

LET'S TALK

HEAT



PHOENIX

A digital version of this booklet, along with links to related resources, can be found at the following link: <http://letstalkheat.org>
You can also scan the QR code below.



This booklet was created to raise heat awareness as part of the sunBLOCK public art project, a partnership between the City of Phoenix and Arizona State University. It is partially supported by the National Endowment for the Arts.

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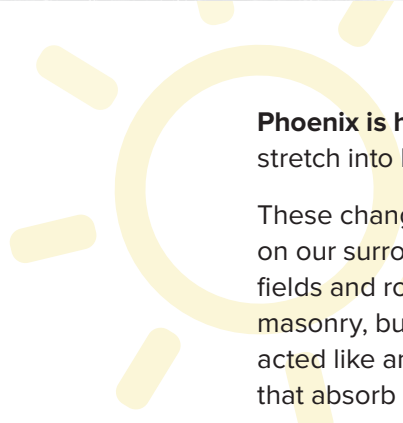
The title is *Bloomcanopy* and it was designed by Matter Architecture Practice. Photo by Craig Smith.

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Phoenix is hot and getting hotter. Summer days in triple digits now seem to stretch into Fall. And we're seeing more nights above 90 degrees than ever before.

These changes are part of global warming. They also reflect urbanization's impact on our surroundings. Over the past century, our city's expansion has replaced farm fields and roads lined with tall trees with a hardscape world of concrete, asphalt, masonry, buildings and machinery. In place of an agricultural landscape that once acted like an enormous evaporative cooler, we now have one of hard, dry surfaces that absorb more heat during the day and hold it longer at night.

Yet, as this booklet points out, we are not passive observers, powerless to change and adapt. Necessity breeds invention, and each of us can play a vital role in meeting the challenges of rising temperatures.

We can add more trees to our homes, communities and public spaces. We can work our way toward cooler communities by creating smarter designs for public spaces, new cooling technologies and community partnerships to increase shade and reduce heat along our streets and sidewalks. We can combine these common efforts with more personal ones to protect ourselves, our friends and families from the dangers of extreme heat. This booklet has tips on how we can be safer by staying hydrated, wearing hats, carrying umbrellas and watching out for one another.



By tackling the challenges of global warming and rising urban heat from many angles, we can make Phoenix the most heat-ready desert city on the planet.

A tree-lined residential street in Phoenix in 1901.

Why is Phoenix **HOT?** ...and getting hotter?

Phoenix is the hottest large city in the United States!

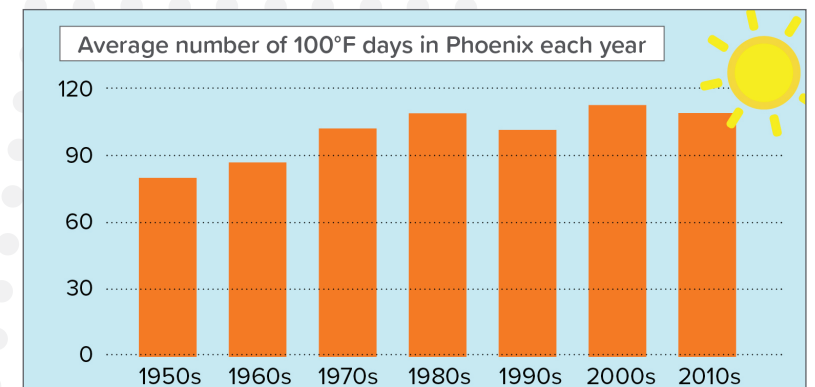
Phoenix's hot and dry climate is a result of where it is located on the planet: too far north of the equator to consistently receive tropical moisture, but too far south to be in the path of most storm systems that impact the United States. The hot and dry climate is further reinforced by mountains to the west, which create a "rain shadow" effect, and the cool ocean current off the coast of California, which makes it hard for storms to form. These are the same types of factors responsible for many of the world's other hot desert areas.



