

An Assessment of the Ecosystem Services Provided by Trees and Shrubs in the City of Truro

Key findings

- 29.7% of Truro's land mass has canopy cover from trees and shrubs (23.7% by trees alone). This is higher than the UK average for towns and cities of 17% (for trees alone)
 - 8.1% of the total canopy cover in Truro is from land owned and managed by Truro City Council.
- Each year trees and shrubs in Truro sequester (take up) the equivalent amount of CO₂ produced each year by 274 households.
 - The *total amount of carbon stored* by trees and shrubs in Truro is equivalent to the annual CO₂ production of 6879 households.
- Each year trees and shrubs in Truro are estimated to remove thousands of kilograms of air pollution, including of nitrogen dioxide and particulates (PM₁₀ & PM_{2.5}).
 - The total amounts removed are roughly equivalent to 40% of annual NO₂ and 75% of particulates from traffic on the A390 in Truro.
- Each year trees and shrubs in Truro are estimated to prevent the equivalent of 210 swimming pools of rainwater running off into drains and water courses.
- Over a third of Truro's land cover is grass and herbaceous, and a proportion of this will be suitable for planting of trees and shrubs.
- Further work should refine the estimates of ecosystem services from trees and shrubs in Truro and examine the potential for increasing these services by planting more trees and shrubs.

Background

- Trees and shrubs are known to have many benefits in urban settings, including beautifying the environment, providing habitat for birds, insects and other wildlife, reducing 'heat islands' through providing shade and reflecting solar radiation, removing air pollution, reducing storm water runoff, and sequestering and storing carbon from the atmosphere.
- Through its Parks Department and Countryside Ranger, Truro City Council is directly responsible for managing large numbers of trees and shrubs.
- Truro City Council has declared a climate emergency and has committed to achieving net zero greenhouse gas emissions by 2030. The maintenance of current tree and shrub cover, and ideally increased cover, will have an important part to play in meeting this commitment.

Aims

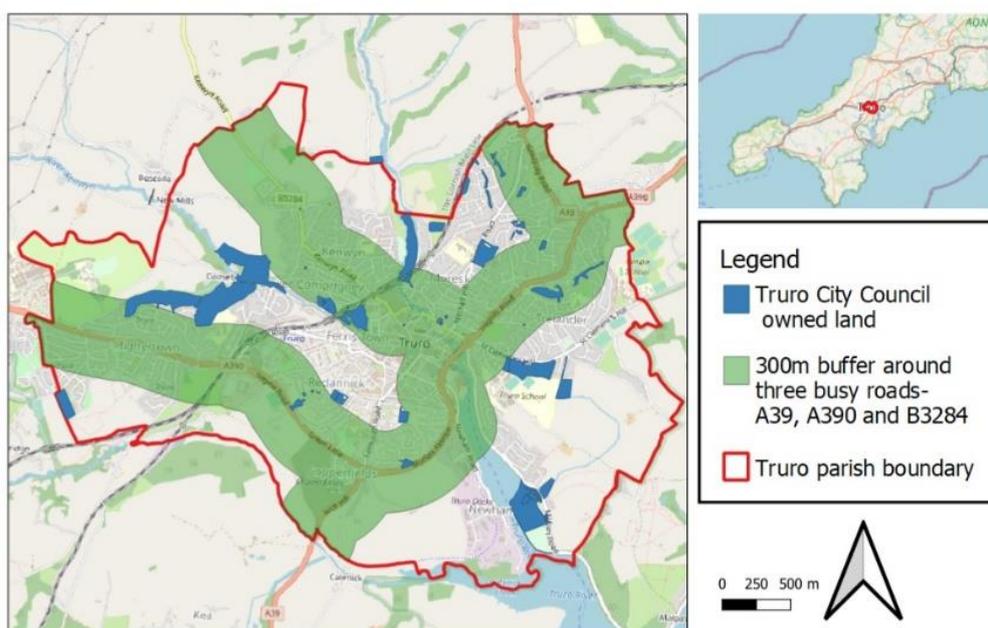
Our aims were to assess the current tree and shrub cover in City of Truro, how much of that cover is in areas managed by the city council, and some of the ecosystem services that are obtained from it.

In order to meet these aims, we used freely available software, i-tree canopy, applied to google satellite maps, through which estimates were derived on carbon sequestration and storage, removal of air pollution, and mitigation of rainwater water runoff. Some of the strengths and limitations of the methods and data sources we used are described towards the end of this report.

Methods and Data Sources

The online tool i-tree canopy <https://canopy.itreetools.org> was used to assess canopy cover, other forms of land cover, and estimate ecosystem services, including carbon sequestration and storage, removal of air pollution and avoided water runoff. Appropriate shape files were applied to google satellite maps to delineate the following areas: Truro as a whole, land owned and managed by Truro City Council (TCC) Parks Department (and within this Countryside Ranger land), and 300m either side of selected busy roads (the A390, A39 and B3284). The distance of 300m from busy roads was chosen based on research that suggests the negative effects of traffic pollution can extend to at least this distance (e.g: www.lung.org/clean-air/outdoors/who-is-at-risk/highways). For each geographical area selected, the land cover for 1000 data points was classified, giving a high degree of statistical precision for all estimates presented (standard errors less than 1.5 for all). TC and NU classified the land cover using i-tree canopy. To determine whether TC and NU classified land cover consistently, both classified the land owned by TCC.

