

A strategic approach to canopy cover

Hannah Walker, Forest Research
TDAG seminar, 3rd April 2025

Why are canopy cover assessments important?

- Canopy cover is an indicator of tree presence and potential provision of benefits by urban trees
- City-wide assessments indicate places that do not have enough tree cover
- Can be estimated using quick, reliable, reproducible, and repeatable measurements (with caveats!)
- Can be combined with other spatial data (social deprivation, urban temperatures) to help plan canopy cover increases for areas that have greatest need (good example of this later)



Image: Sheffield by Benjamin Elliott via Unsplash

Why are canopy cover assessments important?

- If we don't measure canopy cover:
 - we can miss key trends such as declining tree cover
 - we don't know where trees are and aren't
 - we can't meaningfully set realistic canopy cover targets or timeframes to meet them
 - we may not know whether schemes/interventions are working

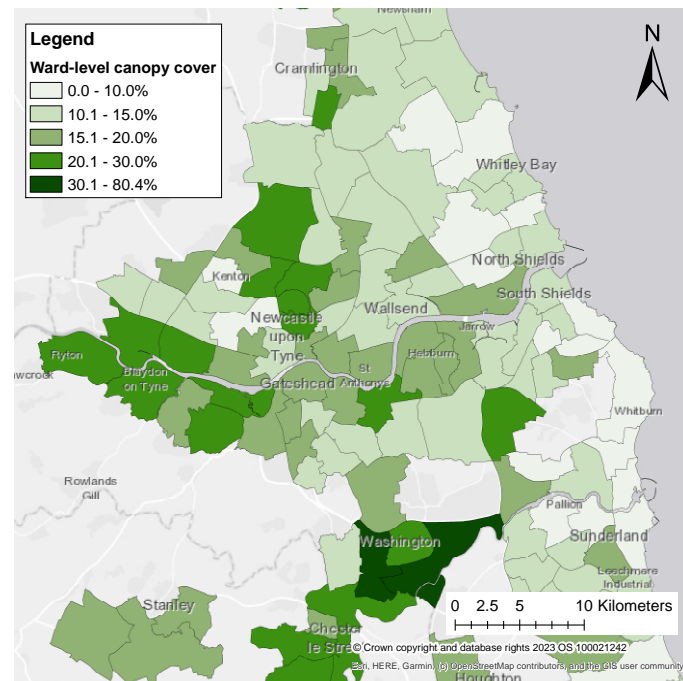


Figure: Ward-level canopy cover in north east England from Sales et al., 2023

What does canopy cover not tell us?

- Ownership
- Health
- Condition
- Diversity
- Species
- Age
- Size
- Climate and site suitability
- Accessibility
- Presence of really small trees



Image: Tree in Bath by Bradley Pritchard Jones via Unsplash

Choosing the right data or assessment approach can be a challenge

Use

- Have you clearly defined your aim(s)?
- What can you afford?
- How quickly do you need the data?
- What size area do you need to cover?
- Smallest geographical scale?
- Need to monitor change?
- Need to compare to other locations?
What approach have they used?
- Smallest size of tree you need to detect?

Data or method

- Verified? Measures of uncertainty reported?
- What has changed as the method has developed? What are the impacts? (e.g. change in image resolution)
- Expected changes to the methodology in future? What are the impacts?
- Data from a single time point, or a composite of dates? What is the time span? What are the implications?
- Will (or when will) updated data be available?

Existing canopy cover data

Source	Comments
Friends of the Earth tree mapping	Free at Local Authority and LSOA scales. Based on Environment Agency lidar data (machine-learning object identifier). 1 metre resolution. Date well-defined.
Google Environmental Insights explorer	Free at city scale for some cities; other cities can be requested. City boundaries are not the same as LA boundaries. Data derived from aerial imagery using a range of dates so date unknown.
Tree Equity Map	Uses Google data at LSOA scale, so date unknown.
Urban Tree Canopy Cover Webmap	Citizen-science assessments using sample points over aerial imagery. Free at ward scale for all urban UK wards. Date of assessment well-defined but dates of underlying imagery unknown.
TreePlotter Canopy	Tree canopy viewing and analysis platform. Canopy calculated by machine-learned image classifier. Paid-for subscription.
TreeKeeper	Tree inventory viewing platform, including canopy cover. Paid-for subscription.

