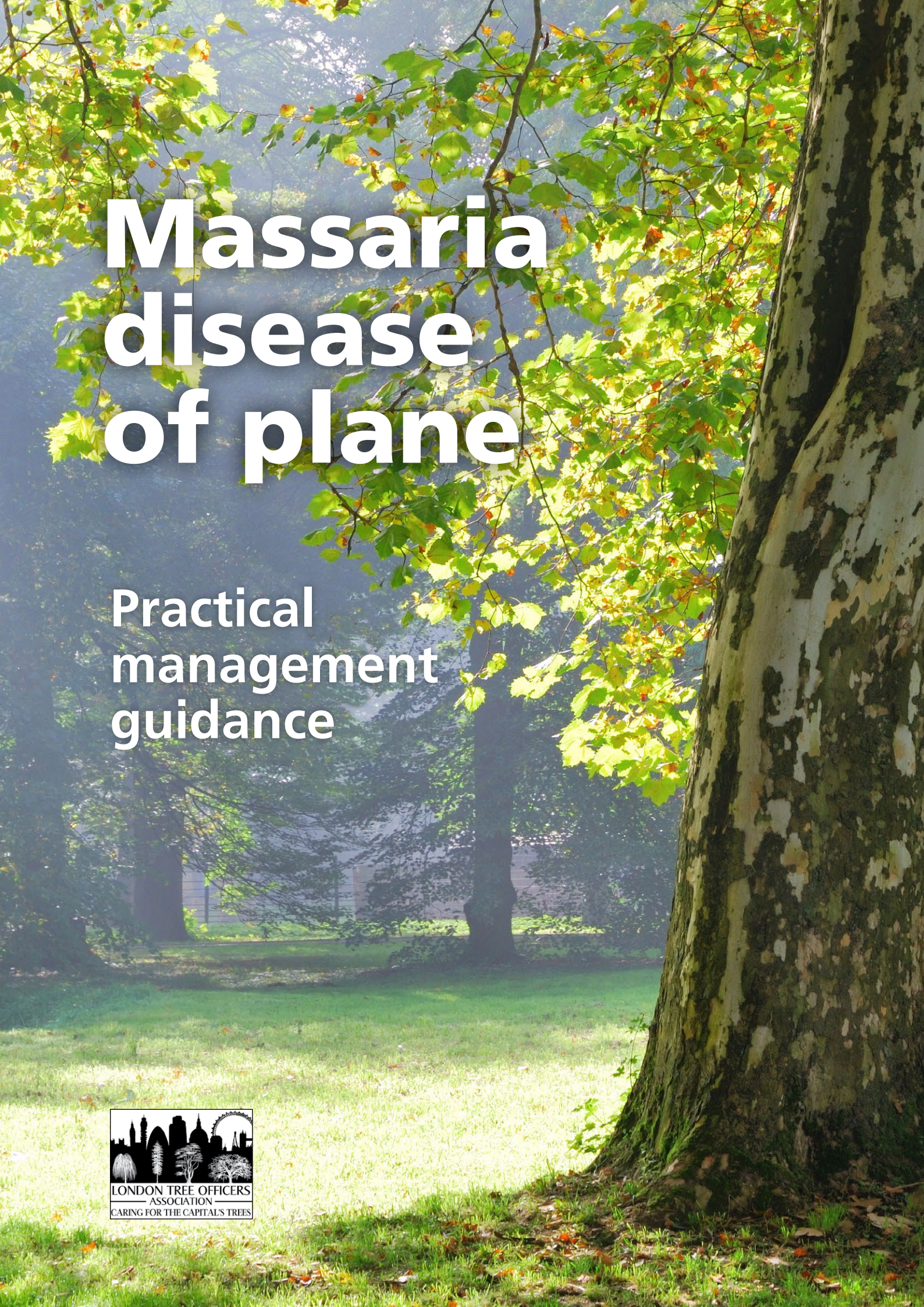


Massaria disease of plane

Practical management guidance

LONDON TREE OFFICERS ASSOCIATION
CARING FOR THE CAPITAL'S TREES

Massaria disease of plane practical management guidance

Foreword

The LTOA guidance on massaria disease of plane (commonly referred to as 'massaria' and abbreviated in this document as MDP) consists of the following three documents:

1 The Position statement

This outlines the aims and core principles of the LTOA massaria working party. It can be found at: www.ltoa.org.uk/resources/massaria-disease-of-plane-mdp

2 Part A – Practical management guidance

This provides managers with guidance and the tools for implementing a reasonable, balanced and proportionate response to massaria and a sustainable management approach.

3 Part B – The technical Information

This provides the background information supporting the approaches specified in Part A.

Part A can be referred to on its own as a guide for the management of massaria. However, Parts A and B together provide a fuller picture of MDP and both should be read.

Members of the LTOA massaria working party are Jake Tibbetts (Islington Council), Mike Turner (Royal Parks), Neville Fay (Treework Environmental Practice), Peter Holloway (Arboricultural Association) and Neil Tailor (Royal Parks). Thanks also are due to Adolfo Gonzalez, Patrick Prendergast and David Humphries. In researching current knowledge and understanding of massaria we consulted a number of scientific colleagues, and particularly acknowledge Prof Dr. Rolf Kehr.

