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Climate Change and Health Equity

Tool Kit

Creative Strategies to Mitigate Extreme Heat: Miami-Dade County's Chief Heat Officer and Phoenix's Office of Heat Mitigation and Response

Introduction

Extreme heat poses a serious threat to community health and is the top cause of fatalities for all weather events in the United States. Extreme heat events are also occurring more frequently; impacting the health and well-being of communities in regions that have long dealt with heat and regions that have not typically experienced such weather events. In 2021, Miami-Dade County in Florida created the position of Chief Heat Officer to address heat response and mitigation, the first position of its kind in the U.S. The City of Phoenix, the largest city in Maricopa County Arizona, has since appointed its own director to run the Office of Heat Response and Mitigation, the first such fully publicly funded office in the U.S.[1] The Chief Heat Officer and Heat Director (collectively, "Heat Officers") are both tasked with creating solutions to meet the immediate health needs of communities vulnerable to heat exposure (e.g., unhoused people and outdoor works) and developing long-term heat mitigation strategies. This table provides a side-by-side overview of the activities of the Heat Officers to assist other jurisdictions who may be considering implementing similar initiatives.

Miami-Dade County and Phoenix have historically been hot. This means that compared to other localities, such as Seattle and Chicago, there can be important differences in what resiliency and mitigation strategies are needed. For instance, in Miami-Dade County and Phoenix there are high numbers of residents overall who have an air-conditioning (AC) unit compared to regions that have not typically experienced extreme heat.[2] Despite such differences, there are shared health equity issues related to exposure to extreme heat across the U.S. In Phoenix, for example, the inability to pay for electricity to power AC units has contributed to heat-associated deaths. Similarly, unaffordable utility bills are an issue seen in all states that will become an even greater threat to public health as climate change contributes to the frequency and severity of extreme heat.

Another cross-regional issue is that as in Miami-Dade County and Phoenix, across the U.S. heat vulnerability is shaped by factors like race and income—meaning that individuals and communities within the same state, city, county, or Tribal lands are not exposed to the same threats of heat illness or death. A few examples underscore this reality. The Environmental Protection Agency predicts rising temperatures will disproportionately impact the livelihoods of Hispanic and Latino/a, Native American and Alaska Native, and Black workers.[3] An examination of urban neighborhoods in the Southwestern U.S. concluded that on average urban neighborhoods containing the poorest 10% of residents were hotter than neighborhoods with the

wealthiest 10% on extreme and average heat days; with similar patterns holding for Latino/a communities.[4] In Miami-Dade County, formerly redlined communities experience disproportionate exposure to heat and less energy efficient housing, which is an issue seen in too many states.[5] Compared to White people, people of color on average overwhelmingly live in urban census tract areas with the highest exposure to surface heat islands (built environments that often contain concrete and asphalt that retain heat and cause the areas to be hotter) with "particular intense difference[s] in the Northeast and upper Midwest."[6] These are just a few examples of how factors like place, race, and class inform how heat threats manifest.

Public health departments and others working on heat mitigation strategies across the U.S. must not trade one inequity for another. The first step to avoiding this outcome is for public health departments to work directly with communities while recognizing that community members' lived experiences and concerns are valid. Government agencies often promote increasing tree canopy and other forms of green infrastructure to mitigate heat and correct past inequities that have meant that formerly redlined communities are hotter because they lack shade and other green infrastructure. At the same time, there are legitimate community concerns about the affordability of these initiatives (e.g., the cost of tree maintenance) and the threat of climate gentrification. These concerns must be simultaneously addressed to avoid further exacerbating disparities by merely shifting one inequity (hotter homes and neighborhoods) to another (displacement). This requires intentional, inclusive community engagement and balancing multiple community needs rooted in the Social Determinants of Health (e.g., housing, healthcare, and employment).

Finally, although Miami-Dade County and Phoenix (the hottest city in the nation) have long dealt with extreme heat, like other regions in the U.S. both are experiencing more and prolonged heat. In Arizona, the number of extreme heat days and nights have been trending up over the last five years. Miami-Dade County is expected to experience a dramatic increase in the number of days over 105°. Thus, as in other regions, new heat mitigation strategies are needed to prevent a rise in avoidable heat-related illness, hospitalizations, and deaths. These are just a few examples of the health and health equity issues that public health departments and anyone working on heat resilience and mitigation can expect to encounter.

