

# Extreme Heat



## Actions

N1

Establish a larger, better coordinated, and more responsive network of cooling centers and draft clear guidelines for network members.

N2

Implement educational campaign, health advisories, and best practices for time spent outdoors in extreme heat.

A1

Internalize climate resilience practices in city planning to reduce the urban heat island.

A2

Enhance programs to distribute fans, air conditioners, and water to vulnerable populations.

# Background

The *Climate Change in Columbus Ohio* report identifies increasing temperatures as one of the two climate changes that have and will likely continue to affect our city.<sup>1</sup> From 1951 to 2012, the annual average temperature for Columbus warmed by 2.3°F, which was faster than both the national and global rates. This trend is expected to continue, with annual average temperatures projected to rise by an additional 3 to 5°F by mid-century. Increasing temperatures result in several impacts – deteriorated air quality, stress on vegetation, increased demand for water and energy – that can negatively affect our community. One of the most concerning effects is the projected increase in extreme heat events by mid- twenty-first century, including an increase in the warmest day of the year (> 6°F), with an additional 20 to 40 days per year of high temperatures greater than 90°F (comparison made to the 1976-2005 period).<sup>2</sup>

Extreme heat refers to air temperatures that are much hotter than average. Extreme heat events are generally characterized by consecutive days of excessively hot weather, often including elevated humidity and warm nighttime temperatures. The lack of cooling at night leads to sustained heat indices and health concerns. These events are already occurring throughout the country and are expected to increase in severity and frequency as the climate continues to change. The projected increase in extreme heat events increases the likelihood of more heat-related illnesses and deaths in Columbus.

According to the National Weather Service, heat remains one of the greatest weather-related causes of death in the United States.<sup>3</sup> In 2016, 94

people died as a result of extreme heat. Although the most vulnerable are those living in permanent homes with little to no air conditioning, loss of life can include others as well. Individuals engaging in strenuous outdoor work during periods of high temperatures are at increased risk as well as those that are socially isolated and unable to cool themselves during widespread heat waves. Of particular note is the loss of life that occurred during the *summer of 1995 in Chicago*, where more than 700 individuals were estimated to have died in an extended heat wave.<sup>4</sup> Similar events have been documented within the United States and around the globe.<sup>5</sup>

To combat the risks associated with extreme heat, two necessary (N) actions and two aspirational (A) actions are proposed. These actions provide ways for the public to avoid the negative effects of extreme heat and ensure that best practices will be utilized for anyone that has to spend time outdoors on dangerously hot days. Additionally, these actions focus on providing resources for vulnerable populations who are disproportionately affected by heat-related illnesses, often due to limited mobility, lack of access to residential air conditioning, and/or failure to be a part of a community that can provide support during an emergency (e.g., faith community, neighborhood group, senior citizen center). Many groups of people are especially vulnerable to heat-related illness, including infants and young children, the elderly, people with chronic medical conditions, low-income households, and outdoor workers. If the proposed actions are taken, Columbus can minimize the serious risks posed by continuously rising temperatures.

N1

**Establish a larger, better coordinated, and more responsive network of cooling centers and draft clear guidelines for network members.**

Cooling centers provide air-conditioned facilities that are open to the public during extreme heat events. By simply providing an air-conditioned environment, these facilities can significantly reduce the risk of heat-related illness, especially for the members of the community that do not have access to household cooling.<sup>6</sup> Additionally, many of these facilities provide water to protect against dehydration. The City of Columbus should establish a larger, better coordinated network of cooling centers to accommodate residents during extreme heat events. This network could include a combination of public and private facilities operating under the same guidelines.

Currently, 29 of the 34 cooling centers in Franklin County are located in the City of Columbus.<sup>7</sup> The majority of these facilities are community centers run by the City of Columbus Recreation and Parks Department (CRPD). They operate as cooling centers during their respective hours of operation, which is generally Tuesdays through Saturdays from 11 am to 9 pm.<sup>8</sup> If extreme heat conditions warrant extended hours to support vulnerable populations, Community Center hours can be adjusted to accommodate residents during these events as the City recently did during extreme heat events in July 2018. The American Red Cross (Ohio Buckeye Region) also utilizes the CRPD centers for emergency needs, related to conditions that include extreme heat but also other emergency situations. While these buildings are geographically well-distributed and often in close proximity to transit routes, there are no centers that are open 24 hours a day.

