

# Selecting urban trees for ecosystem service provision

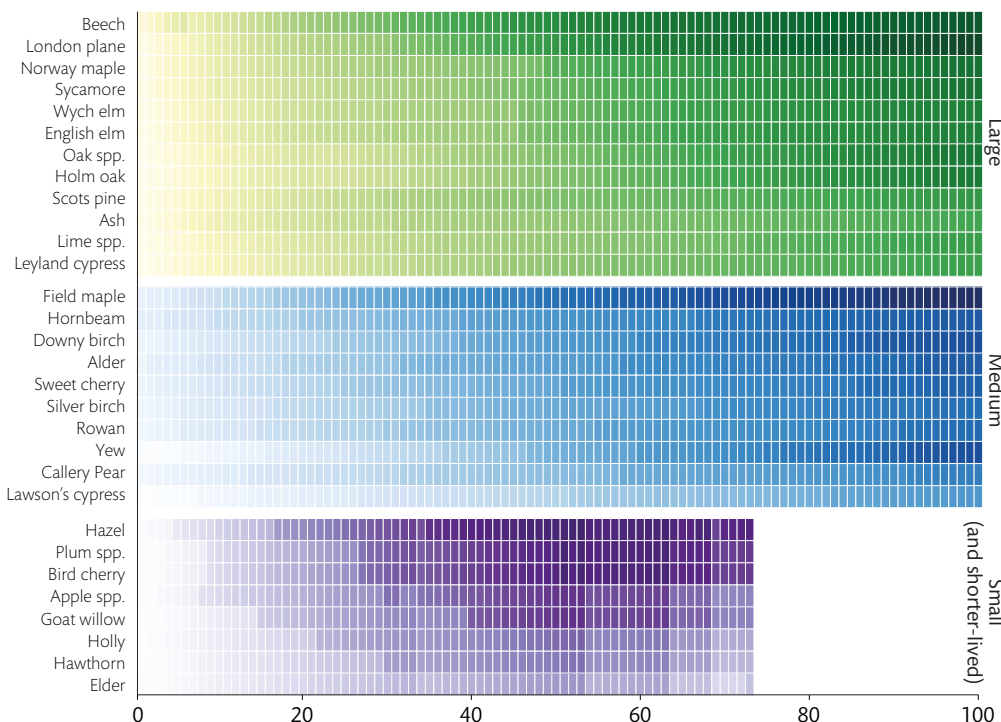
Urban trees provide a range of benefits or 'ecosystem services' to society. The provision of these benefits depends on many factors, including the species of tree, its stature, location, condition and management. Ecosystem service delivery is one of many factors to be considered in selecting a tree. Other important considerations include the suitability of the species to the location, resilience to climate change and pest and diseases, and the diversity of the wider urban forest. Research comparing the provision of four ecosystem services (carbon storage, rainfall interception, pollution removal and amenity) by 30 urban tree species in three size groups (small, medium and large) over 100 years has shown that tree species, size, and location affect the delivery of ecosystem services over time. Results show that larger sized trees provide greater benefits than smaller and shorter-lived counterparts, even over short time frames. They also show that trees planted in open locations provide greater levels of benefit compared with those in more enclosed settings.

## The role of tree species

- Species vary in their provision of ecosystem services within all three size groups.
- Across all sizes, the species which perform best are those with larger and denser canopies. Those that perform poorer are typically smaller in height and leaf area.
- Although large stature trees provide the most benefit overall, they are not suitable for all urban locations, where medium or small stature trees may be better suited.

For the greatest levels of benefit, this research supports the selection of larger trees wherever possible, especially in open space locations.

Change in ecosystem service provision over time (0–100 years after planting) for 30 trees.



The chart on the left shows aggregated values for the four ecosystem services studied for each size category. Values have been normalised within each category to aid comparison: the darker the colour, the greater the service provision.

- The faster growth rate of large conifers means their amenity value rises faster than that for broadleaved trees. However, because of their smaller leaf area, conifers are less efficient at absorbing air pollution and intercepting rainfall.

## The role of tree size

- Trees in all three size groups provide low levels of ecosystem services at early ages.
- As tree size increases the provision of benefits increases. For example, a tree intercepts more pollutants from the air as canopy volume and leaf area expand.
- Overall, tree stature is an important driver of ecosystem service delivery.
- Newly planted trees should be supported if they are to attain older ages where benefit provision is greatest.
- Lifespan affects benefit provision. After year 50, the decreasing life expectancy of small stature trees results in their value starting to decline.

## The impact of location

- The location of a tree affects its growth rate and the size it can attain, determining its ecosystem service provision.
- The diagram on the right summarises the air pollution removal ecosystem service provision for trees growing in three types of locations (Enclosed, Semi-open and Open). The trends shown are similar across the other three benefits.
- Across all sizes and types, trees perform best overall in open growing locations – where they are not crowded by neighbouring trees or buildings.
- Trees in the open provided between 45% and 63% greater benefit compared with enclosed trees for carbon sequestration, avoided run-off and air pollution removal.
- Trees with some neighbouring objects, such as street trees in rows, provide greater service in comparison to trees grown in crowded environments (e.g. when surrounded by other trees in a forest) but less than open growing trees.

## The right tree in the right place

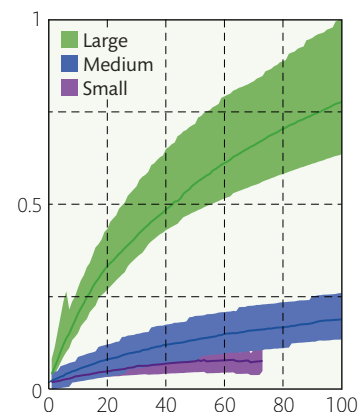
Ecosystem service delivery is one of many factors to be considered when selecting a tree for planting. However, the results of this research can be used to help inform species selection for urban tree planting programmes as part of a ‘right tree right place’ approach. Large and mature trees typically compose a small proportion of the urban tree population. The results support the case to increase this proportion as these trees provide the highest levels of benefit per tree.

This information and its supplementary data can be used to:

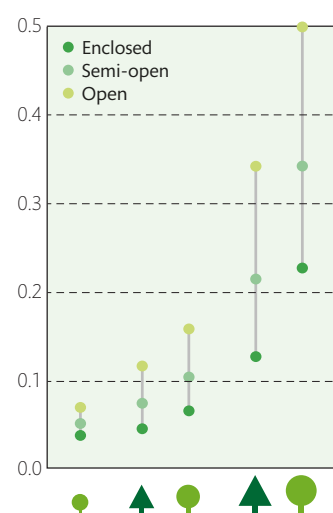
- support the case for planting larger stature, long-lived trees rather than smaller, shorter-lived specimens;
- help identify the optimal species in terms of benefit delivery;
- provide annual values for ecosystem service provision that can be used in cost-benefit analyses of tree planting programmes.

You can find out more about this research, its full methodology and assumptions, and download supporting information and data resources by visiting our website.

Comparison of the range of benefits provided by trees of different sizes over 100 years.



Air pollution removal per year by tree location.



Research contacts:  
**Kathryn L Hand and  
 Kieron J Doick**

To find out more about this research and download supporting information and data resources, go to:  
[forestresearch.gov.uk/research/urban-tree-benefits/es-provision](https://forestresearch.gov.uk/research/urban-tree-benefits/es-provision)