Wider application

Trees and woods in towns make a very positive contribution to improving air quality. Increasing tree cover will obviously enhance this effect and be particularly beneficial in highly polluted neighbourhoods. Strategic plans for health and for improving air quality should therefore incorporate urban forestry. Further research is required on the pollution amelioration effects of trees in order to quantify the benefits to public health.

Further information

National Urban Forestry Unit

This leaflet is one of a series produced by the National Urban Forestry Unit. NUFU provides a national focus for the exchange of information and good practice in urban forestry.

If you would like further information on other case studies or their application, or if you have examples of good practice to share with others, please contact:

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Further reading

Beckett KP, Freer-Smith PH & Taylor G (1998)
Urban Woodlands : Their Role in Reducing the Effects of Particulate Pollution
Environmental Pollution 99 347 - 360

Bradshaw A, Hunt B & Walmsley T (1995)
Trees in the Urban Landscape : Principles and Practice **E & F N Spon London**

Broadmeadow M, Beckett P, Jackson S, Freer-Smith P & Taylor G (1998)
Trees and Pollution Abatement Report on Forest Research 1998) **Forestry Commission, Edinburgh**

Broadmeadow MSJ & Freer-Smith PH (1996)
Urban Woodland and Benefits for Local Air Quality Research for Amenity Trees No 5,
HMSO, London

Department of Health (DoH) (1995)
Committee on the Medical Effects of Air Pollutants : Health Effects of Non-biological Particles
HMSO, London

Farmer AM (1993)
The Effects of Dust on Vegetation - a Review ***Environmental Pollution 79 63 - 75***

Freer-Smith PH, Holloway S & Goodman A (1997)
The Uptake of Particulates by an Urban Woodland : Site Description and Particulate Composition
Environmental Pollution 95 27-35

McPherson EG, Nowak DJ & Rowntree RE (1994)
Chicago's Urban Forest Ecosystem : Results of the Chicago Urban Forest Climate Project
USDA General Technical Report NE - 186

Quality of Urban Air Review Group (QUARG) 1996
Airborne Particulate Matter in the United Kingdom **Third Report of QUARG, Birmingham**

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Urban Forestry in Practice

The effects of urban woodland on air quality

CASE STUDY 7

The effects of urban woodland on air quality

Introduction

Trees are known to have a beneficial effect on air quality by absorbing gaseous pollutants into their leaves and by trapping airborne particles. By helping to improve air quality, trees assist in improving the environment and as a consequence they benefit human health. This is particularly important with regard to the smaller dust particles known as PM_{10}s (i.e. less than 10 microns in diameter) which are often a causal factor in respiratory complaints such as asthma.

Specific example

Project name and location

MONITORING THE AIR FILTERING EFFECT OF WOODLAND Rough Wood, **WALSALL**, West Midlands, UK *Grid reference SJ 984 008*

Project partners

- National Urban Forestry Unit
- Forestry Commission Research Agency
- Walsall Metropolitan Borough Council

Project objectives

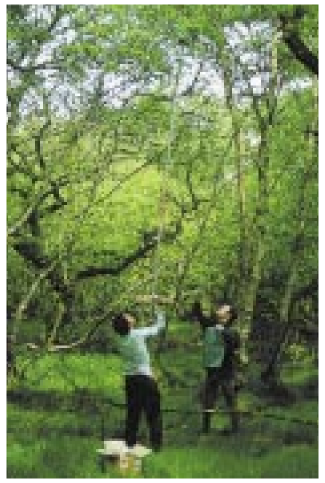
To determine the nature and quantity of particulates trapped by the leaves of an area of urban woodland

Site description

Rough Wood in Walsall is an area of 21 hectares of mature broad-leaved woodland, predominantly oak with a hawthorn understorey. It lies alongside the M6 motorway, just north of junction 10 and close to other known sources of pollution. It is an important recreational area for local people.

