Treework Environmental Practice

North Kent Woods and Downs National Nature Reserve

Ancient and Veteran Tree Survey

On behalf of

Kent Downs National Landscape and its partners

2501219-NKWD-AVTR-01-MS

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Executive Summary

The ancient and veteran tree survey, undertaken between September and December 2024, was initiated with the aim of updating the baseline information to better understand the ancient and veteran tree population and its significance across an initial 18 sites in the proposed North Kent Woods and Downs National Nature Reserve (NNR), in recognition of both the special and significant habitat provided, the historic cultural landscape in which they are a part and to assist the medium to long term management of these important trees and inform the wider site wide vision for the NNR.

It follows an initial scoping study of the area, carried out between February and March 2024 (report ref:240323-KNNR-AVTR-02-MS).

A total of **1,398** trees have been surveyed. The analysis indicates a population of **907** ancient and/or veteran trees, including a strong cohort of candidate, or future veteran trees.

Veteran Type	Quantity	Veteran Type Definition
Ancient and Veteran Trees	**193**	At a life stage and girth that could be described as 'ancient' and exhibiting at least x3 'primary veteran features'
Ancient trees with less than x3 veteran features	**185**	At a life stage and girth that could be described as 'ancient' but exhibiting less than x3 'primary veteran features'
Non - Ancient Veterans	**529**	Not sufficiently old or of a sufficient girth to be described as 'ancient, but of a life stage of mature or older, exhibiting some form of crown reorganisation and exhibiting at least x3 'primary veteran features'
Candidate Veterans	491	At a life stage of at least full to late maturity, exhibiting x3 'primary veteran features', the features considered to have longevity that persist into the future.

The survey data includes the following:

- Basic Tree Data (Specialist Survey Method Level 3) (all 1,398 trees)
- A tree viability evaluation (Specialist Survey Method Level 5) (all 1,398 trees)
- A habitat and associate evaluation (Specialist Survey Method Level 4) (for the 907 Ancient and/or Veteran trees.
- Recommendations, initially, for management over the short to medium term to address viability and continuity of veteran tree habitat (for the 907 Ancient and/or Veteran trees)
- A photographic record of each surveyed tree (all 1,398 trees)
- A plan identifying the location of all trees (all 1,398)

Taking all of the current 18 sites within the proposed National Nature Reserve area together, and using all available data known to the author, albeit limited, the evaluation indicates that the area, much of which is historically part of the medieval Cobham Hall Estate, is considered to be both nationally and internationally significant for ancient and veteran trees.

The ancient and/or veteran tree population is comprised predominantly of Sweet Chestnut, (Castanea sativa, 32%), Hornbeam (*Carpinus betulus*, 18%), English Oak (*Quercus robur,* 16%) and Ash (*Fraxinus excelsior,* 15%) and other species (19%).

Veteran trees offer rare micro-habitats primarily associated with the presence of decay and dead wood. Dead wood and decay within standing live trees offer the richest saproxylic biodiversity and the rarest resource within any tree population.

This report presents Individual Tree Management Plans (ITMPs) for each of the 907 ancient and or veteran trees, the key aim of which is to ensure the long-term retention of each tree. The management objective offers a long-term goal, proposed to be achieved over a decade or more, sometimes involving more than one stage of treatment.

The evaluation indicates a more-or-less stable population of trees with only 23% of the population having a moderate or greater risk of decline. 88% of the population had a vitality assessed as 'moderate' or higher.

Only 7% were assessed as having a 'moderate to probable' or higher chance of collapse. Some of these trees have recommended remedial works to reduce this risk.

A reflection of the relatively favourable condition of the trees is that significant proportion, 85% have live growth occupying 50% or more of their canopy, all trees being maintained at their current crown scale, managed cyclically for trees previously reduced over the medium term or allowed to grow.

85% were considered to have moderate or above vitality, where the likelihood of decline is low to moderate or better. On the basis, the population can be considered to be robust and resources allocated to the management of these trees to further reduce the likelihood of physiological decline or structural collapse, likely to be effective.

A reflection of the relatively good structural condition of the trees within the population is that a large proportion of trees simply require maintenance of the current crown scale to ensure a low likelihood of loss through structural collapse.

Pruning operations to initiate a new reduction in crown size, including retrenchment pruning has been recommended for 17% of trees within 10 years to create a more stable form primarily to maximise tree longevity and the associated habitat value.

Decline of veteran and ancient trees is often heavily influenced by shading and suppression by neighbouring trees. Just over a quarter of the trees (26%) have recommendations to reduce the influence of adjacent competing trees and vegetation.

A number of trees were found to have compaction within their rooting area, mostly, those located close to well used pedestrian paths. Recommendations are made to apply bark chip to

reduce compaction. Alternatively, consideration could be made to diverting paths further away from the trees if practicable.

Soil amelioration in the form of adding composted woodchip beneath crown spreads has been specified for 37 trees (4%) in an attempt to improve physiological condition. An application of a compost tea has been specified for a further two trees to further improve physiological condition.

The assessment indicates that the Habitat and Associate scores, based on the number of habitat features and associated fungi, epiphytes, signs of invertebrates and signs of birds and mammals, observed at the time of survey, found that 842 of the 907 ancient and, or veteran trees surveyed (93%) attained a habitat score considered 'notable' and above. Associate scores for the majority of trees within the population were found to be in the lower ranges. This does not however mean that the population is not valuable as a habitat resource.

Trees should be reviewed according to the proposed inspection regime. All works with a priority longer than 2 years should be reviewed prior to commissioning the operations.

Contents

1 Introduction

1.1 North Kent Woods and Downs National Nature Reserve

1.1.1 This Ancient and Veteran tree survey, commissioned by Kent Downs National Landscape and its partners was initiated with the aim of updating and adding to the ancient and veteran tree baseline information to better understand the population across the proposed North Kent Woods and Downs National Nature Reserve (NNR) area, in recognition of both the special and significant habitat provided by the trees and the historic cultural landscape in which they are a part and, over the medium to longer term, the aspiration to manage these important trees to inform the wider vision for the proposed reserve.

1.1.2 The area covers approximately 2,009 hectares in total and consisting of 18 individual sites located in north Kent and siting within the Kent Downs National Landscape, much of the area historically part of the medieval Cobham Hall Estate. In addition to the ancient and veteran tree population, the area consists of ancient woodland and chalk grassland with a rich diversity of associated species.

1.1.3 The 18 sites, their owners and/or mangers and size are shown in Table 1 below as well as in Appendix G, the site tree plans.

Table 1: The Sites

Site Name	Map ID	Owner	Area (Ha)
Ashenbank Wood	5	Woodland Trust	28.4
Camer Park	19	Gravesham BC	26.3
Cobham Hall School	9	Cobham Hall School	61.2
Cobham Wood	2	National Trust	79
Court Wood	16	Private	-
Crabbles Bottom	14	Shorne Parish Council	11.6
Cuxton and Cobham Woodland Project	3	West Kent Downs Countryside Trust	47.6
Great Crabbles Wood	13	Shorne Parish Council	
Holborough Woodlands	15	Tarmac	594.7
Jenskyns Community Woodland	6	Forestry England	149.8
Ranscombe Farm	4	Plantlife	275.1
Scalers Hill Wood	18	Private	-
Shorne Common Rough	7	Shorne Parish Council	1.95
Shorne Pasture	17	Shorne Parish Council	-
Shorne Wood Country Park	1	Kent County Council	171.2
Silverhand Estate	10	MDCV UK	533.0
South Ashenbank Wood	12	Private	7.5
West Park	11	Gravesham BC	21.2

1.2 The Scope

1.2.1 The survey was undertaken with the aim of identifying, plotting and recording data against those trees considered to be ancient, veteran and candidate veteran trees within the project areas boundaries, to identify, costed, individual tree management plans for each ancient and/or veteran tree and to provide an opinion on the significance of the ancient and veteran tree stock across the reserve.

1.2.2 The survey data includes the following:

- Basic Tree Data (Specialist Survey Method Level 3) (all 1,398 trees)
- A tree viability evaluation (Specialist Survey Method Level 5) (all 1,398 trees)
- A habitat and associate evaluation (Specialist Survey Method Level 4) (for the 907 Ancient and/or Veteran trees.
- Costed recommendations, initially, for management over the short to medium term to address viability and continuity of veteran tree habitat (for the 907 Ancient and/or Veteran trees)
- A photographic record of each surveyed tree (all 1,398 trees)
- A plan identifying the location of the trees (all 1,398)

1.2.3 The survey was carried out between September and December 2024.

1.2.4 The survey team consisted of the following:

- Matt Searle (Principal Arboricultural Consultant, Treework Environmental Practice)
- Luke Fay (Senior Arboricultural Consultant, Treework Environmental Practice)
- James Butler-White (Senior Arboricultural Consultant, Treework Environmental Practice)
- James Covenant (Arboricultural Consultant, Treework Environmental Practice)
- Paul Muir (Principal Arboricultural Consultant, Treework Environmental Practice)
- Claire Harbinson (Principal Arboricultural Consultant, Treework Environmental Practice)
- Charlie Sproul (Arboricultural Consultant, Place Services).

1.3 The Value of Ancient and Veteran Trees

1.3.1 Ancient and veteran trees are valuable primarily for the continuity of rare micro-habitats primarily associated with the presence of decay and dead wood. Dead wood and decay within standing live trees offer the richest saproxylic biodiversity and the rarest resource within any tree population. This habitat value is recognised in the National Planning Policy Framework, recognising that such trees, considered to be irreplaceable habitat can only be removed in 'wholly exceptional' circumstances.

1.3.2 Such trees are defined by their longevity. This longevity is a product of the genetic attributes of the individual tree, the environmental conditions within which the tree is growing and an element of chance.

1.3.3 For a tree to undergo extended life stages it will have experienced either a retarded rate of growth due to stress or resource limitations, or it will have survived collapse, storm damage or pruning operations that have rejuvenated the crown structure through the initiation and development of dormant or adventitious buds. These latter processes illustrate an important distinction between the ageing of animals and trees. Trees have the ability to generate new growth from undifferentiated meristematic tissue so that whilst a tree's origins might be considered old in chronological terms, the age of individual parts may vary considerably in a developmental and functional sense (del Tredici, 1999 and Thomas, 2001). For example, at initiation, epicormic growth has the physiological characteristics of a juvenile shoot (Raumbault, 2006 and Halle, 2007). This means that in the ancient phase the tree can be viewed as being comprised of relatively distinct, discrete, independent functional units with crown parts occupying a range of developmental stages (Lonsdale, 2013).

1.3.4 Size can limit longevity. Whether this is due to the problem of transporting water over long distances (Čermák, 2008), the availability of resources for laying down annual increments across an increasing crown structure, the restricted width of those annual increments or the increased hydraulic resistance due to the increased number of vessel endings along a branch with great age (Rust and Roloff, 2002), longevity in trees does not generally favour a large crown.

1.3.5 The processes that occur as a tree passes into the ancient phase of development create habitat features that in any other context could be viewed as damage and as undesirable. The dieback, dead wood, decay and hollowing, split and broken branches and loose bark are all rare and valuable attributes that support unique ecosystems and populations of rare species that rely on these micro-environments.

1.3.6 The unique habitat supported by an ancient or veteran tree develops over long periods of time. Longevity of the individual tree and continuity of the habitat across populations of trees is an important consideration when determining management approaches for any population of veteran trees.

2 Survey and Assessment Method

2.1 Ancient or Veteran?

2.1.1 A tree is defined as an ancient tree when it has passed into the ancient phase of development, characterised by the features outlined, but primarily determined by a reconfiguration or reorganisation of the crown (dieback at the periphery) and decay within the bole and principal crown limbs.

2.1.2 Ageing in trees is not a simple concept and is not analogous with ageing in animals. Trees progress through developmental stages, but it is common for a tree to have parts that are different ages in both a chronological and a physiological sense.

2.1.3 Trees of different species pass through developmental stages at different rates. A birch, for example, will reach maturity and enter the ancient phase much sooner (in terms of years) than an oak. Trees of the same species with different genetic attributes and growing under different environmental conditions may also pass though stages of development at very different rates.

2.1.4 Consequently, an ancient tree can be considered to have reached the ancient phase of development by passing through the stages at a rate typical for a tree of a particular species, with certain genetic attributes and under particular growing conditions. This cannot be defined in simple chronological terms. Given that we cannot, generally, be sure of the history of development of any individual tree, an ancient tree is identified by the features associated with the re-organisation of the crown at the latter phases of development. These features are described in Box 1.

2.1.5 Consequently, a veteran tree is one that exhibits the morphological features that one would observe in a tree at the ancient phase of development, but at an earlier age than might be expected, due to the tree having been exposed to some shock, stress, environmental change or management practice. An important criterion for a tree to be considered to be a veteran is that it must demonstrate resilience and longevity. A damaged tree that has only declined since the incident that forced it out of the mature phase is unlikely to qualify as a veteran tree.

2.1.6 The reality is that it is often not possible to reliably distinguish between an ancient and a veteran tree in the field during a survey. More importantly the habitat value offered by both is significant and may be indistinguishable. Whilst recognising the challenges of distinguishing between the two, for the purpose of this survey, the approach for identifying ancient, veteran and candidate veteran trees in the field, is set out below:

2.1.7 A tree will be defined as a **veteran** tree if:

- It has passed into the early ancient phase of development (D-E, figure 1 below), characterised primarily by a reorganisation of its crown (retrenchment and the increased establishment of a lower crown), either due to natural ageing or due to shock or stress,
- It has a minimum of x3 Primary veteran tree habitat features (Box 1 below) that have developed over time,
- Its habitat features are considered to have had and will continue to have longevity (thought to persist into the future),
- It has chronologically aged for its species, assessed primarily on a girth size (either its current size, or, where the trunk is substantially decayed already, its likely maximum

girth size prior to decay) that is large for its species in its growing conditions (see Figure 2).

2.1.8 A tree will be defined as **ancient** if:

- It meets the criteria of the veteran above, and,
- it is chronologically aged for that species, assessed primarily on a girth size (either its current size, or, where the bole was substantially decayed already, its likely maximum girth size prior to decay) that is very large for its species in its growing conditions (see Figure 2).

2.1.9 A tree will be defined as a **candidate veteran** tree if:

- It has passed into the full to late maturity (but not early ancient to ancient developmental stage. (C-D figure 1),
- It has a minimum of x3 Primary veteran tree habitat features (Box 1 above),
- The habitat features are considered to have longevity (thought to be able to persist into the future).