The table provides a high-level overview of the office and activities of the Heat Officers. The policy strategies identified include activities led by the Heat Officers and activities done in coordination and consultation with multiple stakeholders. To name a few examples, the Chief Heat Officer in addition to collaborating across Miami Dade County's activities and programs also leads a Climate and Heat Health Task Force with the Miami Foundation and is funded by the Atlantic Council's Adrienne Arsht-Rockefeller Foundation Resilience Center (Arsht-Rock).[7] The Heat Director similarly works closely with different agencies in the City of Phoenix, shelters for unhoused people, the Maricopa County Department of Public Health (which provides detailed heat surveillance), and others. Such cross-collaboration reflects the reality that meeting the challenge of mitigating the health impacts of heat is an interdisciplinary task.

The table contains examples of key goals, challenges, and strategies of the Heat Officers with special focus on community-based needs and initiatives to center health equity. It identifies: (1) who holds the position; (2) how the position is funded, (3) the program's purpose and goals, (4) key heat issues and disparities, (5) populations vulnerable to heat exposure, (6) community needs and concerns, and (7) heat policy strategies. It is not an exhaustive list, but a quick guide to help other local governments identify challenges, solutions, and creative strategies to protect communities from the increasing challenges of extreme heat.

Table: An Overview of Phoenix's Office or Heat Response and Mitigation and Miami-Dade County's Chief Heat Officer

Office	**Director** (David Hondula) – Office of Heat Response and Mitigation[8]	**Chief Heat Officer** (Jane Gilbert) – Miami Dade County[9]

How is the Position Funded?	• Publicly funded by the City of Phoenix[10]	• Fully publicly funded by Miami-Dade County as of summer of 2022[11]
Purpose and goals	• Protect communities from heat related illness and deaths via immediate heat response strategies • Developing and implementing long-term heat mitigation plans to cool the city[12]	• Reducing the health and economic impacts of extreme heat[13]
Key Heat Issues and Disparities	• Urban heat island effect[14] • Urban development is occurring at a faster pace than heat mitigation plans[15] • The number of extremely hot days (100°+) is increasing statewide; extremely warm nights (80°+) are also increasing, especially in Phoenix[16] • The PHX area is expected to have 25 more days above 90° every year[17] • Heat-associated deaths are rising in Maricopa County (increasing 70% from 2019 to 2021)[18] • Compared to White and wealthy residents Hispanic people and poorer residents are exposed to more extreme temperatures and hotter temperatures[19] • In Maricopa County outdoor heat-associated deaths (versus indoors) deaths are rising[20] • In Maricopa County a lack of a functioning AC is a common contributor to indoor deaths.[21]	• Urban heat island effect • Hurricane season and extreme heat occur at the same time[22] • Hurricanes cause large scale power outages during the summer impacting AC in homes and cooling centers[23] • Since 1970 the city of Miami has experienced 79 more summer days above 90°[24] • Miami is expected to have about 3 months per year with heat index over 105° by midcentury (the current average is 7 days)[25] • Formerly redlined communities are hotter, lack energy efficient houses, and have less green infrastructure (e.g., trees, shade)[26] • Census blocks groups with the greatest percentage of Hispanic populations generally have less existing urban tree canopy, a trend that increased in 2019[27]
Populations vulnerable to heat exposure	• In Maricopa County heat associated deaths unevenly impact males and people who are unhoused, have substance use disorders, are Black, Indigenous, or aged 50+[28] • Gender disparities in heat-associated deaths in Maricopa County mean more men die outdoors and more women die indoors[29] • Outdoor workers compose 22% of Arizona's workforce[30]	• Individuals at-risk for heat-related illness, visits to the emergency department, and/or hospitalization, include people who are Indigenous, live in mobile homes, who are poor, and outdoor workers[31] • Outdoor workers compose 26% of Miami-Dade County's workforce and most of the agriculture and construction workers are immigrants[32]
Community Needs and Concerns	• AC is too expensive to run or fix[33] • Cooling centers with limited hours[34] • Bus stops are not shaded[35]	• AC is too expensive to run or fix [39] • Bus stops are not shaded[40] • Economic impacts of extreme heat on residents well being[41]