Statements in this document have been given a score to indicate the authors' confidence in and origin of that statement.

Scoring confidence indicator

1 Scientific evidence – strong evidence basis

2 Hypothesis based on science/evidence

3 Informed professional opinion

G Guidance – based on facts/professional opinion

1 Introduction

1.1 The purpose of this guidance on massaria is to provide:

- General background about the disease
- Disease symptoms and their recognition
- Recommendations for surveying
- Recommendations for the sustainable management of populations of plane trees
- Guidance integrating current knowledge and practical experience; this will subject to updating as experience and knowledge develop in the field

1.2 Background

a) Massaria affects the genus Platanus (plane). [1]

b) planes are particularly successful urban trees due to their general resilience and tolerance to urban environmental stresses. [1]

c) Over recent decades environmental impacts on city trees including London's mature planes have increased as a result of changes in pressures from human population density and associated demands for space. [2]

d) As trees reach maturity they become less able to adapt to changes in their environment. In particular changes to their rooting environment with a significant factor being water availability. [2]

e) Reduced water availability is positively correlated with the incidence of massaria, i.e. increased massaria incidence is observed to follow periods of drought and conversely it is observed that periods of high annual rainfall correlate with reduced new massaria incidence. [1]

f) Massaria is considered part of the natural fungal flora of plane trees, normally functioning as an innocuous weak pathogen involved in the shedding of twigs, (typically less than five years' growth); a type of "natural pruning" connected to water regulation. [2]

Typical stepped branch failure

g) The fungus appears to take advantage of branches predisposed by drought stress, leading to larger diameter branches being affected, that are then shed (naturally 'pruned'). 2

h) Apart from a few isolated reports of massaria on plane in the UK, massaria has only been recorded in London since 2007. 1

i) On sites where monitoring has been undertaken in recent years the number of reported new incidences increased year on year until the abnormally wet summer of 2012, after which new incidents reduced significantly. 1

j) Reports of trees managed by cyclical crown reduction appear to show little evidence of massaria affected branches. 2

k) Many urban plane trees that have not been subject to cycles of reduction have been managed under a regime of repeated crown thinning. 3

l) Higher levels of thinning of the inner crown can lead to end loaded branches ("lion-tailed" in extreme cases) with reduced capacity to produce compensatory taper. 1

m) Crown thinning is thought to contribute to the current expression of MDP symptoms on larger branches. 3

n) Massaria symptoms have been more commonly observed in open spaces and in certain areas with street trees. Also to a greater degree in avenues with inter-connecting crowns, particularly on exposed outer-facing branches. 3

o) Massaria affected branches can fail within three months of the symptoms first becoming sufficiently developed to be noticeable. However branch failure may occur between one to two seasons from inception, though in many cases longer. 1

p) The disease expression is associated with bark and cambial death, a canker-like characteristic ('massaria strip'), on the upper side of the branch, progressing outwards along the branch. It appears to spread along the branch beneath the bark potentially affecting up to 30% of the branch circumference. 1

Fallen limb showing typical step breakage associated with MDP

Cross sections showing typical decay pattern

q) Wood decay occurs within the branch below the canker, characterised by soft rot, often resulting in the death and / or the fracture of the branch. 1

r) Massaria decay does not normally spread from branch to the parent stem. 1

s) Due to the endemic nature of massaria we do not consider that biosecurity measures for climbers and equipment would have a significant effect on controlling its spread. Without further knowledge of the modes of fungal disease transmission, in addition to the use of precautionary measures to prevent climbing operatives damaging the bark of plane trees, where possible it is recommended that chippings and arisings are reused on site. G

t) It is the LTOA's position that we do not support the premise that plane trees in the urban environment require climbing inspections to establish the presence of massaria if no symptoms are visible from the ground. Nor do we believe that any given population of plane trees should all be inspected aerially to ascertain the presence of massaria. Instead we advocate a balanced and proportionate response to the problem based upon regular ground level inspections and believe this approach can ensure that any risk is managed as low as reasonably practicable. G

1.3 Disease symptoms; 'what to look for', 'how to recognise'

Identifying massaria affected branches requires targeted inspection, ideally in bright conditions, using binoculars where appropriate. There is no single feature that on its own identifies MDP, rather a range of visual signs contributes to positive identification. A survey of fallen plane branches of any size should be undertaken to seek out likely symptoms of massaria. G

The following are considered to be the key characteristics and symptoms:

- MDP features more commonly on outer facing, less-shaded branches in mature groups, avenues and lines of trees. 3
- In one sample of 320 branches identified with MDP 95% were on branches less than 200mm diameter, and 63% were on branches with a diameter smaller than 100mm . Branches in the lower crown with a diameter less than 200mm are more likely to be affected. 2
- The disease first appears as a pinkish, sometimes orange-coloured strip (the 'massaria strip'), on the upper surface of the branch, and as a lesion close to a union with the parent branch or stem. 1
- The massaria strip is often wider nearer the union, tapering, sometimes sinuously for some distance along the branch length. 1
- Part of the massaria strip can also appear blackened, which is caused by the fruiting bodies of the fungus. 1
- In the earlier stages, the branch foliage is still alive with little or no indication of a decline in vitality. 1
- As it is usually the upper portion and surface of the branch that is affected, this is not easy to spot from ground level. However, in summer symptoms can be seen in the pattern of branch decline. 1
- Branch decline manifests as dieback from the extremities of the branch, progressing inwardly. This has the appearance of a drought affected branch contrasting with the surrounding live branches. 1

