



Trees in focus

Management of Avenue Trees

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Summary

Avenues of trees have long been a popular feature of the British rural and urban landscapes. The planting style is of European origin and became fashionable in Britain during the 17th century. Today, established avenues are not always managed with the sensitivity they deserve. A lack of commitment to the available management options results in decline of an existing avenue or failure of regeneration strategies. This Practice Note offers guidance in avenue management; it identifies the problems which can affect avenues, highlights the importance of establishing management objectives and discusses some practical solutions.

More than a line of Trees

From the cherry tree-lined streets of Welwyn Garden City and the beech tree-lined roads of Aberdeenshire, to the planes along The Mall in London and the streets of central Milton Keynes, the tree lined avenue is a ubiquitous and popular planting style, able to transform an area, largely by defining space. A walk in the 'enclosure' between the colonnades of mature trees forming an avenue across an historic park can be a relaxing experience (Plate 1); sunlight and breeze filtering through the foliage can evoke a peaceful attitude of mind particularly if there is an accompaniment of bird song. Avenues have also been used to direct the eye to a view or a particularly noteworthy feature (e.g. a statue or a building).

Although the term 'avenue' has broad applications, it can generally be described as a regular and linear planting of trees whose grandeur often results from the general uniformity of the trees, which give the impression of all having been planted at the same time. An avenue can be straight to form a focus on a feature (e.g. a statue or a vista) or curved as in the case of a drive access, it can define a linear space or enclose an area to form a static space. The eye can also be distracted away from an unsightly structure or feature.

An avenue may comprise a single line of trees, but the

popular perception is of a double row or multiple rows.

Besides planting trees to create an avenue, a similar effect can be formed by cutting through an existing grove or wood to create a vista or ride.

Records suggest avenues were first planted in England in the sixteenth century to form shaded walks close to the house (Cecil, 1910, cited by Pigott, 1989). Grand avenues crossing parks and forming an approach or vista increased in popularity during the 17th century, particularly following the Restoration of Charles II (Carmichael, 1995). The appeal of avenues grew among the land-owning classes and they remained a popular landscape feature until the mid-nineteenth century.

Today opportunities do occur, both in town and country, for new avenues to be created (Plate 2). It will be many decades before these new avenues can be enjoyed in their full splendor. This is perhaps the ongoing motivation for piecemeal regeneration of the old historic avenues.

Despite shifts in landscape and garden styles, and pronounced changes in the land use since the original plantings, many old avenues remain, often as relics of their original glory. Given the visually homogeneous nature of an avenue, its unity can easily be lost if one or more trees fail or when the avenue trees succumb to old age. A proactive approach to the management of an avenue is essential to secure its landscape value over the long-term.

Loss of Unity

Neglected avenues, including those that, because of disease or other damage, have become gappy or a mix of old and young trees, quickly develop a worn and patched appearance, lacking the continuity and distinction intended in the original design (Plate 3). Left unmanaged, such an avenue will disintegrate progressively and it will eventually be lost, although

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the individual trees may continue to have a valuable role both as significant ecological habitats and as landscape features if they can be seen perpendicular to the line of the original avenue (Plate 4).

It can be argued that the very charm of an old avenue is derived from the appearance and character of the ancient trees and that to reinstate it to some earlier, more youthful form would be inappropriate. In other words the avenue should be allowed to disintegrate with any work being kept to a minimum and being for safety only (Plate 3). But that may not be acceptable in all circumstances!

This Note offers options and suggestions for avenue management, however, the appropriateness of intervention and the amount of work to be undertaken should be the decision of the owner and manager of the landscape along with other interested parties working to agreed defined objectives.

Decline and Disintegration

The feature of uniformity which creates an effective and attractive avenue, such as even-age and single species, becomes the source of management and regeneration problems. Many avenues in Britain, planted in the 18th and 19th centuries are now past their prime. They consist of over-mature trees that are in decline, with individual trees being ultimately weakened by infections of parasitic, and root and wood-rotting fungi.

