
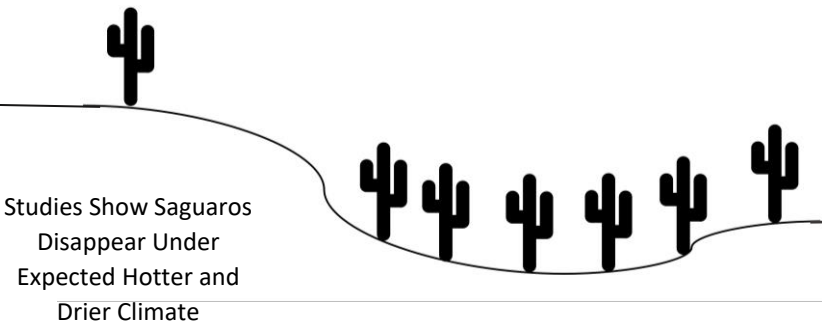


# Adaptation to Droughts and Heat Extremes under Climate Change


## A Southern Arizona Home and Farm Owner's Guide to Heat and Drought Damage Prevention

Learn how to:

- Identify you are in a drought zone
- Protect your property from drought
- Adapt to drought impacts
- Prepare yourself for a heat emergency
- Adapt to extreme heats
- Use green electricity



The investigations found that nearly one of four wells in Arizona groundwater monitoring program has dropped 100 ft since they were drilled.



A message from NextGen



Is this the drought you weren't waiting for?

In Southern Arizona, drought is common and mostly everywhere. In the past Arizona was primarily a rural, sparsely populated state. However, within the last century cities have expanded and it has become increasingly difficult to control and manage droughts. The primary vision of drought control is to protect life, properties and crops and monitor to give early warning, preparedness, and response to the dangers and damages associated with drought. Individuals, homeowners and farmers can protect their lives and properties by implementing the drought prevention strategies. With proper preparedness and planning we can adapt to drought consequences or help to mitigate this phenomenon.

First Things First!

As droughts comes with extreme heats most of the time, you need to take care of your life. There are different illnesses related to heat and each of them has their own symptoms. Please take a moment to familiarize yourself with emergency response tips. There are three KEY reminders to fight the heat. Stay Cool! Stay Hydrated! Stay Informed!

To reduce damages of drought you can use simple strategies inside this booklet. The most important precaution is the smart use of water. Using grey water for toilet, harvesting rainwater, using drip irrigation are some examples of smart water use.

With ongoing climate change and increasing air temperature this guidebook helps our community to first adapt and second mitigate the drought impacts for today and next generations.

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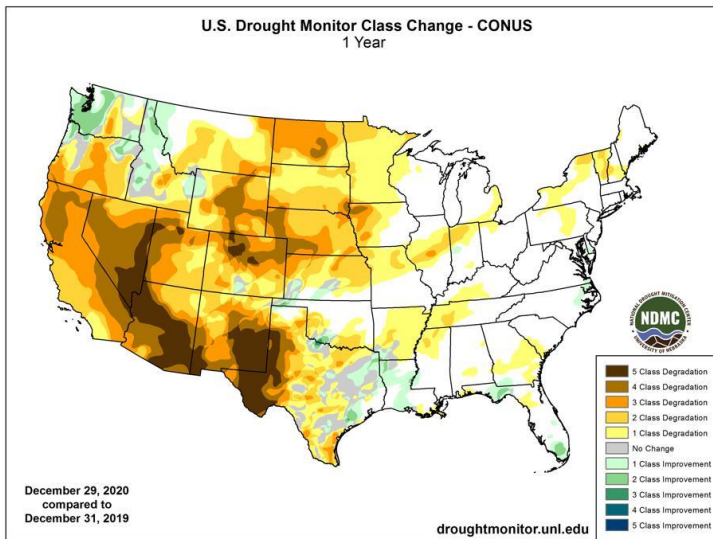
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## General Drought Information

Drought can be a hard phenomenon to monitor and cope. It is caused by rainfall deficit combined with other vulnerable factors like heat. A drought is often caused by a few drier than normal years whereas it is characterized by a string of drier than normal years. Drought causes streamflow to decline and water levels in lakes and reservoirs to fall. Droughts also bring a period of dryness that affects the crops under cultivation. Based on the period and source of water deficiency we may experience agricultural or hydrological droughts; these terms are explained in “Drought Terminology” Section.

## 2020 Drought

People affected by drought conditions during the first week of August 2020 alone totaled 52.5 million according to the U.S. government drought website U.S. has been in some form of drought since October 2020. That drought brought the driest and 2<sup>nd</sup> warmest year on record for US Yet 2020 was only 0.03 inches behind from being the single driest year with a record of less than 2 inches. The reason behind 2020 drought is laid over the winter snowfall. Although snow cover on the West was not too far from average, early snowmelt in many areas caused a water deficiency in warmer months because more runoff caused by early snowmelt is not as useable as snow melt in the spring and late summer (droughtmonitor.gov). There are five different class from “abnormally dry” to “exceptional drought” defined by US Drought Monitor (USDM) for areas experiencing drought and suffering from lack of precipitation. In the following figure you can see drought class degradation during 2020 drought, showing propagation of drought in 2020 over the US. Although there are minor improvements, most of the US experienced more intense drought caused in severe drought class degradation.



