

2024
Recommendations Report
to the Office of the Governor on

Extreme Heat Preparedness in Arizona



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Executive summary



Arizona's 2023 summer was the hottest we've experienced thus far. Searing daytime temperatures coupled with diminishing relief at night are not expected to be unusual going forward, as nighttime lows continue to rise.

Heat exposure, illness, emergency department visits and heat-related deaths are increasing – especially among vulnerable populations – but impacts on all residents of the state are undeniable in terms of health and economic well-being.

It is clear Arizona is at a critical turning point.

Recognizing this and understanding extreme heat preparedness and response requires new and innovative approaches, in August 2023 Governor Katie Hobbs issued Executive Order 2023-16. This order outlines a framework for statewide response to extreme heat that emphasizes preparedness and coordination, and calls for an articulated statewide plan. EO 2023-16 includes many important directives to be coordinated by the Governor's Office of Resiliency (OOR).

In turn, the Governor's Office of Resiliency requested the support of the broader academic community to inform the planning process. Arizona State University's Knowledge Exchange for Resilience (KER) was asked to produce a report that directly informs the development of this statewide plan. Guided by the Governor's leadership and the executive order, the following report highlights the guided review of symbiotic priorities through the interrogation of currently siloed data sets. KER also utilized a variety of tools to help key agency leaders visualize, examine, and find intersectional meaning to inform joint strategies and decision frameworks to address extreme heat and resilience across Arizona.

This report is aligned with the vision articulated below that guided the engagement with the Governor's Office of Resiliency and leaders of agencies mentioned in EO 2023-16:

We envision an Arizona that anticipates and successfully responds to extreme heat; ensuring safety, well-being, and prosperity for all Arizonans. We embrace a future where our communities are prepared, resilient and collectively prioritize heat preparedness, response, mitigation and long-term adaptation, serving as an innovative inspiration for the rest of the nation.

The following pages of this report include critical context about extreme heat and its impacts; four Priority Action Domains; ideas on how to engage federal partners; and a categorized set of 43 unique and specific recommendations that were prepared with input from various agencies, and many stakeholders, drawing upon many years of research and practice reflected upon over the past several months.

Our report advocates for a statewide, integrated approach that calls for commitment and collaboration across many state agencies, and across all sectors, from public to private, nonprofit and academic actors. Only through such an approach can the State of Arizona prepare and respond to the impacts of extreme heat upon the most vulnerable; as well as lead adaptation for all Arizonans who are affected by extreme heat impacts to health, livelihood, and property. The path to equitable heat preparedness requires a robust and sustained multisectoral response, genuine partnership, intentionality, robust knowledge exchange, frequent review, and course correction. A concerted, thoughtful, and innovative approach to addressing extreme heat impacts also promises to bring resilience dividends, where we stand to gain benefits as we seek to thrive in the Arizona climate.

We hope that these insights, ideas, and recommendations may be taken up in the first State of Arizona Extreme Heat Preparedness Plan, and that they may inspire the constellation of Arizona stakeholders to take action at this critical turning point.



Introduction and purpose

The State of Arizona is committed to planning for heat preparedness and response, as well as executing long-term strategies for heat resilience and adaptation. This report, prepared with input from many stakeholders and drawing upon knowledge accumulated over many years, advocates for a statewide, integrated, and collaborative approach that builds upon the work of the broader community addressing extreme heat. It calls for renewed and coordinated commitment and collaboration across many state agencies. It also requires coordinated commitment across all sectors, from public to private, nonprofit, and academic actors. Only through such an approach can the State of Arizona prepare and respond to the impacts upon those who are harmed first and worst from exposure and vulnerability to extreme heat, as well as adapt for all Arizonans who are affected by extreme heat impacts to health, livelihood, and property.

The ideas contained in this report stem from decades of experiences with extreme heat in the desert southwest, and can be credited to the resilience and ingenuity of the residents of Arizona, as well as countless academic actors and knowledgeable stakeholders who live and work in our state and lend their expertise to solutions.

More specifically, this report was prepared in the wake of the hottest summer experienced thus far. Sparked by this experience, in the context of many years of accumulated actions, the recognition for a whole-of-state response prompted the Governor of Arizona, Hon. Katie Hobbs, to issue an Executive

Order (2023-16) with key directives, coordinated by the Governor's Office of Resiliency (see Appendix, Reference Documents).

In turn, the Governor's Office of Resiliency requested the support of the broader academic community to inform their planning process. Arizona State University's Knowledge Exchange for Resilience (KER) was asked to produce a report that directly informs the development of this statewide plan. The mission of KER is to build resilient communities in Maricopa County, Arizona, and beyond, by sharing knowledge, discovering vulnerabilities, and responding to challenges together. KER works to advance social cohesion, promote economic prosperity, and enhance environmental security to create profound and enduring change that brings resilience dividends.

Guided by both OOR's leadership and Executive Order 2023-16 (EO), this work focused on examination of symbiotic priorities through the interrogation of currently siloed data sets. We utilized a variety of tools to help the Interagency Resiliency Forum visualize, examine, and find intersectional meaning to inform joint strategies and decision frameworks to address extreme heat and resilience across the State of Arizona - with the ultimate goal to create a heat preparedness plan. KER relied on the many partners and experiences of the heat resilience community that is acknowledged in the appendix.

This report has consolidated some of the most important insights, experiences, and input from the state agencies that comprise the Interagency Resiliency Forum, which was formed as part of a directive of the executive order; as well as the latest knowledge and insights from the broad community of stakeholders

concerned with extreme heat in Arizona, across all sectors, and from all public universities. While many convenings, conversations, data explorations, research, community consultations, request for public input, and at-large experiences fed into the end product (see the Recommendation Development Process in the appendix for details and acknowledgements), the result is a reflection of a much larger and broader set of knowledge from many years' worth of research, practice, and experience in Arizona. Over the course of reflecting and compiling these insights, it is clear that the leadership and knowledge of extreme heat within the state is robust and unique.

There are many efforts that have had significant positive impact on saving lives and protecting livelihoods, property, and desert landscapes that already makes Arizona first among the states in terms of heat preparedness, adaptation, response, and recovery.

Nevertheless, the persistent and growing outcomes on loss of life and economic well-being compel that there is much more to be done. Similarly, this resulting report remains inherently limited. Not all efforts can be acknowledged given the focus on statewide action, and the end document falls short of a completely comprehensive set of ideas available. The need for a swift compilation of the best recommendations in time for the next summer, and the time it takes to gain commitments of intentions for improvements has not fully played out. Furthermore, the commitment to present robust recommendations ideally is driven by access to data and statistics that simply are not yet available everywhere.

We thus propose that this report be considered as a living document, to be continuously improved, and to be used as the basis for a more detailed implementation plan that can be iterated as greater knowledge, data, and experience are incorporated. While not all decisions about responsibility for action can yet be attributed to a state agency or stakeholder with the right authority to take that action, often action will require a collaboration across actors, and while many such actions will require resources that are not yet allocated or even identified, we nevertheless present these recommendations in the spirit of innovation and the ambition that our community in Arizona be even more prepared for extreme heat.

We likewise suggest that future iterations of an implementation framework begin to include a clear accountability and resource framework to effect change and monitor progress to advance heat preparedness for all Arizonans. The path to equitable heat preparedness requires a robust and sustained multisectoral response, genuine partnership, intentionality, robust knowledge exchange, frequent review, and course correction. May this effort – the report and the plan that it informs – be considered the launch of a renewed cycle of attention and innovation to extreme heat preparedness in the State of Arizona.

Vision and outcomes

The vision proposed by the reporting team and adopted by the Interagency Resiliency Forum during convenings, follows:

We envision an Arizona that anticipates and successfully responds to extreme heat; ensuring safety, well-being, and prosperity for all Arizonans. We embrace a future where our communities are prepared, resilient and collectively prioritize heat preparedness, response, mitigation and long-term adaptation, serving as an innovative inspiration for the rest of the nation.

Starting with this vision, we aspire to create a State of Arizona where:

- Cross-agency and stakeholder expertise will leverage effective, coordinated communication and action for extreme heat preparedness, response, mitigation, and adaptation efforts for the State as a whole.
- Data collected and used will accurately reflect all heat-vulnerable and exposed populations, the latest research on extreme heat, and resident experiences to inform decisions aimed at addressing extreme heat challenges across public, private, and nonprofit sectors.
- Everyone will have equal access to high-quality resources and support for coping with extreme heat events and there will be no barriers to life-saving actions.

In striving for these outcomes, we will advance a future in which all people living in Arizona can not only survive, but also thrive and prosper, in the face of anticipated profound environmental change. With a concerted, coordinated effort, Arizona can leverage these right actions not only for heat readiness, but also for economic development, workforce expansion, and greater general well-being and prosperity.

We furthermore envision Arizona to be the “gold standard” for the United States in terms of action towards extreme heat preparedness, response, mitigation and adaptation.

To that end, this report presents a set of proposed priority action domains, which represent an integrated, coordinated, synergistic, cross-agency approach to extreme heat. In addition, a set of 45 final recommendations have been derived from detailed analysis of how to frame a state-wide response that comprehensively addresses the spirit of the executive order in terms of much-needed innovation. These additional recommendations are guided by a set of seven major objectives, developed as part of the many consultations across a broad set of stakeholders, and driven by the context of these very state agencies responsible for implementation. This compiled set of additional recommendations also includes relevant content from a public Request for Information, to ensure that Arizona at large weighed in on this plan. All verbatim responses have already been provided directly to the Director of the Office of Resiliency during consultations.

Again, it is important to note that this report has limitations. The knowledge that our Arizona community develops from the experiences of living with extreme heat is continuously advancing, and future iterations of the statewide plan must find ways to incorporate in near-real-time the learnings and evolution of our ever-growing body of knowledge. It is also partial in the sense that the context of extreme heat is dynamic, as the global climate and our regional experiences of a changing planet, are in flux and dependent upon longer- term mitigation efforts that are not part of this report and plan. Finally, this report is not intended to serve as a detailed implementation schedule, given the vision to convey a statewide action framework. Instead, we call upon the very knowledgeable set of leaders of the agencies represented in the Interagency Resiliency Forum, and in the Governor’s Office of Resiliency, to incorporate, integrate, and synergize the details of this report into their existing comprehensive implementation plans. So long as we view extreme heat preparedness an integral part of the mission of these agencies, we will better prepare and respond in the long run to the realities of life in Arizona. The result will be a thriving state, not only preventing the worst outcomes, but also proactively leveraging the co-benefits of a robust resilience strategy for social cohesion, economic prosperity, and environmental sustainability.

The case for action

The impact and frequency of extreme heat days has notably increased since the original Arizona Extreme Weather, Climate and Health Synthesis Report of 2015, referenced in the executive order. The state assessment for Arizona from the National Climate Assessment Reports verifies the types and range of changes, as well as the nature and intensity of impacts, that justify statewide action. Climate is increasingly a moving target, wherein the models and forecasts of the past are in continuous need of updating and improving in order to meet the needs for future planning.

One consistent observation is that temperatures are rising and causing interdependent effects of extreme heat which affect numerous aspects of society across the state of Arizona. Urban areas experience a notable urban heat island effect while rural regions of the state continue to face challenges of resilient infrastructure necessary to keep all residents cool. Strategizing toward thermal comfort is a pragmatic strategy that takes issues of heat equity and increased risk of heat-related illness for vulnerable populations into account. Occupations with prolonged heat exposure, those facing homelessness, and mobile home communities are three populations highlighted below with increased risks related to extreme heat.

Nevertheless, the whole population of the State of Arizona is currently impacted by heat, or facing risks of heat as a multiplier threat, in ways that should be better understood. While the Governor’s Executive Order 2023-16 requested proposals to update the 2015 plan, the state of knowledge has been continuously updated since that time through the many efforts of scholars and practitioners in Arizona. Still, additional knowledge on climate assessments is necessary for local, specialized, and up to date application of general climate information. A key recommendation of this report is to **Update Knowledge on Climate Assessments**, equipping state agencies and the communities they serve with the information and data resources needed to assess their climate risks and develop resilience solutions most appropriate for them, while incorporating robust understanding of substate differences in impacts due to environmental change.

This following pages of this report provide a snapshot of some of the most pertinent dimensions of the current state of knowledge. The next section summarizes the case for statewide heat preparedness action.



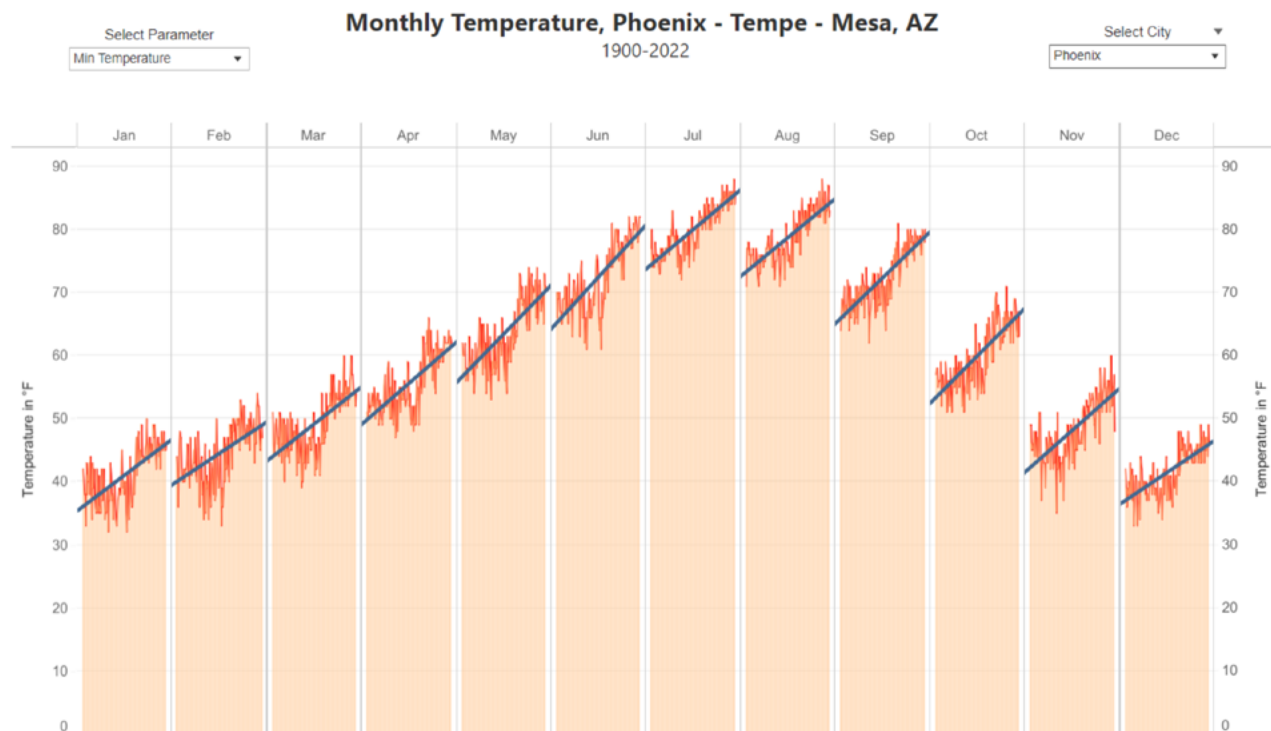


Extreme heat in Arizona

Over the past century, the desert Southwest has witnessed a steady and concerning trend of increasing minimum temperatures. This warming phenomenon is indicative of broader climate change impacts on the region. Nighttime temperatures, traditionally known for providing relief from the daytime heat, have been on the rise, posing significant ecological and societal challenges.

Elevated minimum temperatures contribute to more persistent and intense heatwaves, impacting various aspects of the region's ecosystems, water resources, and human communities. The warming nights in the desert Southwest underscore the urgent need for comprehensive climate mitigation and adaptation strategies to address the long-term consequences of these temperature shifts on both the natural environment and the daily lives of residents in the region.

Using data from the Arizona State Climate Office, the interactive dashboard screenshotted below, was presented to the Interagency Resiliency Forum during October 2023 convenings. It summarizes this historical increase in nighttime temperature in several metropolitan areas in Maricopa County.



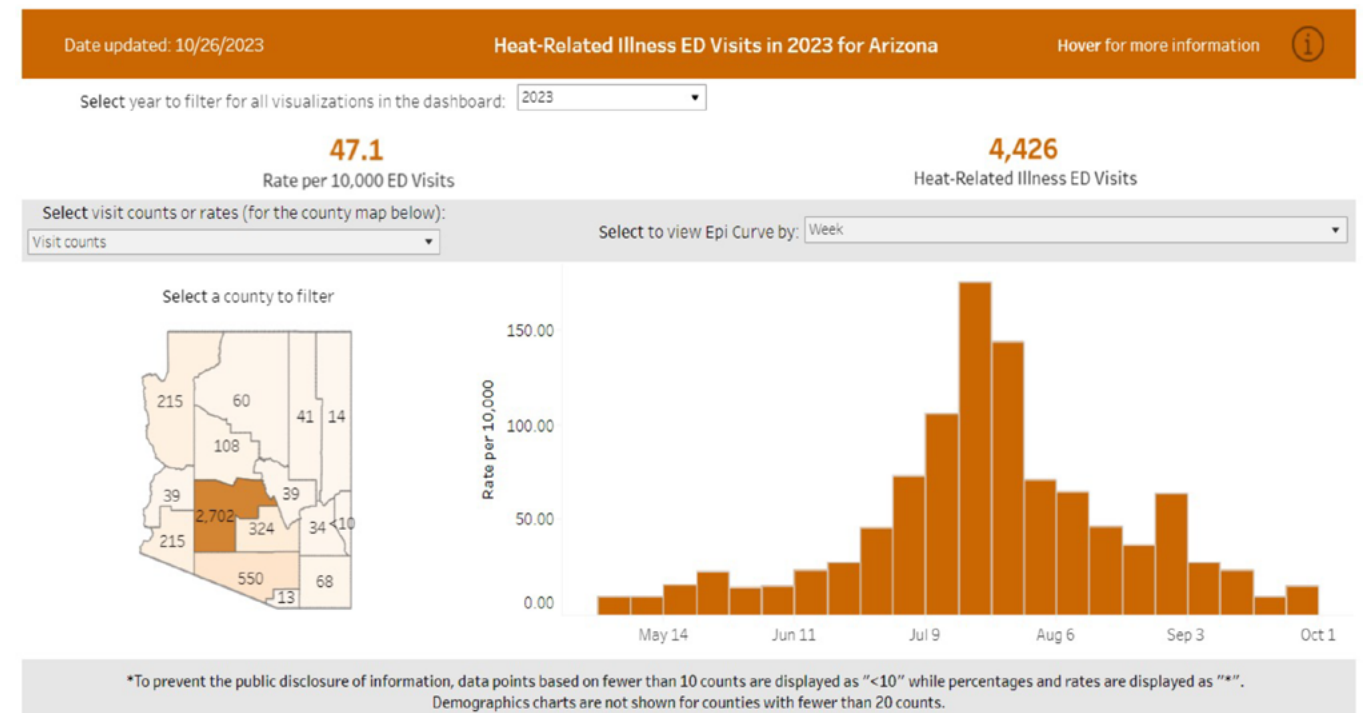
See interactive visualization at: Praharaj, Sarbeswar, Elizabeth A. Wentz, Yash Vakil, Patricia Solis, Amal Shifwath Shaik, and Brajesh Karna. (2023). "Visualization: Temperatures in Maricopa County." Resilience Data Dashboard Series, Knowledge Exchange for Resilience and Arizona State Climate Office, 1900-2022. Available from Arizona State University, <https://resilience.asu.edu/temperature>.

Effects of Extreme Heat

Extreme heat acts as a potential threat multiplier, amplifying challenges across various sectors and exacerbating vulnerabilities in numerous aspects of society. In particular, outcomes related to health, the environment, infrastructure, and the economy are directly affected by extreme heat.

Health

High temperatures impact individuals through the increase of the rate of water loss by sweating, leading to dehydration. This can result in dizziness, weakness, and, if left untreated, can escalate to more serious issues. Prolonged exposure to extreme heat can lead to heat-related illnesses such as heat exhaustion and heatstroke. These conditions can range from mild discomfort to severe medical emergencies and may require immediate medical attention. Certain groups, such as the elderly, children, and those with pre-existing health conditions are more vulnerable to the effects of extreme heat. Social and economic factors, such as access to affordable housing, can also play a role in determining who is most at risk. The graph below from the ADHS dashboard highlights the prevalence of heat-related emergency room visits during the hottest summer months. According to the ADHS data, out of every 10,000 emergency department visits in the record year 2023, 47.1 were due to a heat-related illness.



From the ADHS Extreme Weather and Public Health Heat-Related Illness Dashboard available at <https://www.azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/heat-safety/index.php#heat-dashboard>.



In addition to the health risks of prolonged exposure to extreme heat, elevated temperatures can intensify the formation of ground-level ozone, a key component of smog, as well as increase the concentration of particulate matter. These pollutants pose serious risks to respiratory health, exacerbating conditions such as asthma and other respiratory diseases. Additionally, extreme heat can contribute to the expansion of wildfires, releasing substantial amounts of smoke and pollutants into the air. The combustion of organic matter during wildfires releases fine particulate matter, carbon monoxide, and other harmful substances, degrading air quality over large areas.

Environmental impact

Extreme heat can also negatively affect agriculture and the environment. Hot and dry conditions contribute to the increased risk of wildfires. Extreme heat can dry out vegetation, turning it into fuel for fires, which can spread rapidly and cause extensive damage to ecosystems and communities. It also causes heat stress on agricultural crops, reducing yields and altering growing seasons. This can have economic implications for farmers and impact food production. Extreme heat can disrupt ecosystems by affecting plant and animal life. It may lead to shifts in the distribution of species, changes in migration patterns, and even contribute to the bleaching of coral reefs in marine environments. The recent National Climate Assessment report (USGCRP 2023) projected that high-severity wildfires are expected to continue in coming years, placing the region at considerable risk.

Water use is another critical facet influenced by extreme heat, impacting both quantity and quality. Higher temperatures increase evaporation rates, diminishing water availability for agriculture, urban consumption, and ecosystems. Concurrently, prolonged heat can lead to drought conditions, further stressing water resources. This scarcity has cascading effects on air quality as dust and particulate matter increase, posing respiratory risks. Additionally, the economic implications of reduced water availability can be significant, affecting agricultural yields, water-dependent industries, and exacerbating competition for scarce resources.

Economic impact

Extreme heat can dramatically escalate health costs associated with emergency room and urgent care visits. During periods of intense heatwaves, there is a surge in heat-related illnesses like heat exhaustion, heatstroke, and dehydration, leading to a substantial influx of individuals seeking medical attention. The strain on healthcare facilities escalates as these heat-induced health issues require immediate and often intensive care, elevating the burden on emergency services. Consequently, the increased demand for medical assistance during extreme heat events drives up healthcare costs, including expenses related to emergency room visits, urgent care treatments, hospitalizations, and associated medications. Moreover, these visits not

only strain healthcare resources but also lead to productivity losses as individuals may need extended recovery periods, impacting their ability to work and contributing to wider economic challenges within communities and regions affected by extreme heat.

In addition, industries reliant on outdoor labor, such as construction and tourism, suffer from decreased productivity and increased health risks for workers due to extreme heat, leading to lower output and higher healthcare costs. Additionally, energy demands spike during heatwaves as air conditioning usage intensifies, resulting in increased electricity costs that strain household budgets and business operations, further amplifying economic pressures. The average annual economic consequences of inaction to mitigate against high heat in the Phoenix metro region are anticipated to range from \$1.9 billion to \$2.3 billion dollars (per TNC 2021). According to a report from the Atlantic Council's Adrienne Arsht Rockefeller Foundation Resilience Center (2021), under baseline climate conditions, the United States could lose on average approximately \$100 billion annually from heat-induced lost labor productivity.

Infrastructure

Extreme heat exerts a profound impact on infrastructure, posing significant challenges to the resilience and functionality of various systems. Prolonged exposure to high temperatures can cause thermal expansion and stress in materials, leading to structural damage and deterioration in roads, bridges, and buildings. Elevated temperatures can also compromise the integrity of transportation networks, such as railways and roads, as materials like asphalt become more susceptible to softening and deformation, buckling and warping under extreme heat conditions. The increased demand on cooling systems during heatwaves can strain energy infrastructure, potentially resulting in strain on power grids and power outages that further disrupt critical services. Addressing the impact of extreme heat on infrastructure necessitates adaptive measures such as resilient design, the use of heat-resistant materials, and comprehensive urban planning to mitigate the vulnerabilities associated with rising temperatures and ensure the long-term sustainability of essential infrastructure systems.