A change in the site conditions around one or more trees can quickly, and adversely affect their growth causing dieback and so affect the flow and rhythm of the avenue as a whole. The gales of 1987 and 1990 were the most recent significant events to have eroded the cohesion of avenues. Other avenues have been completely destroyed by disease - for example, the Wheatley elms (*Ulmus carpiniifolia* var. *sarniensis*) in East Anglia killed by Dutch elm disease (*Ophiostoma* species) in the 1960s/70s and the Elm avenues at Blenheim Palace, Oxfordshire (Greig 1981).

Although some avenues appear to be in good health, they may suffer from their trees having been planted too close together and not having been subsequently thinned. Trees are often planted too close either in a desire to provide visual impact during their early growing phase or because there is genuine ignorance regarding the ultimate crown spread and growing space required by each mature tree. In the past, thinning has been neglected in avenues due to a genuine lack of appreciation for the long term effects failure to adopt positive management can have on the appearance, safety and even the long term viability of the avenue. The task of thinning closely planted avenue trees should not be shunned because of an unwillingness to remove healthy looking trees or for a fear of losing the present aesthetic

value. Timely thinning will generally be rewarded with the retained trees growing to fill the available space. Delayed decisions about thinning often result in distorted crowns on the trees that are unlikely to recover even given more space.

What is Appropriate?

The immediate reaction to a gappy, declining avenue is to try to patch it with a tree-for-tree replanting (Plate 5). Such piecemeal regeneration results in uneven ages, heights and shapes within the avenue. The newly planted trees often develop slowly; growth is poor because of root competition from adjacent mature trees, and the crown developing under the shade of branches from the adjacent trees tends to be suppressed, frequently growing sideways towards available light instead of upwards. Even when there is clear blue sky directly overhead at the time of planting, the light will be quickly poached as the lateral branches of the adjacent mature trees develop to fill the available space. Such shading should be removed either by timely pruning or further felling of mature trees.

New trees planted into a mature avenue can also lead to an introduction of different genetic stock, undermining the avenue's historic and visual integrity. As failed old trees are replaced, slight variations in distances between trees and rows may be created because new trees are not planted in exactly the same positions as the originals and even with the best management, trees may grow at different rates and so develop asymmetry. Although slight, these differences can, if compounded, become a distraction particularly in a long avenue.

Where to Begin

Regenerating an avenue involves arboricultural, ecological, landscape and management skills all blended with some ability to solve arithmetic problems. All but the arithmetic skills will depend upon the participants having taken a broad over view of the avenue and its surroundings.

Reviewing current management and either confirming the relevance of existing objectives or formulating new ones for a site provides an opportunity to assess both the land use and landscape needs (Table 1). At the same time changes that may have occurred for example by imposition of a Site of Special Scientific Interest (SSSI) designation may have an over-riding influence on what may be done and what is practical. Consider the options and decide if restoration or indeed, the replanting of an avenue

Table 1 Management options based on function of avenue

Function of Avenue	Properties Required	Management Strategy
Vista	Encloses an area and directs the eye forward.	If the purpose of the avenue is to direct the eye towards a view etc., the original avenue may be reinstated by maintaining existing trees and filling in gaps, provided the gaps are large enough to allow full development of new trees. Some unevenness is inevitable but acceptable in this situation.
Historical marker	Planting is of a great age or a commemoration.	If the priority is other than visual, trees can either be left in their present condition or, if safety demands, they can undergo remedial/preventative tree surgery.
Habitat quality	Host to rare or endangered flora / fauna or to an unusually high number of species	Remember that trees have a finite lifespan and if an avenue is not regenerated, the avenue feature will cease to be visually effective. Tree provenance
Approach / Walk (Plates 6 & 7)	Typical components of an avenue important - even-aged, regular spacing, same species.	An avenue designed for walking or driving through cannot be effectively repaired piecemeal. The whole avenue (or part of it if multi-row) needs to be replanted, using either the same species as before (or their cultivars) or completely new species.
Horizon feature / landscape divider	Uniformity in age, spacing, height etc. essential.	A highly visual avenue requiring a similar management strategy to the approach / walk category (above).

