

PROTOTYPE

HeatRisk v2

Identifying Potential Heat Risks for a WRN
Updates and Impact-Based Verification



20th Annual CPASW
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Developing a Modern Heat Service

Leverage Peer Reviewed Heat-Health Science consistently:

- Acclimation of heat important
- Communities adapt and build to local climate
- Everyone has differing heat tolerance
- Duration and time of year matter

Incorporate nationally consistent CDC expert heat-health model-derived data

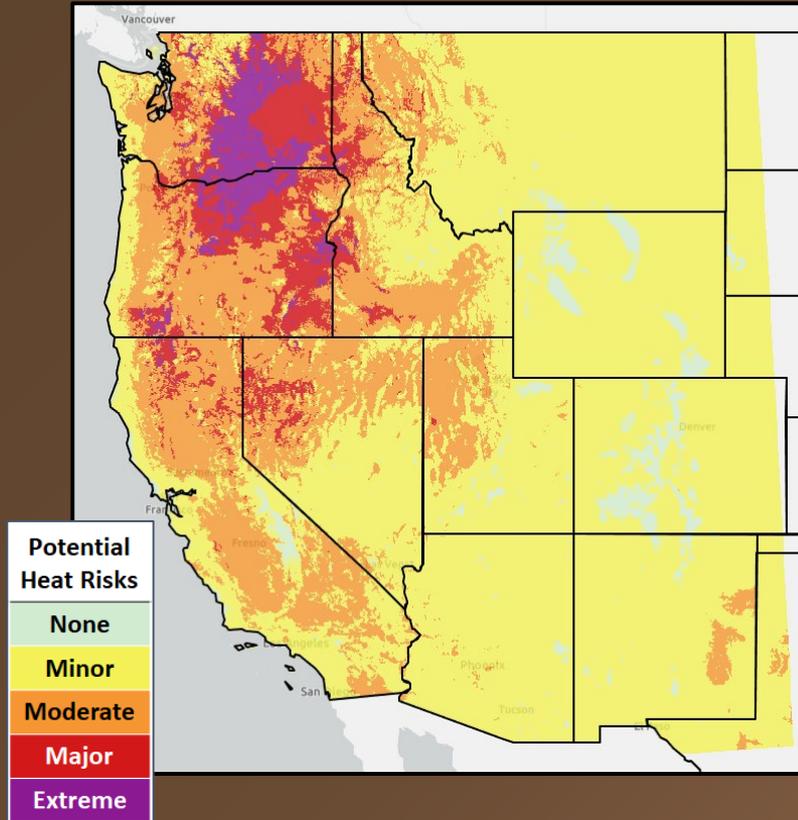
Heat Service should be:

- easy to understand + communicate
- available everyday at all locations
- consistent with the 7-day NWS forecast
- automated





HeatRisk



Gives customers/partners a **color/numeric-based framework** to act when they need to.

Builds **consistency and science** into our messaging efforts & legacy products.

Puts NWS forecast temperatures into a **climatological context** based on location & time of year.

v2.0 leverages 1991-2020 Normals and **CDC collaboration**.

Expansion Nationally in 2023.

HeatRisk Levels



Extreme (4)

Rare long duration and/or extreme event, extreme risk of widespread heat-related impacts (including illness and mortality) for anyone without effective cooling and/or hydration. Temps above 95th percentile for 2+ days and/or near all-time records.

Major (3)

Major risk of widespread heat-related impacts (including illness and mortality) for anyone without effective cooling and/or hydration.

Excessively warm day and nights (generally above 95th percentile).

Moderate (2)

Moderate risk of heat-related impacts, **mostly in “at risk” populations** without effective cooling and/or hydration, primarily heat-related illness. Non-zero, but low, risk of heat-related mortality expected. “Hot” during the day, “warm” at night to general population in normally cooler climates.

Minor (1)