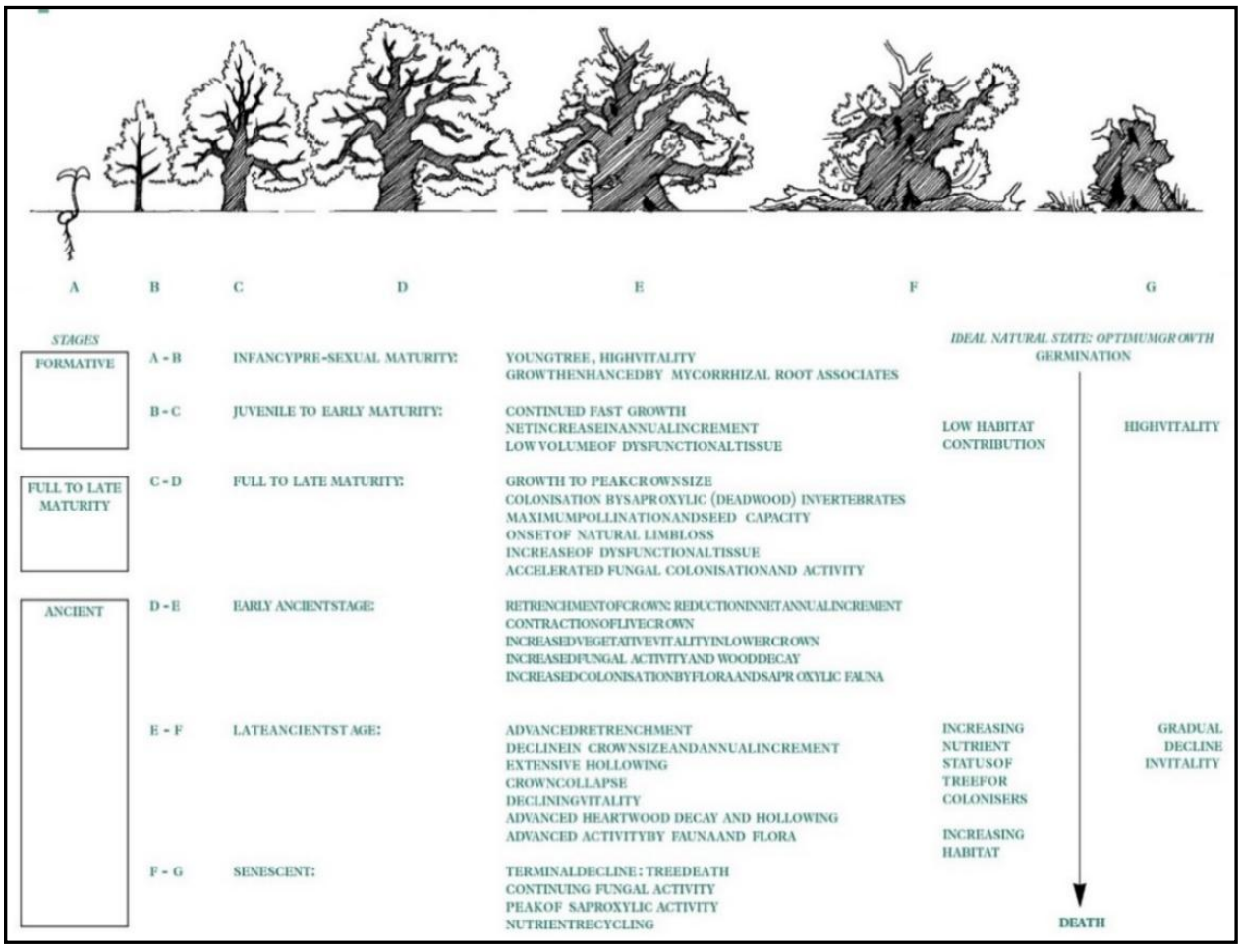


Figure 1: Life Stages of a Tree (taken from Read, H. (2000) Veteran Trees: A Guide to Good Management)

Box 1. Key Veteran Features

In addition to crown reorganisation

Hollowing
Decay processes are natural and inevitable during the ageing process of a tree. Hollowing in the trunk or major limbs often has limited impact on stability where stem diameters are large. Decaying wood is recycled by being broken down with nutrients returned directly to the soil or captured by adventitious roots within the hollow stem.

Dead wood
Dead wood is often colonised by decay fungi. Fallen and attached dead wood may support different suites of colonising species. Extensive, large diameter dead wood whether standing or fallen is of great habitat value.

Rot holes.
These can develop through limb loss and bark wounds, are expanded by microorganisms and invertebrates, and can become occupied by birds and bats.

Rot sites.
Wood may be colonised by decay fungi eventually leading to the creation of rot holes (see above). Such sites can then become valuable for saproxylic species.

Fungal fruiting bodies
Fruiting bodies of fungi known to cause wood decay are significant as evidence of fungal processes.

Secondary Veteran Features

Split limbs
The process of gradual limb loss may be initiated in a small proportion of upward curving limbs where internal stresses result in longitudinal splits (along the grain).
Tears
Exposed woody tissue wounds usually elongated in shape, principally torn along (not across) the grain. Tears are associated with the recent shedding of live limb parts and result when attached fibres on the underside resist separation from the parent stem.
Scars
An aged tear with exposed tissue surrounded with a roll of wound wood.
Live stubs
Stubs are naturally fractured, truncated ends of live stems or branches. A stub is a result of a natural fracture and may follow the process described under splitting.
Loose and dead bark
Areas of dead, loose and flaking bark consistent with the tree developing individual functional units.

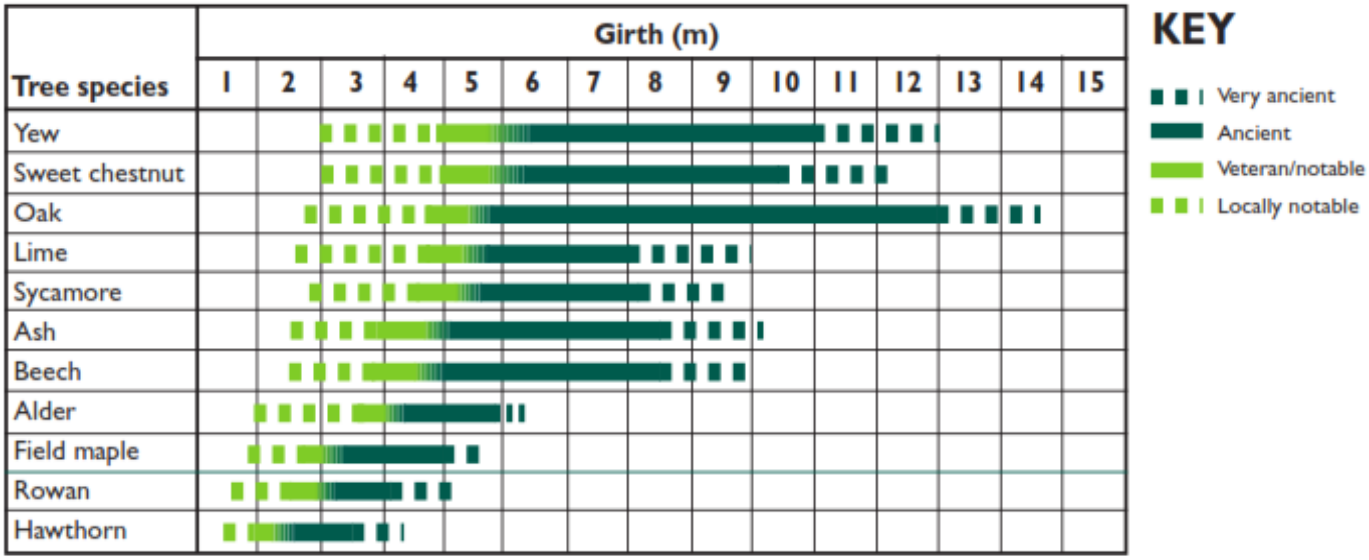


Figure 2: Relationship between Girth and Age (taken from Lonsdale D, (2013) Ancient and veteran Trees: Further Guidance on Management, ATF, London).

2.2 The Specialist Survey Method

2.2.1 The Specialist Survey Method (SSM) was developed by Treework Environmental Practice as part of the Veteran Trees Initiative (Fay and de Berker, 1997), a project run by English Nature (later part of Natural England) with the aim of providing a standardised framework for recording data during surveys undertaken to identify, locate and assess veteran trees. The Specialist Survey Method is intended to record key morphological characteristics of veteran trees as well as to quantify the habitat features and attributes and the associated and dependant organisms that rely on these habitat features.

2.2.2 The Specialist Survey Method was designed to enable data to be collected according to a range of levels, with Level 1 being a simple introductory level, Level 2 being an intermediate level and Level 3 being the comprehensive specialist survey.

2.2.3 This survey followed the Specialist Survey Method Level 3 for all 907 ancient and veteran trees, collecting all the tree details identified in the Specialist Survey Method (fields 1-31) as set out in detail in Appendix F.

2.3 Habitat Evaluation (SSM Level 4)

2.3.1 An evaluation method has been developed by Treework Environmental Practice to interpret the data collected during the SSM Level 3 survey to assist with management decisions required for large populations of veteran and ancient trees, by rating each tree according to a Habitat Score and an Associate Score (described in section 2.4). This approach has been described as a Specialist Survey Method Level 4 evaluation, although this has not been published. The purpose of the scoring system is to identify the trees within a population that provide the greatest potential habitat value to direct an

appropriate allocation of management resources to these trees, and conversely to direct expenditure away from those trees that provide the lowest habitat value, where resources are limited.

2.3.2 The data recorded during the SSM Level 3 survey is predominantly a record of the quantity and quality of the decay and deadwood habitat present within each tree, representing the potential for each tree to support wildlife.

2.3.3 The scoring system has the potential to be used as an index of tree biodiversity and can provide comparative data to assist with the analysis of a veteran tree population over time.

2.3.4 The Habitat Score references the data recorded in the following five fields: Hollowing (Trunk and Mature Crown) (16), Holes (Trunk and Mature Crown) (17), Rot (19), Deadwood (Attached to the Tree) (20) and Deadwood (Fallen) (21).

2.3.5 Table 2 shows the allocation of scores to SSM Level 3 data records that are used to generate the Habitat Score. The scores for Hollowing (Trunk and Mature Crown) (16) references the SSM Level 3 codes [1]-[5] directly with a total score for hollowing of the trunk ranging from 3-15. Hollowing within the crown is allocated a score based on placing the count of hollows within a number of ranges, with resulting scores of 0-4. Holes (Trunk and Mature Crown) (17) is allocated a score based on placing the count of holes within a number of ranges, with resulting scores of 0-4. Up to 3 Rots (19) are recorded during the SSM Level 3 survey. Each occurrence is allocated a score of 1, or a score of 2 if the occurrence is marked as extensive in volume, with resulting total scores of 0-6. Deadwood (Attached to the Tree) (20) and Deadwood (Fallen) (21) are allocated scores based on placing the counts of each into a number of ranges with resulting scores for each of 0-4.

2.3.6 Habitat Scores of between 3 and 37 can be generated for an individual tree. As a general rule, trees with scores of 9 and above might be considered to offer notable habitat features within the local landscape.

2.3.7 Clearly this scoring system is simply a guide to inform broad management decisions across a tree population. It is of course possible for individual trees to have a low numerical score but to offer high individual habitat value, by virtue of the presence of specific unique habitats, or through the significance of the volume of habitat present not being fully reflected by the Specialist Survey Method Level 3 data collected. It is also possible for trees to provide habitat that supports specific species such as those scheduled in the Wildlife and Countryside Act (1981).

Table 2 Habitat Score

Score	Hollowing Base	Hollowing Mid	Hollowing Top	Hollowing Crown	Holes	Rot Sites (1-3)	Deadwood (Attached)	Deadwood (Fallen)
0	N/A	N/A	N/A	None	None	None	None	None
1	[1]	[1]	[1]	1-3	1-3	1	1-5	1-5
2	[2]	[2]	[2]	4-6	4-6	2	6-10	6-10
3	[3]	[3]	[3]	7-9	7-9		11-15	11-15
4	[4]	[4]	[4]	10+	10+		15+	15+
5	[5]	[5]	[5]					
Range	1-5	1-5	1-5	0-4	0-4	0-6	0-4	0-4

2.4 Associate Evaluation (SSM Level 4)

2.4.1 The Associate Score is a useful index that can be considered alongside the Habitat Score to rate veteran trees within a population according to their relative value in terms of the diversity of species supported.

Table 3 Associate Score

Score	Fungi	Epiphytes	Invertebrates	Birds and Mammals
0	None	None	None	None
1	1-3	1-3	1-3	1-3
2	4-6	4-6	4-6	4-6
3	6+	6+	6+	6+
Range	0-3	0-3	0-3	0-3

2.4.2 The SSM Level 3 survey involves a count of Fungi (22), Epiphytes and Hemiparasites (23), Invertebrates (24), Birds and Mammals (25). Clearly such observations can be limited to determining presence by noting signs of use, rather than making positive identification of certain species. The record is also heavily dependent on seasonal factors season (e.g., fungal fruiting bodies are most abundant during the autumn) and can differ between years depending on variations in weather patterns. The survey was undertaken between September and December.

2.4.3 Each associate type is allocated a score based on placing the count (of species and occurrence) within a range, where absence is given a score of 0, occasional presence (1-3 species/occurrence) is given a score of 1, considerable presence (4-6 species/occurrence) is given a score of 2, and species rich (6+ species/occurrence) is given a score of 3, as set out in Table 3.

2.4.4 Associate Scores of between 0 and 12 can be generated.

2.5 Viability Evaluation (SSM Level 5)

2.5.1 Further development of the Specialist Survey Method since publication in 1997 has been initiated by Treework Environmental Practice. This has included advanced modules to record additional data to help inform management decisions and allocate resources across large tree populations.

2.5.2 SSM Level 5 is an arboricultural evaluation system used to assess the potential for the loss of a veteran tree, and the habitat that the tree supports, through either physiological decline, through structural collapse, or through a combination of both.

2.5.3 The evaluation, carried out for all 1,398 trees, generates a Viability Score based on an assessment of current vitality, the likelihood of loss of a tree within 10-15 years through physiological decline and the likelihood of loss of a tree within 10-15 years through structural collapse. This Viability Score is then intended to inform treatment or management priorities to address the various threats to the survival of the tree, and the retention of the habitat supported, within the context of budget and resource limitations.