Establishing a larger, better coordinated network of cooling centers would ensure that sufficient cooling centers are available and that all facilities

operate as part of an organized network using the same guidelines that are designed to be responsive to the needs of the community. These guidelines should establish the requirements necessary for each of the facilities to operate as a cooling center, recommended hours of operation, the appropriate temperatures the centers should maintain to ensure cooling, and additional services that may be offered. Additional services may include providing food and water, allowing pets, offering information, or providing resources and activities that de-escalate tension and ease transition (e.g., activities for families and children, counseling, etc.). Key community organizations, such as the American Red Cross, could play instrumental roles in this process. Facilities with backup power generation should be provided in the network to maintain operations in the event of a power failure. If backup generators are installed or updated at these facilities, natural gas generators should be prioritized over diesel generators in order to ensure greater efficiency and cleaner emissions.

Another reason to establish a network of cooling centers is that while a list of “formal” cooling centers can be provided to citizens, many residents might seek cooling in other “informal” locations such as retail centers, churches, libraries, and buses. There are ample opportunities for local businesses, faith communities, and community assets to participate in the cooling center network. Residents will turn to trusted locations, regardless of their identified status as “formal” cooling centers. Therefore, it is important to involve these facilities in planning and communication to efficiently extend coverage of this important resource throughout Franklin County. Under the Extreme Heat Plan, *Franklin County Emergency Management and Homeland Security (FCEM & HS)* will coordinate information flow between various agencies, community partners, and the general public during an extreme heat

emergency, but the responsibility of opening and managing cooling centers will fall to local governments and non-profit organizations.<sup>9</sup>

Updated plans for a network of cooling centers during extreme heat events will also draw from and inform plans for heating centers during extreme cold events.

**N2**

**Implement educational campaign, health advisories, and best practices for time spent outdoors in extreme heat.**

A proactive educational campaign should be offered to the general public to emphasize the dangers of extreme heat. It should especially target individuals who work outdoors (e.g., construction workers, yard/tree care professionals, roofers), supervise children (e.g., summer camp supervisors and coaches), and care for senior citizens (e.g., social workers, nursing homes, faith communities). This campaign should clearly articulate ways to reduce risk by stressing sufficient hydration, reducing strenuous activities outdoors during the hottest hours of the day, and encouraging frequent cooling breaks when working outdoors.

Likewise, this campaign should include materials that will be distributed when a heat wave is imminent. These materials should include the recommended actions for the general population to take to mitigate the impacts of heat waves, which are largely the same as those of the proactive campaign. Specific reminders should be included for caretakers who look after high-risk populations. These reminders empower individuals to take action, thus reducing the likelihood of a high-risk populations being overlooked and emergency services being overtaxed. Additionally, information regarding specific heat wave events, such as the intensity and expected duration, should be available through the *MyColumbus* and *ALERT Franklin*

*County* apps (A19).<sup>10, 11</sup> Educational campaigns need to take into account the methods of reaching particular audiences (e.g., television, radio, print media), languages spoken within all communities, literacy status, and trusted information sources within neighborhoods/populations (e.g., faith communities and neighborhood centers). Detailed guidance for working with vulnerable populations is provided in a *2007 public health report by Wingate*, the *BRACE Framework from the CDC*, and a *2018 publication of the OPHA*.<sup>12, 13, 14</sup>

To have maximum impact and avoid duplication of services, the City of Columbus should coordinate with FCEM & HS and the Extreme Heat Plan, updated in 2017. For instance, FCEM & HS has already identified conditions that activate their plan, developed a list of community partners to be engaged, and specified communication methods to be employed.<sup>9</sup>

**A1**

**Internalize climate resilience practices in city planning to reduce the urban heat island.**

The urban heat island (UHI) is defined as a city/metropolitan area that is warmer than its surrounding rural region as a result of human activities and has long been established as an accepted phenomenon.<sup>15</sup> Reduced vegetation and pervasive use of asphalt and concrete lead to heat absorption and reduced evapotranspiration, while tall buildings and narrow streets restrict air flow. Together, these features often cause a significant increase in air temperature within the city. The difference between urban and rural areas is generally greatest after sunset, and in a *study of 60 major US cities including Columbus*, the difference was as much as 24°F.<sup>16</sup> Columbus had the 8th most intense UHI, with summers averaging 4.4°F higher in the city compared to rural areas, and the fastest-growing UHI with a 0.84°F per

decade increase since 1970. UHIs have many negative impacts, including increased energy consumption and reduced air and water quality, and they exacerbate the risks associated with extreme heat for those who live in or spend most of their time in the city.<sup>17</sup> Especially at risk are the high-risk populations discussed above and those who do not have or cannot afford to run air conditioning.

