

# What have we learned about Urban Heat Island Effect



TERRALOGOS  
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## What is the Urban Heat Island Effect?

Air temperatures are warmer above most cities and intensively paved areas such as shopping malls and airports, compared to less developed areas. This temperature increase is called the Urban Heat Island Effect, and is primarily attributed to impervious surfaces such as rooftops, paving, concrete and brick. Impervious surfaces both absorb and reflect the sun's radiant energy. As a result, cities are noticeably hotter and have poorer air quality, especially in the summer.

Energy is reflected by light colored materials, and is trapped in the atmosphere above cities. This contributes to smog, entrapment of greenhouse gases and increases in allergens, molds and dust in the warm, polluted air. Darker surfaces such as asphalt paving, brick walls and tar roofs absorb the energy from the sun. On a sunny day, roof and pavement temperatures can be 27° to 50° hotter than the surrounding air, so the phrase, "It's hot enough to fry an egg!" might well be true. This radiant solar energy is released as heat throughout the day and well into the night.

Over less developed suburban or rural areas, or even large city parks, air temperatures are cooler and ground conditions more moist and temperate. Plant materials and trees absorb the solar energy through photosynthesis for growth and transpiration. Average land surface temperatures typically change by 1.8 to 5.4 deg F as one moves away from the city center. At night however, the temperature difference may change by as much as 22 deg.<sup>1</sup>

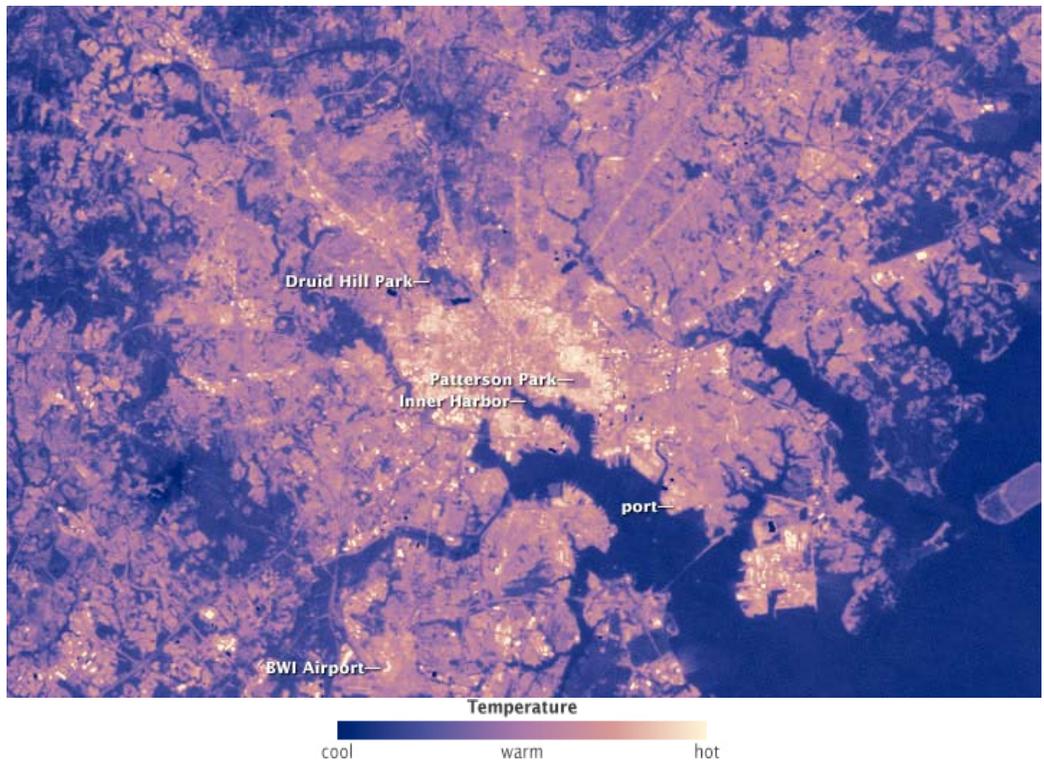


Photo: NASA Earth Observatory

Elevated temperatures created by the Heat Island Effect, particularly in the summer, generate many negative impacts:

- Poor air quality is caused by trapped greenhouse gas emissions, smog (ground level ozone) and increased general air pollution in urban environments.
- Compromised human health is evident by increases in asthma, breathing problems and allergic reactions from the air pollutants. Warmer air holds more moisture and gunk.
- Hotter cities require more air conditioning in turn, increasing energy demand and use. More fossil fuels are burned to generate electricity, equipment wears out faster and the cooling systems throw off significant heat on their own.
- Impaired water quality occurs as stormwater runs over hot pavement, warming as it picks up pollutants. Warmer stormwater then gets dumped into area streams, drinking water supplies and fisheries such as the Chesapeake Bay, disrupting aquatic life and eco systems.



# Urban Heat Island Effect

## Strategies for reducing Urban Heat Island Effect



- Plant trees along streets, in schoolyards and in parks. The increased city tree canopy shades pavement and buildings, maintaining cooler air temperatures;
- Install green roofs.

Left: Chicago City Hall, Green Roof. Completed in 2001 as the City of Chicago's Department of Environment's green roof pilot project, the rooftop garden was designed to explore heating and cooling benefits, the planting of native and non-native species and reductions in rainwater runoff. Monitoring over the first summer indicated that there was a roof surface temperature reduction of 70° and an air temperature reduction of 15°.ii



- Install or replace asphalt roofs with light-colored or white "cool roofs." More radiant energy is reflected, rather than absorbed into the roof's surface, so the building stays cool. This saves energy in the summer.

