



Advancing the Theory and Practice of Urban Heat Resilience

Aspen Global Change Institute Virtual Workshop

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Background

Urban heat is deadlier than nearly all other U.S. weather-related hazards combined, with risks increasing due to climate change and the urban heat island effect. During the 2020 summer's record-breaking temperatures, urban heat was at the forefront of the national conversation on climate risk, intersecting with and compounding the COVID-19 pandemic, social inequity, and racial injustice. Foundational research continues to advance understanding of the characteristics of resilient cities and their governance, but translating this knowledge about urban resilience into practice remains a challenge. Despite decades of scholarship to document extreme heat impacts on quality of life, economic productivity, national security, physical and mental health, ecosystems, water and energy usage, and infrastructure, heat is a climate risk still without a mature governance structure for the 14,000 U.S. municipalities. While communities enhance their resilience to risks such as hurricanes, wildfires, and earthquakes with local land use controls, state and federal legal precedence, mapping resources, and national guidance, no comparable urban heat resources exist. Researchers have made significant advances to understand and model urban climate dynamics and document uneven public health impacts of heat. Less work has focused on integrating these discipline-specific insights with the broader urban resilience literature to characterize a heat resilient city and its governance. This gap in understanding critically impacts the communities and organizations across the U.S. that are pursuing strategies to mitigate and manage urban heat in a largely ad-hoc and uncoordinated manner.

This inaugural workshop was organized to bring together the critical theories, methodological approaches, data, and practical knowledge from the wide range of academic and professional disciplines that influence urban heat resilience, including public health, emergency management, social services, urban planning, landscape architecture, architecture, geographic information systems, urban climatology, real estate development, utilities, climate service providers, materials scientists, and civil and structural engineers. The overarching goal of the workshop was to lay the groundwork for the next decade of actionable science on urban heat resilience.

Additionally, the workshop sought to articulate the current state of urban heat resilience research and practice and areas of need within expertise areas; identify the most critical research gaps and needed synergies between focus areas; foster an interdisciplinary community of urban heat resilience research and practice; and develop a practice-driven research agenda on urban heat resilience.

The workshop engaged over forty key stakeholders representing thirteen universities, twelve non-profits, five federal agencies, and five local governments on the focus areas of public health, planning, built environment, energy infrastructure, heat mapping, and climate services. Stakeholders engaged in presentations on the current state of research and practice, small group-facilitated dialogues, individual homework time, informal opportunities for networking, a public lecture focused on equity, and student poster presentations.

Survey Outcomes

Participants described their vision of a heat resilient city by 2050 in a pre-workshop survey, and several characteristics were shared across disciplines. A heat resilient city where heat has equal status and attention as other hazards were commonly mentioned, along with more proactive and coordinated planning efforts. Many visions highlighted equity and the reduction or elimination of thermal disparities in the built environment. Improvements to the built environment to mitigate heat were also frequently included in the vision of a heat resilient city, including increased vegetation, shade, energy efficiency of buildings, and no utility interruptions. The vision of a community-focused approach was also commonly described, with residents being informed, engaged, connected, and adequately resourced. Another was a “vision zero” idea, and elimination of all heat deaths and severe illnesses.

Participants also described what is currently understood about urban heat resilience. Many participants reported that the social causes of heat vulnerability and inequitable health outcomes were currently well understood. Many also said that the general causes of the urban heat island effect and strategies to mitigate heat were well understood. The importance of climate change in increasing extreme heat events was also reported. There was also general consensus of known areas over associated research gaps, such as the biophysical aspects of heat risk over social aspects, general understanding of the urban heat island effect over specific contributors, and generic strategies over actual implementation.

Workshop participants also shared what gaps in knowledge and practice need to be urgently addressed to advance urban heat resilience. Knowledge-focused gaps included economic and health impacts of action or inaction, the relative effectiveness of interventions, multi-scale urban climate conditions both contemporary and projected, indoor thermal environments, and effects of chronic exposures versus acute extreme heat events. Participants also mentioned the experiences of the most vulnerable populations and heat risk perception among the public and decision-makers. Practice-focused gaps included data discovery and access; policy, funding, and

market mechanisms; measuring and modeling heat across scales; and training opportunities for decision-makers. Participants also mentioned the equity implications of accessibility of strategies for those with lower-income and smaller municipalities.

Finally, workshop participants described what areas of research and practice are critical for advancing urban heat resilience. One participant summed up the most common sentiment with, “Heat resilience is uniquely multidisciplinary -- it is hard to imagine a practice area that wouldn't be beneficial to include.”

Discussion Group Outcomes

Throughout the workshop, participants worked both within and across their disciplinary focus areas to further identify how to advance urban heat resilience. The most critical practice-oriented research gaps and synergies that emerged from discussion groups included having a national strategy for heat resilience paired with local guidance for urban heat resilience strategies tailored to local climate, geography, cultural, and economic conditions. The lack of evidence on the economic impacts of urban heat as well as the effectiveness, cost, and implementation of heat mitigation and management strategies were also identified as critical gaps. Finally, participants noted the importance of involving both decision-makers and vulnerable communities in the co-production of knowledge.

Participants also identified several priority areas for action to advance urban heat resilience. These included collaboratively developing a framework for urban heat resilience that connects all system components and relevant sectors. Participants also prioritized the development of universal heat resilience language to be used across the nation's diverse geographic, professional, and cultural differences to better share emerging practices. Participants also prioritized the development of shared metrics to evaluate and monitor the effectiveness of urban heat resilience strategies. Finally, aligning heat resilience strategies with co-benefits of other resilience actions was identified as an opportunity area.

Conclusion

Urban heat is an underestimated and increasing climate risk with impacts across urban systems. Urban heat lacks a historic governance and legal framework, and as such, current heat resilience efforts are fragmented across disciplines, scales, and timeframes. Developing a holistic, equitable, and actionable framework for urban heat resilience that could be tailored to local climatic, built environment typologies, and social conditions would help advance urban heat resilience. This would require a universal urban heat language and indicators to monitor and evaluate progress that span siloed disciplines and connect research and practice. Prioritizing urban heat as a national climate risk would help ensure that the social, economic, and environmental impacts of heat are equitably reduced and prevented in communities across the U.S.