Table 1. Average Annual Economic Consequences of Inaction, 2020-2059

| Indicator | Emissions Scenario RCP 4.5 | Emissions Scenario RCP 8.5 |
|------------------------|----------------------------|----------------------------|
| Mortality | \$898M | \$1.2B |
| Morbidity | \$4M | \$5M |
| Labor Productivity | \$855M | \$964M |
| Roadway Infrastructure | \$4M | \$4M |
| Energy Demand | \$116M | \$116M |
| Total | \$1.9B | \$2.3B |

Notes: Shown in \$2021 as average annual consequences from 2020-2059 for RCP 4.5 and RCP 8.5 using mean of 10 GCMs. No financial discounting applied. Figures are rounded.

Table excerpted from TNC (2021). Economic Assessment of Heat in the Phoenix Metro Area [deBoer, A. Schwimmer, E. McGregor, A. Adibi, S. Kapoor, A. Duong, S. Love, J. Bonham-Carter, C. Lindquist, J.]



In addition, extreme heat intensifies energy demand, particularly for cooling purposes. As temperatures rise, the reliance on air conditioning escalates, putting immense pressure on energy grids. This heightened demand strains energy infrastructure and can lead to power outages, affecting not only residential areas but also critical facilities such as hospitals and emergency services. The resulting economic costs, both in terms of repair and lost productivity, underscore the interconnectedness of extreme heat with the economy, highlighting the urgent need for sustainable energy solutions and efficiency measures to enhance resilience.

Phoenix, Arizona stands out as a prominent example of an urban heat island, a phenomenon exacerbated by its unique geography and urban development. The city's rapid growth and extensive use of impervious surfaces, such as asphalt and concrete, contribute to the absorption and retention of heat, creating localized temperature differences between urban and surrounding rural areas. The sprawling infrastructure, coupled with limited vegetation, minimizes natural cooling through processes like evapotranspiration. During the scorching summer months, Phoenix experiences elevated temperatures compared to its surrounding desert landscape, intensifying the urban heat island effect. Data from the National Weather Service and NOAA indicate that the number of days with minimum temperatures above 90°F in 2023 reached 35 days, five times the average for the period of 1991-2020 which was 7 days. Similarly, the number of days with maximum temperatures above 100°F was 105 days, and 110°F was exceeded for 55 days in 2023, more than double the average of 21 days during 1991-2020 (per P. Iniguez, NWS/NOAA). The consequences of the urban heat island effect are multifaceted, impacting public health, energy consumption, and overall urban livability. Residents face prolonged exposure to extreme temperatures, increasing the risk of heat-related illnesses. The demand for air conditioning surges, leading to higher energy consumption and strain on power grids. Additionally, disadvantaged communities often bear the brunt of the heat island effect, as they may have less access to cooling resources and green spaces.

Heat equity and differing narratives of extreme heat

"Heat equity" refers to the concept that the impacts of extreme heat are disproportionately felt by vulnerable populations, creating disparities in exposure, susceptibility, and the ability to cope with rising temperatures. Vulnerable communities, often characterized by lower socioeconomic status, inadequate housing, and limited access to resources, face heightened risks during extreme heat events. Factors such as limited access to air conditioning, healthcare, and green spaces exacerbate the vulnerability of these populations. Additionally, certain demographic groups, including the elderly, children, and those with pre-existing health conditions, are more susceptible to heat-related illnesses. Addressing heat equity involves not only implementing strategies to mitigate the immediate impacts of extreme heat but also addressing underlying social, economic, and environmental factors that contribute to vulnerability. Creating inclusive policies, ensuring equitable access to resources, and engaging communities in the development of heat adaptation plans are crucial steps in promoting equity and resilience in the face of rising temperatures.

Socioeconomic backgrounds play a decisive role in shaping the diverse experiences of extreme heat, ranging from a mere inconvenience for some to a manageable problem, and for others, an outright catastrophe (Guardaro et al. 2022). Affluent individuals often have the means to mitigate the impact of heat and minimize their outdoor exposure, enjoying the comfort of air-conditioned homes and workplaces and possessing the financial capacity to pursue thermal comfort alternatives, such as escaping to cooler climates during heatwaves. For this group, extreme heat may be seen as a temporary inconvenience, swiftly addressed through access to resources. Such decisions and application of resources are often not life-altering or detrimental to their everyday quality of life.

In contrast, those with moderate means may find extreme heat to be a manageable problem, necessitating careful budgeting for increased cooling costs and adaptation strategies like the use of fans or seeking refuge in public spaces or cooling centers with air conditioning. Although they manage their outdoor exposure and energy use carefully, there is not necessarily a feeling of panic about an upcoming anticipated extreme heat period. They may increase reliance on networks and extended family during heat-related, emergency situations.

However, for marginalized and economically disadvantaged communities, extreme heat can escalate into a catastrophic event. Limited access to cooling infrastructure, inadequate housing conditions, and lack of financial resources make it challenging for these individuals to cope, leading to heightened risks of heat-related illnesses, economic hardship, and a deepening cycle of vulnerability and desperation. With unavoidable outdoor exposure, they cannot afford to be thermally comfortable. Addressing the disparate impacts of extreme heat requires targeted interventions that consider the socioeconomic disparities, ensuring that no segment of the population is disproportionately burdened by the consequences of rising temperatures.

Strategizing toward thermal comfort as a pragmatic approach

Because of the diverse experiences of extreme heat along socioeconomic lines, focusing on strategies to ensure thermal comfort (Olesen 1982) rather than attempting to reduce temperatures overall or calibrate to a specific temperature offers a more pragmatic and adaptable approach to addressing the challenges posed by extreme heat. The subjective experience of thermal comfort varies among individuals and communities, making it a more responsive metric for assessing the effectiveness of heat mitigation efforts. Instead of solely concentrating on temperature reduction, which can be logistically challenging and resource-intensive, tailoring interventions to enhance thermal comfort allows for a more nuanced understanding of the diverse needs and vulnerabilities within a population.



In addition, the emphasis on thermal comfort enables a more holistic consideration of factors influencing well-being during extreme heat events. This approach encompasses not only temperature but also humidity levels, access to cooling infrastructure, and community-specific needs. By prioritizing thermal comfort, policymakers and urban planners can implement targeted measures such as cool roofs, green spaces, and community cooling centers that directly address the specific conditions contributing to discomfort. This approach fosters a more inclusive and adaptable response, acknowledging that achieving an absolute reduction in temperatures may be impractical, while ensuring thermal comfort allows for a more realistic and achievable goal in promoting the resilience and well-being of communities facing extreme heat challenges.

Some key vulnerable populations in Arizona

Homelessness and extreme heat

The intersection of homelessness, extreme heat, and heat-related illness and death forms a critical nexus that underscores the heightened vulnerabilities faced by individuals experiencing homelessness. Homeless populations often lack access to consistent shelter and cooling resources during extreme heat events, leaving them exposed to the severe health risks associated with elevated temperatures. Prolonged exposure to scorching conditions can lead to heat-related illnesses such as heat exhaustion or heatstroke, and without adequate hydration or relief, these conditions can escalate, posing life-threatening risks to individuals without a stable place to seek refuge. In the summer of 2023, it is estimated that about half of the outdoor heat associated deaths involved individuals experiencing homelessness, continuing trends from years past. Among all outdoor heat-associated deaths, 92 percent of the increase in total mortality from 2017-2022 correlates to the increase in the number of unhoused people in Maricopa County ($p < 0.01$).

Homelessness exacerbates the challenges of managing heat-related health issues, as individuals may face barriers in accessing medical care or lack a supportive environment for recovery. The lack of proper hydration and restrooms further compounds the risks. Tragically, extreme heat events can lead to a higher incidence of heat-related illnesses and fatalities within homeless communities, highlighting the urgent need for targeted interventions. Addressing this issue requires a multifaceted approach that combines outreach and support services, the provision of cooling centers, and collaborative efforts between local governments, nonprofits, and healthcare providers to ensure the well-being of those experiencing homelessness during extreme heat events.

Homeless individuals facing the harsh conditions of extreme heat may be more susceptible to engaging in substance abuse as a coping mechanism or to escape the harsh realities of their circumstances. The stress and discomfort associated with exposure to extreme temperatures can contribute to a cycle of dependency on substances, as individuals seek solace or relief from the challenges of life on the streets. An estimated 67 percent of recorded heat-associated deaths in 2022 involved substance abuse, be it drugs and/or alcohol, and over half of all heat-associated deaths involved drug use.

Substance abuse can exacerbate the vulnerabilities of homeless individuals during extreme heat events. The impacts of drugs or alcohol on cognitive function and decision-making may compromise one's ability to seek shelter, stay adequately hydrated, or make informed choices about personal well-being. The combination of extreme heat, homelessness, and substance abuse creates a particularly high-risk scenario, increasing the likelihood of heat-related illnesses and fatalities among this already vulnerable population. Addressing this complex issue requires holistic strategies that integrate mental health and addiction support services within broader efforts to combat homelessness. Providing access to shelter, addiction treatment, mental health services, and targeted interventions during extreme heat events is crucial for breaking the cycle and improving the overall well-being of individuals experiencing homelessness and struggling with substance abuse.

Mobile homes and indoor heat deaths

The connection between mobile homes and indoor heat deaths underscores the distinct vulnerabilities associated with this form of housing during extreme heat events. Mobile homes is a broad category that includes living structures like manufactured housing and RVs, but for the purposes of understanding extreme heat impacts, we are especially concerned about older units, structures with insufficient insulation, low energy efficiency, or sited in paved locations with little shade. Mobile homes typically have thinner walls, less insulation, and lower-quality roofing compared to traditional houses, making them more susceptible to rapid temperature fluctuations. During heatwaves, these homes can quickly become overheated, and the lack of efficient ventilation exacerbates indoor temperature. Additionally, many mobile homes lack central air conditioning, relying on individual units that may be inadequate or in disrepair, further amplifying the risk of indoor heat-related issues.

The indoor heat deaths in mobile homes are often a result of the confluence of socioeconomic factors and substandard living conditions. Residents of mobile homes, who are often of lower socioeconomic status, may face challenges in affording proper cooling solutions or relocating to cooler environments during extreme heat. Inadequate access to air conditioning, combined with the specific vulnerabilities of mobile home construction, creates a heightened risk of heat-related illnesses and fatalities.



Despite **5%** of housing in Maricopa County being mobile homes, trailer residents make up **38%** of indoor heat deaths

Most women died indoors  Most men died outdoors 



7 in 10 were at least 50 years old

Credit: Solis, P. (2020) "Convergence of Heat, Health, and Housing Vulnerabilities of Mobile Home Residents in the time of COVID," Security and Sustainability Forum: Health and Equity Impacts of Extreme Heat. Data reflect 2019 statistics from MCPHD and Census ACS.

The economically disadvantaged and precarious

Among Arizonans who are most at risk for heat associated impacts are those without the means to continuously remain cool where they live, work, travel, and play. Vulnerability is particularly high when cooling technologies are not affordable or available, such as AC, and the access to or ability to pay for the power that run them. In instances of all indoor heat deaths, the presence of air conditioning becomes a poignant factor when it is either not functioning or not in use. All indoor heat-associated deaths in 2022 occurred in uncooled environments. While modern buildings, including residences, are equipped with air conditioning units, the effectiveness of these systems is contingent on their proper maintenance and use. Mechanical failures, power outages, or financial constraints may render air conditioning units non-functional or inaccessible to certain individuals. In some cases, occupants may choose not to use air conditioning due to concerns about electricity costs, lack of awareness of the severity of the heat, or an assumption that their living space is adequately cooled. Comparing the indoor heat associated death rate per capita in Maricopa County from 2016-2022, to the annual CPI for residential electricity costs, about 83% of the variance in indoor heat associated deaths is explained by the cost of electricity ($p < 0.05$).

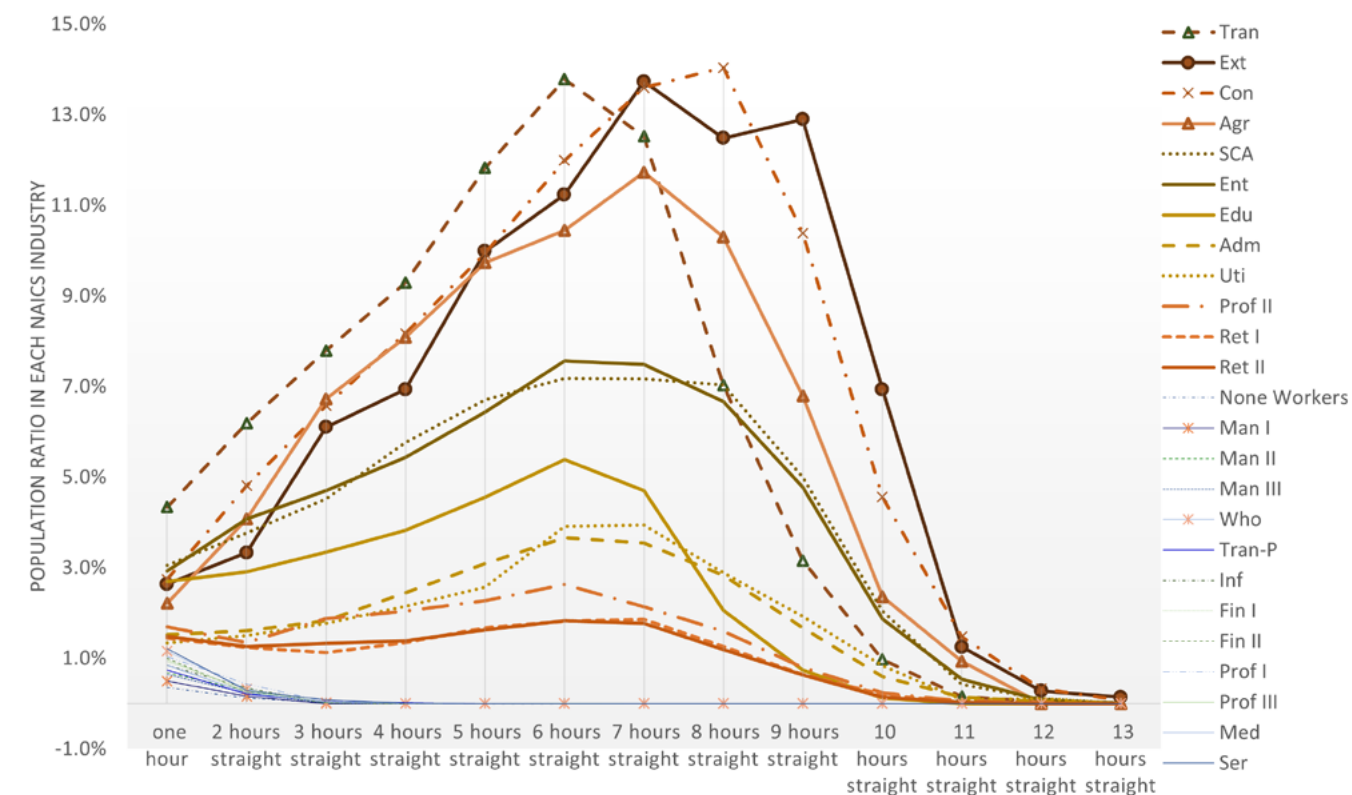
Other characteristics of households with low economic resources that studies have consistently identified as having higher risk of exposure or greater vulnerabilities include lack of a vehicle and/or reliance on public transit, older adults living alone and/or on a fixed income, homes where there are communication barriers, such as limited English speaking or poor understanding of how to access public services, persons with disabilities, and unemployed persons, to name a few. The confluence of economic factors highlights the critical importance of not only ensuring the availability of cooling techniques for families with financial hardship, but also addressing barriers to their use, such as cost of use, improving maintenance infrastructure, and increasing public awareness about the risks of extreme heat to prevent indoor heat deaths.

Tribal Nations

Some indigenous populations have higher rates of certain chronic medical conditions that increase risk for illness and death due to extreme heat. Climate change is threatening natural ecosystems that are essential to many First Peoples' livelihoods, food sources, and cultural practices. In some of Arizona's Tribal Nations, a lack of infrastructure and essential services, such as roads, water, emergency response, and health care, presents barriers to heat preparedness and exacerbates the impact of extreme heat on residents. For example, according to the Navajo Tribal Utility Authority, an estimated 15,000 families on the Navajo Nation live without electricity, limiting access to common cooling technologies. The end result is that members of indigenous communities are disproportionately represented among heat associated mortality. Nevertheless, many efforts at adaptation, preparedness, and response are present, and represent opportunities for strengthening knowledge and action, and for learning ways to address extreme and chronic heat impacts.

Occupations with prolonged heat exposure

Occupations that involve prolonged exposure to extreme heat, especially in the arid climate of Arizona, face severe challenges that can impact both the health and productivity of workers. Construction workers face challenges such as handling hot tools and working on sun-exposed surfaces, increasing the risk of burns and heat-induced injuries. Agricultural workers may endure long hours of labor in direct sunlight, leading



Li, R., Chester, M. V., Vanos, J., Middel, A., Hernandez-Cortes, D., Characterizing Individual Occupation and Travel Heat Burdens through Both Exposure and Reprieve. Paper submitted to the International Society of Biometeorology, 2024.



to dehydration and heat-related ailments. Additional occupations such as transportation and extraction workers, electric grid workers and utility maintenance crews, delivery drivers, and entertainment occupations, particularly restaurants and food service, are particularly vulnerable.

Prolonged high temperatures can lead to heat-related illnesses, ranging from heat exhaustion to potentially life-threatening heatstroke. Such conditions not only jeopardize the well-being of workers but also contribute to increased healthcare costs and absenteeism. The physical toll of extreme heat can impair cognitive function, concentration, and decision-making abilities, and pose additional risks to occupation safety, particularly situations that involve heavy machinery.

The urgent need for interventions related to the effects of extreme heat on both occupational health and broader community well-being cannot be overstated. Proactive measures are imperative to safeguard the health and productivity of outdoor workers and those exposed to high temperatures for prolonged periods of time. Workplace interventions, including mandatory breaks in shaded areas, hydration programs, and the provision of cooling measures, are essential to mitigate the risks of heat-related illnesses. Public health campaigns and community outreach initiatives can raise awareness about the dangers of extreme heat and educate both employers and workers about preventive measures. Implementing heat-resilient infrastructure, such as shaded rest areas and proper ventilation in workplaces, is crucial to create environments that prioritize the well-being of those vulnerable to prolonged heat exposure.

Benefits of an Extreme Heat Preparedness Plan

Creating an extreme heat preparedness plan for the State of Arizona is of paramount importance due to the region's susceptibility to high temperatures being in the desert Southwest, but also in a changing dynamic of increasing temperatures affecting the landscape in myriad ways.

As Arizona continues to experience rising minimum temperatures, greater extremes, and prolonged heatwaves, the well-being of its residents, ecosystems, and critical infrastructure is increasingly at risk. Addressing extreme heat through proactive measures and interventions can yield numerous benefits, both in terms of public health and overall societal well-being.

Some key advantages include:

- **Health Protection:** Implementing strategies to address extreme heat helps protect public health by reducing the incidence of heat-related illnesses and fatalities. This is particularly important for vulnerable populations, such as the elderly and those with pre-existing health conditions.
- **Community Resilience:** Developing and implementing heat action plans, along with community engagement and education programs, enhances community resilience to extreme heat. This includes providing cooling centers, promoting green urban spaces, and fostering a sense of community preparedness.
- **Air Quality Improvement:** Extreme heat can exacerbate air quality issues, especially in urban areas. Implementing measures to address heat, such as reducing urban heat islands through green infrastructure, can also contribute to improved air quality and public health.
- **Reduced Mortality:** By mitigating the impacts of extreme heat, especially during heatwaves, the risk of heat-related deaths can be significantly reduced. Timely interventions, such as heat health warning systems and public awareness campaigns, can contribute to saving lives.
- **Economic Stability:** Addressing extreme heat can contribute to economic stability by preventing damage to critical infrastructure, reducing healthcare costs associated with heat-related illnesses, and maintaining productivity in various sectors, including agriculture and energy.
- **Energy Efficiency:** Implementing energy-efficient practices and technologies can help manage the increased demand for cooling during extreme weather events. This, in turn, can contribute to the stability of energy systems and reduce greenhouse emissions.

Overall, addressing extreme heat involves understanding the changing environmental circumstances. The Arizona climate has experienced rising temperatures, similar to much of the United States and the world as a whole. It also means consideration of a multi-faceted approach to mitigate, prepare, adapt, respond, and recover from the impacts of heat that combines public health initiatives, environmental conservation, infrastructure resilience, and community engagement. These efforts not only address the immediate impacts of extreme heat but also contribute to building a more sustainable and resilient society in the face of a continually changing climate.

Proposed priority actions

Recognizing the Governor’s Office will be integrating various agency recommendations and prioritizing multiple approaches to heat preparedness and response, it is critical that a small number of key immediate priority actions drive the plan’s creation and implementation. We recommend four general domains of action as the most critical starting points to consolidate a statewide Arizona Extreme Heat Preparedness Plan.

Collaborative Systems Execution Structure

Integrated Dynamic Planning Framework

Formalized Ubiquitous Communications Support




Innovative Forward-Looking Components

Collaborative systems execution structure

Our primary system-change recommendation is the establishment of a collaborative execution structure to make sure the plan serves the people of Arizona. This starts with the appointment of a Chief Heat Officer (CHO) for the State of Arizona, a first-in-the nation position. The CHO would be housed within the Operations Department of the Governor’s Office, tasked with coordinating and collaborating with two key bodies – the Interagency Resiliency Forum (IRF) and the Arizona Heat Resilience Working Group. This individual would have a direct line of communication with the Executive and work in partnership with the Director of the Governor’s Office of Resiliency.

While the CHO would be empowered to make decisions and access resources, the role would not be authoritarian in execution, nor would this individual have sole responsibility for implementation of heat response actions. In practice, the CHO would be a coordinating and supporting position, whose role would be to coordinate the work of those state agencies and key community stakeholders who are on the frontlines of heat response. Additionally, the CHO would serve to ensure community stakeholders’ needs, feedback and leadership are fully integrated into heat response planning.

The role would be nested within two primary leadership collectives. The first is the Interagency Resiliency Forum (IRF), chaired by the Governor. The IRF’s agenda and goals are articulated and driven by a Steering Committee of four key leaders (Heads of the Governor’s Office of Resiliency; Arizona Department of Health Services; Department of Emergency and Military Affairs, and the CHO) and the IRF would be staffed by key heat response agency heads and those staff with the expertise and authority to both map state heat planning and activate agency response. The IRF will partner with the Arizona Heat Resilience Working Group (AZHRWG). This group meets monthly but transitions to bimonthly during the heat season and is composed of city leadership, health departments, non-profits, faith communities, academia, and emergency management. It is, and would continue to be, a space for sharing best practices, future plans, and reflections on what has and has not been successful. To ensure this group’s voice is fully integrated into heat response, a member of the AZHRWG should sit on the IRF. More details on these individual recommendations are provided in the full set later in this report.

-  **Chief Heat Officer for the State of Arizona**
-  **Interagency Resiliency Forum**
-  **Arizona Heat Resilience Working Group**

Integrated dynamic planning framework

Once the above execution structure is in place, the actions that should be prioritized by the above groups relate directly to the Arizona Extreme Heat Preparedness Plan. This planning framework should be integrated across state agencies and stakeholder communities and exhibit a dynamic character that evolves and improves over time. Embedded within the responsibilities of the CHO would be the primary task of maintaining in real time the statewide plan as a point of integration, or “plan of plans.” The overarching Extreme Heat Preparedness Plan should function as both a storehouse of new, integrated approaches to proactively address extreme heat while also serving as a documented, coordinated location where individual agency heat approaches should be housed, assessed, and referenced.

As part of the extensive process to create a statewide approach to preparing and responding to extreme heat, individual executive agencies – and specifically Interagency Resiliency Forum members – would be creating internal plans, policies, and procedures specific to serving their individual missions and constituencies. In order to support that work, as well as ensure there is no unnecessary duplication of effort and opportunities for synergies and collaboration are identified, the statewide Extreme Heat Preparedness Plan can serve as a storehouse and index. In addition, consultation of best practices and how to assess the quality of individual plans, tools such as the Plan Integration for Resilience Scorecard™ (PIRS™) for Heat should be utilized.

The extreme heat plan is in direct response to the recognition Arizona’s summers would continue to create long durations of extreme heat and the negative outcomes associated with those heat events. However, extreme heat is a permanent, yet ever-evolving challenge, with each summer unique and with unforeseeable events that would impact state response. Further, as key elements of this plan are implemented, positive impacts would also likely result in changes that would require modifications. As a result, a statewide plan must maintain dynamism. To ensure responses are current, it is important a statewide strategy and cadence for long-term institutionalization of the Office of Resiliency, the Interagency Resiliency Forum, and review and application of the statewide plan is established.