	• City's plan to plant trees will be too expensive for residents (e.g., water bills, care, and dead tree removal)[36] • Affordable housing has decreased as the number of unhoused individuals dying from heat-associated deaths has greatly increased.[37] • Currently no laws specifically protect workers from heat-related illness[38]	• Formerly redlined neighborhoods and communities with low incomes often lack green infrastructure, weatherized housing[42] • Displacement due to climate gentrification[43] • Governmental climate measures need to support community empowerment[44] • Currently no laws specifically protect workers from heat-related illness [45]
Heat Policy strategies (underway or being considered)	**Infrastructure/Environment[46]** • Grow the city's total tree canopy to 25% by 2030 • Create 100 cool corridors in areas with little shade and high pedestrian use (e.g., walking paths to bus stops and libraries) • Resurface roads with light reflective material (Cool Pavements program) • Expand use of reflective materials on roofs **Community Engagement and Meeting Immediate Needs[47]** • Created a Heat Response Plan • Building a new shelter for unhoused people • Increasing summertime shelter capacity • Use of mobile cooling buses • More advertising for cooling centers and cooling buses • Training city workers to notice signs of heat danger • Consider adapting thermostats to send heat alerts to emergency responders and family when homes are too hot • Partnering with homeless shelter staff to increase education about and access to cooling centers and other resources • Utilizing volunteers to increase awareness about cooling centers and other resources (We're Cool program) • Volunteers conduct telephonic welfare checks during the summer (Cool Callers program) • Partnership with American Forest to provide community outreach and education about trees • Plant trees using resources like the Phoenix tree equity score	**Infrastructure/Environment[48]** • Grow the county's tree canopy to 30% prioritizing communities with less trees • Cooling commuting spaces with high urban heat island impacts • Develop county-wide climate resilience hubs with backup power • Implement solar power with battery backup into new infrastructure • Advocate for building codes to requires cool roofs on multifamily housing • Pilot a cool pavements program for bike paths, lots, sidewalks, and roads • Create equitable access to public cooling areas like drinking fountains and splash pads • Explore setting minimum cooling standards for rental properties as Phoenix does • Help residents access energy efficiency assistance programs and functioning A/Cs • Helped develop county's Extreme Heat Toolkit **Community Engagement and Meeting Immediate Needs[49]** • Created an Extreme Heat Action Plan in collaboration with community-based stakeholders • Created a Climate and Heat Health Task Force with team members from housing, immigrant labor, and climate justice • Taskforce conducted public heat workshops • Working with the national weather service to lower heat advisory/ warning thresholds • Working to pass a county law creating the first heat standard for outdoor workers • Working to create greater access for emergency management and healthcare • County heat vulnerability assessment

		• Targeted heat vulnerable areas for outreach including increasing communications in English, Spanish, and Haitian creole • Focused heat season communications in areas with highest heat-related illness rates • Added heat enhancement to Community Emergency Response Team training

SUPPORTERS

The Network for Public Health Law is a national initiative of the Robert Wood Johnson.

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The information in this document reflects research completed in December 2022.

[1] The City of Los Angeles also recently appointed a Chief Heat Officer.

[2] There are of course community-wide and individual differences within these populations in terms of who has access to an AC unit.

[3] THE ENVIRONMENTAL PROTECTION AGENCY, *Climate Change and Social Vulnerability in the United States: A Focus on Six Impacts* (Sept. 2021) https://www.epa.gov/system/files/documents/2021-09/climate-vulnerability_september-2021_508.pdf.

[4] John Dialesandro, Noli Brazil, and Yaser Abunnaser, *Dimensions of Thermal Inequity: Neighborhood Social Demographics and Urban Heat in the Southwestern U.S.*, INTERNATIONAL JOURNAL OF ENV. RESEARCH AND PUBLIC HEALTH (Jan. 2021) https://www.researchgate.net/publication/348689283_Dimensions_of_Thermal_Inequity_Neighborhood_Social_Demographics_and_Urban_Heat_in_the_Southwestern_US#pfe.

