Extreme Heat

in the Intermountain Southwest

In late June and early July, 2013, a heat wave settled over the Intermountain Southwest, breaking temperature records in some cities and inducing deaths and damages across the region. The 2013 heat wave killed several people in Las Vegas and Phoenix, knocked out power in Las Vegas, caused the buckling of an Interstate 215 highway on-ramp in Salt Lake City, caused flight cancellations at Sky Harbor International Airport in Phoenix, and taxed emergency rooms at regional hospitals as concert-goers, homeless people, and others were treated for dehydration and heat-related illnesses.

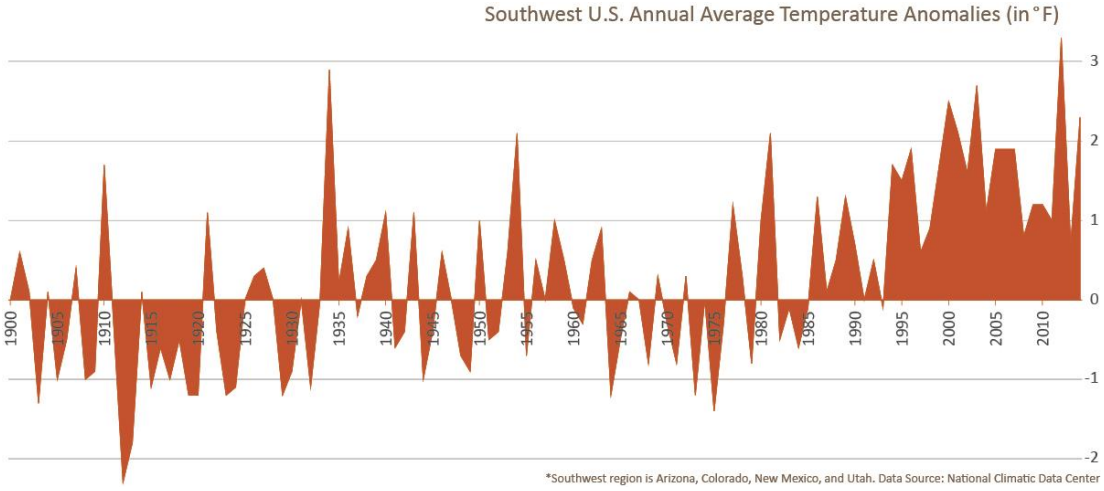
It may be hard to believe that high temperatures—a weather phenomenon that seems benign in comparison to tornadoes or hurricanes—could inflict such severe hurt on our region, but "heat stress is the leading weather-related cause of death in the United States"[1]. According to weather records, fewer cold waves and more heat waves have occurred over the Southwest during 2001-2010 compared to their average occurrences[2]. In addition, as the population of the Southwest grows, many more people are exposed to extreme heat, and land use changes—paving and building—have increased the chances of high temperatures occurring in the Intermountain Southwest's urban areas.

KEY MESSAGES:

- Extreme heat has killed hundreds of people across the region and caused countless illnesses.
- Increasing temperatures have led to more heat waves and higher nighttime temperatures.
- A rapidly growing population has exposed more people to heat-related risks and increased the urban heat island effect
- As temperatures increase, *all* Southwest cities will need to plan for the risks associated with extreme heat episodes.

TEMPERATURE TRENDS

In the Southwest, regional annual average temperatures have increased by more than 1.5°F during the last 110 years, with some cities registering annual average maximum temperature increases of more than 5°F[2]. The combination of regional temperature increases with heat wave events, which are amplified by heat-trapping urban heat islands, poses risks to public health and safety. Beating future heat, which is often elevated during the drought episodes to which the region is prone, will require creative solutions and active outreach to at-risk populations, including tourists.



