

# Trees, greenspace and urban cooling

High air temperatures during periods of excessively hot weather can seriously affect human health and well-being. Towns and cities often have higher air temperatures than surrounding rural areas, a phenomenon called the 'urban heat island effect'. Trees and greenspaces can play an important role in reducing the negative impact of the urban heat island effect on urban communities, in addition to providing a wide range of other ecosystem services. To maximise its benefit, the creation and retrofitting of greenspace needs to incorporate strategies that prioritise the tree species that can provide the most cooling. There is also a need to ensure that trees and greenspace are given the conditions they need to achieve their full potential in terms of growth and function. Research into the cooling potential of different species and greenspaces typologies has advanced in recent years. Application of this knowledge can help our cities adapt to the changing climate.

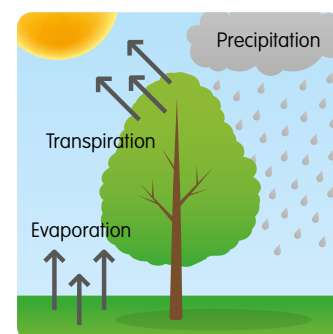
## Why is air temperature a problem in urban areas?

- Towns and cities are made up of a high proportion of built and manufactured surfaces, for example those used in buildings and for pavements and roads. These materials absorb and store much of the solar energy they receive during the day. The energy is then released as heat during the night, warming the surrounding air.
- Cities and towns are often densely populated. The fuel and energy consumed by the inhabitants creates more heat, intensifying warming.
- During heat waves temperatures become elevated and even the night time offers little or no respite. Prolonged high temperatures can impact on human well-being and aggravate a range of health conditions leading to an increase in hospital admissions and deaths. Young children and the elderly are particularly vulnerable.
- High air temperatures can also increase air pollution, further increasing the health risks for those in vulnerable groups.
- Projections show that the UK will experience more intense and more frequent heat waves in the coming decades. Given the time required to plan and establish greenspace and for trees to grow to maturity, greening strategies with the aim of helping to combat the urban heat island need to be implemented now.

## How can trees help to regulate air temperature?

- The process of evapotranspiration uses up heat energy from solar radiation and cools the surrounding air by combining the evaporation of water from soil and other surfaces with transpiration (the process by which trees and plants absorb water through their roots and release it as vapour through their leaves).
- Trees provide shade. Shaded buildings and other manufactured surfaces absorb and store less energy, lowering their capacity to release heat during the night.

Cooling from trees and greenspaces is expected to become more crucial in future decades due to climate change. Strategies to maximise this benefit are required throughout urban planning and greenspace management.



- **Trees reflect sunlight.** Trees and greenspace are typically lighter in colour than built surfaces, which again means they absorb and store less energy.

## What factors affect the cooling benefits of trees?

There are a number of factors to consider when selecting trees and designing new greenspaces to provide cooling benefits. These include the traits of a particular tree species that influence its growth, form and functioning, the characteristics of the greenspace, and the site conditions. Each must be taken into account in the design process to allow trees and greenspace to reach their full cooling potential.

### Tree species characteristics

- **Canopy size and crown density** – a wider canopy and high density of leaves and branches in the crown of the tree will provide more shade.
- **Leaf type and colour** – the ability to reflect solar radiation is normally increased in trees with lighter leaves or leaves with certain characteristics, including hairs or waxy surfaces.
- **Evapotranspiration rate** – the higher the rate, the more cooling a tree will provide.
- **Drought tolerance** – higher tolerance to drought ensures that evapotranspiration will occur for longer.

### Greenspace characteristics

- **Size of the greenspace** – the larger the greenspace, the greater its cooling capacity.
- **Design of the greenspace** – including the shape of the greenspace; choice of trees, shrubs and groundcover; plant arrangement and topography.
- **Distance between greenspaces** – cooling from a greenspace can extend beyond its borders but only up to a certain distance. Greenspaces need to be optimally placed if they are to provide effective cooling to a whole neighbourhood.

### Site conditions

- **Water supply** – an adequate water supply is crucial to ensure evapotranspiration and the long-term health and growth of trees and shrubs. Design strategies such as using sustainable drainage systems can help achieve this.
- **Ground cover** – the use of vegetated groundcover and permeable pavements will allow rainwater to infiltrate the soil.
- **Soil quality** – techniques such as soil profiling, mulching, and the incorporation of organic matter (such as green waste composts) will improve the quality and water-holding capacity of soils, which will help improve water retention and accelerate plant establishment and growth.
- **Tree planting pits** – the pits that are dug when the tree is planted should match species requirements and be proportional to the canopy projection.
- **Landscaping** – the aim should be to offer a microclimate favourable to plants, which seeks to minimise barriers to growth such as restricted access to light and poor airflow.



Detailed information and references for this piece of work are published in Forestry Commission Research Note *The role of urban trees and greenspace in reducing urban air temperatures*.

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