



Tree valuation

Trunk formula: method or myth?

Julian A. Morris

This article is for the benefit of anyone who carries out, uses or procures tree valuations. It is also intended as a less formal discussion of some of the ongoing issues in the peer review of the CAVAT article, published in the *Arboricultural Journal* in 2018.¹

How many tree people involved in tree valuation stop to think what 'valuation' really means?

Valuation in its purest sense is the imitation of markets. It should reflect how much something cost or could be sold for or is contributing financially to a particular purpose. The term 'value' as used to describe concepts such as 'usefulness', 'amenity' and other social benefits has no universally understood meaning or basis of quantification and cannot be used in financial statements or interchangeably with valuation-derived figures.

Tree valuation should be no different. The method chosen should be defined in terms of its purpose and, if it is to have any meaning alongside valuations of other property, it should imitate markets. It is the responsibility of the valuer to be satisfied that their selected valuation method is appropriate to the task in hand. Using formulae can be a useful part of valuation as long as they are appropriate. The tree valuer must therefore understand

the limitations of any formulaic method and be able to substantiate to the client or employer (or court) that it is fit-for-purpose.

The trunk formula 'technique', used by the Council of Tree and Landscape Appraisers (CTLA) and the Capital Asset Valuation of Amenity Trees 'method' (CAVAT), are similar tools used in tree valuation to estimate the replacement cost of an actual tree by analysing nursery-gate costs for small trees and proportionally increasing them to infer the cost of a larger tree that is being valued. The bigger the valuation tree, the more it would cost to buy a replacement of the same size. So far, so good.

But why do we do this? The reason is that there is a dearth of market evidence as to the difference a tree makes to the value of a property, and so we must assume that if someone is willing to pay so much for something it must add at least that much to the value of the property. Put another way, *'The cost approach is based on the economic*

*principle that a purchaser will pay no more for an asset than the cost to obtain one of equal utility whether by purchase or construction.*² This is known as the Replacement Cost Method and is widely used for non-market properties, typically those created for use in the public sector; it supposes that cost equals worth, equals value.

Instead of analysing sales transactions for evidence of value, the valuer instead can analyse actual tendered construction costs for real-world projects. These are market evidence. The build-cost rates can then be applied to valuation assets of any similar size. One could say that they reflect how much money the organisation has sunk into its assets. One might at a stretch say that if the asset could be transferred to another non-commercial organisation for the same use it could form the basis of a sale value. Still not a market value, but rooted in market costs and the cost-equals-value principle, and so better than nothing.

The Trunk Formula Method/technique (TFM) is a specialist version of the Replacement Cost Method. Using the Replacement Cost Method, the TFM thus assumes that if a small tree can be bought for £T, a tree twice the size if it was for sale would cost, and therefore be worth, £2xT.

Both CAVAT and CTLA then go on to apply the property valuation principle of

Depreciated Replacement Cost (DRC), which is the modification of Replacement Cost by reducing it to reflect the extent to which the asset is used up, obsolete or damaged, or in some other way less valuable than a perfect replacement. However, no more mention of this is made in this article, as we are concerned for now only with Replacement Cost.

In most senses trees must be considered heritable assets, and be valued like any other heritable asset. At least, that is, when they get too big to be realistically moveable without damage.

A Depreciated Replacement Cost valuation has the following core elements:

$$\text{DRC} = [(\text{Unit cost} \times \text{size of asset}) \times \text{depreciation (\%)}] + \text{land value}$$

Note that the land value has to be added, as it is essential to any heritable asset, and it does not ever depreciate in value.

The cost of a tree from a nursery reflects the work that has gone into germinating, potting, pruning, transplanting, nurturing and preparing it, and includes an element of the cost of the land on which it was grown, plus profit and reward for expertise.

Here's where it starts to get awkward. When a nursery sells a tree it does not sell the land it was grown on. The buyer has to use his own land to keep the tree alive. While we might say that the nursery-gate cost (=value) reflects the nursery's production costs, conversely when the owner plants the tree out in its final position and gets it established there are no further production costs. The only cost, other than occasional tree maintenance, is the present and future use of the buyer's land.

There is no further propagation, potting-up, transplanting or nursery profit. It follows that scaling up the nursery-gate cost has no financial relationship to the cost of increasing the tree's size after planting out.

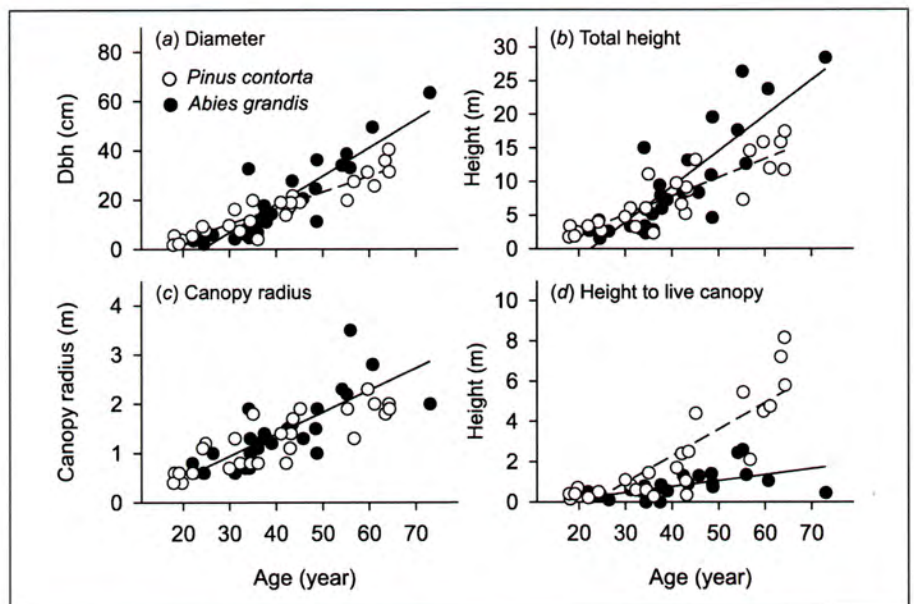
A scaled-up cost reflects neither the post-planting costs of production (and therefore the money spent on it by the owner) nor the saleable price (since it cannot be moved in the way that a nursery tree can).