that no longer exists, is necessary, practical and makes economic sense. Can we afford to restore the avenue? Or should a new avenue be created along the existing or a new line? Is there really enough space for an avenue? Does the avenue complement the 'design style' of the rest of the area? Is an avenue still appropriate? Or should the old trees, the remnants of the avenue, be allowed to stand as a valuable habitat? (Plate 3)

The avenue's purpose and its ability to fulfill that purpose, whether now or in the future, need to be assessed in order to decide which management option to adopt. For example:-

- a vista / focal point - define the landscape feature to be emphasised.
- a visual screen - what is to be screened and at what time(s) of year?
- conservation of genetic material and/or habitat - tree species/varieties of historic value or rare/ endangered flora and fauna species.
- shelter - what is to be sheltered, from what and at what time(s) of year?
- spatial definition - must recognise space is needed to determine the separation of trees and lines allowing for lateral growth of branches (see Gruffydd, 1987).
- can the desired effect be achieved with an alternative strategy?
- Is the need static or are changes likely in the

foreseeable future because of changes of the site for example?

The available management options fall loosely into three groups:

- *minimum intervention* - where an existing avenue is retained in its present condition for the conservation value its trees offer and is allowed to lose its regular structure. This places an importance on individual trees rather than the avenue as a whole and, for management purposes, the feature need no longer be considered as an avenue. However, a minimum intervention strategy may actually require fairly intensive management because the need to cater for the safety of people and property may have heightened significance.
- *active management* of constituent rows of the existing avenue - consideration is given to planting an entire row, or phased replanting of trees within a single row if space is limited. Many permutations and options exist within this approach.
- *creation of a new avenue* either by total removal of all the existing trees or planting a new row of trees or even a whole avenue outside or within the existing one.

Every avenue is likely to have problems and limitations specific to that site. There will be need to review management/regeneration options which should become obvious with increasing familiarity with the avenue.

Site Inspection and Tree Survey

A comprehensive survey of the individual trees forming the avenue will provide a clear picture of not only their condition as well as any risk they pose to people and property but also the original planting design. Several layouts of the trees have been used when planting avenues, for example opposite, staggered and in a quincunx (Crane 2001). At the same time, an appreciation of the avenue's surroundings will inform decision making about future management.

Inspection and categorisation of individual trees according to their general health and vigour, highlights life expectancy and structural defects that could render the trees a future liability. One method of grouping the trees would be to use the system outlined in British Standard BS 5837 : 1991 *Guide for Trees in Relation to Construction* (section 5.2) or a similar method. The British Standard method categories trees into four priority / desirability groups which can be colour coded on a plan:

- *high* - trees whose retention is most desirable and feasible (green).
- *moderate* - trees where retention is desirable although they may require management work in the future (blue).
- *low* - trees which could be retained but require significant management work now (brown).
- *fell category* - trees for immediate removal because they pose an unacceptable hazard (red).

Once the trees are categorised, and particularly if they are coloured on a plan, patterns through the avenue may become evident to assist in the regeneration process. Site aspects, which should also be assessed, include soil conditions, micro-climate, pests and diseases, habitat value (the presence of any notable or rare flora and fauna³) and obstacles to planting⁴.

The survey should identify the size/age, positions and spacings of every tree in the original avenue, including stumps and gaps. Measurements of branch spread into the avenue and, where gaps exist, the width of the space between the branches from the

adjacent trees should be recorded. The condition and positions of more recent plantings should also be recorded.

Historic records giving details of the design and subsequent changes in the site should be referred to at the planning stage; if none exist, surveying may be needed, especially if there is doubt about the siting of the avenue or indeed, the spacing between the trees. Existing trees may be unreliable as markers if, for example, they are not the original trees and if they were not properly aligned with the avenue when they were planted. Stumps or depressions in the ground may help to plot the original layout. Knowledge of the geometry of the overall design will help establish the number of rows within the avenue and any possible changes in direction. The survey data focuses attention and helps to establish a management strategy, based on the existing, the original or a future function of the avenue.