Figure 1 – The areas within which canopy cover was assessed



Data on the carbon footprint of households in Truro were taken from Impact: community carbon calculator (<https://impact-tool.org.uk/>). Estimates of the territorial (rather than consumption) household carbon footprint were used.

Estimates of air-pollutants from traffic on the A390 in Truro were derived from average daily traffic flows taken from Department for Transport data for 2019, downloaded from <https://roadtraffic.dft.gov.uk/local-authorities/139>. We extrapolated the flow between Threemilestone Roundabout and Station Road to the length of the A390 within Truro. Air pollutants from this traffic flow were estimated using the DEFRA Emissions Factors Toolkit (v11.0), downloaded from <https://laqm.defra.gov.uk/air-quality/air-quality-assessment/emissions-factors-toolkit/>.

The volume of water in a swimming pool is based on dimensions of 25m long, 10m wide, 1.5m deep.

Data on tree canopy cover in other towns and cities in the UK was taken from <https://urbantreecover.org/>, which is part of an initiative sponsored by Barcham, Forest Research, Treeconomics and the Woodland Trust. The majority of the estimates presented there were also derived by using i-tree canopy.

Findings

Canopy cover, carbon sequestration and storage

For each of the areas shown in figure 1, table 1 shows the land area, the percentage canopy cover by trees and shrubs, the carbon sequestered each year and the *total* carbon stored.

Table 1 – Estimated canopy cover, carbon sequestration and storage

Area	No. Hectares	Canopy cover (%)	Carbon sequestered annually(t) ^a	Total carbon stored(t) ^a
Whole of Truro	1072	29.7	3562.58	89469.7
Land owned by TCC	47.8	54.0	289.5	7269.7
Countryside ranger land only	22.8	82.0	210.1	5277.3
300m either side busy roads	525.3	24.2	1428.9	35884.2

^aFigures given as tonnes of CO₂

The amount of carbon sequestered (taken up) by trees and shrubs each year in Truro is equivalent to the annual carbon footprint of 274 households in Truro (3% of all households). The total amount of carbon currently stored by trees and shrubs in Truro is over 89,000 metric tons, which is equivalent to the annual carbon footprint of 6879 households in Truro (75% of all households).

The land owned by TCC makes up 4.5% of total land area of Truro. However, due to the higher tree and shrub cover, this land accounts for 8.1% of the annual carbon sequestration by trees and shrubs in Truro. The land managed by the Countryside Ranger accounts for almost three quarters of the carbon sequestration from TCC owned land. The Countryside Ranger land makes up only 2.1% of the land in Truro, but accounts for 5.9% of the annual carbon sequestration and total carbon storage.

Removal of air pollution

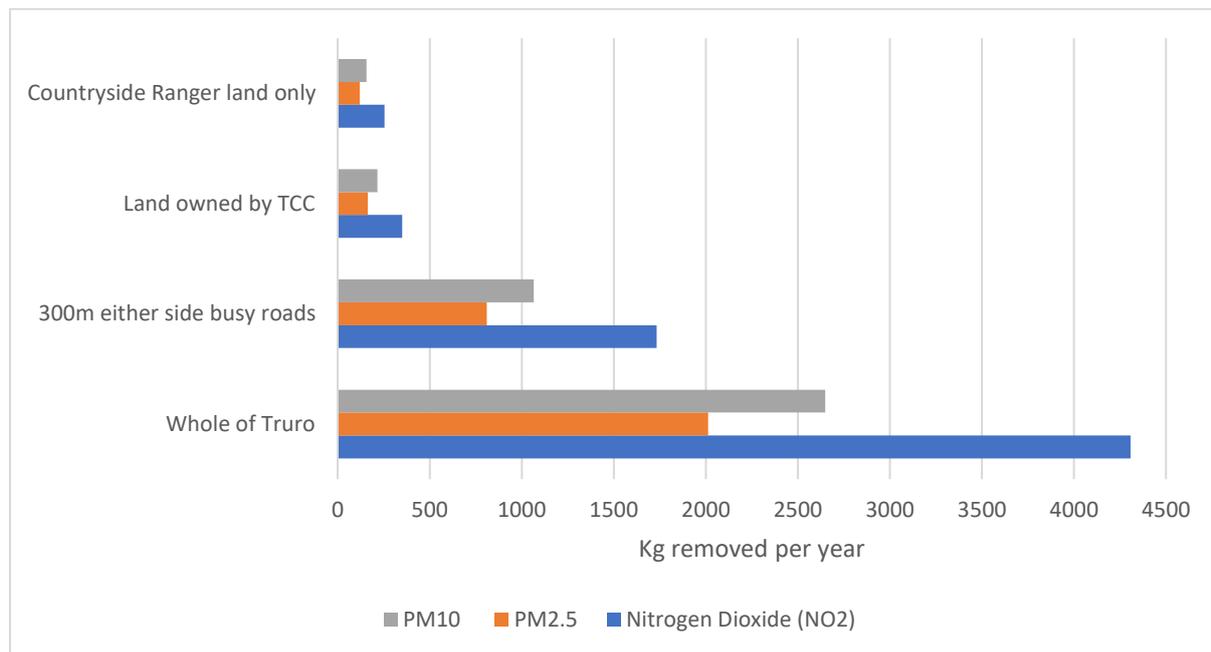
I-tree canopy provides estimates for the removal of several air pollutants. Estimates for the annual removal of nitrogen dioxide, PM10 and PM2.5 are shown in figure 2. In order to give a sense of the relative size of the removal of air pollutants by trees and shrubs, we compared the estimates shown in figure 2 to estimates of pollutants generated by traffic in Truro along the A390 (see methods for details).

