Tree Shadows: Part 1

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Introduction

If you are involved within the planning process then you may need to assess trees in relation to sunlight-shading when a proposal plans to place new houses close to trees. Such an assessment should always be included within an 'Arboricultural Implication Study' (AIS). Problems relating to the reduction of daylight & sunlight is one of the many reasons why trees located near houses are pruned. Home owners who have gardens expect a certain level of sunlight for recreation although no law specifically assures this. If the trees are protected with a 'Tree Preservation Order' (TPO) and are a cause of shade then the council may receive an application to prune or remove the trees. The council can refuse the request but may have their decision overturned upon appeal to the 'Secretary of State' (the Secretary of State will appoint an independent consultant to assess the situation). Subsequently, if the councils decision is overturned, the protected (important) trees may be lost. Consequently, it is in the councils interest to avoid such a set of circumstances from occurring by ensuring that any new development has considered existing trees within its plan.

- **Assessment**

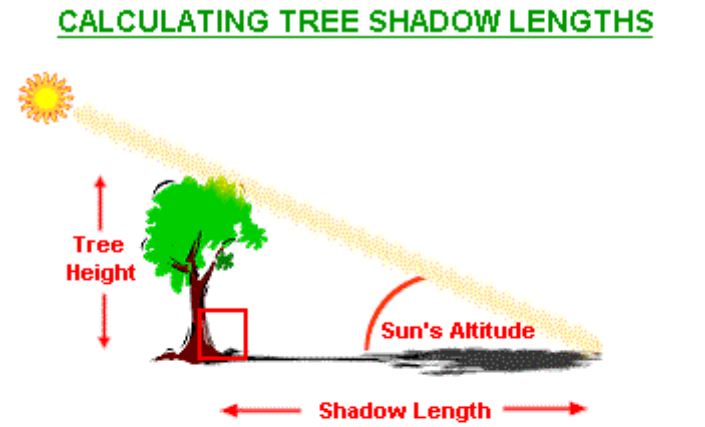
The arboriculturist needs to assess the impact of the tree shadow on the proposed development. To do this he/she needs to calculate the length of the tree shadow for a given hour, day, month and latitude. Once the shadow length is known, the distance can be plotted onto a site plan and an assessment made. It is likely several calculations will be needed for different times of day and for different months of the year.

Additionally, the crown width, habit, condition and density need to be incorporated into the assessment. Evergreen trees will produce shadow all year round. Allowance for future growth also needs to be considered so that small trees with the potential to increase their height and canopy spread are catered for.

- **Simple Calculation of Shadows**

Shadow length can be calculated quite simply using trigonometry. All that is needed is the trees height and the suns altitude (for a specific hour, day, month & latitude). The calculation assumes the tree is not leaning and is on perfectly level ground.

The following diagram illustrates the calculation using the tangent of the angle.



So for a tree of 20m height located in London, UK at midday (solar noon) on 21st June the suns altitude will be 62.15 degrees.

Shadow Length = 20 / Tan(62.15)

Shadow Length = 10.56m

Of course you need to know the suns altitude which isn't easy to calculate as it changes with time and latitude. The following equation will enable you to calculate it!

Sin (Altitude) = Sin(Dec) * Sin(Latitude) + Cos (Latitude) * Cos(Dec) * Cos(AV * T)

where:

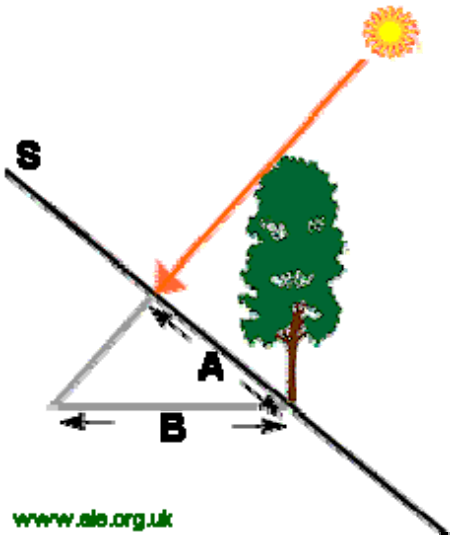
Dec = the suns declination for that day/month.

AV=Angular Velocity of the earth's rotation

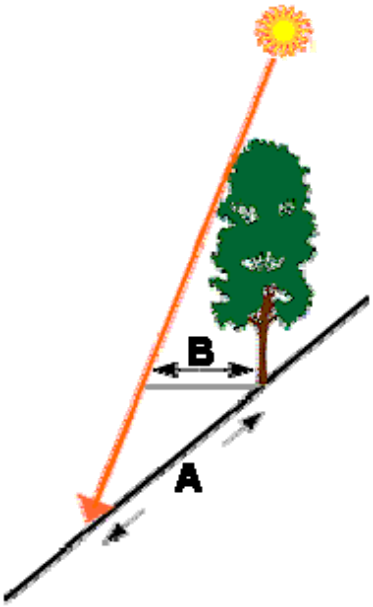
T= +/- Time displacement from solar noon.

- **Trees on Sloping Ground**

The shadow cast by a tree located on sloping ground will be longer or shorter than one cast by the same tree on level ground. The following picture illustrates the point where the tree located on slope **S** produces a shadow with a length of **A** from the sun. This distance is shorter than length **B**, which is the length of shadow cast by the tree, should it be standing on level ground.

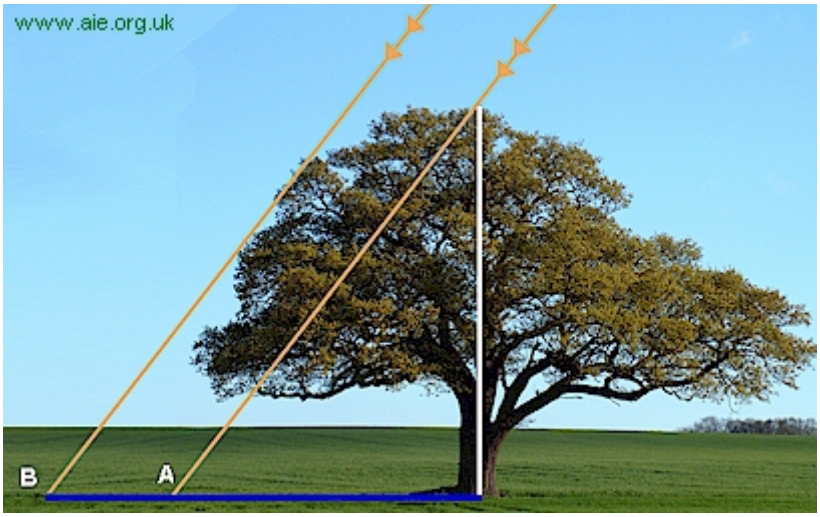


Looking at the situation with a slope in the opposite aspect (see following picture). This time the actual cast shadow of **A** is longer than length **B** (which is the length of shadow when standing on level ground).



- **The Influence of Tree Canopy**

An often overlooked point when calculating tree shadow lengths is the radial distance of the crown spread. The following picture illustrates the point; *the sun's rays are shown as orange lines with the trees centre represented by a white vertical line*. The shadow distance **A,** which is the calculated distance in relation to the trees height, is traditionally measured from the tree centre. However, as the picture shows, the shadow will obviously not be at this point, but will instead be at point **B**. Most tree shapes will increase a calculated shadow distance by some amount but those species with typically broad shapes such as Oak and Beech can increase the distance significantly by several meters.



Most calculation programs available don't take into consideration the upper crown shape when calculating shadow lengths (except for Arbor-Shadow of course)!