

Tree Management Using National Tree Map (NTM™)

White Paper



NTM™ White Paper

Executive Summary

Trees, woodlands and forests have a very special place in UK culture and have provided us with many of the essentials of life through history. Their health is essential for our wellbeing and prosperity. They shape our landscapes and street scenes. Our choices today will shape our future landscapes, prosperity and wellbeing. UK Government ambition is for a major increase in the area of woodland in Britain, better management of existing woodlands and a renewed commitment to conserving and restoring ancient woodlands. Forests and woodlands must play a full part in achieving a resilient and coherent ecological network across Britain.

The UK has many millions of trees. In general these trees are very poorly mapped, particularly in urban areas and there is no standard for those that are mapped. Currently the mapping and managing of these valuable assets is carried out in an *ad hoc* fashion involving lots of costly fieldwork, or using 'broad brush' techniques which are often online systems. This presents a range of problems for both public and private sector organisations. National Tree Map (NTM™) has been developed to change this. NTM™ is a digital map database of trees created from high-resolution aerial photography and other geographic data that provides a cost-effective solution to custodians responsible for the effective mapping and management of trees in our various environments.

The Problems

Central & Local Government

UK Biodiversity Action Plan (UKBAP) was published in 1994 and is part of the Government's response to the Convention on Biological Diversity (CBD) at the 1992 Rio Earth Summit. The CBD called for development and enforcement of national strategies and plans to identify, conserve and protect existing biodiversity.

The UK BAP sets out the UK's strategy for conserving over the next 30 years, including measures to promote biodiversity and conservation in all woodland. Action plans for the most threatened species and habitats have been set out to aid recovery. A number of woodland types are priority habitats:

- Lowland beech and yew woodland
- Lowland mixed deciduous woodland
- Lowland wood-pasture and parkland
- Native pine woodlands
- Upland birchwoods
- Upland mixed ashwoods
- Upland oakwood

Local Biodiversity Action Plans aim to help protect biodiversity, enhance and improve biodiversity where possible, and promote biodiversity at a local level.

The biodiversity strategy for England clearly states that the Government will “take measures to prevent loss or damage to ancient woodland and trees, and their uniquely rich biodiversity, from development.” (DEFRA, 2002, Working with the grain of nature. A biodiversity strategy for England, para 6.9)

The UK Forestry Standard sets out the UK Government’s approach to sustainable forestry. It states, “Ancient Semi-natural Woods are of special value”. The Standard has a series of UK-wide aims for semi-natural woodland and states, “The area occupied by semi-natural woodland should not be reduced”. The Standard goes on to discuss the importance of expanding and linking small woods to others and recognises that fragmentation of semi-natural woodland is a problem.

Managing trees effectively and efficiently is a challenge for Local Government. Local authorities have a remit to manage the urban trees within their authority area. Trees have an environmental, amenity and monetary value, so they need auditing. Local councils use Tree Preservation Orders (TPOs) to protect selected trees and woodlands within their remit. In the past councils have collected TPO locations via labour-intensive and costly site surveys.

Local Authority Arboricultural Officer’s (Tree Manager) responsibilities include managing trees in public ownership and assisting town planners in protecting suitable trees by legislation. Day-to-day challenges facing Arboricultural Officers include:

- Budgets are being cut.
- Resources are being reduced.
- On-site visits are often the only way of collecting necessary details.
- Trees are dynamic assets that are susceptible to regular change.
- Many trees may be difficult to gain access to.
- Collecting data on every tree is not cost effective.
- Correctly calculating the crown size can be difficult from the ground.
- Trees also present a risk to property and life with freak weather or other occurrences.

Commercial Sector

The effective management of trees and the urban forest presents a range of other problems to many non-government organisations. First and foremost is the access to such data, and the reliance on the accuracy and quality of data that is available.

Planning and Costing of Planting and Landscaping Schemes

Planting new trees too closely to other established trees can lead to growth being suppressed and ultimately a tree failing and being removed.

Planning & Legal

Concern about the location of trees is a major worry to house owners, not only when trees cause damage through subsidence but also because the proximity of trees can jeopardise house purchases, lead to insurance claims, effect planning applications and mortgage loans, and even cause disputes between neighbours.

Insurance Risk Assessment

Building subsidence is estimated to cost the insurance industry in excess of £500 million after each dry year and is usually the second most expensive insured peril after fire. Trees are implicated in 70% of reports of subsidence on clay soil, with the South East being most prone, particularly those homes built on London clay. Trees greater than 26ft (8m) tall within 33ft (10m) of a property cause the most concern. A mature deciduous tree can draw up to 500,000 litres of water a year from the surrounding soil, in the summer such withdraw leads to the soil drying out and this can lead to foundation subsidence.

Highways Maintenance

Non-maintained trees along our streets and roadways come into conflict with other users of the street e.g. high-sided vehicles. Trees situated along busy streets and roads have increased risk of contact with pedestrians/vehicles. These trees require more extensive protection and maintenance measures such as tree guards, grilles and pollarding.

Utilities

Cable and pipe avoidance is critical to the successful installation and maintenance of electricity, water and communications infrastructure both above and below ground. In particular the Distribution Network Operators are allocating significant investment to improving the resilience of the Overhead Line (OHL) network in response to new guidelines from the regulator. Tree roots can cause significant damage to the water pipe network resulting in loss of water and disruption to customers.

Emergency Access Planning

There is a lack of geographic information mapping the density, location and height of trees. This complicates vital decision-making when responding to emergency situations in the built environment.

What Is NTM™?

