

## Urban Heat Islands

On a hot, sunny day if we wear dark clothes, we feel warm. Dark colors **absorb** more heat than light colors. We experience rising heated air when we walk across a paved parking lot on a sunny, summer day. The heat stored in the pavement warms the air and sends out energy in the form of heat to our bodies. On the other hand, when we sit under a tree, we feel cool. The moisture in trees and the shade they provide cools the area around them.

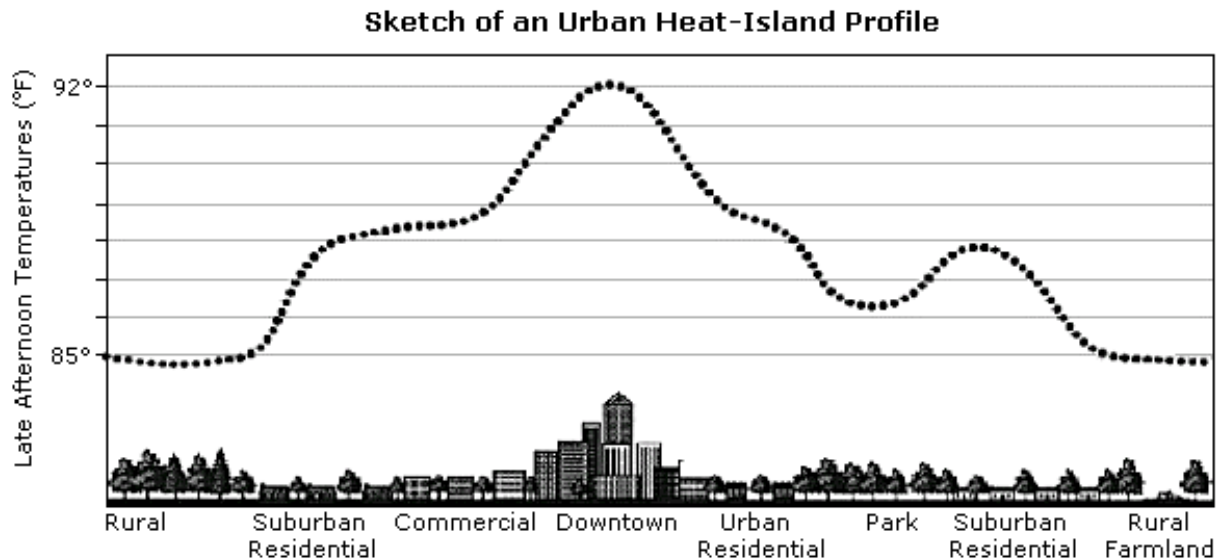
### What is an urban heat island?

Temperatures are not the same across a city area. The amount of vegetation (such as trees and grass) and colors of building materials affect temperatures. **Generally the darker and denser the building materials, the higher the temperatures.** Asphalt in parking lots and on rooftops, in particular, **absorb** heat from the sun's light. This heat is then **released** as infrared light (invisible to our eyes) into the surrounding air.

**Color** is a very important factor in heat gain. Dark colored materials such as asphalt used for building roads and for roofing tiles **absorb** more heat from the sun than materials with lighter colors such as white roofing shingles or cement. Lighter colors **reflect** the rays of the sun back into the atmosphere, and less heat is built up.

When heat builds up in a city, it creates a hot spot compared to the nearby suburban and rural areas. This hot spot is called an **urban heat island**.

On warm summer days, the air in urban areas can be 6-8°F hotter than its surrounding areas. Scientists call these cities "urban heat islands."



The temperature differences shown in the image above are related to how **materials absorb and release heat**. Asphalt absorbs heat from the sun and quickly releases it as heat radiation. For example, temperatures in the Madison Square Mall parking lot during the summer are as high as 48.9°C (120°F) during the day. Tree islands in the lot are only 31.7°C (89°F)—a difference of 17.2°C (31°F)! Nearby wooded areas are as low as 29.4°C (85°F).

## Reducing Urban Heat Island Effects

There are things that communities can do to reduce the impacts of urban heat islands. These **heat island reduction strategies** include:

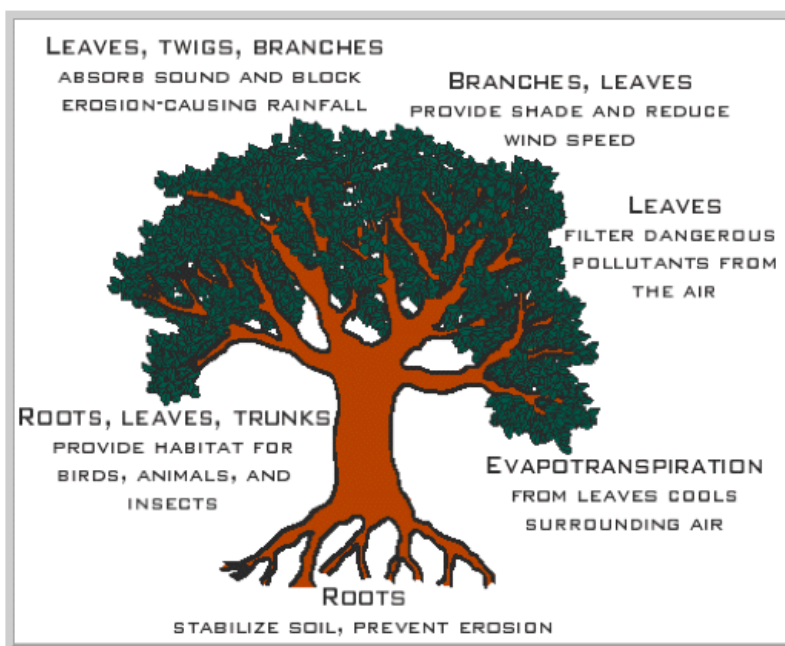
- **Planting trees and vegetation;**
- **Installing cool or vegetated green roofs; and**
- **Switching to cool paving materials.**

### Reducing Heat Island Effects with Trees and Vegetation

Increasing the cover of trees and vegetation in a city is a simple and effective way to reduce the urban heat island effect. Trees, shrubs, and other plants shade buildings, intercept solar radiation, and cool the air by **evapotranspiration**.

**Evapotranspiration** occurs when plants secrete or **transpire** water through pores in their leaves. In a way, plants sweat like people do. Trees have a large water content and release water into the atmosphere to keep cool. A mature tree with a treetop of 30 feet can “*evapotranspire*” up to 40 gallons of water a day. This is similar to removing all the heat produced in four hours by a small electric space heater.

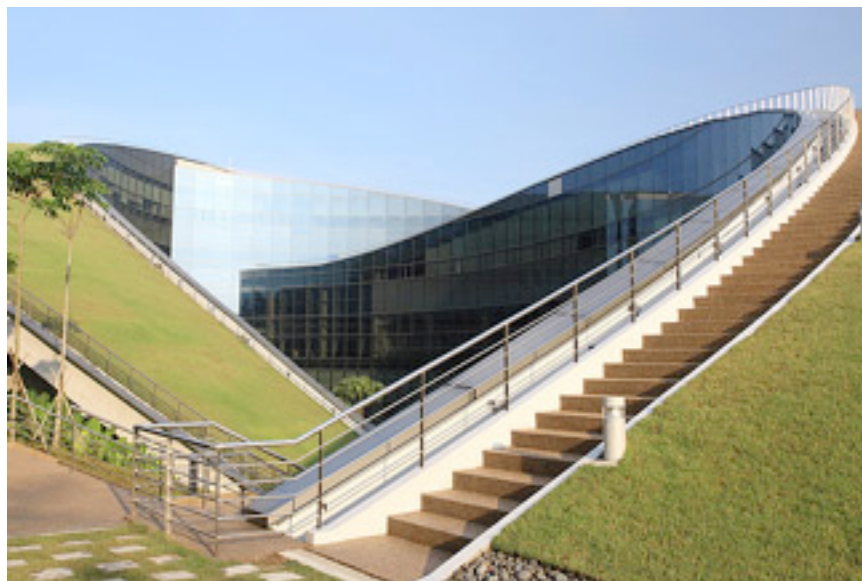
Compared to other surfaces found in cities, trees absorb a lot of the incoming heat and release it over a longer period of time. Further, trees also benefit the environment in a number of other ways as described in the image below.



## Reducing Heat Island Effects with Roofs

On a hot, sunny, summer day, traditional roofing materials may reach summertime peak temperatures of up to 190°F (88°C). By comparison, **cool roofs** only reach peak temperatures of 120°F (49°C).

The term "**cool roof**" is used to describe roofing material that has **high solar reflectance**. These materials **reflect** a large portion of the sun's energy. Cool roofs also may have a **high thermal emittance** and release a large percentage of absorbed heat. This keeps the material cooler and helps to reduce the heat island effect.



Another alternative to traditional roofing materials is a rooftop garden or "**green roof**." Green roofs replace heat-absorbing surfaces with plants, shrubs, and small trees that cool the air through **evapotranspiration**.

Planted rooftops remain significantly cooler than a rooftop constructed from traditional heat-absorbing materials. Further, **green roofs** reduce summertime air conditioning demand by lowering **heat gain** (the amount of heat introduced to a space from all heat producing sources) to a building.



## Reducing Heat Island Effects with Paving Materials

**Cool paving materials reduce the absorption of solar heat** and later transfer of this heat to the surroundings.

There are two types of cool paving materials: **lighter-colored materials** and **porous materials**.

Lighter-colored materials have **higher solar reflectance**, so they **absorb less of the sun's energy** and stay cooler. Lighter-colored materials come in shades of white, beige, light gray and terra cotta.



**Porous** (or **permeable**) pavements allow water to filter into the ground, keeping the pavement cool when moist. Permeable pavements can be constructed from a number of materials including concrete and asphalt, filled with soil, gravel, and grass.