Additional actions can be taken to reduce the intensity of the UHI in Columbus. One of the most important strategies is to increase the amount of vegetation and tree coverage throughout the city.<sup>18</sup> In 2015, *Branch Out Columbus* began an initiative to grow the urban tree canopy by planting 300,000 trees by 2020.<sup>19</sup> CRPD is working with The Nature Conservancy and has identified the need for a strategic plan to guide implementation, as fewer than 40,000 new trees have been planted to date. “Green roofs” also lower temperatures by providing shade and cooling through evapotranspiration.<sup>20</sup>

Another strategy to reduce the UHI involves utilizing reflective and permeable materials on new or rehabilitated roofs and paved surfaces.<sup>21</sup> These materials lead to cooling by reflecting heat and sunlight away from buildings and pavement, and they have the added benefit of reducing stormwater runoff. Some roofing materials are even independently certified through the *Energy Star Program*.<sup>22</sup> Not all surfaces are suitable for utilizing these materials, but they should be considered in new construction projects. This would apply to any projects requiring approval by the city. Additionally, incentive programs could be implemented to encourage the use of green infrastructure (GI), such as the *stormwater credit program* that rewards properties that incorporate green infrastructure with credits that reduce their stormwater service fees.<sup>23</sup> Through the *Greenspot* program, Columbus already promotes many of these practices for both businesses and households, and there should

be an increased effort to grow the number of Greenspot participants.<sup>24</sup>

As mentioned above, the effects of UHI also extend to air quality issues. The most direct connection is through increased energy consumption due to cooling, which leads to greater emissions of air pollutants and greenhouse gases. Additionally, sunlight and high temperatures play a role in the formation of ground-level ozone, so this pollutant can become more prevalent as temperatures rise due to the UHI effect. Therefore, reducing the UHI can lead to several co-benefits that can increase the health and well-being of Columbus residents.

A2

**Enhance programs to distribute fans, air conditioners, and water to vulnerable populations.**

A number of social service organizations have campaigns during the summer to provide fans, and in more limited cases, air conditioning to their constituent audiences. For example, *IMPACT Community Action* offers a *Home Energy Assistance Program (HEAP)* which can aid with seasonal heating and cooling costs and provide support for replacing old appliances with new, energy-efficient ones.<sup>25</sup> The organization also provides a *Home Weatherization Assistance Program (HWAP)* to increase energy efficiency and lower energy bills for low-income households through services such as housing unit inspections, air-leakage detection, and home insulation.<sup>26</sup> The city should work with these organizations and others to increase the reach of services and fill identified gaps. With warmer conditions expected, particularly warmer nighttime lows coincident with higher humidity, fans may not provide sufficient cooling for the elderly or those with certain medical conditions. The same is true for individuals who need air filtration during hot days with air quality alerts. However, there are considerations that

must be made with air-conditioner distribution, including additional load on the household grid, ability to enclose a room for cooling, and affordability of a higher electric bill for the resident. Efficient distribution of fans and air conditioners could reduce demand on cooling centers. A program to distribute fans and air conditioners could replicate the network model described for cooling centers. Information on agencies providing distribution of fans and those entities that could be engaged to expand efforts in an emergency is available in the FCEM & HS Extreme Heat Plan, which was updated in 2017.<sup>9</sup>

In addition to fans and air conditioners, drinking water distribution programs could be established to ensure sufficient hydration during extreme heat events. **Columbus Public Health (CPH) distributed water** to citizens affected by nitrate exceedances in the drinking water in some parts of the city in 2016.<sup>27</sup> Likewise, the **Toledo**