2 Management of plane trees with massaria

2.1 The need for a management policy for London

a) An upsurge in massaria is likely to have significant implications for the Capital's iconic plane tree population. It is vital that the LTOA provide leadership to avoid inappropriate and unbalanced responses in reaction to perceived risk and ill-informed attitudes to tree health and disease. Furthermore there is a need to adopt a proactive evidence-based response that takes due regard of the positive contribution of the plane tree population to the Capital. This requires the development of a coherent framework that guides management of plane trees in light of MDP at a London, borough and local level. 3

b) Massaria, while posing a variable level of risk to public safety, is not considered in itself a threat to the tree. However an inappropriate response may well result in a degradation and loss of trees and their benefits. 2

c) The management policy should take due regard of the range of benefits provided by plane trees so these can be properly balanced against the actual risks posed by massaria affected trees in order to determine appropriate investment of resources. G

d) To develop this policy fully it is necessary to understand the current status of the plane tree population, the context of the disease and its geographical distribution, G with consideration to:

- Benefits of plane trees
- Real (rather than perceived) level of public safety risk
- Status of the plane tree population and its sustainability
- Environmental factors that adversely impact on the trees
- Resource allocation for MDP risk assessment, for managing risks as low as reasonably practicable.

2.2 Strategic management at a local level

In sites where massaria branch death is a problem, controlling these risks needs to be considered within the framework of the existing tree management policy. G

a) Massaria related safety management should follow the key principles outlined in the National Tree Safety Group's (NTSG) '*Common Sense Risk Management of Trees*'. 3

- Trees provide a wide variety of benefits to society
- Trees are living organisms that naturally lose branches or fall
- The overall risk to human safety is extremely low
- Tree owners have a legal duty of care
- Tree owners should take a balanced and proportionate approach to tree safety management.

For guidance on assessing target areas and likelihood of damage or injury due to branch failure refer to the NTSG.

b) Three significant aspects need separate consideration G These are:

1. Controlling the risks from individual massaria affected branches for public safety.
2. An overall management strategy for the plane tree population to optimise resilience to massaria disease.
3. As with the overarching policy, the local strategy should:

- **Map the disease progression**
- **Investigate the likely causes and local environmental factors where tree condition appears affected by massaria**
- **Explore measures to reduce adverse impacts and improve tree health and longevity**

c) Tree inspection and control needs to be balanced and proportionate to the real risks, as opposed to a perceived risk, associated with massaria within the context of overall tree management resources. G

d) A massaria risk management strategy involves a system of inspection and recording to evaluate and prioritise the need for branch removal. This requires a system for ground level inspection (spotting, recording and mapping affected trees and branches) for prioritising treatment according to risk level. 3

e) In many cases the disease cannot be confirmed until dead branches are removed and inspected closely. 1

f) Removing dead branches may affect the tree's ecosystem. Any dead branches in areas with low public access and therefore minimal risk of injury could be left in situ and monitored. 3

g) It is important not to prune affected trees unnecessarily. Only branches showing clear symptoms of being infected need be removed if there is an unacceptable risk to public safety. G

h) Management needs to identify environmental factors that are controllable, which influence the occurrence of the disease such as compaction, root damage, water availability, soil condition/ biological function and competing vegetation. 3

2.3 Massaria interventions

Once MDP has been indentified within a tree where an unacceptable risk to the public is identified, such as from large dead branches in high use areas a method of management will need to be considered. G

Appendix C provides a list of management options. It lists the advantages and disadvantages of these actions, the impacts and effects on the tree and amenity, its effectiveness against massaria, its durability and the notional costs over 30 years. These costs are indicative and are intended as a means of comparison between respective actions. G

2.4 Recording of Information

The LTOA advocates that it is important to record information in a standard format that can be collated to achieve a better understanding of MDP. We have developed documents that can be used to record information.

a) Initial ground based survey.

It is acknowledged that the initial survey is likely to be undertaken using existing databases and equipment. Fallen plane branches of any size should be inspected to identify symptoms of massaria. G

We consider it is important to record the following basic details: G

i. Unique tree reference number
ii. Date of inspection
iii. Overall condition
iv. Age class (Y, SM, M, OM)
v. DBH
vi. Height
vii. Location (Narrative)

The following information would be beneficial: G

viii. X/Y coordinates so locations can be plotted
ix. Ground conditions
x. Crown density (percentage crown loss)
xi. Live crown

It is recommended that the first inspection records whether the tree has suspected or confirmed massaria. If confirmation is required this can be achieved through subsequent works, aerial inspections or examination of fallen branches. G

There is a massaria spreadsheet that can be downloaded at the LTOA's website. This spreadsheet has been developed with the intention that surveys are submitted for central collation. Therefore before surveying it is recommended that surveyors ascertain how they can export the information from their databases into a spreadsheet of identical field names and sequence of fields. G

b) Aerial inspection.