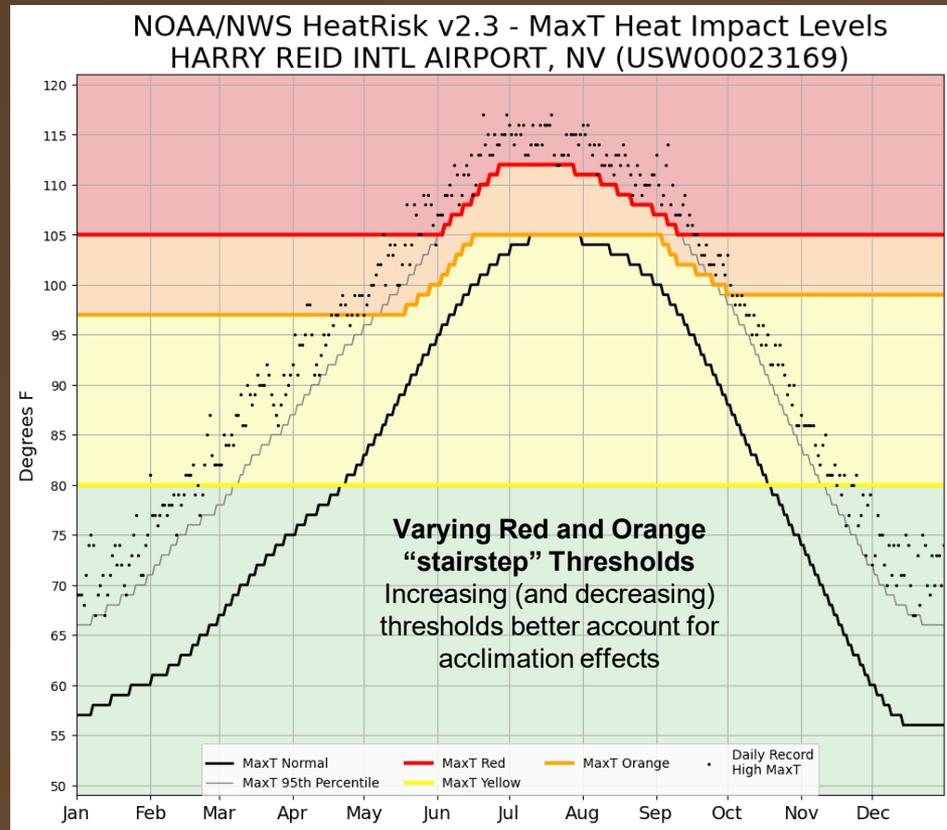
Minor risk in “at risk” populations. Minor spike in heat illness. Non-zero, but very low, risk of mortality expected.

None (0) Little to no risk from expected heat.





HeatRisk - How It Works



High (Red) Threshold

Based on temperature associated with 50th percentile of CDC heat-attributable deaths. Where applicable, increases when 95th POR temperature percentile is intersected.

Moderate (Orange) Threshold

Permutations of the Red and Yellow values, taking into account the time of year (Spring vs Fall) and CDC data, along with capping at the Red base value (where applicable) to better account for less acclimation in heat-sensitive groups.

Low (Yellow) Threshold

Based on CDC Minimum Mortality Temperature; nearly all heat-attributable deaths occur above this.

Daily Records (POR)

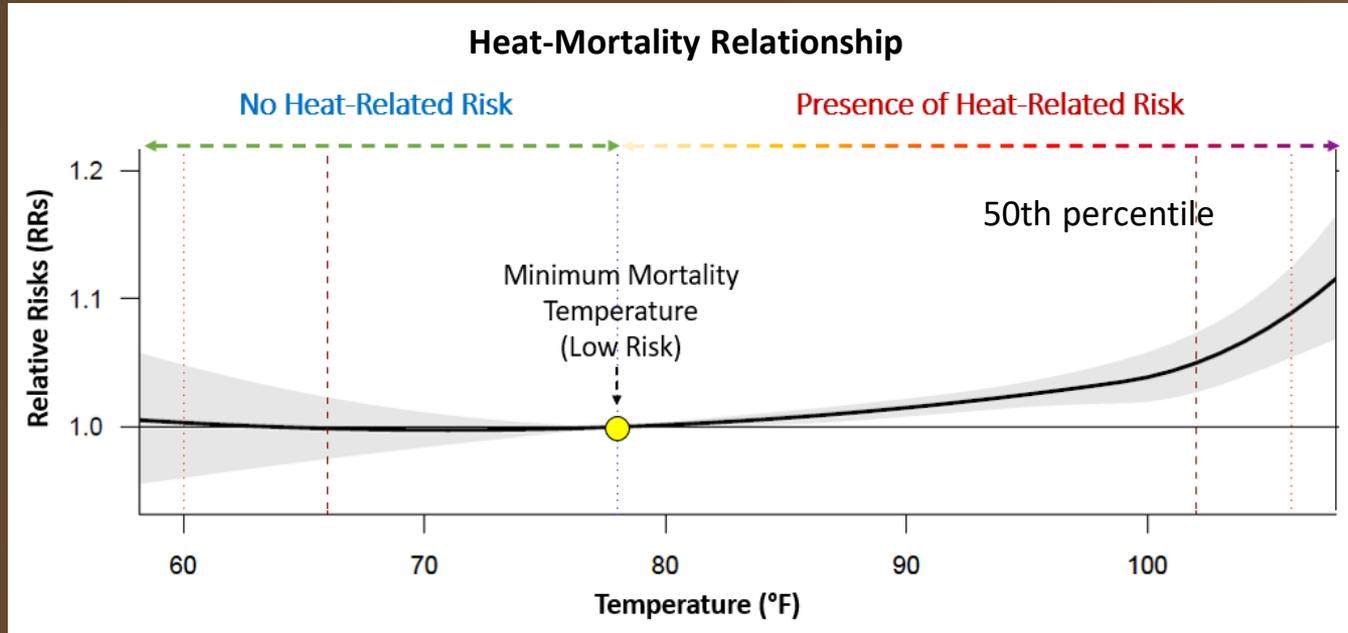
95th Percentile (POR)

