

WHAT IS IT?

As urban areas develop and vegetation is replaced with buildings, roads, and other heat-absorbing infrastructure, the ambient urban air temperatures increase.

Essentially, cities become “heat islands” surrounded by significantly cooler, rural areas. This often overlooked environmental issue is exacerbated during the warm summer months.

Before all the stoplights, parking lots and high rises, trees provided shade and, along with other vegetation, released water into the atmosphere that evaporated and cooled the ground and surrounding air. Surfaces that were once permeable and moist are now impermeable and dry.

According to the U.S. Environmental Protection Agency (EPA), the sun can heat up dry, exposed urban surfaces such as pavements to temperatures 50–90°F hotter than the air. Meanwhile, shaded and moist surfaces remain close to air temperatures. In downtown areas, some North American cities are up to 9°F warmer than surrounding suburban and rural areas.

Moreover, the urban heat island effect doesn’t let up at night. The slow release of heat from urban infrastructure keeps the heat on even after sunset. In fact, temperatures after sunset can be as much as 22°F warmer in urban areas than the surrounding area.

Why is it important?

The EPA estimates that if current heat island trends continue, cities will be 10°F warmer by 2050.

As temperatures rise, cooling demands and electrical consumption increase proportionately. **EPA-supported research indicates that 5 to 10 percent of current electricity demand is used to compensate for the heat island effect alone.** The increased demand adds pressure to the electrical grid during peak periods.

Additionally, elevated temperatures from urban heat islands can affect a community’s environment. Due to the increased energy usage, there are greater emissions of air pollutants and greenhouse gas emissions.

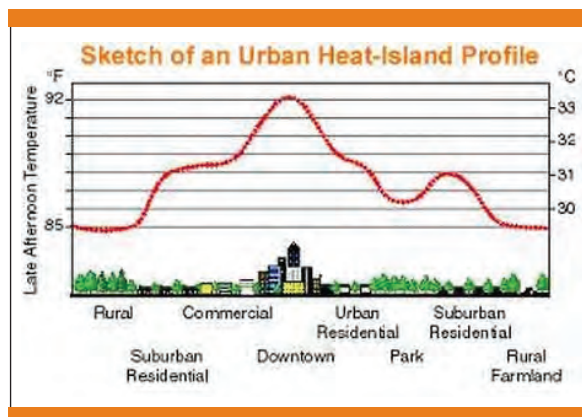


Image Credit:
Lawrence Berkeley
National Laboratory

HEAT ISLAND



The urban heat island effect also contributes to smog by promoting the formation of ground-level ozone. Research from the Lawrence Berkeley National Laboratory indicates that **the probability of smog formation increased 5% for every 0.5°F rise in daily maximum temperatures above 70°F.**

The issue also affects health and comfort among citizens. Common ailments include respiratory difficulties, heat cramps and exhaustion, non-fatal heat stroke, and even heat-related mortality.

Concrete Solutions

Concrete pavement is considered a cool pavement because it reflects more solar energy than dark pavement surfaces.

Combined with other mitigation techniques such as tree planting, concrete pavements can help cut individual home energy bills by \$100 to \$200 per year.

Concrete has a higher solar reflectance or albedo that minimizes the urban heat island effect. A perfect absorber (black) has an albedo of 0, and a perfect reflector (white) has an albedo of 1. New concrete typically has an albedo of 0.35 to 0.40. New asphalt pavement albedo ranges from 0.05 to 0.20.

With the incorporation of slag or white cement, a concrete pavement can exhibit albedo readings as high as 0.70.

Hot pavement and rooftop surfaces transfer their excess heat to stormwater, which raises water temperatures as it is released into streams, rivers, ponds, and lakes. Rapid temperature changes can be stressful to aquatic ecosystems.

Light colored pavements reduce the initial warming of stormwater runoff, while the use of pervious concrete pavements for areas such as parking lots reduces the amount of surface water discharge by absorbing stormwater.

Although the urban heat island effect is prevalent in many cities, intensities vary from community to community because of climate, topography and the degree and pattern of urbanization in a given geographic area. Not surprisingly, the potential benefits that can be gained from urban heat island mitigation also depend on local conditions.



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