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# Trees and Light; Arboriculture emerging from the shadows!

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# Trees and Light; Arboriculture emerging from the shadows!

To the layman, daylight, sunlight, sunshine, skylight and solar radiation sound similar but when applied to trees and the impact they have on people near them, it is not quite that simple. Understanding the differences can have profound implications on the ability of arboriculturists to strike a reasonable balance between retaining the maximum number of trees with the minimum of inconvenience. And yet, how many times are these decisions based on scientific analysis rather than biased guesses driven by personal agendas? Sadly, the answer is almost never! Continuing his theme of best practice in arboriculture, Jeremy Barrell, explores the reasons why this is, explaining how arboriculturists can illuminate the myths and banish the old wives' tales to the shadows where they belong!

In the wider landscape context, the bigger the tree the better it is for visual amenity so big is definitely good. In hotter climates the benefit from their shade is highly valued, which translates into a presumption to retain them wherever possible. In stark contrast, sunshine in the UK is generally in short supply and the national psyche has a distinct focus on getting as much of it as possible. In this context, big trees are not quite so good because they block out sunlight and conflict with our desire to get more of it. For people living close to trees, they are often seen as an inconvenience rather than a benefit, which is a subtle but powerful engine for getting rid of them.

There is no real dispute that trees provide many benefits. This is well recognised in primary legislation and extensive government guidance where there is a clear presumption that trees should be kept unless there are good reasons to remove them. Justifiable reasons for removal include high hazard, poor health, excessive inconvenience and causing damage, amongst others. In this context, establishing the point where the wider amenity benefit to the community unreasonably compromises the enjoyment of the individual is very important. This is a Human Rights issue and councils will be held accountable if they cannot demonstrate they have properly weighted that balancing act. Loss of light is a well recognised tree/people conflict, commonly cited as justification for refusing planning consent or wanting to remove protected trees (see 'Myths' insert). Clearly, pinpointing that threshold of acceptability is an arboricultural decision that can have a significant impact on us as individuals and the trees that grace our surroundings.

**City foresters in Plantation, Florida, advise on tree retention at this new supermarket site at the developer's request! Trees are considered so valuable for the shade that they offer in parking lots that developers will go to extraordinary lengths to secure their retention. This tree has been root pruned the previous season, moved, supported, has its own custom irrigation and is being fenced for the duration of the construction activity.**

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In our work as consultants, we come across this issue on a daily basis and yet there is no consistent or coherent guidance from our Profession on how light and trees should be approached. Shading is often used as a tree reason for refusing a planning proposal and yet it is rarely backed up by any objective analysis if challenged at appeal. Similarly, the same subjective approach is invariably used by councils to refute TPO applications to fell trees because of shading (see 'Myths' insert). Guesswork and hearsay are the norm and any form of objective analysis is extremely unusual. This concerned us so much that several years ago we set out to find out if there was a more objective approach that could be applied to trees. The rest of this article summarises the guidance we have found most useful in making better informed judgements on this rather tricky issue. It is obviously our own view but it is based on extensive interaction with the Building Research Establishment (BRE) who publish the most relevant daylight guidance. We stress that our intention is to set out a framework for approaching the issue rather than the detail of how to carry out the inevitable calculations. It is more an overview as a starting point in the absence of any comprehensive arboricultural guidance rather than a comprehensive reference.

On closer inspection of the technical guidance, it is quite obvious why the arboricultural focus has been on the subjective approach rather than objective analysis. There are a number of different methods of analysing specific aspects, which are all complicated with unfamiliar concepts and jargon. In wading through all this technobilia, two documents emerged above the rest as the most relevant in terms of empowerment, i.e. they would be recognised in the UK planning and legal system as the primary references for guidance. The first is BS 8206 *Lighting for buildings Part 2 Code of practice for daylighting* (1992), which focuses on daylighting within buildings. From this flows the second by direct reference, which is BRE Report 209 *Site layout planning for daylight and sunlight - A guide to good practice* (2003 latest reprint). Whilst BS 8206 is useful for background information, BRE 209 specifically deals with light in the external environment and is the most relevant reference in relation to trees. It was approved by the DoE and has a semi-official status although not mandatory. Whilst there are other publications and courses offering varying approaches to the same issues, BRE 209 takes precedent by virtue of its status and would be deemed the primary reference in the event of any dispute.