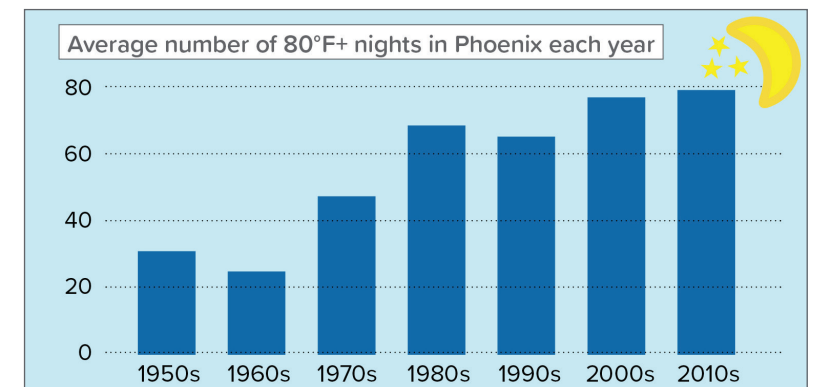
Temperatures have steadily increased in Phoenix and other Southwest cities over the past 100 years. Urbanization and global warming are the two major causes. As Phoenix has become more populated, it has replaced farm fields and open desert with buildings, roads, cars, and other materials and machines that make cities hotter than their surrounding areas. **These changes to the landscape have especially affected nighttime temperatures, which have been increasing much faster than daytime temperatures!** Global climate change is also warming Phoenix and the Southwest. This worldwide environmental change is being driven mostly by the increase in our atmosphere of carbon dioxide and other greenhouse gases.



HOTTEST LARGE CITIES IN THE US and average summer temperature		
1	Phoenix AZ	93.1°F
2	Riverside CA	90.3°F
3	Las Vegas NV	90.0°F
4	San Antonio TX	84.2°F
5	Dallas TX	84.1°F



Map of hot desert areas around the world.



The number of hot nights in Phoenix has dramatically increased in recent decades, and the number of hot days has been increasing as well.

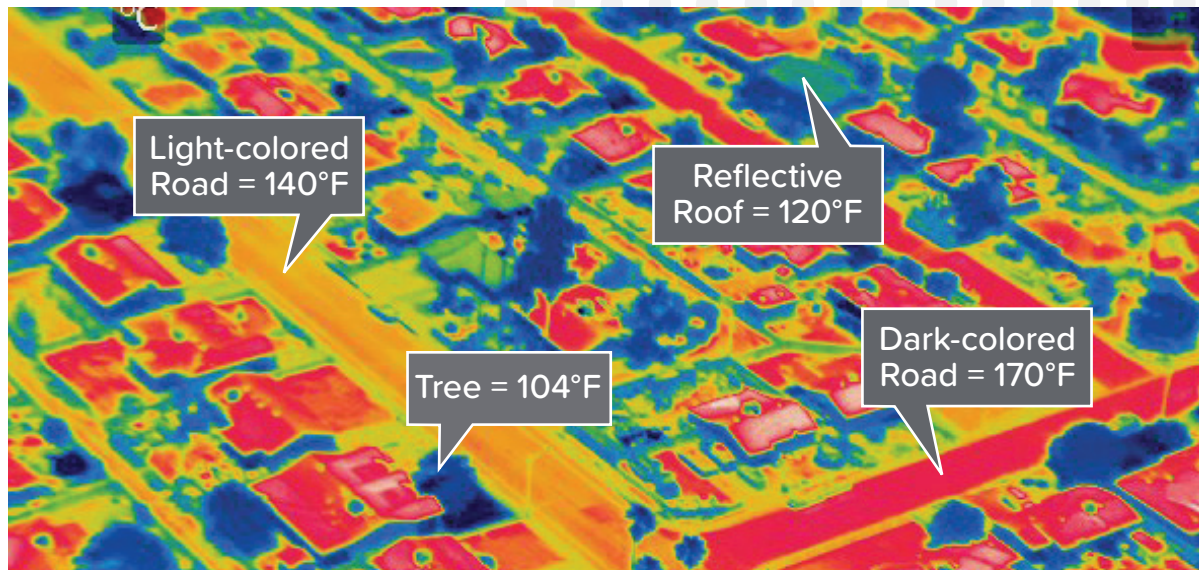
Are some places in Phoenix **hotter** than others?

YES! Nearby neighborhoods can be quite different from each other.