**region water crisis** due to harmful algal blooms (HABs) impacted over 500,000 people in the summer of 2014 and resulted in a response from local and state government and the Ohio Public Private Partnership (OP3).<sup>28</sup> These two events were on opposite ends of a delivery spectrum. While hot days require consumption of additional water by residents, there is no anticipated shortage of water as long as water supplies are not contaminated. Fortunately, Columbus has an inherent resilience due to its three separate water supplies, one of which is groundwater, but algal blooms are becoming an increasingly common occurrence in many waterways in Ohio.<sup>29</sup> Therefore, the hazard exists for source water pollution that could impact a larger population and result in the need for widespread distribution of water. As with many hazards, this would impact vulnerable populations the most. A plan to distribute water should be integrated with any plans already developed by FCEM & HS.

# References

- <sup>1</sup> Great Lakes Integrated Sciences and Assessment (GLISA) and the University of Michigan Climate Center. *Climate Change in Columbus Ohio: An assessment of Columbus' Key Climate Changes, Impacts, and Vulnerabilities of Concern*. March 2016. [http://research.bpcrc.osu.edu/education/greenteam/FINAL\\_ColumbusFinalReport\\_3.0.pdf](http://research.bpcrc.osu.edu/education/greenteam/FINAL_ColumbusFinalReport_3.0.pdf). (Accessed Dec. 2017).
- <sup>2</sup> U. S. Global Change Research Program (USGCRP). *Climate Science Special Report: Fourth National Climate Assessment, Volume I*. [Wuebbles, D.J., D.W. Fahey, K.A. Hibbard, D.J. Dokken, B.C. Stewart, and T.K. Maycock (eds.)]. U.S. Global Change Research Program, Washington, DC, USA, 470 pp, doi: [10.7930/J0J964J6](https://doi.org/10.7930/J0J964J6).
- <sup>3</sup> National Weather Service Office of Climate, Water, and Weather Services. *Summary of Natural Hazard Statistics for 2016 in the United States*. May 2017. <http://www.nws.noaa.gov/os/haztats/sum16.pdf>. (Accessed Jan. 2018).
- <sup>4</sup> Eric Klinenberg. *Heat wave: a social autopsy of disaster in Chicago*. (Chicago: University of Chicago Press, 2002).
- <sup>5</sup> Robine et al. "Death toll exceeded 70,000 in Europe during the summer of 2003." *Comptes Rendus Biologies* 331, no. 2 (2008): 171-178. <https://doi.org/10.1016/j.crv.2007.12.001>
- <sup>6</sup> Centers for Disease Control and Prevention. "Natural Disasters and Severe Weather: Frequently Asked Questions About Extreme Heat." CDC. Sep. 30, 2015. <https://www.cdc.gov/disasters/extremeheat/faq.html>. (Accessed Oct. 13, 2017).
- <sup>7</sup> "Online Directory of Human Services." Hands On Central Ohio. <https://www.211centralohio.org>. (Accessed Jan. 2018).
- <sup>8</sup> National Oceanic and Atmospheric Administration. "Heat Safety Resources." NOAA: National Weather Service. <http://www.nws.noaa.gov/om/heat/ww.shtml>. (Accessed Jan. 2018).
- <sup>9</sup> Franklin County Emergency Management and Homeland Security (FCEM & HS). *Franklin County Emergency Operations Plan*. Document not available to the general public.
- <sup>10</sup> City of Columbus. "Mobile Application." City of Columbus, Department of Technology. <https://www.columbus.gov/technology/innovation/Mobile-Application/>. (Accessed Jan. 2018).
- <sup>11</sup> "ALERT Franklin County: Emergency Notification System." Alert Franklin County. <https://alertfranklincounty.org/>. (Accessed Jan. 2018).
- <sup>12</sup> Wingate et al. "Identifying and protecting vulnerable populations in public health emergencies: Addressing gaps in education and training." *Public Health Reports*, 122, no. 3 (2007): 422–426. doi: [10.1177/003335490712200319](https://doi.org/10.1177/003335490712200319)
- <sup>13</sup> Centers for Disease Control and Prevention. "CDC's Building Resilience Against Climate Effects (BRACE) Framework." CDC. Oct. 2, 2015. <https://www.cdc.gov/climateandhealth/BRACE.htm>. (Accessed Mar. 2018).
- <sup>14</sup> Ohio Public Health Resiliency Coalition. *Climate Resilience in Ohio: A Public Health Approach to Preparedness and Planning*. Ohio Public Health Association. 2018. <https://ohioph.org/download/climate-resiliency-in-ohio/>. (Accessed Jun. 2018).

