. The study also measured the human experience of heat exposure, which was 5.5 degrees Fahrenheit higher in areas with cool pavement due to surface reflectivity but was reportedly like walking on a typical concrete sidewalk. The next phase of the study will analyze temperatures and durability of two new asphalt coatings with higher reflectivity and will try to capture more precise measurements of air temperature changes.<sup>a</sup>

Measurements were taken using multiple platforms and sensors, including a mobile human-biometeorological cart that measures mean radiant temperature, air temperature, relative humidity, and wind speed, and direction at pedestrian height at two-second intervals; a vehicle that measures the surface temperature of pavement; iButton sensors buried in the pavement; and a spectroradiometer that measures solar reflectivity (Arizona State University 2021).

<sup>a</sup> "Next Phase of Cool Pavement Program Begins," City of Phoenix, October 20, 2021, <https://www.phoenix.gov/newsroom/street-transportation/2113>.

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## **Financing Weatherization**

Weatherization is an approach to making homes more energy efficient and comfortable through actions such as attic and wall insulation, air sealing, or adding weather stripping to doors and windows. More than 50 percent of cities have a weatherization program (Meerow and Keith 2021). Some cities provide services free of cost, such as ABCD's Weatherization Assistance Program in the greater Boston area.<sup>19</sup> However, weatherization can sometimes be complicated when trying to help the most vulnerable populations. As one interviewee commented, "Some of the houses are in such bad shape that they don't qualify for weatherization—you can't put in new windows if the roof is falling in."

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*“Some of the houses are in such bad shape that they don’t qualify for weatherization—you can’t put in new windows if the roof is falling in.”—A local stakeholder*

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## **Forming Urban Forestry and Tree Canopy Goals**

In a national survey of cities, the most common intervention was urban forestry and greening (Meerow and Keith 2021). The premise is basic: more vegetation can reduce heat. The execution is more complicated, but interviewees from all cities or counties reported that their communities have set out on this course. In Miami-Dade County, as in many communities, urban heat impacts are highest in high-density areas with low tree canopy, little green space, and a lot of concrete. To counter these impacts, a Street Tree Master Plan and a campaign called Million Trees Miami set out to reach 30 percent tree canopy by 2020.<sup>20</sup> However, despite increases in tree planting, Miami-Dade’s canopy has remained almost the same due to loss of trees from hurricanes. Elsewhere, Phoenix has had a Tree and Shade Master Plan since 2010 which has ambitious goals for 2030 (City of Phoenix 2010). According to interviewees, an ordinance for tree planting was passed in 2020 in Clarksville, IN. In Richmond, IN, the parks department is conducting a tree inventory, and the city wants to plant street trees. Boston is also working on an Urban Forest Plan: the city wants to implement a 20-year plan for increasing urban tree canopy that is tied to the history of redlining. Boston also put a tree protection ordinance in place that would change current zoning for new development. In order to protect the tree canopy, developers of new buildings are prevented from certain actions (City of Boston 2021). Baltimore’s goal is to reach 40 percent tree canopy by 2040. The tree canopy has gone up slightly in recent years, according to an interviewee, and is now 27.3 percent.<sup>21</sup>

Some communities highlight benefits of trees other than shade and heat mitigation. For example, trees can improve air quality, increase property values, and provide natural stormwater retention services.<sup>22</sup> Still, local governments could benefit from more coordination around their greening efforts. For example, increasing the tree canopy can have both hydrological and cooling benefits, but in many jurisdictions different offices tend to manage forestry and stormwater (Fedorowicz et al. 2020).

For all the benefits trees provide, interviewees commented that planting trees and greening in general do not come without trade-offs. A Boston-based interviewee pointed out, for example, that the city’s tree protection ordinance sometimes conflicts with transit or open space goals. Another interviewee said that it is important to keep in mind that vegetation can lead to gentrification and that tree maintenance can be difficult, particularly in low-income communities (Donovan et al. 2021). In fact, in Baltimore some residents do not want more street trees. On the maintenance side, there is a mistrust in government such that residents believe trees could eventually become a problem rather than a solution. Beyond this, trees are associated with a place for people to hide and to have open drug deals in the city.