[1] Brown, H. E., A. C. Comrie, D. M. Drechsler, C. M. Barker, R. Basu, T. Brown, A. Gershunov, A. M. Kilpatrick, W. K. Reisen, and D. M. Ruddell. 2013. "Human Health." In *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment*, edited by G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy. Washington, DC: Island Press, pp. 312–339. http://www.swcarr.arizona.edu/chapter/15

[2] Hoerling, M. P., M. Dettinger, K. Wolter, J. Lukas, J. Eischeid, R. Nemani, B. Liebman, and K. E. Kunkel. 2013. "Present Weather and Climate: Evolving Conditions." In *Assessment of Climate Change in the Southwest United States: A Report Prepared for the National Climate Assessment*, edited by G. Garfin, A. Jardine, R. Merideth, M. Black, and S. LeRoy. Washington, DC: Island Press, pp. 74-100. http://www.swcarr.arizona.edu/chapter/5

Acknowledgements: Funding by Urban Sustainability Directors Network. Narrative created by The University of Arizona and the Western Adaptation Alliance.

URBAN HEAT ISLANDS

Several Intermountain Southwest cities generate *urban heat islands*. The urban heat island (UHI) effect describes the way in which urban and metropolitan areas amplify temperatures, due to the heat-absorbing properties of the built environment. As open land is replaced with pavement and buildings—which are more effective at absorbing and storing heat than vegetated landscapes and soils—the built environment heats up, relative to surrounding areas. The UHI effect is particularly notable overnight, when building materials release heat much more slowly than the vegetated natural environment.

The UHI effect can generate negative impacts, particularly during the warm season. Urban managers are concerned about the UHI effect because (a) the amplified temperatures increase energy demand, as urban residents turn on their fans, evaporative coolers, and air conditioners for extended periods of time, thus increasing the risk of blackouts and brownouts, (b) increased energy use generates more air pollution, and (c) hot pavement and other surfaces transfer heat to stormwater, which, when draining into streams, ponds, and lakes, raises water temperatures in aquatic ecosystems. Both planners and public health officials are concerned about the UHI effect because it can contribute to increased illnesses and deaths. In addition, extreme heat can raise urban air pollution levels, further increasing public health risk.

TACKLING URBAN EXTREME HEAT

Western Adaptation Alliance (WAA) cities are working to prepare for the ongoing challenges of extreme heat, heat wave episodes, and the urban heat island. WAA cities are increasingly proactive in working with public health officials to identify at-risk populations, and are implementing the strategy of providing public cooling shelters, as has been successful in El Paso.

Tucson, in collaboration with its chief electric power provider, has engaged in an extensive tree-planting campaign. Desert adapted trees provide the multiple benefits of providing shade, reducing the urban heat island (UHI) effect, adding to the value of homes and businesses, and making the city more attractive. The City's plan focuses on shade priority areas, which previous development had rendered barren of vegetative shade canopy, and thus prone to amplifying heat.

The general and sustainability plans of Phoenix and Tucson aim to reduce the UHI through explicit policies (e.g., designing public spaces for shade and cooling), and through examples of sustainable building strategies. The Phoenix strategy uses best practices to create a connected oasis that accommodates relief from heat during the "thermally challenging" times of year.

The City of Las Vegas Office of Sustainability 2010 UHI summary report promotes multiple strategies to reduce the UHI effect, such as the use of cool paving and cool roofing materials, and an Urban Forestry Initiative (adopted by the City in 2008).

The El Paso Extreme Weather Task Force (EWTF), an alliance of civic agencies, aims to increase public awareness of extreme weather, and in particular extreme heat. To prepare for extreme heat, the city makes public service announcements that include the locations of designated cool zones, information for citizens to obtain free electric fans, and tips for preventing heat-related illnesses. The EWTF fan donation and distribution program has proven to be useful in combatting the impacts of extreme heat.

THE ROAD AHEAD

Extreme heat and heat waves will continue to be a regular occurrence in the Southwest U.S. and a concern for the region's urban areas. Many WAA cities, especially those at lower elevations, have long experience with extreme heat, and have successfully implemented measures to reduce impacts. Challenges on the road ahead include an increasing population exposed to rising regional temperatures combined with the UHI effect. Intermountain Southwest cities will need to plan accordingly for the risks associated with episodes of extreme heat and prolonged heat waves—including increased energy and water demand, damage to roads, and an array of public health impacts. Cities not accustomed to such extreme temperatures could learn from measures already taken by hotter cities, in their attempts to prepare for the future. With the occurrence of heat waves and the expansion of the region's urban areas on the rise, this is the time to act, for the road ahead is hot, hot, hot!

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