NCEI 1991-2020 Normals

Thresholds for MinT are also generated and used



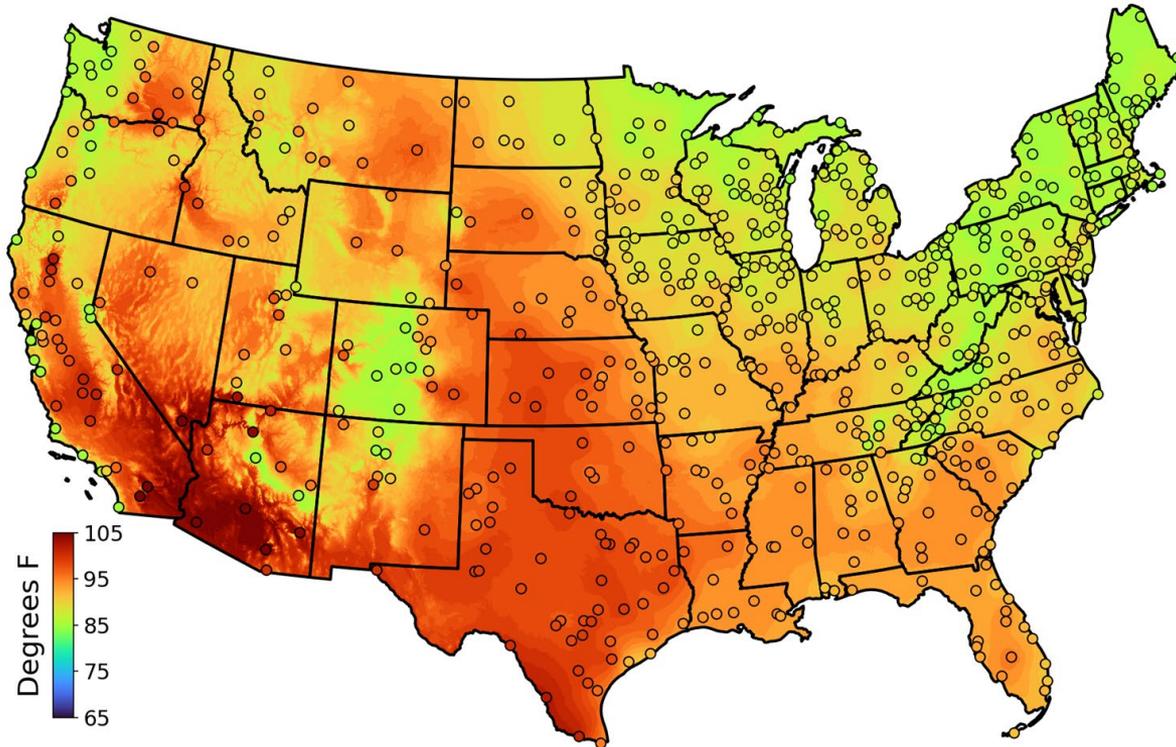
HeatRisk - How It Works



Minimum mortality temperature: The temperature value at which effect of cold is not observed and the effect of heat starts to increase. (Source: CDC)