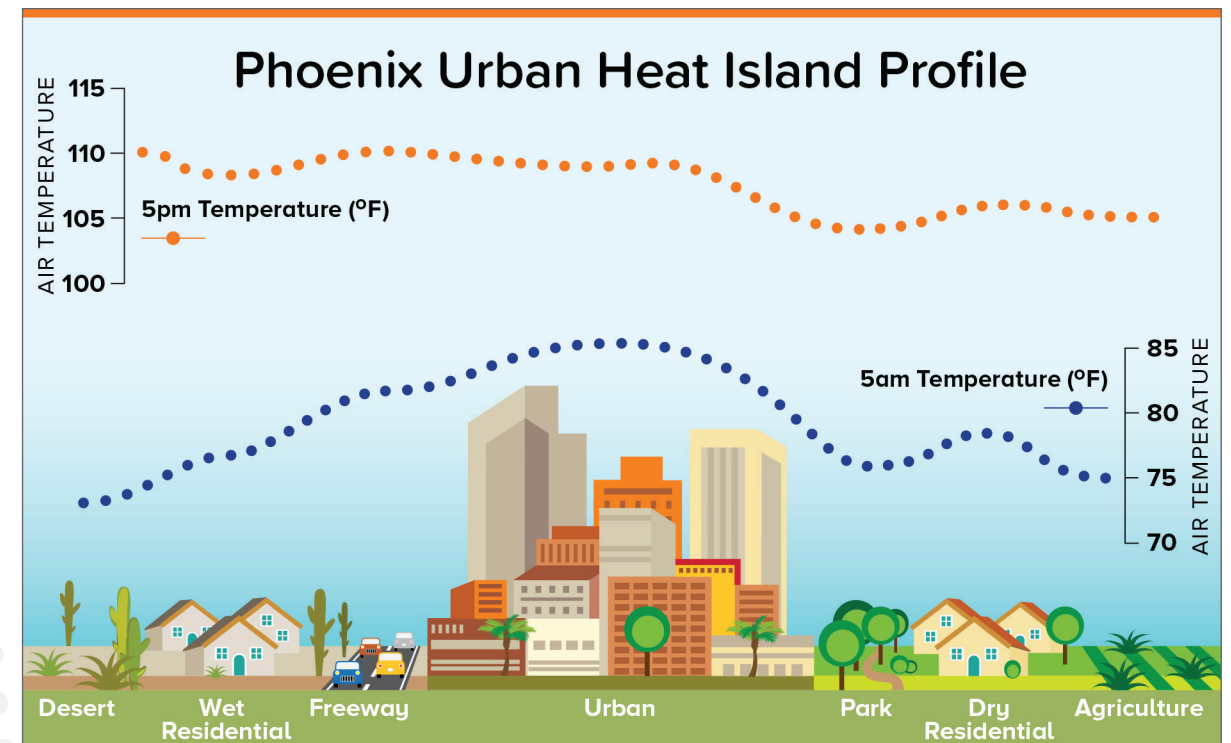
At night, air temperatures in the hottest neighborhoods can be 12°F higher than the coolest neighborhoods.

Phoenix is hot, but temperatures can vary greatly from one neighborhood to the next, and sometimes even from one street to the next! There are several reasons for this. One is each neighborhood's elevation above sea level. Higher locations tend to be cooler. The lowest neighborhoods in Phoenix, along the Salt River, are at about 1,000 feet above sea level, approximately 500 feet lower than neighborhoods in northern Phoenix. This difference equates to about 3°F difference in air temperature on a typical summer day.

Landscape features are also important factors. Cooler neighborhoods tend to have more trees and grass, and have fewer buildings, roads, traffic and heavy commercial or industrial activity. Because areas closer to downtown have more people, buildings, pavement and urban activity, they tend to be hotter than neighborhoods at the city's outskirts, especially if they have little vegetation and tree shade.

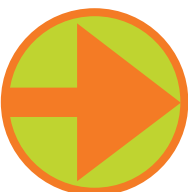


This is a thermal photograph of a Phoenix neighborhood taken from a helicopter on a hot summer day. Look how different the surface temperatures are of the hot surfaces, like streets and roofs, compared to the cool ones, like trees!



The graphic above illustrates how air temperatures vary throughout the city on a hot summer day. Differences from place to place tend to be small during the day and biggest at night. Notice how temperatures are highest near the city center and lowest on the edge. This is the “heat island” effect that scientists talk about. Within the “heat island,” there can be big differences in temperature between one neighborhood and the next — notice the cooling effect of the park on the right-hand side of the city.

Is your neighborhood a “heat island” or a cool oasis? How can you make it cooler? Keep turning the pages to learn how.



What is “heat”?

...and how do we measure it?



There are more than 50 weather stations across the city!

The heat we feel is affected by much more than air temperature. For example, we always feel hotter standing in the sun, and on humid, sticky days. By contrast, breezes can help us feel cooler by helping to evaporate sweat from our skin. That’s why measurements of sun, wind, humidity, and temperature at the more than 50 weather stations across the city are so important! They collect a wide range of temperature, humidity, air quality, wind speed and other data affecting how hot we feel.

The official weather station for Phoenix is located at Sky Harbor International Airport.

Up-to-the-minute conditions at Sky Harbor Airport’s weather station are available from the National Weather Service. Turn to page 16 for a link to our local office’s website!