Given that communities have had tree-planting goals for longer than other UHI mitigation strategies, some studies have already identified several pain points when implementing urban tree canopy plans. For example, a Boston-based case study found that even with a strong focus on planting trees in underserved areas, the lack of physical space to plant trees in some neighborhoods may make equity difficult to attain (Danford et al. 2014). In addition, a 2010 study of the Los Angeles Million Trees Initiative pointed to hurdles related to long-term management and maintenance of trees, redressing canopy inequities in disadvantaged areas, and the appropriateness of the trees being planted (Pincetl 2010). Not all trees are equal, as a 2021 Bloomberg CityLab article points out, in which a US Forest Service researcher is quoted as saying, “It’s not just about planting a million trees. It’s about planting and taking care of a million, and in the right places.”<sup>23</sup>

## Upgrading Energy Infrastructure

Energy-related interventions—how we cool our buildings and pay for it—are among the considerations for cities. Energy upgrades range from energy generation that decreases the use of fossil fuels to energy efficiency upgrades that benefit commercial and residential stakeholders. Upgrades can offer two benefits: some help residents adjust to hotter temperatures and extreme heat events by making at-home cooling more affordable; others reduce greenhouse gas emissions to mitigate climate change.

To realize the first benefit—adjustment to hotter temperatures—cities are exploring new technologies and cost-assistance programs to improve energy efficiency and help people stay cool at home. For example, the City of Boston’s website hosts a Retrofit Resource Hub, managed by Boston’s Environment Department, that links to technical resources related to energy efficiency services and green property management.<sup>24</sup> Energy efficiency can be tied to weatherization and home improvements, such as having windows with coatings that block the sun’s heat.

To achieve the second benefit—reducing greenhouse gas emissions to mitigate climate change—interviewees suggested adding solar panels to buildings, such as cooling centers, to increase air conditioning capacity without increasing greenhouse gas emissions. In fact, many proposed energy upgrades are tied to decarbonization commitments. For example, Miami-Dade County has a Climate Action Strategy with seven approaches to cut emissions 50 percent by 2030. Three of the seven approaches relate to energy and buildings: benchmark, retune, and retrofit existing buildings; expand renewable energy generation; and build ultra low-energy buildings.<sup>25</sup>

Local government should pay attention to who will benefit from energy retrofits and transitions to new energy sources, as benefits are not expected to be equal. Recent research finds that compared to homes in Caucasian neighborhoods, homes in African American neighborhoods are less energy efficient as they tend to be older and home ownership is lower, reducing the likelihood of the home having energy retrofits. One solution is for governments to finance home retrofits in rental housing (Goldstein, Reames, and Newell 2022). Researchers also found disparities in rooftop solar deployment by race and ethnicity in the United States (Sunter, Castellanos, and Kammen 2019).

## Changing Land Use and Development Practices

Along with specific project interventions, communities are thinking broadly about how urban spaces can be developed and governed in ways that will make the UHI effect less prevalent in the future. When it comes to urban design, city planning departments and other stakeholders are thinking critically about the placement of amenities to ensure more cooling. Some Boston residents, for example, want more access to water for cooling: splash pads, misting stations, and access to community pools. In Clarksville, the location of potential cooling centers will ultimately depend on “where people who indicate need are living,” according to an interviewee. The same can be said for canopy growth goals. Thoughtful siting of green space now is expected to reduce the impacts of UHI in the most vulnerable neighborhoods in the future. Several interviewees said their communities have task forces or advisory committees that include community members who will be involved in decisions about where shelters, cooling centers, and other amenities are placed and where tree canopy goals are targeted. These decisions sometimes reflect where the workstreams come full circle: local governments can dedicate resources to identify where emergency support, such as cooling centers, might be missing.

In addition to tree canopy goals and ordinances, communities are also considering how reforms to zoning that stipulates permissible building types and densities can influence urban heat. For example, zoning reforms can influence the compactness of a city and whether there is urban sprawl, that is, when heat-absorbing asphalt spans a wider area. One study found that the rate of extreme heat events between 1956 and 2005 more than doubled in the most sprawling metropolitan areas versus the most compact ones (Stone, Hess, and Frumkin 2010). In contrast, too much density, especially of tall buildings, can prevent adequate release of heat in cities (EPA 2008). Rather than exclusively building vertically, some communities are increasing density and attempting to reduce sprawl by allowing for accessory dwelling units, which are secondary, independent units on a single-family property that can be rented to a nonfamily member. In Phoenix, for example, one additional unit is permitted on a property zoned for single-family use, but it must have matching architecture and may not be allowed in communities with a nonamenable homeowners’ association.<sup>26</sup>