HeatRisk - How It Works

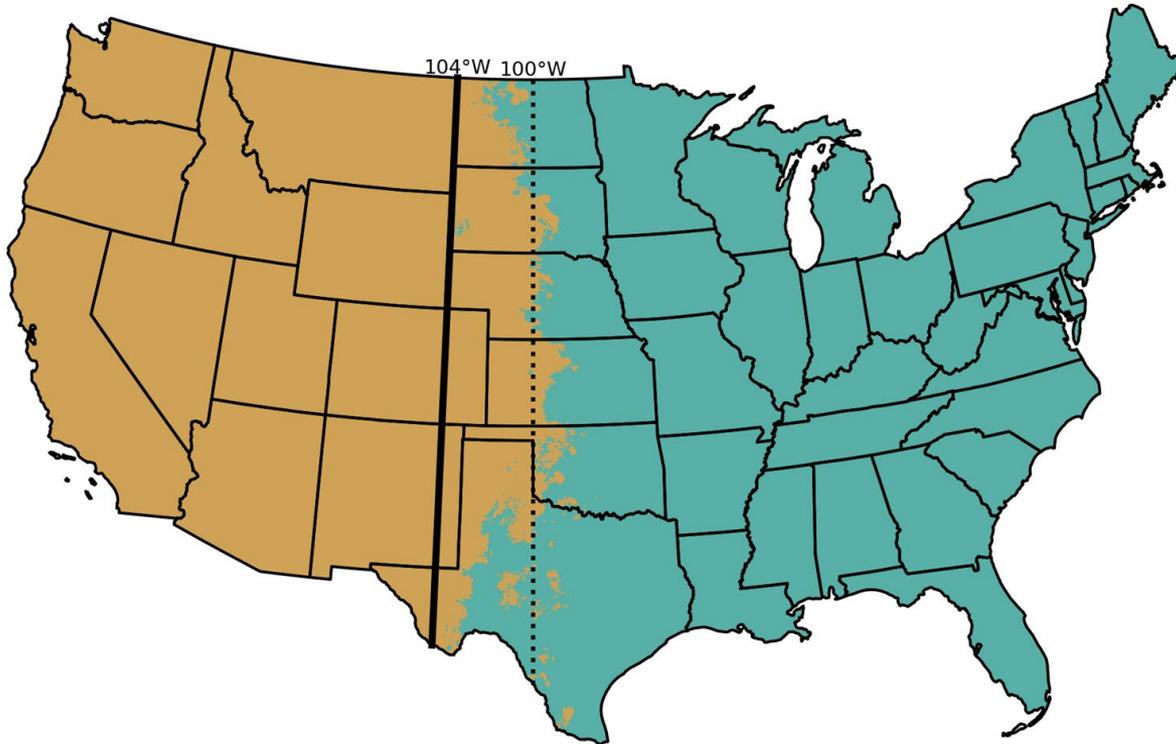
HeatRisk v2 - Red MaxT Base Threshold



Map of the Red maximum temperature threshold across the US based on CDC-derived data for ~700 stations.

Accounting for Humidity

HeatRisk v2 - Diurnal Range Modifier



Locations with “humid” climates exhibit **smaller annual ranges in diurnal values** (highest daily maximum normal temperature minus the highest daily minimum normal temperature).

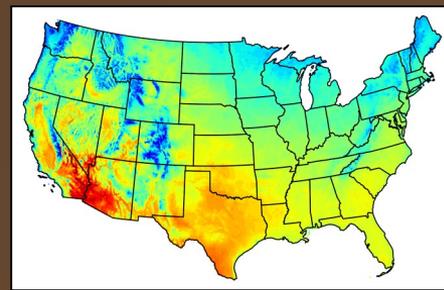
HeatRisk algorithms give **greater influence to minimum temperatures** where this range is less than 26°F and east of 104°W (green areas).



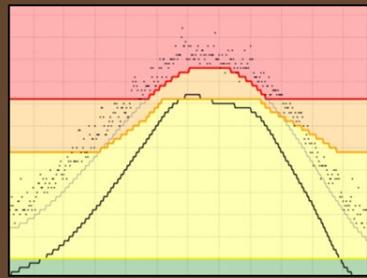
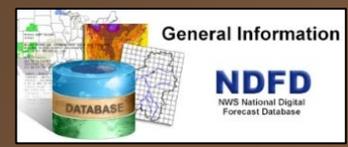
HeatRisk - How It Works



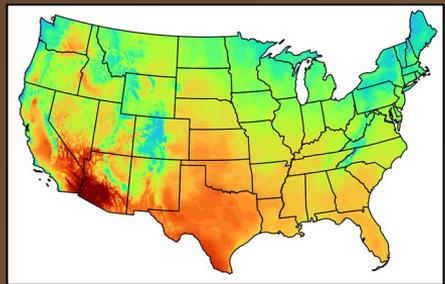
~3500 Stations



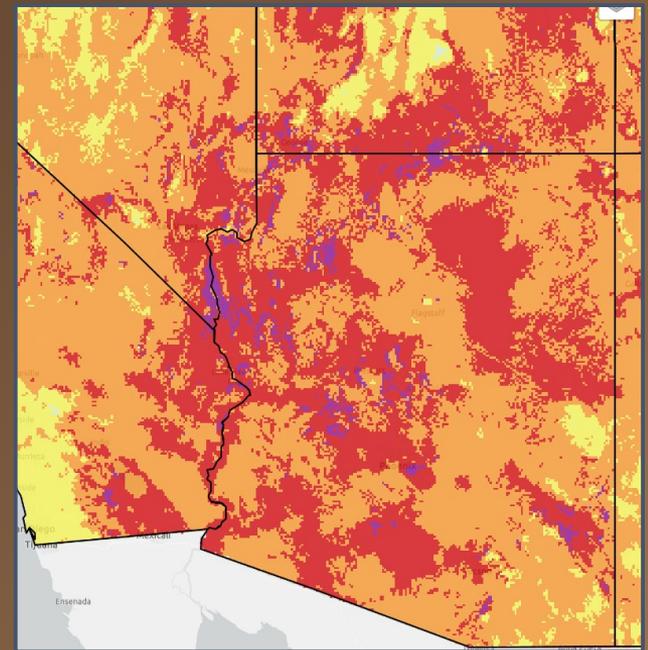
OSU PRISM Normals



Climate & ~700 CDC Point Thresholds



Gridded Thresholds



Algorithms

Accounts for how unusual heat is for that time of year, duration of heat of both daytime and nighttime temps, and if those temps are at levels that pose an elevated risk based on CDC data influenced thresholds and climatology



HeatRisk Web Service (WR)

National Weather Service
National Oceanic and Atmospheric Administration

Bookmark Download **KML** Graphics Survey

NWS HeatRisk Prototype

Identifying Potential Heat Risks in the Seven Day Forecast

Sun	Mon	Tue	Wed	Thu	Fri	Sat
4/9	4/10	4/11	4/12	4/13	4/14	4/15

Click map for potential heat risks and NWS forecast for a location.