Left: The new cool roof at Evergreen Elementary school compared to a more typical residential, asphalt roof.



- Reduce impervious paving, and use lighter, more reflective paving materials. Shade paving areas with trees or structures that can also hold Solar PV panels.

Left: Dark, traditional asphalt, compared to lighter concrete, reflective pavement.



- Create larger, more connected open "green spaces."

Left: Patterson Park, Baltimore MD  
Photo by: Friends of Patterson Park  
An expanse of green in the city offers a cooling respite.



# LEED Fire Station Design

## Benefits of Reducing the Urban Heat Island Effect

Taking steps to mitigate and reduce the Urban Heat Island Effect has many cascading benefits:

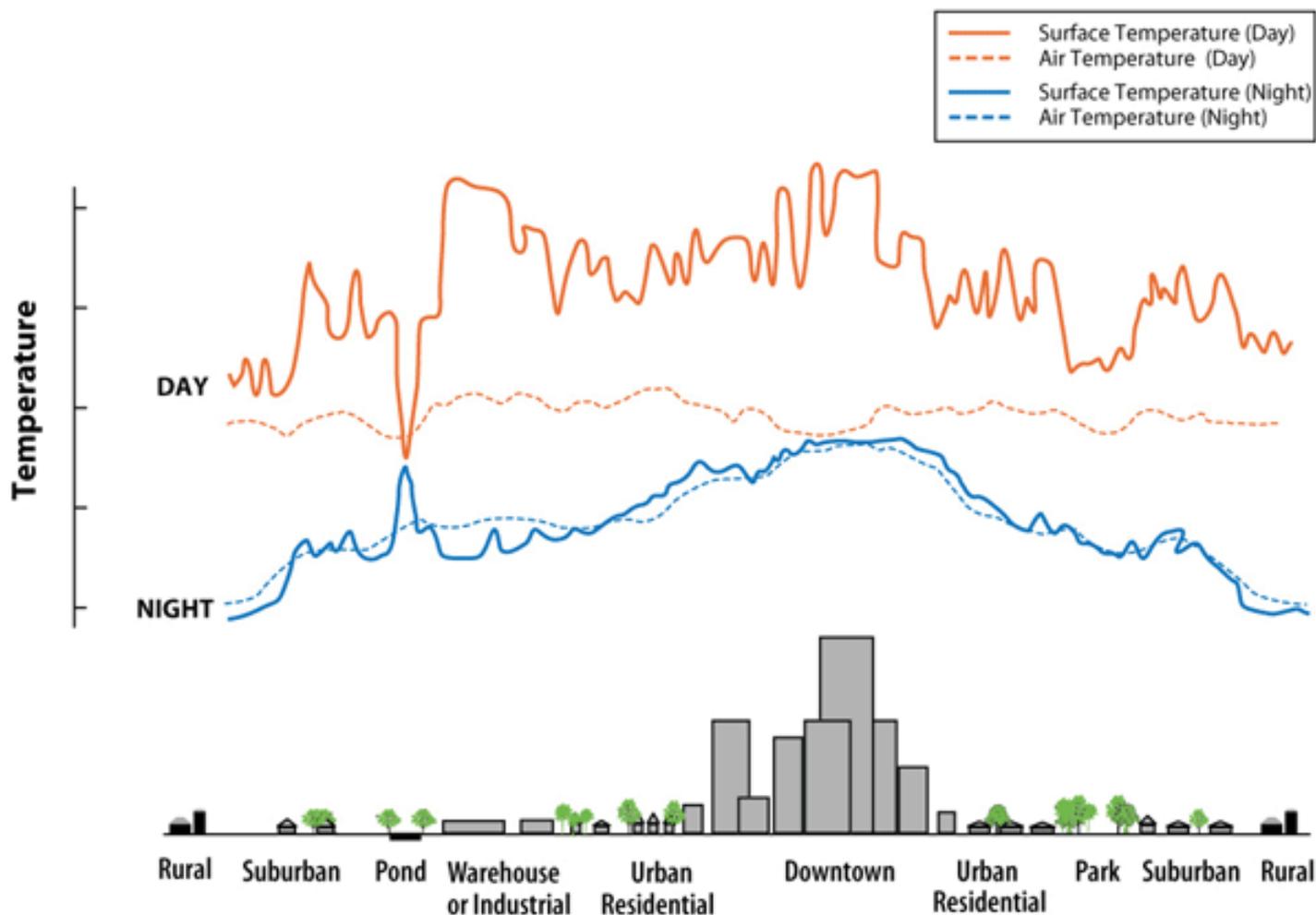
Cooler cities

- Healthier urban areas
- Reduced energy use
- Cleaner air and water

But it takes thought and a group effort to make a difference. In 2008, TerraLogos: eco architecture, in association with CCJM Engineering Solutions and ATI Architects, was awarded the contract to develop the new Baltimore City Green Building Standards (*Standards*). The *Standards* are

based on the USGBC® LEED 2009 rating system, but are adapted and highly customized for Baltimore City’s unique development concerns. The *Standards* meets the requirements of the City’s Green Building Ordinance, passed in 2007. Buildings designed and constructed in accordance with the *Standards* will help to mitigate the Heat Island Effect.

For more information on the *Standards* and our process feel free to contact us at [office@terralogos.com](mailto:office@terralogos.com), and put “Request information on the Standards” in the subject



EPA: Heat Island Effect <http://www.epa.gov/hiri/about/index.htm>

<sup>i</sup> EPA, <http://www.epa.gov/hiri/about/index.htm>.

<sup>ii</sup> American Society of Landscape Architects. <http://www.asla.org/meetings/awards/awds02/chicagocityhall.html>