2.5.4 Vitality is recorded during the survey taking into account factors such as crown condition, extension growth, leaf size and colour, crown density and localised dieback. It is a measure of the current response of the tree to recent environmental and climatic conditions.

2.5.5 Vitality is recorded as follows: [1] Dead, [2] Moribund, [3] Advanced decline, [4] Low, [5] Low to moderate, [6] Moderate, [7] High to moderate, [8] High, [9] Very high, [10] Exceptionally high.

2.5.6 Likelihood of loss through structural collapse takes into account the likelihood of whole tree failure through uprooting or stem fracture, as well as the potential for the loss of major, weakly attached crown parts to either directly drastically reduce the volume or variety of habitat offered by the tree, or to initiate or contribute to the physiological decline or death of the tree, through the reduced ability of the retained crown to support the remaining tree remnants. The assessment takes into account the current context within which the tree is growing, tree species, crown size, loads, stem and limb diameters and extension, and the extent and nature of decay taking place. Changes in setting are likely to require an updated assessment.

2.5.7 Likelihood of loss through structural collapse is recorded as follows: [1] Dead, [2] Extremely high, [3] Very high, [4] High,[5] Probable, [6] Moderate to probable, [7] Low to moderate, [8] Low, [9] Very low, [10] Improbable.

2.5.8 Likelihood of loss through physiological decline takes into account the health of the tree over the longer term. It is an expression of the conditions within which the tree has been growing, the nature of the growing seasons over the recent past and a sense of the tree's genetic attributes and apparent resilience to change. Factors such as the extent of crown dieback, evidence of the development of wound wood and the condition and quantity of epicormic growth contribute to the assessment.

2.5.9 Likelihood of loss through physiological decline is recorded as follows: [1] Dead, [2] Extremely high, [3] Very high, [4] High,[5] Probable, [6] Moderate to probable, [7] Low to moderate, [8] Low, [9] Very low, [10] Improbable.

2.5.10 The Viability Score is the total of the scores allocated to the three assessments Vitality, Likelihood of loss through physiological decline and Likelihood of loss through structural collapse. Viability Scores of 0-30 are possible.

2.5.11 Trees with a Viability Score of **10 or below** are considered to have low viability; there is a high risk of losing these trees within the next 10-15 years.

2.5.12 Trees with a Viability Score of between 11 and 20 are considered to have a moderate viability; the risk of loss within the next 10-15 years is considered to be likely to be remediable.

2.5.13 Trees with a Viability Score greater than 20 are considered to have high viability at the time of inspection; the risk of loss within the next 10-15 years is considered to be low even in the absence of remedial work being undertaken.

2.6 Management Recommendations and Management Objectives (SSM Level 6)

2.6.1 Veteran trees offer rare and important micro-habitats primarily associated with the presence of decay and dead wood. Dead wood and decay present within standing live trees offers the richest saproxylic biodiversity and the rarest resource within any tree population. When considering the management of veteran tree populations,

conservation aims should assume that wherever feasible veteran trees are to be maintained alive and standing for as long as possible.

2.6.2 Whilst live veteran trees tend to offer the highest habitat value, standing dead trees and monoliths are also valuable, and should be retained and managed as a standing deadwood resource. Standing dead trees are generally relatively rare due to public safety concerns and a history of removal, prior to a wider awareness and recognition of the habitat value offered. Note that dead trees were not recorded as a part of this survey.

2.6.3 Fallen dead trees and shed branches, whilst generally less rare as a habitat resource are also valuable and should be retained wherever feasible.

2.6.4 The retention of a population of standing live veteran trees, standing dead trees and monoliths and the retention of fallen dead trees and branches, is an essential management aim for sustaining deadwood ecosystems, and ensuring habitat continuity over the long-term to support the communities that are reliant on these features.

2.6.5 Specialist Survey Method Level 6 aims to present an Individual Tree Management Plan (ITMP) for each tree within a surveyed population to maximise the potential for longevity of the tree as a standing live individual wherever possible. All 907 ancient and/or veteran trees have an ITMP. The management plan involves recording a management objective, initial recommendations to initiate the path required to reach that objective, cyclical operations where appropriate, and, where appropriate, a re-inspection regime to review and revise where necessary the proposed initial recommendations.

2.6.6 The management objective will be a long- term goal, likely to be proposed to be achieved over one or more decades and will generally involve more than one stage of treatment. Initially the ITMP identifies a plan for the tree over the next decade or so.

3 Survey Results

3.1 SSM Level 3 - Basic Data.

3.1.1 A total of 1,398 trees, forming a part of the baseline survey, have been plotted and recorded in MyTrees database and Geographic Information System (GIS) across the park. Table 4 below provides a breakdown and definition of each type. Table 5 provides a breakdown of each type by site.

3.1.2 The ancient and/or veteran tree population is comprised predominantly of Sweet Chestnut, (Castanea sativa, 32%), Hornbeam (Carpinus betulus, 18%), English Oak (Quercus robur, 16%), Ash (Fraxinus excelsior, 15%) and other species (19%). A full list of species can be found in Table A1, Appendix A.

3.1.3 806 (58%) were found to have a ‘maiden’ form, with 209 (15%) ‘coppiced’ trees, 178 (13%) ‘lapsed pollards’, 61 (4%) ‘multi stemmed, 49 (3%) ‘natural and managed pollard

38 (3%) 'phoenix regenerated' trees and other forms making up the remaining 4%. A full list of tree forms can be found in Table A4, Appendix A.

3.1.4 A series of graphs summarising the majority of the SSM Level 3 data collected during the survey are presented at Appendix A.

3.1.5 Trees have been located within MyTrees GIS, and the positions are presented on a site - wide plan and individual site plans, identifying the location of each, colour differentiated by ancient, veteran and candidate. These plans are in Appendix G. The positional data are recorded as twelve figure grid references for all trees. Eastings and Northings are displayed in the individual tree reports.

3.1.6 A tree number has been allocated to provide a unique identifier across the area and within each site. Note that other previously allocated tree numbers, observed tagged to the tree have been recorded in the database.

3.1.7 The assessment of crown loss and remaining live crown growth made during the survey suggests that the majority of trees are in good condition for veteran trees. 1,180 trees 85% were recorded as having live crown growth across more than 50% of the current crown outline, and 1,283 (92%) were assessed to have lost less than 50% of the likely peak crown framework. Numbers of trees and their proportion of crown loss can be found in Table and Graph A6, Appendix A.

3.1.8 1,185 trees (85%) were considered to have moderate or above vitality. 11 trees were assessed as being in advanced decline or moribund (Table and Graph A9, Appendix A).

Table 4 Veteran Types - Site Wide

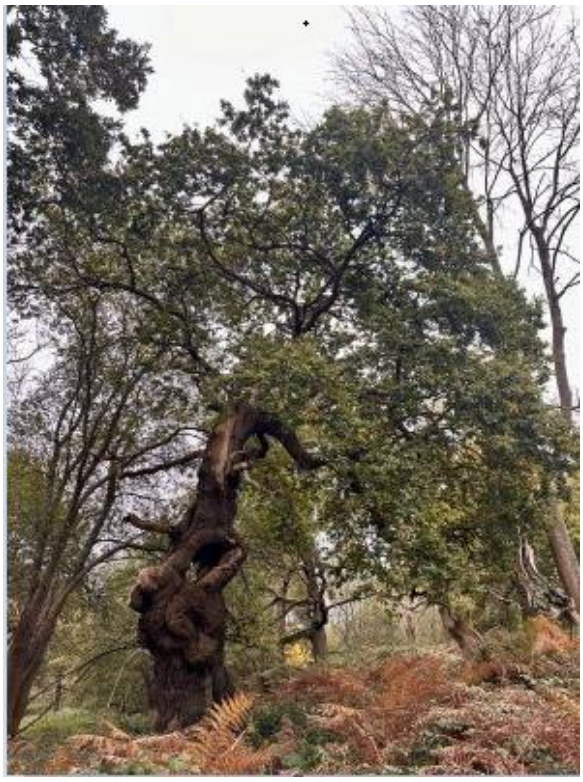
Veteran Type	Quantity	Veteran Type Definition
Ancient and Veteran Trees	**193**	At a life stage and girth that could be described as 'ancient' and exhibiting at least x3 'primary veteran features'
Ancient trees with less than x3 veteran features	**185**	At a life stage and girth that could be described as 'ancient' but exhibiting less than x3 'primary veteran features'
Non - Ancient Veterans	**529**	Not sufficiently old or of a sufficient girth to be described as 'ancient, but of a life stage of mature or older, exhibiting some form of crown reorganisation and exhibiting at least x3 'primary veteran features'
Candidate Veterans	491	At a life stage of at least full to late maturity, exhibiting x3 'primary veteran features', the features considered to have longevity that persist into the future.

Table 5 Veteran Types - Site by Site

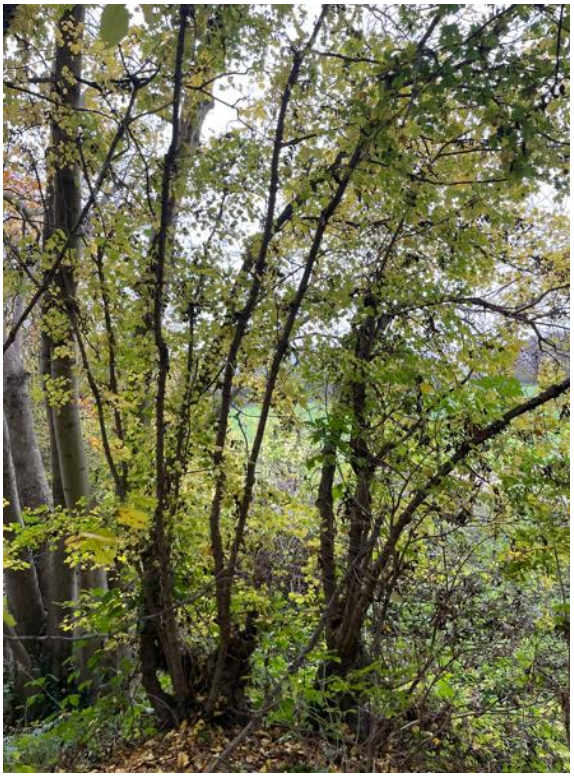
Site Name	Map Ref.	Ancient & Veteran	Ancient- less than x3 features	Non-Ancient Veterans	Candidate Veterans	Total
Ashenbank Wood	5	6	14	32	14	66
Camer Park	19	0	0	7	8	15
Cobham Hall School	9	15	1	56	32	104
Cobham Wood	2	71	1	180	150	402
Court Wood	16	0	22	1	10	33
Crabbles Bottom	14	1	0	0	0	1
Cuxton and Cobham WP	3	1	8	11	26	46
Great Crabbles Wood	13	8	10	1	5	24
Holborough Woodlands	15	11	50	40	34	135
Jenskyns	6	0	16	4	0	20
Ranscombe Farm	4	11	13	14	36	74
Scalers Hill Wood	18	4	2	12	13	31
Shorne Common Rough	7	0	1	1	2	4
Shorne Pasture	17	0	4	0	3	7
Shorne Wood CP	1	25	3	127	131	286
Silverhand Estate	10	31	37	29	23	120
South Ashenbank Wood	12	8	3	12	1	24
West Park	11	2	0	2	2	6

3.1.9 Epicormic growth was recorded at more than one location (base, stem or crown) within the trunk and crown framework of 861 trees (62%) and a further 410 trees were recorded as having epicormic growth within the crown. 42 trees (3%) had no epicormic growth present (Table and Graph A7, Appendix A). Epicormic growth within the low and mid crown is an essential component of the retrenchment pruning process, to enable crown reconfiguration to be undertaken without risking excessive stress and to minimise the potential to initiate decline through pruning operations (see section 5). There are therefore good prospects for effective long-term management of a large proportion of the trees within the veteran tree population.

3.1.10 Decline of veteran and ancient trees is often heavily influenced by individuals becoming shaded and suppressed by neighbouring trees. 434 trees (31%) were found to have either no shade or light shade (shaded on one or more sides but not from above) with 875 trees (63%), found to have 'close shade' (shaded on three or four sides but not from above) or 'heavy shade' (shaded from above and one or two sides). Table and Graph A8, Appendix presents the full shading results. Just over a quarter of all trees (26%) have recommendations to reduce the influence of adjacent competing trees and vegetation through the removal/coppicing of competing adjacent vegetation.

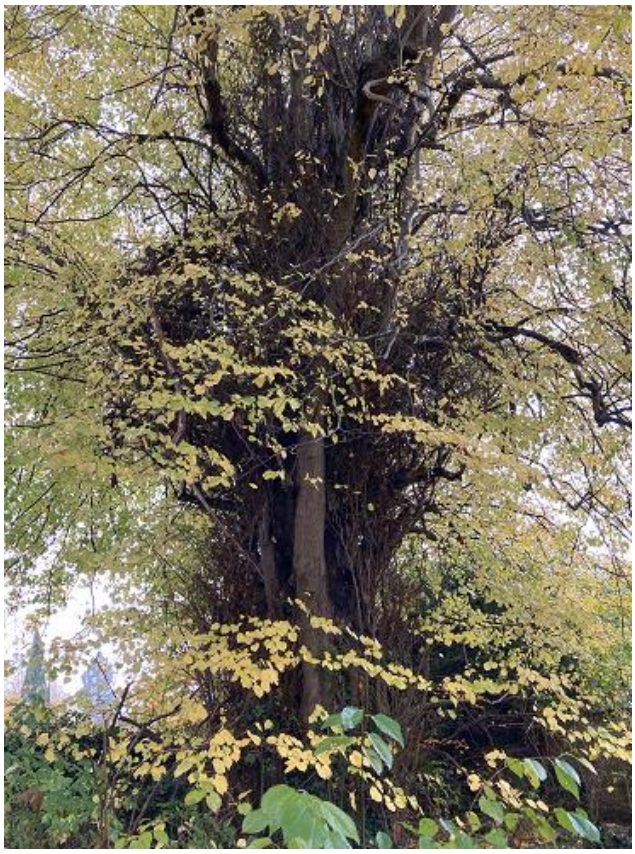


Photograph 1 Tree 2039, a veteran oak at Cobham Woods with 'extensive shade'



Photograph 2 Tree 4076, an ancient field maple coppice at Ranscombe Farm with 'heavy shade'

Photographs 3, 4 and **5**. Tree 5004, an example of a tree with 'very high' vitality at Ashenbank Woods, Tree 9093, a tree with 'low' vitality at Cobham Hall School and an example of a tree in 'advanced decline', tree 2112, a candidate veteran at Cobham Woods.




