## Wokingham Borough Tree Survey

Trees and woodlands in the Wokingham borough help create a quality of place and life that attracts people to live, study, visit and work in the area. As part of the green infrastructure, trees provide the backdrop to our towns and villages.

Trees and woodlands are an essential feature of the Wokingham landscape with many veteran and ancient trees and woodlands creating the 'story of the place'; indeed, the importance of trees, particularly the oak is recognised by the acorn and oak leaf that form the Town's heraldic charge.

While it is generally understood that trees provide a range of benefits understanding and rationalising those benefits is often difficult. Wokingham Borough Council as part of the tree strategy project commissioned an assessment of the tree stock within the borough to ascertain the value of these benefits and to inform on the numbers, condition and diversity of the tree asset across the borough both within their ownership and across the broader land area of towns, villages and parishes.

Two surveys were undertaken during the summer of 2022. These surveys included an assessment of the borough's tree coverage in general using the desk based i-Tree canopy assessment online tool and a ground survey collecting specific tree information across Council ownership across various random locations within each parish.

### i-Tree Canopy Cover Assessment

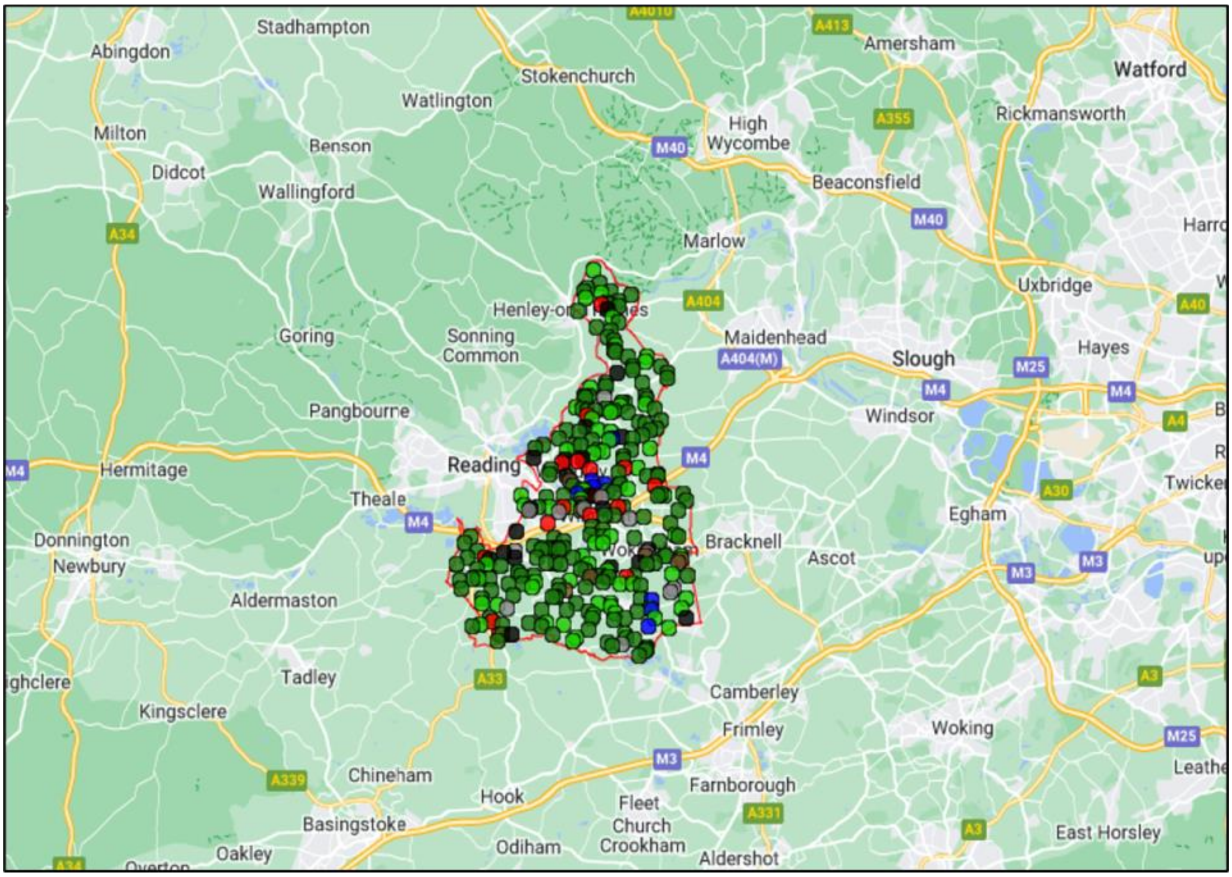
i-Tree is a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban and rural forestry analysis and benefits assessment tools. i-Tree tools can help strengthen forest and tree management and advocacy efforts by quantifying forest structure and the environmental benefits that trees provide.

i-Tree canopy is a desk-based assessment using aerial imagery to randomly select location points within the borough, each location point is then assessed as to the ground cover identifying whether it is a tree/shrub, grass/herbaceous, impervious building, impervious road, impervious other, soil/bare ground or water.