The NWS HeatRisk Prototype is a color-numeric-based index that provides a forecast risk of heat-related impacts to occur over a 24-hour period. HeatRisk takes into consideration:

- How unusual the heat is for the time of the year
- The duration of the heat including both daytime and nighttime temperatures
- If those temperatures pose an elevated risk of heat-related impacts based on data from the CDC

This index is supplementary to official NWS heat products and is meant to provide risk guidance for those decision makers and heat-sensitive populations who need to take actions at levels that may be below current NWS heat product levels.

Category	Risk of Heat-Related Impacts
Green 0	Little to no risk from expected heat.
Yellow 1	Minor - This level of heat affects primarily those individuals extremely sensitive to heat, especially when outdoors without effective cooling and/or adequate hydration.
Orange 2	Moderate - This level of heat affects most individuals sensitive to heat, especially those without effective cooling and/or adequate hydration. Impacts possible in some health systems and in heat-sensitive industries.
Red 3	Major - This level of heat affects anyone without effective cooling and/or adequate hydration. Impacts likely in some health systems, heat-sensitive industries and infrastructure.
Magenta 4	Extreme - This level of rare and/or long-duration extreme heat with little to no overnight relief affects anyone without effective cooling and/or adequate hydration. Impacts likely in most health systems, heat-sensitive industries and infrastructure.

Map Overview What's in HeatRisk? Understanding HeatRisk CDC-NWS Collaboration Verification Looking for Resources?

Valid: Sun Apr 9

100% 0-Little to None 1-Minor 2-Moderate 3-Major 4-Extreme

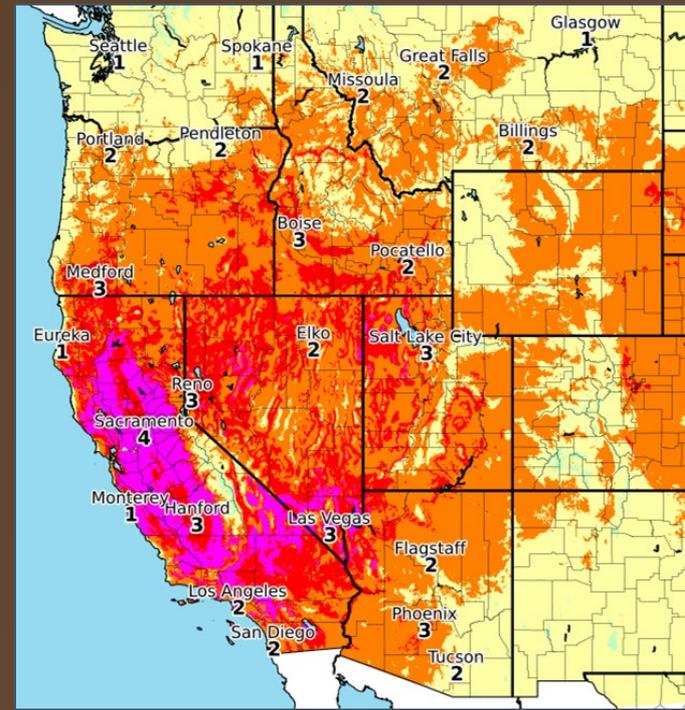
Leaflet | Powered by Esri | Loma Linda University, Port of Los Angeles, UC Riverside, Agua Caliente Band of Indians, City of Buckeye, Arizona, Cl...

Real-time HeatRisk output available online for NWS Western Region.

Available information includes daily interactive maps with active WWA and social vulnerability layers, point-based forecasts, overview of HeatRisk including a definition of each level, static images, KML and GeoTIFF files, and an API.



Legacy Products



For a Weather-Ready Nation, we strive to provide risk-oriented and actionable heat-related information to a wide spectrum of users.

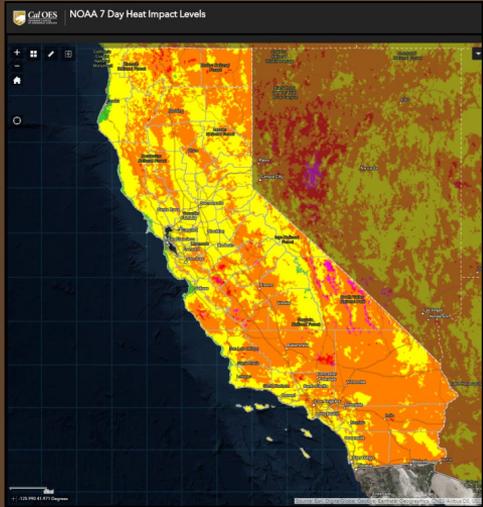
While HeatRisk provides the framework for a continuum of heat services, we recognize that there is still a place for legacy WWA products. The internal HeatRisk process (GFE) provides information to assist forecasters in making alerting decisions.

This is truly Decision Support Services at all facets and levels.

Example of HeatRisk (left) and NWS heat alerts (right) during a significant heat event in Sep 2022. Displayed alerts include Excessive Heat Watches (maroon), Excessive Heat Warnings (magenta), and Heat Advisories (orange). Note the general connection between high/very high HeatRisk levels and alerts.