[5] MIAMI-DADE COUNTY 305 RESILIENT, *Understanding Heat Exposure in Miami-Dade County: Heat and Health,* https://storymaps.arcgis.com/stories/6f1e91cf8a8e4d5d9bd67525575c042e (Last visited Sept. 8, 2022); Jeremy S. Hoffman, Vivek Shandas, and Nicholas Pendleton, *The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas*, CLIMATE (2020) https://www.mdpi.com/2225-1154/8/1/12/htm?utm_medium=website&utm_source=archdaily.mx. For an overview of the practice of redlining and to access maps which used a grading and color-coded system based on race and other factors to demarcate residential neighborhoods for the purpose of denying homeowner loans and other resources see MAPPING INEQUALITY REDLINING IN NEW DEAL AMERICA, *Introduction*, https://dsl.richmond.edu/panorama/redlining/#loc=12/33.483/-112.111&city=phoenix-az&area=B7&text=intro (Last visited, Nov. 10 2022).

[6] Angel Hsu, Glenn Sheriff, Tirthankar Chakraborty, et al., *Disproportionate exposure to urban intensity across major US Cities*, NATURE COMMUNICATIONS (2021) https://www.nature.com/articles/s41467-021-22799-5#Sec6 (finding similar patterns for individuals paid low-incomes versus wealthy individuals).

[7] Miami-Dade County is also part of Reslient305, a partnership between Miami-Dade County, Miami, and the City of Miami Beach. Reslient305 released the Resiliant305 Strategy available at https://resilient305.com/our-future/.

[8] CITY OF PHOENIX, *Heat Expert to Lead City's New Heat Response & Mitigation Office* (Sept. 14, 2021) https://www.phoenix.gov/newsroom/city-manager/2060.

[9] THE MIAMI FOUNDATION FOR A GREATER MIAMI, *Extreme Heat Protection Efforts: Protecting our County's most vulnerable from extreme heat,* https://miamifoundation.org/extremeheat/ (Last visited Sept. 8, 2022); MIAMI-DADE COUNTY, *Miami-Dade County Mayor Levine Cava announces first-ever Chief Heat Officer* (April 30, 2021) https://www.miamidade.gov/releases/2021-04-30-mayor-chief-heat-officer.asp.

[10] CITY OF PHOENIX, *Heat Expert to Lead City's New Heat Response & Mitigation Office* (Sept. 14, 2021) https://www.phoenix.gov/newsroom/city-manager/2060.

[11] The Archt-Rock Foundation initially helped privately fund the position via a grant to Miami-Dade County. In 2022, Miami-Dade County also funded an Extreme Heat Program Coordinator position. THE MIAMI FOUNDATION FOR A GREATER MIAMI, *Extreme Heat Protection Efforts: Protecting our County's most vulnerable from extreme heat,* https://miamifoundation.org/extremeheat/ (Last visited Sept. 8, 2022); MIAMI-DADE COUNTY, *Miami-Dade County Mayor Levine Cava announces first-ever Chief Heat Officer* (April 30, 2021) https://www.miamidade.gov/releases/2021-04-30-mayor-chief-heat-officer.asp. More information on where other chief heat officers have been funded can be found at ADRIENNE ARSHT-ROCKEFELLER FOUNDATION RESILIENCE CENTER, *Resilience in Action: Chief Heat Officers*, https://onebillionresilient.org/project/chief-heat-officers/.

[12] CITY OF PHOENIX, *Heat Ready PHX Office of Heat Response and Mitigation* https://www.phoenix.gov/heatsite (Last visited Sept. 8, 2022).

[13] MIAMI-DADE COUNTY, *Chief Heat Officer* (2022) https://www.miamidade.gov/global/economy/environment/chief-heat-officer.page; THE MIAMI FOUNDATION FOR A GREATER MIAMI, *Extreme Heat Protection Efforts: Protecting our County's most vulnerable from extreme heat,* https://miamifoundation.org/extremeheat/ (Last visited Sept. 8, 2022).

[14] David Hondula, *Urban Heat in Phoenix: Patterns, Causes, Impacts*, PHOENIX URBAN HEAT ISLAND AND TREE & SHADE SUBCOMMITTEE, https://www.phoenix.gov/oepsite/Documents/PHX.UHITS.Hondula.Sept2020.pdf (Last visited Aug. 22, 2022).