The collected data is then automatically analysed by the built-in algorithm to produce an overview of the tree canopy coverage, the amount of carbon sequestered per annum and its value rationalised in monetary terms to the borough, the data also highlights the total amount and value of the stored carbon asset. Further information is also provided on the amount of surface runoff that is intercepted and the monetary saving this provides to the borough.

The i-Tree canopy survey for Wokingham assessed 301 sample points across the borough for their ground cover, a plan of the various points is shown below in Fig.1.

Fig.1 – Location plan of all i-Tree sample points across Wokingham borough

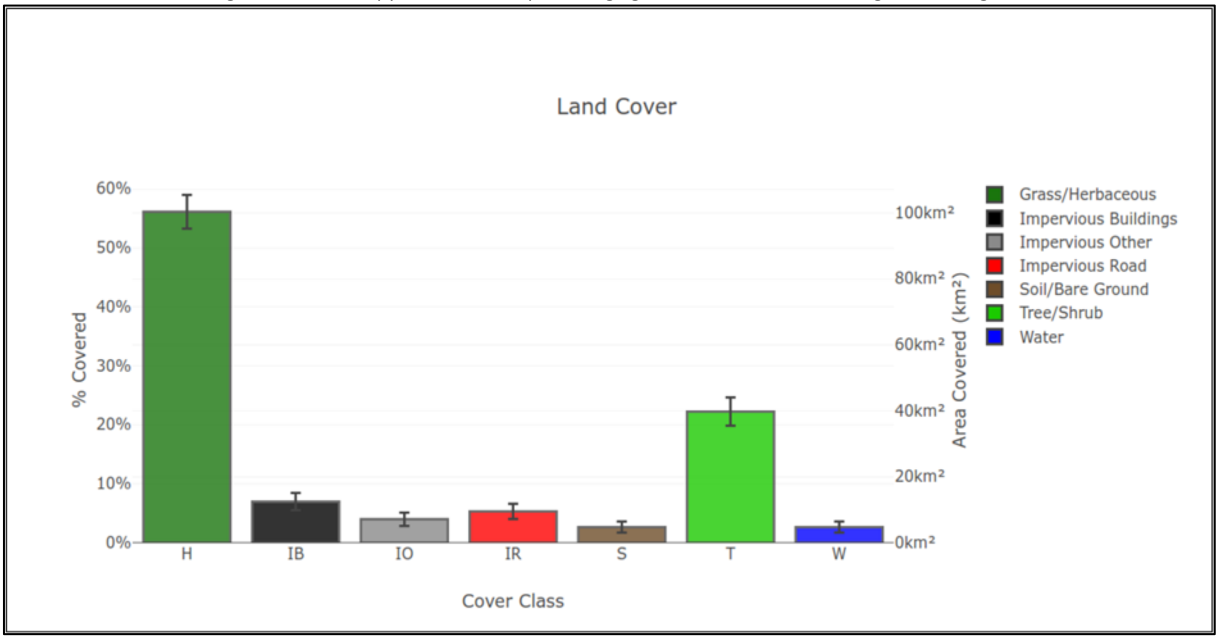



In summary the assessment of the borough indicates that approximately 22% of the borough landmass is under tree or shrub canopy Fig.2 and Fig.3. The average tree canopy cover is 16% in England (Treeconomics, 2017), it is therefore clear that Wokingham borough has an above average tree canopy.

Fig.2 – i-Tree Canopy breakdown of percentage ground cover class in Wokingham borough

| Abbr. | Cover Class | Description | Points | % Cover ± SE | Area (km²) ± SE |
|---|---|---|---|---|---|
| H | Grass/Herbaceous | | 169 | 56.15 ± 2.86 | 100.39 ± 5.11 |
| IB | Impervious Buildings | | 21 | 6.98 ± 1.47 | 12.47 ± 2.63 |
| IO | Impervious Other | | 12 | 3.99 ± 1.13 | 7.13 ± 2.02 |
| IR | Impervious Road | | 16 | 5.32 ± 1.29 | 9.50 ± 2.31 |
| S | Soil/Bare Ground | | 8 | 2.66 ± 0.94 | 4.75 ± 1.68 |
| T | Tree/Shrub | | 67 | 22.26 ± 2.40 | 39.80 ± 4.29 |
| W | Water | | 8 | 2.66 ± 0.94 | 4.75 ± 1.68 |
| **Total** | | | **301** | **100.00** | **178.80** |

Fig.3 – i-Tree Canopy breakdown of percentage ground cover class in Wokingham borough




The canopy of Wokingham provides an annual carbon sequestration Fig.4. of over 12 kilo tons of carbon which would have a value of over £3 million, in total the current tree asset stores over 305 Kilo tons of Carbon with a value of over £77 million.