Trees and shrubs in the whole of Truro are estimated to be able to remove the equivalent of about 68% of the PM10, 88% of the PM2.5, and 40% of the NO₂ produced annually by traffic on the A390.

Avoided water runoff

I-tree canopy provides estimates for avoided water runoff. In simple terms this refers to how much more water from rainfall would run into drains and water courses if the current tree and shrub cover was not present. For Truro as a whole, it is estimated that that the avoided runoff each year is around 79 million litres, roughly the volume of water in 210 twenty-five-meter swimming pools.

Figure 2 – Estimated annual removal of air pollutants, in kg per year, by trees and shrubs in the whole of Truro and in selected areas



Note: PM10 refers to particulate matter less than greater than 2.5 and less 10 microns, and PM2.5 to particulates less than 2.5 microns.

Comparison to canopy cover in other parts of the UK

Canopy cover in other parts of the UK has often been estimated for trees only (i.e. excluding shrubs). For the reasons given under ‘strengths and weaknesses’ we believe it is important to include shrubs. However, in order to compare to other UK canopy estimates we repeated the exercise for Truro as a whole, excluding shrubs. An estimated 23.7% of Truro has tree (excluding shrubs) canopy cover. This is higher than the average of 17%, estimated for 320 towns and cities across the UK. Truro’s canopy cover is similar to cities such as Harrogate, Cardiff and Inverness. It is greater than Exeter (18.8%) and higher than Plymouth (16.9%).

Potential for increasing tree and shrub cover in Truro

I-tree canopy enabled us to classify the land in Truro into several categories, such roads, buildings and other impervious surfaces and grass / herbaceous surfaces. The percentage of Truro as a whole covered by impervious surfaces (e.g., roads, buildings, parking areas) is 26.6% and the percentage covered by grass / herbaceous surfaces is 35.4%. A reasonable assumption is that a proportion of what is currently ‘grass/herbaceous’ could be planted with trees and shrubs, thus overtime providing further carbon sequestration and storage and other ecosystem services. Of the land that is currently managed by the City Council Parks Department, 35.4% is also estimated to be grass / herbaceous.

Strengths and Limitations

It is a strength of the work presented in this report is that it has been undertaken with a tool that has been widely used for estimating canopy cover and ecosystem services from trees and shrubs. This provides transparency in the methods used, allowing others to check the findings. Another strength is that the TC and NU, who did the work with i-tree canopy, duplicated their effort for the areas owned by TCC and demonstrated the consistency of their classification for tree and shrub, and

grass / herbaceous, land cover. All estimates are based on sampling 1000 data points, and thus have a high degree of statistical precision. Finally, estimating canopy cover from trees and shrubs rather than trees alone is also a strength, with around 6% of land cover in Truro being from shrubs.

The most important limitation of the approach taken is that the estimates of the ecosystem services, including carbon sequestration and air pollution take up, are derived from 'typical' UK tree and shrub mix. A fuller assessment of ecosystem services could be undertaken by measuring the number and size of individual trees by species. This, of course, would be a much larger, human resource intensive, undertaking.

The estimates we used for air pollution from traffic on the A390 are based on Department for Transport data and tools. These estimates are intended *only* to provide context for the amount of air pollution estimated to be taken up each year by trees and shrubs in Truro. It cannot be claimed that amount of air pollution from the A390 is actually taken up by trees and shrubs.

Recommendations

1. Use this report to promote awareness, within TCC and among the public, of the importance of trees and shrubs in Truro and of the current ecosystem services that they provide.
2. Explore opportunities, such as on land that is currently 'grass or herbaceous', for further planting of trees and shrubs and estimate the additional ecosystem services that would be derived.
3. Consider undertaking more work in which ecosystem services are estimated by assessing in detail the mixture of trees and shrubs, by species, by size and by health. This could be done using a tool such as i-tree Eco, in an area managed by the Countryside Ranger and perhaps with a volunteer group.
4. Consider assessing the ecosystem services, including carbon storage and sequestration, from other types of natural habitats in Truro.

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