Photographs 6 and 7. Tree 19008 and T18026, examples of trees with epicormic growth found at Their base and on the stem and within the crown, a candidate lime at Camer Park and a veteran sweet chestnut at Scales Hill Wood respectively.

3.2 SSM Level 3- Habitat Data

3.2.1 As described in section 3.1.6, the majority of the SSM Level 3 data collected during the survey are presented at Appendix A. Data relating to the extent of hollowing, the quantity of deadwood, and a count of holes, stubs, tears, scars, loose bark and bark fluxes, describes the value of the veteran trees in terms of a quantification of niche and rare habitat available to support specific associates, particularly saproxylic species. Habitat data is presented at Appendix B.

3.2.2 The assessment of trunk hollowing (Table and Graph B1, Appendix B) identified 36% of the veteran tree population as having apparently solid trunks at all levels (base, mid, top) and 64% some proportion of hollowing. 17% of the veteran trees were found to have advanced hollowing. Other than the hollowing observed, it should be noted that it is likely that many of the veteran tree cohort are hollow to some degree, with decay processes taking place or starting to take place within the boles and principal stems. The SSM Level 3 assessment relies on visible openings, cavities and holes to indicate hollowing. There is a case for enclosed cavities being of higher habitat value when compared with open incomplete shells with the decaying, decomposed wood being liable to drying out in the latter scenario. It is safe to assume that the veteran trees across the

sites are a valuable habitat resource in terms of the decaying hollow stems typical of trees at this developmental stage.

3.2.3 480 (53%) of the ancient and veteran trees surveyed were absent in observable crown hollows. 47% had at least one crown hole (Table and Graph B2, Appendix B).

3.2.4 The survey recorded 139 trees (15%) with at least one water pocket (according to the SSM Level 3 criteria), (Table and Graph B3, Appendix B).

3.2.5 19% of the veteran tree population were recorded as having split limbs, tears and live stubs (Table and Graph B4, Appendix B).

3.2.6 78% were found to contain at least some deadwood within their crowns. 52% having 3 or more units of deadwood within their crowns. 60% were recorded as having associated fallen deadwood on the ground. (Table and Graph B5, Appendix B).

3.3 SSM Level 4 - Habitat and Associates Evaluation

3.3.1 As described in sections 2.3 and 2.4, the SSM Level 3 Habitat and Associates data is evaluated to give a Habitat Score and an Associates Score. These scores are presented for each tree in the individual tree reports presented at Appendix D.

3.3.2 A summary graph is presented at Appendix B.

3.3.3 As explained in section 2.3.6 above, Habitat Scores of between 3 and 37 can be generated for an individual tree. As a general rule, trees with scores of 9 and above might be considered to offer notable habitat features within the local landscape. 764 of the 907 (84%) veteran trees attained a score of 9 or above. The Associate Score is a useful index that can be considered alongside the Habitat Score to rate veteran trees within a population according to their relative value in terms of the diversity of species supported. An associate score of between 0-12 can be recorded. Associate scores for the majority of trees within the population were found to be in the lower ranges. This does not mean that the population is not valuable as a habitat resource. Factors that reduce the habitat scores are identified in section 3.2.2 and issues surrounding seasonality means that these scores should be viewed as a simple and broad guide.

Table 6. Habitat and Associates Scores

Habitat Score	Number of Trees
0-8	65 (7%)
09-20	625 (69%)
21-30	217 (24%)

Associates Score	Number of Trees
0-10	880 (97%)
11-20	27 (3%)
21-30	0 (0%)

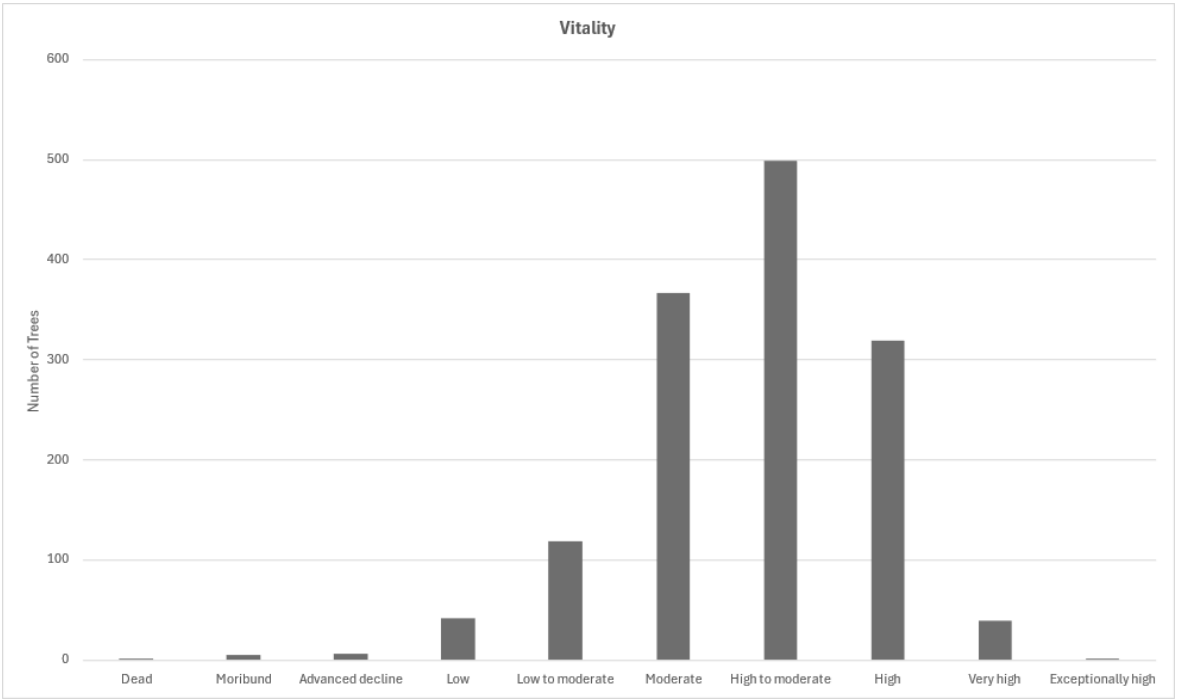
3.4 SSM level 5 - Viability Evaluation

3.4.1 As described in section 2.5, assessments of vitality, the likelihood of loss of a tree through physiological decline and the likelihood of loss of a tree through structural collapse are combined to generate a Viability Score. Summary graphs for these three assessments are presented in the two graphs below and Viability Scores are summarised in Table 6.

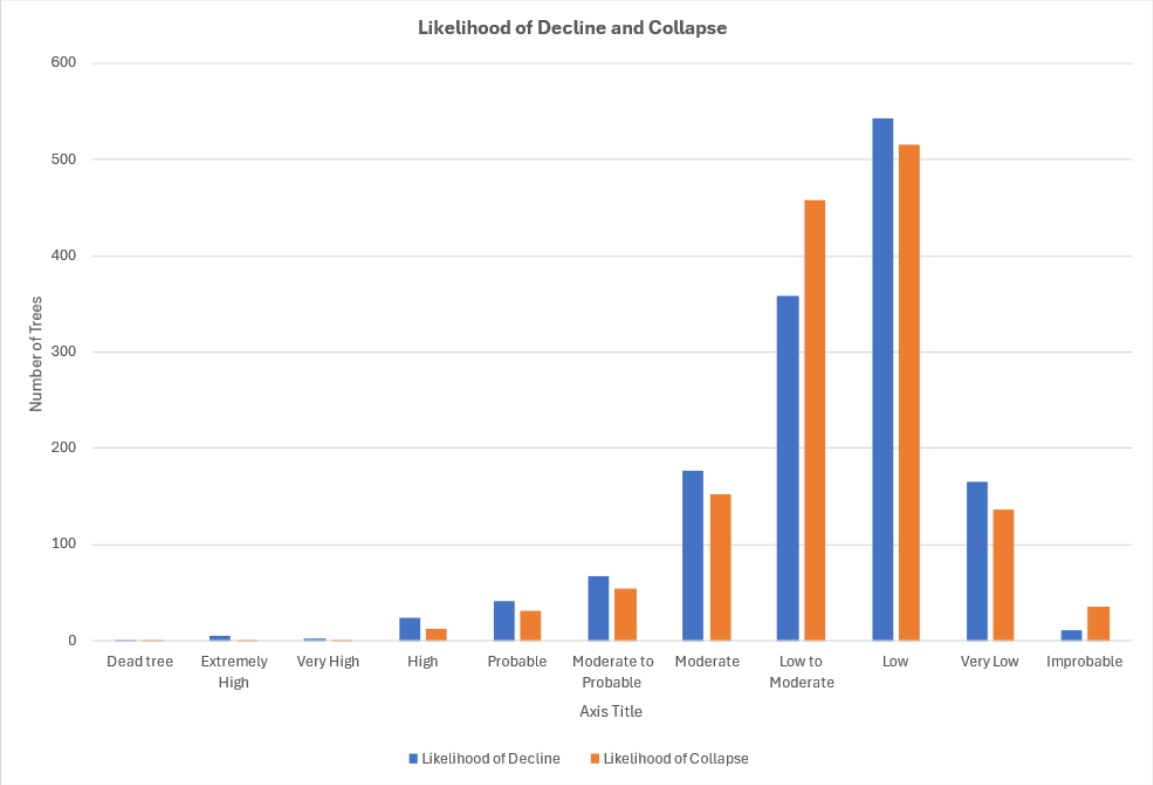
Table 7. Viability Score

Viability Score	Number of Trees
0-10	2 (under 1%)
11-20	298 (33%)
21-30	607 (67%)

Graph 1. Vitality Assessment



Graph 2. Likelihood of Decline and Collapse



3.4.2 These assessments show that the population is distributed at the higher end of the vitality scale and at the lower end of the likelihood of decline or collapse scales. As a consequence, the Viability Scores for the majority of trees are favourable. 88% were considered to have moderate or above vitality where the likelihood of decline is low to moderate or better. On the basis of the distribution of Viability Scores the population can be considered to be robust and resources allocated to the management of these trees to further reduce the likelihood of physiological decline or structural collapse is likely to be effective. Three trees were assessed as being in advanced decline and one moribund, where allocation of resources to maintain these as a habitat resource might have only short- term benefits.

3.5 Significance

3.5.1 In the absence of regional, national and international data, attempting to accurately define significance of any ancient and veteran tree population is limited.

3.5.2 A study by the University of Nottingham (Nolan, Victoria Jayne (2021, 'Predicting the distribution of ancient and other noteworthy trees across the UK'), applied distribution models calibrated with independent field data and found that there could be between 1.7m to 2.1m ancient and veteran trees in England, of which, at the time of writing, only 200,000 are on record, recorded in the Ancient Tree Inventory, a citizen-science database of ancient, veteran and notable trees, managed by the Woodland Trust. The Nottingham

University study presented ancient and veteran tree abundance heat maps which indicate that the proposed National Nature Reserve area is anticipated to have a comparatively high abundance of such trees.

3.5.3 Whilst data is limited, taking all the current 18 sites within the proposed National Nature Reserve area together, and using all available data known to the author, the area is considered to be both nationally and internationally significant for ancient and veteran trees with those trees in a generally favourable condition with a relatively low risk of loss.

4 Management Recommendations

4.1 General

4.1.1 The trees within the survey population across the NNR in general, have good structural condition, with the majority of trees being assessed as having a low risk of loss through structural collapse. Trees with large cavities resulting from historic principal limb failure, major seams of dead cambium, and extensive open hollow boles would generally score very highly in habitat terms, but such features necessarily create structural issues and problems in terms of management.

4.1.2 As a consequence, the trees have good potential for successful retention over the long-term. Provided that a continued commitment to enlightened management is ensured and continued. Subject to appropriate resources being allocated, these trees can avoid the risk of loss following catastrophic failure that some veteran tree populations are prone to as a result of historic neglect and/or lack of funding.

4.2 Management Objectives

4.2.1 A reflection of the relatively good structural condition of the trees within the population is that a large proportion of trees simply require maintenance of the current crown scale to ensure a low likelihood of loss through structural collapse. A summary of the type of management objectives proposed is presented in Table 8 below.

Table 8. Long-Term Management Objectives

Management Objective	Percentage of Trees
Maintain current crown scale (including cyclical crown management of previously reduced/pollarded trees)	83%
Consider reducing current crown scale (including the specified single or multiple reduction of individual limbs)	17%

4.2.2 Management objectives for each individual tree are presented in a section of the individual tree reports at Appendix C (Individual Tree Reports – Viability and Management).

4.2.3 A table of Management Objectives for the veteran trees is presented at Appendix E.

4.2.4 Where retrenchment pruning operations has been recommended, these recommendations are intended to create a more stable form primarily for maximising longevity of the veteran tree population and the associated habitat value. The principles of crown reorganisation through retrenchment pruning operations are presented in Section 5, to inform the longer-term management of these trees.

4.3 Initial Pruning and Management Operations

4.3.1 A schedule of pruning operations that have been proposed to be initiated within the short term are presented along with the general management objectives in Appendix E.

4.3.2 Recommendations have been given a time-based priority in relation to the long-term retention of each tree as well as to manage risks posed to members of the public and site users. Priorities are based on a subjective assessment of the likelihood of failure of the tree or tree part and the level of use of the area within which a tree part might fall. Priorities are also based on the significance of the loss of the tree part to the long-term viability of the tree. No distinction is made between risks posed to the public and the risk of limb loss having a negative impact on the viability of the individual tree, in terms of prioritisation. If budget restrictions mean that the prioritised recommendations proposed cannot be followed then further, more detailed, risk assessments would be recommended.

4.3.3 Whilst it is reasonable to consider higher priority works to be appropriate following this survey, recommendations with a longer priority should certainly be reviewed before these are commissioned, to assess whether they are still appropriate, particularly in relation to each tree's physiological condition. Some of the key work recommendations are as follows:

4.3.4 In addition to the crown retrenchment and size reduction recommendations discussed above, the following general recommendations are proposed, approximately 240 (26%) of the trees have recommendations to reduce the influence of adjacent competing trees and vegetation through the removal/coppicing of competing adjacent vegetation. This does not include the severing of climbing plants such as ivy, which is recommended for a further 21 trees.

