

Valuing the ecosystem services provided by Derby's Urban Trees

Urban trees are a resource that **provides a range of benefits** to human populations living in and around cities. Termed ecosystem services, these benefits help to offset many of the problems associated with urban development. Trees remove air pollutants, store carbon, capture rainwater and help control runoff and flooding, and they influence urban microclimates through cooling. They sustain habitats for other plants, and animals, they can improve social cohesion in communities and provide a space for people to relax and exercise. In **2021** a survey of the trees of Derby city was performed. Using **i-Tree Eco** the survey data was analysed to describe the condition and diversity of Derby's urban trees, and to quantify and value a range of the benefits that these trees provide to those who live and work in Derby.



The benefits provided by Derby's urban trees are **valued at more than £3.26 million per year**

Background

The urban forest comprises all the trees in the urban realm, **in public and private spaces, along linear routes and waterways and in amenity areas. It contributes to green infrastructure and the wider urban ecosystem.**

The 2021 i-Tree Eco study in Derby city summarised the urban forest structure including: distribution across different land uses, species composition, size class distribution, and leaf surface area. The study focussed on four of the benefits provided by Derby's urban forest: carbon capture, rainwater interception, air pollution removal, and habitat/food provision. The health of the urban forest and biological threats to it, such as from Chalara ash dieback, were assessed and the cost to replace the trees, if they were lost, was calculated. Variability in the urban forest's structure between Derby's regions and wards was also considered.

Objectives

The project aimed to:

- 🌳 identify trees' location, species, sizes, and health across Derby, and in its regions/wards therein,
- 🌳 quantify and value some of the benefits which Derby's urban forest provides,
- 🌳 give suggestions for where to plant trees, as well as how to maximise benefits, and limit risk.

Methods

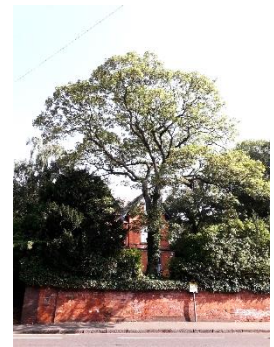
360 plots stratified and randomly distributed across Derby were surveyed. Information on **457 trees** was recorded, including species, height, and canopy spread; as well as data on the land use and ground cover. Results were analysed using i-Tree Eco (itreetools.org).

Derby's urban forest

- 🌳 **Intercepts 81 million litres of rainfall per year**, equivalent to **£79,728** in avoided wastewater.
- 🌳 **Removes 60 tonnes of air pollution annually**, worth over **£278,000** in health damage costs.
- 🌳 **Stores 106,825 tonnes of carbon**, which is worth **£95.9 million**.
- 🌳 **Removes 3,233 tonnes of carbon** from the atmosphere **every year**. This is worth **£2.9 million** and is enough to offset the emissions of 2% of Derby's properties.
- 🌳 Has an average tree **canopy cover of 8%**, when calculated by i-Tree Eco. This is low compared to previous studies such as: Cardiff, (19%); London (14%); Edinburgh (15%), or Wrexham (17%).
- 🌳 Has a species **richness of 61**, and a Shannon-Wiener **diversity of 3.3**; Derby comes mid table compared to previous UK i-Tree Eco studies for species richness and diversity.
- 🌳 Contains a large number of **Leyland cypress, sycamore, and silver birch**.
- 🌳 **45%** of Derby's trees are **UK-natives**, 15% are naturalised.
- 🌳 Is **relatively balanced across tree size classes**. 9% of trees have a girth of over 60cm. There is a slight over-abundance of trees with 40 to 60 cm diameter.
- 🌳 Is in **comparatively poor health** relative to previous studies, only **16%** of Derby's trees had **excellent crown condition**, less than half the average of previous i-Tree Eco studies.
- 🌳 Is **most abundant** in **residential** land, in the **North** region, and in the **Allestree** electoral ward.

Threats and Opportunities

- 🌳 **Chalara ash dieback** and **Ramorum disease** were identified as the diseases of greatest risk for Derby's urban forest. The **Asian longhorn beetle** is likely to be the most damaging if it arrived in the UK.
- 🌳 The **cost of replacing** Derby's trees if they were lost is estimated to be **over £1 billion**. **Chalara** damage alone could cost **£43 million** in amenity value.
- 🌳 **21%** of **Derby** is **suitable** for additional tree **planting**.
- 🌳 **Two of the three most common** tree **genera** ranked **high in food provision** of fruit/nectar and seeds/nuts for animals.



Recommendations

There is a disparity of trees across wards, regions, and land uses in Derby; planting trees in sparsely planted areas would help lead to more equitable provision of tree benefits. Derby generally has a good ratio of large to small trees, however different land uses have very different size class profiles. For example, golf courses and cemeteries would benefit from more small trees for tree community renewal in future, while commercial and transportation areas would profit from large trees which are relatively better at benefit provision. The condition of Derby's trees was lower than expected, particularly in the north, and for certain species like silver birch. Contingency planning for the risk of the most damaging diseases identified would be beneficial, for example within a tree and woodland strategy for Derby. The resilience of Derby's urban forest to climate change and biological threats could be improved by increasing tree species diversity at ward and city scale. Decreasing the proportion of Leyland cypress, and increasing habitat providing trees such as hawthorns, willows, whitebeams, and alders, may improve the biodiversity supported by Derby. Future surveys are advisable, particularly for monitoring tree condition and the arrival of tree pests and diseases.