Partner Usage



Heat Alert

asthealth.gov Health and Wellness for All Arizonans

Excessive Heat Warning Issued for 13 Counties

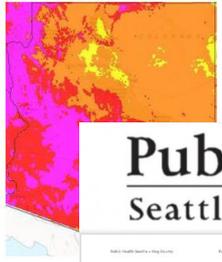
National Weather Service has issued an Excessive Heat Warning for:

- Gila, La Paz, Maricopa, Pinal, Yuma Counties** from 10 a.m. on June 17 to 8 p.m. on June 22;
- Graham, Greenlee, Pima Counties** from 11 a.m. on June 17 to 7 p.m. on June 22;
- Coconino and Yavapai Counties** from 10 a.m. on June 17 to 8 p.m. on June 21;
- Mohave County** from 11 a.m. on June 17 to 11 p.m. on June 22;
- Santa Cruz County** from 11 a.m. on June 18 to 7 p.m. on June 22;
- Cochise County** from 11 a.m. on June 19 to 7 p.m. on June 22.

Daytime highs are expected to be in the **110 to 120 degrees Fahrenheit range**. Residents are advised to stay cool, stay hydrated, and stay informed.

Precautions to prevent heat exhaustion or heat stroke:

- Stay in air-conditioned buildings.
- Limit outdoor activity during the hottest part of the day (mid-day).
- Check on at-risk friends, family, and neighbors at least twice a day.
- Drink water before, during, and after working or exercising outside.



Click [here](#) to learn more

Maricopa County Multi-Jurisdictional Hazard Mitigation Plan

2021

abc 15 Desert Doppler MOST ACCURATE FORECAST

VALLEY HEAT RISK

LOW MODERATE HIGH VERY HIGH

SENSITIVE AT RISK MOST PEOPLE AT RISK EVERYONE AT RISK

VERY SENSITIVE AT RISK NONE

Public Health Seattle & King County

Heat Risk Category	Heat Risk Description	Recommended Public Health Response
Very High	High risk for heat-related illness and death. Daytime temperatures are expected to reach 110°F or higher.	<ul style="list-style-type: none"> Issue an Excessive Heat Warning. Encourage people to stay indoors in air-conditioned buildings. Encourage people to avoid strenuous outdoor activities. Encourage people to drink plenty of water. Check on at-risk individuals.
High	High risk for heat-related illness. Daytime temperatures are expected to reach 105°F or higher.	<ul style="list-style-type: none"> Issue a Heat Advisory. Encourage people to stay indoors in air-conditioned buildings. Encourage people to avoid strenuous outdoor activities. Encourage people to drink plenty of water. Check on at-risk individuals.
Moderate	Some risk for heat-related illness. Daytime temperatures are expected to reach 100°F or higher.	<ul style="list-style-type: none"> Encourage people to stay indoors in air-conditioned buildings. Encourage people to avoid strenuous outdoor activities. Encourage people to drink plenty of water. Check on at-risk individuals.
Low	Low risk for heat-related illness. Daytime temperatures are expected to reach 95°F or higher.	<ul style="list-style-type: none"> Encourage people to drink plenty of water. Check on at-risk individuals.

Public Health Seattle & King County

Public Health Recommendations

ADVISE EARLY MORNING PUBLIC MEASUREMENT AND RESPONSE ACTIVITIES

- Encourage people to measure their own heat risk.
- Encourage people to check on at-risk individuals.
- Encourage people to avoid strenuous outdoor activities.
- Encourage people to drink plenty of water.

RECOMMEND ACTIVATION OF LOCAL CENTERS AND RESOURCES IN OVERHEAT SITUATIONS

- Encourage people to visit local centers for cooling and hydration.
- Encourage people to visit local centers for medical attention.
- Encourage people to visit local centers for social support.