Under the leadership of the Governor’s Office, Interagency Resiliency Forum leaders should, at a minimum, meet quarterly as part of a modified approach to Continuous Quality Improvement, creating a cadence that allows for review of plan implementation and annual updates. This could also include a preparedness check-in during the spring; a real-time assessment of impact and modification during summer; a look-back and suggested plan changes in the fall; and at the beginning of the year, implementation of plan modifications along with updated requests for policy or funding changes. Plan update and renewal is recommended once every three years.

The assets of the State of Arizona are implicated in these plans as well. For example, EO 2023-16 calls for a personnel process to allow State of Arizona employees to provide staffing at cooling centers and to provide heat relief to impacted communities. Supplies, services, and facilities of the State of Arizona would be incorporated into the evolving actions as the implementation of this integrated, dynamic framework is put into place. Further details are available in the specific recommendations later in this report.

- **Plan of plans**
- **Continuous improvement principles**
- **State procedures for holistic heat response**

Formalized ubiquitous communications support

Building upon existing statewide efforts led by the Arizona Department of Health Services’ (ADHS) Arizona Heat Resilience Working Group and the Department of Emergency and Military Affairs (DEMA) specific to communicating heat dangers, warnings, and resources, a formalized, dynamic statewide heat communication plan should be expanded and formalized.

Key to this effort is inclusion of multi-jurisdictional partners and stakeholders including but not limited to: tribal governments, counties, cities, nonprofit organizations, faith communities, academic institutions, and community organizations. Additionally, efforts need to both articulate and then respond to the varying access to information statewide, depending on locality. In addition to utilizing standard practices such as producing materials in multiple formats and languages, statewide communications must also recognize the broader challenges of digital inequity and access to information and develop strategies to account for this.

The “Heatsafe Arizona” information hub of ADHS should be expanded and integrated with the Arizona Emergency Information Network (EIN) of DEMA, thereby enhancing the ability to monitor and accurately visualize the impacts of heatwaves and bolster the state’s capacity in providing immediate assistance and

guidance during extreme heat conditions. Because communications access is not yet ubiquitous across the entire State of Arizona, the expansion of investments in communications and digital infrastructure everywhere to enable public awareness and public warning systems is critical. Further details on specific recommendations related to this priority action domain is available in the full set of recommendations later in this report.

- **Rapid public outreach and awareness campaigns**
- **Heatsafe emergency information network**
- **Digital equity for extreme heat warnings and communications**

Innovative forward-looking components

The Arizona Extreme Heat Preparedness plan offers the state an opportunity to extend our vision beyond the immediate challenges of the upcoming summer. The plan provides the transformative chance to serve as a blueprint for the future, integrating innovative components that not only enhance current capabilities but also prepare the state for evolving climate impacts, economic growth, and workforce dynamics. With a forward-looking perspective, the plan can set the tone for thriving in Arizona's heat.

Arizona is also one of the fastest growing economies in the nation. There is a need for a study that would articulate and then align the state's future workforce needs with the impacts of climate in a proactive and problem-solving framework. This engagement of the employer and employee productive sector reaches beyond workplace safety and health, to better understand at the level of broad capabilities of technical and professional skills, what kind of latent capacity could be called up for future heat response. For example, planning needs to account for needs specific to advancing smart technologies, renewable energies, planning experts, logistics, health navigators, grid resilience specialists, HVAC innovators, entrepreneurs, and more. Based upon employment projections, and a changing environment, there are components to put in place now to realize a future where Arizona works to face of our climate realities and has the workforce to proactively tackle any challenges.

Moreover, the related need for safe and cool shelter that is affordable reinforces this innovation. The need for housing that is affordable but also heat-smart is necessary to meet the objectives for extreme heat preparedness. Strategic investment at the nexus of technology, construction, and housing, with a focus on affordability, enables Arizona to simultaneously boost economic growth, enhance housing accessibility, and strengthen resilience in the face of rising heat challenges.

The State's economic development strategy should synergize such forward looking workforce and housing planning by reinforcing climate-resilient industries more broadly. Incentive structures, financing mechanisms, and policies to accelerate economic development for new and existing private sector entities, as well as related employee workforce and career pathways in strategic areas that provide the latent capacity for statewide extreme heat preparedness and response, would greatly advance economic security across the state.

- **Strategic workforce development**
- **Heat-smart housing development**
- **Climate resilient economic development**

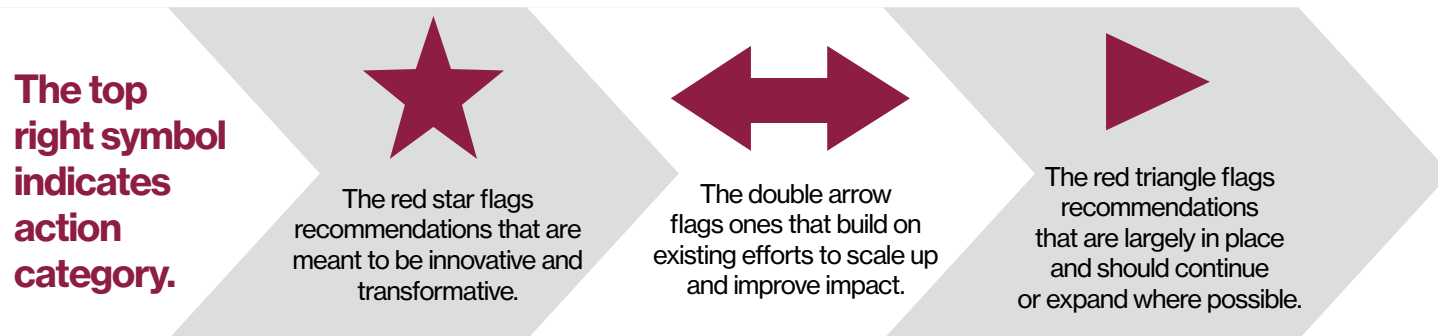


Recommendations

The side tabs indicate which state agencies are involved, where the numbers and letters refer to the specific components of the Governor of Arizona's Executive Order 2023-16. Bright yellow references the lead, and light yellow tags supportive agencies.

- This section of this report compiles a set of one page summaries.
- Each one shares an overview description of a recommendation.
- A set of specific action steps for implementation would be identified by key agencies as part of the State of Arizona Extreme Heat Preparedness Plan.

The text includes the recommended **action, rationale,** and suggests **key actors** including the lead state agency, supporting agencies, and community stakeholders. Metrics of success are suggested in the bottom right corner along with a select few links and references for more details.



| | |
|--|-----------|
| The Office of Resiliency, the Chief Heat Officer, and Interagency Resiliency Forum (IRF) | 1a |
| Office of Strategic Planning and Budgeting (OSPb) | 2 |
| Arizona Department of Health Services (ADHS) | 3 |
| Arizona Department of Emergency and Military Affairs (DEMA) | 4 |
| Arizona Department of Administration (ADOA) | 5 |
| Residential Utility Consumer Office (RUCO) | 6 |
| Department of Economic Security (DES) | 7 |
| Arizona Department of Housing (ADOH) | 8 |
| Industrial Commission of Arizona (IC) | 9 |
| Other agencies and stakeholders may also play a key leadership implementation role, where indicated. | 10 |

The Interagency Resilience Forum has identified seven Extreme Heat Preparedness aims:

- I** To advance readiness / preparedness of key institutions especially state agencies of Arizona to be more prepared to handle extreme heat
- II** To respond effectively during extreme events, including how to know when an emergency is happening, or indicators to activate resources
- III** To lessen Arizonans' exposure to extreme heat, or to improve key settings (workplaces, rural areas, communities without electricity, etc.)
- IV** To reduce vulnerability of Arizonans to effects of heat, especially for key populations (elderly, children, persons with disabilities, etc.)
- V** To grow adaptive capacity to extreme and chronic heat at any scale: at the neighborhood level, in cities or counties, or the whole state
- VI** To build community resilience across sectors, including the public government, private industry, and nonprofit organizations
- VII** To communicate with and engage with the public, the community, and stakeholders around planning to respond to extreme heat.

Statewide systems approach

This set of recommendations advocate for and underpin a statewide, systems approach.



Appoint a Chief Heat Officer.

Recommended Actions: The Governor’s Office should hire and house a Chief Heat Officer (CHO). Arizona would be the first state in the nation to designate such an individual with the dedicated responsibility for statewide support and coordination of agency level responses to the needs of local, county, city, and tribal community preparedness and response to extreme heat.

Rationale: This heat plan is a new and innovative tool to both prepare for and respond to extreme heat, placing Arizona as a national leader in heat response. However, with so many key players and jurisdictions, the challenge of making sure implementation is effective and efficient, meets priorities, and ensuring responses don’t become siloed, will be critical to achieve success. This position is thought to be the first in the United States at the level of the State government, with the dedicated purpose to coordinate extreme heat response, empowered to carry out a statewide plan. This individual should receive staffing, resources, support, and authority, in line with some of the recommendations of this report. Having the statewide Chief Heat Officer under the Governor’s Office will emphasize the importance of this work. It is recommended that the position itself be housed with Operations, and liaise closely with the Office of Resiliency, the IRF, and the stakeholder community. The CHO will focus on extreme heat with individual agency plans as well as help to serve the work of the broad statewide group of stakeholders who have led and will continue to lead local efforts in ways that are enhanced through this role’s focus on collaboration, prioritization, and resource seeking activities.

The CHO should integrate the full population of the state of Arizona affected by extreme heat, facilitate continuous improvement of the plan’s implementation, and convene for the plan’s update every three years. The next edition should also include an assessment of this CHO position and its functions and structure.

Actors: The Governor’s Office leads. Support and liaison will be with the Governor’s Office of Resiliency and the Interagency Resiliency Forum. Critical stakeholders are the network of existing community organizations and the population of Arizona.

Objectives: I, VI, VII
Extreme Heat Preparedness

Timeframe: Short Term
(Less than 6 months)

Metrics of Success:

- Appointment of qualified officer for Summer 2024
- National recognition for first statewide dedicated position

For more details:

City of Phoenix Office of Heat Response and Mitigation <https://www.phoenix.gov/heat>

City of Tucson <https://climateaction.tucsonaz.gov/pages/caap>

State of California’s Heat and Community Resilience Office https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220AB2076

Kingston, Jennifer A. (2023). “Too much heat, too few ‘chief heat officers.’” Axios 12 July. Available at <https://www.axios.com/2023/07/12/chief-heat-officer-extreme-heat-wave-phoenix-Miami>.



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Activate the Interagency Resiliency Forum.

Recommended Actions: In support of, and coordination with, the Chief Heat Officer, the Interagency Resiliency Forum (IRF) should be structured and activated as the primary coordinating body for statewide heat response. Chaired by the Governor and with an agenda determined by a Steering Committee, the IRF will be comprised of professionals who lead their respective agencies in executing the statewide heat plan and individual agency responses.

Rationale: Innovative heat response requires coordination and collaboration. The IRF, established in Executive Order 2023-16, will serve as the primary entity tasked with implementing adaptive heat responses from the plan. Chaired by the Governor, it will be strategically led by a Steering Committee comprised of the Chief Heat Officer, the Director of the Governor’s Office of Resiliency and the agency leads for ADHS and DEMA. The IRF will include key staff from agencies articulated in the executive order and sitting IRF members -- subject matter experts within their respective agencies --who are empowered to craft heat response policy, make decisions on behalf of their agencies, and drive execution of specific tasks that are part of their agency’s heat response. With support of the CHO, the IRF will work with the Arizona Heat Resilience Working Group (AZHRWG), with a member of that stakeholder community assigned as a sitting member of the IRF. It is envisioned that the IRF would meet annually with the Governor to set an annual agenda workplan and review the prior year’s advances. At least once each quarter, the IRF should convene with the AZHRWG, and during hotter months, the IRF should meet internally each month for coordination. The IRF will also serve as the primary coordinating body for formal updates to the Arizona Extreme Heat Preparedness Plan every three years.

Actors: The Governor’s Office, through the coordinating efforts of the Chief Heat Officer, leads, with strategic direction for the IRF set by leaders from the Governor’s Office of Resiliency, the Arizona Department of Health Services and the Department of Emergency and Military Affairs. Critical stakeholders are the network of existing community organizations and state agencies named in Executive Order 2023-16.

Objectives: I, II, VII
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Establishment and convening of newly structured IRF and CHO by Summer 2024
- Update of the Arizona Extreme Heat Preparedness plan in three years

For more details:

Executive Order 2023-16: <https://azgovernor.gov/office-arizona-governor/executive-order/2023-16>



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Collaborate with the extreme heat stakeholder community.

Recommended Actions: The Chief Heat Officer should participate in the Arizona Heat Resilience Working Group and be a member of the steering committee to share state-level actions and coordinate with municipal, non-profit, and academia efforts to address extreme heat. A member of the Arizona Heat Resilience Working Group will also serve on the Interagency Resiliency Forum to ensure grassroots / local voices statewide inform state operating decisions.

Rationale: There is a rich history of active stakeholders collaboratively engaged in mitigating and adapting to extreme heat. The Arizona Heat Resilience Working Group (AZHRWG) was formed in early 2020 when it became apparent that the Covid19 pandemic mandated the closure of public spaces and buildings that offered cooling center services. This group meets monthly but transitions to bimonthly during the heat season and is composed of city leadership, health departments, non-profits, faith communities, academia, and emergency management. It is a space for sharing best practices, future plans, and reflections on what has and has not been successful. The Arizona Heat Resilience Working Group has been involved with the NOAA Roundtables, NOAA Tabletop Exercises, the CDC Building Resilience Against Climate Effects (BRACE) program and, a subgroup, the AZ Cooling Center Working Group. The CHO involvement in the Arizona Heat Resilience Working Group will allow for a more informed, systems approach to extreme heat management and serve the people of Arizona.

Actors: The Chief Heat Officer, the Interagency Resiliency Forum. Critical stakeholders are the network of existing community organizations involved in the cooling center network and heat response working group.

Objectives: I, VI, VII
Extreme Heat Preparedness

Timeframe: Short Term
(Less than 6 months)

Metrics of Success:

- Continuous attendance by Chief Heat Officer to Arizona Heat Resilience Working Group and Steering Committee
- Active cross-committee involvement by a steering committee member to the Interagency Resiliency Forum

For more details:

BRACE Framework: <https://www.cdc.gov/climateandhealth/BRACE.htm>
Heat Working Group: <https://sustainability-innovation.asu.edu/sustainable-cities/az-heat-resilience-workgroup/>
Seventh Annual Arizona Extreme Heat Planning Workshop 2023: https://www.youtube.com/watch?v=cde6FVT_32Y
NOAA Stakeholder Roundtables <https://research.asu.edu/asu-noaa-exercise-visualizes-future-arizona>



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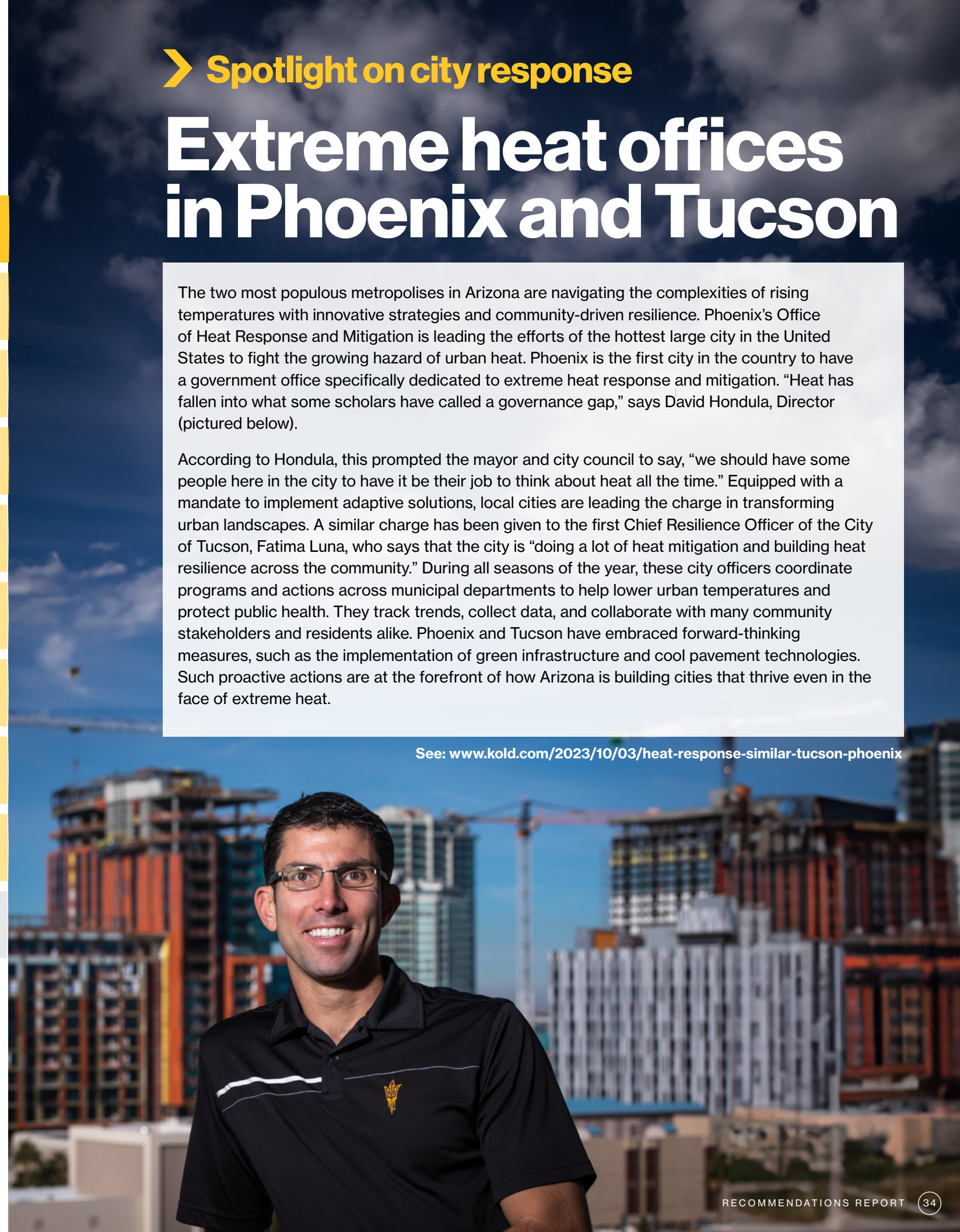
> Spotlight on city response

Extreme heat offices in Phoenix and Tucson

The two most populous metropolises in Arizona are navigating the complexities of rising temperatures with innovative strategies and community-driven resilience. Phoenix's Office of Heat Response and Mitigation is leading the efforts of the hottest large city in the United States to fight the growing hazard of urban heat. Phoenix is the first city in the country to have a government office specifically dedicated to extreme heat response and mitigation. "Heat has fallen into what some scholars have called a governance gap," says David Hondula, Director (pictured below).

According to Hondula, this prompted the mayor and city council to say, "we should have some people here in the city to have it be their job to think about heat all the time." Equipped with a mandate to implement adaptive solutions, local cities are leading the charge in transforming urban landscapes. A similar charge has been given to the first Chief Resilience Officer of the City of Tucson, Fatima Luna, who says that the city is "doing a lot of heat mitigation and building heat resilience across the community." During all seasons of the year, these city officers coordinate programs and actions across municipal departments to help lower urban temperatures and protect public health. They track trends, collect data, and collaborate with many community stakeholders and residents alike. Phoenix and Tucson have embraced forward-thinking measures, such as the implementation of green infrastructure and cool pavement technologies. Such proactive actions are at the forefront of how Arizona is building cities that thrive even in the face of extreme heat.

See: www.kold.com/2023/10/03/heat-response-similar-tucson-phoenix



Create a plan of plans.

Recommended Actions: The overarching Extreme Heat Preparedness Plan should eventually function as both a storehouse of existing and new integrated approaches to proactively address extreme heat, and also serve as a documented, coordinated location where individual agency heat approaches could be housed, assessed, and referenced. As a plan of plans, it would consolidate, synergize, and reinforce coordination of documents and processes to fully incorporate extreme heat preparedness across and within agencies. The Chief Heat Officer oversees implementation.

Rationale: As part of the extensive process to create a statewide approach to preparing and responding to extreme heat, individual Executive Agencies will be creating internal plans, policies, and procedures specific to serving their individual missions and constituencies. In order to support that work, as well as ensure there is no duplication of effort and opportunities for synergies and collaboration are identified, the statewide Extreme Heat Preparedness Plan can serve as a storehouse and index of agency work. In addition, to consult best practices and assess the quality of individual plans plans, tools such as the Plan Integration for Resilience Scorecard™ (PIRS™) for Heat should be utilized.

Actors: Governor’s Office leads. All Interagency Resiliency Forum participating agencies as well as other agencies identified as engaging in heat planning as part of their agency planning. University based planning experts support.

Objectives: I, VI, VII
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Number of agencies engaged
- Number of plans referenced
- Qualitative integration

For more details:

Keith, Ladd and Sara Meerow. (2022). Planning for Urban Heat Resilience. American Planning Association PAS Report 600. ISBN 978-1-61190-208-2 Available at <https://www.planning.org/publications/report/9245695/>

Plan Integration for Resilience Scorecard™ (PIRS™) for Heat <https://www.laddkeith.com/research/pirsh>



Adopt continuous improvement principles.

Recommended Actions: Develop a strategy and cadence for long-term institutionalization of the Office of Resiliency, the Interagency Resiliency Forum, and the review of the Arizona Statewide Extreme Heat Preparedness Plan.

Rationale: Under the leadership of the Governor’s Office of Resiliency, Interagency Resiliency Forum agency leaders should meet quarterly as part of a modified approach to Continuous Quality Improvement, creating a cadence that allows for review of plan implementation and annual updates. This could include a preparedness check-in during the spring; a real-time assessment of impact and the ability to modify in the moment in the summer; a look back and suggested plan changes in the fall; and at the beginning of the year, implementation of plan changes and presentation of potential legislative proposals, and updated funding needs for improved response for the upcoming summer. The Extreme Heat Preparedness plan was called for in direct response to the recognition Arizona’s summers will continue to create long durations of extreme heat and the negative outcomes associated with those heat events. While the permanent nature of the challenge of extreme heat is clear, it is recognized that each summer is unique and there are unforeseeable events that will impact how the state responds in the future. Further, as key elements of this plan are implemented, positive impacts will also likely result in changes that will require modified response.

Actors: Governor’s Office of Resiliency leads. Other Executive staff potentially including policy advisors and OSPB, all Interagency Resiliency Forum participating agencies, other agencies identified as engaging in heat planning are key secondary actors.

Objectives: V, VI, VII
Extreme Heat Preparedness

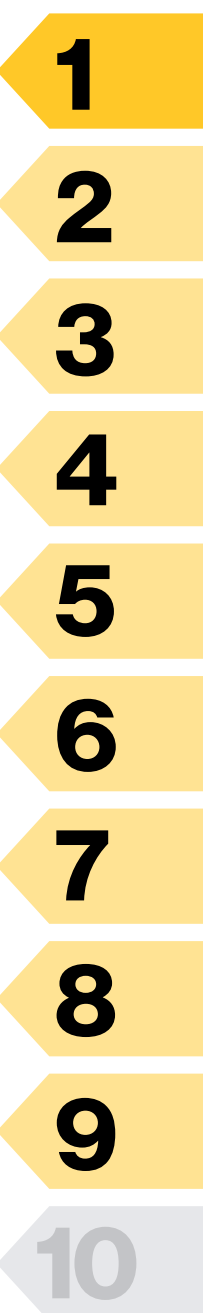
Timeframe: Longer Term
(up to 4 years)

Metrics of Success:

- An established quarterly meeting schedule for Forum members and other key stakeholders.
- A drafted timeline each year of the process cycle the Governor’s Office of Resiliency will utilize so each quarterly meeting’s goals are clear.
- An updated plan at the start of each year with any identified legislative or funding priorities identified for possible inclusion in the Executive Budget and other proposals.

For more details:

Executive Order 2023-16: <https://azgovernor.gov/office-arizona-governor/executive-order/2023-16>



Coordinate a statewide cooling center network.



Recommended Actions: Develop a statewide cooling center network strategy and heat relief cooling center plan building upon existing activities and networks. Establish a statewide Heat Relief Program Manager recruited from within the cooling center community, to annually manage a statewide cooling center network, including improving and expanding current offerings, developing minimum standards for operations, increasing efficiencies relating to supply chain management, and providing consistent communication.