Fig.4 – i-Tree Canopy sequestered carbon from the tree canopy in Wokingham borough

Tree Benefit Estimates: Carbon (Metric units)

| Description | Carbon (kt) | ±SE | $CO_2$ Equiv. (kt) | ±SE | Value (GBP) | ±SE |
|---|---|---|---|---|---|---|
| Sequestered annually in trees | 12.18 | ±1.31 | 44.66 | ±4.81 | £3,081,265 | ±331,907 |
| Stored in trees (Note: this benefit is not an annual rate) | 305.86 | ±32.95 | 1,121.48 | ±120.80 | £77,382,117 | ±8,335,428 |

Currency is in GBP and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Amount sequestered is based on 0.306 kt of Carbon, or 1.122 kt of $CO_2$, per km²/yr and rounded. Amount stored is based on 7.685 kt of Carbon, or 28.178 kt of $CO_2$, per km² and rounded. Value (GBP) is based on £253,000.00/kt of Carbon, or £69,000.00/kt of $CO_2$ and rounded. (Metric units: kt = kilotonnes, metric kilotons, km² = square kilometers)

Further benefits Fig.5 indicate that the tree canopy intercepts and prevents over 985 mega litres of rainwater runoff, this has a value of over £1.5 million per annum.

Fig. 5 – i-Tree canopy hydrological benefits of tree canopy in Wokingham borough

Tree Benefit Estimates: Hydrological (Metric units)

| Abbr. | Benefit | Amount (Ml) | ±SE | Value (GBP) | ±SE |
|---|---|---|---|---|---|
| AVRO | Avoided Runoff | 985.91 | ±106.20 | £1,528,052 | ±164,598 |
| E | Evaporation | 5,563.00 | ±599.23 | N/A | N/A |
| I | Interception | 5,591.58 | ±602.31 | N/A | N/A |
| T | Transpiration | 15,993.78 | ±1,722.81 | N/A | N/A |
| PE | Potential Evaporation | 13,964.68 | ±1,504.24 | N/A | N/A |
| PET | Potential Evapotranspiration | 10,856.37 | ±1,169.42 | N/A | N/A |

Currency is in GBP and rounded. Standard errors of removal and benefit amounts are based on standard errors of sampled and classified points. Hydrological Estimates are based on these values in Ml/km²/yr @ £/Ml/yr and rounded:
AVRO 24.771 @ £1,549.90 | E 139.773 @ N/A | I 140.491 @ N/A | T 401.850 @ N/A | PE 350.868 @ N/A | PET 272.771 @ N/A (Metric units: Ml = megaliters, km² = square kilometers)

The assessment also indicates that approximately 56% of the land is covered by grass or bare earth. While much of this is utilised for agricultural production, changing land use by only a small percentage through woodland creation and tree planting could provide significant benefits to the borough and help the Council's goal of addressing the climate emergency.

The Council recognises that while planting woodlands can sequester large amounts of carbon, many of the extra benefits that trees can provide, for example reduction in air pollution and reduction in surface water runoff, are found in our urban areas. As such while technically more challenging to accomplish, it is recognised that where resources allow increased tree planting in our towns and villages should be a goal of the tree strategy.

### Tree Condition Survey

The purpose of the tree survey was to ascertain the number of trees within the borough, the makeup of the 6 main tree species and their general condition. This data was collected through a desk-based analysis and a ground truthing survey of random plots within the borough. The various survey datasets are provided in the tables and charts Fig.7 and Fig.8.

### Desk based assessment

The desk-based survey utilised the BlueSky's National Tree Map™ (NTM™), a detailed dataset derived from high quality aerial imagery. The NTM™ dataset provides a unique, comprehensive database of location, height and canopy/crown extents for every single tree 3m and above in height. The dataset for Wokingham Borough was analysed to provide the following information:

- The number of trees identified on the NTM as being within WBC including both council and privately owned trees.
- The number of trees from NTM within the ownership of WBC.
- Number of trees within each parish including both WBC and privately owned trees.
- Number of trees from NTM within each parish under WBC ownership.

Fig.6 – Breakdown of tree numbers by parish across both private and WBC ownerships

| | Number of trees | | |
|---|---|---|---|
| **Parish name** | **WBC-owned land** | **Privately-owned land** | **Total land** |
| Arborfield and Newland CP | 1537 | 35464 | 37001 |
| Barkham CP | 3969 | 20473 | 24442 |
| Charvil CP | 3746 | 6596 | 10342 |
| Earley CP | 9740 | 29510 | 39250 |
| Finchampstead CP | 10225 | 90855 | 101080 |
| Remenham CP | 908 | 30337 | 31245 |
| Ruscombe CP | 508 | 11798 | 12306 |
| Shinfield CP | 7031 | 32768 | 39799 |
| Sonning CP | 969 | 14031 | 15000 |
| St. Nicholas, Hurst CP | 9118 | 47945 | 57063 |
| Swallowfield CP | 3533 | 43255 | 46788 |
| Twyford CP | 2368 | 7640 | 10008 |
| Wargrave CP | 2352 | 58762 | 61114 |
| Winnersh CP | 5188 | 15172 | 20360 |
| Wokingham CP | 11744 | 37462 | 49206 |
| Wokingham Without CP | 6964 | 37493 | 44457 |
| Woodley CP | 11453 | 19467 | 30920 |
| **Total** | **91353** | **539028** | **630381** |

Analysis of the NTM dataset Fig.6 has identified that WBC are responsible for approximately 91,000 trees with a further 540,000 being within private ownership. The total number of trees within the borough is indicated to be over 630,000.