[15] Nina Lakhani, *America's hottest city is nearly unlivable in summer. Can cooling technologies save it?*, THE GUARDIAN (Jan 27, 2022) https://www.theguardian.com/us-news/2022/jan/27/phoenix-arizona-hottest-city-cooling-technologies.

[16] NOAA NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION, *State Climate Summaries for 2022 Arizona*, https://statesummaries.ncics.org/chapter/az/ (Last visited Sept. 8, 2022).

[17] Nina Lakhani, *America's hottest city is nearly unlivable in summer. Can cooling technologies save it?*, THE GUARDIAN (Jan 27, 2022) https://www.theguardian.com/us-news/2022/jan/27/phoenix-arizona-hottest-city-cooling-technologies.

[18] The Maricopa County Public Health Department provides detailed surveillance of heat-associated deaths as well as heat related illness. Maricopa County specific information in this table is drawn from yearly county reports, specifically the preliminary 2021 report and the final 2020 report. The reports define "heat-associated" as deaths caused by heat or that are heat related. MARICOPA COUNTY PUBLIC HEALTH, *Heat Associated Deaths in Maricopa County, AZ Final Report for 2021* https://www.maricopa.gov/ArchiveCenter/ViewFile/Item/5494 (Last visited Feb. 24, 2023); MARICOPA COUNTY PUBLIC HEALTH, *Heat Associated Deaths in Maricopa County, AZ Final Report for 2020*, https://www.maricopa.gov/ArchiveCenter/ViewFile/Item/5240 (Last visited Sept. 8, 2022).

[19] Hunter Basseler, *Report: Hispanic and poor communities experience more extreme heat compared to white or wealthy communities in Phoenix*, 12NEWS (June 16, 2021) https://www.12news.com/article/news/local/valley/hispanic-heat-phoenix-extreme-urban-poverty-study/75-6281fbb3-d144-4c39-9809-20d305c02f2a (areas with 30-80% Hispanic residents or 15-40% of residents living in poor communities were among the hottest areas in Phoenix).

[20] MARICOPA COUNTY PUBLIC HEALTH, *Heat Associated Deaths in Maricopa County, AZ Final Report for 2021* https://www.maricopa.gov/ArchiveCenter/ViewFile/Item/5494 (Last visited Feb. 24, 2023); MARICOPA COUNTY PUBLIC HEALTH, *Heat Associated Deaths in Maricopa County, AZ Final Report for 2020*, https://www.maricopa.gov/ArchiveCenter/ViewFile/Item/5240 (Last visited Sept. 8, 2022).

[21] *Id*.

[22] Dan Avery, *Miami Now Has a Chief Heat Officer – and Other Cities Are Following Suit*, ARCHITECTURAL DIGEST (Oct. 11, 2021) https://www.architecturaldigest.com/story/chief-heat-officers.

[23] Dan Avery, *Miami Now Has a Chief Heat Officer – and Other Cities Are Following Suit*, ARCHITECTURAL DIGEST (Oct. 11, 2021) https://www.architecturaldigest.com/story/chief-heat-officers (for example, Hurricane Irma knocked out power and lead to 12 nursing home deaths); Linda Poon, *How the World's First Chief Heat Officer Plans to Keep Miamians Cool*, BLOOMBERG (Sept. 29, 2021) https://www.bloomberg.com/news/articles/2021-09-29/miami-chief-heat-officer-sets-out-resilience-agenda (cooling centers can lack back-up power).

[24] THE KRESGE FOUNDATION, *Climate Change & Health Equity, Climate, Heat & Health Equity: A Learning Tour of Miami-Dade County,* https://kresge.org/wp-content/uploads/Health-GIH-Leave-Behind-Final-Digital-6-16-22.pdf (Last visited Sept. 8, 2022).

[25] MIAMI-DADE COUNTY 305 RESILIENT, *Understanding Heat Exposure in Miami-Dade County: Heat and Health,* https://storymaps.arcgis.com/stories/6f1e91cf8a8e4d5d9bd67525575c042e (Last visited Sept. 8, 2022); Craig Pittman, *Facing rising temperatures, Miami appoints chief heat officer*, THE WASHINGTON POST (May 12, 2021) https://www.washingtonpost.com/climate-solutions/2021/05/12/climate-urban-heat-miami/.