4.3.5 Soil amelioration in the form of adding composted woodchip beneath crown spreads has been specified for 37 trees (4%) in an attempt to improve physiological condition and/or compaction, some standing close to well used pedestrian paths. Recommendations are made apply bark chip to reduce compaction. Alternatively, in some of these cases,

consideration could be made to diverting paths further away from the trees if practicable. A further 2 trees have recommendations to consider an application of composted tea, in the form of a ground drench in an attempt to assist physiological condition.

4.3.6 The breaking down and recycling of a thin layer of woodchip (up to 100 mm), laid over bare earth following turf removal (with minimal disturbance of soil beneath the turf), can alleviate soil compaction and improve both the availability of nutrients and the fauna and flora activity within the soil.

4.3.7 Woodchip should be spread to a distance as far as the crown spread wherever possible. Woodchip should not be spread around the base of the tree or piled up against the stem.

4.3.8 Trees favour a fungi dominated soil, typical of the woodland environment. The tidying of fallen leaves, shed twigs and deadwood diminishes nutrient recycling and creates a stressful environment for old trees.

4.3.9 The optimal time to prune veteran trees is currently open to debate. Experience has shown that pruning during a drought year or a year that follows a drought should be avoided, since the tree's starch reserves may be insufficient to sustain re-growth. Also drying of tissues may encourage dieback and extensive fungal colonisation, at a time when the tree has depleted resources for effective compartmentalisation.

4.3.10 It is advised that pruning of veteran trees is not carried out in the months of June, July and August as it is during these periods that the trees may be stressed due to low water availability.

4.3.11 There is evidence to suggest that pruning during March, April and May is sub-optimal as the trees have low energy reserves due to spring flushing (Lonsdale (1995). There is the possibility that trees may still be experiencing stress from low water availability during September and October making them vulnerable to microbial colonisation of wound areas.

4.3.12 This leaves a window extending from November to February, during the trees' dormant period, where pruning is likely to have the least deleterious effects on tree vitality.

4.3.13 It is recommended that the arboricultural contractor commissioned to carry out any pruning operations is able to demonstrate appropriate and relevant experience in undertaking pruning operations on ancient and veteran trees.

4.4 Inspections and Monitoring

4.4.1 As described above operations should be reviewed on a regular and periodic basis prior to commissioning the work specified in this report to ensure that the proposals are still appropriate. An inspection regime is set out along with the management objectives and tree works in Appendix E.

5 The Long-term Management of Ancient and Veteran Trees

5.1 An appropriate management objective

5.1.1 If continuity of rare habitat features is the key attribute to be retained in an old tree, then an appropriate management objective is to promote longevity. If longevity is related to crown scale, then a management plan will generally aim for a re-organisation of the crown structure over time to create a crown of a smaller scale at a lower height. Reducing crown scale addresses the main factors that tend to threaten the retention of an ancient or veteran tree, the potential for catastrophic structural failure and the transportation and resource allocation issues inherent in large crowns.

5.1.2 Successful management of a tree in the ancient phase requires an acceptance that decay and defects are inevitable and valuable, not undesirable problems to be managed. Equally important is the need to recognize that the operations carried out and the processes instigated will need to be allowed to play out over decades and that the management approach will need to be free to evolve according to the response of the individual tree.

5.1.3 The basis for managing ancient and veteran trees is, as much as is possible, to mimic the natural processes that take place within those individual trees that have successfully progressed to the ancient life stage. Put simply, the expansion of the crown through the mature phase reaches limitations. Dieback at the crown periphery promotes a flush of epicormic, dormant buds low in the crown. Heavy decayed old principal stems fail, and a low crown of young, vigorous shoots remain.

5.1.4 Whilst these natural processes have the potential to be successful at a population level, they cannot be relied on for an individual tree. The processes that can confer longevity are successful only for a minority of trees. Retention of the individual tree generally requires intervention to minimize the risk of loss through structural collapse, particularly the damage caused to the bole by the failure of principal stems.

5.2 Retrenchment pruning

5.2.1 Retrenchment pruning is a collective term still in development, used to describe a pruning programme that initiates and promotes the process of crown re-organisation. It is recognised that we have limited experience of applying these pruning techniques to the management of ancient and veteran trees, and the approach can sometimes seem relatively crude. The response of an individual tree is not guaranteed.

Photographs **8** and **9**. First stage retrenchment pruning using hand tools to remove small volumes of peripheral crown foliage.

5.2.2 Retrenchment pruning aims to initiate, support and encourage the development of a mid and lower crown that will originate in epicormic shoots arising from dormant buds. Dormant buds are released through altering the balance of hormones within the tree and by changing the intensity of natural light falling on crown limbs. Both of these mechanisms are influenced through the removal of a proportion of peripheral buds in the outer crown and an accompanying thinning of the crown periphery. A first stage retrenchment pruning operation will generally involve removing peripheral crown growth sometimes less than one metre in length using secateurs and hand saws.

5.2.3 The creation of a viable lower crown as a long-term objective is likely to take decades. The most appropriate trees upon which to commence a retrenchment pruning regime will already have a resource of low growth or stored buds available close to the origin of the principal stems. A series of tip-pruning and thinning operations at the crown periphery to maintain the altered hormonal regime and to avoid the subsequent suppression of the epicormic shoots that have been promoted will often be required. The development of adventitious shoots from the cut surfaces created at the crown periphery is an inevitable though undesirable consequence of the first stage pruning operation. It is undesirable both in terms of the resources allocated to the initiation and development of these shoots and in terms of the migration of energy reserves to the crown periphery.

5.3 Beyond the concept of staged reductions

5.3.1 The idea that management of an ancient or veteran tree should be approached through a series of staged crown reductions was intended to focus on a commitment to an individual tree management plan (Fay and de Berker, 2016), with a long-term objective of reducing the scale of the crown to proposed new viable structure. The concept was to promote the idea that crown retrenchment is a slow process that cannot be achieved in one simple step. Staged reductions should not be misinterpreted as a formulaic set of predefined, cyclical pruning operations. Viewed in this way there are clear negative consequences in terms of resource and energy depletion that arise from the continual

removal of the re-growth from the last cut surfaces. These detrimental consequences are then exacerbated by the continual creation of new cuts and the accompanying promotion of further adventitious re-growth which is later sacrificed.

5.3.2 A clarification of retrenchment pruning, and the process of phased reductions is required and at the time of writing, being developed. The long-term management objective remains the development of a smaller crown scale. The limitation to being able to remove large heavy crown parts to reach this objective is simply the presence or absence of foliage, low in the crown; foliage that must be present to maintain physiological processes.

5.3.3 It is proposed that the ancient or veteran tree can often be viewed as a colony of individual, independent functional units (Lonsdale, 2013). Sufficient low growth on specific parts of the crown may actually allow a one-step pruning operation to remove scale and weight, without instigating the death of the associated cambium and roots. However, where lower growth is insufficient or non-existent an initial retrenchment pruning operation to attempt to initiate dormant buds may need to be specified. This pruning operation is likely to need to be applied periodically over several decades, by thinning and further tip-pruning operations at the crown periphery, to allow development of the low epicormic growth to form a new low crown capable of sustaining the associated functional systems once the removal of the upper crown parts is undertaken.

5.3.4 During this process there is a balance between maintaining physiological processes and the potential for catastrophic consequences that would arise from the structural failure of large parts of the existing crown. At times it may be necessary to risk removal of significant sections of a heavy principal limb, even if the promotion or existence of the remaining foliage is considered insufficient to ensure that physiological processes can be maintained.

5.3.5 Ancient and veteran trees can be successfully managed only by choosing an appropriate long-term management objective, by prescribing pruning operations over decades and refining those specifications according to the response of the tree, and by acknowledging that there is a potential for each part of the tree to be assessed individually.

6 Limitations

6.1 The following limitations apply to the data collected during the survey and the contents of the report.

6.1.1 The report and the accompanying documentation are time limited and, unless otherwise stated, this is within a period not exceeding 12 months.

6.1.2 This is a preliminary assessment from ground level and observations have been made from visual inspection of external features. Binoculars, trowel, mallet and fine manual

metal probe have been used to aid the assessment. No invasive decay detection devices have been used in assessing trunk condition. No tree or soil samples have been taken.

6.1.3 Trees have been assessed within the context of a veteran tree survey using the Specialist Survey Method (SSM) and veteran tree viability assessment methods.

6.1.4 Unless specifically stated, trees have not been assessed, and management recommendations have not been specified in relation to risks of harm/damage posed to people or property through structural failure.

6.1.5 This assessment does not relate to risks associated with subsidence, heave, other forms of disturbance associated with tree root growth or removal.

6.1.6 Unless otherwise stated measurements of height, girth and crown spread are approximate and recorded in metres. Compass orientations are estimated.

6.1.7 The conclusions relate to conditions at the time of inspection. Tree growth is continual, and the effects of any debilitating factors may be progressive. Due to these factors, further periodic tree assessments may be necessary on an appropriate basis.

6.1.8 The recommended tree works are not intended to address the potential failure of a tree or parts of a tree during extreme weather events that are capable of causing the structural failure of trees or parts of trees that are not faulted.

6.1.9 Following an extreme weather event, the report and accompanying documentation will no longer be valid unless confirmed and updated by a reassessment of the trees on site.

6.1.10 The tree inspection is limited to the season in which the inspection takes place. When in the dormant period and trees are not in leaf, no observation is possible regarding foliar condition; however, twig and general tree condition are taken into consideration.

6.1.11 The presence and abundance of flora and fauna that are recorded as tree associates are may be affected by seasonal or other factors.

6.1.12 Where parts of the tree are obscured, for instance by ivy or debris, it is possible that structural faults may not have been observed by the surveyor. In these cases, where appropriate, works may be recommended to remove the obstruction prior to a subsequent inspection.

6.1.13 At the time of writing, no documented information has been provided regarding the history of root disturbance or severance or changes in local ground conditions (soil levels, drainage patterns *etc.*) or the location of underground services.

6.1.14 Management recommendations need to be considered in the light of relevant constraints, including The Town and Country Planning Act 1990 (as amended) and the Wildlife and Countryside Act 1981 (as amended).

6.1.15 The Town and Country Planning Act 1990: (i) Where a Tree Preservation Order (TPO) applies to trees on the site, consent will be required from the Local Planning Authority (LPA) for any proposed work to the trees, apart from any urgent safety works to address immediate risks. This process can take up to eight weeks. (ii) Where the site is within a Conservation Area (CA), notice will need to be given to the LPA for any proposed work to the trees, apart from any urgent safety works to address immediate risks.

6.1.16 The Wildlife and Countryside Act (1981), Conservation, Natural Habitats Regulations (1994) and Countryside Rights of Way Act (2000): Consideration must be given to the timing and type of tree work operations to avoid causing disturbance to any nesting or breeding birds or bat roosts that may be present within trees and hedgerows.

6.1.17 Where live trees are to be felled, a felling licence may be required from the Forestry Commission. This is subject to a number of exemptions and only applies where the quantity of timber in the trees that are to be felled, is equal to or exceeds 5 cubic metres.

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Appendix A

SSM Level 3 - Basic Tree Data

Table A1. Tree Species

Scientific Name (Common Name)	Number of Trees
Castanea sativa (Sweet Chestnut)	446
Carpinus betulus (Hornbeam)	259
Quercus robur (English Oak)	220
Fraxinus excelsior (Ash)	209
Acer campestre (Field Maple)	71
Fagus sylvatica (Common Beech)	66
Taxus baccata (Yew)	24
Crataegus monogyna (Common Hawthorn)	18
Acer pseudoplatanus (Sycamore)	16
Tilia sp. (Lime sp.)	12
Ilex aquifolium (Holly)	9
Cedrus sp. (Cedar)	8
Platanus orientalis (Oriental Plane cv.)	6
Tilia cordata (Small Leaved Lime)	4
Quercus ilex (Holm Oak)	3
Quercus petraea (Sessile Oak)	3
Aesculus hippocastanum (Horse Chestnut)	2
Betula pendula (Silver Birch)	2
Corylus avellana (Common Hazel)	2
Malus sp. (Apple sp.)	2
Prunus sp. (Cherry sp.)	2
Salix sp. (Willow sp.)	2
Sorbus aria (Whitebeam)	2
Tilia x vulgaris (Common Lime)	2
Aesculus sp. (Horse Chestnut)	1
Davidia involucrata (Dove Tree/Handkerchief Tree)	1
Platanus x hispanica (London Plane)	1
Populus sp. (Poplar sp.)	1
Quercus sp. (Oak sp.)	1
Quercus cerris (Turkey Oak)	1
Salix caprea (Goat Willow/Great Sallow)	1
Sorbus torminalis (Wild Service Tree)	1
Total	**1398**

Table A2. Veteran Tree Type

Veteran Tree Type	Number of Trees
Ancient & Veteran	194
Ancient Trees with Less than 3 Veteran Features	184
Non-Ancient Veterans	529
Candidate Veteran	491
Total	**1398**

Table A3. Standing/Fallen

Stand/Fall	Number of Trees
1 (More or less upright)	1334
2 (Leaning at a strong angle though apparently firmly rooted)	15
3 (Leaning with a loosened rootplate)	3
4 (Collapsed, supported)	4
5 (Collapsed, main trunk propped clear of ground)	7
6 (Collapsed, trunk on ground: rootplate intact, attached to ground)	27
7 (Collapsed, trunk on ground: rootplate intact, detached from ground)	1
8 (Fractured, collapsed trunk or crown attached to parent tree)	3
9 (Fractured, collapsed and separated, rootplate attached to ground)	4
Total	**1398**

Table A4. Tree Form

Form	Number of Trees
Maiden Tree	806
Coppice	209
Lapsed Pollard	178
Multi-stemmed	61
Natural Pollard	49
Phoenix Regeneration	38
Coppard	29
Managed Pollard / Repollard	18
Stored stem	3
Other	2
Tiered Lapsed Pollard	2
Shattered/fractured stump (< 4m height)	2
Bundle Planting	1
Total	**1398**

Table A5. Live Growth

Live Growth	Number of Trees
1 (Live growth occupies > 50% of current outline)	1283
2 (Live growth occupies 25%-50% of current crown outline)	77
3 (Live growth occupies < 25% of current crown outline)	33
4 (Crown is dead)	5
Total	**1398**