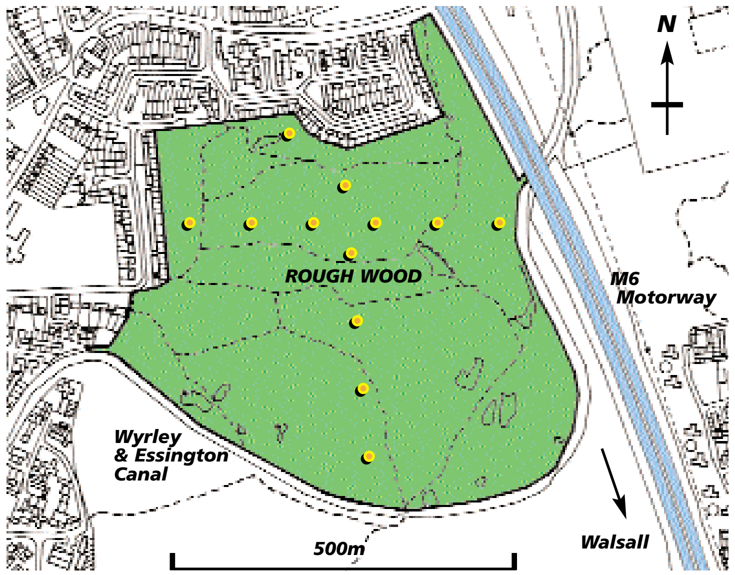
Project design

Two transects were established through the woodland, one running north / south and approximately parallel to the motorway, the other running east / west. Twelve monitoring points were evenly spaced at approximately 100 metre intervals along each transect.



Collecting leaf samples

At each monitoring point, leaf samples of oak were collected from the upper and lower canopy during the summer of 1995. Leaves were washed in water to remove the deposited dust which was then weighed and analysed using an electron microscope. Leaf area index (i.e. leaf area compared to ground area) was calculated from measurements of light penetration into the canopy on each sampling date. This enabled measurements of dust deposition on the leaves to be scaled up to produce estimates of deposition for a unit area of woodland.



Map of Rough Wood, showing position of monitoring points along the N-S and E-W transects

Results

The nature of the accumulated dust was assessed using a scanning electron microscope to gauge particle appearance and an elecron probe for chemical composition microanalysis.

DUST COMPOSITION

A large proportion of particles were found to be organic in origin. Of the inorganic particles, the majority contained silicon and aluminium in varying proportions, suggesting that they were soil-derived. Some particles were clearly identified as the products of combustion, and sea salt was also present, presumably as a result of road salting operations. Some particles contained copper, tin and titanium which may reflect the proximity of the wood to metal processing close by. The proportion of combustion-derived particles increased in samples taken from close to the M6 motorway.

DUST QUANTITY

The quantity of dust deposited on the leaves (dust load) was found to reach a peak (0.55g/m²) in July, after which it gradually decreased.

The lower canopy (sampled at a height of approximately 2 metres) was found to have a higher dust load than the upper canopy (over 3 metres) possibly due to material trapped by the upper canopy then being washed or shaken onto the lower leaves. The lower canopy is also less prone to wind disturbance.

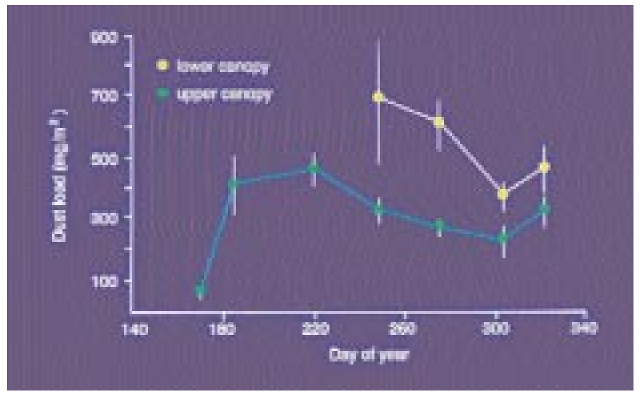
The total dust load of the leaves in Rough Wood was calculated by using the dust deposition figures from a rainfree 50 day period between 18 June & 7 August 1995 and multiplying this by the leaf area index.

The dust load increased from 0.065g/m² of leaf to 0.466g/m² over the 50 day period.

Therefore	Accumulated dust	=	0.40g/m²
	Mean leaf area index in August	=	3
	Dust deposited per m² of ground = 0.40 x 3	=	1.2g/m²
	Dust deposited on leaves per hectare	=	12 kg

Extrapolating the above figures over an entire growing season whilst the trees still have leaves (approximately 200 days):

One hectare of Rough Wood would remove 50 kg of dust each year through deposition on tree leaves.



Mean leaf dust load - Rough Wood 1995

This figure is an underestimate of the total dust trapped, since trunk and branch structure will also have an effect. Dust will also be deposited to the woodland floor through impact with trees and by the sheltering effect of the wood reducing the wind speed and consequently lowering its dust carrying capacity.

Although little dust load gradient was detected across the wood on the N-S transect, an increased dust load was noted closer to the M6 motorway, on the E-W transect.

Looking north-west across the M6 towards Rough Wood