The results for the breakdown of trees in each parish shows that the spread of trees across each parish is not evenly distributed. This is quite common in relation to land use and to the socio-economic classification of areas; with less trees often being found in the heavily developed urban centres and areas with a lower socio-economic base, the numbers of trees generally increase in suburbia as more undeveloped space is available. Many trees are generally found within the wider rural setting.

The information will help to inform the Council of its tree planting goals to target in part those areas that have significantly fewer trees than those that are already well treed. It is the increase in tree and canopy cover within these lower treed areas that will generally provide the largest socio-economic improvements and the financial benefits highlighted in the i-Tree canopy survey.

## Plot survey

By using the NTM data as a basis; a series of sample plots were created across the borough, these were targeted to capture sites within the Council's ownership containing the largest number of trees. The survey consisted of 102 survey plots (50m x 50m) located across the Councils ownership with 6 plots in each of the 17 parishes. The following data was collected for each tree within the plot:

- Tree species
- Tree age
- Tree condition – physiological and structural
- Tree fungus / pest / disease


Image 1: Sample plot selection

### Tree Species

The tree survey identified that the most prevalent trees found within WBC ownership across the borough was oak and ash, as can be seen in Fig.7 and Fig.8 Understanding the makeup of the tree asset is important in terms of identifying risk and ensuring that any new tree planting is designed to be resilient.

Figure 7. The 6 most prevalent tree species identified in the tree survey

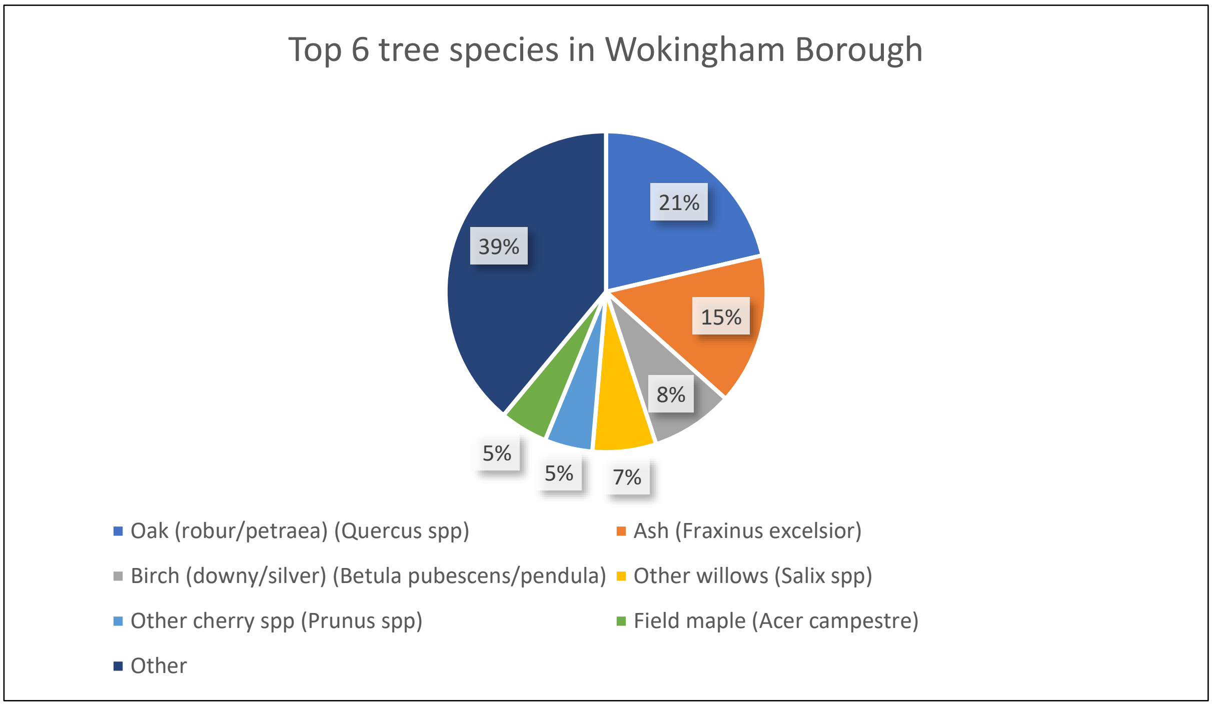


Figure 8. Extrapolated number of each of the top 6 species tree against the number of trees in NTM desk-based analysis.

| Species | Tree count | Tree count scaled up to NTM |
|---|---|---|
| Oak (robur/petraea) (Quercus spp) | 336 | 19513 |
| Ash (Fraxinus excelsior) | 240 | 13938 |
| Birch (downy/silver) (Betula pubescens/pendula) | 131 | 7608 |
| Other willows (Salix spp) | 101 | 5866 |
| Other cherry spp (Prunus spp) | 76 | 4414 |
| Field maple (Acer campestre) | 76 | 4414 |
| Other | 613 | 35600 |
| **Total** | **1573** | **91353** |

Over the last few years, it has become increasingly apparent that the UK is becoming increasingly affected by various tree pathogens that have the potential to cause widespread impacts to our trees and woodlands.