**Trees with dense foliage provide valuable boundary screening but can also cast deep shade on buildings and garden amenity areas**

**The same trees preventing direct sunlight in the afternoon to the patio and balcony on the left. Sunpath calculations can establish the times of shading and objectively inform if the level of inconvenience is unreasonable.**

More specifically, BRE 209 provides "… advice on site layout planning to achieve good sunlighting and daylighting, within buildings and in the open spaces between them.". But it deals with solid buildings and the text has several references that cast doubt on whether it can be reasonably applied to trees. When questioned on this specific point, BRE has confirmed that it is appropriate to use its principles to assess the impact of trees on light to buildings and garden areas. Furthermore, a revision of the BS and BRE guidance is being considered that may include supplementary guidance relating to trees although no timescale is yet available. However, whilst these methods do provide numerical guidance, the BRE emphasis on flexible interpretation applies even more when trees are involved because they are so much more variable than the relatively uniform buildings it was originally

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designed for. As with most tree issues, the common sense caveat must be applied; light is just one consideration in a wider management picture; the BRE guidance is a starting point for interpretation and not an absolute recipe; and there will always be exceptions to the rule.

So can these methods be reasonably applied to trees and, more importantly, can they helpfully inform arboriculturists in practical tree management? As set out in the 'Myths' insert, there are two main scenarios where objective guidance on light would be useful; the new development situation where future occupants may suffer unreasonable inconvenience; and the TPO application situation where homeowners claim that existing trees are adversely affecting the enjoyment of their property. We have found three elements in the BRE guidance that are useful in assessing the impact of trees; the skylight indicator; the sunlight availability indicator; and the sunpath indicators. However, before discussing their application, there are several practical requirements that are common to them all.

Firstly, the guidance is plan based so an accurate site survey is useful showing the location of all the trees surrounding the reference point where the light assessment is required. The scale of the plan is not critical but it should be sufficient to interpret the appropriate detail, i.e. ideally between 1:100 and 1:200. Secondly, a site visit is needed to collect relevant information on each individual tree and other obstructions that may have an impact. For the trees, this must include species, an estimate of crown density and accurate measurements of the crown outline when viewed from the reference point. Once you have these details from site, the rest of the assessment moves to the office following the BRE guidance.

The first part of that desk exercise is to prepare a diagrammatic transparent direction finder based on a special BRE template, the site survey and the crown dimension measurements. This diagram is similar to the site survey and is based on it, but neatly sidetracks the problems of plan scale by using a distance over height ratio to identify the impact area. This impact area is highlighted by colour or hatching on the diagram, which provides a means of quantifying the impact of obstructions on light levels. This direction finder diagram will be the same for any scale of plan and can be used directly with other BRE templates for each assessment element.

BS 8206 sets out that the potential for a room to have good daylighting is directly related to the amount of skylight falling on a vertical building elevation, making this an obvious starting point. This measure is called the vertical sky component (VSC), which is expressed as a percentage with a threshold of 27%. If the VSC falls below this level, there is unlikely to be sufficient daylight; if it is above this level, there is the potential for acceptable light levels within the building. The VSC for any reference point on the building face can be calculated by superimposing the appropriate transparent direction finder diagram on to a skylight indicator template in BRE 209. This has a series of crosses scattered around the diagram area representing all the available skylight. The number of crosses outside the shaded area are added up and converted to a percentage to provide the VSC figure for the reference point.

In addition to skylight, another useful indicator of good daylighting is the sunlight availability to a building elevation. BRE 209 has sunlight availability indicators templates for its calculation using the same transparent direction finder diagram. As with the VSC calculation, the probable sunlight hours for a given reference point can be read as a percentage by superimposing the direction finder diagram on to the sunlight availability indicator and counting the number of points not obscured by the hatched area. BS 8206 recommends that "at least 25% of the annual probable sunlight hours be available at the reference point including at least 5% of probable sunlight hours in the winter months, between September 21 and March 21." It is a simple matter of counting where the template points are on the superimposed diagram to see if the daylighting complies with the BS guidance.