Chart A5. Live Growth

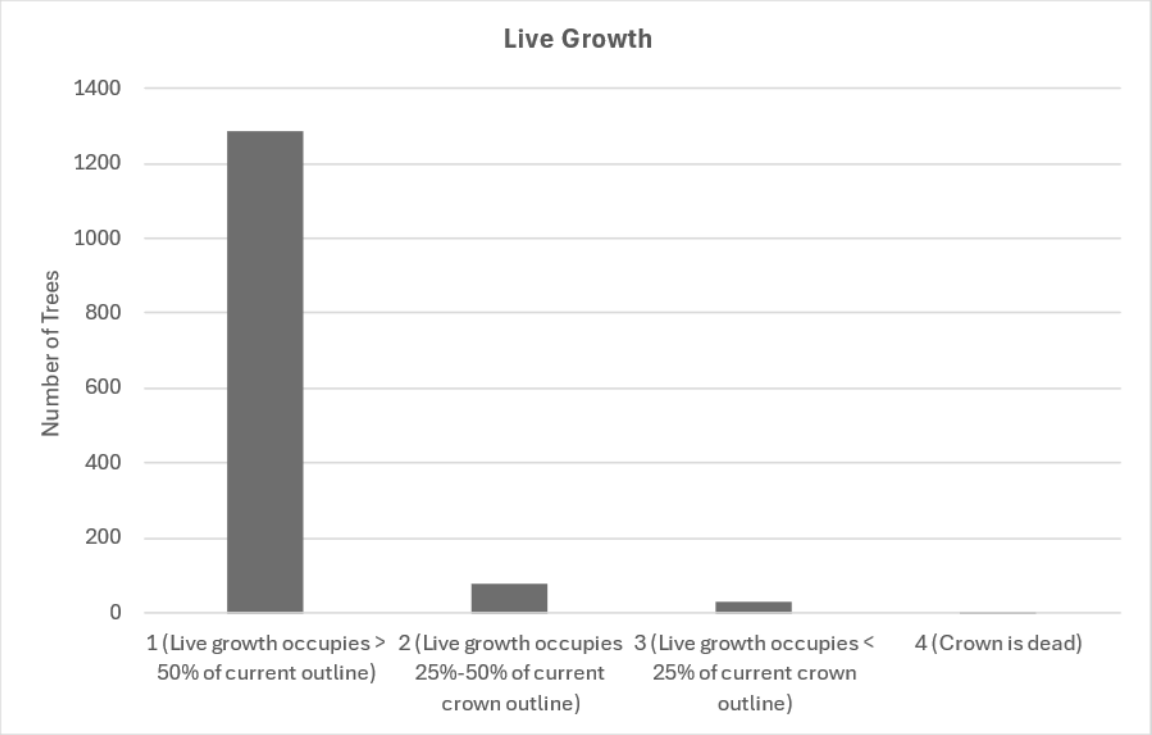


Table A6. Crown Loss

Crown loss	Number of Trees
1 (Tree has shed < 25% of likely peak crown framework)	853
2 (Tree has shed 25%-50% of likely peak crown framework)	327
3 (Tree has shed 50%-75% of likely peak crown framework)	131
4 (Tree has shed > 75% of likely peak crown framework)	87
Total	**1398**

Graph A6. Crown Loss

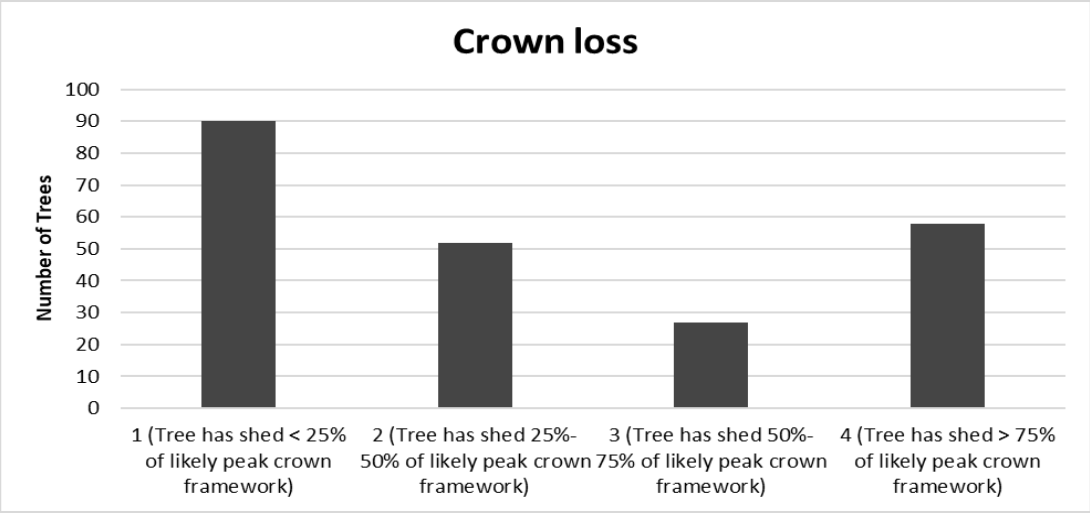


Table A7. Epicormic Growth

Epicormic Growth	Number of Trees
0 (None present)	42
1 (Base)	28
2 (Stem)	57
3 (Crown)	410
4 (Base & Stem)	41
5 (Base & Crown)	51
6 (Stem & Crown)	369
7 (Base, Stem & Crown)	400
Total	**1398**

Graph A7. Epicormic Growth

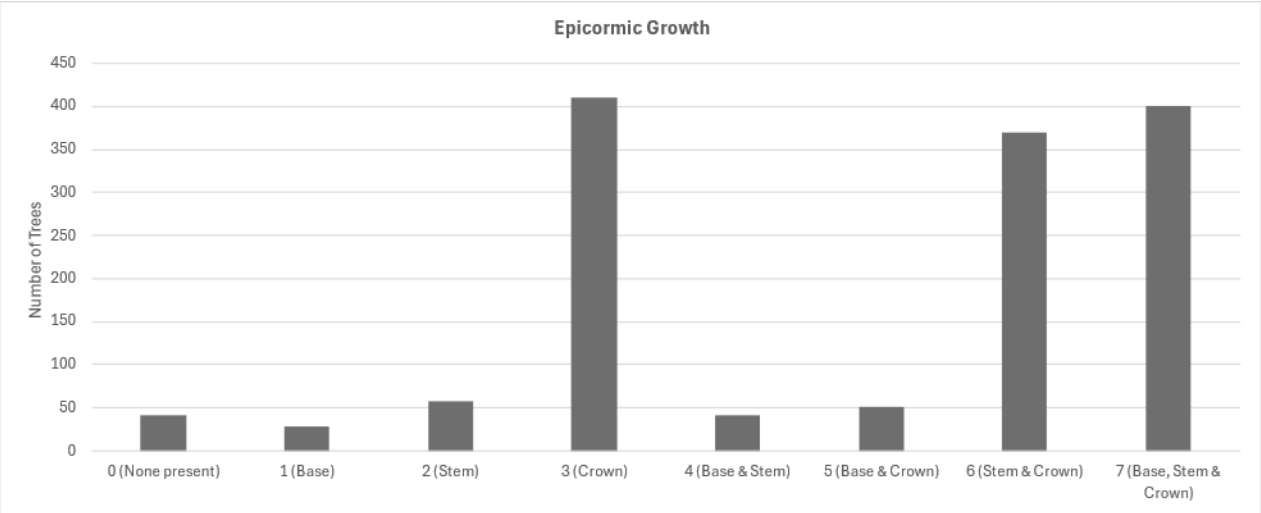


Table A8. Shade

Shade	Number of Trees
0 (Unshaded - unshaded at present)	73
1 (Light Shade - shaded on one or two sides but not from above)	361
2 (Close Shade - shaded on three or four sides, not from above)	728
3 (Heavy Shade - shaded from above and one or two sides)	148
4 (Extensive Shade - shaded from above and all aspects)	88
Total	**1398**

Graph A8. Shade

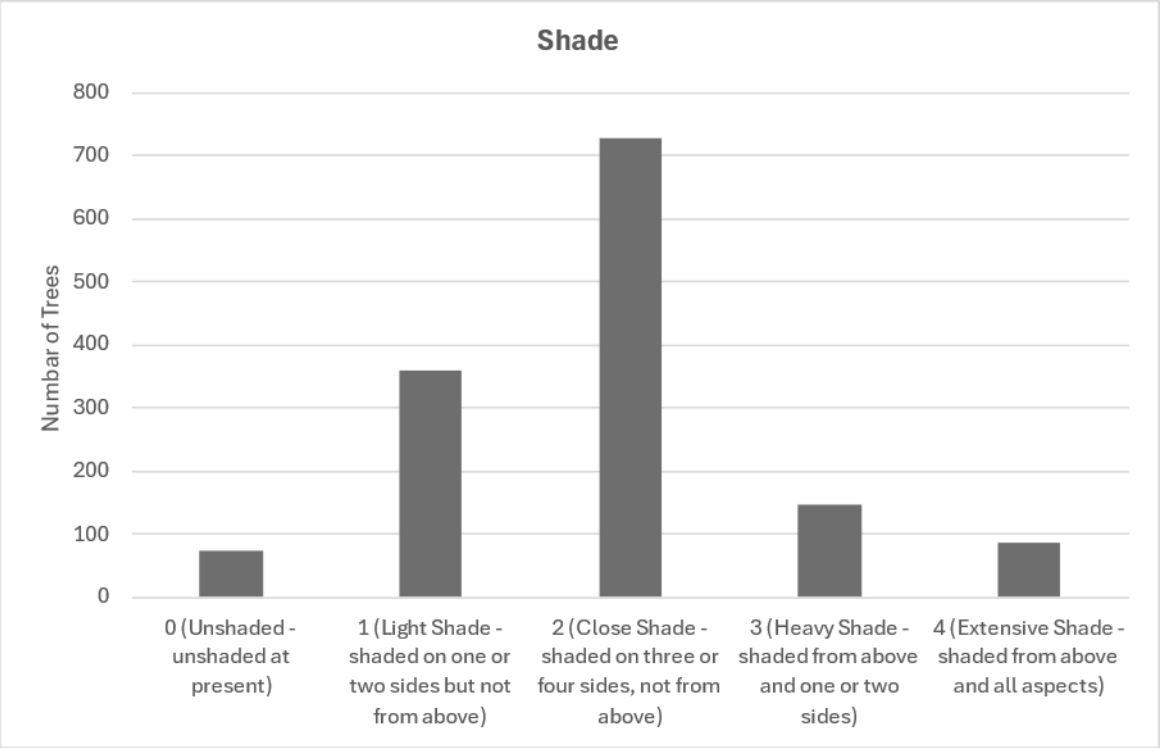


Table A9. Vitality Assessment

Vitality Assessment	Number of Trees
Dead	1
Moribund	5
Advanced decline	6
Low	42
Low to moderate	119
Moderate	367
High to moderate	499
High	319
Very high	39
Exceptionally high	1
Total	**1398**

Graph A9. Vitality Assessment

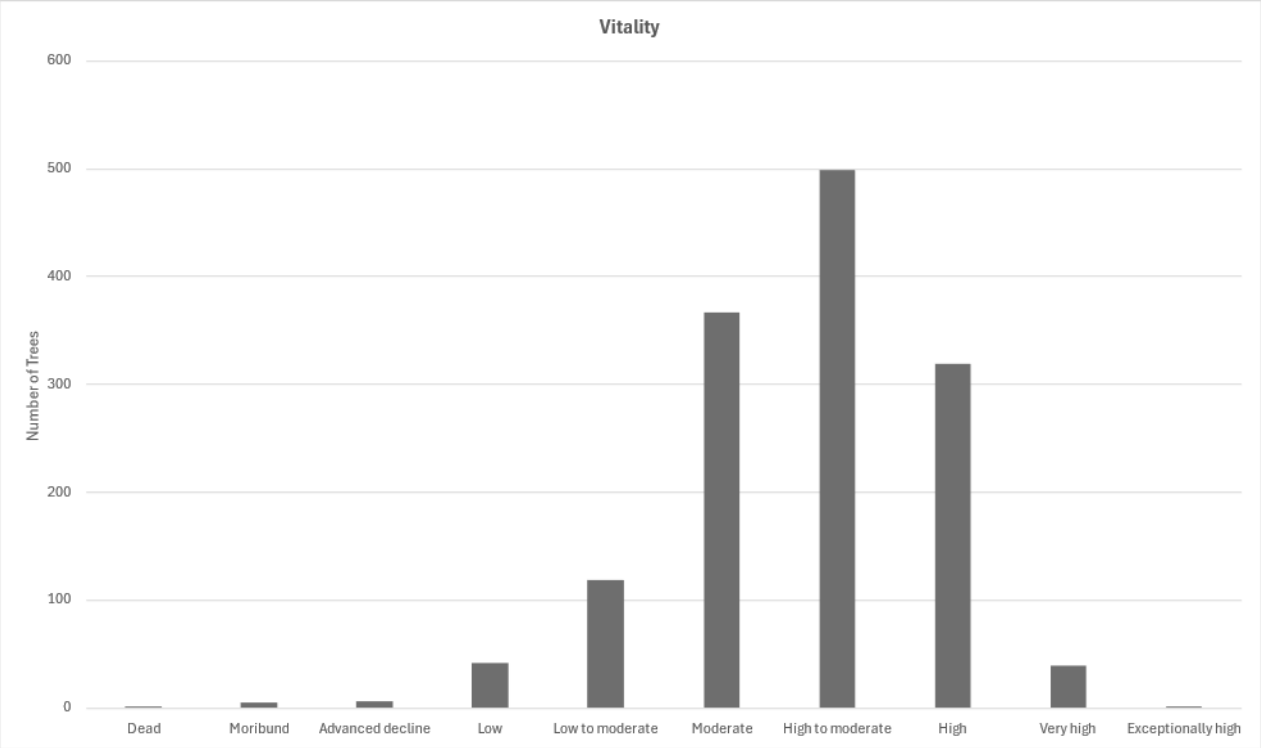
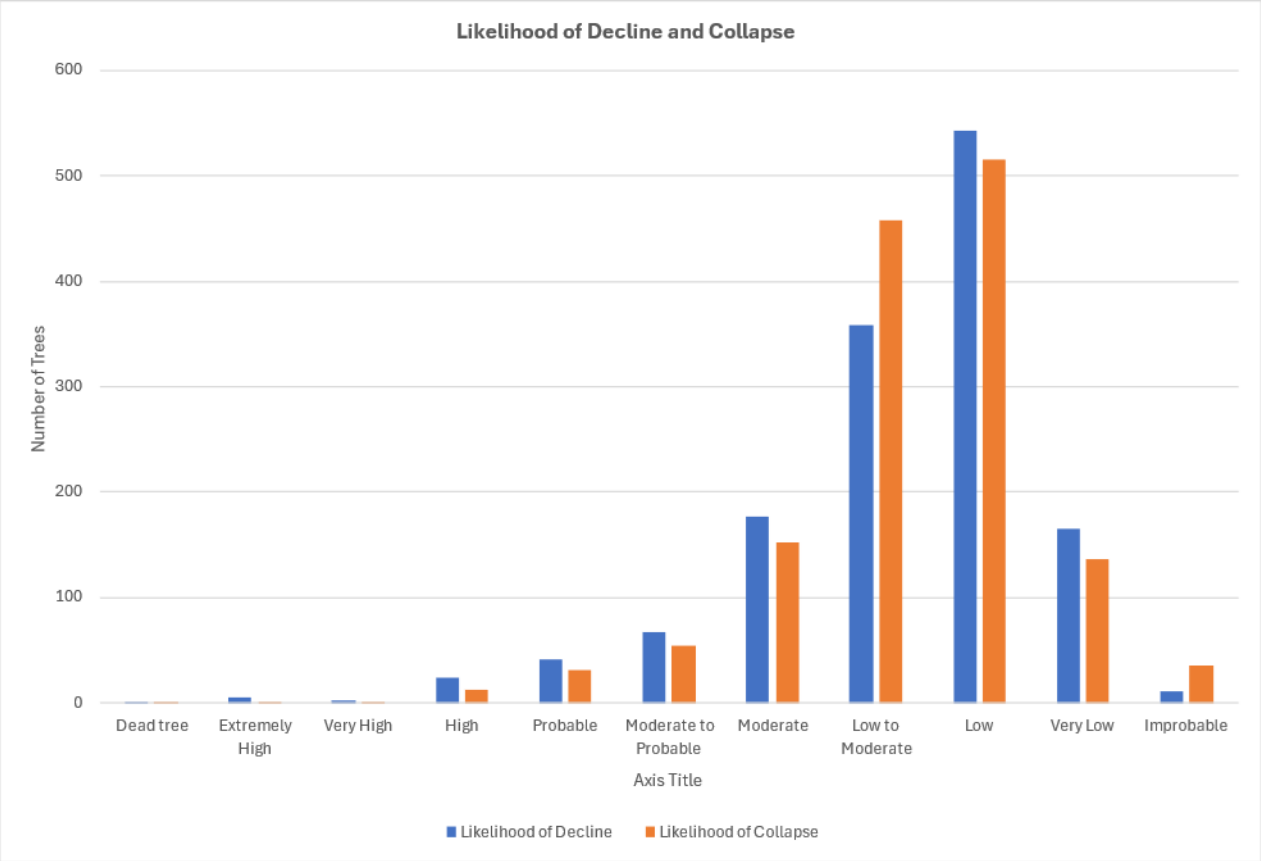