RECOMMEND CANCELLATION OF OUTDOOR EVENTS AND ACTIVITIES

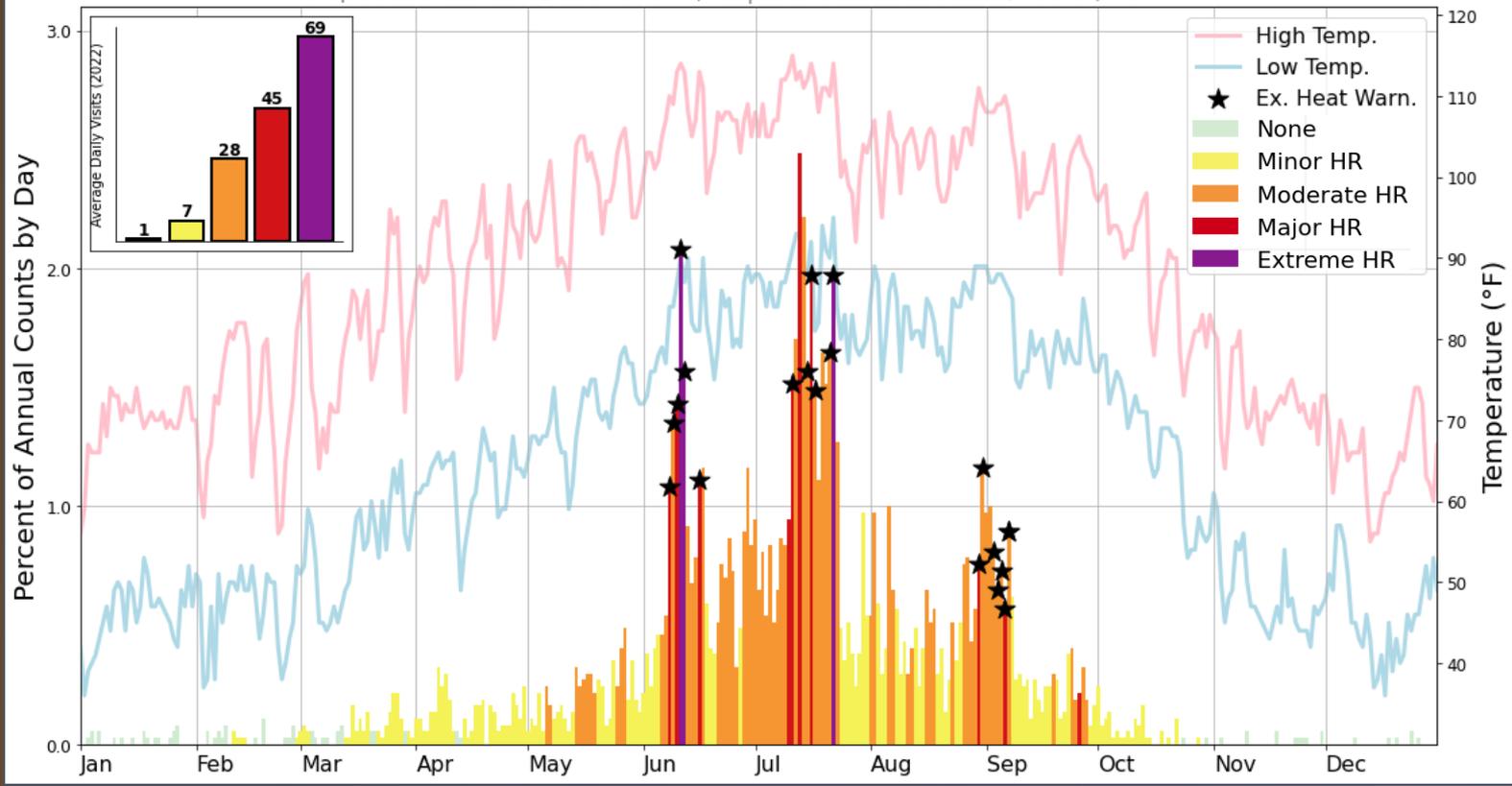
- Encourage people to cancel or postpone outdoor events.
- Encourage people to cancel or postpone outdoor activities.



Verification Examples

Maricopa County Syndromic Heat Illness Counts (2022)

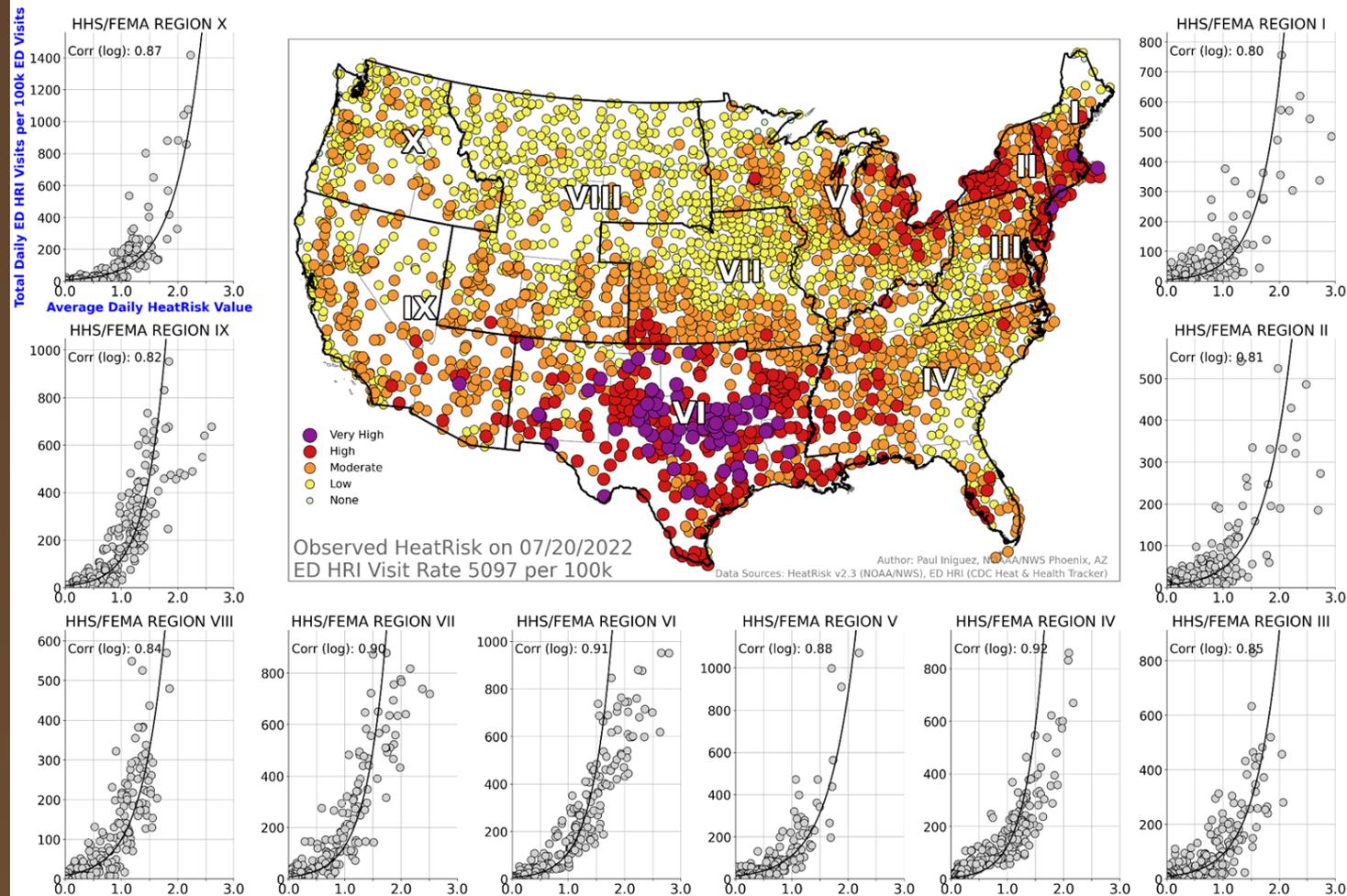
Graphic Source: NOAA/NWS Phoenix, AZ | Data Source: ESSENCE/MCDPH, NOAA