- Anemometer & wind vane** for wind speed and direction
- Radiation Sensor** for incoming sunlight
- Solar panel** provides energy so the station can transmit data
- Temperature and humidity probes** in a special shield to block sunlight
- Communications box** streams weather data to the internet in real time
- Heavy blocks** to prevent the weather station from tipping over



In the photo above, a researcher is making repairs to a weather station on the roof of an apartment building in Phoenix. Did you know there were so many different pieces of equipment involved?

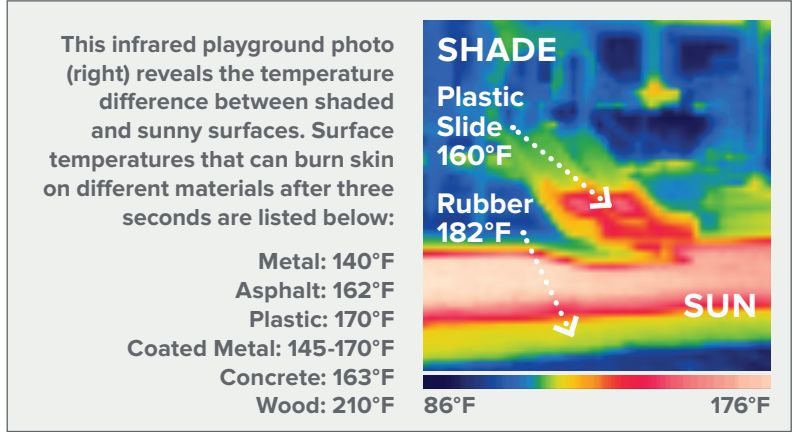


MEET MaRTy
ASU researchers are using this mobile research platform to measure all of the variables that influence our heat balance. MaRTy’s name comes from Mean Radiant Temperature (MRT), which is one index that researchers use to measure heat in the environment. MaRTy is friendly; if you see him out on the streets, say hi!



You can hunt for hot surfaces yourself!
The device in this picture is an infrared thermometer, which measures how hot different surfaces are. They are available to borrow from some schools and libraries, and are sold at some hardware stores.

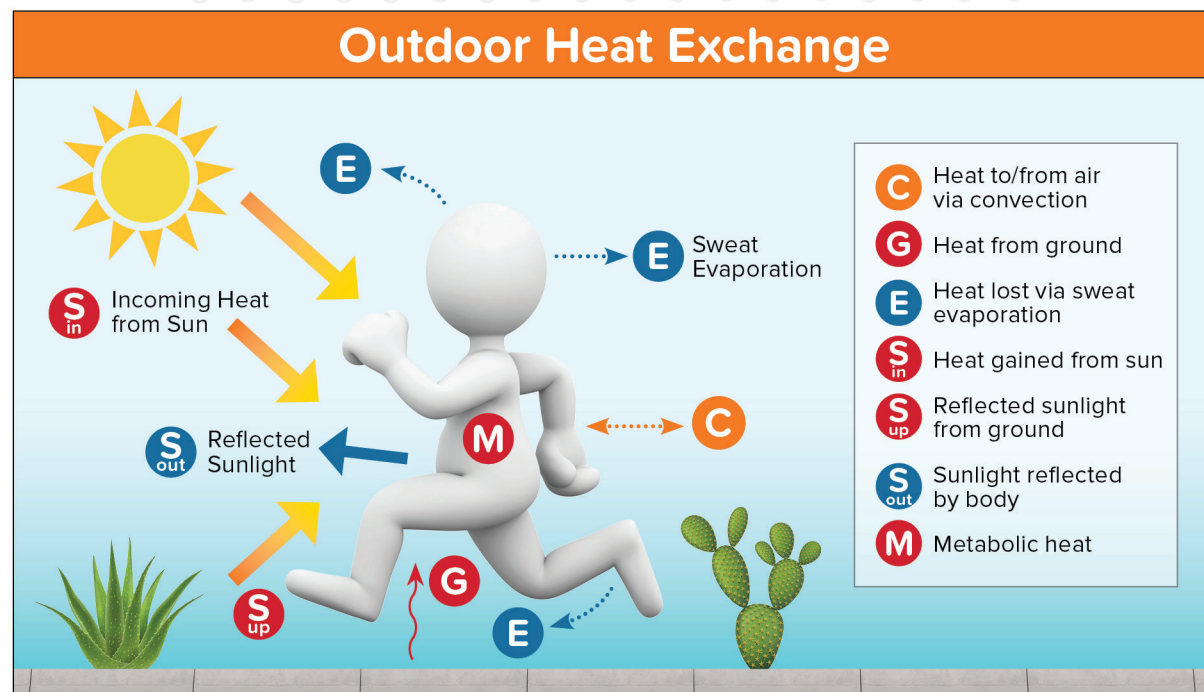
Have you ever touched very hot surfaces, like asphalt, a metal bench, or a playground slide on a sizzling day? **Ouch!** They often are much hotter than the air temperature and can even burn you. Surface temperatures are important to measure for our safety, but also because hot surfaces affect how hot we feel, and they contribute to the urban heat island effect. That’s because some objects and materials, like dark pavement, rubber, and metal absorb and store a lot of heat. Metal or plastic exposed to the sun can heat up very fast and burn your skin. They also cool quickly in the shade and at night.