When undertaking an aerial inspection the massaria Aerial Inspection form in **Appendix C** should be filled in by a competent climber, trained in massaria identification and recording. The information should then be entered into the main massaria spreadsheet and where applicable the massaria status updated as "confirmed" or "misidentified". G

CASE STUDY

2.5 Case study scenario G

This case study is an example of a metropolitan council with a plane tree population with suspected MDP.

Year one

Once massaria had been identified an initial desk based assessment was carried out to identify all plane trees greater than seven meters in height and that were not being managed on a cyclical reduction programme. This group of plane trees was considered to be susceptible to significant branch failure as a result of massaria, and classified as the massaria Risk Group (MRG).

All of the trees in the MRG were subject to ground level inspection by trained staff early in the summer. Trees identified as having symptoms associated with MDP in high risk zones were subject to an aerial inspection and necessary remedial works, or were scheduled for a secondary ground level inspection, to assess the development of symptoms. As part of the climbing inspection, pro forma reports were compiled by the climbers.

Other actions to reduce risk were undertaken such as the relocation of benches and reducing mowing regimes to reduce levels of use under the canopy of affected trees.

All trees displaying symptoms of MDP with medium or high risk targets were pruned to reduce the risk and aerial crown inspections were undertaken in the course of such works. Neighbouring trees were also viewed from a high vantage point within the canopy. Trees in low risk zones were not subjected to pruning works.

Two further ground based inspections were undertaken during the summer. The first was a re-inspection of sites where massaria had been identified during the first survey. The second was a ground level inspection of the entire massaria Risk Group (MRG).

In subsequent years three ground based inspections were undertaken - one of the entire MRG and two of all of the plane trees within sites where MDP was present.

Notes: *All tree inspectors and climbing staff were trained to identify and record MDP in the course of general tree maintenance. All grounds maintenance and park staff also received training and were instructed to report any significant fallen branches and the tree it had originated from, so that Arboricultural staff could undertake follow up inspections.*

Information was also sent out to park friends groups, residents associations and other residents to raise awareness and to encourage the reporting of MDP symptoms.

3 Tables

Table 1

General tree and site factors useful for management decisions

Factors likely to affect susceptibility to massaria	Description of factor	Confidence indicator
Canopy condition	Massaria more likely where there is stress from past management including extensive canopy thinning	3
Tree maturity	Mature trees appear to have greater incidence	2
Branch orientation	Incidence may be associated more commonly on branches with certain aspects/ orientations	3
Shade effect	Typically MDP occurs where branches are not exposed to full light	3
Branch diameter, elongation/ end-loading	Incidence is associated with slender, small diameter, long branches, with little taper in diameter that extend to the crown periphery with leaf-growth predominating at the tips	3
Branch position in the crown	Larger diameter branches affected with MDP are typically in the lower crown, whereas small diameter branches may be found throughout	3
Extreme weather conditions	Increased susceptibility following weakening effects/ events. E.g. temperature, precipitation and humidity	2
Soil conditions/edaphic factors	Ground compaction, inundation or other factors that adversely affect root function	1
Drought	Greater incidence associated with drought, including dry periods in winter (Long periods of freezing weather and salt gritting can produce a physiological drought which may be a factor).	1
Tree health (foliar condition)	In sites where massaria is found trees are often growing in sub-optimal conditions, already showing decline or stress symptoms.	3
Avenue	Massaria symptoms have been found to be associated with lower branches in closely planted avenue trees growing at right angles to the avenue, i.e. outer facing exposed branches.	3
Climatic	Climate trends that reduce the availability of moisture could increase massaria incidence.	2
Crown reduction	Crown reduction pruning reduces the incidence of massaria, implying that reduced water transportation distances are beneficial with respect to MDP.	2

Table 2

Symptoms of massaria

Symptom	Description	Other causes of these symptoms	Description
Pink and orange-coloured strips on bark	When London plane bark is killed it changes colour and takes on a pinkish or orange hue. This is a characteristic of massaria disease in early stages and can also occur with other diseases or dysfunctions that affect the bark or cambium.	**Bark death due to sun scorch**	Exposed branches on thin barked trees like London plane can be killed. This is usually visible on the upper surface of branches in full sun (usually on the southwest - the direction where the sun is hottest). Frequently the wood beneath the sunscald will decay and in extreme cases such weakened branches can break. Sunscald is more likely on shade grown parts of thin barked trees when exposed suddenly to the sun as would be expected after branch failure or pruning operations. PR
		Cryptosporiopsis anamorph of Pezicula cinnamomea	Cryptospriopsis targets existing wounds in many tree species and can kill bark and cambium in vulnerable trees causing twigs and small branches to die. Cryptosporiopsis on narrower branches can be long and narrow tapering to a point and can also discolour thin freshly killed bark pink. A similar pattern of symptoms is also shown by other fungi like Phomopsis and Cytospora but unlike massaria they do not produce black spores in the later stages and only Cryptosporiopsis can cause small branches to break off. RK
Scars/lesions	In the period following bark death the area develops a bark scar or lesion appearing as a sunken area where the living bark surrounding the dead continues to grow or the dead bark can be displaced exposing the sapwood beneath the bark.	**Any disease that kills bark can lead to these symptoms as above and include Anthracnose (Apiognomonia veneta), Fusarium (Fusarium solanum), Botryosphaeria canker (Botryosphaeria dothidea) and the shaggy polypore (Inonotus hispidus) RK**	Description of fungi that kill bark above. Secondary fungi that may be associated with areas of dead bark include Jelly ear (formally Jew's ear) (Auricularia auricula-judae).

