

# Outdoor Air Quality #1

## Air pollution & how plants help

Air pollution is considered to be a major contributory factor for cardiovascular disease as well as exacerbating asthma. Outdoor pollution causes 35,000 – 50,000 premature deaths in UK pa and more than 1 million across the world. (Environmental Audit Committee Fifth report: Air Quality 2010).

Estimates claim that a reduction of  $1\mu\text{g}/\text{m}^3$  in the annual average population-weighted concentration of fine particulates would result in a saving of approximately 4 million life-years over the next 106 years.

Plants help as part of the solution because...



During photosynthesis, plants absorb  $\text{CO}_2$  and other gases like oxides of sulphur & nitrogen ( $\text{SO}_2$  &  $\text{NO}_x$ ), ozone (O) and airborne ammonia ( $\text{NH}_3$ ) through their stomata.



Plants also reduce air pollution by intercepting suspended particulate matters (SPM) and aerosols and retaining them on the leaf surface.

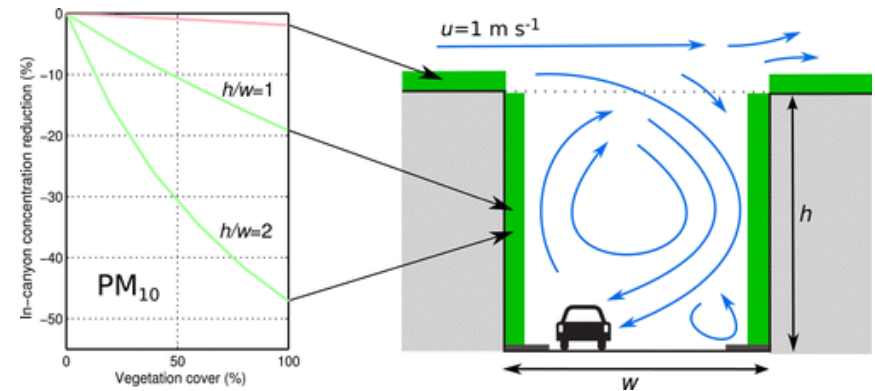


Living Walls

## Urban street canyons

There have been a number of studies on the effect of living walls on air pollution. One of the most recent and important studies is entitled “Effectiveness of Green Infrastructure for Improvement of Air Quality in Urban Street Canyons” published in 2012.

The definition of a canyon is when the height of the buildings in a road exceeds the distance between them – a common issue in most cities – and why this study is so important.



Effectiveness of Green Infrastructure for Improvement of Air Quality in Urban Street Canyons  
– Pugh, MacKenzie, Whyatt and Hewitt, Environmental Science & Technology, 2012

“Previous studies which have shown only modest improvements in air quality from the introduction of green infrastructure failed to take into full account the interplay between urban form and vegetation”. The study shows “Increasing deposition by the planting of vegetation in Street Canyons can reduce street-level concentrations by as much as 40% for  $\text{NO}_x$  and 60% for PM (Particulate Matter)”  
Living Walls

# Outdoor Air Quality #2

## Living walls as air pollution busters

The Living Wall at Edgware Road in London was one of two walls commissioned by Transport for London (TfL) with funding secured from the Mayoral Clean Air Fund. It was installed in 2011. The primary driver for the wall was to improve air quality.

Part of the TfL funding for the Edgware Road wall went towards an evaluation of the effectiveness of the wall and in particular an evaluation of the different species and their relative effectiveness.

The study was carried out by Imperial College on behalf of the APRIL group (Air Pollution Reduction in London) and it showed some really interesting results.



Biotecture Living Wall – Edgware Road London UK

## Do some plants ‘work’ better than others?

Hairy leaves have been shown in previous studies to be of significant benefit, but it turns out that the arrangement of leaves is of more importance. Grasses have densely arranged long thin blade like leaves which affect the ‘near-surface airflow’ and increase deposition of particles.

So plants that have a habit to tend away from the wall fair better than those that form a mass of green like the geraniums. This is because of near surface roughness – the grasses and more open plants that stick out into the air disturb the air and change its velocity more than the mass forming plants. This reduction in velocity causes the deposition of what is in the air (the pollutants).

As a result of this research we are now able to design more efficient living walls for mitigating air pollution, both in their siting and their plant palette

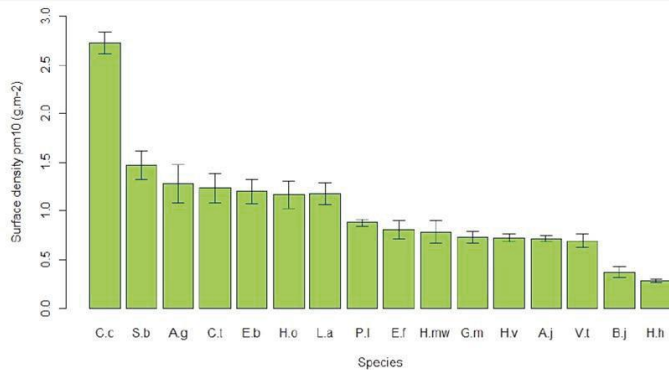


Figure 1: Mean surface density of PM<sub>10</sub> capture across each plant species (± 1 standard

error) – C.c = *Convolvulus cneorum*, S.b = *Stachys byzantina*, Ag = *Acorus Gramineus*, C.l = *Carex testacea*, E.b =

*Erysimum bicolor*, H.o = *Hebe odora*, L.a = *Lavandula angustifolia*, P.l = *Prunus laurocerasus*, E.f = *Enonymus fortunei*, H.mw = *Hebe*

*'Mrs Winder'*, G.m = *Geranium maculatum*, H.v = *Heucheravillosa*, A.j = *Aucuba japonica*, V.l = *Viburnum tinus*, B.j =

*Berberis julianae*, H.h = *Hedera helix*.

Imperial College London – Living Wall Plant Evaluation 2011 - 2012

# Biophilia



*“Biophilia is the instinctive bond between human beings and other living systems particularly those whose very existence supports our very existence”*

Edward O. Wilson, a Harvard Professor, introduced and popularized the hypothesis in his book, Biophilia (1984).




He further defines biophilia as “the urge to affiliate with other forms of life”.

**And this means PLANTS!**

Living walls provide large numbers of easily visible plants held within a dynamic system = maximum benefit of biophilia for little or no loss of floor space.

## Living Walls




Further studies with particular respect to plants have found that:

-  The mere insertion of plants into the built environment can enhance comfort, satisfaction, well-being and performance.
-  Buildings with green facades often provoke interest and satisfaction.
-  Connection to nature on a daily basis reinforces the values of respect and care for the environment.

And Biophilia is measurable:

Office workers in Northern Europe spend between 80% and 90% of their time indoors. There have been a number of studies as to the effect of plants on people’s health and psychological wellbeing.

For example a series of studies in Oslo found in an evaluation between two offices – identical except that one was filled with plants and the other had none – in the planted offices:

-  Headache complaints reduced by 45%
-  Complaints of tiredness reduced by 32%
-  Absenteeism was reduced by 33%

The results can be distilled down to this, the more plants we can see from our desks or workplaces

- 1. The less self-reported sick leave there is!**
- 2. The more healthy and productive we are!**