How our bodies work to beat the heat ... and how to know when we need **HELP.**

Staying cool is all about staying in balance!

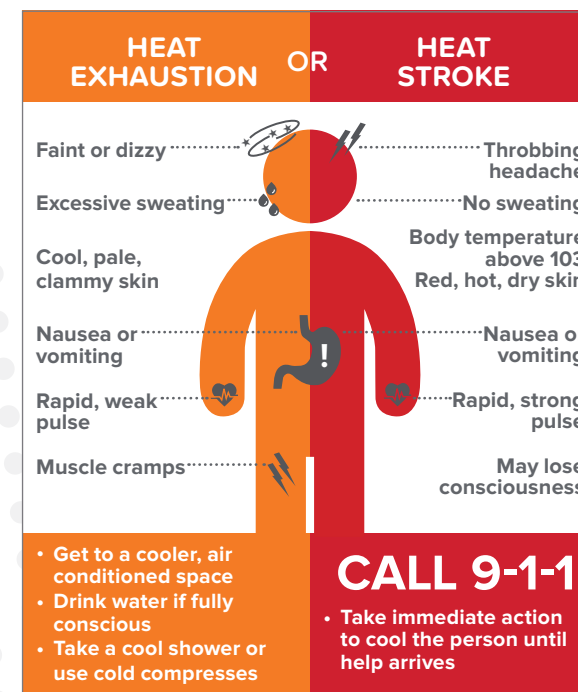
Our bodies are constantly exchanging energy with the environment. We lose extra heat most effectively by sweating because when the sweat evaporates, it cools our skin. We gain heat from the ground, the sun, and our own metabolic rate. When we work hard (like exercise) in the heat, we can be more at risk for heat illness. Be careful not to over-exert yourself, bring additional resources (like water), be open to changing your plans, and watch out for others! Heat illness and stroke are life threatening and occur much quicker during activity.



The figure above illustrates all of these different processes at work, from evaporative loss (E) to solar heat gain (S). When the air is very hot (over 95°F), we can gain heat from the air through convection (C). On a hot day, try to minimize the factors shown in red and maximize the factors shown in blue!

Each year in Arizona thousands of people need hospital treatment for heat-related illnesses. In 2020, more than 500 Arizonans died from heat exposure. Recognizing the symptoms of heat-related illness can help us take early action to protect ourselves and others. Early symptoms include feeling light-headed or slightly nauseous, having a headache, or feeling dehydrated. These are important warning signs to take a break, find a cool space, and take water, to avoid feeling worse. **Always check in on family, friends and neighbors when it's hot!**

Heat illness can be serious, and even deadly if left untreated.



Use the chart to the left to help determine if someone (including you!) is experiencing heat exhaustion or heat stroke. **Heat stroke is a very serious illness that can lead to death without immediate and proper treatment.**

How to help
In the case of heat cramps or exhaustion, move the person to a cooler place and give a half glass of COOL (not cold) water every 15 minutes (not too quickly). Apply wet cloths and/or seek an air-conditioned space, if possible.

If you think someone is suffering from the life-threatening symptoms of a heat stroke, call 9-1-1 fast and move the person to a cooler space. Quickly cool the body by using any means, including cool water and ice. Have them lie down and place cold packs on their wrists, ankles, armpits, and neck while monitoring for signs of breathing issues.



DID YOU KNOW?
Heat illness is 100% survivable if the correct precautions are followed.

Strategies to **STAY SAFE** ...in the summer heat.

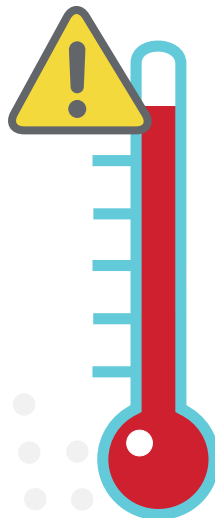
Everyone can get sick because of the heat, and because of our hot climate, there are a lot of days each year that we need to be careful.

Days with afternoon temperatures of 102°F and above have high risk for heat-related emergency department visits, according to ASU research. In 2020, there were 131 of these high risk days.