Table A10. Likelihood of Decline and Collapse

	Likelihood of Decline	Likelihood of Collapse
Dead tree	1	1
Extremely High	5	1
Very High	3	1
High	24	13
Probable	42	32
Moderate to Probable	68	55
Moderate	177	152
Low to Moderate	358	457
Low	543	515
Very Low	166	136
Improbable	11	35
Total	**1398**	**1398**

Graph A10. Likelihood of Decline and Collapse



Appendix B

SSM Level 3 - Habitat and Associates Data

Table B1. Trunk Hollowing

	Hollowing base	Hollowing mid	Hollowing top
Apparently solid trunk	311	335	359
Minor hollowing <15cm	198	200	192
Moderate hollowing 15 - 30cm	138	127	125
Advanced hollowing	157	145	133
Shell	103	100	98
Total	**907**	**907**	**907**

Graph B1. Trunk Hollowing

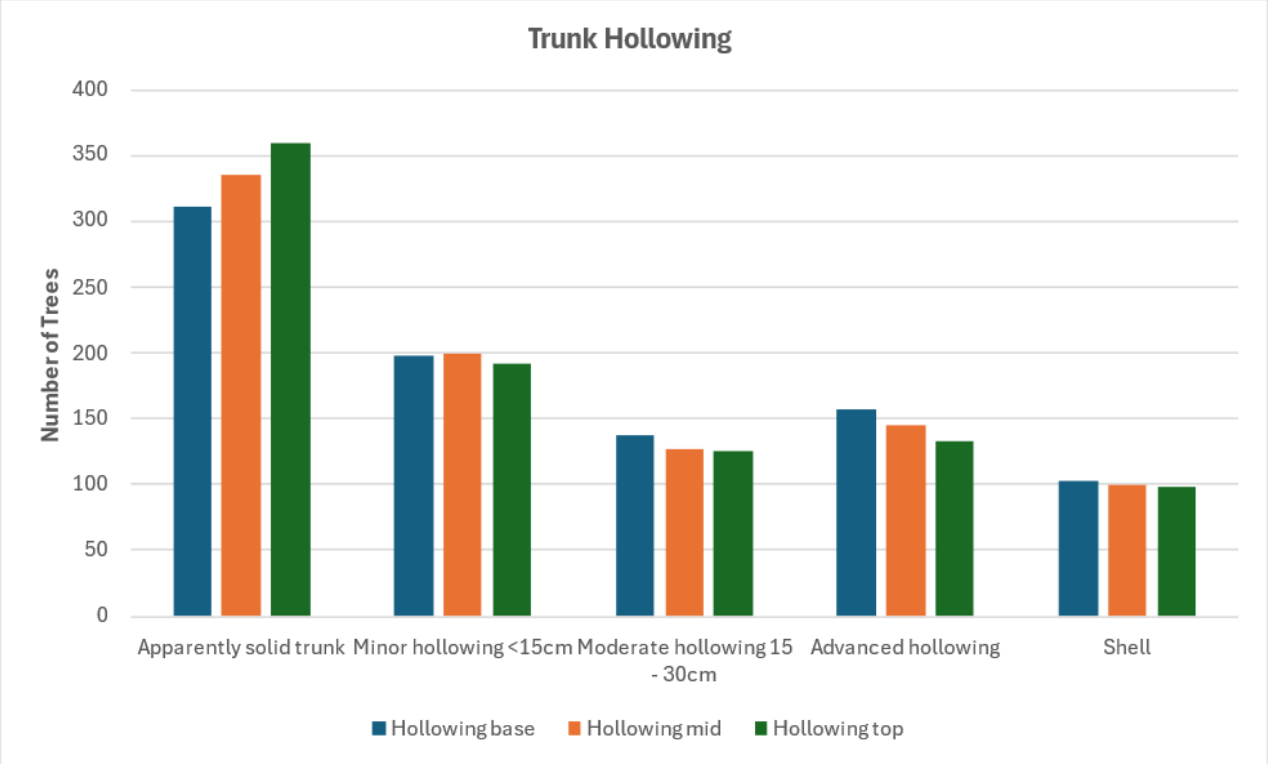


Table B2. Crown Hollowing and Crown Holes

	Crown Holes	Crown Hollows
0	117	480
1	124	180
2	130	109
3	100	51
4	62	34
5	65	21
6	54	10
7	44	7
8	35	8
9	26	2
10	25	2
11	12	1
12	12	0
13	9	0
14	2	0
15	90	0
16	0	1
17	0	1
Total	**907**	**907**

Graph B2. Crown Hollowing and Crown Holes

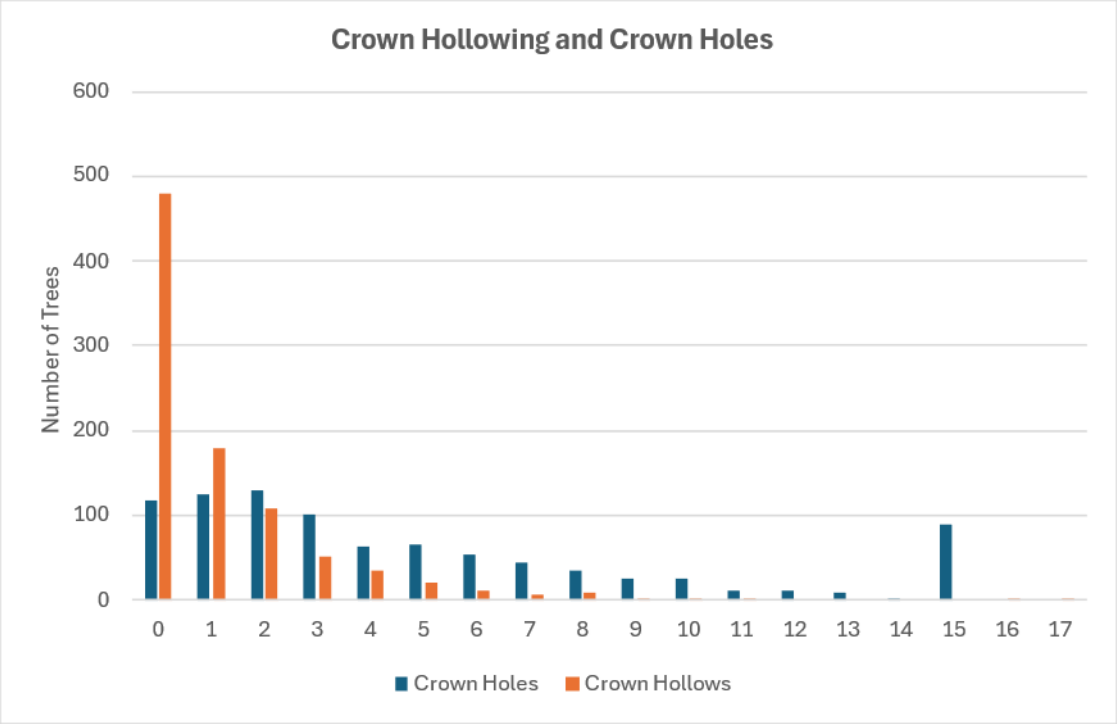


Table B3. Water Pockets

Water Pockets	Number of Trees
0	768
1	87
2	37
3	10
4	3
7	1
9	1
Total	**907**

Graph B3. Water Pockets

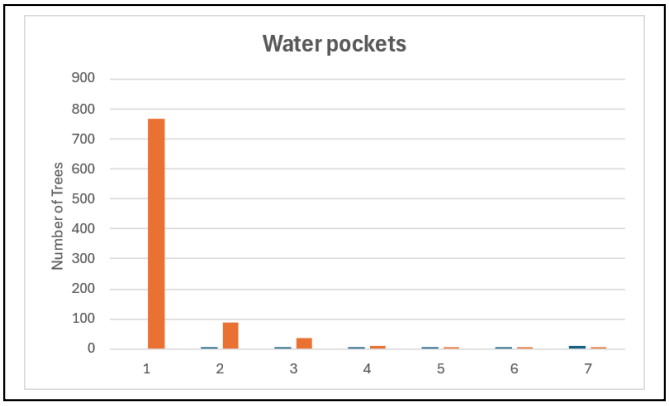
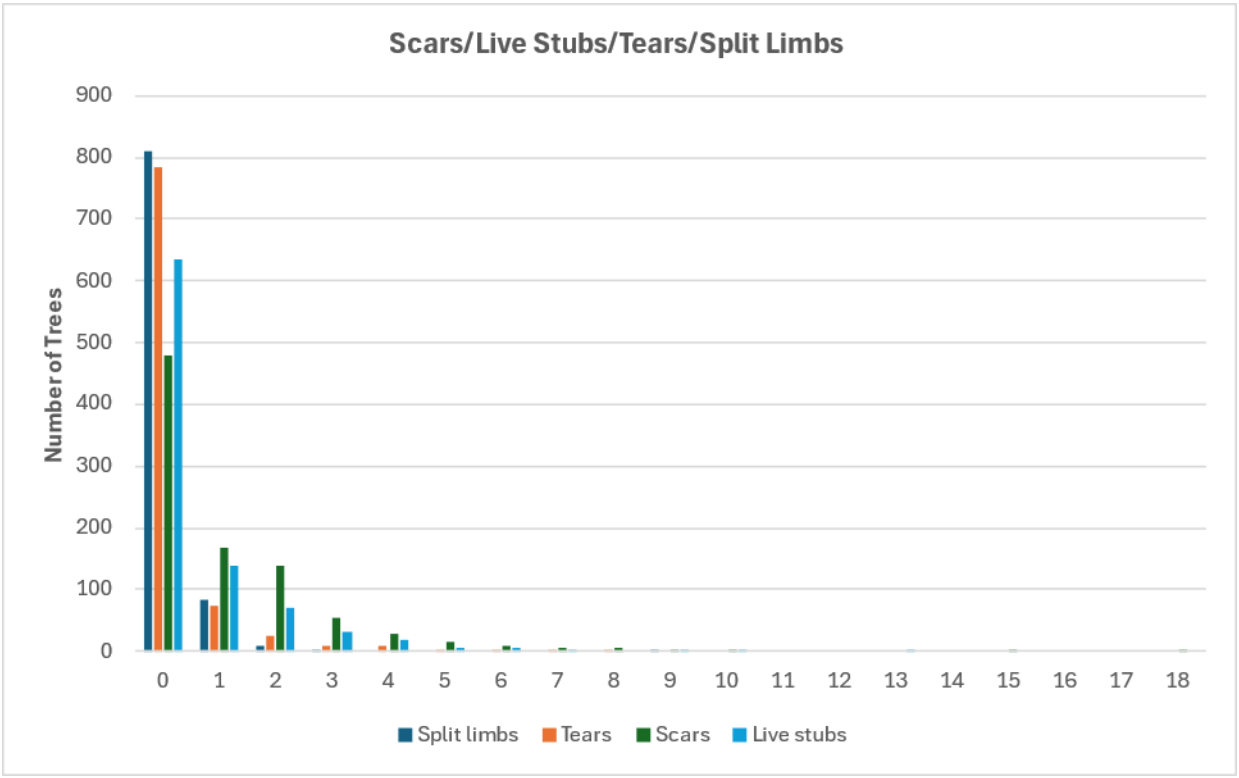


Table B4. Split Limbs/Tears/Scars/Live Stubs

	Split limbs	Tears	Scars	Live stubs
0	810	783	478	635
1	83	74	169	137
2	10	24	137	69
3	2	10	54	33
4	0	9	28	18
5	0	3	15	6
6	0	1	8	5
7	0	1	7	1
8	0	2	4	0
9	2	0	3	1
10	0	0	1	1
11	0	0	0	0
12	0	0	0	0
13	0	0	0	1
14	0	0	0	0
15	0	0	2	0
16	0	0	0	0
17	0	0	0	0
18	0	0	1	0
Total	**907**	**907**	**907**	**907**