Rationale: Prior to each heat season, the Heat Relief Cooling Center strategic plan should be updated based upon feedback from the previous heat season and changing needs (geographically and by vulnerable population shifts). The Chief Heat Officer should facilitate oversight and support. Cooling centers are utilized by residents that do not have access to free, indoor, cooled spaces and includes those on a limited budget, people without working air conditioning, and unsheltered populations. Various types of cooling centers (hydration stations, cooling centers, and respite centers) in Arizona are collaboratively managed through a network of cities, non-profits, local businesses, the faith-based community, health departments, and volunteers. The Arizona Cooling Center Workgroup, established in 2020, seeks to address concerns, share best practices, and advocate for a sustainable funding stream to operate cooling centers. Though various evolutions of the Cooling Center Network have been operating for many years, there are numerous gaps in coordination, funding, and communication that necessitate a designated position and a coordinated strategic plan. A dedicated manager will coordinate optimal locations for providing publicly available heat relief sites, ensuring standards across sites, increasing access to and dissemination of supplies, collecting data for better decision making and planning, and communicating for the network. In Maricopa County cooling centers operate continuously from May through September, whereas other counties launch cooling centers based upon extreme heat warnings from the National Weather Service.

Actors: The position would be aligned with the Chief Heat Officer in the Governor's Office, and populated by the cooling center community. Activities planning is led by ADHS in partnership with DEMA, ADOA, OSPB, RUCO together with current cooling center providers (City of Phoenix and other municipalities, AFN, Salvation Army) and organizations assisting with cooling center operations (211, county health departments, ASU, University of Arizona).

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Objectives: III, IV, V
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

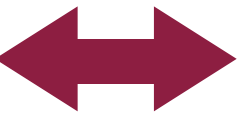
- Launch of Cooling Center Network
- Contract a Statewide Manager
- Release of Strategic Plan
- Number of cooling centers engaged
- Number of counties participating

For more details:

On the Arizona Cooling Center Workgroup: <https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/heat/statewide-cooling-centers.pdf>

On the Maricopa County Heat Relief Network: <https://azmag.gov/Programs/Heat-Relief-Network>

Manage state-owned assets for heat response.



Recommended Actions: Make available State-owned assets and equipment that could be used to assist in heat relief both in and around the Governmental Mall, and across the State. Assess and align supply chains for State acquisition of heat-smart assets.

Rationale: The implementation of Smart Grid Technology within the state government's infrastructure can significantly enhance the management of energy demand and response to power outages, particularly during heatwaves. By integrating this technology, state agencies can efficiently monitor and control energy consumption, ensuring optimal utilization and resilience across diverse facilities. Additionally, prioritizing infrastructure upgrades for state-owned assets, including critical facilities, becomes paramount to bolster resilience against extreme heat. This involves investing in equipment upgrades capable of withstanding higher temperatures, thereby minimizing vulnerabilities. Furthermore, strategic investment in backup power systems is crucial, especially for essential facilities like hospitals, emergency services, and schools, ensuring uninterrupted power supply during extreme heat events. Identify potential evacuation centers and processes. This comprehensive approach aligns with the state's commitment to enhancing the reliability and adaptability of its assets. Immediate action can be taken in Summer 2024. Commission of a more detailed study of assets and opportunities is also recommended for long-term actions.

Actors: ADOA leads. **Note:** EO 2023-16 directs ADOA to plan for how to manage State-owned assets and equipment that could be used to assist in heat relief. Partnerships should include Arizona Commerce Authority, ADOT, and DEMA for continuity planning.

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Objectives: I, II, VI
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Miles of roads and square miles of land areas with assets converted to heat smart and heat relief purposes
- Utilization of state assets for heat relief by number of persons served
- Commission and completion of a detailed asset study

For more details:

<https://www.azcommerce.com/resources/arizona-assets/>

<https://land.az.gov/maps-gis>

<https://azdot.gov/maps>

Align state procedures for holistic heat response.

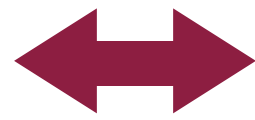
Recommended Actions: Address actions aligning the State of Arizona as a whole of government approach to contribute human, fiscal, and physical resources for extreme heat preparedness and response.

Rationale: The Executive Order 2023-16 calls for the Arizona Department of Administration to:

1. Develop a personnel process to allow State of Arizona employees to provide staffing at cooling centers and to provide heat relief to impacted communities. The process should allow State of Arizona employees who choose to serve at a cooling center or other State-approved heat relief efforts to receive regular duty pay following written approval from their supervisor.
2. Amend the State of Arizona Accounting Manual (SAAM) to allow for the purchase of necessary supplies and services to carry out the requirements of this Executive Order.
3. Assess and make recommendations for use of ADOA owned and managed facilities to mitigate effects of extreme heat to the public where appropriate, and collaborate with the ADOA and ADOT Building System agencies for the same.

We also recommend training for cooling center volunteers in necessary skills such as first aid, heat health awareness, Narcan, mental health training, and other skills.

Actors: ADOA leads. Secondary state agencies include state employees, ADOT and the IRF as a whole for end use purposes. Critical stakeholders are county transportation agencies and tribal governments.



Metrics of Success:

- Launch staffing strategy
- Manual is amended
- Number of buildings / facilities engaged in the strategy

For more details:

On the Arizona Cooling Center Workgroup: <https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/heat/statewide-cooling-centers.pdf>
 On the Maricopa County Heat Relief Network: <https://azmag.gov/Programs/Heat-Relief-Network>

Align hazard mitigation plans.



Recommended Actions: Align hazard mitigation plans at multiple levels and provide technical guidance for all government agency emergency preparedness plans in accordance with the potential anticipated amendment of the Stafford Act that includes provisions for extreme heat.

Rationale: This alignment and guidance necessitates that each city, county, or state agency reviews their existing hazard mitigation plan and/or emergency preparedness plans to include a provision, if not already included, focused on extreme heat mitigation, preparedness, response, and recovery. The primary goal of these amendments is to develop and incorporate specific strategies and actions that directly target extreme heat situations. These strategies and actions should be designed so they can be quickly implemented using FEMA's resources upon potential passage of the Stafford Act amendment to include extreme heat as a qualifying disaster. These same revisions can also be used in case of executive-issued emergency declarations. Insights gained from the process should be communicated with FEMA, NOAA, and other heat.gov federal entities

Actors: Led by DEMA, per ongoing FEMA hazard mitigation planning efforts. The secondary State Agencies to implement include all of the Interagency Resiliency Forum, as well as governments at all levels, all Tribal Nations, counties, and incorporated cities across Arizona which have FEMA-related or local emergency plans.



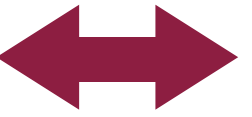
Metrics of Success:

- Establishment and convening of newly structured IRF and CHO by Summer 2024
- Update of the Arizona Extreme Heat Preparedness plan in three years

For more details:

Executive Order 2023-16: <https://azgovernor.gov/office-arizona-governor/executive-order/2023-16>

Take a basic needs approach to extreme heat preparedness.



Recommended Actions: Analyze and assess availability of and need / demand for program dollars for meeting the basic needs of Arizonans, by examining various economic security programs (ex. TANF, SNAP) to ensure during the hottest months of the year their usage can be maximized and optimized for the most vulnerable households at the most vulnerable time.

Rationale: Basic needs programs serve many of the state's most vulnerable households and individuals; including the elderly and households with children. Households that are more financially stable are able to better weather extreme heat situations and ensuring supports are available at the hottest months of the year can increase those who remain housed and can pay for air conditioning. We recommend that this analysis to optimize and improve economic security programming, which is anticipated to have already begun within DES, to specifically pay attention to data during the summer months. We recommend that the cumulative impact that heat may play or that the timing of these insecurities due to other causes be recognized by the State of Arizona, as a whole, and that pertinent data be shared with researchers in time periods that permit temporal analysis of the nature of heat as a threat multiplier.

Actors: DES leads, in partnership with Community Action Agencies and non-profit providers that process and administer applications and programs throughout the state.

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Objectives: III, IV
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Data collection and application to maximize or optimize resources in place
- Maximized usage of supports during highest-heat months

For more details:

Zhao, Q., C. Dickson, J. Thornton, P. Solis, E.A. Wentz. (2020). Articulating strategies to address heat resilience using spatial optimization and temporal analysis of utility assistance data of the Salvation Army Metro Phoenix. *Applied Geography* 122(2020):1-10. DOI: 10.1016/j.apgeog.2020.102241

Who we are.

This set of recommendations focuses especially on Arizonans who are among the most vulnerable to heat.

Provide universal basic access to electricity to all Arizonans.

Recommended Actions: Provide Universal Basic Access to Electricity (UBAE), at a minimum number of kilowatt-hours (KWh) of free electricity to qualifying Arizona residents that suffices to provide power for basic needs for survival, such as for security (light at night), food (refrigeration), and life (AC and medical devices).

Rationale: In the State of Arizona, access to electricity is not simply a convenience. It is a matter of life and death. A basic minimum amount of power supply is a fundamental human need, particularly in light of extreme heat that is experienced frequently. The Arizona Technology Council estimates that 15,000 Native American families live without electricity. The Maricopa County Public Health Department reveals that among indoor heat associated deaths, lack of electricity has been a factor in approximately one third of cases. The City of Phoenix has a basic water allocation following this same principle and may serve as a model to adapt. Providing Universal Basic Access to Electricity (UBAE) directly supports the mission of the state for protection of life and security.

Actors: RUCO and ACC to lead. Partnerships that are important include Navajo Nation, other tribal governments, DES, as well as stakeholders in the Arizona Technology Council, solar power industry, utilities, municipalities, and the public.

Objectives: III, IV
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Number of persons supported by the provision of UBE
- KWh provided by the program
- Equivalent number of dollars of energy granted
- Reduced heat associated illness and death

For more details:

OECD international standard metric: <https://www.oecd-ilibrary.org/sites/e6a2a7bd-en/index.html?itemId=/content/component/e6a2a7bd-en#:text=SDG%20Target%207.1%20sets%20out,narrower%20than%20%E2%80%9Cenergy%20services%E2%80%9D>

Arizona Technology Council: <https://www.aztechcouncil.org/15000-native-american-families-live-without-electricity-how-can-solar-power-help/>

Reported 2023 Heat Associated Deaths: <https://www.azcentral.com/story/news/local/phoenix-weather/2023/10/20/425-confirmed-heat-associated-deaths-maricopa-county-2023/71246754007/>



Ensure universal power provision to all Arizonans.

Recommended Actions: Ensure Universal Power Provision (UPP) to all residents of Arizona, so that resources reach unelectrified parts of the state.

Rationale: The Arizona Technology Council estimates that 15,000 Native American families in Arizona live without electricity. Because having a source of electric power can be a matter of life and death in Arizona, particularly in light of extreme heat, providing Universal Power Provision directly supports the mission of the state for protection of life and security.

Actors: RUCO and ACC to lead. Partnerships that are important include Navajo Nation, other tribal governments, DES, as well as stakeholders in the Arizona Technology Council, solar power industry, utilities, municipalities, and the public.

Objectives: III, IV
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Number of persons with new access to electricity by the provision of UPP
- Percentage of persons with access to electricity to 100% in all jurisdictions
- Reduced heat associated illness and death
- Sustainable Development Goals (SDG) indicator 7.1.1

For more details:

OECD international standard metric: <https://www.oecd-ilibrary.org/sites/e6a2a7bd-en/index.html?itemId=/content/component/e6a2a7bd-en#:text=SDG%20Target%207.1%20sets%20out,narrower%20than%20%E2%80%9Cenergy%20services%E2%80%9D>

Arizona Technology Council: <https://www.aztechcouncil.org/15000-native-american-families-live-without-electricity-how-can-solar-power-help/>

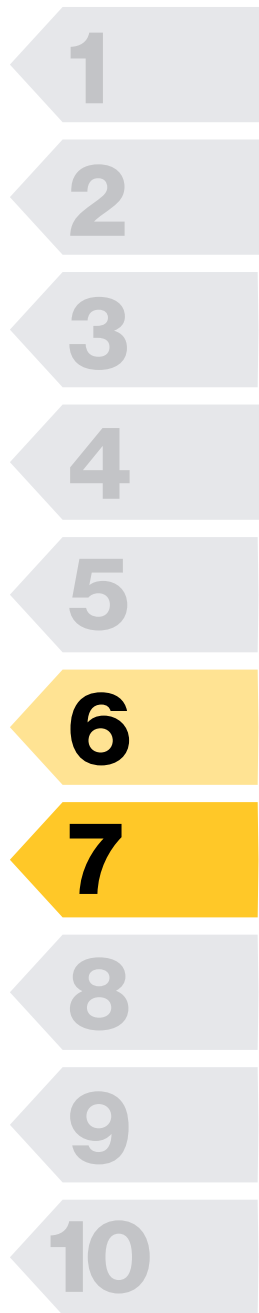


Streamline support for utility assistance.

Recommended Actions: Explore potential data-sharing opportunities between the Arizona Department of Economic Security (DES) and participating utilities and cooperatives to allow applicants for DES supports including TANF and SNAP to automatically be referred for utility bill assistance if they meet qualifying requirements.

Rationale: The Arizona Department of Economic Security is responsible for eligibility determination for Temporary Assistance for Needy Families (TANF or cash assistance); SNAP (Supplemental Nutrition Assistance Program or food stamps); and Medicaid. They also administer both the TANF and SNAP programs for qualifying households.

Actors: DES to lead, RUCO to support. All Arizona utilities and utility cooperatives are important partners.



Objectives: III, IV
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Establishment of a data-sharing agreement between DES and participating utilities.
- Increase in number of households receiving utility assistance.

For more details:

<https://des.az.gov>

Protect children.

Recommended Actions: Analyze and assess availability and usage around child care assistance dollars and provider reimbursements to ensure during the hottest months of the year (also when children are not in school), so that usage can be maximized and optimized. This could include protecting recent increased reimbursements for childcare providers for those providers who conform to cooling standards and explore expansion of the provision of child care subsidies as well as maintain no wait list.

Rationale: Children are one of the most vulnerable populations to heat. Families that are more financially stable are able to better weather extreme heat situations and expanding households who qualify for the childcare subsidy expands the size of the population who have a safe, stable (air-conditioned) place for their children. This subsidy also allows parents to work and redirect income to provide for other necessities such as housing and utilities. Maintaining the increased funding (federal dollars provided in response to COVID) allows providers to not only retain more staff and keep centers open, but also allow for lower costs to families.

Actors: DES leads, in partnership with ADHS Bureau of Childcare Providers. Stakeholders include entities with oversight of childcare providers in conforming to cooling standards and providers themselves.



Objectives: I, II, VII
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Data collection and application to maximize resources in place
- Continued support at previous levels
- Maximized / optimized usage of support during highest-heat months

For more details:

DES Child Care information is available at <https://des.az.gov/services/child-and-family>

Work with Tribal governments.

Recommended Actions: Recognizing the distinct challenges faced by Tribal Nations in the context of extreme heat, underscoring the importance of Arizona's 22 Federally Recognized Tribes to the State of Arizona, and acknowledging the unique cultural and social assets of members of First Nations, we recommend a dedicated and concerted effort to collaborate directly with Tribal Governments around the vision, strategy, content, updates, and implementation details of the Arizona Extreme Heat Preparedness Plan.

Rationale: Some indigenous populations have higher rates of certain chronic medical conditions that increase risk for illness and death due to extreme heat. Climate change is threatening natural ecosystems that are essential to many First Peoples' livelihoods, food sources, and cultural practices. In some of Arizona's Tribal Nations, a lack of infrastructure and essential services, such as roads, water, emergency response, and health care, presents barriers to heat preparedness and exacerbates the impact of extreme heat on residents. For example, according to the Navajo Tribal Utility Authority, an estimated 15,000 families on the Navajo Nation live without electricity, limiting access to common cooling technologies. The approach for working with Tribal Governments directly as part of the statewide extreme heat plan, should leverage the distinct sovereignty and unique traditions of Tribal communities for supporting solutions. It is vital that Tribal Governments are brought into the early phases of planning for heat resilience for long-term continuity and coordination. Engagement should take into account the cultural, social, and environmental considerations of each Nation. It should co-develop support strategies that are culturally sensitive, respectful of traditional knowledge, and tailored to the specific circumstances of the various 22 Nations, ensuring tribal leadership in their central roles of decision-making within their respective communities are fully engaged in the plan development, execution, and evolution.

Actors: The Governor's Office, through the Chief Heat Officer, leads. Essential stakeholders include members of Tribal Nations themselves; existing community organizations engaging with and comprised of First Peoples; the Intertribal Council of Arizona, and other specialized entities such as the Navajo Nation Commission on Emergency Management, Navajo Tribal Utility Authority, and others within each Nation.

Objectives: I, IV, VI
Extreme Heat Preparedness

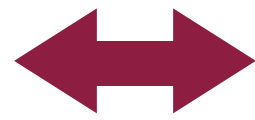
Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Number of Tribal Nations represented in plan engagement, quality of the engagement.
- Successful co-identification of responses for incorporation into the statewide plan that directly address needs of Arizona's indigenous population
- Reduction in the disproportionate share of heat associated mortality and morbidity.

For more details:

Jantarasami, L.C., et al. (2018). Ch. 15: Tribes and Indigenous peoples. In: Impacts, risks, and adaptation in the United States: Fourth national climate assessment, volume II. U.S. Global Change Research Program, Washington, DC, USA, p. 582.



Improve digital equity for extreme heat warnings and communications.



Recommended Actions: Connect digital equity and universal broadband access efforts to extreme heat preparedness and response planning and implementation action. Expand investment in communications and digital infrastructure everywhere to enable public awareness and public warning systems. Establish real-time alerts that support the World Meteorological Organization's Early Warnings for All program.

Rationale: Access to reliable internet and cellular communications is critical to response in times of emergency, as well as access to preparedness and adaptation resources. Communication of extreme heat response and relief is enhanced significantly by improving digital equity. Populations that are vulnerable to heat correlate to populations that experience inequities in digital access. This recommendation reinforces the aim to implement Public Warning Systems that provide real-time warning and prevention recommendations during periods of extreme heat. Investing in low-cost non-subscription technologies for community alerts to be distributed among extremely vulnerable people with multiple risks is critical to addressing extreme heat preparedness. This approach could reinforce technology innovation, which could be purchased and distributed by the State of Arizona for extremely vulnerable residents, such as the prototypes developed by ASU students in the EPICS program for low-cost early warning devices.

Actors: Governor's Office of Resiliency, DEMA, ADHS under leadership of Digital Equity Leadership. Tribal governments.

Objectives: II, IV, VII
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Increased number of people connected to digital infrastructure
- Percentage of populations connected that are underrepresented minorities, Native American, or economically disadvantaged
- Dollars leveraged for improved connectivity and heat awareness

For more details:

Governor Katie Hobbs Celebrates Nearly \$1 Billion to Support Broadband Connectivity in Arizona: <https://azgovernor.gov/office-arizona-governor/news/2023/06/governor-katie-hobbs-celebrates-nearly-1-billion-support>
World Meteorological Organization's Early Warnings for All Dashboard: <https://wmo.int/activities/monitoring-and-evaluation-merp/early-warnings-all-dashboard>
Drake, Thomas, Trenton Ward, and Will Yeager. (2023). Heat Warning Detection System - Utilizing Connective Solutions to Reduce Heat-Related Deaths in Low-Income Communities. ASU Barrett Honors College Undergraduate Thesis and EPICS Project. Director Dr. Jared Schoepf and Committee Member Dr. Patricia Solis.



➤ **Spotlight on technology**

Low-cost heat warning detection device

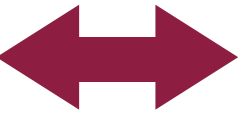
Recognizing the heightened risk faced by older adults, particularly in regions prone to scorching temperatures, and of lower income residents in housing that is difficult to keep cool, a dedicated group of Arizona State University Barrett Honors Students in the Engineering Projects in Community Service (EPICS) program has embarked on a mission to design a low-cost early warning alert device tailored for the unique needs of Arizona residents. These students have developed an early prototype that serves as a vigilant guardian against the dangers of high indoor temperatures. They are also designing an accompanying unmoderated alert system via internet and cell communications. This unobtrusive device monitors indoor thermal measurements and, when conditions reach a potentially hazardous threshold, the device triggers a text message alert to both the resident and a designated loved one. The device has successfully achieved proof-of-concept after testing with older residents of mobile home communities in Tempe. Team leader Thomas Drake (pictured below) says, “It’s great to be a part of something like this, to potentially utilize connective solutions that could ultimately reduce heat-related deaths in low income communities.” Their technology initiative aims not only to provide a crucial early warning to vulnerable residents, but also to foster a sense of community vigilance. This entrepreneurial team continues to move the project forward, seeking to manufacture and distribute the detection devices to make them broadly available.

See: <https://barretthonors.asu.edu> and epics.engineering.asu.edu



PHOTO BY KEVIN BUSHAW

Protect uniquely vulnerable populations from extreme heat.



Recommended Actions: Assess and create statewide actions to protect Arizonans in the prison system, assisted living facilities, and youth aging out of the foster care system.

Rationale: While elderly are known to be more vulnerable to heat and its effects, the explicit statewide promotion of extreme heat preparedness planning within assisted living facilities is not universal. Incarcerated persons may face higher exposure to extreme temperatures when facilities are inadequate or heat preparedness is not in place. Minors in the foster care system who age-out are more at risk to experience homelessness, and thus would be susceptible to higher exposure, as lack of shelter raises risk rather than characteristics of their age and physiological factors. These vulnerable populations interact with state agencies and must be protected by assuring adequate facilities and cooling, educational awareness and training for future heat readiness, and systematic oversight where state funds are provided.

Actors: Leadership of broad planning actions to initiate actions for these populations should be assumed by the Chief Heat Officer alongside significant attention and engagement from the specific state entities with direct authority over special populations, namely Department of Corrections, Rehabilitation and Reentry for the incarcerated; ADHS for assisted living and Department of Child Safety for foster care youth; plus the nonprofit and services sector, such as AARP, ResilientMe, United Way, and others.

Objectives: I, IV
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Number of facilities improved
- Number of vulnerable people affected

For more details:

Skarha J, Peterson M, Rich JD, Dosa D. An Overlooked Crisis: Extreme Temperature Exposures in Incarceration Settings. *Am J Public Health*. 2020 Jan;110(S1):S41-S42. doi: 10.2105/AJPH.2019.305453. PMID: 31967879; PMCID: PMC6987924.

Skarha J, Spangler K, Dosa D, Rich JD, Savitz DA, Zanolotti A. Heat-related mortality in U.S. state and private prisons: A case-crossover analysis. *PLoS One*. 2023 Mar 1;18(3):e0281389. doi: 10.1371/journal.pone.0281389. PMID: 36857338; PMCID: PMC9976996.

Naketa Ross, ResilientMe (2020). From foster care to resilience: saving lives by changing the foster care model, available at <https://resilience.asu.edu/ross-project>.

AARP Arizona <https://states.aarp.org/arizona/a-guide-to-heat-safety-in-arizona>.

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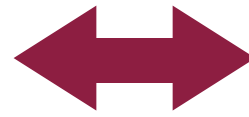
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Site cooling centers close to vulnerable populations.



Recommended Actions: Assess across urban areas of the state, the locations of existing cooling centers relative to the needs and locations of the most vulnerable populations. Using results from this assessment, prioritize establishment of new cooling centers in areas to optimize where all Arizonans at risk may either safely walk or use public transit to reach a safe place during extreme heat events.

Rationale: In order to make the support offered by cooling centers ubiquitous, it is imperative to assess their current accessibility for populations most susceptible to extreme heat and heat-related illnesses. Understanding these characteristics in relation to spatial proximity to cooling centers is crucial for evaluating the overall coverage and impact of a statewide cooling center network. A model analysis performed by University of Arizona researchers (reference below) focused on mapping catchment areas and evaluating accessibility for individuals relying on walking or public transportation in Tucson. It is important to note that the results assume the population to be ambulatory and do not account for time spent waiting at bus stops. The report emphasizes the need to analyze urban areas and vulnerable populations to ensure 100% access via public transportation to cooling stations. This methodology, if replicated for all urban areas of the state, would help to prioritize locations of cooling centers as well as identify additional sites for solutions, such as offering free transit during extreme heat days; prioritization of shade installation at bus stops along key routes; incentivizing ride share programming to assist with omitted vulnerable populations, or other innovations. The objective is to guarantee accessibility to cooling centers for all vulnerable populations in Arizona, as the Plan Integration for Resilience Scorecard™ (PIRS™) for Heat should be utilized.