What's the heat season?

Earliest 102°F day	▶▶▶	April 21
Typical first 102°F day	▶▶▶	May 10
Typical last 102°F day	▶▶▶	Sept. 26
Latest 102°F day	▶▶▶	Oct. 16

Based on data from 2011-2020



The NOAA National Weather Service issues Excessive Heat Warnings on the most dangerously hot days. These messages are relayed by health departments, local governments, media partners, and other organizations. When you hear an Excessive Heat Warning, it's time to play it safe!

Here's what you can do today to keep yourself and others from falling ill from the heat:

- **Drink water** — 32 to 64 ounces for every hour you're outdoors, drink even if you don't feel thirsty, avoid alcohol and ask your doctor for personalized hydration advice
- **Dress for heat** — wear light-weight, light-colored clothing, wear a wide-brimmed hat, bring an umbrella, and apply sunscreen to exposed skin.
- **Slow down** — avoid hard physical activity during peak heat hours or adjust activity during cool morning or late evening hours
- **Stay indoors or seek shade** refuge when possible. Never leave children, pets, or others who need care in a car.
- **Take regular breaks** and **monitor those at high risk!**



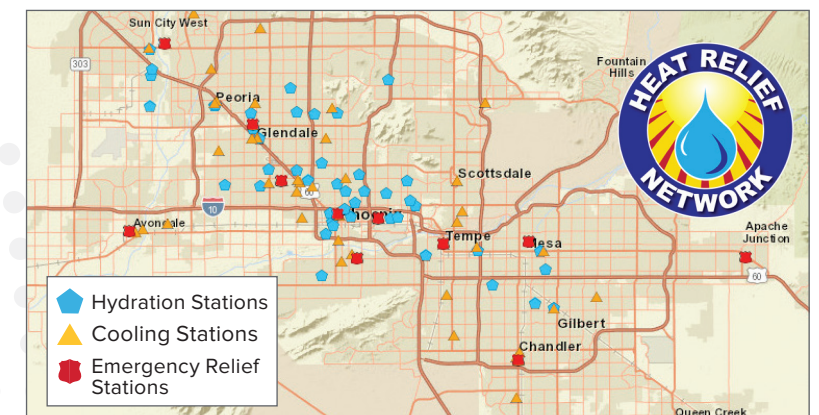
Need help paying your utility bills in the summer? Contact your utility provider first. If they don't have the right program to help, call 2-1-1 Arizona Information and Referral Services next. They'll connect you to other organizations that can help.

Need help getting your landlord to fix your air conditioning? Phoenix has a Cooling Ordinance that requires all habitable rooms to be cooled to 82°F where there is air conditioning and 86°F where there is evaporative cooling. The Human Services Department helps renters take action when their space is not being properly cooled.

Need a place to cool off for a few hours? The Maricopa Association of Governments coordinates the regional Heat Relief Network of cooling centers and water distribution sites. In 2019, there were more than 100 participating locations across the Valley! Check the Heat Relief Network website for up-to-the-minute information about cooling centers open near you.

The City of Phoenix and its partners offer a wide variety of programs and services to help everyone stay safe in the summer.

Heat Relief Hotlines	
Life-threatening emergencies	9-1-1
Non-emergency police assistance	602.262.6151
Human Services Department for renters' rights and cooling issues	602.262.7210
Human Services Department for utility assistance	602.262.4520
Neighborhood Services Department for weatherization assistance	602.534.4444
PHX C.A.R.E.S. [homelessness services]	602.262.6251
Heat Relief Network	602.254.6300
Other community services and programs	
Arizona Information and Referral Services	2-1-1
Maricopa County Department of Public Health Heat Surveillance	602.506.6900
Report power outage APS	602.688.2437
Report power outage SRP	602.236.8811
American Red Cross	602.842.7349



An updated map of regional cooling centers can be found online, by following the resources link on page 16 of this booklet.

What can we do... to keep the city cool?

A cooler future is possible!

There are many strategies that we can use to make our neighborhoods and the entire city cooler and more comfortable, but, we need to use the right strategy in the right place. This includes thinking about what we can do at our own homes, at our work places, as well as what we can do collectively as a city in our public spaces like streets and parks.