**BRE provide no figures for the transparency of conifers so photographs provide a useful means of estimating the percentage of light that the trees block out**

Both the above measures of daylight are based on solid buildings that are opaque so some

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interpretation is necessary when applying these principles to trees, which have variable crown densities. BRE address this point in principle in another publication, BRE Digest 350 (1990), where a method of adjustment for winter and summer crown densities for a number of deciduous species is set out. However, it does add a strong caution to the limitations of the published data and there are no figures for coniferous trees. BRE has confirmed that the principle of adjustment is appropriate but the final figure used is very much down to individual circumstances and interpretation by arboriculturists.

BRE 209 also makes provision for situations where there are already very poor levels of lighting but considers the impact that a change will have. In the guidance, this change is in the form of new development and the impact that has on light levels to existing properties. The principle it sets out is that if the VSC or the probable sunlight hours as a result of new development is less than 0.8 times its former value, the loss of light will be noticeable. In reverse, this principle can be applied to trees that already exist to assess whether the impact of their removal would be noticeable. If a calculation without the tree is less than 80% of the value with the tree, the change will be noticeable and the removal of the tree will have a significant impact. If the difference is quite small, i.e. there is less than a 20% reduction, the change will not be noticeable and the removal of the tree will not have a significant impact.

Moving away from the actual buildings to garden areas such as patios, it is often useful to know at what time of day a reference point will be in direct sunlight. Again, BRE 209 has a template for working this out by using the same transparent direction finder diagram. Superimposing the two allows the duration of sunlight at the reference point to be established at different times of the year. Gardens are not generally used much in the winter months so the spring and autumn dates give a reliable minimum during the main use period.

Whilst these methods have been developed in the context of buildings, it is pertinent to question whether they can reliably inform tree management decisions. Unlike static buildings, trees have immensely variable outlines and crown densities with the added complication of changing over time. Obviously, these variables have to be estimated and this limits the reliability that can be placed on the end figures. Our experience is that the objective nature of the methods is helpful in many situations provided the results are interpreted in context rather than in isolation. Where results show that light levels are excessively bad or good, it would be appropriate to rely on them without further analysis. However, where the results are close to the threshold and could go either way, less reliance should be placed on them and other relevant factors should inform the decision making process.

In a planning scenario, these calculations are useful for predicting if a layout will cause excessive inconvenience to future occupants; will retained trees cause a sufficient reduction in light so that future occupiers could justify their removal, even in the face of statutory protection? For a building, VSC and sunlight availability calculations will establish if light levels will be acceptable and help the council make their decision. The implications of results at both extremes are obvious but where the results are inconclusive, then consideration of the pruning options to improve light and further more conclusive calculations based on reduced tree size may be a solution. In the other direction, if trees have the potential to significantly increase in size and controlling growth by pruning would be inappropriate, calculations based on their mature size would be an effective way of establishing whether future light levels would be acceptable. Beyond the house, the sunpath calculations are more useful because of the way people use their gardens. Occupants would expect to use patios in the summer and have direct sunlight in the afternoon and evening. Shade in the morning or early afternoon would not be considered so inconvenient that it warranted the removal of trees providing other benefits.

Once properties are occupied, the reasonableness of past planning decisions is put to the test if occupants feel trees are adversely affecting their lives through shading. If offending trees have statutory protection, the council in the first place and the government if it goes to appeal, have to decide if the concerns are justified. Daylight calculations are very helpful in this scenario, especially if they are available at an early stage because a definitive answer can save lots of wasted effort and cost. Often, these tree/people conflicts arise through no particular fault of any party but still need to be resolved in an equitable way if councils are to comply with their Human Rights responsibilities. This is where the 0.8 rule discussed above can be particularly useful for councils to argue for the retention of trees that are important to the community but their removal would result in very little improvement to the light inconvenience suffered by the individual. If the benefit is less than a 20% improvement in light levels, then it is unlikely that the difference will be noticeable so the public benefit will probably outweigh the shading disbenefits.