The most significant of these currently is the *Hymenoscyphus fraxineus* fungus that causes ash dieback (ADB). This fungus is of particular significance in our broadleaf woodlands where it has the potential to significantly affect the timber yield in commercial hardwood production. It has significant relevance in terms of our landscape often found in roadside verges and hedges as well as planted in our town and cities. As the fungal infection progresses with the ash, the tree becomes increasingly weakened with dead branches and sparse crowns becoming obvious, a link between ADB and *armillaria* spp (honey fungus) has also increased concern in relation to the potential for windthrow to occur.

Concern is so great that The Tree Council have issued guidance on the identification of this infection and on its management. Understanding the potential impact and risk this infection poses are crucial to WBC from both their climate emergency tree planting goals and from a health and safety point of view. ADB has the potential to impact our trees in the manner that Dutch elm disease, caused by the fungus *Ophiostoma novo-ulmi,* ravaged our trees in the 1970's. Widescale felling may be required, especially across the highway network to ensure these routes remain safe. Understanding the potential number of trees this may affect will allow the Council to plan and budget for such work in the future.

Further detail on the number of ash trees by parish can be found in Figure 9.

Figure 9. Number of Ash trees on WBC owned land per parish

| Ownership | Parish | Tree count (all species) | Ash count estimate for WBC land |
|---|---|---|---|
| WBC-owned land | Arborfield and Newland CP | 1537 | 235 |
| | Barkham CP | 3969 | 606 |
| | Charvil CP | 3746 | 572 |
| | Earley CP | 9740 | 1486 |
| | Finchampstead CP | 10225 | 1560 |
| | Remenham CP | 908 | 139 |
| | Ruscombe CP | 508 | 78 |
| | Shinfield CP | 7031 | 1073 |
| | Sonning CP | 969 | 148 |

| | | | |
|---|---|---|---|
| | St. Nicholas, Hurst CP | 9118 | 1391 |
| | Swallowfield CP | 3533 | 539 |
| | Twyford CP | 2368 | 361 |
| | Wargrave CP | 2352 | 359 |
| | Winnersh CP | 5188 | 792 |
| | Wokingham CP | 11744 | 1792 |
| | Wokingham Without CP | 6964 | 1063 |
| | Woodley CP | 11453 | 1747 |
| | **All** | **91353** | **13938** |

## Tree age

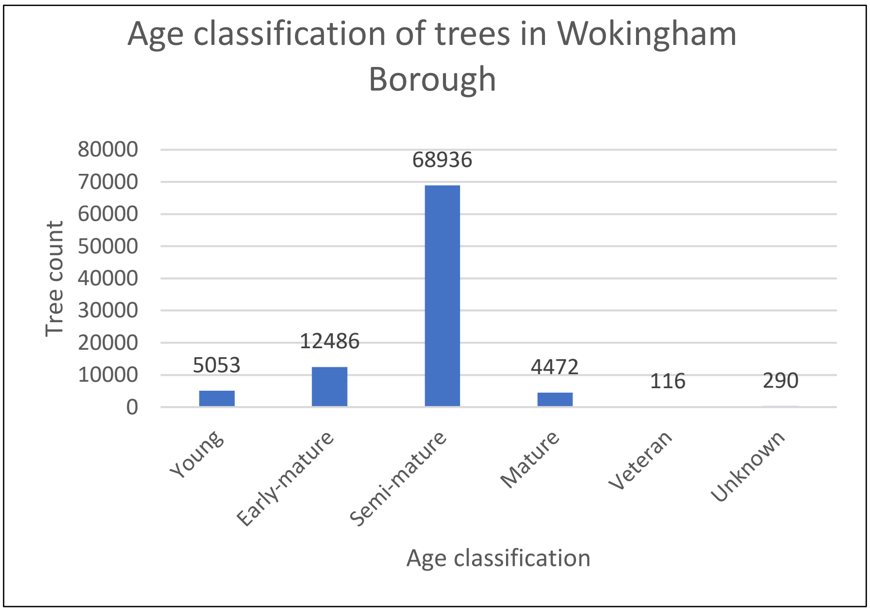
It is generally understood that to have a sustainable and flourishing urban forest you require a diverse age structure, trees will grow, decline and die at different rates and times dependant on a variety of factors including but not limited, to species, environment and climate.

To achieve continuity of trees and woodlands within a landscape it therefore stands to reason that the trees and woodlands must be replaced as fast as they are lost; however, if we simply only plant a new tree every time one is removed or dies, we will slowly lose the age diversity we find in a well-developed urban forest. To ensure continuity of tree canopy cover we must therefore ensure that the age structure of our urban forest is such that we have most tree numbers across the young, early mature and semi mature age classes with lower numbers of mature, veteran and ancient trees.

The sample plot survey, see Fig 10, indicates that Wokingham has many semi-mature trees in comparison to the other age classifications. While at first this appears to be in line with the previous statements regarding a sustainable urban forest the profile, in Wokingham it does highlight a level of risk.