Planning neighborhoods in ways that favor walkability or transportation other than vehicles can reduce heat levels, too, as researchers have found that vehicular flow can make the UHI phenomenon more pronounced (Zhu et al. 2017). The Smart Growth Network,<sup>27</sup> a network of government, business, and civic organizations that the Environmental Protection Agency helped found, recommends 10 Smart Growth principles to mitigate against UHI formation, including zoning for mixed land uses, such as residential, commercial, and recreational; creating walkable neighborhoods; preserving open space; providing a variety of transportation choices; and encouraging community and stakeholder collaboration in development decisions.<sup>28</sup> In alignment with these concepts, in Clarksville, the planning committee is considering mixed-use rezoning of the commercial corridor that would allow the land to be developed differently. One interviewee noted that more clarity for developers could be beneficial: “Developers appreciate consistency and clarity; it is not that they are opposed, it is more that it isn’t clear how things should be.”

## EQUITY CONSIDERATIONS: ADAPT AND MITIGATE THROUGH PLANNING AND DESIGN

Here is what practitioners, academics, and funders can keep in mind to center equity when considering the best course for adapting to and mitigating urban heat through planning and design.

- **Recognitional equity: Are historical inequities being addressed?**
  - » Acknowledge and correct for the history of redlining and the impacts it has had on city development, such as the lack of tree coverage in some formerly redlined neighborhoods, in a way that recognizes the perspectives of those who have historically been left out of planning processes.
  - » Recognize and be sensitive to the abuse and neglect by government that populations experienced in the past and are still experiencing today when presenting options and making decisions about land use and urban design.
- **Reparative equity: Are the conditions of a specific group being improved?**
  - » Target poor-quality housing that has been overlooked in the past for improvements that will make way for energy efficiency and weatherization interventions.
  - » Target areas for green space where it has historically been lacking, but do so in a way that meets the needs of current residents and does not cause displacement.
- **Procedural equity: Who is involved in the process of decisionmaking? Are such processes representative and transparent?**
  - » Consider community members' attitudes and hesitations toward long-term design interventions by soliciting and incorporating their feedback.
- **Distributive equity: Who is benefitting? How disparate are the benefits and harms?**
  - » Identify ways to distribute the costs of tree plantings across residents such that community members living in areas with low canopy cover—often areas where residents have fewer time and financial resources—do not bear disproportionate maintenance costs.
  - » Site amenities and infrastructure that have heat-reducing benefits, such as green space, cool roofs, green roofs, and cool pavement, in ways that distribute heat reduction benefits across the community, including to historically marginalized populations, while ensuring that no population bears disproportionate costs.

## Funding Your Heat Strategy

Both the literature and interviewees identify funding as a major barrier to the implementation of heat resilience strategies. This section summarizes general trends in funding for extreme heat interventions based on a scan of available resources and highlights a few sources from which communities have secured funding.

**There is not enough dedicated heat resilience funding.** Because extreme heat is not an issue that has historically been prioritized, it lacks an obvious or dedicated source of funding. For example, in

Miami-Dade County, heat is not yet written into the county's local mitigation strategy. Consequently, funding from the Federal Emergency Management Agency's Hazard Mitigation Grant Program and Building Resilient Infrastructure and Communities program has not been mobilized to address heat shocks. When cities do receive funding to address heat challenges, there are often limitations on what it can be used for. Moreover, ongoing funding sources that a city can rely on year-over-year to ensure that supports, such as cooling centers, are reliably open every time there is extreme heat are often lacking.

**Tools used to determine funding, such as benefit-cost analyses, do not accurately measure the value of heat resilience projects.** The primary impact of extreme heat is on human health. Extreme heat exacerbates an array of health conditions, but direct attribution is difficult to determine or record. The benefit-cost analyses used to determine community investments do not reflect the full cost of the heat threat. The reluctance to dedicate funding to heat stems from the fact that heat, unlike floods and hurricanes, rarely damages buildings. Traditional benefit-cost analyses for resilience infrastructure tend to measure benefits like avoided physical damage to buildings and infrastructure—they are not focused on people (Junod et al. 2021). This orientation is evidenced by interviewees' comments that Federal Emergency Management Agency hazard mitigation funding in their communities is focused on preventing physical damage and loss. In addition to failing to capture the full costs of extreme heat, benefit-cost analyses can also fail to reflect the full benefits of green interventions. In addition to cooling-related health benefits, green space or trees, for example, can also provide cobenefits (such as recreational opportunities) or ecosystem services (such as natural stormwater management and soil stability).