So can the TFM be used reliably at all as a measure of value? It is necessary to look at the 'formula', which is not at all complicated. Both CTLA and CAVAT take the same initial approach. The cross-sectional stem area of the nursery tree is divided by the nursery gate cost to give a rate per area. This is then multiplied by the cross-sectional area of the replacement tree or tree to be valued, giving a hypothetical cost for it. The method assumes that this equals value. But as has been seen, this last assumption cannot be true, since increases in size beyond nursery sizes do not involve nursery production costs.

The difficulty does not stop there. Even if nursery cost rates were applicable, in valuation there is the fundamental problem that one cannot reliably apply the build-cost rate for a



An unmodified trunk formula method is like inferring the value of a hotel from the cost of a caravan.



An example of a study showing the actual size and age relationships for two tree species.³

small item to the size of a very large item, if there is no evidence of costs or even projects at a much larger size. Like comparing a caravan with a hotel, it is an unsound proposition.

There is a further complication. Does stem size reflect tree size? In other words, can stem measurement (girth or diameter) be used to express a tree's utility? Many published studies have tried to relate real-world tree sizes to stem sizes by a variety

of statistical analysis-derived formulae.³

For maturing trees there may be an approximately linear relationship between stem cross-sectional area and biomass, and between stem diameter and crown diameter, but increases in tree height slow as the tree reaches maturity, and height eventually reduces. There is not, however, one formula that relates all size aspects to stem cross-sectional area, and the relationship is likely

to be a complex one over time that varies from species to species and climate to climate. Particularly as trees get bigger, stem diameter does not correspond with height, crown spread, leaf area or biomass.

So what does stem diameter reflect, apart from perhaps timber volume? What do current tree valuation methods do with it?

- **The Helliwell system** makes no attempt to use stem size, but in a very straightforward representation of the quantity of amenity of a tree, it derives base value from the size of the area of the vertical profile of the tree in the landscape. The value is then calculated by applying the appropriate size category to a centrally-generated £ per points figure.
- **CTLA** in previous editions limited the valuation of large trees by using a quadratic equation, but has recently abandoned that in favour of offering alternative approaches for larger trees. One approach is to take the cost of the original small tree and scale it up as if the money had been invested in an interest-bearing account for the relevant age in years of the tree (the Cost Compounding Technique). Another is to apply instead evidence from sales-based studies (of which there have been many in the USA⁴) that suggest the percentage that trees typically add to property values. In the end, CTLA cautions that appraisers (i.e. valuers) should embrace the principle of the 'Reasonable and Credible Appraisal', i.e. the trunk formula value should not be considered market value unless it is tied to the market value of the real estate of which it is part.
- **CAVAT** applies no limit and keeps scaling up the small tree cost to trees of any size, despite the evidence

that this does not imitate production costs, money invested, sales prices achievable (for trees without the land they stand on) or any linear relationship between stem area and tree size.

The CTLA Reasonable and Credible sentiment is echoed by the Royal Institution of Chartered Surveyors;⁵ after examining the case law where full hypothetical replacement costs for removed trees were rejected, it advises valuers that *'At the very least, these judicial comments seem to indicate that the test of reasonableness requires the valuer to "stand back" and have regard to the value of trees in the context of the value of the property as a whole, as well as to the likely actions and motivations of real owners. This may be especially relevant where trees are being assessed for compensation purposes.'*

The conclusion is that the Trunk Formula Method can be useful and relevant in valuing trees that are a little larger than those that can readily be bought from nurseries, but that the reliability of comparable cost evidence and the rationale for using the formula break down irreconcilably for bigger trees. In such cases calculation methods need to be tempered with, or replaced by, other methods, including a reality-check against the value of the whole property. Formulae alone cannot do this, since calculation is not valuation unless it imitates markets and/or reflects the scale of benefits.

Clearly, beyond semi-maturity the scaling up of a tree's nursery-gate cost does not reflect expenditure on the tree asset, the benefits it provides or its possible sale price, and is therefore not valuation.

Footnote: It can readily be seen that in most cases the correct valuation approach may be to use the Cost Compounding Technique figure added to the cumulative annual value of the planting land for

the relevant number of years. This approach would reflect the actual financial investment in the asset.



Julian A. Morris is a tree consultant based in Cambuslang, Glasgow.

References

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- My thanks to Dr Jon Heuch and Colin Price for their input into the peer review of CAVAT and their helpful comments during the drafting of this article.*



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