Options for estimating canopy cover at scale

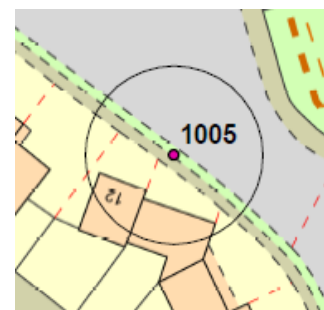
Approach	Source	Comments
National Tree Map	Bluesky International	Paid-for. Polygons of tree crowns. Requires basic GIS. Dates available, but data collection month has a large impact on results. Historical data is available.
Trees Outside Woodland map plus National Forest Inventory data	Forest Research, Defra	Free. England-only. Based on EA data. Polygons of tree crowns (some isolated, some grouped) and woodland. Requires basic GIS. Data from various dates used but validated using 2020 ground data. Updates unknown.
Lidar-derived Vegetation Object Model	Environment Agency	1 metre resolution. Requires basic GIS. Dates well defined, but multiple dates.
i-Tree Canopy	i-Tree Tools	Free, but time-consuming if assessing many areas. Dates of underlying imagery unknown.
DIY version of i-Tree Canopy	In house	Requires purchase of imagery (or use of free imagery of known date) plus basic GIS. Can do historical assessments.

A note about i-Tree Canopy and i-Tree Eco

- i-Tree is a suite of tools
- i-Tree Canopy and i-Tree Eco are different tools within that suite
- i-Tree Canopy is designed for measuring canopy cover, and for very approximately estimating benefit provision
- i-Tree Eco is a survey protocol and mathematical model designed to take sample a city, extrapolate to represent the whole city area, and provide a more realistic estimate of benefit provision
- They both give estimates for canopy cover, but we generally don't recommend i-Tree Eco as purely a canopy cover tool



i-Tree Canopy



i-Tree Eco

A note about data collection dates

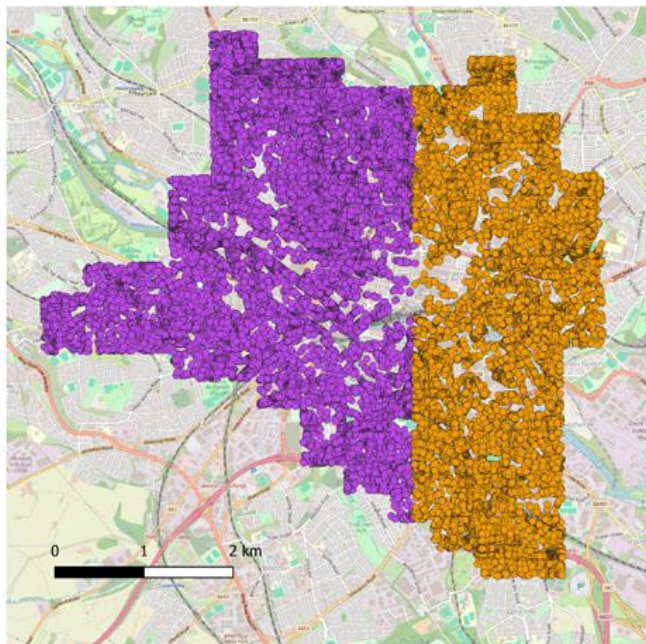


Figure: Most recent NTM data for Leeds, showing April 2020 (purple) and June 2020 (orange)



Figure: Comparing spring 2020 data (orange) with summer 2017-2018 data (brown). Spring data collection misses whole trees and lots of canopy.

Baselines and change

- Baseline: An initial measurement against which we can measure change
- To reliably measure change:
 - use the same or a compatible technique
 - measure at the same scale or be comfortable calculating at different scales
 - measure the same area or have a means to calculate comparisons between the same areas
 - know the dates of the baseline and the new assessment
 - take account of method changes (e.g. change in image resolution)
 - take care with precision (is it statistically significant?)
- Key points
 - Most newly-planted trees will not be visible in canopy cover assessments for many years
 - We must know of existing trends, such as declining canopy cover, before we can plan, or measure success of, canopy cover increase initiative



**Figure: New tree planting.
Crown copyright.**

An example: Decadal changes in canopy cover

What worked:

- Clear aim
- Known dates
- Consistent methodology
- Consistent boundaries

“Over the past two decades, however, the trends are more variable, with six towns displaying no statistically significant change, one declining and just three increasing in canopy cover”



Figure: Aerial images of the same location showing change in tree cover, from [Doick et al., 2020](#)

An example: Bristol canopy cover targets

- [Bristol One City Plan](#) launched 2019, aiming for 25% increase in canopy cover by 2036 and doubling of canopy cover by 2046. No baseline quoted in initial plan.
- More than one baseline became available: i-Tree Eco estimated 12%, i-Tree Canopy and repeat measurements estimated 18%. 12% was accepted.
- Later, Bluesky and OVO released data that reached [national media](#). Bristol canopy cover estimated at 8%!
- Once the boundary was rectified, NTM estimated 18%.
- 18% has now been accepted but the targets remain the same.