Distances between individual trees and between rows were traditionally measured in feet and were often based on certain multiples, such as the 'Toise' (6 feet) or the 'Rod' (16feet 6inches)(Couch, 1992).

Actions Speak Loudest - Management Solutions

Land Use and Soil Conditions - Ground conditions may have altered over the years due to land-use changes (e.g. development), soil compaction or changes in drainage patterns. Indeed, such changes may have contributed to the present condition of the trees forming the avenue. Existing ground conditions around the trees may be improved by aerating the soil to relieve compaction, improving any impeded drainage or even excluding grazing animals from the immediate area. However, venture into applications of fertilizers only after foliar analysis has demonstrated a nutrient deficiency.

Remedial Tree Work - The survey and assessment of the avenue and its individual trees, should identify the minimum work necessary to ensure the continued well-being and safety of people and property. Likely options to meet safety and management objectives include:

³ It is important to be aware of the conservation status of many plants, animals and habitats and of the legislation in place to protect them. Protection of many individual species and habitats is enshrined in the Wildlife and Countryside Act 1981 (Amended 1985) and Countryside and Rights of Way Act, 2000. Bats for example, are protected by the Acts but also by the Conservation Regulations 1994, which together make it illegal to deliberately disturb bats or to damage, destroy or obstruct access to bat roosts. EC Directives, such as *Wild Birds* 79/409, offer European-wide protection to various bird species and more recently, UK Biodiversity Action Plans (UKBAPs) have been developed to protect this country's most rapidly declining or threatened species and habitats. Red List species (rare and endangered plants and animals) have recently been revised to set Britain's flora and fauna in an international context so that Global Red Lists, as well as national lists now exist.

⁴ Note other features that may influence new planting, e.g. drives, services, streetlights, windows etc.



Plate 1. *A walk between colonnades of mature Lime trees.*



Plate 2. *An avenue of maturing trees not yet fulfilling the design objectives.*



Plate 3. *The remnants of a Lime avenue which continues to focus attention.*



Plate 4. *A skyline avenue that is showing early signs of disintegration.*

- Undertaking any work necessary to improve the useful safe life of the trees. For example, the removal of damaged, dead or diseased branches, crown thinning, crown lifting or selective crown reduction to allow light to reach younger trees. All work to the trees should be in accordance with British Standard 3998 *Recommendations for Tree Work*.
- Re-pollarding the trees (Plate 8). Initially, this can be visually unattractive, although such management can dramatically extend the useful life of some tree species and enable the historic and genetic integrity of individual trees to be maintained. Pollarding may help redefine the avenue as a landscape feature by creating a uniform height and making new adjacent planting possible by allowing more light through the canopy. Some tree species (E.g. beech and many conifers), regardless of previous pollarding, may not survive such a severe reduction of their crowns. Before commencing work, the process of pollarding should be studied and the likely response of different tree species and, as far as practical, individual trees to such management should be appreciated (see Lonsdale, 1995, Read, 1991 & Read et. al. 1991). It should also be borne in mind that pollarding is a management regime which requires a commitment to being repeated regularly.
- Pollarding can also give a means of conserving the important wildlife habitat provided, by veteran trees.
- Where a non-intervention strategy is adopted it may be sufficient to fence the avenue to exclude the public.

Replanting - Replanting should be planned to address short, mid and long-term objectives.

- Short-term objectives may be fulfilled by piecemeal replanting, to replace individual trees as they fail (Plate 5). This would result in an uneven-aged avenue where younger trees have to compete with established neighbours for light, moisture and nutrients. In order to fill gaps successfully, the original trees will need regular pruning to maintain enough direct overhead light to the young trees to ensure their continued upward growth. Such a provision would involve significant cost, perhaps every five years.
- Phased replanting may be an attractive option where clear felling is unacceptable but where regeneration of the whole avenue is desired. The exact method selected would depend on how many rows of trees there are in the avenue, the species, their condition and spacing, and their aesthetic qualities. In a multi-row avenue, one option might be to fell all but one row either side of the avenue and plant inside or outside of these, although

this may alter the character of the avenue.

