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Street studies: keeping the urban environment cool

Trees and other vegetation have an important influence on urban temperatures. To explore these effects, Japanese researchers have built and studied scale models of tree-lined streets. This approach could help designers and planners create urban environments that are cooler during summer months.

Under climate change, temperatures in urban environments are rising. For example, the European Environment Agency (EEA) recently published a report which predicted that cities in southern Spain, southern France, Italy, Greece, Serbia and western Turkey may be exposed to 50 days above 35°C each year in decades to come[1]. Pedestrian comfort in these conditions can be improved by roadside trees, which provide a cooling effect. Research exploring this effect can contribute to designs for cooler, more comfortable streets.

In the design of outdoor environments, computer simulations are becoming a powerful tool. On the other hand, research carried out in real urban environments is specific to a certain situation, but is still valuable and often used to check predictions made using simulations. The authors of this study tried to bridge the gap between these two approaches by building a scale model of a street environment. This approach allowed them to maintain tight control over the different factors that influence temperature in the urban environment – as with a simulation – whilst exploring the effects of on-street vegetation under conditions similar to real-world.

The researchers built their models in an outdoor environment, at the fifth of the size of a typical Japanese residential district, using 1.5 metre high cubes arranged on a concrete slab. The study took place over two summer months, when temperatures varied between 25-40°C and wind speeds were around 0-2 metres per second. Vegetation took the form of potted plants, to represent trees, and grass, and was used to differing degrees in three different models, but arranged on the same basic street plan. A fourth street with no vegetation was used for comparison.

Although all the different models were much simpler than real streets, they allowed the researchers to answer questions about the kinds of designs that might create more comfortable conditions. For example, what influence would a larger number of trees have on air temperature, or wind speed.

By analysing measurements, the researchers concluded that the number of trees planted along a pavement has a significant effect on wind speed. The street with the most trees produced the biggest reduction in wind speed compared to the control. Temperature, measured at a height equivalent to that of pedestrians, also varied considerably depending on street design. Tree-lined streets were cooler for most of the day thanks to shading, except for two to three hours before midday, when the street with the most trees was hottest. According to the researchers, this was probably caused by the low wind speed in this model. During mid-afternoon, all the tree-lined streets were around 7°C cooler. The researchers also found that trees on the sidewalks were more effective than trees in the middle of the street for reducing the temperature.

1.See: www.eea.europa.eu/highlights/publications/urban-adaptation-to-climate-change