Symptom	Description	Other causes of these symptoms	Description
Broken branch ends	Healthy, Dead or decayed branches can break at various places along their length. To be more certain that massaria is implicated look for the the classic segmental decay in a branch cross section combined with a tapering scar along the branch.	**Secondary fungus development may suggest that secondary fungi were the cause of branch breakage rather than massaria.**	Look for other causes of decay that may have caused a branch to break rather than assume it is massaria. Check for decay, decay in the classic upper branch segment and a strip of dead bark or decay tapering along its length.
Scars/Lesions	In the period following bark death the area develops a bark scar or lesion appearing as a sunken area where the living bark surrounding the dead continues to grow or the dead bark can be displaced exposing the sapwood beneath the bark.	**Any disease that kills bark can lead to these symptoms as above and include Anthracnose (Apiognomonia veneta) , Fusarium (Fusarium solanum), Botryosphaeria canker (Botryosphaeria dothidea) and the shaggy polypore (Inonotus hispidus). RK**	Description of fungi that kill bark above. Secondary fungi that may be associated with areas of dead bark include Jelly ear (formally Jew's ear) (Auricularia auricula-judae),
Dead leaves 'droughted' branches	When branches die quickly while in leaf the dry dead branches with their brown leaves can be conspicuous.	**Branches broken from impact, wind etc.**	From ground level branches killed by massaria or any other disease are indistinguishable from branches broken by wind or other forms of mechanical damage. Check dead branches for typical massaria symptoms - do not assume it is massaria.
Brittle fracture – Soft Rot	massaria can cause this kind of failure on smaller branches.	**Many fungi can cause a soft or brown root leading to a brittle failure.**	Inonotus hispidus causes simultaneous white rot which also results in a brittle fracture but it produces a soft rot pattern in the early stages of decay. LO
Broken branches with distinct stub along neutral plane fault	massaria preferentially decays the upper part of the branch and so it can leave branch stubs and branches with a distinct step where the upper part breaks near the main stem and the lower section further away.	**Mechanical damage, storm damage, previous pruning wounds**	Mechanical damage on the upper side of a branch, pervious pruning wounds can mean that the upper part of the branch fails first giving a similar shape to massaria affected broken branches.

Table 2

Symptoms of massaria *(cont)*

Symptom	Description	Other causes of these symptoms	Description
Strip cankers	Strips of sunken, discoloured or dead bark can be caused by a number of biotic and abiotic factors.	**Shaggy Polypore (Inonotus hispidus)**	This fungi can cause short sections of dead bark that appear like strip cankers, these strips can extend over many years but usually the fruit bodies or their remnants are visible as the cause.
		Scars/Dysfunction from severe pruning	Pruning, especially during periods of drought, can cause strips of sapwood to dry out, and these can appear as a strip canker. Strips of dead bark near pruning wounds should be evaluated to check for clear symptoms of massaria
		Fomitiporia punctate (previously - Phellinus punctatus)	Uncommon. First found in south east in 2008. Resupinate (flat to the trunk) buff coloured fruit body. Creates a canker leading to white rot of both the sap wood and heart wood. Potential for limb failure
		Ceratocystis platanii Canker Stain of plane	This fungus disease has not been recorded in the UK. Sunken cankers appear on trunks, large branches and occasionally small limbs. These cankers usually have longtitudinal cracks and roughened bark. Freshly exposed wood has brown or bluish black discolouration. Dark coloured streaks extend from the canker inwards to the centre of the trunk/branch and radiating brown streaks can be seen in areas not affected by canker. There is no decay. PR RK
		Apiognomonia veneta RK	This is generally thought of a disease that causes patches of necrosis on the leaves and the bark of twigs. More rarely it can affect larger branches and trunks causing dead patches measuring up to 10x2cm but there is no decay. RK

Symptom	Description	Other causes of these symptoms	Description
Strip cankers (cont)	Strips of sunken, discoloured or dead bark can be caused by a number of biotic and abiotic factors.	**Fusarium solani**	Fusarium is a weak parasite found throughout the world and can cause bark damage on many trees influenced by water availability and tree health. In Europe it has been observed in the Mediterranean area and southern Germany to cause large cankers on branches that appear in the dormant season. These cankers were measured as 2-15cm long and several centimetres wide and resemble cankers caused by Apiognomonia veneta and similarly do not decay wood. RK
		Botryosphaeria dothidea	This fungus has been known to kill bark on the branches and trunks of London plane in the Mediterranean and in the warmer parts of north America. In 2000 it was found on planes in Mannheim causing long thin strips of cambium to die and the wood to discolour. These strips of dead bark affected the trunks originating at ground level and were several metres long and 10-20cm wide. The dead wood behind the bark was dark brown/bluish in colour. RK. The wood does not become decayed but the discolouration in a circumferential zone beneath the bark may look like decay. It is distinct from massaria in that the discolouration does not spread towards the centre of the stem. RK has not found this in branches but Botryosphaeria is known to affect branches so it should not be ruled out.