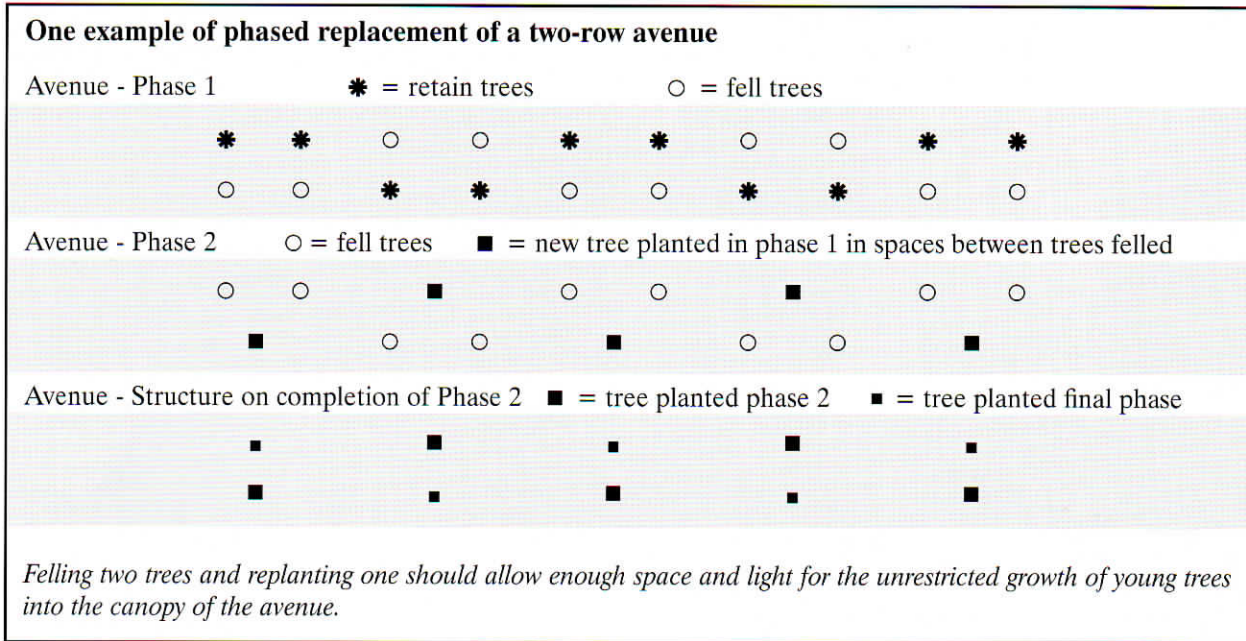
Whether planting inside or outside the avenue care will be needed to ensure that the new trees are away from the branches, and future growth of the retained trees.

If the avenue focuses on a building or other object where scale and siting are important, the planting could be with a short-life expectancy, fast-growing species. This would create an interim avenue to allow time for the remaining rows of the original avenue to be felled and replanted with a long-lived species. The fast-growing trees should be felled as soon as the long-lived trees are well established, and further planting should be done to reinstate a multi-row feature. There are disadvantages associated with such a method; depending on the available space, the quick-growing replacement plantings may 'lean away' from the older trees, particularly on the south side of the avenue.

With such a long-term scheme it is essential that there is an agreed detailed management plan documenting the work needed. Failure to have such a document can result in timely work being overlooked and also perceptions change with time and public resistance to removal of trees may have to be overcome. For example the Coleshill by-pass, Warwickshire, was planted in the 1950s using six rows of Poplar with the primary objective of producing timber. By the 1980s, when concern was rising that the trees were becoming a threat to the users of the by-pass, the local residents saw the avenue as an amenity feature and did not want the trees felled. This may have been eased if the long term objectives had been clearly stated and placed in the public domain.