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In all of these scenarios, there are invariably other benefits of trees to the wider community such as contribution to visual amenity that need to be balanced against the disbenefits they cause to individuals close to them. Decisions are rarely simple objective calculations that come out with a clear answer so daylight guidance should not be considered a substitute to common sense interpretation based on experience. In principle, this is great news for arboriculturists because it means they have an influential role with the expertise they bring to the process rather than it being a paper exercise that any other professional could do. In practice, the concepts are unfamiliar and involve multiple calculations, which can deter the less enthusiastic from using the guidance. However, for those who deal with light issues on a regular basis, BRE 209 is an opportunity to bring some science to the table and move the Profession on from the old wives' tales mentality that currently prevails.

## Myths and old wives' tales

There is no question that if trees are too close to people, they cause excessive shade, adversely affecting living conditions and quality of life. The difficulty arises in establishing how much is too much and how close is too close. In the absence of simple guidance, a culture of myths and old wives' tales has evolved where judgements are based on vague and woolly opinions rather than objective measurement. This is often a curse for those who have a genuine grievance and a gift horse for the articulate opportunist who can manipulate the uncertainty in favour of their own personal agendas. These injustices are a far cry from the ideal of sustainability that is touted as a cornerstone of our planning system.

Disappointingly, this mindset already becoming entrenched in our planning institutions. A frequently cited reason for councils refusing development is that there will be an adverse impact on trees through irresistible pressure to fell from future occupants. Sounds reasonable on the face of it but does it stand up to rigorous objective analysis? The answer is 'not even remotely' and yet time after time, councils are getting away with perpetuating this myth because it sounds good when challenged on the same subjective level. Even a cursory scan of TPO appeal decisions shows beyond any doubt that there is a clear presumption by the government to support councils at appeal in their efforts to retain trees. The emotive spectre of wholesale tree removal is not quite as real as they make out and yet it is being used as a means of reducing development densities by the back door. A short term victory for the tree lobby maybe but suboptimal use of space now has a future consequence of greenbelt encroachment that is contrary to the spirit of sustainable development. That is unjust and bad for us all in the end!

On the other side of the fence, unscrupulous homeowners have spotted that getting rid of trees can dramatically increase the redevelopment value of their plot. With little chance of an objective argument to challenge the lack of light approach, it has to be a good no-risk bet with a weak council. It ends up as homeowner opinion against council opinion, which is not a reliable basis for refuting spurious claims. Again, lack of precision and reliance on opinion is damaging the delivery of justice in all directions.

Of course, well established professions have tried and tested best practice protocols to reduce the negative impact of such opinion based judgements. However, despite BRE 209 offering that option, Arboriculture has not yet taken advantage of it, which gives some indication on just how far we have to go!

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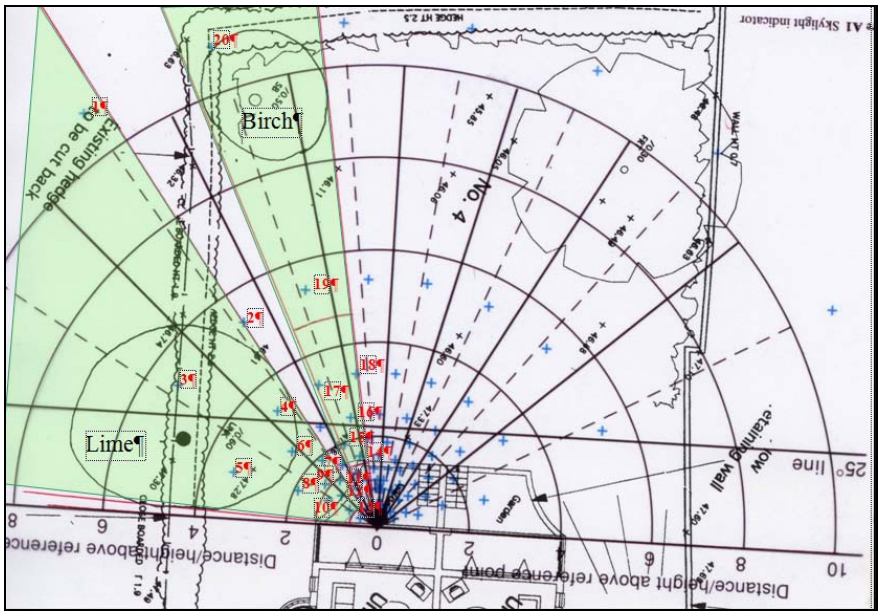
**The lime on the left and the birch on the right are the two trees on the composite diagrams used to illustrate the VSC and sunpath calculations**