Semi mature trees are required to ensure mature trees develop in the future however these trees are regularly viewed as less important when considering land for development or where highway renewal schemes are undertaken, these trees often do not have the prominence in the landscape that larger mature trees provide and as such they are often removed. This diminishes the available tree stock that can reach the levels of maturity where the greatest number of ecosystem services are provided.

Figure 10. Bar chart indicating the number of trees in each age class

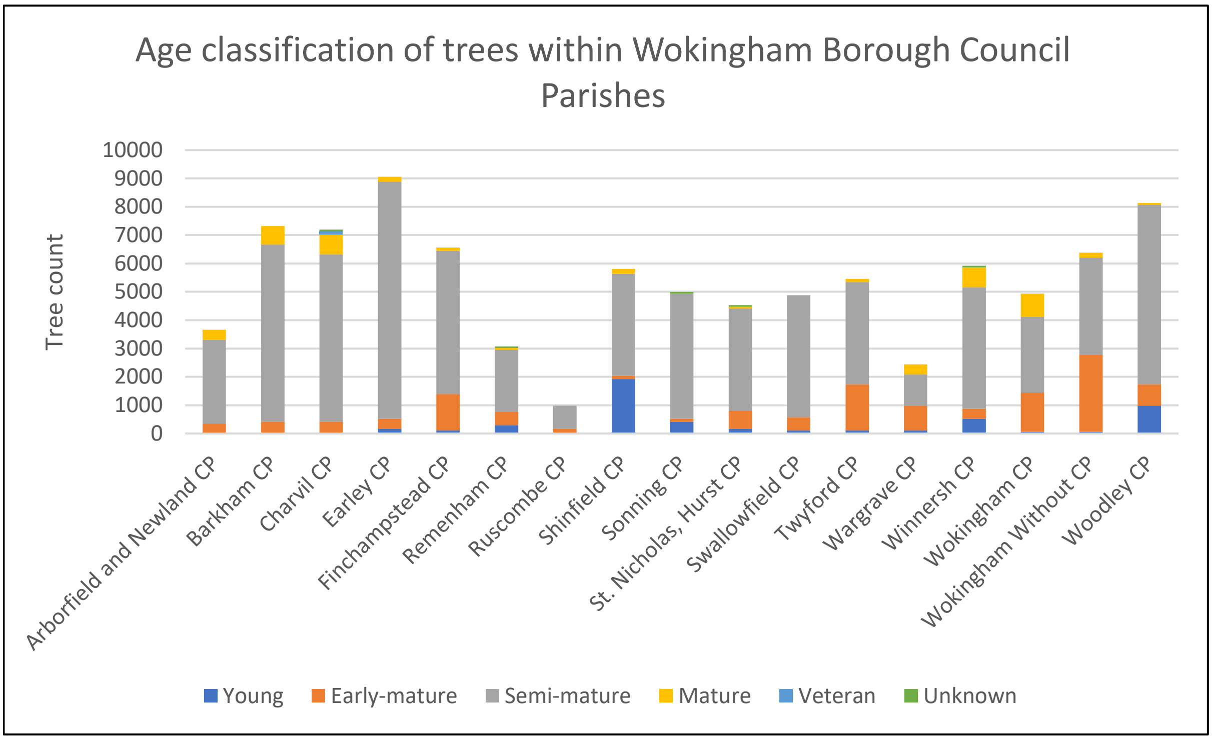



The results indicate that WBC's Tree Planting goal in line with the Climate Emergency Action Plan would go a significant way to addressing the potential risk of decline in the number of mature trees within the borough. It also highlights the importance of both ensuring those newly planted trees are maintained to full establishment and the importance that semi-mature trees play in the developing urban forest.

The extrapolated data from the tree survey against the NTM dataset indicates the statistical presence of 116 Veteran trees within the borough, however the local veteran tree group Wokingham and District Veteran Tree Association have been systematically surveying trees in the borough as part of the Woodland Trust Ancient Tree hunt. This volunteer survey has identified the presence of over 8.5k trees within the borough which it has identified as being ancient or veteran trees. It is recognised that ancient and veteran trees are a significant visual and ecological asset that requires great care and protection. WBC have recognised this within the tree strategy and seek to formally protect these important trees where circumstances and resources allow.

The chart found at Figure 11. provides a breakdown of the age structure of the WBC owned tree cover in each Parish scaled up to the number of trees within the NTM dataset. This data can be used in conjunction with the tree planting potential plans to identify and target those areas most in need of new planting subject to resource availability.

Figure 11. Age structure of WBC owned trees within each parish.



