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Urban Heat Island Affects Phoenix All Year-Round

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The monsoon may be the most talked-about weather feature of Phoenix in recent days, but another weather-related phenomenon going on in the Valley is in effect 12 months of the year. It's the urban heat island, or UHI, a phenomenon that makes the Phoenix nighttime low temperatures 10 to 15 degrees Fahrenheit warmer than temperatures in rural areas. The reason for an increasing UHI is the growth of Phoenix as we build out farther and farther into the desert valley.

Urban regions are among the most rapidly changing environments on Earth, and Phoenix is the fastest-growing large (more than 2 million people) metropolitan area in the U.S. As a result, the warming rate for Phoenix is one of the fastest urban-warming rates in the world for its population.

The UHI effect is caused by changes in the thermal properties, moisture, and aerodynamic character of the "built" environment. These changes create a distinct urban boundary layer, or heat dome. This heat dome extends vertically above the city and, in windy conditions, can be located downwind as a plume.

The UHI typically occurs after sundown as large heat absorption by cement, asphalt, and other materials during the day is slowly released back into the atmosphere. High evening temperatures caused by urbanization account for most of the differences in the urban-vs.-rural warming rates.

Special circumstances in desert cities alter the character of the UHI, both in general and its character throughout the day. For example, the highest daytime temperatures in our region often occur in the natural desert rural areas. There is a slight mitigation of daytime temperatures in the urban center and xeriscaped residential areas due to evaporation of surface water, shading, and heat-absorption rate into the built surfaces. Heavily irrigated residential areas are coolest, due both to evaporating surface water and the shading effect of trees. The agricultural areas have the highest surface moisture, but without shading of the surface, the temperatures sometimes may be higher than in the residential areas.

The situation at night is different from the day. At night, the surface temperature decreases as heat is radiated away from the surface. Often, the most dramatic difference is seen in the desert areas where cooling is faster. Within the built urban area, radiation trapping by the buildings and the large heat stored in these features during the day inhibit cooling, and this results in the urban area being warmer than the surrounding areas at night.

Temperatures in the urban core are the highest, with the residential areas being somewhat cooler and open areas being coolest. In residential areas, the density of housing, even spacing of vegetation may act to curtail rapid cooling to the nighttime sky.

These higher temperatures affect those who live in cities in many ways, influencing their health and comfort, energy costs, air quality and visibility levels, water availability and quality, ecological services, recreation and overall quality of life. Urban warming also is occurring at a time when global warming affects our region.

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