RK *Entwicklung Der massaria-Krankheit In Deutschland In Den Letzen Jahren*, by Rolf Kehr, JAHRBUCH DER BAUMPFLEGE 2011

PR *Pirone's Tree Maintenance 7th Edition* by Hartman Pirone and Sall, Oxford University Press, April 2000

LO *Principles of Tree Hazard Assessment and Management* by David Lonsdale, TSO 1999.

A Appendix A – Model management protocol for massaria disease in plane trees

The flow chart on the following page describes a model process for managing massaria Disease of London plane in different scenarios.

The process is designed to assess and manage tree related risks in a way that is balanced and proportionate to the real risks from MDP branch failure. As such the method aims to concentrate effort on high risk areas and monitor low risk areas.

Determination of Low/High Susceptibility Massaria Areas

Some localities seem to be more prone to massaria.

High Susceptibility Massaria Areas

(Close grown tree canopies, avenues, mature plane trees)

Low Susceptibility Massaria Areas

(Trees subject to cyclical reduction, individual trees, young plane trees, riparian environment)

Determination of Low/High Target Risk Zones

The level of risk posed by massaria is clearly greatest where there is the greatest potential to cause harm and these will be where there are the largest number of 'targets' be they people or high value damageable property.

High Target Risk Zones

(e.g. overhanging roads with high volume of traffic, high use public open space and busy footpaths)

Low Target Risk Zones

(e.g. roads with low volume of traffic, low use public open space and other areas with low public access)

RISK LEVEL GUIDE	High Susceptibility Massaria Areas (**HSMA**)	Low Susceptibility Massaria Areas (**LSMA**)
High Target Risk Zones (**HTRZ**)	High Risk	High Risk
Low Target Risk Zones (**LTRZ**)	Low Risk	Low Risk

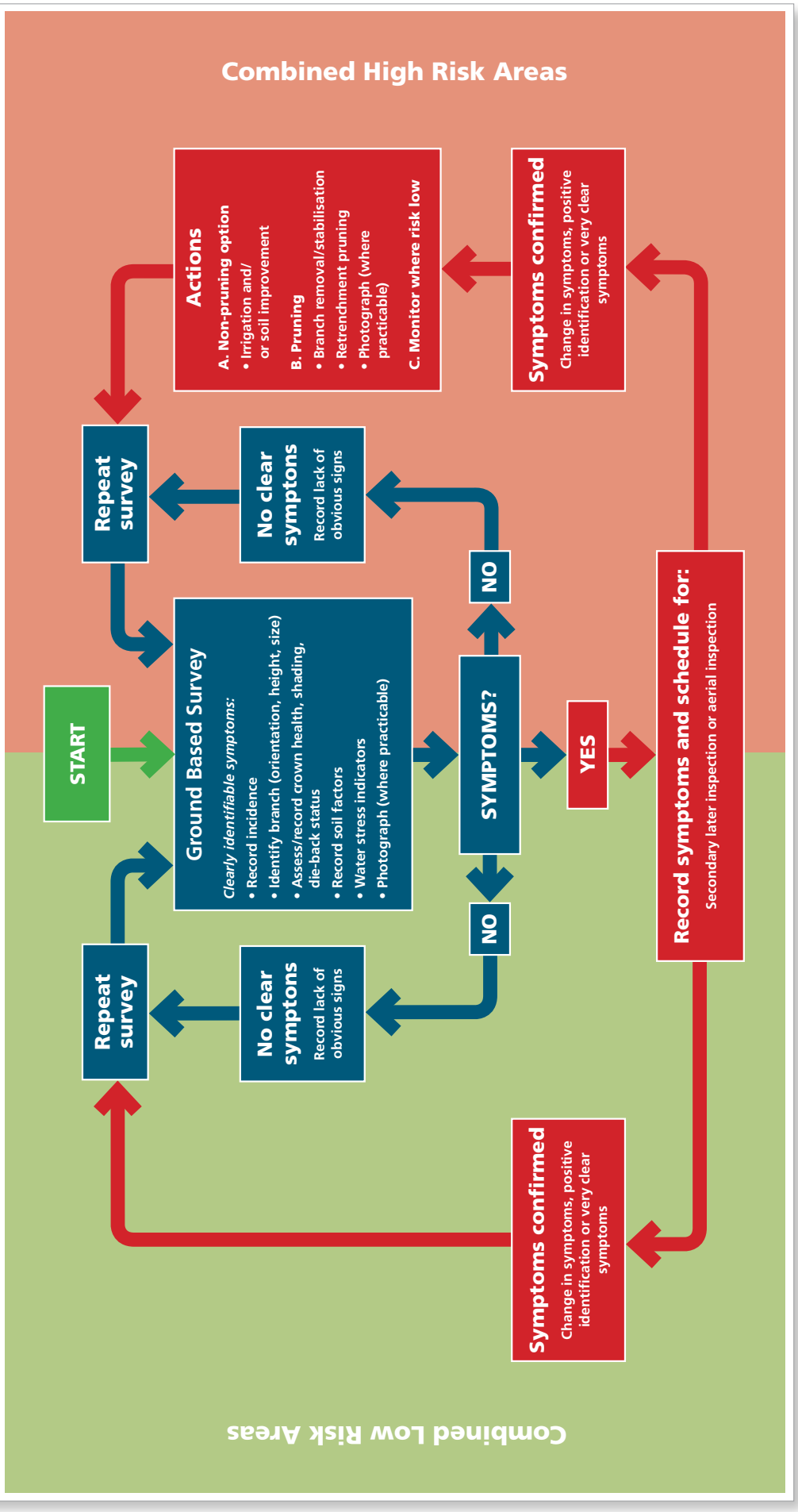
Visual tree assessment

Regular Visual Tree Assessment from ground level will monitor the occurrence of symptoms that could be massaria. Trained and experienced assessors will generally be able to identify massaria during ground level inspections.