- <sup>15</sup> Oke, T.R. "City size and the urban heat island." *Atmospheric Environment* (1967) 7, no. 8 (1973): 769-779. [https://doi.org/10.1016/0004-6981\(73\)90140-6](https://doi.org/10.1016/0004-6981(73)90140-6).
- Kenward, A., D. Yawitz, T. Sanford, and R. Wang.
- <sup>16</sup> "Summer in the city: Hot and getting hotter." *Climate Central*. Aug. 2014. <http://assets.climatecentral.org/pdfs/UrbanHeatIsland.pdf>. (Accessed Jan. 2018).
- <sup>17</sup> "Heat Island Impacts." U.S. Environmental Protection Agency. Jun. 20, 2017. <https://www.epa.gov/heat-islands/heat-island-impacts>. (Accessed Jan. 2018).
- <sup>18</sup> Rogan et al. "The impact of tree cover loss on land surface temperature: A case study of central Massachusetts using Landsat Thematic Mapper thermal data." *Applied Geography* 45, (2013): 49-57. <https://doi.org/10.1016/j.apgeog.2013.07.004>.
- <sup>19</sup> City of Columbus. "Branch Out Columbus." City of Columbus, Office of Sustainability. <https://www.columbus.gov/branch-out/>. (Accessed Jan. 2018).
- <sup>20</sup> "Using Green Roofs to Reduce Heat Islands." U.S. Environmental Protection Agency. Sep. 20, 2018. <https://www.epa.gov/heat-islands/using-green-roofs-reduce-heat-islands>. (Accessed Sep. 2018).
- <sup>21</sup> Epstein et al. "Air-quality implications of widespread adoption of cool roofs on ozone and particulate matter in southern California." *PNAS* 114, no. 34 (2017): 8991-8996. <https://doi.org/10.1073/pnas.1703560114>.
- "Roof Products." Energy Star Program. [https://www.energystar.gov/products/building\\_products/roof\\_products](https://www.energystar.gov/products/building_products/roof_products). (Accessed Jan. 2018).
- <sup>22</sup>
- <sup>23</sup> City of Columbus. "Stormwater Credit Guidance." City of Columbus, Utility Contractors, Developers, Design & Consultants. <https://www.columbus.gov/utilities/contractors/Stormwater-Drainage-Manual/>. (Accessed Aug. 2018).
- <sup>24</sup> City of Columbus. "GreenSpot." City of Columbus, Office of Environmental Stewardship. <https://www.columbus.gov/GreenSpot/>. (Accessed Aug. 2018).
- <sup>25</sup> "Emergency Assistance." IMPACT Community Action. [http://www.impactca.org/what\\_we\\_do/programs/emergency\\_assistance/heap.html](http://www.impactca.org/what_we_do/programs/emergency_assistance/heap.html). (Accessed Jun. 2018).
- <sup>26</sup> "Departments & Programs." IMPACT Community Action. [http://www.impactca.org/what\\_we\\_do/programs/energy\\_efficiency.html](http://www.impactca.org/what_we_do/programs/energy_efficiency.html). (Accessed Jun. 2018).
- <sup>27</sup> Lori Kurtzman. "City of Columbus issues nitrate warning for tap water." *The Columbus Dispatch*. Jun. 30, 2016. <http://www.dispatch.com/content/stories/public/2016/0630-city-issues-nitrate-warning.html>. (Accessed Aug. 2018).
- <sup>28</sup> Tom Henry. "Water crisis grips hundreds of thousands in Toledo area, state of emergency declared." *The Blade*. Aug. 3, 2014. <http://www.toledoblade.com/local/2014/08/03/Water-crisis-grips-area.html>. (Accessed Jan. 2018).
- <sup>29</sup> "Harmful Algal Blooms (HAB): Information for Public Water Systems." Ohio Environmental Protection Agency. <http://epa.ohio.gov/ddagw/hab.aspx>. (Accessed Jan. 2018).