- Total replanting following felling all of the trees may be justified where an avenue is so damaged that it no longer forms a cohesive unit or where no other option can be considered because of susceptibility to disease, for example. Such an option could be considered if the avenue is significant enough today to justify its recreation. Although a somewhat controversial management option, the destruction of the visual effect should be relatively short-lived and justified if the original design can be revived and sustained over the long-term. However, if the trees to be felled coppice readily, it may be desirable to retain the basal sprouts to define space until the new trees are established.
- If an objective of the avenue is to form a skyline feature, one row of the avenue could be felled and replanted without any loss of distant visual amenity, leaving adjacent rows to be replaced once the first row has become established. Any decision regarding which row to fell (i.e. leeward or windward) must be made after surveying the trees, inspecting the site and undertaking a risk assessment.

Figure 1. An example of thinning an avenue to allow replanting.



Thinning - In some cases it may be possible simply to rejuvenate the avenue by removing trees at regular intervals along the length of the avenue and planting in the resultant gaps. To be successful this must create space for further crown development of the retained trees while opening up sufficiently large gaps to allow new trees to become established, with confidence that they should not become overtopped and shaded. This may involve removing two adjacent trees and replanting one tree in the gap (see figure 1)

While such an approach may be seen as compromising the uniformity of the avenue the actual may not be significant. This is because mature trees can differ in age by as much as 20 years without actually looking like two age classes.

Making it Work

With avenues of historic or focal significance, the exact position occupied by each tree to be felled should first be recorded to ensure that the original spacing between the trees and the general alignment of the rows remain unaltered.

As individual trees are felled, the stumps should be removed to reduce the risk of disease (e.g. Honey fungus - *Armillaria* species). Chipping tree stumps will break up the mass of the root system, destroy the bulk (but not all) of the major roots and reduce the risk of future infection of the old trees. Wood chips by virtue of their size, are a poor food base for Honey fungus and do not necessarily have to be removed to restrict the spread of the disease, although any significant pieces of root revealed by subsequent cultivation of the soil should be removed from site. However, newly planted trees are vulnerable to

infection by pathogens, such as Honey fungus, until they become established and this may justify thorough removal of all traces of the previous tree before replanting. Also woodchips, if not thoroughly composted before they are used, will initially tie-up nitrogen and may be detrimental to the new tree (Webber and Gee 1996).

Ideally, therefore, woodchips produced by chipping stumps should be removed prior to replanting.

What Species?

In the late seventeenth and eighteenth centuries, fast growing lime, particularly clones of the common lime *Tilia x europaea* (syn. *T. x vulgaris*)⁵ imported from the Netherlands, were widely used to create avenues (Crane 2001). Trees which have also traditionally been used in avenues include: Elm (*Ulmus* spp.) (e.g. Blenheim, see Greig, 1981), Horse chestnut (*Aesculus hippocastanum*), Beech (*Fagus sylvatica*), Sweet chestnut (*Castanea sativa*) and Oak (*Quercus* spp.). Popular avenue trees planted in the twentieth century include London plane (*Platanus x hispanica*) (e.g. The Mall in London), poplars (*Populus* spp.) (e.g. The Parkway in Milton Keynes; Coleshill, West Midlands) and many conifer species, including monkey puzzle (*Araucaria araucana*) (Bicton College in Devon). In effect, any species can be used to create an avenue so long as it is suited to the site conditions and available space. The ultimate spread of the trees (see table 2) should be taken into account when specifying planting distances (see Gruffydd, 1987).

⁵ Tree nomenclature follows Coombes, A. J. (1992) *Trees*. Eyewitness Handbooks, Dorling Kindersley, London.



Plate 5. *Piecemeal regeneration of a Lime avenue, the young crown is becoming distorted.*



Plate 6. *A narrow driveway of very closely spaced Sycamores.*



Plate 7. *A very wide avenue focusing attention on a gate house*



Plate 8. *A closely planted Poplar avenue managed by pollarding.*

Table 2 Suggested minimum final distances between trees.