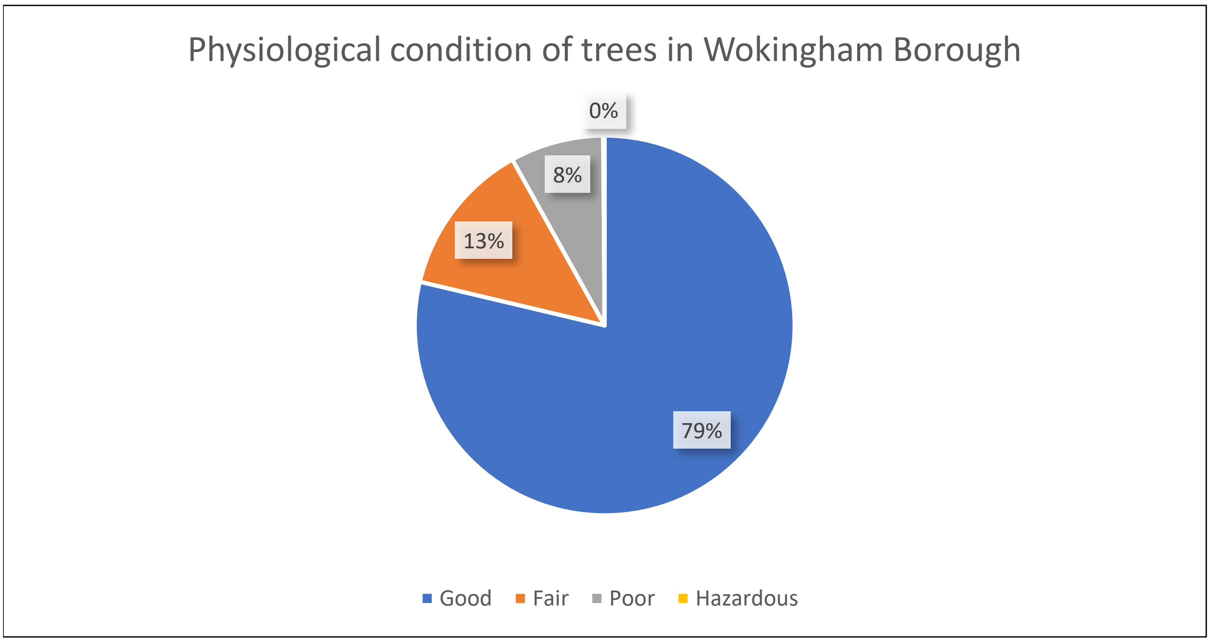

**Tree condition**

During the plot survey each tree was assessed for both its physiological condition and that of its structural condition. This information again is important to planning and maintaining a resilient and sustainable urban forest. Physiological condition considers the abiotic and biotic factors that may be affecting the health of a tree. Understanding the relationship, a tree has with its natural surroundings and how these may affect the trees health are important to ascertain whether remedial action should be taken to address significant issues or in some cases whether a tree can be left to its own devices.

Visual cues such as thinning canopies, small leaves, prolific production of epicormic growth, wilting and premature leaf loss can all be evidencing a tree is under stress. Stresses may be caused by the environment such as through extreme changes to our climate such as the summer drought conditions of 2022 or through the impact of human actions such as use of herbicides or road salt. Trees that are under such stresses are often more prone to infection by fungal pathogens such as the previously mentioned *Hymenocyphus fraxineus*.

The results of this element of the survey can be found in the chart below Fig 12. In general, the surveyed trees were in a good physiological condition with only a small percentage falling into the fair or poor category. This indicates that most of the tree asset is in a healthy condition, considering the large bias in age classification toward semi mature the future may be positive for seeing many trees developing into maturity, this may however also rely on sufficient resources to both maintain and protect these trees.

Figure 12. Breakdown by percentage of the physiological condition of trees within WBC