Analysis of Daily HeatRisk Values and Emergency Department Heat-Related Injury Visits for Apr 01, 2022 through Oct 31, 2022

Comparing regional observed HeatRisk values (FEMA regions) against emergency dept. (ED) heat-related illness (HRI) for much of the 2022 heat season finds a **strong** correlation (0.80-0.92).





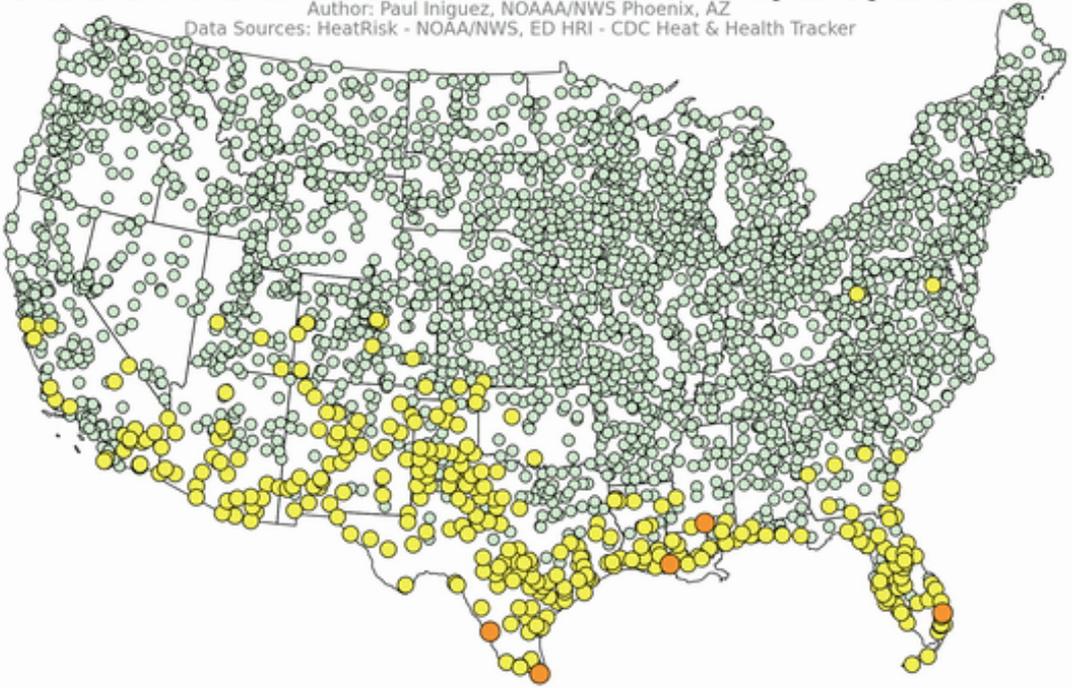
PROTOTYPE

HeatRisk v2

Observed HeatRisk on 04/16/2022

Author: Paul Iniguez, NOAA/NWS Phoenix, AZ

Data Sources: HeatRisk - NOAA/NWS, ED HRI - CDC Heat & Health Tracker



Next Steps

- Combining HeatRisk directly with CDC Social Vulnerability Index
- Point-based Probabilistic HeatRisk Service

THANK YOU!

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