Species		Spacing (m)
<i>Aesculus hippocastanum</i>	Horse chestnut	10 - 15
<i>Araucaria araucana</i>	Monkey puzzle	5 - 7
<i>Castanea sativa</i>	Sweet chestnut	10 - 15
<i>Cedrus</i> species	Cedars	10 - 15
<i>Fagus sylvatica</i>	Beech	10 - 15
<i>Platanus x hispanica</i>	London plane	10 - 15
<i>Populus</i> species	Poplar	10 - 15
<i>Prunus padus</i>	Bird cherry	7 - 10
<i>Prunus avium</i>	Gean	
<i>Quercus robur</i>	English oak	10 - 15
<i>Quercus petraea</i>	Sessile oak	
<i>Tilia x europaea</i>	Common lime	7 - 10
<i>Tilia platyphyllos</i>	Broad-leaved lime	
<i>Tilia cordata</i>	Small-leaved lime	

The existing trees within an avenue may not be the species originally planted; if historical integrity is deemed essential there could be need for research to determine the composition of the original avenue and to source the desired young trees.

Any decision regarding species choice for the new planting will be influenced not only by existing site constraints but any known future constraints (e.g. land development) as well as the objectives of the design.

The source of new planting stock should be decided early in the planning stages, allowing enough time to organise a contract with a commercial nursery to produce the trees. This should ensure that sufficient numbers and quality of a single species or cultivar will be available.

Time and resources allowing, plants can be raised from the existing avenue stock for the historic integrity of the trees to be continued. Indeed, propagation by layering or from suckers may be the only known source of some traditional cultivars, such as the historic clones of Common lime. If the objective remains to continue planting *Tilia* species in an avenue whilst avoiding the suckering nature of the Common lime (*T. x europaea*), the Broad-leaved lime (*T. platyphyllos*) or Small-leaved lime (*T. cordata*) or their cultivars should be considered.

Where the crown form and rate of growth of trees are considered important objectives within a formal

avenue and if the species or cultivar is being changed the ultimate branch spread, and therefore spacing at planting should be decided. Genetically identical stock produced from cuttings will be the only reliable method of propagation - trees from seed origin and grafted trees can be expected to exhibit variation in growth and habit.

Care may be needed if a species or variety change is planned. For example, recently introduced cultivars of traditionally planted species, such as *T. x europaea* 'Konigslinde', are readily available from commercial nurseries but they retain the suckering bole associated with this species. Similarly the use of grafted plants may create a maintenance problem if the root stock produces sucker shoots that have to be routinely removed.

Site Preparation - get the soil conditions right!

Once a tree has been planted, improvement of the soil's physical conditions is very difficult, if not impossible and is therefore rarely done. Before planting, whether a single tree or whole avenue, improve drainage and relieve compaction over as large an area as possible by breaking up the soil (e.g. by ripping) to a depth of at least 0.5m - check for services and drains before commencing. If necessary, the soil in the planting pit should be amended prior

to planting. Organic manure, such as well rotted farmyard manure, spent mushroom compost and digested sewage sludge, which are commonly available, provide both organic matter and slow release of nutrients, aiding initial survival and early growth. In moisture-retentive soils such as amendments, which may lead to increased wetness in the soil favouring attacks by the soil borne pathogens known as *Phytophthora*, should not be used (see Strouts, 1981).

What Size of Stock Trees?

The decision regarding the size of trees to plant may be dictated by adjacent land use, the management objectives of the avenue and available budget. If an avenue is to be clear felled and replanted, larger stock such as standards (bare-root, root-balled or containerised) may be desirable to create an instant effect, for example if the avenue is a prominent landscape feature. However, if the new trees can be allowed to develop for some years before the original trees are removed or if instant impact is not important (such as in a rural setting), smaller stock such as whips would be adequate (see British Standards Institution 1992) and would dramatically reduce planting costs. The use of smaller sizes of planting stock also tends to reduce plant losses as a larger proportion of the root system is lifted with the plant, thus maximising root to shoot ratio, leading to less moisture stress and rapid growth after planting (Hodge, 1991). All sizes of planting stock need thorough aftercare if they are to survive (see below).