[26] MIAMI-DADE COUNTY, *Miami-Dade County Extreme Heat Toolkit* (2021) https://miamifoundation.org/wp-content/uploads/2021/10/Extreme-Heat-Toolkit.pdf.

[27] Hartwig Henry Hochmair, Adam Benjamin, Leventy Juhasz, et al., *Miami-Dade County Urban Tree Canopy Assessment Final Report*, UNIVERSITY OF FLORIDA AND FLORIDA INTERNATIONAL UNIVERSITY, p. 5, 58 (Oct. 2021) https://www.miamidade.gov/parks/library/urban-tree-canopy-assessment-2021.pdf.

[28] MARICOPA COUNTY PUBLIC HEALTH, *Heat Associated Deaths in Maricopa County, AZ Final Report for 2021* https://www.maricopa.gov/ArchiveCenter/ViewFile/Item/5494 (Last visited Feb. 24, 2023); MARICOPA COUNTY PUBLIC HEALTH, *Heat Associated Deaths in Maricopa County, AZ Final Report for 2020*, https://www.maricopa.gov/ArchiveCenter/ViewFile/Item/5240 (Last visited Sept. 8, 2022).

[29] *Id*.

[30] Kristina Dahl and Rachel Licker, *Too Hot to Work: Assessing the Threats Climate Change Poses to Outdoor Workers*, UNION OF CONCERNED SCIENTISTS (Aug. 17, 2021) https://www.ucsusa.org/resources/too-hot-to-work#ucs-report-downloads (information is contained in the downloadable state data spreadsheet accompanying this resource).

[31] MIAMI-DADE COUNTY RESILIENT305, *Understanding Heat Exposure in Miami-Dade County: Heat and Health,* https://storymaps.arcgis.com/stories/6f1e91cf8a8e4d5d9bd67525575c042e (for more details see the downloadable *Extreme Heat Vulnerability Report on the webpage*) (Last visited Sept. 8, 2022).

[32] Kristina Dahl and Rachel Licker, *Too Hot to Work: Assessing the Threats Climate Change Poses to Outdoor Workers*, UNION OF CONCERNED SCIENTISTS (Aug. 17, 2021) https://www.ucsusa.org/resources/too-hot-to-work#ucs-report-downloads (information is contained in the downloadable county data spreadsheet accompanying this resource); WECOUNT!, *Que Calor Campaign*, https://www.we-count.org/quecalor (Last visited Sept. 6, 2022); NEW AMERICANS IN MIAMI-DADE COUNTY, *The Demographic and Economic Contributions of Immigrants in the County*, p. 4 (June 2021) https://research.newamericaneconomy.org/wp-content/uploads/sites/2/2021/08/G4G_Miami-Dade_County_online.pdf.

[33] Nina Lakhani, *America's hottest city is nearly unlivable in summer. Can cooling technologies save it?*, THE GUARDIAN (Jan 27, 2022) https://www.theguardian.com/us-news/2022/jan/27/phoenix-arizona-hottest-city-cooling-technologies; Elizabeth Whitman, *Arizona Regulators Don't Know What to Do About Summer Shutoffs*, PHOENIX NEW TIMES (Feb. 10, 2020) https://www.phoenixnewtimes.com/news/arizona-summer-heat-deaths-utility-shutoff-corporation-commission-11434353 (this 2020 article, one of the deadliest years for heat associated deaths in PHX, discusses a county survey finding that 30% of residents could not afford to run their AC at night or during the day and that for people living below the federal poverty line their electricity bill can constitute up to 40% of their yearly income). The Arizona Corporation Commission later passed a rule protecting some Phoenix residents from shutoffs during June to October 15th or when the temperature exceeds 95° (the regulated utility has the option to determine which standard to follow). A.A.C. R14-2-211(A)(11) available at https://apps.azsos.gov/public_services/Title_14/14-02.pdf#page=62.

[34] CITY OF PHOENIX, *Office of Heat Response and Mitigation Q&A* (Feb. 9, 2022) https://www.phoenix.gov/heat/Resources.

[35] *Id*.

[36] *Id*.