**Communities are finding disparate sources of funding for their heat work.** The pockets of funding available for heat work from the federal government, state governments, city budget allocations, and philanthropy can be augmented through collaborations with universities and other not-for-profit organizations. Although there are multiple sources of funding to finance multiple workstreams, funding is often cobbled together. More could be done to make sure resources are working in the same direction.

Examples of funding sources are discussed below.

*Federal funding.* With limited dedicated funding, there is a lot of room for creativity in finding federal funds that can be tapped to address the problem of urban heat while also meeting non-heat-specific funding objectives. The *Federal Funding Compendium for Urban Heat Adaptation* identifies 44 programs that could support heat interventions (Hoverter and Dziorny 2013) (see box 7). More recently, interviewees said federal funding to address heat is available in the form of mitigation-oriented programs, such as the Federal Emergency Management Agency's Building Resilient Infrastructure and Communities program and Hazard Mitigation Grant Program. There are a few dedicated sources of funding for heat resilience studies, such as the funding the National Oceanic and Atmospheric Administration provides for heat mapping in communities across the United States. Because of an interest in moving beyond mapping, the National Oceanic and Atmospheric Administration also funded five research grants in fiscal year 2021.<sup>29</sup> Some federal funding goes to programs to support households, such as the Low-Income Home Energy Assistance Program, which helps eligible households pay for weatherization, energy-related minor home repairs, or home energy bills.

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## BOX 7

### The Federal Funding Compendium for Urban Heat Adaptation

The 2013 *Federal Funding Compendium for Urban Heat Adaptation* identifies a variety of federal funding sources to support multiple heat-related interventions, including Investments for Public Works and Economic Development; Choice Neighborhoods; Community Development Block Grants (Entitlement Communities and state programs); HOME Investment Partnerships Program; Public Housing Operating Fund; Capital Fund Financing Program for public housing agencies; State Energy Program; Nonpoint Source Implementation Grants; Water Pollution Control Program Grants; and Brownfields Assessment and Cleanup Cooperative Agreements. Transportation-related grants are also mentioned (Hoverter and Dziorny 2013).

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*State funding.* The Beat the Heat program is funded by the Indiana State government and is administered by Indiana University. Most of the \$120,000 per city from the Beat the Heat program pays the salary of the two-year heat coordinator position. Some of the funds will help support a heat management program and the operational elements of the program, such as providing meals, Spanish translation, and child care for some focus group participants. But funding for the implementation of the heat interventions will need to come from other sources.

*City budgets.* Heat-related funding many times comes out of a city's resilience budget, if it exists; however, there are often competing priorities for resilience funding. For example, one interviewee said that in Boston, resilience funds tend to go to critical infrastructure. Similarly, very few resilience projects in Baltimore are aligned with heat. A Baltimore interviewee said they have not always asked for funding for heat in the past but are hopeful that they will be able to make bigger asks in the future as the mayor becomes more attuned to the issue of extreme heat. At present, Baltimore's Resiliency Hub Program is "run on a shoestring budget, which is not necessarily something to be proud of," as one interviewee reflected. Heat-related funding can come from other budgets, as well. For instance, in some cities there are pockets of funding in the health care space, especially where there have been correlations between COVID-19 and heat vulnerability. In Baltimore, tree planting is a line item in the forestry department budget. Boston does not have dedicated sources of funding for extreme heat, which is why stakeholders there want to explore private-public partnerships.

*Philanthropy.* With limited funding from elsewhere, cities are looking to foundations to fill gaps in financing for extreme heat-related projects. For example, in Clarksville some small foundation grants were received for short-term projects, such as funding for cooling centers or fans for at-home cooling. In Baltimore there is some reliance on donations for responding to extreme heat; for example, bottled water may come from the food bank, and fans have been donated in the past. Philanthropies, including place-based foundations, have also funded urban heat studies. The Owsley Brown Charitable Foundation and the Augusta Brown Holland Philanthropic Foundation, for example, supported the 2016 Louisville Urban Heat Management Study (Urban Climate Lab 2016).

*Private sector.* This brief does not focus on the numerous opportunities for collaboration between the public and private sectors. But there are many, which were generally referenced by interviewees.