Actors: ADOT leads. State agencies essential to implementation include ADOA, ADHS and DES. Stakeholders include researchers at University of Arizona, ASU, NAU, as well as local city transportation departments, and ride share companies.

Objectives: I, II, III
Extreme Heat Preparedness

Timeframe: Mid term
(6 months to 1.5 years)

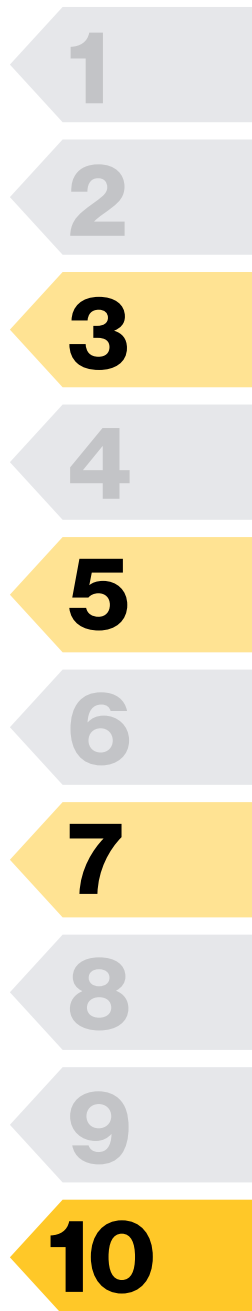
Metrics of Success:

- Number of new cooling center facilities established
- Change in number of vulnerable people served

For more details:

Brown, Heidi, Ladd Keith, Sam Chambers, Kristina Currans, Erika Austhof, Cheyenne R. McChesney. (2023). Cooling Center Walkshed & Transit Accessibility Analysis. White Paper Report by the Building Resilience Against Climate Effects (BRACE) Team at The University of Arizona in Cooperation with the Pima County Health Department.

Fraser, A. M., Chester, M. V., Eisenman, D., Hondula, D. M., Pincetl, S. S., English, P., & Bondank, E. (2017). Household accessibility to heat refuges: Residential air conditioning, public cooled space, and walkability. Environment and Planning B: Urban Analytics and City Science, 44(6), 1036-1055. <https://doi.org/10.1177/0265813516657342>



Activate armories infrastructure.



Recommended Actions: Local communities, especially in rural regions of Arizona, that are equipped with a National Armory should be encouraged to transform a portion of their facilities to be able to function as cooling centers or resilience hubs, particularly during potential catastrophic extreme events where a significant portion of the population not acclimated to extreme heat might be impacted by cascading hazards, such as a blackout during a heatwave.

Rationale: Local communities that have a National Armory should be incentivized to convert or add some functionality to cooling centers and resilience hub services. This is particularly true of rural communities, which may have far fewer resources to respond to extreme heat. This strategic shift not only optimizes existing infrastructure for emergency cooling deployments but also serves as a proactive adaptation strategy for enhanced preparedness. By repurposing National Armories, these sites can efficiently address the cooling needs of communities during extreme weather events, mitigating health risks and bolstering community resilience. Ample infrastructure exists for deployment of capacity for emergencies that require cooling; also as an adaptation strategy for preparedness. This recommendation also addresses the request for ideas on engagement at the federal level, with National Guard leadership.

Actors: DEMA leads in direct concert with the Governor's Office of Resiliency. Other stakeholders include entities also involved in Resilience Hubs and Cooling Center network activities.

Objectives: I, II, VI
Extreme Heat Preparedness

Timeframe: Mid term
(6 months to 1.5 years)

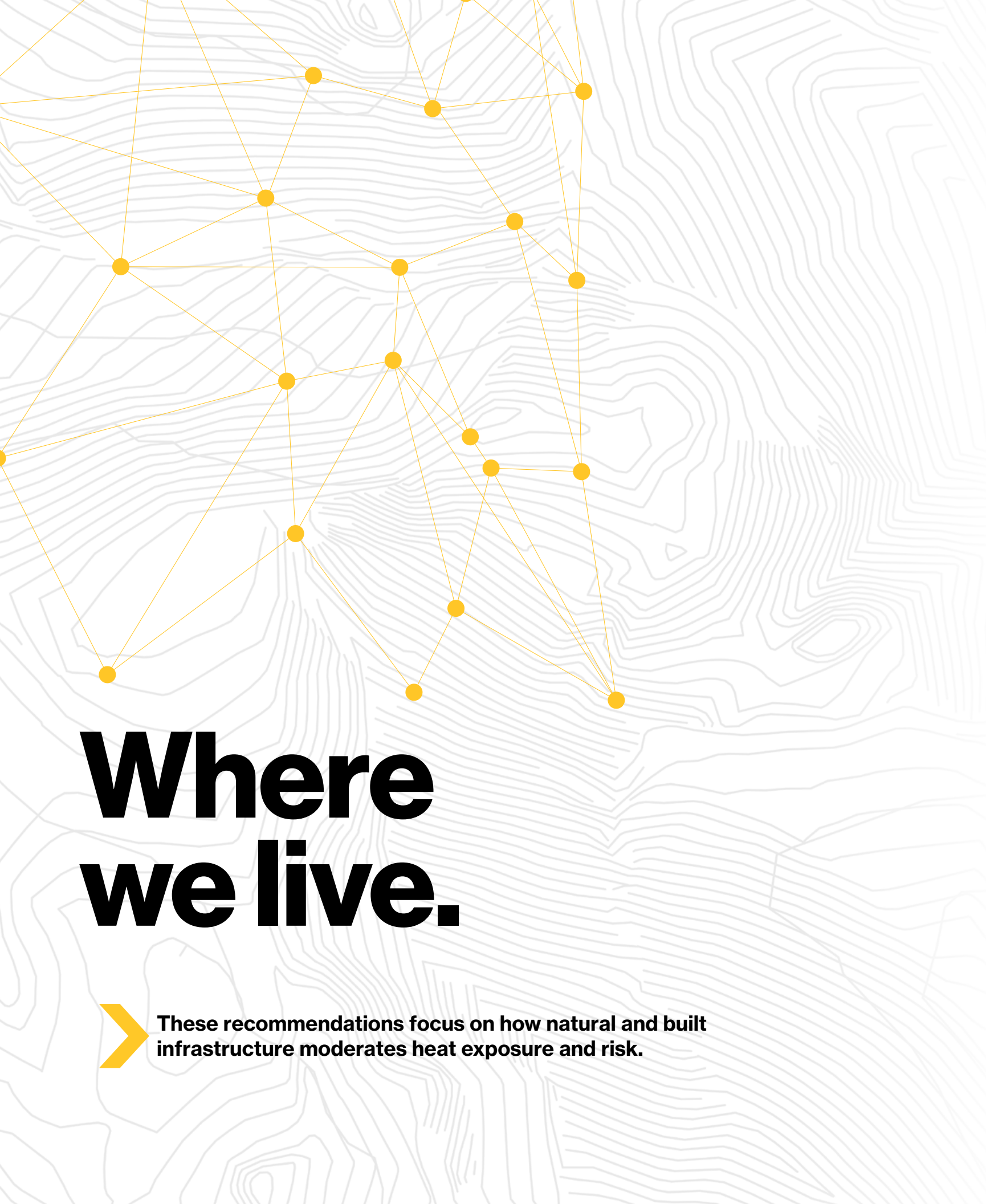
Metrics of Success:

- Number of armories adding extreme or catastrophic heat preparedness functionality
- Number of armories becoming emergency added capacity cooling centers
- Number of armories supporting or engaging with community resilience hubs

For more details:

<https://dema.az.gov/arizona-national-guard/Arizona-Army-National-Guard>





Where we live.

➤ **These recommendations focus on how natural and built infrastructure moderates heat exposure and risk.**

End homelessness.

Recommended Actions: Eliminate experiences of street homelessness. Create and normalize cool shelter for all individuals experiencing homelessness throughout the continuum of care. Expand investment in emergency, short term, and long term housing.

Rationale: Trends show the increase of outdoor heat related deaths correlates significantly to the rising number of individuals and families experiencing homelessness. Nearly half of all outdoor heat associated deaths occur among people without shelter. Solutions addressing the problem of heat mortality clearly imply ensuring cool shelter for everyone. There exists in Arizona a major multi-sector ecosystem of institutions providing integrated responses to homelessness, which should be expanded and provided greater resources, particularly to implement during the hottest summer months. Recommendations to address extreme heat preparedness should emphasize and support the many actions and plans to address street homelessness, and stress the importance of such actions for moving the needle on heat-related illness and death.

Actors: ADOH leads as the state agency with a purview to frame leadership for statewide objectives, including adoption of relevant stakeholder recommended actions to reduce homelessness. Supportive implementing agencies are ADHS, ADES, and DEMA. Greater cross-agency coordination, response, and engagement with other stakeholders at multiple levels include Central Arizona Shelter Services, Community Action Agencies, Keys to Change (formerly Human Services Campus), faith based communities, Salvation Army, United Way, researchers in public health and housing, counties, and many others.

Objectives: III, IV
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)
Longer Term (up to 4 years)

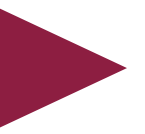
Metrics of Success:

- Steep reduction in the number of outdoor heat associated deaths
- Steep reduction in the number of Arizonans experiencing homelessness
- Increase in the number of unhoused individuals and families receiving permanent housing

For more details:

Arizona Point-In-Time Count https://housing.az.gov/sites/default/files/documents/files/2023-AZBOSCO-PIT-Count-Submitted-to-HUD_4-2023.pdf

Arizona Heat-related Illness Dashboard <https://www.azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/heat-safety/index.php#heat-dashboard>



➤ **Spotlight on community action**

The Arizona Faith Network

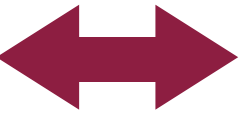
Arizona's scorching 2020 heatwave prompted a significant bold response from the state's religious leaders. In short order, they opened a dozen new cooling centers in neighborhoods where services were most needed. Led by the Arizona Faith Network (AFN), this community response emerged as a beacon of hope and space of transformation. During the 2023 record-breaking heatwave, the AFN served 25,000 residents across their expanding set of respite locations. These sanctuaries, housed in places of worship, have become a lifeline for those facing the relentless heat. They provide air-conditioned spaces, hydration, rest, and access to social services. Such organizations offer comprehensive solutions during heat crises, such as heat-risk education, neighbor check-ins, extended services beyond cooling hubs, and partnership with local entities for cohesive emergency strategies. "Faith communities stand as lifesaving sanctuaries, offering vital relief amidst extreme heat emergencies," says Reverend Katie Sexton-Wood, AFN executive director. AFN's advocacy has included organizing an educational bus tour series for decision-makers, spotlighting various heat relief centers and their work, offering press conferences featuring heat relief experts and the perspective from the faith community, emphasizing the need for regulations and solutions for heat emergencies, and releasing a guidebook for setting up heat relief hubs in faith communities.

See: www.arizonafairhnetwork.org/cooling-centers



COOLING
HEAT RELIEF
NETWORK
CENTER

Support housing that is affordable.



Recommended Actions: Adopt well known, widely used housing policies that can increase affordability and availability of housing, because the existence and quality of shelter is a critical component to preventing heat illness and death. Ensure that such housing is heat-smart.

Rationale: Arizona Community Foundation funded the report titled "State-Level Legal Barriers to Adopting Affordable Housing Policies in Arizona." The report details widely used policies that can increase the affordability and availability of housing. However, many of these tools are preempted or limited by Arizona law. 1) Inclusionary zoning: Supply of affordable housing can increase incentives to developers to construct a certain number of housing units that are affordable to low-to-moderate income people as part of development or redevelopment projects. Arizona is one of only seven states that prohibit local governments from enacting mandatory inclusionary zoning. 2) Rent control. Policies that limit the amount that a landlord can charge for rent range from strict cost ceilings to rent stabilization. 3) Tax increment financing (TIF). Using this tool, municipalities encourage development in a particular targeted area for redevelopment and placing it under a special tax district. While TIFs are widely used across the country, Arizona is the only state where TIFs are not permitted. This report's recommendation adds that moving forward, efforts aimed generally at increasing the availability and access to housing that is affordable and housing that is affordable and that such infrastructure is also heat ready and heat smart.

Actors: ADOH leads. Critical stakeholders include local governments and developers.

Objectives: I, II, VII
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Adoption / Rescinding of restrictive policies
- Rent stabilization
- Reduced housing burden

For more details:

Gentry, Katie, Brian Irvine, and Alison Cook-Davis (2021). State-Level Legal Barriers to Adopting Affordable Housing Policies in Arizona. Morrison Institute for Public Policy, Arizona State University. Available at <https://morrisoninstitute.asu.edu/sites/default/files/state-level-legal-barriers-to-adopting-affordable-housing-policies-in-arizona-nov-2021.pdf>.

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Promote adoption of mobile home park heat emergency plans.

Recommended Actions: Encourage adoption of specialized extreme heat emergency preparedness site plans for all mobile and manufactured home communities and parks by their owners / landlords, and site management, especially for outages of individual unit AC, park-wide power outages, and/or larger regional blackouts that affect the neighborhood of the park.

Rationale: During the summer of 2023, some site specific power outages occurred in locations that include urban mobile home parks left residents without the ability to cool their homes, refrigerate food or medications, and power medical devices. The fact that many parks are master metered (owned and maintained by the landlord as the utility customer) can mean slower response times for power restoration, as that is not directly done by utility companies. Indoor heat associated deaths are disproportionate among people living in housing that is difficult to keep cool, especially older mobile homes and particularly those situated in urban park settings. In Maricopa County studies indicate that mobile home residents are 6 to 8 times more likely to experience heat-related deaths; less likely to have working AC; and more likely to have higher temperatures than residents in other types of housing with similar incomes. Ensuring that each park has in place a plan for addressing extreme heat generally, and electricity outages specifically, ensures conformity to public safety standards. A model plan has been developed by residents, the resident association AAMHO, and academic researchers at ASU, available to promote for adoption. Utilities should understand which customers are on master meters, and improve customer service information during times of outages regarding what are their options for reaching a nearby cooling center and who to contact for restoration of power, in cases where it is not the utility provider responsible.

Actors: ADOH leads, in partnership with RUCO and DEMA. As for engagement with residents, AAMHO, and park owners or associations such as AMHC are critical. Stakeholders also include utility providers, tribal governments, city emergency departments, and private companies offering electrical services.

Objectives: I, II, III, IV
Extreme Heat Preparedness

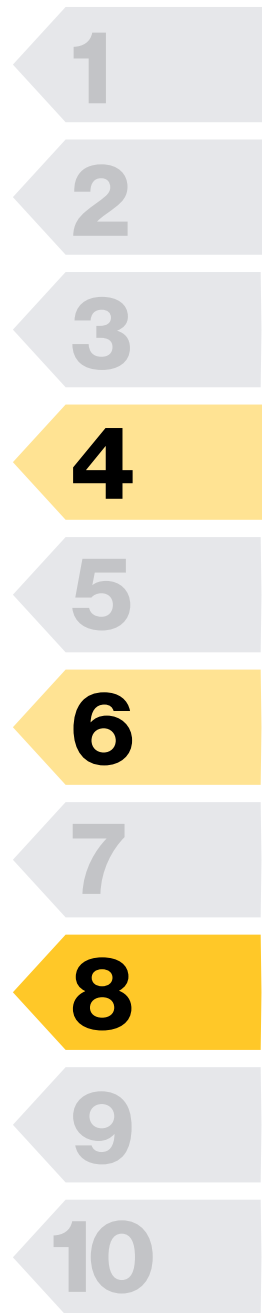
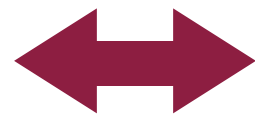
Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Adherence to standards - mostly new - property scale plans exist but rarely for MMHC
- Quicker restoration response time for MMHC in outages
- Increase in number and percent of parks with a plan in key locations
- Referrals made by utility providers

For more details:

The Model Plan by AAMHO and ASU KER: <https://keep.lib.asu.edu/collections/160080>



Interpret extreme heat as part of tenant public safety.

Recommended Actions: Provide oversight and establish / improve / strengthen accountability and enforcement mechanisms around the safety and heat security and health responsibilities of landlords in rental homes and rented lots.

Rationale: This recommendation includes to interpret existing governance, legislation, and policy dealing with the health, safety, and security of tenants in all types of housing to refer to times of extreme heat, even if not explicitly mentioned. During extreme heat times, tenants should be protected from cost spikes and evictions to remain in housing / shelter and retain electricity access and functioning AC (renters) in properly weatherized and maintained buildings and parks and grounds, where adequate shade and/or emergency cooling locations are available and posted. Ensuring code standards of upgrades of on-site power distribution systems is critical. Residents should be trained on rights and responsibilities. Renters may not always control their exposure to heat given lack of ability to improve or adapt to cool residential infrastructure that they do not own. Mobile home park residents may own their own unit but have a rental relationship with park landlords. Renters (of homes, units, or lots) may sometimes not be direct customers of utilities but pay utilities to landlords and thus might not receive assistance benefits, or experience additional eviction risk due to nonpayment of utilities. Evictions spike during the hottest summer months, a trend related to costs of keeping cool. Currently regulation exists in the form of landlord-tenant regulations (including a specific act for mobile and manufactured home parks), but explicit interpretation and enforcement that public safety includes protection from harm caused by extreme heat is strongly recommended.

Actors: ADOH leads in partnership with RUCO, DES housing assistance, and many stakeholders for implementation, such as Arizona Housing Coalition, renters associations, AAMHO, landlords, and cities. For accountability and underscoring interpretation of public safety to include heat risk, this may include the Arizona Attorney General's Office.

Objectives: I, II, VII
Extreme Heat Preparedness

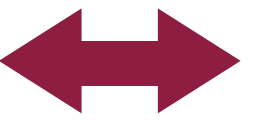
Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Lower eviction rates during summer months
- Greater access of renters / mobile home owners to utility / weatherization / other benefits
- Fewer heat associated health indicators

For more details:

Executive Order 2023-16: <https://azgovernor.gov/office-arizona-governor/executive-order/2023-16>



Incentivize heat-smart housing development.

Recommended Actions: Increase access to safe, affordable and heat-smart housing options. Incentivize construction and manufacturing industry for innovating a Heat-Smart (not just energy efficient) housing industry with smart manufacturing at scale and at affordable price points to meet the need for housing and simultaneously the need for homes that are resistant and resilient to extreme heat.

Rationale: Indoor heat associated deaths are disproportionate among people living in housing that is difficult to keep cool. To enhance extreme heat preparedness, a strategic focus should be directed towards advancing technologies in the manufacturing of housing, particularly manufactured homes. By integrating heat-smart features into the construction process, jobs are created within the local construction industry while simultaneously meeting the pressing demand for more affordable and climate-resilient housing. The incorporation of innovative technologies, particularly in the realm of smart IoT (Internet-of-Things, digitally connected devices and sensors) can play a pivotal role in creating a new Arizona manufacturing industry that is already underway. By investing in this intersection of technology, construction, and housing, and being purposeful that it is affordable, communities can simultaneously bolster economic development, improve housing accessibility, and fortify resilience in the face of escalating heat challenges.

Actors: ADOH leads. State agencies engaged should include Arizona Commerce Authority (ACA). Critical stakeholders would be urban metro area economic development entities such as GPEC, TREO, etc.

Objectives: I, II, VI
Extreme Heat Preparedness

Timeframe: Longer Term
(up to 4 years)

Metrics of Success:

- Reduction in indoor heat associated deaths and illness
- Reduction in the housing shortage
- Increase in manufacturing jobs
- Increase in taxes from economic development

For more details:

ACA Strategic Plan : <https://www.azcommerce.com/about-us/business-plan>
Greater Phoenix Economic Council (GPEC) Strategic Plan: <https://www.gpec.org/fy23-25-strategic-plan/>
Tucson Regional Economic Opportunities (TREO) / Sun Corridor : <https://suncorridorinc.com/>



Promote green infrastructure.

Recommended Actions: Launch the “Arizona Heat Mitigation Infrastructure Program” (AHMIP), aimed at addressing the state’s escalating challenges with extreme heat and its impact on critical infrastructure. The AHMIP would focus specifically on enhancing heat resilience infrastructure and strategies across Arizona using green infrastructure best practices (e.g., nature-based infrastructure, engineering with nature).

Rationale: Arizona’s urban centers are increasingly experiencing the impact of heat island effects, a phenomenon where urban areas experience higher temperatures compared to rural surroundings as a result of human activity. According to the Arizona State Climate Office, Phoenix alone has one of the largest recorded heat island magnitudes globally of nearly 15 degrees Fahrenheit in 2023. Without intervention, this magnitude will likely increase. The AHMIP program would initiate pilot projects in regions most affected by extreme heat, supporting innovative strategies for both small and large-scale infrastructure including, but not limited to, transportation, transit, aviation, freight, municipal/public works, and materials. Project examples include designated cool corridors, desert adapted trees to increase shade, use of vegetation and soil for improved evapotranspiration and reduced heat absorption, green roofs to increase the albedo (reflectivity) of surfaces, heat conscious land use planning, building orientation, shade-casting architecture, and the integration of stormwater management into public-use infrastructure. The insurance industry should be consulted and engaged where it makes sense to use or develop risk mitigating products to protect against loss of investment of trees and other infrastructure. Reducing the heat island effect will support the limiting of cooling demand while also supporting outdoor thermal comfort. The AHMIP program would also inventory existing and new green infrastructure for future planning and monitoring as well as sharing data for research analyses

Actors: AZDEQ and ADOT would lead this effort. DEMA would be involved where critical infrastructure is implicated. Local governments and insurance are partners.

Objectives: I, II, VII
Extreme Heat Preparedness

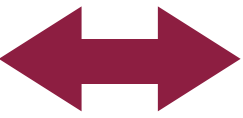
Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Number of people impacted
- Dollar value of property protected by changes in infrastructure
- Number of Arizona communities reached with green infrastructure

For more details:

<https://azclimate.asu.edu/urban-heat-island/>
https://static.azdeq.gov/p2/p2_green_infrastructure.pdf
https://cfpub.epa.gov/si/si_public_record_report.cfm?Lab=NERL&dirEntryId=325750
https://www.epa.gov/sites/default/files/2015-10/documents/phoenix_gi_evaluation.pdf
<https://www.ncsl.org/environment-and-natural-resources/state-policy-options-for-green-infrastructure>
<https://www.sciencedirect.com/science/article/pii/S0378778819326696>



> Spotlight on nature-based solutions

Trees Are Cool

Beyond mere aesthetics, planting certain types of native and adapted trees is a way to champion nature-based solutions for extreme heat. Dotted yards, parks, parking lots, business fronts, and shared spaces, trees become ecological sentinels, offering shade, filtering emissions, and cooling for the immediate surrounding community. The City of Mesa aims to plant one million trees by 2050 through their initiative called “Trees Are Cool.” Aligned with their local climate action plan, the effort seeks to increase tree canopy coverage to fifteen percent, after community feedback revealed a desire for more shade and green infrastructure. Rallying residents to participate, the city has created a crowdsourced website where people and business owners can record when and where they plant their trees and see which parts of the city need more trees planted. A map, spotlighting areas where six key environmental and equity indicators demonstrate priority locations, helps residents and decisionmakers to track and visualize this transformation over the city’s landscape. In the shade of these newly planted trees, Mesa envisions a future where environmental consciousness blooms, creating a tangible heat response with a legacy of sustainability. Mayor John Giles says “I encourage everyone to get involved in planting trees so we can maintain and grow a healthy, resilient community for generations to come.”

See: www.mesalistens.com/trees-are-cool



Where we work, study, and play.

> The settings for implementing these recommendations center on schools, employers, neighborhoods and the systems of transit and transportation taking us there.

Advance Resilience Hubs.

Recommended Actions: Support and advance resilience hubs, amplifying existing community trusted spaces with various missions (schools, libraries, houses of worship, arts centers) to become safe havens during extreme heat, cascading disasters, and other disruptions.

Rationale: The resilience hubs will have back-up power (or micro-grids) that provide 5+ days of energy, refrigeration, clean water, and food service capabilities that provide shelter and services during disruptions. The resilience hubs will also serve as a centralized location for coordination of recovery efforts post disturbance. The resilience hubs will also operate as cooling centers during extreme heat and connect with a statewide network for better coordination of service, especially to high heat vulnerable populations. The State of Arizona could also support through identifying co-funding options and federal grants opportunities. Extreme heat impacts are varied across neighborhoods, with landscape level design and historic disinvestment resulting in as much as 15°F difference in surface temperatures. Social connectivity is a preventative measure for extreme heat vulnerability and the lack of opportunities to increase community cohesion makes this a challenge. During disasters, mutual aid frameworks can be more efficient in providing emergency services, than formal, governmental response. Resilience Hubs would ideally operate year round, incorporate renewable energy and back-up power, offer training and education in equitable ways, and adopt a continuous improvement model. The State of Arizona can promote this mechanism and support ways to finance and/or find funding opportunities.