### How Dry Was 2020 in Arizona?!

This map shows drier the US became during 2020. Arizona and most of the southwest experienced 3-5 drought class degradation which means so many regions experienced more intense drought, degraded from “abnormally dry” to “exceptional drought” during this year.

### Are you at risk?

It is important to know if your property is in drought, and how to protect your land. Certain areas are much more vulnerable to droughts than others. However, if you are in low to moderate drought zone, it doesn't mean your property would not be affected during extreme heat days.

## How to identify if you are in a drought zone

Talk to local community officials. Local Community officials can provide specialized information about your area. National Drought Mitigation Center (NDMC) has a drought map database as well which can be accessed through the following steps:

1. Visit NDMC's drought map service at <https://www.drought.gov/about/partners/national-drought-mitigation-center-ndmc>
2. Go to the tab labeled "Data and Maps". There you can find maps and information about current conditions and locations of Drought zones, Drought impacts and, Outlook and Forecasts.
3. By clicking on Drought Impacts, you can find different statements available for your region, U.S. Crops and Livestock in Drought and USDA Drought Disaster Designations.

## Curious? Want to know more?

Components of drought are frequency, intensity, and duration. In most parts of the U.S. drought components are increasing. This year's (2021) drought was from the period of January to March. Arizona streams have droughts as long as 5 years commonly and those streams are technically under the average flow 60%-80% of the time. Average streamflow is getting lower than the rate that water users originally have had before. The lack of rain in Tucson is caught up to us not only from the monsoon but for the past year.

The most intense period of drought occurred during the week of December 1, 2020, where D4 (exceptional drought) affected 76.81% of Arizona land. This year (2021) marks the 26<sup>th</sup> year of a long-term drought. Extreme variability in precipitation is normal since Arizona has an arid and semi-arid climate.



## Drought Terminology

**Agricultural Drought:** conditions that result in adverse crop responses due to water shortage in growing season

**Hydrological Drought:** prolonged period of below normal precipitation, causing deficiencies in water supply, as measured by below normal streamflow, lake and reservoir levels, groundwater levels, and depleted soil moisture content

**USDM:** United States Drought Monitor. The U.S. Drought Monitor releases drought map of the US every Thursday, showing parts of the country that are in drought. The map uses five drought classifications that are explained in detail in "Drought index".

**NDMC:** National Drought Mitigation Center

They help people, organizations and institutions build resilience to drought through monitoring and planning, and they are the academic partner and web host of the U.S. Drought Monitor

**Drought Index:** a numerical scale that scientists use to describe the severity of a drought. Scientists take many kinds of data (like streamflow, rainfall, temperature, and snowpack) and "blend" it into a single number, called a drought index value, to make it easier to understand the drought conditions of a particular area. USDM has classified drought indexes into five classes.

Class	Description	Possible Impacts	The
D0	Abnormally Dry	<b>Going into drought:</b> <ul style="list-style-type: none"> <li>• short-term dryness slowing planting, growth of crops or pastures</li> </ul> <b>Coming out of drought:</b> <ul style="list-style-type: none"> <li>• some lingering water deficits pastures or crops not fully recovered</li> </ul>	
D1	Moderate Drought	<ul style="list-style-type: none"> <li>• Some damage to crops, pastures</li> <li>• Streams, reservoirs, or wells low, some water shortages developing or imminent</li> <li>• Voluntary water-use restrictions requested</li> </ul>	
D2	Severe Drought	<ul style="list-style-type: none"> <li>• Crop or pasture losses likely</li> <li>• Water shortages common</li> <li>• Water restrictions imposed</li> </ul>	
D3	Extreme Drought	<ul style="list-style-type: none"> <li>• Major crop/pasture losses</li> <li>• Widespread water shortages or restrictions</li> </ul>	
D4	Exceptional Drought	<ul style="list-style-type: none"> <li>• Exceptional and widespread crop/pasture losses</li> <li>• Shortages of water in reservoirs, streams, and wells creating water emergencies</li> </ul>	

**Palmer Drought Severity Index (PDSI):** This index uses readily



available temperature and precipitation data to estimate relative dryness. It is a standardized index that generally spans -10 (dry) to +10 (wet)

**Root Zone Soil Moisture:** the water that is available to plants—generally considered to be in the upper portion of soil, 200 cm (6.5 ft) top soil.

**Hydrozone:** A hydrozone is a portion of the landscape area where plants with similar water needs are grouped. Hydrozones helps to keep plant with similar water need together and make your irrigation schedule more efficient.