TREES ARE COOL

The City of Phoenix's 2010 Tree and Shade Master Plan calls for doubling tree canopy to 25% by 2030. This will require lots of new trees to be planted on both public and private land. Trees keep us cool by:

- **Shading city surfaces** — Trees block sunlight from heating up surfaces like roads and sidewalks that contribute to the urban heat island
- **Evapotranspiration** — Trees release water through their leaves, and when this water evaporates into our dry air, it lowers the air temperature
- **Shading us** — Our bodies feel much cooler in the shade than in the sun! Scientists measure the radiant temperature in the environment to capture this effect, and radiant temperatures are much lower in the shade provided by trees and other objects



RIGHT TREE, RIGHT PLACE

Some trees are much better suited for our desert climate than others. Plus, other factors like water consumption, shade, maintenance, safety, and cost also come into play when selecting a new tree. Fortunately, there are many resources available to help with this process!

Examples include a landscaping booklet from the City of Phoenix and a tree selection list from the Maricopa County Department of Air Quality.



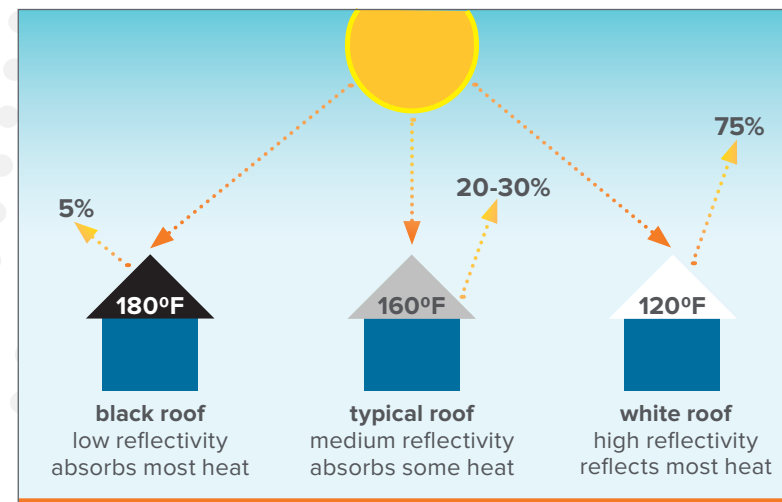
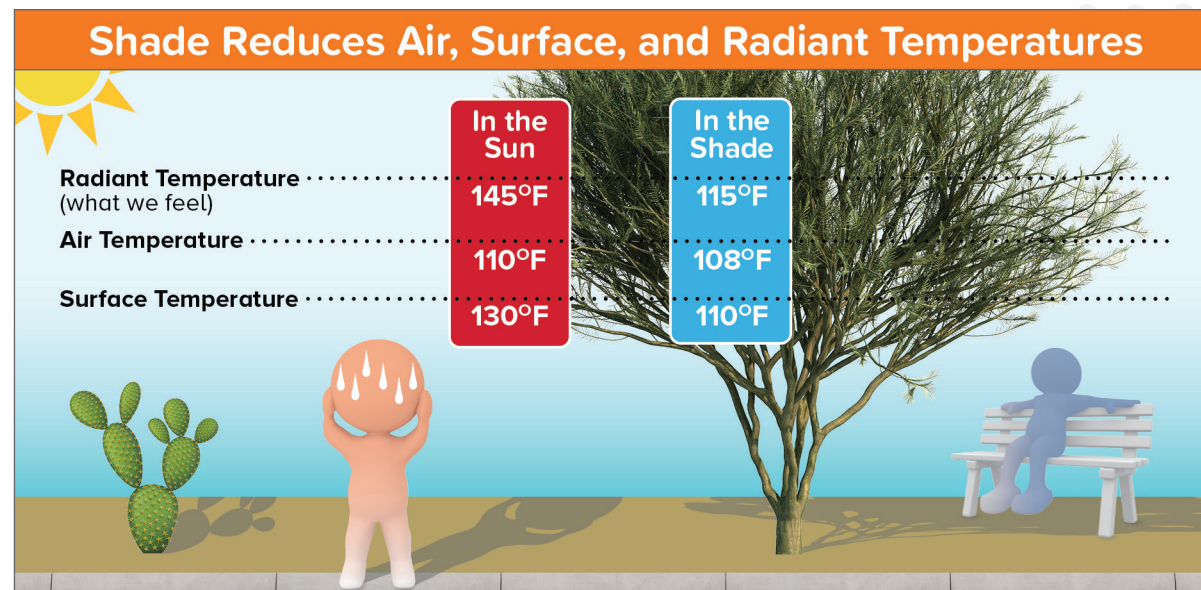
OTHER COOLING STRATEGIES

Cool Surfaces

We can take advantage of the fact that different materials absorb and reflect different amounts of energy to help with urban cooling. If you own your own home, when it's time to replace the roof, you might consider a lighter-colored material. There are also new roofing materials available that come in traditional colors but reflect more sunlight!

