London Plane trees (Platanus x acerifolia) before, during and after a heatwave: losing leaves means less cooling benefit

ABSTRACT

Platanus x acerifolia (London Plane) is a widely planted street tree throughout cities in temperate and Mediterranean climates. Heatwave intensity and frequency is likely to increase in these cities as a combined result of the urban heat island and climate change. High air temperature during heatwaves can lead to canopy leaf loss in vulnerable tree species, such as P. acerifolia. This rapid change in canopy cover may lead to subsequent reductions in ecosystem service benefits, such as shade cooling, human well-being, pollution interception and stormwater interception. This study investigates canopy leaf loss in two streets planted with P. acerifolia trees following a summer heatwave and the impacts upon street micrometeorological conditions and human thermal comfort. The plant area index of P. acerifolia, trees, and the micrometeorological conditions under and away from these trees was measured before and after a >43 °C heatwave in Melbourne, Australia. Physiological equivalent temperature was calculated from micrometeorological parameters to estimate human thermal comfort. Canopy loss was significant (30–50 %) and rapid and reduced thermal comfort benefits provided by canopy shade on two of the three warm summer days measured after the heatwave. However, the under-canopy areas of the street maintained a cooler micrometeorological conditions than areas in the open. This study suggests that as summer air temperature extremes and heatwave frequency increase in urban areas, more vulnerable urban tree species may experience sparse canopy cover throughout summer months reducing some ecosystem service benefits when they are needed most.

Keyword: Cover photography; Human thermal comfort; Plant Area Index (PAI); Physiological equivalent temperature (PET); Solar noon micrometeorological conditions