## Are you a Drought-Concerned Rancher or Farmer?

There are two components involved in agricultural drought, below normal precipitation and/or above normal temperature and wind. Both of these cause the soil and plants lose more water than usual. If you are a rancher or farmer interested to know about different aspects of drought that might affect your crops there are different ways to do that:

- 1- Check your soil moisture zone in present time and see the changes over next few months at Climate Prediction Center Soil Moisture Monitoring ([https://www.cpc.ncep.noaa.gov/products/Soilmst\\_Monitoring/US/Outlook/CAS/SM.shtml](https://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Outlook/CAS/SM.shtml) )
- 2- Check out Weekly Weather and Crop Bulletin provided by USDA for more information and update on your region (<https://www.drought.gov/data-maps-tools/weekly-weather-and-crop-bulletin-wwcb>)
- 3- Start to grow crops with less water need and more resiliency to drought to reduce the risk of loss. For water need and growing period see <http://www.fao.org/3/s2022e/s2022e02.htm>
- 4- Set up rain sensors to override your scheduled irrigation system

Install soil sensors to monitor soil moisture and adjust your irrigation system based on that. You can save considerable amount of water with avoiding overwatering.

# What Can We Do for Drought Adaptation and Mitigation!

## Inside Home

- Install an aerator on your kitchen faucet to reduce flow to less than 1 gallon per minute
- Fixing the worn washers in a faucet with a slow steady drip saves 350 gallons per month
- Installing a water-efficient clothes washer saves up to 16 gallons a load
- Replacing a pre-1990 toilet, which can use 5 gallons per flush, with a newer high-efficiency model can save 38 gallons a day per toilet
- Replace your showerhead with an ultra-low-flow version.
- Kitchen sink disposals require lots of water. Start a compost pile as an alternate way to dispose of food waste.

## Outdoors

- Use mulch to retain moisture in the soil. Mulch also helps control weeds that compete with landscape plants for water
- Plant native and/or drought-tolerant grasses, ground covers, shrubs and trees. Once established, your plants won't need as much watering
- Consider rainwater harvesting where practical
- Grassy lawns might make sense in wet climates, but in dry areas like the south and southwest, they're huge water-wasters
- Use a drip irrigation system instead of a hose or sprinkler to water your garden
- Invest in a weather-based irrigation controller—or a smart controller

- Install a new water-saving pool filter. A single back flushing with a traditional filter uses 180 to 250 gallons of water

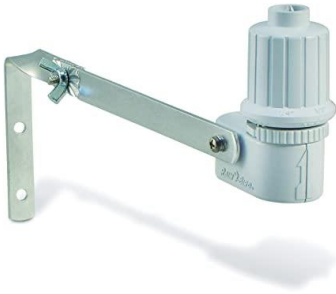
## Adaptation to Agricultural Drought

Prevention is better than cure

There are different ways that each irrigation system waste water. Based on the type of irrigation you can lose water through transportation (leaky channels), runoff (trench flooding), evaporation (open channels and reservoirs and sprinkles). Most of the irrigation method fail to deliver right amount of water to the right spot (root zone) with right paste (the slower the better). Additionally, an ideal irrigation system is adjustable for different seasons and soil moisture. So, it is important to know when it is raining and how much water is stored at the root zone. How? Keep reading!

An efficient way to save water and reduce you water bill is installing rain or soil moisture sensors. They can override your scheduled automatic watering system when there is rain or the soil is still wet enough. Once a certain amount of water has been detected they will shut down your irrigation.

Rain sensors are less expensive and easier to maintain. They are small and easy to install and can be done by yourself. On the other side, soil sensors give you more information of the root zone moisture and how much water your plants are receiving. Thus, they offer greater water saving. Soil sensors can be more expensive and more complicated to install and manage.



Rain sensors



Tensiometer sensors

You want to know more about different type of sensors and cost?  
Check out this! <https://www.agric.wa.gov.au/horticulture/soil-moisture-monitoring-selection-guide>

## Plant Native Plant Smart

By planting native plants, you can save water and reduce losses. Native plants for each region have been evolved through million years and have adopted different ways to flourish. In desert climate, they are more resilient to drought and consume less water. By planting them either in your lawn or your farm you can make a use of this history-long evolution. Here is only some of the plants native to Sonoran desert.

### Arizona Rosewood

Evergreen shrub tolerant to drought and cold hardy. Excellent as a screen hedge or small shade tree, or for use in an entry area.



**Arizona Rosewood**

Source: Wikipedia

### **Brittlebush & Chuparosa**



**Brittlebush**

Source: Wikipedia



**Chuparosa**

Brittlebush does best in the warmer areas of the desert and grows to 2 to 5 feet high. Chuparosas wonderfully adapted to Xeriscape garden and an attraction to hummingbirds and can survive on rainfall alone in the natural desert areas.

## Creosote Bush



**Creosote Bush**

Source: Wikipedia

Also known as Greasewood It is extremely drought tolerant and enjoys minimal water and excellent as a foundation plant.

## Green Feathery Senna

Also sold as Desert Cassia is excellent in mass plantings and as a privacy screen. They are Extremely drought-tolerant and requires little to no supplemental fertilization or irrigation, once established.