Weatherization & Energy Efficiency

Cooling and heating are a large share of our energy bills. We can reduce energy use and wasted heat in the environment by upgrading insulation, maintaining cooling equipment, replacing weather stripping, and using a programmable or smart thermostat. Check with your utility provider, or the City of Phoenix about programs to help make these options more affordable.



\$283
average national annual energy savings for weatherized homes

What can we do...

to get involved?

There are many strategies to make your neighborhood and the entire city cooler and more comfortable.

At the community level, residents can organize to advocate for solutions, work together to plant trees, and share information to keep neighbors safe and comfortable.



Organize a tree planting program. The City's Citizen Forester program offers great ideas about how to get started. Learn more online by following the resources link on page 16 of this booklet.

Local non-profit organizations work with homeowners to provide free shade trees in partnership with utility companies.



Apply for grants. Local tree planting efforts, shade structures and other projects for urban heat solutions can be funded through local grant opportunities, such as Community Development Block Grants.



Share information with schools, PTAs, and school district leadership to promote heat health safety and provide cool spaces for school children on routes to schools and generate interest in providing more shade in playground spaces.



Phoenix residents prepare tree planting at an event organized by the Nature Conservancy, Trees Matter, and Spaces of Opportunity.



ADVOCATE FOR HEAT SOLUTIONS!

City officials want to hear from their constituents. What you say is important, especially since residents do not frequently speak at public meetings! Decision makers benefit from hearing the impact their decisions have on their communities. Better yet, you can volunteer to serve on public committees to have your ideas heard.

Who's talking heat?

These City of Phoenix groups hold public meetings where you can share your ideas about reducing urban heat:

- Your local village planning committee
- The City of Phoenix Environmental Quality and Sustainability Commission
- The City of Phoenix Urban Heat Island and Tree Shade Subcommittee
- The City of Phoenix Parks and Recreation Board
- The City of Phoenix Arts and Culture Commission
- The City of Phoenix Citizens Transportation Commission
- Redevelopment and rezoning project briefings and workshops
- City Council

You can also directly contact your City Council representative and have a conversation with them or one of their staff members. **They are eager to hear from you!** Community-based organizations can also help share your opinions with those groups.

How to participate:

- Meeting agendas are posted publicly. Study agenda items that you can provide comments on.
- Understand the speaker guidelines for meetings. Public comments may be reserved for a certain period before, during, or after meetings.
- Fill out a card to speak at the meeting. Deliver it to the meeting officer or clerk.
- Decide what you will say beforehand, and keep within the time limits when commenting on the agenda item.
- Follow up with an email to the decision makers.
- Many city meetings provide Spanish translation.





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SOURCES AND CREDITS

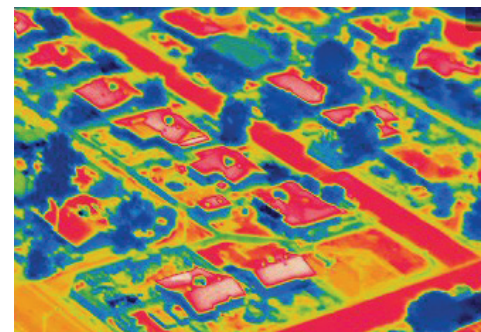
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Phoenix is getting hotter!

High Temperatures	2020	2001-2019 Average
110°F	53 days	21 days
100°F	145 days	111 days
90°F	191 days	173 days

Temperatures can vary from street to street and neighborhood to neighborhood.



Strategies to make your neighborhood and the entire city cooler:

- **Trees** – the right tree in the right place
- **Materials** – use cooler materials when replacing roofs or pavement
- **Energy Efficiency** – lower cooling bills by weatherizing and maintaining equipment
- **Work together to advocate for cooling solutions** – participate in public meetings

Heat illness is 100% survivable if the correct precautions are followed. Know the difference between heat exhaustion and heat stroke.

HEAT EXHAUSTION	OR	HEAT STROKE
Faint or dizzy		Throbbing headache
Excessive sweating		No sweating
Cool, pale, clammy skin		Body temperature above 103 Red, hot, dry skin
Nausea or vomiting		Nausea or vomiting
Rapid, weak pulse		Rapid, strong pulse
Muscle cramps		May lose consciousness
<ul style="list-style-type: none"> • Get to a cooler, air conditioned space • Drink water if fully conscious • Take a cool shower or use cold compresses 		<p>CALL 9-1-1</p> <ul style="list-style-type: none"> • Take immediate action to cool the person until help arrives

Take precautions to stay safe in the heat:

- Drink water
- Dress for heat
- Slow down
- Stay indoors
- Seek shade
- Take regular breaks when outdoors
- Monitor those at high risk!