**Heat resilience aligns with federal investment priorities.** Many newer federal funding sources can be tapped to address urban heat. These include funding tied to the Infrastructure Investment and Jobs Act which, although investing in roads and other infrastructure, promises to “tackle the climate crisis, advance environmental justice, and invest in communities that have too often been left behind.”<sup>30</sup> If passed, the Build Back Better legislation would add funding to the pot for resilient infrastructure and emissions-reducing investments. Proponents of Build Back Better point to the 2021 record-breaking heat that killed more than 200 people in the Pacific Northwest and to the long-term costs of inaction as reasons for its adoption.<sup>31</sup> In addition to new investment, President Biden is calling on federal agencies to transform programs to meet the equity and resilience goals of the Justice40 Initiative.<sup>32</sup>

## Conclusion

Broadly speaking, as communities start to address extreme heat challenges, a few key points for policymakers, local government managers and staff, nonprofit organizations, community-based organizations, and institutions such as universities to keep in mind are listed below.

- **Having dedicated staff that are focused on heat can help draw attention and resources to the issue.** Staff such as heat officers or coordinators have mandates that cut across policy silos. Their existence sends a message within and outside government that heat is a serious issue. However, small or even midsized cities may not have the resources for a full-time heat staffer. If city-level staff funding cannot be identified, finding ways to share a resource at the county level or engaging multiple government officials in relevant offices to coordinate on heat issues via committee could be an alternative way to give heat the dedicated attention it needs.
- **Recognizing heat as a hazard can make it a bigger priority for limited and competitive funding.** Communities juggle many risks, and heat is among the least understood. Making it a priority for funding may require up-front investment into research and public awareness efforts.
- **Actively engaging community members, especially the most vulnerable to heat, in heat resilience planning can both ground plans in reality and begin to raise awareness about localized and sector-specific heat risks.** Mechanisms for feedback and accountability in planning processes can ensure that the voices of community members are present in plans.
- **Targeting interventions at the hottest areas with the most vulnerable populations can help address past underinvestment and ensure that all populations can access cooling during extreme heat events.** Input and buy-in from these communities will be necessary for successful interventions. Some community members may require individual-level financial support.
- **Incorporating heat priorities into urban planning and design can help mitigate the UHI effect in the future.** Additional green space, new materials, and updates to land use standards can all contribute to curbing rising temperatures in areas with concentrations of development. Careful implementation of heat strategies that avoids exacerbating inequities is critical.



Equity will have to drive all these conversations and solutions. Without an intentional focus on equity, inequities of the past may be overlooked or made worse, and well-meaning plans may have unintended consequences for the most vulnerable community members. As more and more communities begin to see the risk that extreme heat poses, it will be important to draw on lessons learned and progress made in communities that have already begun this journey with an equity lens. Communities will also need to be careful to recognize the bespoke nature of the heat-related challenges they face, some of which stem from decades of neglect.

## Appendix

Centering equity is important in efforts to address extreme heat. Practitioners, academics, and funders can keep the following types of equity in mind when considering the best course for extreme heat interventions.

- **Recognitional equity:** Are historical inequities being addressed? Past policies and discrimination that have contributed to current disparities should be recognized (McCauley et al. 2013).
- **Reparative equity:** Are the conditions of a specific group being improved? The intent of a policy is to explicitly and exclusively benefit a specific group (Palmer, McShane, and Sandler 2014).
- **Procedural equity:** Who is involved in the process of decisionmaking? Are such processes representative and transparent? A focus on meaningful engagement of the public in the process for developing policies should be established and maintained (Bullard 2005).
- **Distributive equity:** Who is benefitting? How disparate are the benefits and harms? A focus on the outcomes of the policies being promoted and disparate distributions of benefits and harms should be ongoing (Martín and Lewis 2019; Svara and Brunet 2005; Taylor 2000).

The following recommendations under each line of equity correspond to one of the three workstreams covered in this brief.

### Recognitional Equity

Recognitional equity refers to recognizing past policies and discrimination that have contributed to current disparities and respecting the perspectives of all populations, especially those that have been historically marginalized (McCauley et al. 2013).

#### ARE HISTORICAL INEQUITIES BEING ADDRESSED?



Fully recognize and respect the views of populations that have suffered compounding disparities due to past policies, such as redlining.



Make heat-related messaging available in multiple languages and appropriate for multiple cultures, recognizing that past messaging with inappropriate language may not have been interpreted as intended.