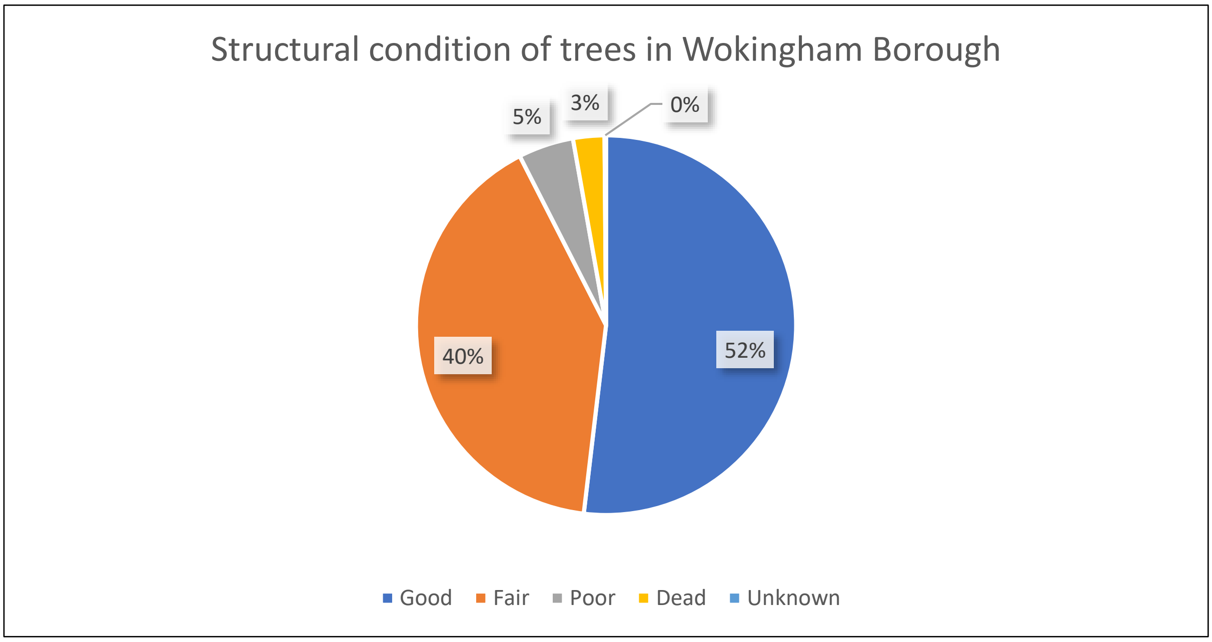



The second element of tree condition is that of its structure, this comprises of both natural elements, such as the growth habit of a particular tree species e.g., the propensity of a Norway maple *Acer platanoides* to produce included unions which can later lead to branch failures, from the action of weather, e.g., storm damage or from the actions of humans, e.g., mechanical damage to tree roots from inconsiderate trenching or sub-standard tree works.

The results of this element as indicated in Fig 13. below, are still broadly positive; however as significant proportion of trees are identified as being within the fair category. This seeming decrease in the condition of the tree stock is however not a significant issue. Most trees found in our towns and cities will be affected in some way through specific growth traits as previously mentioned or through some form of mechanical damage via either natural or human interaction which will have caused damage to the tree.

The low numbers of trees in a poor or dead condition highlight the quality of condition the trees bring to the borough. Had the results indicated a significant percentage of trees of being in a poor structural condition, this would highlight a potential significant liability for the Council, it should be noted however that these percentages are derived from a physical survey of trees extrapolated against the NTM dataset – which indicates that WBC have approximately 91k trees under their responsibility, if around 8% of these are in a poor or dead condition this still equates to over 7k trees that may require some action to ensure the tree is in a safe condition that poses little or no risk to the public or property.

Figure 13. Breakdown by percentage of the structural condition of trees within WBC.




## Pathogens

The pressure on the borough's trees has never been higher from pest and disease. Nationally we are seeing the increase in foreign pests and diseases. Some of these pests and diseases have been present in the UK for many years while others are more recent. While some of these pests and diseases are endemic and well understood others are less so. It is however recognised that pests and diseases have the potential to significantly impact both tree health and safety; and some may also affect the health of the local population.

While undertaking the tree survey several pests and diseases were identified, see Figure 14. and 15. Dutch elm disease (DED) was identified 30 times across the borough, while this is now endemic across the UK the impact is clear in the decline and death of many of our elm trees. The disease generally affects the semi mature elm growing from original root stock of trees that were infected and either died or were removed in the last 40 years. The survey indicated the presence of 30 trees with the infection which when extrapolated against the NTM indicates there are around 1750 trees within the borough that have DED. As the trees succumb to the disease they are at increased risk of branch and stem failure posing a risk to highways, property and people.

Ash dieback caused by the fungus *Hymenocyphus fraxineus* is perhaps of more relevance than DED as this fungal infection as previously noted has the potential to cause the rapid decline and death of our mature ash trees. This has the potential to dramatically and suddenly change the view of our landscapes and woodlands while also placing a significant burden and liability on the local authority resources. It is recommended by the Tree Council that all local authorities undertake surveys of their trees to identify the presence of both ash trees and the prevalence of the disease, the Tree Council provide a useful guidance note with the recommended approach for the management of ADB based on a 4-tier classification system.

Regarding the potential of pest and disease to also affect the health of the residents of the borough the survey identified 1 tree with Oak processionary moth, the caterpillars of this moth and their nests contain fine hairs which can cause severe skin irritation and affect breathing if inhaled.

Significant infestations of the oak processionary moth may place a significant burden on the local authority with a requirement to undertake nest removal and the use of pesticides to kill the moth and caterpillars. The use of such chemicals however is nonselective in the various moth (*Lepidoptera spp*) they affect, given the importance of the ancient and veteran trees that are found within the borough and the ecological communities they support, it is important to identify and address infestations an early stage.

Fig 14. Overview of the most common identified pests within the tree survey.

| Pests | Tree survey count | Tree count scaled up to NTM |
|---|---|---|
| Dutch elm disease (*O. novo-ulmi*) | 30 | 1742 |
| Oak processionary moth (*Thaumetopoea processionea*) | 1 | 58 |
| Other | 1 | 58 |
| None | 1541 | 89495 |
| **Total** | **1573** | **91353** |

Fig 15. Overview of the most common identified pests within the tree survey.

| Fungus | Tree survey count | Tree count scaled up to NTM |
|---|---|---|
| Ash bracket (*Innonotus hispidus*) | 1 | 58 |
| Ash dieback (*Hymenoscyphus fraxineus*) | 75 | 4356 |
| Other | 1 | 58 |
| None | 1496 | 86881 |
| **Total** | **1573** | **91353** |

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