[37] MARICOPA COUNTY PUBLIC HEALTH, *Heat Associated Deaths in Maricopa County, AZ Final Report for 2021* https://www.maricopa.gov/ArchiveCenter/ViewFile/Item/5494 (Last visited Feb. 24, 2023) (although there was a decrease in the number of unhoused individuals who died in 2021 compared to 2020, since 2019 the number of unhoused people who have died nearly doubled); Nina Lakhani, *Unhoused in Phoenix's perilous heat: "If I don't keep cool, I'll die,"* THE GUARDIAN (June 20, 2022) https://www.theguardian.com/us-news/2022/jun/20/phoenix-extreme-heat-housing-crisis (noting that in 2016 only 5% of apartments in Maricopa County cost $1,500 or more versus 54% in 2021).

[38] Juanita Constible, *Occupational Heat Safety Standards in the United States*, NATURAL RESOURCES DEFENSE COUNCIL (May 20, 2022) https://www.nrdc.org/resources/occupational-heat-safety-standards-united-states. Arizona does currently have a proposed bill (HB 2708) pending that would protect indoor and outdoor workers. This bill is available at https://apps.azleg.gov/BillStatus/BillOverview/77770.

[39] Craig Pittman, *Facing rising temperatures, Miami appoints chief heat officer*, THE WASHINGTON POST (May 12, 2021) https://www.washingtonpost.com/climate-solutions/2021/05/12/climate-urban-heat-miami/; Dan Avery, *Miami Now Has a Chief Heat Officer – and Other Cities Are Following Suit*, ARCHITECTURAL DIGEST (Oct. 11, 2021) https://www.architecturaldigest.com/story/chief-heat-officers.

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[41] Jane Gilbert, *Preparing Miami-Dade County for Extreme Heat in an Already Hot Climate*, FLORIDA PLANNING MAGAZINE (Summer 2022) https://issuu.com/apa_florida/docs/apanewletter-summer2022-final/s/16471953.

[42] MIAMI-DADE COUNTY, *Miami-Dade County Extreme Heat Toolkit* (2021) https://www.miamidade.gov/global/economy/environment/heat-toolkit.page.

[43] Jane Gilbert, *Preparing Miami-Dade County for Extreme Heat in an Already Hot Climate*, FLORIDA PLANNING MAGAZINE (Summer 2022) https://issuu.com/apa_florida/docs/apanewletter-summer2022-final/s/16471953.

[44] Natalia Brown, *From Public Participation to Community Empowerment*, CATALYST MIAMI (August 2022) https://assets.nationbuilder.com/catalystmiami/pages/2209/attachments/original/1661811707/Final_Report_for_County_Aug_2022.pdf?1661811707.

[45] Juanita Constible, *Occupational Heat Safety Standards in the United States*, NATURAL RESOURCES DEFENSE COUNCIL (May 20, 2022) https://www.nrdc.org/resources/occupational-heat-safety-standards-united-states. A bill to protect workers from heat illness (SB 732) was introduced in 2022, but died in committee, https://www.flsenate.gov/Session/Bill/2022/732/?Tab=BillHistory.

[46] For a graph outlining the priorities of the Office of Heat Response and Mitigation in City programs see ARIZONA STATE UNIVERSITY URBAN CLIMATE RESEARCH CENTER, *City of Phoenix Office of Heat Response and Mitigation*, https://www.phoenix.gov/heatsite/Documents/ASU%20Poster%20Final.pdf (Last visited Sept. 9, 2022). For more details about some of the initiatives and impacts see Brandon Loomis, *Phoenix names a heat officer, with a goal of easing the risk of rising temperatures*, THE ARIZONA REPUBLIC (Oct 7, 2021) https://www.azcentral.com/story/news/local/arizona-environment/2021/10/07/phoenix-hires-heat-officer-cool-city-ever-warming-future/6029086001/ (discussing 100 cool corridors project); Ariane Middel, Nalini Chhetri, and Raymond Quay, *Urban forestry and cool roofs: Assessment of heat mitigation strategies in Phoenix residential neighborhoods*, URBAN FORESTRY & URBAN GREENING (2015) https://www.sciencedirect.com/science/article/pii/S161886671400106X (finding greater benefits from tree planting with 25% coverage than cool roofs); CITY OF PHOENIX, *Cool Pavement Program*, https://www.phoenix.gov/streets/coolpavement (Last visited Sept. 9).

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