Actors: EO 2023-16 mentions Resilience Hub functions in components 3c, 3d, 1c, 1e, 4, 5b, 5, for which this recommendation consolidates under the State Agency co-leads ADHS and DEMA, in partnership with ADOA, Energy Policy Advisor, DES, and the Governor's Office of Resiliency. Stakeholders include Wildfire, Community Action Agency, Community Based Organizations, Faith based campuses, schools, libraries, YWCA, Boys and Girls Clubs and many more.



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Objectives: I, II, V, VI
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Number of Resilience Hubs established
- Number of residents served

For more details:

<https://resilience.asu.edu/resilience-hubs>

Create a HeatReady™ Arizona.



Recommended Actions: Expand the HeatReady™ certification for schools, cities, neighborhoods, and businesses that focuses on hazard mitigation, emergency preparedness, and long-term intervention of extreme heat. The HeatReady™ brand, modeled from the National Weather Service's StormReady certification process, trains residents to be advocates for each other and with decision makers using scientific data and evidence-based solutions.

Rationale: HeatReady™ Cities has been piloted in the City of Phoenix through the Office of Heat Mitigation and Response to identify key personnel responsible for managing heat mitigation and to be prepared for heat emergencies. The HeatReady™ School program is running in more than forty schools throughout Maricopa County, with more schools joining every season. HeatReady™ Neighborhoods, similar to HeatReady™ Schools, are those that are able to identify, prepare for, mitigate, track, and respond to the negative effects of extreme heat. Tackling heat at multiple scales through the HeatReady™ rubrics will increase the efficiency of heat responses and tactics. Extreme heat is a growing concern for government, schools, and residents and previous research has mapped vulnerable populations to identify where there are problematic locations for coping with extreme heat. The HeatReady™ suite of approaches addresses differing heat islands within a city and within neighborhoods

Actors: ADHS and DEMA co-lead from among the state agencies, with support from OSPB, ADOA, DES, expressly under leadership of Arizona's School system (public and private participating districts and campuses).

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Objectives: I, IV, VII Extreme Heat Preparedness

Timeframe: Longer Term
(up to 4 years)

Metrics of Success:

- Number of schools
- Number of school districts
- Number of students protected

For more details:

HeatReady Schools: <https://sustainability-innovation.asu.edu/research/project/heatready-schools/>

HeatReady Programming: <https://news.asu.edu/20180327-solutions-asu%E2%80%99s-helps-phoenix-prepare-first-heatready-program>

See also Wilhelmi and Hayden, 2010; Ueijo, et al, 2010; Hondula, 2015; Keith, 2019; Meerow and Keith, 2021.

HeatReady™ Schools

Schools, often regarded as community hubs, play a pivotal role in the well-being of children, teachers and parents alike. Recognizing the profound impact of heat conditions on health and education, HeatReady™ Schools embarked on a mission to formalize school heat preparedness, ensuring the safety of students in scorching temperatures and at the same time, offering an engaging educational experience. The culmination of this effort is a set of thirty recommendations that provide adaptable solutions for schools in diverse contexts and climates. The impact extends to over 30 schools and community centers, a number that continues to grow. HeatReady™ Schools Project Coordinator Mary Muñoz Encinas (pictured below at Desert Garden Montessori in Phoenix) says they want this to become the standard for schools. “In Arizona, we cannot escape the heat. So I would love to see this implemented Valley-wide, and then maybe adjusted to go state by state so that everyone who is vulnerable to heat risk can be protected.” Beyond recommendations, the initiative has cultivated a tree growth rubric, bilingual training programs, a K-12 summer preparedness course, and teacher training materials. As part of this effort, a scorecard was created, designed to help school administrators gauge their school’s heat preparedness, and find areas for improvement. As the program grows, the team hopes to create an official HeatReady™ certification that schools can earn. This approach aligns with the broader HeatReady™ Neighborhoods initiative, where schools emerge as critical players in the collective effort to build resilience and education against extreme heat.

See <https://sustainability-innovation.asu.edu/research/project/heatready-schools>



Expand heat safety in the workplace.

Recommended Actions: The Executive Order 2023-16 specifically requires the Industrial Commission of Arizona to report on the impact and results of their newly created state emphasis program to ensure the availability of water, rest, and shade in at-risk workplaces.

Rationale: Many people are exposed to heat on the job in both indoor and outdoor environments. Worksites involving high air temperatures, radiant heat sources (e.g., sunlight, hot exhaust), high humidity, direct contact with hot objects, or strenuous physical activities have a high potential for causing heat-related illnesses. Pending the results of the ICA analysis of impacts and results from the statewide emphasis that the E.O. 2023-16 directs, these lessons learned and data collected for input to the statewide plan should be made available to heat researchers in sufficient detail to support improvement of knowledge around current trends and situations of workplace heat stress. Related recommended actions include to expand the successful components of the state emphasis program, and promote broader and widespread adoption of the employer information campaign and worker awareness efforts across a greater number of industries and locations. Finally, it is highly recommended that the State of Arizona refine and promote broader use of the free evaluation of worksites and employee trainings by ADOSH consultants.

Actors: Industrial Commission of Arizona leads. Integration is encouraged with the plans and activities of ADHS. Stakeholders include industry representatives, Arizona employers, and unions. Actions can inform federal agency efforts at OSHA.

Objectives: I, III, VI, VII
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

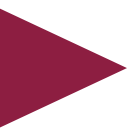
Metrics of Success:

- Uptake by % or number of employers and/or number of workers engaged
- Reduction in on-the-job injury or fatalities due to heat
- Reduction in lost hours
- Increase in economic productivity

For more details:

IC’s current state emphasis program: www.azica.gov/heatstress

National emphasis program : www.osha.gov/sites/default/files/enforcement/directives/CPL_03-00-024.pdf



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Explore code standards for heat.

Recommended Actions: Establish a multi-agency, multi-stakeholder focus group dedicated to a study of building code programs into workplace temperature standards, code reconciliation, and potential support to cities for effective implementation.

Rationale: To address the crucial need for safe and comfortable work environments amidst rising temperatures, we recommend establishment of a multi-agency, multi-stakeholder focus group dedicated to exploring possible code enforcement ideas including maximum allowable indoor temperatures. This group should prioritize examining the economic impact of lost revenues in hazard mitigation dollars for heat, drawing insights from successful projects, case studies, and best practices with peer states (e.g., Utah, California). This group, comprising representatives from relevant state agencies, federal bodies like OSHA, cities, and industry experts, would be tasked with developing standards for possible statewide codes and viable indoor workplace temperatures,

akin to those in California's OSHS board. Other sites may be considered for inclusion, such as childcare providers or other critical private services. Further, FEMA funds for hazard mitigation should be incorporated into the focus group efforts because these monies are often contingent on existing code enforcement. The discussion within the focus group should include the topic of maximum indoor air temperatures, drawing parallels and ideas from cold weather environments to establish best practices. This approach aligns with the strong desire to quantify the economic impact of such initiatives and addresses the need for a proactive stance of hazard mitigation in the state that serves all sectors, including employers and the private sector.

Actors: Industrial Commission of Arizona leads. Integration is encouraged with the plans and activities of ADHS and DEMA. Stakeholders include industry representatives, Arizona employers, and unions. Actions can inform federal agency efforts at OSHA.

Objectives: I, III, VI, VII
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Extent of agency and stakeholder participation in the focus group
- City/county uptake of code guidance or enforcement
- Reduction in indoor injury or fatalities due to heat

For more details:

California Occupational Safety & Health Standards Board (OSHSB) of the State of California Department of Industrial Relations: <https://www.dir.ca.gov/oshsb/documents/Indoor-Heat-proptxt.pdf>

Address agricultural workers.

Recommended Actions: Given the occupational risk to extreme heat that outdoor exposure presents to agricultural workers, such as migrant and seasonal farmworkers, ensure that targeted measures are considered and implemented in the statewide plan.

Rationale: Agricultural agriculture in Arizona contributes on the order of \$20 billion to the state's economy and supports hundreds of thousands of jobs. Many of these jobs require employees to work outdoors, raising exposure levels to extreme heat during certain seasons of the year. This risk is especially significant during prolonged hours, and for vulnerable members of the agricultural workforce who may be migrant and seasonal. This recommendation stresses that extreme heat preparedness in Arizona warrants targeting this sector of the labor market. The IC's state emphasis plan should be sure to extend to this sector. The DES Migrant and Seasonal Farmworker (MSFW) program which assists them with economic independence and improved living and working conditions, should incorporate greater attention to heat risk and prevention of health disparities. For instance, offering orientation and multi-lingual materials, MSFW should add content that mentions heat safety as well as resources such as cooling locations, utility assistance, flexible work schedules to minimize exposure to peak temperatures, exposure limits, and hydration programs that guarantee access to supply of cool drinking water throughout the workday. Furthermore, leveraging extension programming such as with the University of Arizona, combined with communications strategies for non-native English speakers, would enhance the outreach to a particularly vulnerable workforce.

Actors: Industrial Commission of Arizona leads. Integration is encouraged with the plans and activities of ADHS and DES. Stakeholders include agro-industry entities and representatives and farmworker unions, as well as university-based extension agents.

Objectives: I, III, VI, VII
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

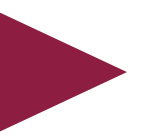
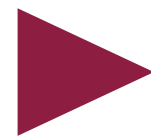
- Uptake by % or number of employers and/or number of workers engaged
- Reduction in on-the-job injury or fatalities due to heat
- Reduction in lost hours
- Increase in economic productivity

For more details:

DES's Migrant and Seasonal Farmworker program: <https://des.az.gov/services/employment/job-seekers/migrant-seasonal-farm-workers>

Arizona@Work orientation for Migrant and Seasonal Farmworkers: <https://des.az.gov/sites/default/files/dl/ESA-1349A.pdf?time=1705325757381>

University of Arizona Cooperative Extension: <https://extension.arizona.edu/>



Grow critical weatherization workforce capacity.

Recommended Actions: Incentivize and accelerate workforce development pathways for workers who are trained in weatherization, retrofit construction, HVAC, and residential housing related trades and expertise. Create a manufacturing workforce capable of producing components for weatherization upgrades, in addition to manufactured housing at a scale needed to turn over aging stock of homes while meeting increased demand.

Rationale: Currently weatherization programs are actively engaging households with weatherization programming to the tune of thousands of homes per year, and resources may allow for expanding them, but the current greatest barrier reportedly is the lack of a sufficient number and caliber of workers knowledgeable about retrofit to implement weatherization solutions, respond to upgrading AC systems, or to replace older units. Short-term needs are urgent to address a set of already known fields / worker needs, while longer term workforce opportunities could provide incentives for apprenticeships. We recommend commission of a dedicated study of the trajectory of future heat workforce needs and that the findings inform future statewide plans for training, certification, incentivization, or other mechanisms that quickly grow workforce capacity.

Actors: ADOH leads, in partnership with IC, and other state agencies. Stakeholders include the private sector, academic, community college, trade education entities for training and workforce retraining organizations, and Arizona Board of Regents. Existing organizations working with weatherization also include Community Home Repair Program Arizona, Pima County Home Repair Program, Habitat for Humanity, the Home Depot Foundation, Foundation for Senior Living, Chicanos por la Causa, and others.

Objectives: V, VI
Extreme Heat Preparedness

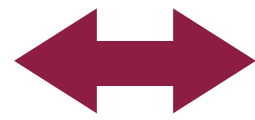
Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Number of workers in key industries increases to meet need
- Expenditures of current weatherization programs increase
- Expand program to larger number of counties across the state
- Average age of housing unit in state of AZ trends to newer
- Reduce number of aged mobile home units from the estimated 175,000 in need of weatherization or replacement

For more details:

Arizona Department of Housing Weatherization Assistance Program is at : <https://housing.az.gov/general-public/weatherization-assistance-program>



Develop solutions for managing blackouts during heat waves.



Recommended Actions: Work together with all of the state providers of electricity to encourage development of best practices and coordinate plans for how to respond and communicate with residents on what to do in case of power outages, be they temporary or extended, localized or widespread, accidental or planned such as in case of fire prevention needs.

Rationale: When power delivery is halted or fails simultaneously with the occurrence of extreme heat events or prolonged heat waves, the ability of communities, households, and individuals to use electricity for staying cool is diminished or restricted. This can lead to an increase in the heat-related illness or death experienced by Arizona residents, at the concurrence of blackouts or outages with extreme temperatures. These phenomenon might be highly localized and planned; such as intentional shutoffs for construction safety, or wildfire prevention strategies across a specified place for a discrete time. They might also be widespread over longer time periods due to unforeseen accidents, disruptions, or even vandalism. A set of best practices should inform back up plans, and these should integrate with solutions development such as alternative temporary electricity generation, mini-grids, solar communities, or other means of maintaining sufficient cooling options for residents in need during power restoration. Evacuation protocols must be included. Specific considerations and communications strategies should be explored with respect to certain vulnerable populations that have unique power situations, such as locations with elderly populations, hospital centers, remote rural communities, or mobile home parks which require landlords to also contract private entities for onsite-park restoration.

Actors: RUCO and ACC lead. DEMA coordinates on evacuation protocols. Critical partnerships include Salt River Project, Arizona Public Services, Navajo Tribal Utility Authority, City of Mesa, Trico Electric Cooperative, Tucson Electric Power Company, and all other power companies and electric cooperatives across the state.

Objectives: I, II, VII
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Development of best practices for outage response during heat waves
- Number of individual utility company plans that incorporate such practices
- Number of utility customers covered by plan components
- Development of a communications strategy to disseminate response options

For more details

Executive Order 2023-16: <https://azgovernor.gov/office-arizona-governor/executive-order/2023-16>



Design community lifelines specific to extreme heat.

Recommended Actions: To address the critical challenge of heat-related risks within the framework of FEMA Community Lifelines, develop a comprehensive action plan specifically tailored to heat emergencies. This plan should prioritize the integration of heat as a significant factor in the existing Lifelines structure, recognizing its current absence as a second priority issue.

Rationale: The Arizona Action Plan for FEMA Community Lifelines Specific to Extreme Heat would become a new national standard. FEMA's Community Lifelines are essential infrastructures crucial for maintaining societal safety and function. In the event of extreme heat, it is vital to clearly identify and monitor these Lifelines. This allows emergency response partners to effectively track their status, ensuring continuity and safety during and after such heat events. The Community Lifelines does not apply to extreme heat currently, limiting incident response and stabilization of critical infrastructures such as medical care, communications, power, or transportation. The action plan should include a detailed study with a clear outline that encompasses identifying levels of risk associated with extreme heat, mapping these risks to the relevant FEMA Community Lifelines, and determining the types and scales of efforts required for restoration and mitigation. Of particular importance will be to incorporate evacuation protocols as a part of an Action Plan. Additionally, the plan should establish specific metrics to evaluate the impact of heat on these Lifelines, particularly focusing and linking to other efforts that assess the loss of life and property for extreme heat. Such a targeted approach will ensure that communities are better prepared and more resilient in the face of increasing heat-related emergencies.

Actors: DEMA leads, in partnership with ADHS and ADOT. Stakeholders come from Community Lifelines related sectors (e.g., energy, water systems, etc.) and Tribal Nations.

Objectives: I, II, VI
Extreme Heat Preparedness

Timeframe: Longer Term
(up to 4 years)

Metrics of Success:

- Release of a comprehensive plan
- Number of agencies engaged in plan development

For more details:

FEMA Community Lifelines: <https://www.fema.gov/emergency-managers/practitioners/lifelines>
https://azgovernor.gov/sites/default/files/state_of_arizona_extreme_heat_fact_sheet_2.pdf
 Singh, E. (2021). Compounding Impacts of Lifeline Infrastructure Failure During Natural Hazard Events; https://library.oapen.org/bitstream/handle/20.500.12657/42577/1/2021_Book_TheDemographyOfDisasters.pdf#page=198
 Clark, S., Chester, M., et al. (2017). The vulnerability of interdependent urban infrastructure systems to climate change: could Phoenix experience a Katrina of extreme heat? <https://www.tandfonline.com/doi/abs/10.1080/23789689.2018.1448668>



Elevate attention to heat issues in transportation planning.

Recommended Actions: Increase the visibility, synergy, and outreach of efforts with the Arizona Department of Transportation (ADOT) that support statewide efforts to prepare for, mitigate, adapt to, respond to, and recover from extreme heat.

Rationale: Sustainable and resilient transportation has been broadly defined as “effective and efficient system performance, with positive impacts on the triple-bottom-line goals of social quality of life, economic competitiveness, and the preservation of the natural environment” (FHWA 2011). Today, many DOTs, including ADOT, are analyzing transportation investments using this triple-bottom-line framework. In the nine areas where ADOT promotes environmental planning (NEPA, federal aid, air quality, noise, biology, cultural resources, hazardous materials, material sources, water resources, operations, programs, and training), we recommend that Extreme Heat be elevated as a tenth priority for the agency. ADOT has focused attention on reducing Urban Heat Island effects in urban areas. This work has also generated focus on issues of water and air quality, where problems are exacerbated by high temperatures. The transportation construction workforce is among those who regularly pay attention to the challenges of extreme heat, and measures and training are a part of the ADOT operations. Additionally, ADOT communications tools (text alerts, freeway signs, etc.) are critical for reaching the public directly with heat warnings and alerts. It is important to consolidate and synergize these kinds of actions within ADOT and share those efforts broadly. Finally, ADOT will need to assess where further action is needed and advance partnerships with other state agencies and stakeholders as required, especially with response to the development of evacuation plans, siting of cooling centers, and best use of state assets.

Actors: ADOT leads, in partnership with ADHS and DEMA.

Objectives: I, II, III
Extreme Heat Preparedness

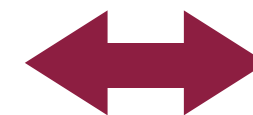
Timeframe: Longer Term
(up to 4 years)

Metrics of Success:

- Release of updated planning strategy and guides that increase attention to extreme heat
- Number of new actions identified

For more details:

ADOT Environmental Planning: <https://azdot.gov/business/environmental-planning>
 ADOT Guidebook: <https://azdot.gov/sites/default/files/2019/06/complete-transportation-guidebook.pdf>



Promote rapid public outreach and awareness campaigns.

Recommended Actions: Develop public awareness mechanisms and materials to promote comprehensive resources, messaging, and best practices in managing extreme heat that can be made available to workplaces, schools, and congregate care facilities - quickly.

Rationale: Research has shown that there is a continual “last mile” problem in communicating about the effects of heat exposure and preventative measures to avoid poor heat health outcomes. Targeting specific groups with tailored messages is important. Among the most vulnerable to heat exposure are workers that are not in a climate controlled environment during the extreme heat season, including, but not limited to outdoor workers, restaurant workers, factory and warehouse employees, delivery workers. Children are also a vulnerable class given their underdeveloped thermoregulation systems. Elderly people and those with pre-existing health conditions would benefit from special consideration during high heat events and those in congregate settings are most concerning during cascading events such as a heat wave and a power outage. Speakers whose first languages are those other than English may also be at a disadvantage for receiving critical communications. ADHS leads among state agencies for public outreach and communications, but more attention to prevention is recommended. Additional messaging and awareness communication campaigns should be targeted to each of these and other specialized audiences.

Actors: ADHS leads communication outreach campaigns. Secondary state agencies to implement and support include DEMA. Stakeholder input is needed from university partners, schools, health care providers, and faith-based communities, especially congregate setting providers. Note: ADHS is currently crafting a detailed update to communications strategy in their agency-specific extreme heat preparedness plan in response to E.O. 2023-16.

Objectives: I, II, III, IV, VII
Extreme Heat Preparedness

Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Pre and post surveys of targeted populations to measure effectiveness of the improved emergency awareness campaigns
- Number of new specialized messages and campaigns
- Number of additional languages and/or audiences reached

For more details:

It's Hot Outside Brochure in multiple languages www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/heat/its-hot-outside-brochure.pdf
Heat warnings sign-up service <https://public.govdelivery.com/accounts/AZDHS/signup/37495>
Director's blog <https://directorsblog.health.azdhs.gov/staying-safe-in-arizonas-heat/>

What we know.

This set of recommendations promotes sharing insights, data, knowledge and awareness through communications.

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Add Heatsafe efforts to the Emergency Information Network.

Recommended Actions: Expand the ADHS “Heatsafe Arizona” centralized hub for coordinating resources, disseminating information, and engaging the public in addressing heat-related health risks to include a call center for public questions and information. This should be integrated with the Arizona Emergency Information Network (EIN) thereby enhancing its ability to monitor and accurately visualize the impacts of heatwaves, with a focus on vulnerable populations.

Rationale: The “Heatsafe Arizona” hub of ADHS should be expanded and integrated with the Arizona Emergency Information Network (EIN) of DEMA, thereby enhancing its ability to monitor and accurately visualize the impacts of heatwaves, with a focus on vulnerable populations, such as residents of mobile homes. Furthermore, an expansion of the 211 emergency response system, akin to the poison control hotline, is advised to bolster the state’s capacity in providing immediate assistance and guidance during extreme heat conditions. Currently, Arizona does not have a centralized call center that conveys heat-related data (e.g., health data, temperature forecasting) and resource availability (e.g., cooling centers, emergency supplies) that are real-time and public serving. A central site, hosted by experts, would bolster the state’s capacity in providing immediate assistance and guidance during extreme heat conditions. Use of relevant dashboards, mapping tools, and other relevant data should be incorporated.

Actors: ADHS leads, in partnership with DEMA. Note: Component 4 of Executive Order 2023-16 directs DEMA to include information in the interagency Extreme Heat Preparedness Plan for how best coordinate resources and structure emergency response to incidents of extended extreme heat. Stakeholders include Solari and 211 partners.

Objectives: I, II, VII
Extreme Heat Preparedness

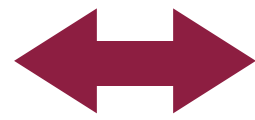
Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Quantity and quality of new datasets and information added to the DEMA’s EIN
- Number of new entries in the 211 emergency response system
- Number of agencies engaged and using the EIN

For more details:

The Arizona Emergency Information Network (EIN) by DEMA is at <https://ein.az.gov/>
ADHS’s Hub for Extreme Heat information is at : <https://www.azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/heat-safety/index.php#heat-home>



Track cross-service heat relief and assistance.

Recommended Actions: Use and improve an internal service-provider surveillance tracking system to report real time heat relief and utility assistance program utilization with data points to potentially include program type, average payment, household demographics, and geography. It should be inter-operable with respect to data on demand or needs for heat relief internal to critical agencies at the state level, as well as local service providers for operations coordination. A mechanism should be established for tracking across agency responses by household or individual to follow trajectories of service usage and outcomes with de-identified summaries shared in reports available to researchers.

Rationale: Arizona residents and households receive various programs related to federal and state heat relief dollars, especially utility assistance and crisis funding through numerous entities. Arizona received a record \$49.8 million for the Low Income Home Energy Assistance Program (LIHEAP) for October 2021 to September 2022, including the annual appropriation of \$26.2 million with an additional \$23.6 million from the American Rescue Plan. The standard annual allocation provides assistance for approximately 22,000 recipients, which is estimated as only a fraction of eligible households. Creating a robust, real-time, spatially explicit data collection mechanism which identifies recipient households compared to eligible populations (and demand, if possible) could help uncover specific gaps and under utilization rates. Tracking outcomes can help with program assessment as well. De-identified archival data should be made available to state public university health observatories and/or scholars in heat resilience for analysis and iterative improvements.

Actors: DES leads. Note: this recommendation directly responds to EO 2023-16 component 7. Stakeholders include Community Action Agencies and other entities providing LIHEAP distribution, and other federal and state funded assistance programs.

Objectives: III, IV, VII
Extreme Heat Preparedness

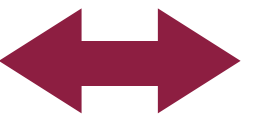
Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Ability to report in real time heat program utilization and demographics statewide
- Establishment of a mechanism to demonstrate impact on households who successfully and unsuccessfully apply

For more details:

<https://des.az.gov/liheap>
<https://public.tableau.com/app/profile/asuresilience/viz/LIHEAPDemographics/Dashboard1>
Phillips, L.A., B. Karna, S. Morgan, P. Solís, E.A. Wentz. (2021). “LIHEAP disbursements to vendors & at-risk populations in Arizona.” KEEP Resilience <https://hdl.handle.net/2286/R.2.N.160734>

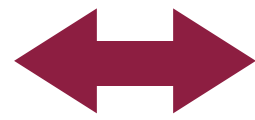


Create near real-time public dashboard on extreme heat.