Improve access to critical cooling resources, acknowledging the ways historic policies like redlining and segregation continue to contribute to limited access for many residents, and the preferences of residents who currently lack cooling.



Create educational and emergency-related messaging that historically misinformed or underinformed populations will be receptive to, being sensitive to language barriers, culture, and circumstances.



Acknowledge and correct for the history of redlining and the impacts it has had on city development, such as the lack of tree coverage in some formerly redlined neighborhoods, in a way that recognizes the perspectives of those who have historically been left out of planning processes.



Recognize and be sensitive to the abuse and neglect by government that populations experienced in the past and are still experiencing today when presenting options and making decisions about land use and urban design.

## Reparative Equity

Reparative equity refers to making it the intent of a policy to explicitly and exclusively benefit a specific group that has been disadvantaged in the past (Palmer, McShane, and Sandler 2014).

### ARE THE CONDITIONS OF A SPECIFIC GROUP BEING IMPROVED?



Target the most heat-vulnerable communities for surveys, focus groups, casual conversations, and, ultimately, interventions.



Target public communications campaigns to vulnerable communities using careful framing and multiple languages.



Train emergency management technicians, particularly frontline staff, to help vulnerable populations, such as elderly individuals living alone or limited English speakers, during heat events.



Target utility assistance to cost-burdened households.



Target poor-quality housing that has been overlooked in the past for improvements that will make way for energy efficiency and weatherization interventions.



Target areas for green space where it has historically been lacking, but do so in a way that meets the needs of current residents and does not cause displacement.

## Procedural Equity

Procedural equity refers to ensuring community members a meaningful and transparent engagement and a role in decisionmaking in the process for developing policies (Bullard 2005).

### WHO IS INVOLVED IN THE PROCESS OF DECISIONMAKING? ARE SUCH PROCESSES REPRESENTATIVE AND TRANSPARENT?



Involve community members in citizen science campaigns.



Actively engage community members and listen to their input when designing interventions.



Make meetings and focus groups accessible to participants by providing services, such as translations, child care, and meals.



Create structures, such as task forces and advisory groups, that allow local residents with lived experience to have a seat at the decisionmaking table.



Seek public input about whether residents would use cooling centers or would prefer cooling interventions at their homes.



Evaluate the quality of resilience hubs and whether the resources offered address critical needs and the multiple hazards a community might face.



Consider community members' attitudes and hesitations toward long-term design interventions by soliciting and incorporating their feedback.

## Distributive Equity

Distributive equity refers to focusing on the outcomes of the policies being promoted and the disparate distributions of benefits and harms (Martín and Lewis 2019; Svava and Brunet 2005; Taylor 2000).

## WHO IS BENEFITTING? HOW DISPARATE ARE THE BENEFITS AND HARMS?



Assess the existing conditions and plans through mapping and conversation to understand who is bearing the cost of heat to ensure that intervention benefits reach vulnerable populations.



Design processes that engage vulnerable community members to ensure that vulnerable populations are not excluded from the benefits of interventions.



Implement programs that use targeted focus groups to find out what community members do *not* want: listen for the unintended consequences of interventions that appear harmless at the surface.



Establish cooling centers and water access points in locations where all community members can access them, including those with a legacy of redlining and extreme heat.



Identify ways to distribute the costs of tree plantings across residents such that community members living in areas with low canopy cover—often areas where residents have fewer time and financial resources—do not bear disproportionate maintenance costs.



Site amenities and infrastructure that have heat-reducing benefits such as green space, cool roofs, green roofs, and cool pavement, in ways that distribute heat reduction benefits across the community, including to historically marginalized populations, while ensuring that no population bears disproportionate costs.

## Notes

- <sup>1</sup> Cecilia Martinez and Candace Vahsing, “Delivering on Justice40,” *The White House*, December 2, 2021, <https://www.whitehouse.gov/omb/briefing-room/2021/12/02/delivering-on-justice40/>.
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## About the Authors

**Rebecca Marx** is a research analyst in the Climate and Communities practice area of the Metropolitan Housing and Communities Policy Center at the Urban Institute. She conducts research on the connection between our built and natural environments and social and economic outcomes.

**Jorge Morales-Burnett** is a research analyst in the Climate and Communities practice area of the Metropolitan Housing and Communities Policy Center at the Urban Institute. His research focuses on urban governance and resilience.

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500 L'Enfant Plaza SW  
Washington, DC 20024

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