**Creosote Bush**

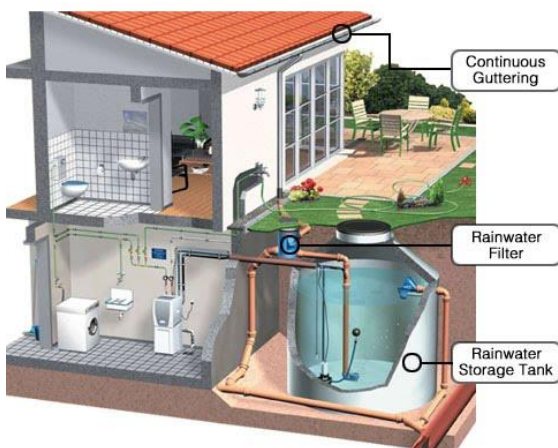
Source: Wikipedia

Want to know more about native and invasive plants in AZ?! Check out Arizona Native Plant Society website <https://aznps.com/>

## Successful Stories of Drought Adaption Mitigation Plans

### Tucson Water Harvesting Rebates Program

Tucson city offers you \$2,000 to buy cisterns, gutters and downspouts for active water harvesting off of your roof. This program started in 2012 helps Tucsonans save water on average by 10% official say. It also offers up to \$500 for “passive” harvesting that helps your yard to capture runoff. This program has given nearly 2,000 homeowners rebates, costing nearly \$2 million. These and other rebate costs are paid by a fee in water bills of 9 cents per 748 gallons used — scheduled to hit 10 cents by fiscal year 2019-20. Since 2014, the city has expanded the rebates to help businesses buy cisterns and neighborhoods to use curb cuts to suck water off city streets, and has started a loan program for low-income households.



Credit: General Knowledge Bank Club

[www.ngeneng.com](http://www.ngeneng.com)

July 2021

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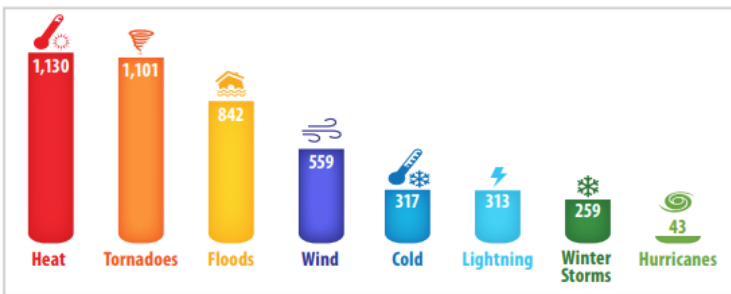


## General Heat Information

**Hurricanes, floods and tornados are deadly but not as much as **HEAT!****

About 500 deaths related to heat has been reported in 2020 in Arizona which surpassed 283 heat-related death in 2019 (azcentral).

### Fatalities by Hazard, 2006–2015



Source: NOAA National Weather Service, 2016

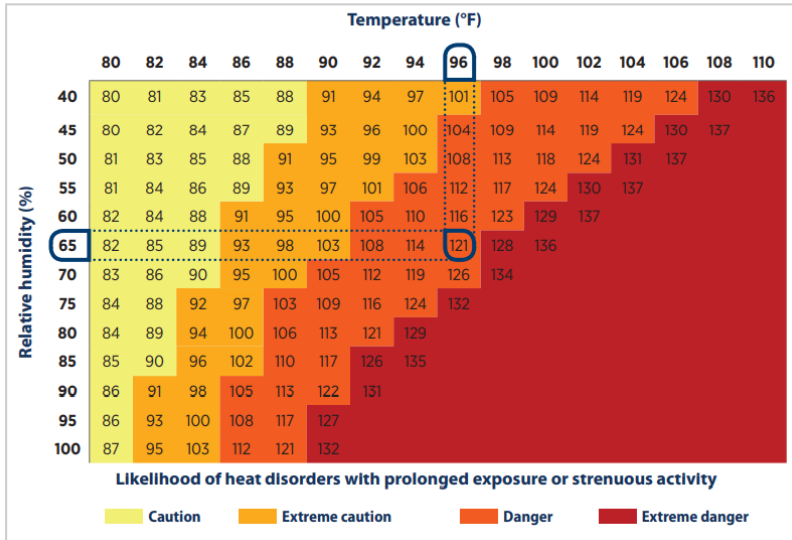
## Simple definition

What is Extreme Heat?



Have you ever noticed a hot day for you doesn't feel that hot for another person? That's why extreme heat definition is region based. In other words, temperatures that are much hotter and/or humid than average of a location is called extreme heat. **Humid and muggy conditions can make it seem hotter than it really is.** The heat index helps you to measure how hot it feels like when relative humidity is factored with actual air temperature. For example, a humid day in monsoon season (say with 45% humidity) with 96 F feels 104 F. How Horrible is that! A day with heat index of 105°F or hotter is called Danger Day.