Occasional aerial inspections may be desirable to confirm diagnosis but these can normally be carried out when suspected massaria affected branches are removed or during dead wood removal operations when there is a perceived significant risk of injury or high value property damage.

Management flow chart

1 Identify High (HSMA) & Low (LSMA) Susceptibility Massaria Areas (e.g. close grown canopies, avenues, mature plane trees)
2 Correlate HSMA / LSMA with Target Risk Zones (High (HTRZ) Moderate (MTRZ), Low (LTRZ)
3 Calibrate accordingly to prioritise sequencing of inspection and response e.g. 1st HTRZ-HSMA; 2nd HTRZ-LSMA etc
4 Regular VTA control, combined with massaria control



B Appendix B – Massaria inspection record

Massaria inspection record

Date

Site name

Contract

Order created by

Works order ref.

Tree Sequence no.

Name of climber

Work undertaken

Infected branches removed

Branch Number	**% of Live Wood**	**Length of Branch** (cm)	**Diameter at thickest point** (mm)	**Diameter at thinnest point** (mm)	**Height from ground level** (m)	**Branch Orientation** (Compass Point)	**Branch Tier:** Trunk (T), Primary (1º), Secondary (2º), Tertiary (3º)
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

Glossary

% of Live Wood – look at the thickest part of the branch once removed and see how much uninfected wood is present.

Length of Branch – measure entire length of branch that was removed, not just the length of infection.

Diameter at thickest point (mm) – measure diameter at the point that branch has been removed closest to the stem/trunk.

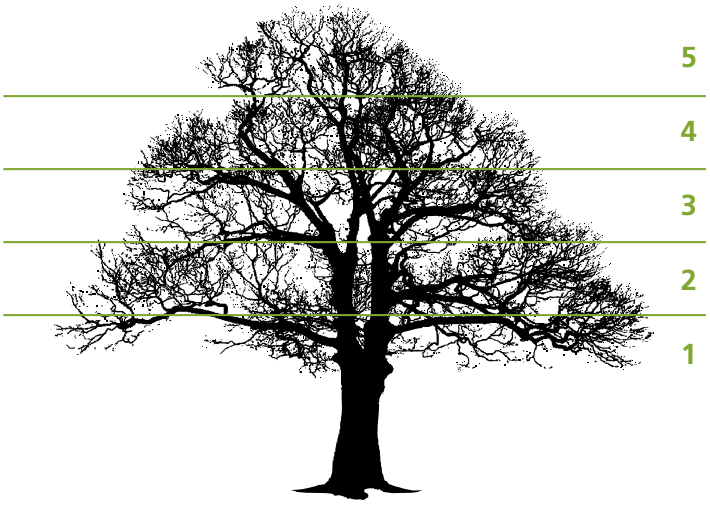
Diameter at thinnest point (mm) – measure diameter at the point on the branch furthest from the stem/trunk. (If bud/twig at tip put 1mm)

Height from ground level (m) – this is the measured from the ground to the middle point of the wound left on the stem.

Branch Orientation – direction the branch extends from the trunk using points of the compass. (i.e. – NW)

Branch Tier – The type of branch that has been removed. (Trunk = main trunk removed; Primary = Large limb attached to trunk; Secondary = smaller limb attached to Primary branch; Tertiary = small branch attached to Secondary branch)

For all branches removed and listed overleaf, indicate the Crown Zone (1 – 5)



Branch	1	2	3	4	5	6	7	8	9	10
Crown Zone (1 – 5)										

Recommendations for future action

Signature _____ Date _____

Name _____

Once completed, this form must be:

1 Passed back to the contract manager;
2 Scanned and saved as a PDF document;
3 E-mailed to the person who created the order.

LONDON TREE OFFICERS ASSOCIATION
CARING FOR THE CAPITAL'S TREES

Pruning*

Actions	Advantages	Disadvantages	Initial impact on Tree Health	Effect on tree health wellbeing and amenity benefits	Effectiveness against massaria	Durability	Indicative Total Costs Over 30 Year Period Per Tree
Repeated massaria Branch Removal	• Removes affected branch • Quick initial resolution **NB - Branches identified for treatment do not necessarily need to be pruned back to their origin (stabilised rather than removed)**	• Pruning in anticipation of branches dying is not recommended as it is likely to place increased demands on tree energy reserves • Disfigures crowns over time • Reduction of crown density - Increased local exposure • May speed up progression within remaining crown • Damages tree and may shorten life span	Negative	Reduced	Short term, no medium to long term effectiveness	As little as 3 months	£1,000 - £6,000
Crown reduction works (2 Year Pollard Cycle)	• Crown reduced trees do not appear to suffer from branch failure due to massaria	• Damages tree and may shorten life span • Disfigures the canopy of the tree • Commitment to ongoing re-reduction works required and increased maintenance costs	Negative	Reduced	Appears to stop branch failure due to massaria	2 years	£4,000 – £6,500

