Keeping Your Cool

How Communities Can Reduce the Heat Island Effect

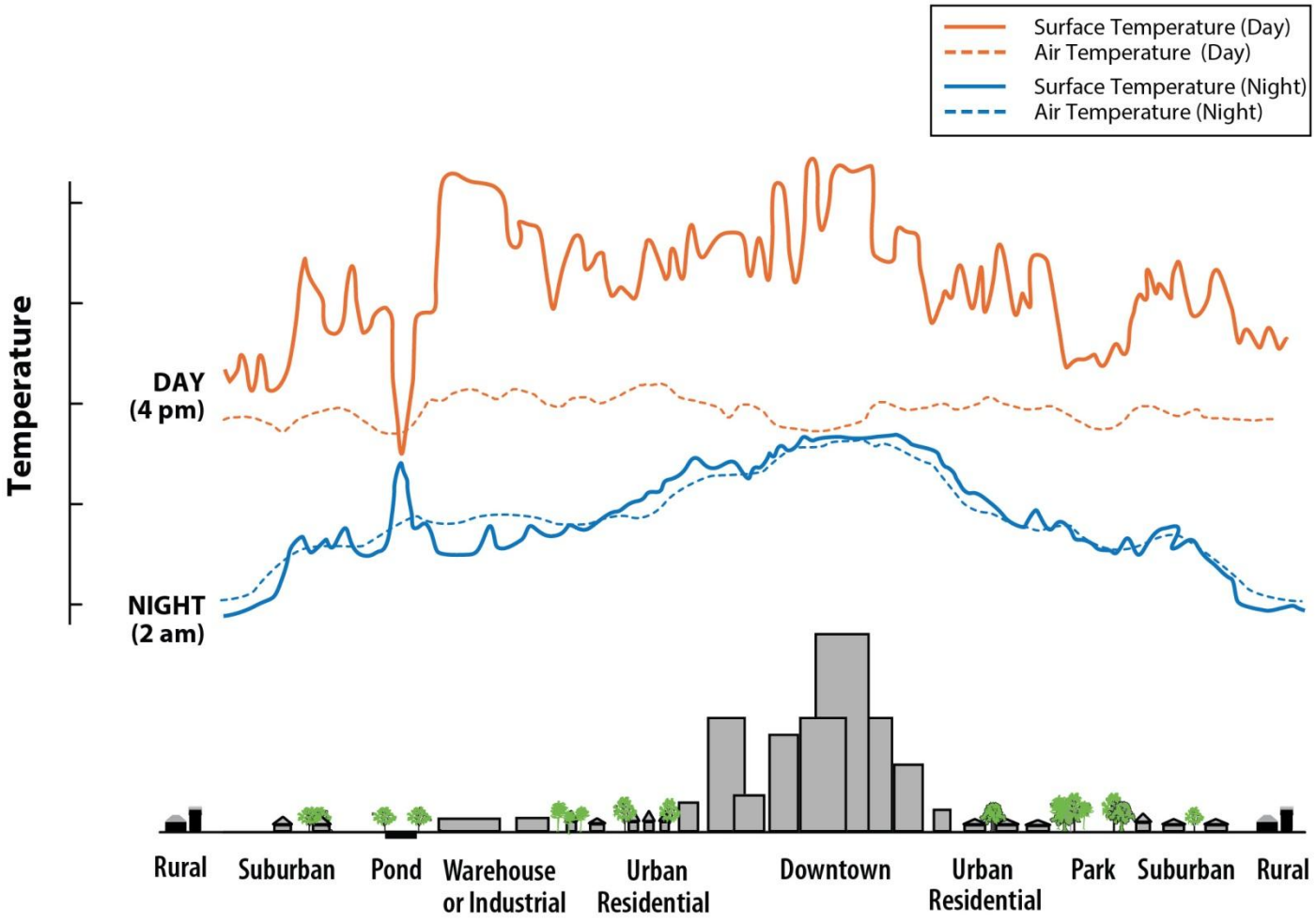
Millions of people living in and around cities experience summertime temperatures that are higher than those in surrounding natural areas. These urban "heat islands" increase energy demand for air conditioning, raise air pollution levels, and can cause heat-related illness and death. As temperatures continue to rise due to climate change, urban areas are more likely to experience more frequent, more intense, and longer heat waves. Fortunately, there are proven actions that communities can take today to keep cool in the future.

The Basics: What Is a Heat Island?

Heat islands are zones of relative warmth created by urban air and surface temperatures that are higher than those of nearby rural areas. Air temperatures in a large city can be 2–22° F (1–12° C) higher than its rural surroundings.

The sketch below shows a hypothetical city's heat island profile at two times during a 24-hour period, demonstrating how temperatures typically rise during both the day and night as you move from rural areas toward dense downtown areas.

Typical Heat Island Temperature Differences Between Urban and Rural Areas



What Causes Heat Islands?

Heat islands form when cities replace natural land cover—trees, grass, wetlands—with pavement and buildings. These changes lead to higher urban temperatures because:

- Removing trees and vegetation eliminates the natural cooling effects of shade and evaporation of water from soil and leaves.
- Pavement, rooftops, and other non-reflective surfaces absorb heat during the day and release it at night, inflating overnight temperatures.
- Tall buildings and narrow streets reduce wind flow and heat air that is trapped between them.
- Waste heat from vehicles, factories, and air conditioners add warmth to the air, further increasing the heat island effect.

Heat islands are also influenced by a city's geography and prevailing weather conditions. For example, strong winds and rain can flush out hot, stagnant air from city centers, while sunny, windless conditions can intensify heat islands.

How Do Heat Islands Affect Us?