### NOAA's National Weather Service Heat Index

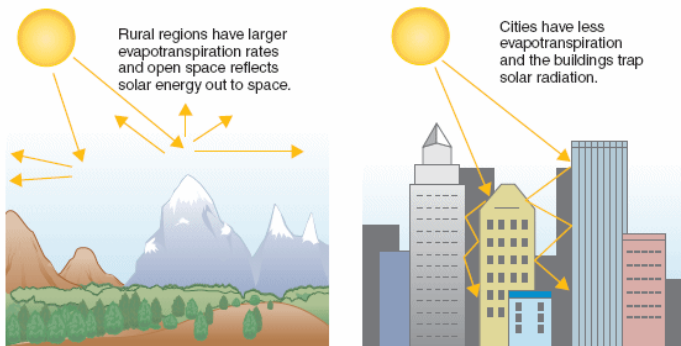


Classification	Heat Index	Effect on the body
Caution	80°F - 90°F	Fatigue possible with prolonged exposure and/or physical activity
Extreme Caution	90°F - 103°F	Heat stroke, heat cramps, or heat exhaustion possible with prolonged exposure and/or physical activity
Danger	103°F - 124°F	Heat cramps or heat exhaustion likely, and heat stroke possible with prolonged exposure and/or physical activity
Extreme Danger	125°F or higher	Heat stroke highly likely

Source: National Weather Service

### Why Phoenix is so much hotter than Tucson?!

We trap more heat in our cities as we build more structures and roads with dark material. This is one of the heat impacts on our environment called Heat Island. In consequence nights are as warm as days, we use more energy to cool down areas during nights, use more water in household and industrial sectors, loose more lives and go on .... The following figure shows the Heat Island effect on cities like Phoenix. Heat Island in Phoenix increases nighttime low temperatures by 10 to 15 degrees Fahrenheit compare to rural areas ([Arizona State University](https://www.asu.edu/heat-island))



This figure shows different heat sinks in an urban area compared to a rural landscape. More reflective sources are seen in the natural environment than cities

<http://cimss.ssec.wisc.edu/climatechange/globalCC/lesson7/UHI2.html>

Heat also can put your health at danger!

## Heat-related Illnesses

Heat-related illnesses, like heat exhaustion or heat stroke, happen when the body is not able to properly cool itself down. While the body normally cools itself by sweating, during extreme heat, this might not be enough. In these cases, a person's body temperature rises faster than it can cool itself down. This can cause damage to the brain and other vital organs. (cdc.gov)

### Are you at risk?

Older adults, the very young people, and people with mental illness and chronic diseases are at the highest risk. However, even young and healthy people can be affected if they participate in strenuous physical activities, over-exercising and working in exposed places during hot weather.

## Are you protected?

### What makes you more vulnerable

- High levels of humidity
- Obesity
- Fever
- Dehydration
- Prescription drug use
- Heart disease
- Mental illness
- Poor circulation
- Sunburn
- Alcohol use

## Heat terminology

**Heat Index:** An index combines humidity and heat which show how hot it feels for different combinations.

**Danger Day:** A day with the Heat Index of 105°F or hotter.

**Extreme Heat:** a period of high heat and humidity with temperatures above 90 degrees for at least two to three days (ready.gov).

**Excessive Heat Wave:** a period of excessively hot weather, which may be accompanied by high humidity, especially in oceanic climate countries. While definitions vary, a heat wave is usually measured relative to the usual weather in the area and relative to normal temperatures for the season. Temperatures that people from a hotter climate consider normal can be called a heat wave in a cooler area if they are outside the normal climate pattern for that area (Wikipedia.org).

## Heat Alerts:

- **Excessive Heat Warning**—Take Action! An Excessive Heat Warning is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Warning is when the maximum heat index temperature is expected to be 105° or higher for at least 2 days and night time air temperatures will not drop below 75°; however, these criteria vary across the country, especially for areas not used to extreme heat conditions. If you don't take precautions immediately when conditions are extreme, you may become seriously ill or even die.
- **Excessive Heat Watches**—Be Prepared! Heat watches are issued when conditions are favorable for an excessive heat event in the next 24 to 72 hours. A Watch is used when the risk of a heat wave has increased but its occurrence and timing is still uncertain.
- **Heat Advisory**—Take Action! A Heat Advisory is issued within 12 hours of the onset of extremely dangerous heat conditions. The general rule of thumb for this Advisory is when the maximum heat index temperature is expected to be 100° or higher for at least 2 days, and night time air temperatures will not drop below 75°; however, these criteria vary across the country, especially for areas that are not used to dangerous heat conditions. Take precautions to avoid heat illness. If you don't take precautions, you may become seriously ill or even die.
- **Excessive Heat Outlooks**—Be Aware! The outlooks are issued when the potential exists for an excessive heat event in the next 3-7 days. An Outlook provides information to those who need considerable lead-time to prepare for the event.

Source: National Weather Service

**Heat Island:** An urban area having higher than average temperature than its rural surroundings owing to the greater absorption, retention,

and generation of heat by its buildings, pavements, and human activities. Studies show this increase in temperature can vary between 1-7°F in daytime and 2-5°F at nighttime (epa.gov).