Crown reduction works (6 year crown volume reduction cycle)	• Crown reduced trees do not appear to suffer from branch failure due to massaria	• Damages tree and may shorten life span • Disfigures the canopy of the tree • Commitment to ongoing re-reduction works required and increased maintenance costs	Negative	Reduced	Appears to stop branch failure due to massaria	6 years	£1,750 - £3,000
Retrenchment Pruning	• Retains trees branch tracery and canopy shape • Mimics the natural self-shedding of the tips of branches apparent in periods of reduced moisture in the soil • Least damaging of the pruning methods and on balance considered to be a potential long term benefit to tree health	• Effectiveness against massaria not yet evaluated • Requires experienced skilled arboriculturists and specialised equipment	Minimal	Minimal	Not yet evaluated	4-6 years	£2,000-£3,000
Other Pruning Considerations	• Sterilisation of equipment not considered necessary	• Transportation of arisings from infected to non-infected sites should be avoided	N/A	N/A	N/A	N/A	N/A

Non pruning**

Actions	Advantages	Disadvantages	Initial impact on Tree Health	Effect on tree health wellbeing and amenity benefits	Effectiveness against massaria	Durability	Indicative Total Costs Over 30 Year Period Per Tree
Irrigation	• Non-invasive • Trials have demonstrated positive effects with large quantities of water (Equal to an additional 3mm precipitation per day over the year)	• May not be possible under drought orders • Effectiveness of smaller quantities of water not yet known • Only applicable to trees in certain sites	Positive	Increased	Reduces massaria branch incidence with high volume applications. Not yet evaluated with smaller quantities	Needs to be continuous	Unquantifiable due to the range of irrigation options
Mulching	• Non-invasive • Improves overall soil conditions and tree health • Reduces competition for water	• May not be possible for all tree locations • Existing cultural/ management views of trees in grassed areas may need challenging • Effectiveness against massaria not yet evaluated • Only applicable to trees growing in open ground • On a mature tree 12m3 of mulch may be required	Positive	Increased	Not yet evaluated	Annual	£1,500 Upwards
Soil and foliar organic feed	• Non-invasive • Improves overall soil conditions and tree health • No visual changes to canopy or surrounding soil surface	• Effectiveness against massaria not evaluated. Soil application only applicable to trees in open ground	Positive	Increased	Not yet evaluated	Ongoing until assessed benefit is shown	£7,200 *NB Soil only treatment is cheaper (30 - 40% of above total cost) than soil plus foliar feed or foliar on own

Natural leaf litter retained	• Non-invasive	• May not be possible for all tree locations • Existing cultural/ management views of trees in grassed areas may need challenging • Effectiveness against massaria not yet evaluated • Only applicable to trees growing in open ground	Positive	Increased	Not yet evaluated	Ongoing	£0 to cost of maceration of leaf litter
Soil structure improvement/ decompaction	• Improves rooting potential, porosity and drainage	• Can be invasive • Some methods not effective in all situations • Only applicable to open grown trees • Effectiveness against massaria not yet evaluated	Minimal	Increased	Not yet evaluated	Long Term	£1,500 - £4,000
Physical replacement of soil	• Improves rooting potential, porosity and drainage	• Highly invasive. (recommend phased operational approach) • Difficult to achieve on clay soils • Only applicable to open grown trees • Effectiveness against massaria not yet evaluated	Minimal	Increased	Not yet evaluated	Long Term	£3,000-£5,000

Non pruning** *(cont)*

Actions	Advantages	Disadvantages	Initial impact on Tree Health	Effect on tree health wellbeing and amenity benefits	Effectiveness against massaria	Durability	Indicative Total Costs Over 30 Year Period Per Tree
Survey - Ground Level	• Inexpensive • Efficient • Practicable • No specialist equipment required • Targeted • Symptom identification can be readily learned	• Requires experienced inspectors • Increased frequency • Difficult to identify early stages • Weather/ visibility dependent	None	None	N/A	N/A	£250-£300 *NB based on 3 inspections a year at estimated unit rate of £3 per tree
Survey - Aerial	• Early development identified • Can be combined with planned/ routine tree work	• Costly • Time consuming • Labour intensive • Specialised equipment and training	Minimal	None	N/A	N/A	£2,500 - £8,000 *NB This is based on one or two inspections per annum
Engaging stakeholders, public and other staff	• Raises general awareness and understanding of issue. • If managed properly should reduce overall service resource pressure on inspections and collection of management information	• Requires training, engagement and initial impact on resources	N/A	N/A	N/A	N/A	N/A

* *All pruning works to be undertaken in accordance to BS 3998 2010*

** *NB non pruning works do not necessarily negate the need to undertake some form of pruning. Before undertaking, soil tests should be undertaken to establish the soil type, structure as well as biological and mineral assessments*

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