Higher temperatures affect people's health, air and water quality, and the amount of energy that we use for summertime cooling.

People's Health: Heat islands can intensify extreme hot weather, which can cause breathing problems, heat cramps, and heat stroke, and may lead to illness or even death—especially in vulnerable populations such as the elderly.

Air Quality: Heat islands raise energy demand to power air conditioning, which in turn can increase utility bills and increase power plant emissions of carbon pollution that causes climate change. Higher temperatures also accelerate the chemical reaction that produces ground-level ozone, or smog.

Water Quality: Hot pavements heat up stormwater runoff, which can hurt aquatic life in local waterways.

Energy Use: Heat islands are responsible for 5–10 percent of summertime electricity demand, leading to higher electricity bills, pressure on the electricity grid, and brownouts and blackouts.

How Can Communities Cool Down?

Communities that want to cool down have options. They include installing reflective **cool roofs**; planting **trees and vegetation,** including "**green" roofs**; and using **cool paving materials** for roads, sidewalks, and parking lots.

"Urban canyon" photo courtesy of Frederick V. Slocum, Minnesota State University

Four Strategies to Reduce Heat Islands

1 Green Roofs replace heat-absorbing traditional roofing materials surfaces with plants, shrubs, and small trees.

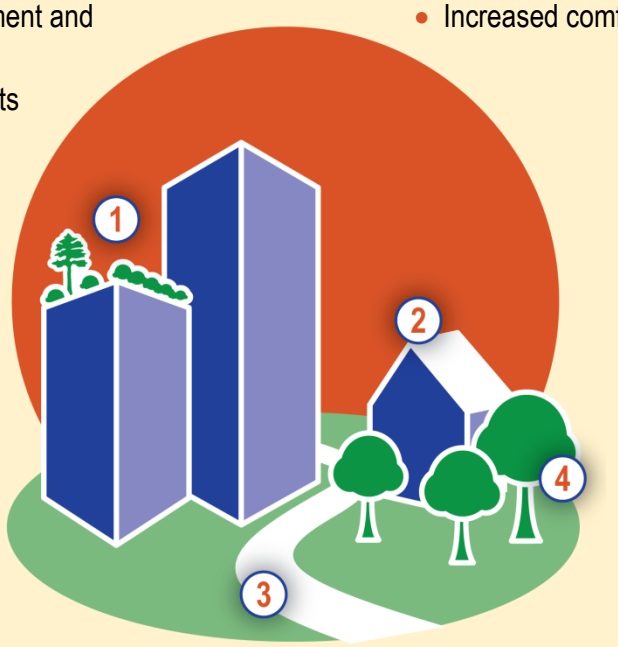
BENEFITS:

- Lower energy bills and energy demand
- Less air pollution
- Better stormwater management and water quality
- Aesthetic and habitat benefits

2 Cool Roofs reflect or release the sun's solar energy rather than retain it, are typically 50–60° F (28–33° C) cooler than traditional roofs.

BENEFITS:

- Lower energy bills and energy demand
- Less air pollution
- Increased comfort of occupants



3 Cool Pavements store less heat and reflect more solar radiation than conventional pavements. They may be permeable or porous to allow water to percolate and evaporate, cooling the pavement surface and surrounding air.

BENEFITS:

- Reflective pavements can improve nighttime visibility
- Permeable pavements can reduce stormwater runoff and tire noise, and can improve safety during rainstorms

4 Trees and Vegetation provide shade and cool the air through evapotranspiration.

BENEFITS:

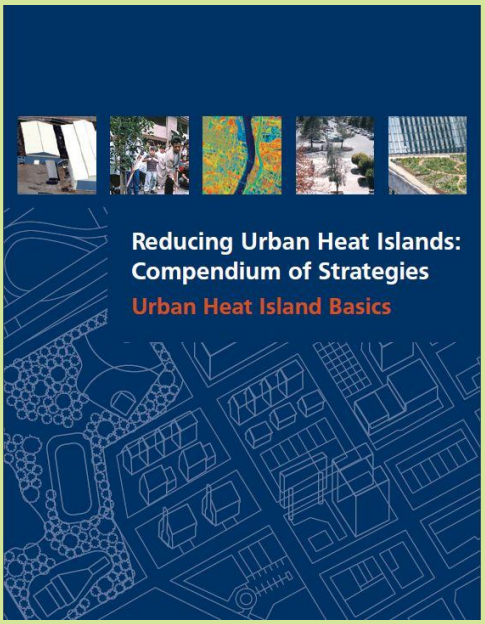
- More green space
- Better stormwater management
- Less air pollution and erosion
- Lower energy bills and energy demand

What Are the Benefits of Cooling Down?

Implementing cooling strategies across a community has many benefits, including reducing summertime temperatures, lowering energy use and costs, curbing air pollution, and alleviating heat-related health issues.

By adding these strategies to long-term local and regional planning, communities can also prepare for or adjust to higher temperatures and changing conditions that come with climate change. For instance, planting trees helps prevent flooding while also lowering local temperatures.

Photo courtesy of American Society of Landscape Architects, ENERGY STAR partner, 2014



Learn more about these strategies in EPA's *Reducing Urban Heat Islands: Compendium of Strategies*, available at: **http://epa.gov/heatisland/resources/compendium.htm.**

About EPA's Heat Island Reduction Program

Through its Heat Island Reduction Program, EPA works with local officials, community groups, researchers, and other stakeholders to identify opportunities to implement heat island reduction programs and policies that create comfortable and sustainable communities.

HEAT ISLAND REDUCTION PROGRAM

Learn more at:
epa.gov/heatisland

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