### Did You Know?

Those living in urban areas maybe at a greater risk from the effects of a prolonged heat wave than those living in rural areas.

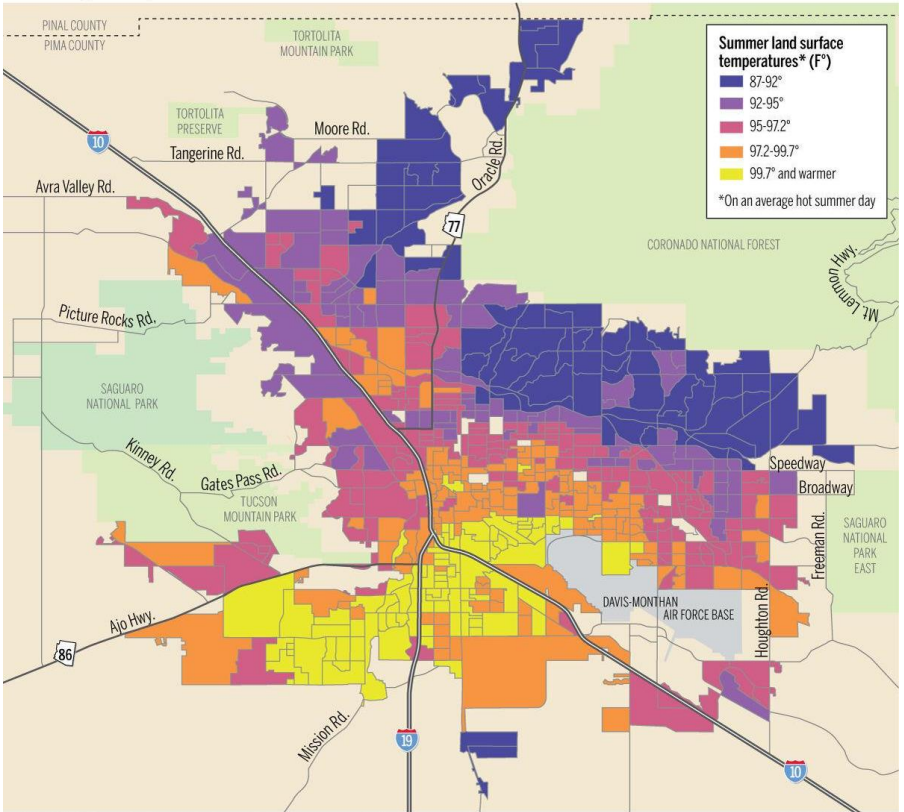
Most heat-related illnesses occur because of overexposure to heat or over-exercising

Sunburn can significantly slow the skin's ability to release excess heat.

During 1999-2009, an average of 658 people died each year from heat in the US.

## Heat zone? What part of city has more heat?

There is a great division in Tucson neighborhoods temperature. A Study by Jake Dialesandro, a Ph.D. candidate at the University of California-Davis shows seven out of 10 hottest neighborhoods in the Tucson area were found on the south side. It is good to know where you are located and how you can be prepared.



4/4/21 SOURCE: Jake Dialesandro, Ph.D. candidate at University of California-Davis; ARCGIS Pro

ARIZONA DAILY STAR



## Heat Reminders



**Wear Appropriate Clothing:** Choose lightweight, light-colored, loose-fitting clothing.

**Stay Cool Indoors:** Stay in an air-conditioned place as much as possible. If your home does not have air conditioning, go to the shopping mall or public library—even a few hours spent in air conditioning can help your body stay cooler when you go back into the heat. Call your local health department to see if there are any heat-relief shelters in your area.

**Keep in mind:** Electric fans may provide comfort, but when the temperature is in the high 90s, they will not prevent heat-related illness. Taking a cool shower or bath or moving to an air-conditioned place is a much better way to cool off. Use your stove and oven less to maintain a cooler temperature in your home.

**Schedule Outdoor Activities Carefully:** Try to limit your outdoor activity to when it's coolest, like morning and evening hours. Rest often in shady areas so that your body has a chance to recover.

**Pace Yourself:** Cut down on exercise during the heat. If you're not accustomed to working or exercising in a hot environment, start slowly and pick up the pace gradually. If exertion in the heat makes your heart pound and leaves you gasping for breath, STOP all activity.

Get into a cool area or into the shade, and rest, especially if you become lightheaded, confused, weak, or faint

**Wear Sunscreen:** Sunburn affects your body's ability to cool down and can make you dehydrated. If you must go outdoors, protect yourself from the sun by wearing a wide-brimmed hat, sunglasses, and by putting on sunscreen of SPF 15 or higher 30 minutes prior to going out. Continue to reapply it according to the package directions

**Tip:** Look for sunscreens that say "broad spectrum" or "UVA/UVB protection" on their labels- these products work best

**Do Not Leave Children and Pets in Cars:** Cars can quickly heat up to dangerous temperatures, even with a window cracked open. While anyone left in a parked car is at risk, children and pets are especially at risk of getting a heat stroke or dying. When traveling with children and pets, remember to do the following:

Never leave infants, children or pets in a parked car, even if the windows are cracked open.

