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THE URBAN HEAT ISLAND

In urban areas, buildings and paved surfaces have gradually replaced pre-existing natural landscapes. As a result, solar energy is absorbed by roofs, roads, and paved surfaces. This causes the temperature of the urban areas to become higher than the surrounding temperature. Hence, when the surfaces throughout an entire community or city become hotter, the overall temperature of that community increases. This phenomenon is known as the **Urban Heat Island.** Due to this heat island effect, cities and urban areas are said to be 2 to 10 degrees Fahrenheit (1 to 6 degrees Celsius) warmer than the surrounding natural cover.

Temperature differences between cities and rural areas are most extreme in cold climates. The major cause of this temperature change is the difference in surface materials in cities and rural areas. Additionally, some secondary factors include heat loss from buildings, and heat generation through car usage and concentration of people. The greatest surface change occurs in the centre of the city where fewer trees and natural open spaces exist. These areas are called Central Business Districts (CBDs) and can have up to 100% of solid impervious surfaces.

Physical characteristics of surface materials like colour, type, structure, composition, and most importantly, the solar reflectance (popularly known as Albedo), determine the ability of the surface to absorb and release heat. Concrete, asphalt, brick, and wood-materials commonly used in urban areas-absorb heat very quickly during the day. In contrast, grasses and trees, widespread in rural areas, absorb heat very slowly. As a result, urban built surfaces lose their heat quickly while vegetative surfaces lose theirs slowly. This effect raises the temperature of the city at night while parks and countryside remain cool. An interesting point to emphasize is that vegetation not only modifies the local climate, it also absorbs pollution particulate matter.

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Here are some of the additional causes[1] and effects of the Urban Heat Island:

- In rural areas, the solar energy absorbed by vegetation evaporates surface/ground water resulting in a cooling effect.
- The greater water runoff in cities, caused by largely non-porous surfaces (i.e. pavement), results in less evaporative cooling.
- Waste heat from cars, building, and people contributes to higher temperatures in cities.
- The structure of the city enhances warming as solar energy is trapped by multiple reflections off tall and closely packed buildings.
- Winds are also a factor in the temperature difference between cities and the surrounding areas.
- Cloudiness and precipitation in the city may be increased by the Urban Heat Island.

Elevated temperatures can affect cities in a number of ways:

- During summers, increasing peak energy demand
- Increasing power-plant emissions of harmful pollutants
- Increasing air conditioning costs
- Accelerating chemical reactions that produce ground-level ozone or smog
- Increasing heat-related illness and mortality

Mitigation of the Heat Island Effect:

- Increased vegetation in the city (including planting trees and creating living walls)
- Applying storm water management practices that encourage the preservation of natural environments
- Installing green roofs on city buildings (including offices and condos)
- Incorporating the Urban Heat Island effect into city planning especially when considering which materials to use for construction in urban centres

[1] For more information on the Heat Island Effect, please see the EPA website at http://www.epa.gov/hiri/index.htm