Trees must also be protected from browsing animals (e.g. tree shelters or traditional wooden 'crates' for larger trees), the design must reflect the risk and the length of time the trees are expected to be at risk (Pepper, Rowe & Tee, 1985). Any tree losses should be replaced at the earliest possible stage to ensure that the avenue develops in an even and uniform manner, although once the trees are mature, up to 20 years difference in age may be unnoticeable.

How Far Apart?

It is only as trees grow to maturity that the design objectives of an avenue start to be fully appreciated; a line of newly planted trees has little visual impact and some years must pass before they begin to coalesce as an avenue. To produce a quicker effect, there may be a temptation to plant trees too close together either within the lines or between them. Gruffydd (1987) gives guidance on spacing of different species (see table 2). Careful consideration must be given to the clear space that is needed to be able to achieve the desired effect. For example a view may call for 10+

metres between the branch tips, while framing an architectural feature or a statue may warrant only 2 or 3m. However, the equation is made more complicated by a need to consider also the heights that the trees will grow. Very tall trees too close together could become inhibiting and so render the avenue unsuccessful because people will not travel along it!

If spacing is wrong, failure to acknowledge the fact and thin the avenue will result in tall whippy trees that have a short safe useful life expectancy!

Timely Care

Weed control

Survival and growth of newly planted trees can be greatly enhanced by effective weed control, reducing competition for water and nutrients. To maximise growth, a weed-free area of at least 1m diameter should be maintained around each tree for a minimum of three years (Davies, 1987). Of the available methods, chemical control is the most cost-effective. Although other methods such as plastic sheet mulches can be as efficient in reducing weed competition they can on grassy sites increase the risk of vole damage to the trees (Davies and Pepper 1993).

Protection

There are few areas of Britain that can be regarded as free from mammals that could cause damage to young trees. It is essential, therefore, to assess regularly the threats that exist and then ensure the protection afforded to the trees is appropriate and effective. Timely repairs and amendments can ensure that the avenue is not disfigured before the trees reach maturity.

Pruning

Formative pruning of young trees is important where branch free trunks of an equal length on each tree are desired for example to allow a view out of the avenue, or to allow sight of the trunks. A single leading shoot must be encouraged to achieve crown uniformity and to avoid structural defects that could fail, leading to disfigurement of the avenue. The smaller the branches, thus the younger when they are removed, the smaller the entry site of potential pathogens, thus minimising the likelihood of dieback and decay in the future. Such early pruning should also help to reduce the threat the maturing trees pose to people and property.

Trees planted into the gaps of an avenue created by tree deaths or felling need direct overhead light and space to develop if they are to have a long useful life. Vigilance is essential to ensure that the existing trees receive regular attention (pruning or felling) to prevent growth of their branches closing canopy and suppressing or deforming the growth of the younger trees. *New trees within or adjacent to existing avenues need to develop without restrictions to their growing environment.*

The Critical Points

- A proactive approach to the management of an avenue is essential to secure its landscape value over the long-term.
- Establishing management objectives for the site will provide an opportunity to assess the situation and to decide if the restoration, or indeed, the new planting of an avenue is necessary, practical and makes economic sense.
- In order to achieve the successful regeneration of an avenue, there must be a management plan based on a realistic timescale designed and programmed to fulfill the management objectives particularly during the formative years of the avenue.
- Once established, avenue trees should require little attention or management for many years.
- Avenues have the potential to develop into spectacular, long-lived, multi functional landscape features. To ensure that trees fulfill their potential, careful consideration should be given to objectives, design, plant selection and adoption of sound cultural practices.
- There must be a detailed written management plan so that future managers have guidance on what is to be done and when if success is to be achieved.

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