

Urban heat island

America's population, which according to the 2010 census now exceeds 308 million, has never before lived in such dense, developed communities. The connectivity fostered by dense living has important social, economic, and environmental benefits. For example, in metropolises, more people opt to walk or use public transportation than own a car, which reduces fuel consumption and emissions. (The Brookings Institution, a Washington D.C.-based research firm, reports that in 2005, the average New York metropoli-

tan resident emitted only 1.495 tons of carbon into the atmosphere from highway- and residential-energy use, compared to 2.6 tons of carbon emitted by the average American.)

However, dense living has serious implications, some of which have been outlined in **black** in the adjacent illustration.

84% of the American population now lives in a metropolis as defined by the U.S. Office of Management and Budget, which currently recognizes 366 metropolises nationwide. The Brookings Institution breaks these areas into five regions based on population density.



EXURBS

EMERGING SUBURBS

MATURE SUBURBS

The isolated bubble of warm air created around a metropolis, also known as an urban heat island, can cause a host of problems. One solution to help dissipate urban heat islands is integrating cool roofs on homes and buildings. Other ways to help remedy the problems associated with heat islands are highlighted to the right in **blue**. Author Linda Reeder surveys the latest cool-roof materials on pp. 48-52 of this issue and explores some of their other residential benefits. To get the most out of that article, however, it's important to understand what an urban heat island is, whom it affects, and how it works.

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As sprawl increases and neighborhoods become denser, natural vegetation is replaced with dry, impermeable houses, driveways, and roads, and the cooling qualities of the natural landscape are lost.

Dark, dense building materials tend to retain more heat than do light-colored materials or natural vegetation and lead to sustained higher temperatures.

Building materials like black-asphalt shingles, driveways, and roads absorb more heat and reflect less energy from the sun than lighter-colored alternatives.

Trees and plants help to cool the atmosphere by emitting moisture into the air through a process known as evapotranspiration. Trees provide shade, and plants and soil help to retain moisture that keeps surface temperatures low.

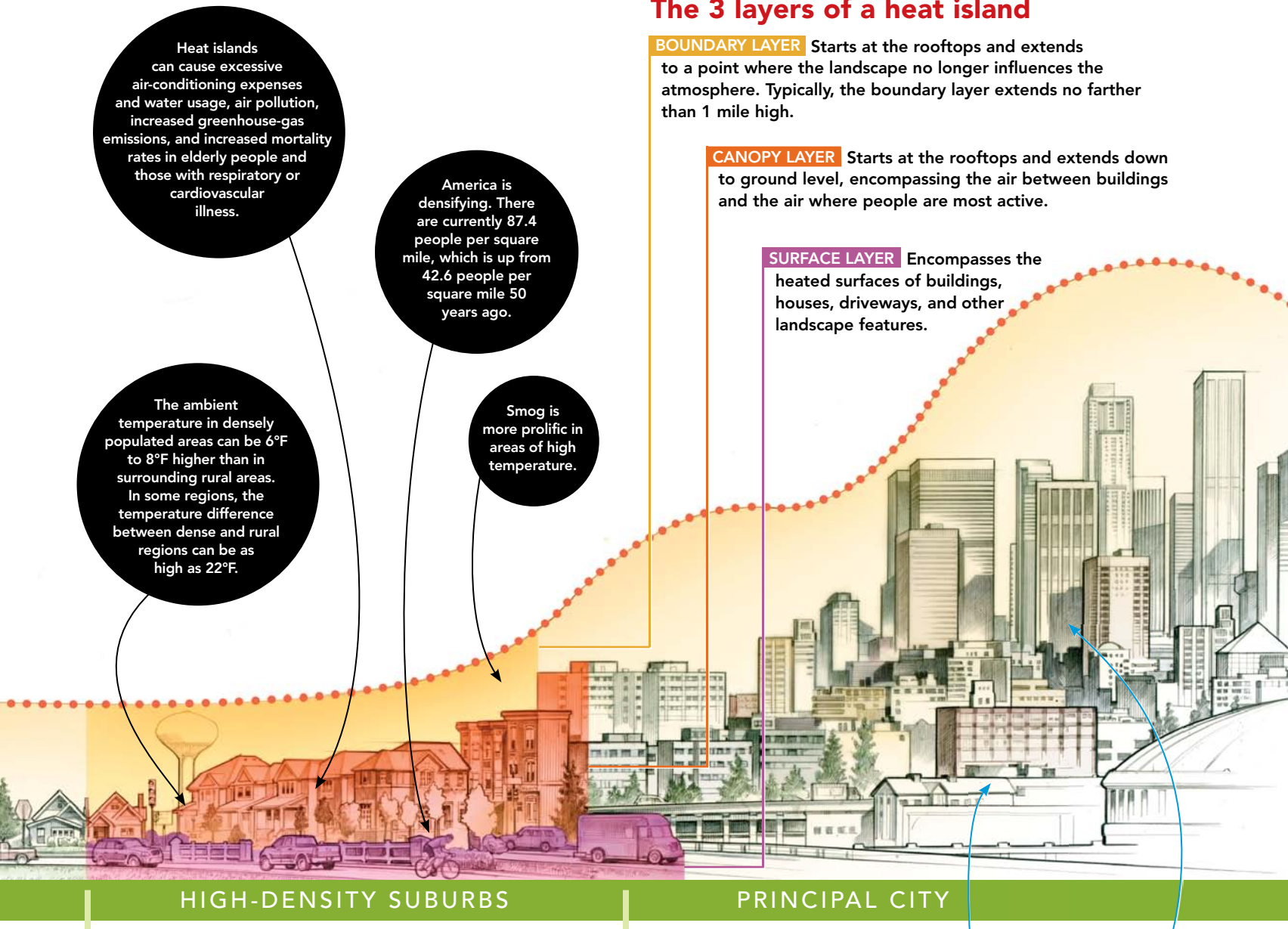
To help restore natural cooling processes, make driveways, patios, and landscapes as permeable and vegetated as possible. Plant trees if you have the room, and consider the benefits of adding a vegetative or cool roof to your home.

The 3 layers of a heat island

BOUNDARY LAYER Starts at the rooftops and extends to a point where the landscape no longer influences the atmosphere. Typically, the boundary layer extends no farther than 1 mile high.

CANOPY LAYER Starts at the rooftops and extends down to ground level, encompassing the air between buildings and the air where people are most active.

SURFACE LAYER Encompasses the heated surfaces of buildings, houses, driveways, and other landscape features.



Cooling a populated region like Los Angeles by roughly 5°F over a 15-year period can reduce levels of smog by roughly 12%. The temperature decrease also could save about \$100 million in annual electricity costs.

Daytime surface temperatures of highly reflective white building materials can be up to 70°F cooler than those of black building materials, which helps to cool the air.



Native landscapes. Whether they're placed in your yard or on your roof, drought-tolerant plants help to minimize the effects of an urban heat island by providing moisture and by reflecting the sun's energy.



Reflective roofs. To help cool your neighborhood, increase the solar reflectivity of your house with a cool roof (see p. 48), especially if your current roof is due for replacement.



Permeable paving. Impermeable surfaces should be replaced with permeable products that help to keep your lot moist and cool. This driveway is made of Grasspave2 by Invisible Structures Inc.