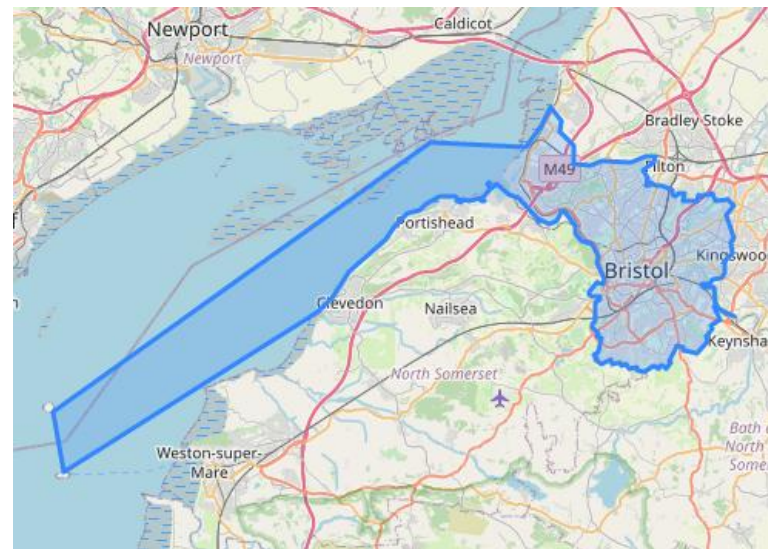


Figure: Bristol unitary authority boundary contains a lot of water. [Bristol Tree Forum](#), 2021

An example: Birmingham canopy cover with other data

1. Select a Geography

LSOA

2. Set All Weight Priorities to:

None Low Medium High

Health Rank ?

Medium

Tree Equity Score ?

Medium

Areas With Low Existing Tree Canopy ?

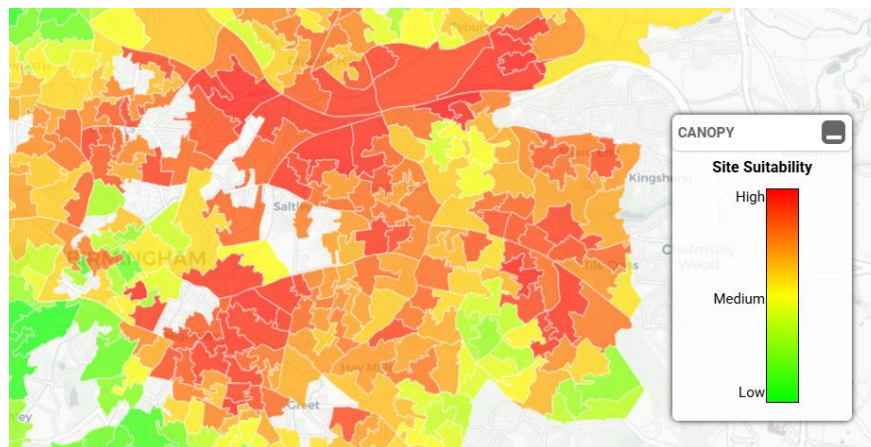
Medium

Possible UTC ?

Medium

Why it works:

- Single source of canopy cover data, used as a snapshot
- Boundaries are consistent across different data
- It's not just canopy cover that informs planting need



[TreePlotter - Birmingham Tree People](#)

Some concluding thoughts

- Canopy cover has the potential to be a useful metric
- We need to be aware of potential pitfalls, challenges, what it can and cannot tell us
- With most available data and methods, it is difficult to know the date of the underlying data, and it is usually a mix of dates
- It's therefore difficult to measure meaningful change
- The DIY approach with high-quality imagery of known date may be the safest approach
- Canopy cover doesn't tell us everything. Combine it with other data.