Recommended Actions: Create a real-time dashboard of actionable extreme heat data that can be used by state, county, and local governments and the public to better manage impacts during extended heat waves.

Rationale: The Arizona Department of Health Services and Maricopa County Department of Public Health compile heat mortality and morbidity statistics, with heat surveillance procedures that are among the most comprehensive in the country. However, the data is often available outside of the heat season, and weeks post-facto, limiting real-time responses. A dashboard that would inform government agencies, health care providers, emergency managers, and public stakeholders in the heat relief network of increasing incidents of heat-related illnesses and deaths as well as other key indicators or metrics they may identify, would allow for proper provisioning, shifting of resources, or warnings for increasing readiness. Developing additional data requirements will ensure more successful allocation and management of resources for responding to extreme heat, including: emergency room visits, heat-related death and illness, heat-related workplace incidents, morgue capacity, distribution of cooling and heat relief centers, incidents reported from school nurses, and other information to ensure the people of Arizona are safe and healthy from extended heat waves. This public-facing resource should also include impacts to economic and property damage and loss, with archived spatial-temporal data deposited into a de-identified health observatory in universities for analysis that in turn informs further future action and data collection.

Actors: ADHS leads, supported by DEMA and stakeholders from hospitals, cooling center operators, medical offices, school nurses, 211 information system. End-user stakeholders include the public, vulnerable populations, and heat relief service providers, as well as Arizona public universities, health observatory researchers, actuary scientists, and analysts.



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Objectives: II, VII
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Data available year-round
- Data available in real time
- Release of dashboard
- Number of dashboard users

For more details:

See the DEMA Geospatial Hub at <https://adem-azdema.hub.arcgis.com/>

See ADHS Dashboard at <https://www.azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/heat-safety/index.php#heat-dashboard>

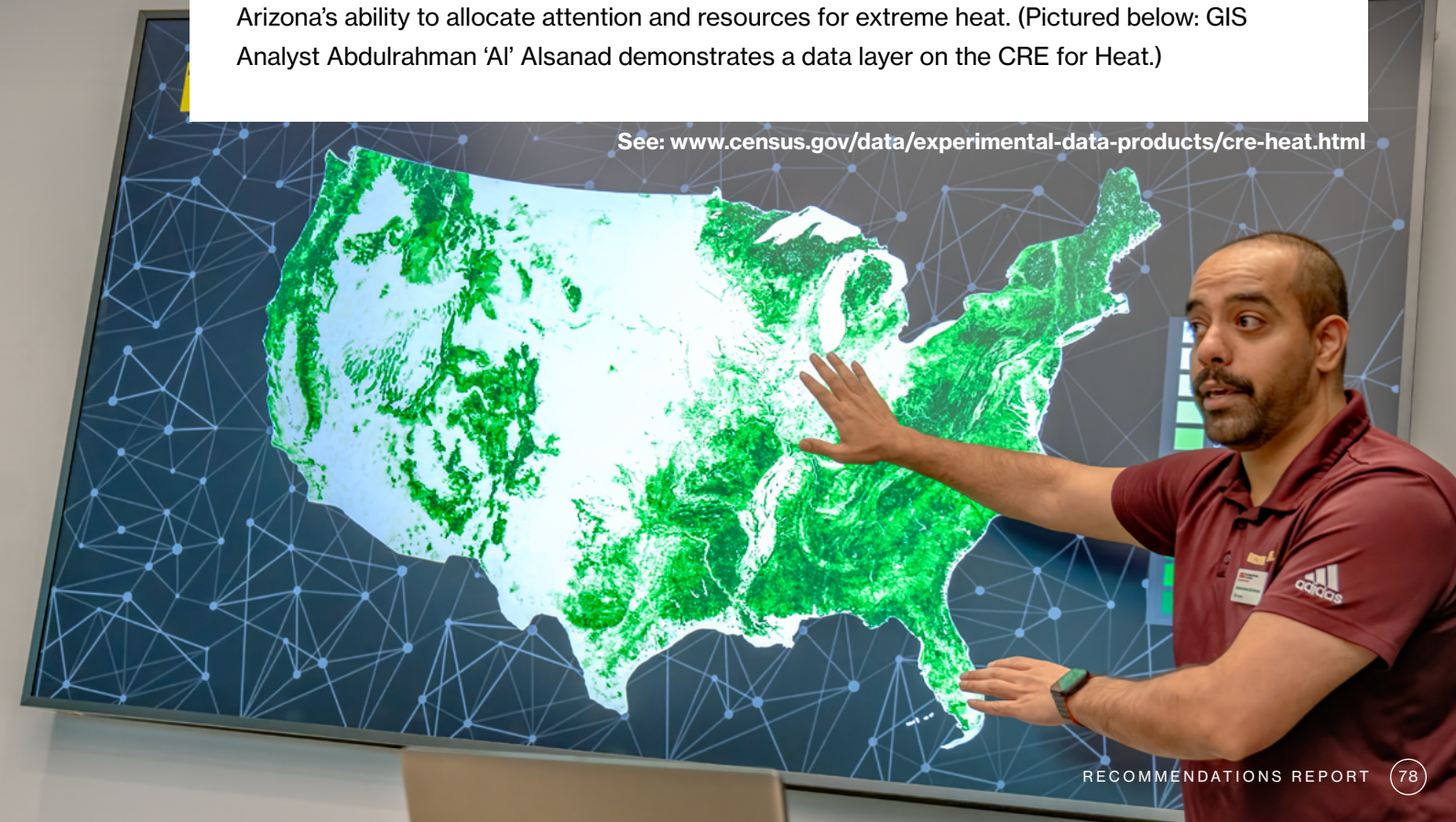
See the Sustainable Cities Network mapping tool at : <https://sustainability-innovation.asu.edu/sustainable-cities/heat-vulnerability-map/>

> Spotlight on data innovation

Risk estimates for heat

In the realm of preparedness, understanding a community's risk is paramount. The US Census Bureau's groundbreaking data product, the Community Resilience Estimates (CRE) was first released in 2019. While the original CRE gauges social vulnerability hindering general resilience, a new experimental data product was released in 2023, tailored to assess risk in the specific context of extreme heat exposure. Developed by the U.S. Census in collaboration with ASU's Knowledge Exchange for Resilience, the new "CRE for Heat" leverages research-informed variables from the American Community Survey and the Population Estimates Program. ASU Lead Researcher on the partnership, Patricia Solís says, "the value of this approach is that it results in an index that calculates aggregate-level small area estimates, providing a much more nuanced understanding of the capacity at the scale of individuals and households to withstand the stresses of extreme heat than other area-aggregated risk indices are able to accomplish." The CRE for Heat supports local planners, policymakers, public health officials, and community stakeholders to assess the potential resilience of communities based on the number of risks to its component households. This valuable tool empowers targeted strategies tailored to the specific challenges posed by extreme heat. Indeed, ADHS is pioneering the development of an Arizona-specific Social Vulnerability Index (AZSVI). Arizona will be the first state in the nation to incorporate the new CRE for Heat data into their own state-tailored SVI, further enhancing Arizona's ability to allocate attention and resources for extreme heat. (Pictured below: GIS Analyst Abdulrahman 'Al' Alsanad demonstrates a data layer on the CRE for Heat.)

See: www.census.gov/data/experimental-data-products/cre-heat.html



Update knowledge on climate assessments.

Recommended Actions: The Chief Heat Officer and the Governor's Office of Resiliency will work with the Interagency Resiliency Forum and other key agencies to identify specific knowledge gaps needed for making decisions and determining timing for responses and recovery efforts. They will also work with the academic and research community in the State of Arizona, to remain up to date on current climate assessments, as well as advances in knowledge on climate.

Rationale: The impact and frequency of high-heat days has notably increased since the original 2015 Extreme Weather, Climate, and Health Synthesis report was issued. Needs for specific knowledge about the context of a changing climate are increasing, and new domains are expected to be discovered in the process of developing and implementing new solutions. This recommendation seeks to equip state agencies and the communities they serve with the information and data resources needed to assess their climate risks and develop the climate resilience solutions most appropriate for them, while incorporating robust understanding of substate differences in impacts due to environmental processes. The executive order requested proposals to update the 2015 plan, which was discussed in a special forum with the authors and an audience of scientists and stakeholders in December 2023. Key takeaways include enthusiastic endorsement of the need to maintain up to date information on the state of Arizona's climate, and the need to better understand from responding agencies what knowledge would best inform actions. Consensus has that the CDC BRACE Program in Arizona as well as the state climate assessment that is part of the national climate assessment process, are currently the most appropriate mechanisms to share the latest science and remain up to date. Note: the state climate assessments are presented to the US President and Congress every four years. Funding for climate research is encouraged.

Actors: CHO, Governor's Office of Resiliency lead. IRF and the State Climatologist are key state partners. Stakeholders include the relevant academic research community in Arizona, and authors from Arizona participating in the National Climate Assessment.

Objectives: I, II, VII
Extreme Heat Preparedness

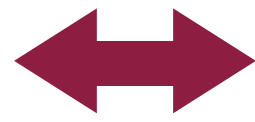
Timeframe: Short Term
(less than 6 months)

Metrics of Success:

- Necessary data and updates are completed by target dates
- Roster of scientists and researchers engaged

For more details:

<https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/pubs/climate-and-health-profile-synthesis-report-2015.pdf>
<https://www.cdc.gov/climateandhealth/BRACE.htm>
<https://statesummaries.ncics.org/chapter/az/>



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Where we will thrive.

With this set of recommendations, we envision a future Arizona with innovative approaches to extreme heat.

Quantify the costs of extreme heat impacts.

Recommended Actions: Develop a study quantifying the dollar value of loss of life and property specific to extreme heat. This study should encompass an evaluation of broad health impacts of extreme heat, including mortality and morbidity, in coordination with public health departments for Arizona, following standard methodologies for valuing health and life. Emphasis should include property damage or loss, albeit often difficult to quantify for extreme heat.

Rationale: The context for developing a study to quantify the loss of life and property due to extreme heat arises from a current, significant gap in the FEMA's disaster management framework, which does not recognize extreme heat as a qualifying disaster in the Stafford Act. This recommended study would prepare the State of Arizona, pending the potential passage of this federal legislation, to be able to immediately answer and fill anticipated information gaps by providing comprehensive data on multifaceted impacts of heat. The study should be conducted by a multidisciplinary group (agriculture, transportation, forestry, engineering, planning, actuarial science, economics, geography) to clearly identify metrics that would reflect a potential Stafford Act amendment, specifically, what is reimbursable for public assistance as a result of a heat emergency. Existing databases and indices should be utilized where relevant. The study should be comprised of two sections, one that focuses on how to quantify the loss of people and one on the impact for property. This includes a detailed assessment of the impacts on critical infrastructure in alignment with the FEMA Community Lifelines, such as the energy grid, public health resources, surface transportation, transit systems, rail networks, and aviation facilities under conditions of continual heat exposure. Parallels with cold weather communities should be included as reference for how to assess and manage the impacts of cold (i.e., salt and brine on infrastructure). Economic implications of extreme heat should distinguish between the impacts on businesses and individual households.

Actors: DEMA leads a study partnership with the academic research community, nonprofits, and insurance sector. Note: Component 4 of Executive Order 2023-16 directs DEMA to quantify the impacts of heat related emergencies.

Objectives: I, II, VI
Extreme Heat Preparedness

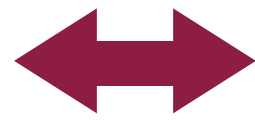
Timeframe: Longer Term
(up to 4 years)

Metrics of Success:

- Number and range of impacts quantified
- Release of study offering relevant understanding of the costs of extreme heat

For more details:

See Representative Gallego's Statement on amending the Stafford Act at <https://rubengallego.house.gov/media-center/press-releases/gallego-introduces-bipartisan-bill-declare-extreme-heat-emergencies>



Analyze the cost-benefit of statewide heat efforts.

Recommended Actions: The State of Arizona can partner with experts to support various strategic analyses specific to the cost of extreme heat and heat recovery in relation to state agency programs as well as stakeholder interventions and opportunities for co-benefits for resilience. Provision of budget to actual cost amounts will illuminate what is being spent and impact of dollars.

Rationale: Meaningful cost-benefit analysis about the value of the impact of heat and heat emergencies is not widely available for the State of Arizona and the lack of data prevents thoughtful scenario planning. Access to that data will allow state agencies as well as private investment and non-profit service partners to be proactive in planning instead of mostly reactive to the cost of addressing heat. This will allow deeper understanding based on data which can also be used to support forecasting and scenario planning conducted in partnership with academic institutions. Data should be made available to experts in the academic sector at a level detailed enough to conduct further analyses at high spatial-temporal resolutions, blend with other datasets, and used for predictive analysis that enables scenario build to in turn support decision support systems for the Office of Resiliency, Interagency Resiliency Forum, and the Statewide Heat Officer. Funding for this activity could be pursued from BRIC (FEMA's Building Resilient Infrastructure and Communities Program), and contribute to the proposed National Academies study as well as national strategic planning such as with NIHHS.

Actors: Actors: OSPB leads. Note: EO 2023-16 Component 2 specifies this to be led by OSPB, supported by DEMA and others where data sharing would be enabled across all state agencies involved in the Interagency Resiliency Forum, particularly providing program-specific data protected for human subjects. Stakeholders are Arizona taxpayers.

Objectives: I, II, V
Extreme Heat Preparedness

Timeframe: Longer Term
(up to 4 years)

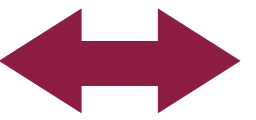
Metrics of Success:

- Provision of heat-related expenditures by agency and program
- Established relationships with university experts
- Predictive analyses enabled
- Completion of cost-benefit analysis and scenario planning reports by partners

For more details:

National Academies of Sciences, Engineering, and Medicine. 2023. Toward a 21st Century National Data Infrastructure: Mobilizing Information for the Common Good. Washington, DC: The National Academies Press. <https://doi.org/10.17226/26688>.

Colorado's Future Avoided Cost Explorer Tool :<https://cwcb.colorado.gov/FACE>



Accelerate efforts to mitigate greenhouse gas emissions.

Recommended Actions: In light of the urgent need to slow the rate of climate change, accelerate efforts to mitigate greenhouse gas (GHG) emissions, being led currently by the Governor’s Office of Resiliency. This recommendation includes linking the concepts of mitigation as they appear in the statewide Arizona Climate Action Plans with the need to prepare and respond to the impacts of rising temperatures in the Extreme Heat Preparedness Plan.

Rationale: Efforts are ongoing to produce the State’s Priority Climate Action Plan (PCAP), with follow-on work to evolve into the Comprehensive Climate Action Plan (CCAP). These activities aim to reduce GHG emissions in ways that ultimately reduce the effects, severity, or impact of future climate change, while improving lives for Arizonans. In particular, GHG reduction measures, identifying the most effective actions that can be enacted to reach targets, are important to reinforce and accelerate. We should pursue adaptation to extreme heat and mitigation of greenhouse gas emissions simultaneously. There is an opportunity to include emissions reductions among the evaluative criteria for projects and programs that reduce the impacts of extreme heat. Additionally, the plans will consider heat implications of proposed measures and prioritize those measures that contribute to heat resiliency and community resilience more broadly, in addition to greenhouse gas emissions reductions. The plan’s inclusion of an analysis that contemplates costs and benefits associated with each of the proposed actions and measures, should be in conversation with the recommendations in this report to better understand possibly mutually reinforcing measures or actions that might reduce costs and amplify benefits. In addition, possible trade-offs or conflicting solutions should be carefully considered and mitigated. Finally, elements of the climate action plans that focus on low income/ disadvantaged communities should speak to the set of populations who are most vulnerable to heat in Arizona. Given these mutually reinforcing state priorities, any opportunities to synergize implementation should be encouraged.

Actors: Governor’s Office of Resiliency leads. Support and partnership with participating implementing state agencies is key. Stakeholders include academic institutions, EPA, and the US Climate Alliance.

Objectives: V, VI
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

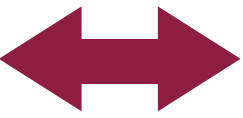
- Dollars of impact per the cost benefit analyses

For more details:

Georgescu, M., Broadbent, A.M. & Krayenhoff, E.S. Quantifying the decrease in heat exposure through adaptation and mitigation in twenty-first-century US cities. Nat Cities 1, 42–50 (2024). <https://doi.org/10.1038/s44284-023-00001-9>



Incentivize private sector investments for heat resilience.



Recommended Actions: Enlist and motivate private sector engagement in heat resilient solutions by developing incentives and benefits for identifying and implementing measures that protect households and businesses from negative impacts of extreme heat. The financial sector in particular should be encouraged to develop products and services to underwrite investments that are well known to have heat resilience benefits.

Rationale: Many Arizona homeowners would like to improve their property to mitigate and adapt to extreme heat, adding micro-investments for weatherization or utility independence. Businesses, alike, are interested in the co-benefits of preventing loss, reducing risk, and increasing efficiency in their operations. Support in other programs may take the form of direct assistance, but additional capacity to build adaptive capacity may only need state sponsored underwriting or risk guarantees. This recommendation encourages develop offerings together with banking industry actors and credit unions that remove current barriers and risks for the financial sector to engage in supporting solutions that Arizona small businesses and households may seek to participate in heat resilience. This might take the form of the establishment of a state fund to guarantee loans, subsidize interest rates, compliment city-level programming, incentivize solutions adoption, match private sector efforts, or other means to activate the significant interest and resources of the private sector.

Actors: The Arizona Finance Authority would lead with the partnership and direction of the Governor’s Office of Resiliency. Other state agency partners may include ADOH, DES, and IC. Stakeholders include the banking and financial sector as well as economic development entities of various counties and cities, as well as governments at all levels, all Tribal Nations, counties, and incorporated cities across Arizona which have FEMA-related or local emergency plans.

Objectives: III, V, VI
Extreme Heat Preparedness

Timeframe: Longer Term
(up to 4 years)

Metrics of Success:

- Number of households participating
- Number of businesses participating
- Dollar value of improvements made

For more details:

“The Arizona Finance Authority (AFA) is a one-stop shop for financing, supporting expanding and relocating businesses, communities’ infrastructure needs, and homebuyers. The AFA is committed to providing a streamlined, predictable process, getting borrowers the affordable financing they need more quickly.” <https://www.azcommerce.com/financing/about-the-arizona-finance-authority/>



Attract and develop a strategic workforce.

Recommended Actions: Commission a Future Heat Workforce Study to better understand strategic opportunities to simultaneously reduce risks, build a latent skill capacity for extreme heat response, and leverage job growth within future climate scenarios.

Rationale: Arizona will experience climate impacts including on temperature, air quality, and water availability. Arizona is also one of the fastest growing economies in the nation. There is a need for a study based on the future climate to align with the future workforce needs to address the impacts of climate. As these two dynamics collide, the current definition of “at-risk workplaces” will change and shift, so preparedness requires strategic projections. Certainly current categories such as agricultural workforce, restaurant workers, delivery drivers, healthcare professionals, emergency responders, and others should be a major focus.

But this recommendation goes beyond workplace safety and health, to better understand at a skill level, what kind of latent capacity could be called up for future opportunities, including smart technologies, renewable energies, planning experts, logistics, health navigators, grid resilience specialists, HVAC innovators, entrepreneurs, and more. The study should be based on agency needs, employment projections, and a dynamic future where Arizona thrives in the face of our climate realities.

Actors: IC leads. Significant other stakeholders to engage in the research would be the public university research community, workforce development agencies, ACA, etc.

Objectives: VI, VII
Extreme Heat Preparedness

Timeframe: Longer Term
(up to 4 years)

Metrics of Success:

- Launch staffing strategy

For more details:

On the Arizona Cooling Center Workgroup: <https://www.azdhs.gov/documents/preparedness/epidemiology-disease-control/extreme-weather/heat/statewide-cooling-centers.pdf>

On the Maricopa County Heat Relief Network: <https://azmag.gov/Programs/Heat-Relief-Network>



Incentivize climate resilient economic development.

Recommended Actions: Building upon strategic workforce, industry, and economic projections and opportunities, develop strategies to incorporate climate-resilient solutions into statewide economic development planning that would bring a resilience dividend of improving extreme heat preparedness and response while building economic security and prosperity.

Rationale: The state Office of Economic Opportunity, housed within the Arizona Department of Commerce, is projecting that Arizona will add about 477,968 jobs over the next 10 years. The new employment projection report claims that the state will outpace the national rate of job growth through 2032. Building upon the results of the recommended future workforce study, an economic development strategy should adopt some of the directions indicated for climate resilient industries that would provide a resilience dividend. The State of Arizona would develop incentive structures, financing mechanisms, and policies to accelerate economic development for new and existing private sector entities, as well as related employee workforce and career pathways in strategic areas that provide the latent capacity for statewide extreme heat preparedness and response, and advance economic security across the state. Additional co-benefits of a comprehensive climate resilience approach would include protection against flooding, fire, and air quality.

Actors: Governor’s Office of Resiliency leads. Support and partnership with Arizona Commerce Authority is key. Stakeholders include statewide economic development entities, Arizona Board of Regents.

Objectives: II, V, VI
Extreme Heat Preparedness

Timeframe: Mid Term
(6 months to 1.5 years)

Metrics of Success:

- Number of jobs created
- Number of jobs retained
- New industries established
- Dollars of impact

For more details:

www.azcommerce.com/oeo/





On how to engage with federal partners

The executive order requires the Director of the Office of Resiliency to include recommendations on how to engage with federal partners, around the efforts to ensure the State of Arizona is prepared to respond to and recover from extreme heat in future years.

Below are the top five priority recommendations that relate to how the State of Arizona could engage specifically with federal partners in the course of implementing the full set of recommendations in this report, as well as for promoting broader recognition, knowledge exchange, and innovation towards extreme heat impacts, not only serving the population of Arizona directly, but also the nation as a whole through the leadership of Arizona towards resilient solutions.



1. Develop and execute an overarching economic development strategy

that leverages multiple sources of federal economic development funding for adaptation to climate change by addressing extreme heat mitigation and adaptation together. This activity would build upon recent experiences administering the \$13.3 million in Infrastructure Invest and Jobs Act funds to prevent outages and improve grid resilience across the state, as well as other ongoing and special resources for housing, economic security, health, and climate knowledge. This strategy should include active participation under the White House's National Climate Resilience Framework (September 2023) and should inform the National Heat Strategic Plan being developed by the 24 federal agencies engaged in the planning process under the leadership and auspices of the National Integrated Heat Health Information System (NIHHIS) co-created by NOAA and CDC as an interagency integrated information system to develop and provide actionable, science-based information to help protect people from heat. The voice of Arizona's public, academic, private, and nonprofit sector regarding the cost of hotter temperatures to health, and to the economic well-being of residents and businesses, is an important and unique contribution to this conversation. The Arizona

perspective on heat resilience dividends and building adaptive capacity to extreme heat as an economic development and workforce development strategy under the proactive leadership of state government offers significant insights to federal partners and a potentially transformative dimension to the nationwide effort.



2. Continue to pursue federal utility assistance and weatherization funding increases

, namely through persistent attention that for many years has advocated for permanent increases in LIHEAP allocations, as well as for the review and revision of allocation formulas at the federal level that would ensure that warm weather states are not shortchanged. As climate change ensues, and temperatures everywhere across the country and the planet are expected to rise in general, more resources will be needed for cooling solutions that utility assistance and weatherization can offer to the most vulnerable and economically precarious across the state, tribal lands, and the nation. More broadly, Arizona should advocate that federal formula and discretionary programs include heat mitigation and heat response as central priorities, and that notice of opportunities for funding and project evaluation criteria align with heat resilience goals.



3. Track and strategically engage national legislative actions that include extreme heat issues

, resources, or responses, activating the State of Arizona Governor's Office personnel who are charged with legislative affairs. The legislative affairs offices of the state public universities may also be helpful for adding expert scientific knowledge exchange on various issues that the state may choose to prioritize, promote, or advocate where they have subject matter expertise. Currently, there are a number of such actions that should be included in this recommended set of items that should be tracked at the federal level for strategic engagement when appropriate, for example:

- H.R.3965: Rep. Ruben Gallego introduced the bipartisan Extreme Heat Emergency Act to add extreme heat to the Federal Emergency Management Agency's (FEMA) list of major disaster qualifying events.
- S.2510: Sen. Kyrsten Sinema co-sponsored the Preventing Health Emergencies and Temperature-related (HEAT) Illness and Deaths Act to provide financial assistance for community-based projects that reduce exposure to extreme heat, commission a National Academies of Science study issuing recommendations for federal action on heat health, and creating an interagency committee to enhance cross-government efforts.