**We find it helpful to illustrate the Vertical Sky Component (VSC) calculation by superimposing the transparent direction finder diagram and the site plan on to the BRE skylight indicator template. The site plan shows the location of the reference point on the proposed building and the outline of the trees - a birch and lime in this case. The green shading on the direction finder diagram indicates the extent of light reduction by each tree and the red numbers 1–20 count the number of blue crosses affected on the skylight indicator. This allows the VSC to be calculated with a crown transparency adjustment if appropriate.**

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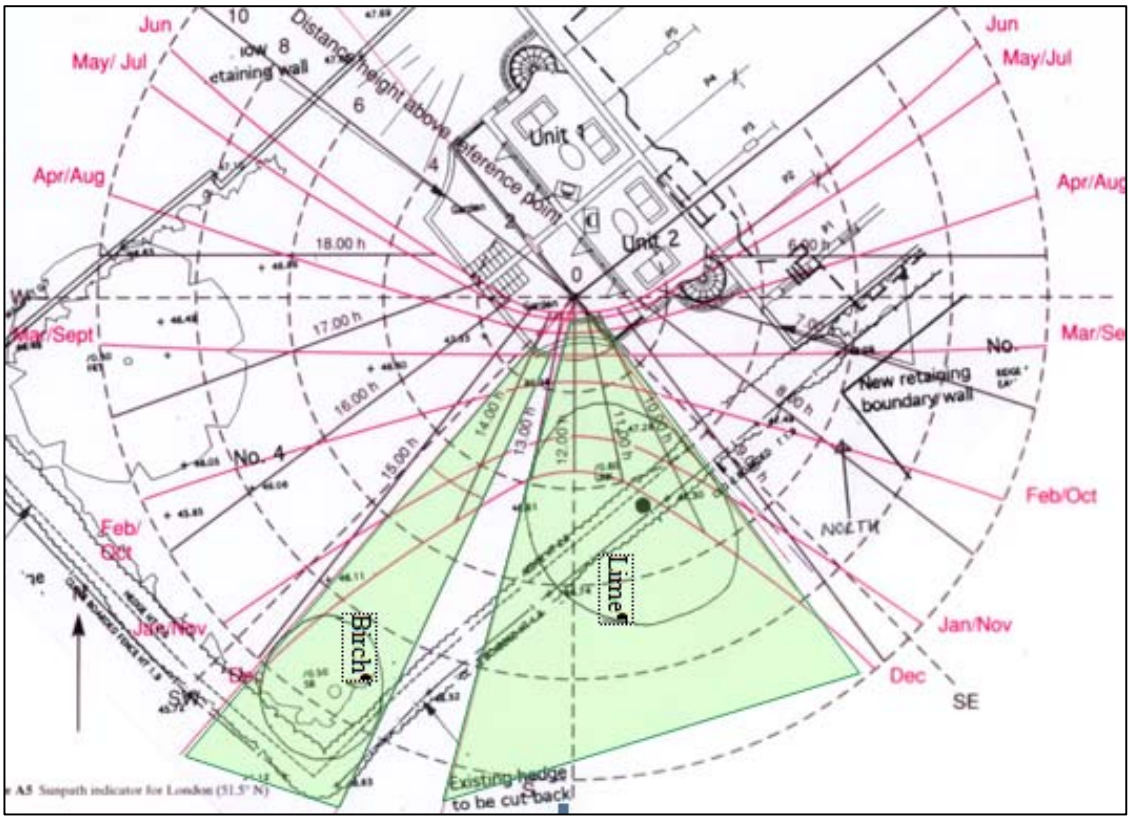


**The same transparent direction finder diagram can also be superimposed onto the sunpath indicator template to show at what time of the day the reference point will be in sunlight. Taking the March/September sunpath indicated in red, the reference point will be in direct sunlight from 1–1.30pm and again from 2.15pm to the end of the day.**