CLAIRO Urban Innovative Actions project
Reduction of air pollution with the use of greenery

CARI Boot Camp, Szeged, 9 September 2021
dispersion

- Trees and hedges introduce turbulence and increase dilution of pollutants.

- An average 8% reduction can be achieved in ground-level concentration of PM$_{2.5}$ due to the dispersive effect of trees.

Source: Hewitt, C. N. et al
dispersion, linear obstacles

Hedges: extended effective path-length of air from source to receptor

Hedges can cut exposure to black carbon by up to 63% (University of Surrey)

Source: Hewitt, C. N. et al
deposition

• Greenery can potentially protect against air pollution by enhancing the deposition rates of pollutants

• Pollutants deposit more efficiently on vegetation than on smoother artificial surfaces

• Highly dependent on the available surface area and the aerodynamic roughness of the surface
Which are the BEST TREE SPECIES to reduce air pollution?
filtering activity of trees depends mainly on the **canopy size**

**Small Trees**
- 1-4m canopy diameter
- 3-7.5m² planting area
- e.g. Malus 'John Downie'
- Amelanchier lamarkii 'Robin Hill'

**Medium Trees**
- 4-7m canopy diameter
- 7.5-23m² planting area
- e.g. Prunus 'Pandora'
- Betula pendula
- Alnus cordata

**Large Trees**
- 7-25m canopy diameter
- 23-300m² planting area
- e.g. Quercus robur
- Platanus x hispanica
- Tilia platyphyllos

*This area calculation assumes that a 1m depth of soil is available, if there is less depth then a larger area is required.*
the density of the foliage is a key factor
shape of the crown

Source: Organically Green Blog
shape of the crown

a **spherical crown** is more effective than one with a pyramid shape
foliage longevity is a key aspect

Image: Yoksel Zok, Unsplash
leaf size

species with smaller leaves tend to be more effective in filtering pollutants
features of leaf surface

rough, hairy surfaces, sticky leaves have better filtration potential
COMPOSITION and STRUCTURE of the vegetation
complex, well-functioning urban ecosystems

- focus on environmental conditions
- plants to be adapted to topographical, soil and climatic conditions
- plant diversity

Image: Gábor Adonyi, Unsplash
vertical layering of forests

Multi-level tree cover:

multiple floors with trees complemented by shrub floors

Source: University of Missouri
sensitivity of the proposed greenery to the air pollution

species with increased tolerance to air pollution
CLAIRO Plant Database
(Silesian University in Opava)

- climatic requirements
- sensitivity to acid deposition
- sensitivity to ozone
- ability to remove dust particles

Image: Jan Antonin Kolar, Unsplash
USING GREEN INFRASTRUCTURE TO PROTECT PEOPLE FROM AIR POLLUTION

April 2019

https://www.london.gov.uk/sites/default/files/green_infrastruture_air_pollution_may_19.pdf
<table>
<thead>
<tr>
<th>Street canyons</th>
<th>Open roads</th>
</tr>
</thead>
<tbody>
<tr>
<td>street canyons with little or no traffic</td>
<td>people to be protected immediately at the roadside</td>
</tr>
<tr>
<td>street canyons with moderate or heavy traffic</td>
<td>people to be protected further away</td>
</tr>
<tr>
<td>wider canyons</td>
<td></td>
</tr>
<tr>
<td>(height/width ratio &gt; 2)</td>
<td></td>
</tr>
<tr>
<td>narrower canyons</td>
<td></td>
</tr>
<tr>
<td>(height/width ratio &lt; 2)</td>
<td></td>
</tr>
<tr>
<td>A dense avenue of trees</td>
<td>A hedge or green wall to one side</td>
</tr>
<tr>
<td>Addition of green open space</td>
<td>A hedge or green wall between vehicles and people</td>
</tr>
<tr>
<td>A hedge or green wall between vehicles and people</td>
<td>A hedge or green wall between vehicles and people</td>
</tr>
<tr>
<td>A combination of hedge and dense line of trees</td>
<td></td>
</tr>
</tbody>
</table>

Source: Greater London Authority (2019) ‘Using Green Infrastructure To Protect People From Air Pollution’
Thank you for your attention!

Tamas Kallay
UIA Expert, CLAIRO

Image: Pixabay