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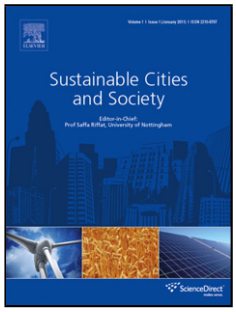

Title: The impact of trees on street ventilation, NO_x and $PM_{2.5}$ concentrations across heights in Marylebone Rd street canyon, central London

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The impact of trees on street ventilation, NO_x and $PM_{2.5}$ concentrations across heights in Marylebone Rd street canyon, central London

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Highlights:

- The impact of trees on street ventilation is assessed using the OpenFOAM CFD software
- Worst and best scenarios of trees on road emissions are evaluated.
- The impact of trees changes depending on heights and locations within the street.
- For perpendicular wind, trees decrease wind speed which leads to increased air pollution concentration
- For parallel wind, trees are found to increase the exchange rate at the roof leading to lower air pollution concentration

Abstract

This paper assesses the effects of trees (*Platanus x hispanica*) of different leaf area density on ventilation, NO_x and $PM_{2.5}$ concentrations across heights in Marylebone Rd street canyon in London (UK). Computational Fluid Dynamics steady state simulations are performed with OpenFOAM. The ventilation is evaluated through flow patterns and the analysis of the impact of trees on wind speed, turbulence kinetic energy, flow rates, mean and turbulent pollutant exchanges.. Results show that the effects of trees are local. For parallel winds planting new trees is positive since flow channelling and turbulence distribute the pollutant over the height which is removed by both mean flow and turbulent fluctuations through the roof. Both areas close and far from the trees within the road have a beneficial effect, with pedestrian average concentration reductions up to 18% due to aerodynamic effects. For perpendicular winds recirculation zones diminish the dispersion of pollutants and the introduction of trees has an additional negative effect with local average concentration increase up to 108% close to trees.