To remind yourself that a child is in the car, keep a stuffed animal in the car seat. When the child is buckled in, place the stuffed animal in the front with the driver

When leaving your car, check to be sure everyone is out of the car. Do not overlook any children who have fallen asleep in the car

**Avoid Hot and Heavy Meals:** They add heat to your body!

# Stay Hydrated



**Drink Plenty of Fluids:** Drink more fluids, regardless of how active you are. Don't wait until you're thirsty to drink

**Stay away from very sugary or alcoholic drinks**—these actually cause you to lose more body fluid. Also avoid very cold drinks, because they can cause stomach cramps. Coffee and caffeinated beverages are not substitution for water.

**Replace Salt and Minerals:** Heavy sweating removes salt and minerals from the body that need to be replaced. A sports drink can replace the salt and minerals you lose in sweat

**Keep Your Pets Hydrated:** Provide plenty of fresh water for your pets, and leave the water in a shady area

## Stay Informed



**Check for Updates:** Check your local news for extreme heat alerts and safety tips and to learn about any cooling shelters in your area.

**Know the Signs:** Learn the signs and [symptoms of heat-related illnesses](#) and how to treat them.

Heat Cramps come with heavy sweating and muscle cramps, Heat Exhaustions are linked with fatigue and nausea and Heat Strokes alter mental state and confusion. More on the symptoms and corresponding treatments are provided in the next sections.

**Use a Buddy System:** When working in the heat, monitor the condition of your co-workers and have someone do the same for you. Heat-induced illness can cause a person to become confused or lose consciousness. If you are 65 years of age or older, have a friend or relative call to check on you twice a day during a heat wave. If you know someone in this age group, check on them at least twice a day.

**Monitor Those at High Risk:** Although anyone at any time can suffer from heat-related illness, some people are at greater risk than others:

Infants and young children

People 65 years of age or older

People who are overweight

People who overexert during work or exercise

People who are physically ill, especially with heart disease or high blood pressure, or who take certain medications, such as for depression, insomnia, or poor circulation

Visit adults at risk at least twice a day and closely watch them for signs of heat exhaustion or heat stroke. Infants and young children, of course, need much more frequent watching.

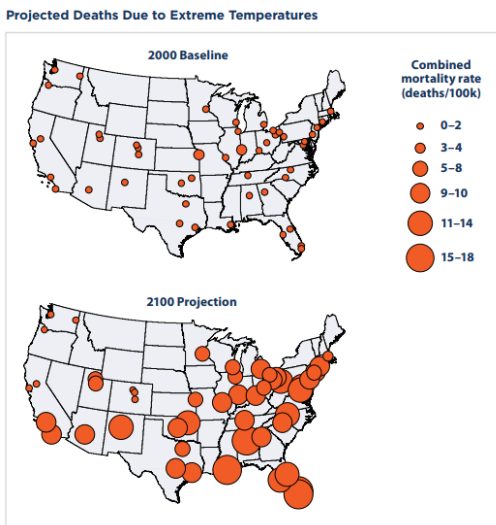
# Heat-Related Illnesses

	SYMPTOMS		TREATMENT
HEAT CRAMPS	<ul style="list-style-type: none"> <li>• Heavy sweating</li> <li>• Painful muscle cramps or spasms</li> </ul>		<ul style="list-style-type: none"> <li>• Stop activity for a few hours.</li> <li>• Move to a cooler location.</li> <li>• Drink water, clear juice, or a sports beverage.</li> <li>• Seek medical attention if cramps do not subside within one hour.</li> </ul>
HEAT EXHAUSTION	<ul style="list-style-type: none"> <li>• Heavy sweating</li> <li>• Weakness</li> <li>• Fatigue</li> <li>• Headache</li> <li>• Dizziness</li> <li>• Nausea or vomiting</li> <li>• Fainting</li> <li>• Irritability</li> <li>• Thirst</li> <li>• Decreased urine output</li> </ul>		<ul style="list-style-type: none"> <li>• Move to an air-conditioned environment.</li> <li>• Lie down.</li> <li>• Loosen clothing or change into lightweight clothing.</li> <li>• Sip cool, non-alcoholic beverages.</li> <li>• Take a cool shower or bath, or apply cool, wet cloths to as much of the body as possible.</li> <li>• Seek medical attention if symptoms worsen or last longer than one hour, or if the victim has heart problems or high blood pressure.</li> </ul>
HEAT STROKE	<ul style="list-style-type: none"> <li>• Very high body temperature</li> <li>• Altered mental state</li> <li>• Throbbing headache</li> <li>• Confusion</li> <li>• Nausea</li> <li>• Dizziness</li> <li>• Hot, dry skin or profuse sweating</li> <li>• Unconsciousness</li> </ul>		<ul style="list-style-type: none"> <li>• Call 911 immediately and follow the operator's directions—<b>this is a medical emergency.</b></li> <li>• Reduce the person's body temperature with whatever methods you can: wrap the person in cool cloths, immerse them in a cool bath, or spray them with cool hose water.</li> <li>• After administering cooling methods, move the person to a cooler place.</li> <li>• Do NOT give liquids.</li> <li>• If there is uncontrollable muscle twitching, keep the victim safe, but do not place any objects in his or her mouth.</li> <li>• If there is vomiting, turn the victim on his or her side to keep the airway open.</li> </ul>