NTM™ is a digital map layer and database accurately depicting and recoding the location and extent of trees. Designed as a tool to aid local authority officers, insurance assessors, property developers and asset managers to name but a few; NTM™ details the spatial location and height of individual trees, together with the circumference of its crown. From this information the potential impact can be assessed.

The maximum and average heights of the crown and the size of the crown of each tree are calculated automatically using robust algorithms applied to a range of Bluesky's own highly accurate geographic data, including aerial photography, colour infrared and digital surface models. Bluesky's team of editors, trained in accurate photo-interpretation, examine the resulting data to ensure consistency and quality control.

NTM™ is delivered in formats suitable for use in desktop Geographical Information Systems (GIS), web mapping applications and Computer Aided Design (CAD) packages. The fact that NTM™ comprises both 2D location and 3D height measurements means it can be viewed and interrogated in both 2D and 3D GIS and CAD software. It should be noted that NTM™ is simply a database and can be provided in all common database, text or spreadsheet formats.

Solutions & Benefits

Using an NTM™ dataset within a GIS or Tree Management System enables the end-user to analyse the spatial location, size and height of trees against existing vector mapping sources, address database information and orthorectified aerial photography to make informed decisions about the volume, proximity to buildings & assets and potential risk of trees at a local level. Integration of NTM™ with aerial photography or large-scale mapping (e.g. Ordnance Survey MasterMap®) provides a direct on-screen representation of how trees spatially relate to both the built and natural environments around them.

Using NTM™ removes the need for hand-plotted maps and provides a baseline audit of crown height and canopy coverage of trees within a local area. Field officers can use this spatial dataset to add, manage and update information on their tree portfolio from their desktop or portable device out in the field.

NTM™ is easy to use with an existing council GIS or Tree Management System. With minimum training a member of a Tree Preservation Unit team can quickly query an expansive NTM™ dataset to provide members of the public or site contractors with rapid and accurate information. NTM™ assists new planting schemes. It pinpoints the exact location of existing trees in order to help make decisions on where to correctly locate new planting. The data can be used to assist with biomass and canopy cover calculations.

Spatially accurate mapping of trees helps insurance assessors and underwriters to estimate root spread and calculate subsidence risk at a local level using NTM™. Look-up tables can be derived based on these datasets and integrated with existing procedures at various stages of the claim process.

NTM™ provides the emergency services with a GIS layer tree-mapping solution for disaster and risk planning. A geographically accurate map auditing the location, tree crown height and width of trees assists in vital access and route planning when responding to major disruption caused by severe weather (e.g. flooding, fire, chemical incidents). The tree height information provided in NTM™ gives easy to read information to assess the suitability of use and access of high-sided emergency vehicles and ladders en route or at the scene of an incident.

NTM™ can be used as a data layer within a utility company's GIS & mapping systems to provide vital information about the exact location of trees in relation to overhead and underground cabling and pipework essential for network maintenance to proactively mitigate against damage caused by branches or roots. The data can also be used for new infrastructure design; a phase one desktop study using NTM™ saves time and cost-intensive field surveys and reduces outage and leakage risk. The data will be huge benefit to telcos, for modelling of signal propagation and for network planning, including determining new sites for masts and other infrastructure.

Specification of NTM

NTM has been created as a GIS database and is therefore compatible with all common GIS as well as CAD, and can also be provided for use as a database or spreadsheet, or even for use in Google Earth.



NTM is supplied as three separate layers:

1. Polygons - representing individual tree crowns
2. Idealised circular crowns - regular circles depicting individual trees for ease of use and display
3. Height points detailing the highest point of each tree crown

Rigorous tests have shown that the overall canopy coverage represented in NTM is accurate to over 90% and over 95% accurate within 50m of buildings.

NTM is also subject to an on-going maintenance and update program which is on a 5 year rolling scheme.

Conclusion

NTM™ is a unique, easy-to-use and accurate reference base for all decisions relating to the location of trees, their size and their proximity to existing or proposed assets accurate and up-to-date mapping of tree locations helps custodians geographically locate trees more likely to cause risk along a road or street, ultimately helping them reduce the risk of damage to citizens, properties, vehicles and trees.

Capturing tree height and crown span information from a consistent level of detailed aerial imagery provides a unique opportunity to derive a standardised tree inventory at parish, district, county or even national level. Accurately-dated new, modern, or historic aerial imagery provides precise metadata to the end user. NTM™ offers a recorded 'snapshot' in time of trees within a geographic region which will be renewed through a rolling update programme.

This 'off the shelf' baseline tree inventory cuts out costly and time-consuming field data collection. Although not intended to replace field work, NTM™ will allow field assessors to spend less time collecting the base data and more time collating additional, valuable information on the ground that is not so readily observed from aerial photography.

Connectivity with an organisation's existing GIS or digital tree mapping software means there are no hidden software costs.

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Useful and Interesting links

[http://www.forestry.gov.uk/pdf/Cultural_value_woods_full_report_March2010.pdf/\\$file/Cultural_value_woods_full_report_March2010.pdf](http://www.forestry.gov.uk/pdf/Cultural_value_woods_full_report_March2010.pdf/$file/Cultural_value_woods_full_report_March2010.pdf)

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/14956/tposguide.pdf

<http://www.njug.demon.co.uk/pdf/NJUG%20Publication10.pdf> [NJUG's guidance on trees which lists all the potential damage and what needs to be taken account of trees existing and new.]

www.njug.org.uk/publication/52 [Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees (Issue 2) Operatives Handbook.]

[http://www.forestry.gov.uk/pdf/FCRN201.pdf/\\$file/FCRN201.pdf](http://www.forestry.gov.uk/pdf/FCRN201.pdf/$file/FCRN201.pdf)