Graph B4. Split Limbs/Tears/Scars/Live Stubs



Graph B5. Deadwood (Attached) and Deadwood (Fallen)

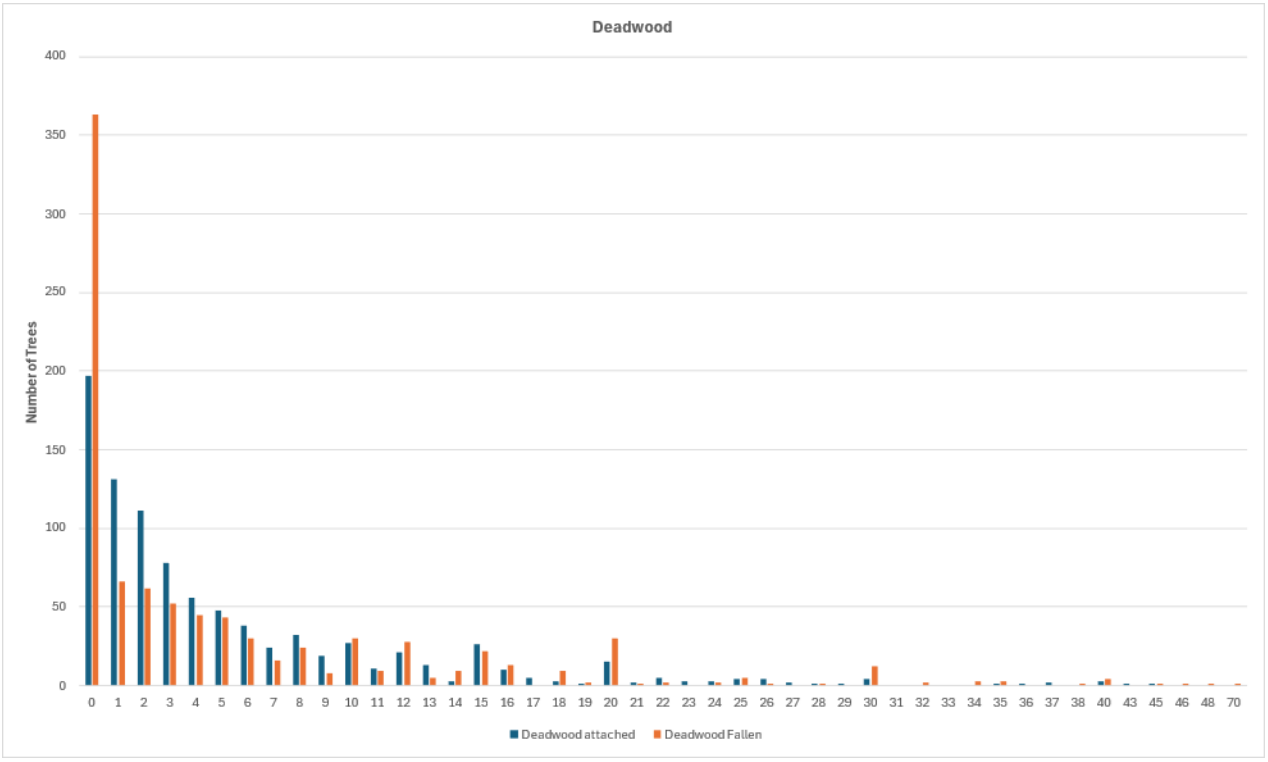


Table B5. Deadwood (Attached) and Deadwood (Fallen)

	Deadwood attached	Deadwood Fallen
0	197	363
1	131	66
2	111	62
3	78	52
4	56	45
5	48	43
6	38	30
7	24	16
8	32	24
9	19	8
10	27	30
11	11	9
12	21	28
13	13	5
14	3	9
15	26	22
16	10	13
17	5	0
18	3	9
19	1	2
20	15	30
21	2	1
22	5	2
23	3	0
24	3	2
25	4	5
26	4	1
27	2	0
28	1	1
29	1	0
30	4	12
31	0	0
32	0	2
33	0	0
34	0	3
35	1	3
36	1	0
37	2	0
38	0	1
40	3	4
43	1	0
45 +	1	4
Total	**907**	**907**

Appendix C

Individual Tree Reports – Viability and Management

Appendix D

Individual Tree Reports – Habitat and Associates

Appendix E

Management Objectives and Recommendations

Appendix F

The Specialist Survey Method

1.1.1 The Specialist Survey Method (SSM) was developed by Treework Environmental Practice as part of the Veteran Trees Initiative (Fay and de Berker, 1997), a project run by English Nature (later part of Natural England) with the aim of providing a standardised framework for recording data during surveys undertaken to identify, locate and assess veteran trees. The Specialist Survey Method is intended to record key morphological characteristics of veteran trees as well as to quantify the habitat features and attributes and the associated and dependant organisms that rely on these habitat features.

1.1.2 The Specialist Survey Method was designed to enable data to be collected according to a range of levels, with Level 1 being a simple introductory level, Level 2 being an intermediate level and Level 3 being the comprehensive specialist survey.

1.1.3 The survey followed the Specialist Survey Method Level 3 for all 214 ancient and veteran trees, collecting all the tree details identified in the Specialist Survey Method (fields 1-31) as set out below.

1.2 SSM Level 3 Tree Details (SSM field numbers in round brackets/data entry codes in square brackets)

1.2.1 **Tree Number (1)**. Tree number or reference to provide a unique numerical identifier within the site. All trees have a unique reference number (e.g., T1172).

1.2.2 **Grid reference (2)**. Twelve figure grid references to identify the location of each tree.

1.2.3 **Species (3)**. Common and scientific names are recorded for each tree.

1.2.4 **Dimensions (4)**. Girth (circumference) measured at 1.3 m above ground level. Where swellings, burrs, branches or other irregular features would distort the girth measurement the nearest height below the obstruction is chosen to take the girth measurement. Measurement height is recorded. Specific criteria for measuring multi-stemmed trees and stumps are set out in the SSM.

1.2.5 **Number of Trunks (5)**. The number of stems over 0.3 m diameter arising from below a height of 1.3 m.

1.2.6 **Tree Form (6)**. A description of tree morphology, depending on growing conditions and past damage or management. More than one description may apply to each tree. [1] Maiden, [2] Shredded, [3] Multi-stemmed, [4] Coppice, [5] Stored stem, [6] Bundle planting, [7] Natural pollard, [8] Managed pollard/re-pollard, [9] Lapsed pollard, [10] Tiered lapsed pollard, [11] Coppard, [12] Phoenix regeneration, [13] Felled stump (<1.0

m), [14] Shattered/fractured stump (<4.0 m), [15] Shattered/fractured stump (>4.0 m), [X] Other.

1.2.7 Standing/Fallen (7). An assessment of how upright the tree is. [1] More or less upright, [2] Leaning at a strong angle though apparently firmly rooted, [3] Leaning with a loosened root plate, [4] Collapsed, supported by an adjacent tree, [5] Collapsed, main trunk propped clear of ground, [6] Collapsed main trunk lying on ground, root plate intact, partially attached to ground, [7] Collapsed, main trunk lying on ground, root plate intact, entirely detached from ground, [8] Fractured, collapsed trunk or main crown still attached to parent tree, [9] Fractured, collapsed and separated, root plate attached to ground.

1.2.8 Live Growth (8). An assessment of the current proportion of live growth about the tree (excluding past crown collapse). [1] Live and mostly full canopy (live growth occupies >50% of current canopy outline), [2] Live partial canopy (live growth occupies 25-50% of current canopy outline), [3] Live residual canopy (live growth occupies <25% of current canopy outline), [4] Crown is dead (some live growth remains on the trunk), [5] Entire tree is dead (no live growth).

1.2.9 Crown Loss (9). A comparison between the current scale of the crown and the likely peak crown framework: [1] Full crown outline (tree has shed <25% of likely peak crown framework), [2] Nearly full crown outline (tree has shed 25-50% of likely peak crown framework), [3] Partial crown outline (tree has shed 50-75% of likely peak crown framework), [4] Remnant crown outline (tree has shed >75% of likely peak crown framework).

1.2.10 Epicormic Growth (10). The presence and location of twiggy growth/shoots that develop from the bark surface as a response to stress, environmental changes, or controlled by a balance of hormones within the tree. The presence of strong, healthy, established mid or lower crown epicormic or adventitious shoots (reiterations) is essential for successful crown retrenchment in veteran and ancient trees. [1] Base, [2] Stem, [3] Crown, [4] Base and stem, [5] Base and crown, [6] Stem and crown, [7] Base, stem and crown, [0] None present.

1.2.11 Bark Condition (11). The presence and location of large areas (greater than 30 cm x 30 cm) of dead, loosely attached, missing or flaking bark. [1] Base, [2] Stem, [3] Crown, [4] Base and stem, [5] Base and crown, [6] Stem and crown, [7] Base, stem and crown, [0] None present.

1.2.12 Bark Fluxes (Sap Runs) (12). A description of exudations from within the tree, leaking to the bark surface, resulting from bacterial or fungal activity, bleeding from wounds or local reactions to surface colonisation. [A] Dry, [B] Wet, [C] Sticky, [D] Bubbly, [X] Other, [0] None.

1.2.13 Split Limbs (13). Longitudinal splits and limbs that have broken or torn but are still attached. A count of split limbs greater than 15 cm diameter, or [0] if none present.

1.2.14 Tears/Scars/Lightning Strikes (14). Tears are associated with the recent shedding of live limbs. Scars are old tears with wound wood development. Lightning strikes are wounds

derived from direct lightning strikes. A count of scars and tears greater than 30cm in area or [0] if none present. Wounds derived from a lightning strike are recorded as present or not present.

1.2.15 Live Stubs (15). Fractured and truncated ends of live stems or branches following natural fracture. A count of live stubs with a diameter close to the fractured surface of greater than 15cm, or [0] if none present. Live stubs are also likely to be subtended by a tear or a scar and these should also be recorded separately.

1.2.16 Hollowing (Trunk and Mature Crown) (16). An assessment of the extent of clearly visible wounding and natural decay processes within the main stem (without boring). Hollowing is categorised separately for the lower, mid and upper thirds of the bole. [1] Apparently solid trunk (minor cavities less than 15cm in diameter), [2] Hollow trunk (outer circumference complete, minor holes present), [3] Partially solid trunk (outer circumference partial, major cavities >15 cm or merging apertures), [4] Remnant trunk (<30% of outer circumference missing), [5] Remnant trunk (>30% of outer circumference missing). In addition, within the main crown limbs a record of the count of hollows with a diameter of greater than 15cm is made.

1.2.17 Holes (Trunk and Mature Crown) (17). A count of small apertures originating from limb loss or bark wounds between 5cm and 15cm diameter throughout the trunk and crown framework. [0] if none present.

1.2.18 Water Pockets (18). A count of hollows or depressions with an orientation that allows organic matter and water to collect, typically at the union of major stems or between surface buttress roots. [0] if none present.

1.2.19 Rot (19). A record of the presence and type of decay for areas of degraded wood. [A] Brown, [B], White, [C] Black, soil-like, [D] Other, [0] None observed. Where the areas of decayed wood are greater than 30cm x 15cm they are recorded as being extensive.

1.2.20 Deadwood (Attached to the Tree) (20). Dead branches or stems attached to the tree with a diameter greater than 15cm or dead trunks are assessed in terms of a count of deadwood units, with 1 unit equal to each 1.0m length. Moribund branches are treated as dead limbs.

1.2.21 Deadwood (Fallen) (21). Fallen dead stems or branches with a diameter greater than 15cm that are no longer attached to the tree but are lying near the tree within its natural height scope are counted as deadwood units, with 1 unit equal to each 1.0m length.

1.2.22 Fungi (22). An assessment of the presence of fungi both upon the tree and beneath the drip line of the crown. A count representing both species and number of locations is made (a count of 2 is recorded if the same species is observed in more than one location). [0] if none present.

1.2.23 Epiphytes and Hemiparasites (23). An assessment of the presence of lichen, moss, polypody/fern, ivy, mistletoe, other trees/shrubs or climbers. A count representing both species and number of locations is made (a count of 2 is recorded if the same species is observed in more than one location). [0] if none present.

1.2.24 Invertebrates (24). An assessment of occupation by invertebrates through the observation of activity indicated by the presence of bore or exit holes, frass (the powdery residue from tunnelling) or other evidence. A count representing both type of activity and number of locations is made (a count of 2 is recorded if the same activity is observed in more than one location). [0] if none present.

1.2.25 Birds and Mammals (25). An assessment of occupation by birds or mammals through the observation of activity indicated by the presence of feeding debris, droppings or urine stains, feeding damage to bark, or other indications.

1.2.26 Context (26). A description of the landscape context within an area two times the height of the tree, indicative of the setting and historic land use about the tree (not recorded against individual tree records during the current survey).

1.2.27 Management (27). A description of the history of tree management over the past ten years. More than one description may apply to each tree. [1] Pollarding, [2] Other arboricultural work, [3] Weed control (within crown spread), [4] Management of competitive tree growth, [5] Protective fencing (effective), [6] Protective fencing (ineffective), [7] Controlled public access, [8] Planting: for veteran continuity, [9] Planting: potentially competitive, [X] Other, [0] None known.

1.2.28 Damage (28). A description of major damage or debilitation to the tree and the associated fauna and flora, such as browsing, mechanical impact or excavations, soil compaction or contamination, fire, vandalism or inappropriate pruning operations.

1.2.29 Shade (29). An assessment of the extent of shade caused by adjacent trees. [0] Unshaded (unshaded at present), [1] Light shade (shade on one or two sides but not from above), [2] Close shade (shaded on three or four sides but not from above [3] Heavy shade (shaded from above and one or two sides), [4] Extensive shade (shaded from above and on all aspects).

1.2.30 Photographs (30). Photographs are taken from a number of aspects and of specific areas of the crown where appropriate to identify certain defects or to help inform pruning or management recommendations.

1.2.31 Notes (31). Further notes to expand on any of the information recorded during the survey.

Appendix G

Site Tree Plan

Treework Environmental Practice

Monarch House, 1-7 Smyth Road, Bedminster, Bristol, BS3 2BX
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