Source: CDC, 2012<sup>9</sup>

## Climate Change Impact on Heat

With ongoing climate change and global warming, the chances of having more frequent, more intense and longer-lasting heat extremes are increasing. Since the beginning of the 20<sup>th</sup> century global temperature is rising and is expected to continue to rise through the end of this century. As discussed earlier heat is coupled to multiple health problems and was recognized as the deadliest natural hazard based on 2006-2015 hazard fatality records. As the temperatures get hotter in the US, heat-related fatalities are expected to grow especially for vulnerable groups such as the elderly, children, and economically disadvantaged communities. In this order the projected mortality rate by the end of 21<sup>st</sup> century due to hot and cold extremes (combined actual death) is shown below. The increase in heat-related deaths is expected to far outweigh the decrease in cold-related deaths.



Source: U.S. EPA, 2015

Arizona is expected to have increase in mortality rate from 0-2 to 11-14 death/100K by the end of 21<sup>st</sup> century due to the hotter temperature, under climate change.

## Mitigate The Heat

### **Plant a green roof**

Green roofs provide shades and reduce the temperature of the roof surface as well as the surrounding air

### **Install a cool roof**

A cool roof is made of more bright and reflective material to absorb less heat which helps you to have cooler temperature inside your house

### **Plant trees and install shade structures**

Trees and vegetation can lower the surrounding air temperature and reduce your energy bill

### **Use cool paving materials in your driveway**

Cool pavement can be created from asphalt and concrete with reflecting coatings which absorbs less heat

### **Contribute to a community-wide heat response plan**

Many communities and local agencies are developed to identify more vulnerable communities, infrastructures and locations. Check online or call your local representative for more information.



## Turning Risk to Opportunities, Especially the Hot ones?

Sun is the main source of heat. Normally cities with hotter temperature are the ones have higher sunshine hours. Tucson is among top 5 cities with the most sunshine hours. You can use these sunny hours to harvest lots of electricity and help your community to tackle with climate change.



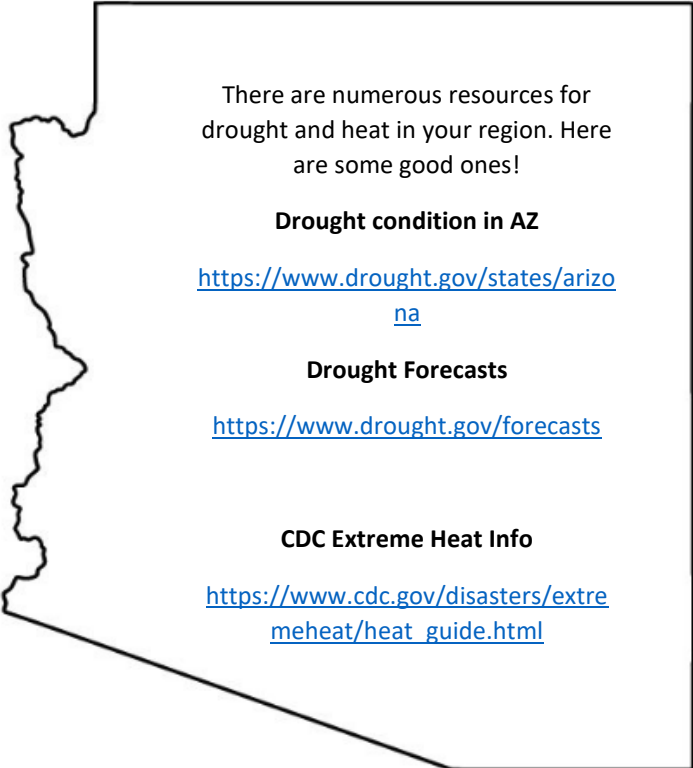
David Sanders / Tucson Electric Power

Either you want to install your own solar panels or use electricity provided by local solar farms you can look up TEP and other agencies website for more information and incentive-based programs.



Solar parking panels is another useful way of providing shade and produce electricity. As part of this effort the partnership between Town of Oro Valley and TEP there would be solar parking panels at Naranja Park. This project can power up about 50 local homes and provide shade through the half of the park's parking spaces.

## Additional Sources



There are numerous resources for drought and heat in your region. Here are some good ones!

### **Drought condition in AZ**

<https://www.drought.gov/states/arizona>

### **Drought Forecasts**

<https://www.drought.gov/forecasts>

### **CDC Extreme Heat Info**

[https://www.cdc.gov/disasters/extremeheat/heat\\_guide.html](https://www.cdc.gov/disasters/extremeheat/heat_guide.html)

## Acknowledgement

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