- H.R.5760: The Climate Resilience Workforce Act seeks to establish a climate resilience workforce and convene multiple federal agencies in a strategic planning framework.
- S.2501: The Asunción Valdivia Heat, Illness, Injury and Fatality Prevention Act protects employees by requiring basic labor protections, such as water and breaks, to safeguard indoor and outdoor workers from heat stress and extreme temperatures.
- H.R. 4531: Rep. Juan Ciscomani co-signed the bipartisan Patients and Communities Reauthorization Act that would reauthorize key federal programs for patients with substance use disorder and permanently extend required Medicaid coverage for medication-assisted treatments. This directly relates to heat associated deaths since the combination of substance abuse and experience of homelessness has shown to be deadly for Arizona residents.

There are and will continue to be other examples of federal legislation that the State of Arizona should be purposefully aware of and track with respect to how it impacts state agencies.



4. Propose a Federally Funded Research and Development Center (FFRDC) dedicated to Extreme Heat Resilience to be located in the state of Arizona.

The federal government supports research and development (R&D) that is conducted by a wide variety of performers, including federally owned and operated laboratories, universities, private companies, and other research institutions. A special class of research institutions referred to as federally funded research and development centers, or FFRDCs, are owned by the federal government, but operated by contractors, including universities, other nonprofit organizations, and industrial firms. FFRDCs are intended to provide federal agencies with R&D capabilities that cannot be effectively met by the federal government or the private sector alone. FFRDCs are required to have a long-term strategic relationship with the federal agency that supports them. In particular, Arizona State University is keen on serving as the central home for such an FFRDC, and the topic of extreme heat would leverage not only ASU expertise, but also from NAU and UA, as well as the many local and state partnerships in place. ASU recently established a Health Observatory; is planning a major Data Science initiative; and has the Knowledge Exchange for Resilience in the Global Futures Laboratory with significant capacity on the subject. Furthermore, ASU is at the cutting edge on technologies such as Open AI. These entities and others would be proposed to form the core operating functionality of an FFRDC. Arizona scholars already heavily participate in national climate assessments and state assessments. There are many federal agencies that could potentially serve as lead agency for this center, and others that would join in partnership. These include Department of Defense or Homeland Security (with a perspective that extreme heat catastrophic impacts may be of national security importance); NASA or NOAA (given that environmental data is a key component of understanding and preparing for extreme heat); CDC (relating to health impacts); FEMA; Census and the National Science

Foundation (relating to knowledge of risk, vulnerability and climate-hazard response, among other topics). Our recommendation would prioritize the possibility of engaging with the NIHHS on establishment of such a federal center.

(Note: There is only one FFRDC in the US that is located in the state of Arizona, administered by the Association of Universities for Research in Astronomy in Tucson. See also the Master Government List of Federally Funded R&D Centers at <https://www.nsf.gov/statistics/ffrdclist/>).



5. Enlist and bolster statewide participation in the American Climate Corps. The White House has initiated a new program to train young people in high-demand skills for jobs that advance climate resilience <https://www.whitehouse.gov/climatecorps/>. The American Climate Corps aims to put a new generation of Americans to work conserving our lands and waters, bolstering community resilience, advancing environmental justice, deploying clean energy, implementing energy efficient technologies, and tackling climate change. Arizona’s participation would introduce a key missing subject on workforce: responding to extreme heat. The federal report underscores several recommendations for workforce development that could be enhanced through a State of Arizona engagement with this federal partnership. Given that the program is new, there may be innovative ideas for how to promote a statewide approach to massive and/or strategic participation, such as state chapters of the Climate Corps, matching workforce skills-development programming, placements with key state agencies in apprenticeships, or other alignment with state personnel, functions, or strategies.



These recommendations engage with a significant number of federal partners, from the White House, to Senators and House Representatives, to mission agencies, data agencies, and legislation. These represent a key starting point for decisions by the Office of the Governor on how to best align state action with reinforcing resources and efforts at the federal level.



Conclusion



To take a bold step towards extreme heat preparedness, we, as a state, must transform the status quo, hand in hand with communities and across sectors. We also must maintain continued attention from the various state agencies directed with responding to extreme heat preparedness and leadership across state government.

Reflecting upon the need for action, the set of priorities and recommendations, and the potential benefits, we conclude by recommending to the State of Arizona, in conjunction with the established Interagency Resiliency Forum, that the following actions guide implementation to address the equitable heat resilience outcomes that vulnerable, exposed populations require, and that would benefit all Arizonans. Specifically, we understand that in order to accept this set of recommendations, the State will need to commit to:

- Invest in multi-sector, stakeholder-identified solutions to address extreme heat as integral to the missions of the respective state agencies involved in the forum;
- Enable a data ecosystem that promotes evidence-driven decision making and innovation, accessible to researchers and practitioners in near-real time, to support early warning communications, critical infrastructure protection, and optimization of lifelines deployment;
- Increase accountability for extreme heat outcomes, recognizing the opportunity for co-benefits from resilience solutions when engaging the economic development and workforce sector;
- Leverage local and federal relationships for collaborative and innovative actions to increase extreme heat preparedness for all Arizonans; and
- Lead and coordinate implementation of this report's recommendations from a permanent infrastructure in the Governor's Office, including a Chief Heat Officer.

The authors and contributors encourage the Governor's Office of Resiliency, the Interagency Resiliency Forum, and the Chief Heat Officer to utilize this report as a tool for inspiration. Its contents have already been provided to be taken as direct input to help finalize the development of the statewide plan in coordination across agencies, as directed in the executive order. The state of Arizona's plan was released on March 1, 2024. As the plan is implemented, and as our community continues to address extreme heat preparedness, we hope that our report will be revisited over the course of time, to continue to support the State of Arizona and all of its residents in terms of a coordinated response to extreme heat.

The future will bring many opportunities to improve this set of knowledge and ideas, and invest in further action, which is greatly encouraged by its authors and contributors.



Appendices

Recommendation development process

Acknowledgements

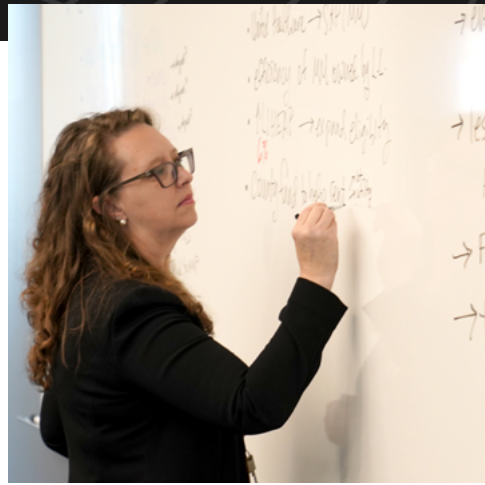
List of recommendations

List of acronyms

**Reference documents:
Executive order and RFI request**

Bibliographic references





Recommendation development process

This report is the is a reflection of a much larger and broader set of knowledge from many years' worth of research, practice, and experience in Arizona. It has been prepared with input from many stakeholders, who share our mission for a heat resilient Arizona.

The resulting set of recommendations encapsulates an extensive compilation of insights garnered over many years of dedicated research, practical implementation, and experiential learning amassed by countless actors across many sectors, and the authors aspire to convey the full and rich context from which this report compilation was made possible. While the text that appears in these pages was collaboratively crafted with invaluable input from a diverse array of stakeholders over an ostensibly short timeframe, in the wake of the declaration of emergency after a particularly record-breaking summer, this document nevertheless would have never been possible without a long-term collective commitment towards cultivating a more heat-resilient Arizona unfolding over decades. As such, this report draws upon knowledge accumulated over a concerted, embedded, purposeful agenda of extended work, which belongs to all of Arizona, and for which our author team is immensely grateful. We are appreciative of, and hope that this report and the subsequent plans and actions build upon the efforts and goodwill of the broader community addressing extreme heat. Any omissions or errors will be willingly added and corrected in subsequent editions. Simultaneously, we call for the renewed, expanded, and coordinated commitment and collaboration across the many state agencies, and all sectors, from public to private, nonprofit and academic actors, to continue.

It is also important to note that the above set of actions generated valuable insights and recommendations that go beyond the scope of this report. Content that did not contain some component of action that speaks to the jurisdiction and role of the State and it's state level agencies, however valuable, is generally not able to be reflected in the set of recommendations offered in this report. We encourage actors and stakeholders at other levels of influence, to continue to innovate and continue to contemplate how state agencies may reinforce, support, and initiate extreme heat preparedness in collaborative ways.

The following timeline thus summarizes only the particular focused set of events that brought the authoring team to consolidate, query, and report for input to this process, responding to the Governor's call for extreme heat preparedness, and the request made by state officials for a report of this nature; specifically:

- August 11, 2023** Declaration of Emergency and issue of EO 2023-16 by Governor Hobbs
- August 21** Internal coordination meeting w/ OOR director
- September 7** Introduction of Author Team via Zoom with the Interagency Resiliency Forum
- October 4** Request from OOR to conduct a public Request for Information (RFI)
- October 15** Public release of the RFI
- October 23** Vision Meeting with IRF members in ASU's Decision Theater, Tempe
- November 9-10** Author team internal writing workshop
- December 1** Compilation of responses to the public RFI
- December 14** Priority Action Meeting with core IRF members in ASU's Decision Theater, Tempe
Delivery of First Consultative Draft of Recommendations for Iteration
Full verbatim unedited delivery of public responses to the RFI
- December 18** Stakeholder meeting on Update to 2015 Climate Assessment
- January 4, 2024** Report revision workshop
- January 12** KER and OOR report recommendations feedback workshop
- January 22** Internal delivery of complete Report Draft, iterations
- January 31** Submission of final Review Version of the Report, sans bibliography

In addition, this development included:

- Weekly coordination meetings w/ OOR Director
- Weekly KER authoring team coordination meetings
- Weekly KER data team meetings, including with Decision Theater, Walton Solutions Service
- Periodic check-ins with parallel efforts (such as the ADHS support team in Knowledge Enterprise, the Climate Action Plan effort in the Global Futures Laboratory, the AZSVI team, SW-IFL Resilient Solutions Team, and many others)
- Occasional media inquiries and responses
- Numerous emails, phone calls, research, data requests, on a daily basis

In parallel, a number of efforts within state agencies, within stakeholder communities, and at multiple levels of action from individuals, institutions, cities, counties, and subregions of the state took place since the declaration of emergency. Our team remained in touch with these complimentary activities, and made every effort to attend and acquire takeaways that could inform this report. This included a series of convenings and consultations commissioned by ADHS with support from the university public health community to prepare a health-focused set of recommendations; internal meetings within each of the agencies named in the executive order; regular convenings of the statewide cooling center network; and the Southern Arizona Heat Planning Summit led by colleagues at the University of Arizona. Various companion reports, meeting summaries, and recommendations arose from these activities, and have been taken into account in this report to the extent possible.



It is also important to note that the above set of actions generated valuable insights and recommendations that go beyond the scope of this report. Content that did not contain some component of action that speaks to the jurisdiction and role of the State and its state level agencies, however valuable, is generally not able to be reflected in the set of recommendations offered in this report. We encourage actors and stakeholders at other levels of influence, to continue to innovate and continue to contemplate how state agencies may reinforce, support, and initiate extreme heat preparedness in collaborative ways.

Work with the Governor’s Office of Resiliency continued throughout February 2023 after the submission of the review version, answering questions, offering clarification, providing sources of data or information to substantiate recommendations, in support of the internal process to develop an action plan from this report and internal development. This activity culminated in the March 1, 2024 delivery of the Arizona Extreme Heat Preparedness Plan from Governor Hobbs.

Our authors and contributors are pleased that some of the recommendations were able to be adopted, adapted, or used as inspiration in the plan itself, particularly those that had been prioritized. We understand that some of the recommendations and goals may not be immediately actionable, given such possible barriers such as contradictions with existing state agency plans, lack of available resources to implement recommended actions, availability of staffing or expertise to execute recommendations, the need to focus on a reasonable set of immediate actions, political expediency, or other practicalities that may have nothing to do with the value of the recommendations.

This report has been updated very slightly since the submission of the review version at the end of January. The minor changes made reflect corrections of fact or edits for clarification, and the addition of one recommendation that had resulted from a planned meeting that had been delayed into the first week of February. The review version did not include this description of the development process, acknowledgements, and the bibliography, so this final version differs by the addition of these important components. Finally, the professional formatting of this report was completed in order to release publicly in print.

It is important that this full version is released publicly to capture the complete set of recommendations, including those that had been adapted or remained unadopted, so that future iterations may be able to return to these ideas as they become viable.

Our report is hereby released to the public on April 9, 2024. The event celebrating its release is a showcase summit and policy workshop held in Washington, DC, co-hosted and co-sponsored by the ASU Knowledge Exchange for Resilience and the Federation of American Scientists.

Please also see the State of Arizona Extreme Heat Preparedness Plan, FAQ, LIHEAP Letter and press release:



<https://azgovernor.gov/office-arizona-governor/news/2024/03/governor-hobbs-announces-extreme-heat-preparedness-plan>

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Arizona Department of Health Services
Arizona Department of Housing
Office of Governor Katie Hobbs,
Office of Strategic Planning & Budgeting
Arizona Department of Emergency and Military Affairs
Industrial Commission of Arizona
Residential Utility Consumer Office

Local Government, Community-based Organizations and Non-Profits

A League of Arizona Cities and Towns
AARP Arizona
AAMHO
Arizona Community Foundation
Arizona Faith Network
Arizona Hispanic Chamber of Commerce
Arizona Housing Coalition
Arizona Public Service Company
City of Phoenix
City of Tucson
Maricopa County Department of Public Health
Pima County Department of Public Health
Black Chamber of Arizona
Brookhaven National Laboratory
Salt River Project
UMOM New Day Centers
Greater Phoenix Leadership
LGBTQ Victory Institute
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Wildfire

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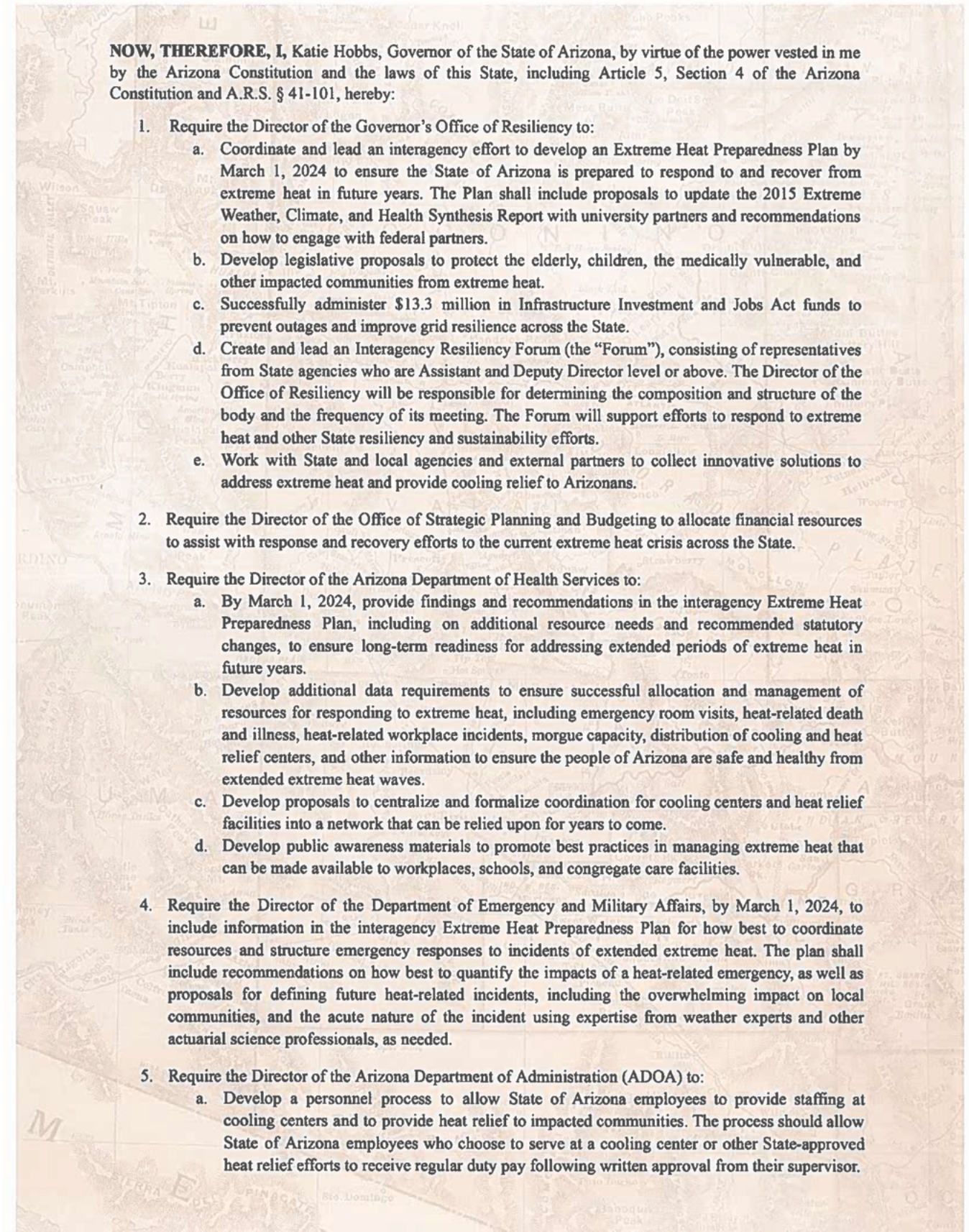
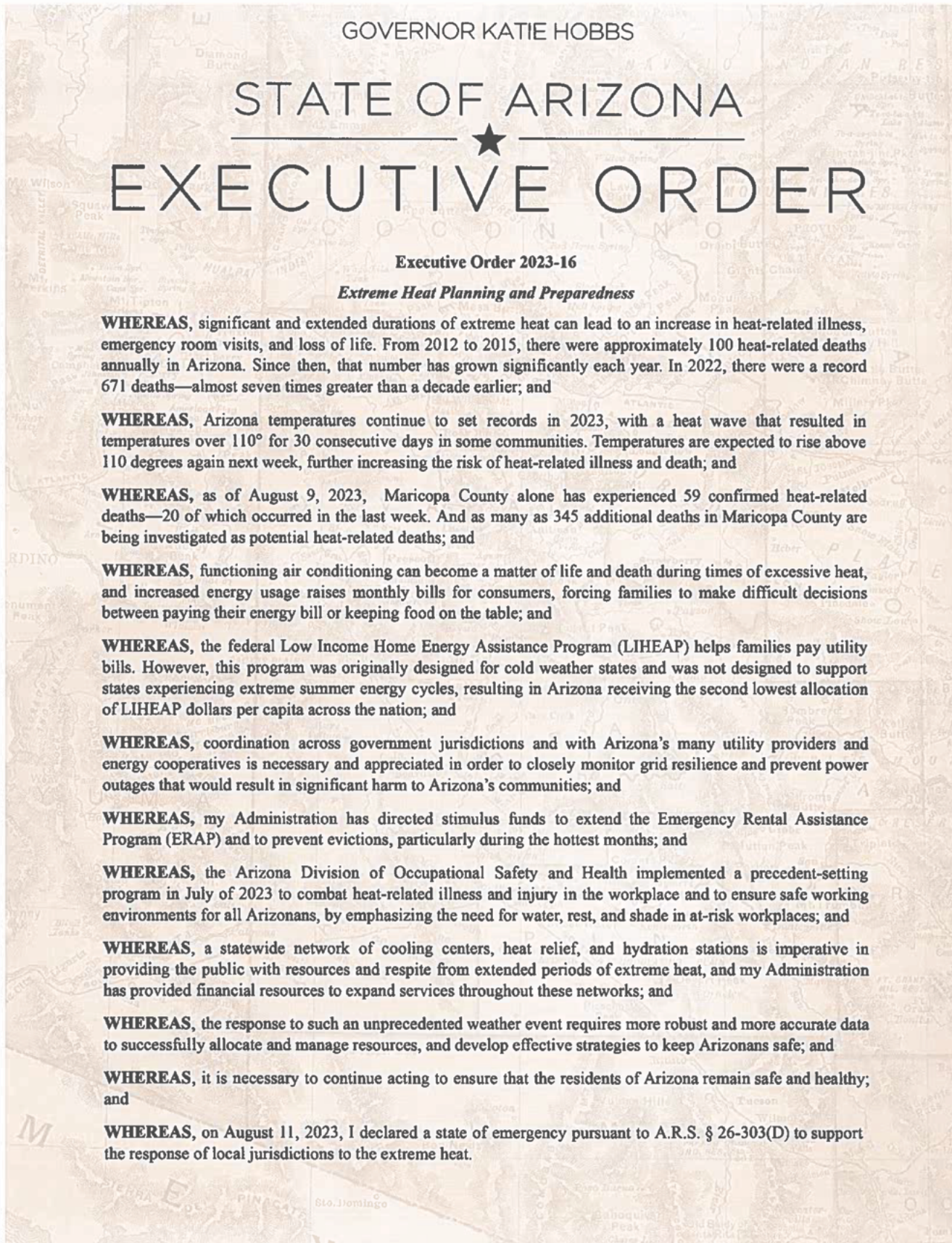
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List of acronyms

| | | | |
|---------------------|--|---------------|---|
| AAMHO | Arizona Association of Mobile and Manufactured Home Owners | EIN | Emergency Information Network |
| AARP | American Association of Retired Persons | FEMA | Federal Emergency Management Administration |
| ACA | Arizona Commerce Authority | FFRDC | Federally Funded Research and Development Center |
| ACC | Arizona Corporation Commission | OOR | Governor's Office of Resiliency |
| ACCW | Arizona Cooling Center Workgroup | GPEC | Greater Phoenix Economic Council |
| ADHS | Arizona Department of Health Services | HRN | Heat Relief Network |
| ADOA | Arizona Department of Administration | IC | Industrial Commission of Arizona |
| ADOH | Arizona Department of Housing | IRF | Interagency Resiliency Forum |
| ADOSH | Arizona Department of Occupational Safety and Hazards | KER | Knowledge Exchange for Resilience |
| ADOT | Arizona Department of Transportation | LIHEAP | Low Income Home Energy Assistance Program |
| AFN | Arizona Faith Network | MMHC | Mobile and Manufactured Home Communities |
| AHMIP | Arizona Heat Mitigation Infrastructure Program | NAS | National Academies of Sciences |
| AMHC | Association of Manufactured Housing Communities | NASA | National Aeronautics and Space Administration |
| ASU | Arizona State University | NAU | Northern Arizona University |
| DEMA | Arizona Department of Emergency and Military Affairs | NIHHIS | National Integrated Heat Health Information System |
| AZDEQ | Arizona Department of Environmental Quality | NOAA | National Oceanic and Atmospheric Administration |
| AZHRWG | Arizona Heat Resilience Working Group | NSF | National Science Foundation |
| BRIC | Building Resilient Infrastructure and Communities | NWS | National Weather Service |
| CDC | U.S. Center for Disease Control | OSHA | U.S. Occupational Safety and Hazards Administration |
| CHO | Chief Heat Officer | OSPB | Office of Strategic Planning and Budgeting |
| DES | Department of Economic Security | RUCO | Residential Utility Consumer Office |
| DOD | U.S. Department of Defense | TREO | Tucson Regional Economic Opportunities / Sun Corridor |
| E.O. 2023-16 | Executive Order for Extreme Heat Planning and Preparedness | UA | University of Arizona |

Reference documents



Reference documents



STATE OF ARIZONA
OFFICE OF THE GOVERNOR

EXECUTIVE OFFICE

KATIE HOBBS
GOVERNOR

Via Email Transmission: patricia.solis@asu.edu

October 4, 2023

Patricia Solis, Ph.D.
Executive Director
Knowledge Exchange for Resilience
Arizona State University

Dear Dr. Solis:

Please let this letter serve as a request for the Arizona State University Knowledge Exchange for Resilience to initiate, operate, and execute the Request for Information (RFI) process on behalf of the Governor's Interagency Resiliency Forum. This RFI process will inform the Extreme Heat Preparedness Plan, due March 1, 2024, as directed by Governor Katie Hobbs' Executive Order 2023-16.

Thank you in advance for your consideration. If you have any questions pertaining to this matter, please contact me at: 602.501.4954 or mmahoney@az.gov.

Sincerely,

Maren Mahoney
Director
Office of the Governor's Office of Resiliency

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