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## Treeconomics: How to put a fair price tag on urban forests

We can now calculate the exact value of a tree, from shade to beauty. Doing so could be the best way to protect them – and plan the forests of the future



Andrius Aleksandravicius /EyeEm/Getty

By **Simon Usborne**

THE Broad Walk is one of London's leafiest avenues, stretching between two corners of Hyde Park. On a cold but sunny spring day, it is a welcome escape from Park Lane's noisy traffic, luxury hotels and car showrooms.

I'm taking a walk with Ian Rodger, who manages trees for the city's Royal Parks. "These were planted in about 1860," says Rodger, gazing up at the giant London planes on either side of the path. Their canopies spread out high above him and fuzzy fruits fall occasionally from clusters in the branches.

The Victorians planted thousands of these trees because they thrive in any soil and their flaking bark and glossy leaves made them impervious to the soot and smoke of the industrial revolution. But as we have learned to our cost, their roots can spread widely, disrupting roads, pavements and buildings. "What the Victorians didn't know was how bloody big they get," says Rodger.



It's not just disputes between councils and residents where the value of trees is important to know. Imagine a situation where a builder damages a tree during construction and is pursued in court for damages. Or where a tree falls and the owner wants to make an insurance claim.

It was situations like these that set Chris Neilan trying to value the benefit of trees more accurately. He began his career as a tree surgeon in the 1970s. Back then, councils counted the number of trees they planted, but not the number that survived long term. Neilan and his colleagues knew that most of the saplings died, often from under-watering or damage from mowers and strimmers. "There was a joke at the time," he says, "plant a tree in 73; plant some more in 74."



**Chainsaw massacre: some 17,500 trees could be felled in Sheffield**

JasonBatterham/Getty

When he started working for Epping Forest District Council just outside London in the late 1980s, Neilan was called to give evidence in a court case involving a young oak that a developer had failed to protect in front of a row of new houses. That entailed giving the oak a value.

He could have used an existing method developed by a British forester named Rodney Helliwell, which focused on a tree's aesthetic contribution to a landscape. This typically generated values and thus fines in the hundreds of pounds. Neilan thought that seemed too low.

**Read more:** [The world's tallest tree costs more than a private island](#)

He began developing a new method, which attempted to capture trees' worth as an amenity, taking into account their attractiveness and how they accentuate or diminish a sense of place.

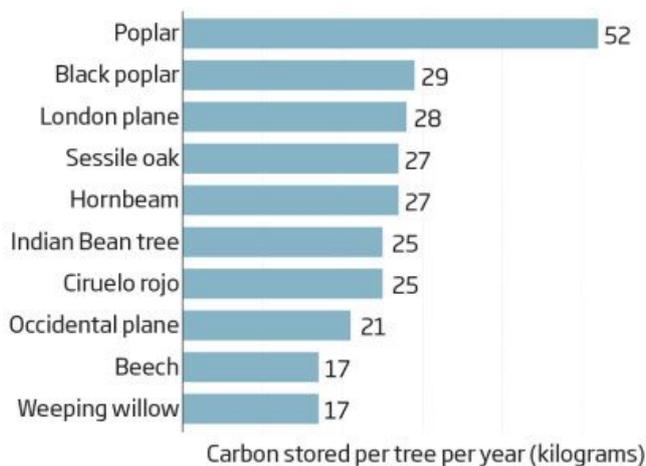
Now called Capital Asset Value for Amenity Trees (CAVAT), it starts by multiplying the cross-sectional area of the tree's trunk by a unit price – currently £15.88 – that relates closely to what the tree costs to buy, and which goes up with inflation. This gives a basic value based on its size, which is then augmented in several steps that take into account the tree's species, visibility to the public, local population levels, the size and condition of the leaf canopy, the suitability of the species for its site and the tree's life expectancy. "When I described the tree's true value, the developer was fined exactly that sum – which was about £12,000," says Neilan.

But scientists have long known that trees have far more to offer us than pleasant feelings. Around the turn of the century, organisations like the World Bank and the UN Environment Programme pushed for a rigorous valuation of the merits not just of trees, but of rocks, rivers, soils and sediments too. The result was the landmark Millennium Ecosystem Assessment of 2005, which put a price on the services humans gain from nature, ranging from direct benefits like food and water to supporting services like the pollination of crops by insects and the absorption of carbon dioxide by plants.

Some say nature is priceless; that valuing it in financial terms ties it to an economic system that has only threatened it. Yet incentivising conservation with cash can work. In 1997, Costa Rica began a scheme that paid landowners to preserve forests rather than clear them to make way for profitable crops. The amount they received was based on the value of the services provided by the forests. This seemed to aid conservation: from around 1980, the country's forest cover was either in decline or stable, but between 2000 and 2005 it increased by about 2 per cent.

## Carbon suckers

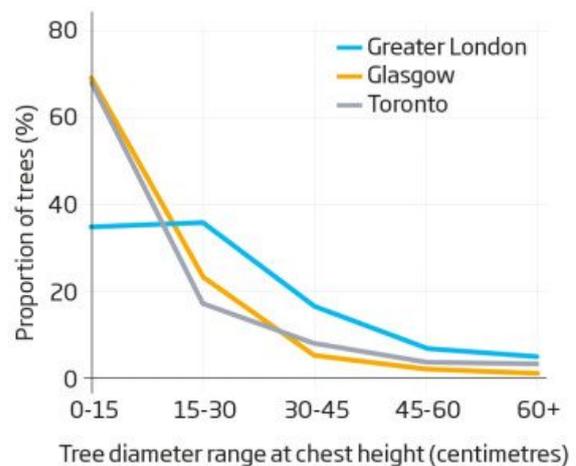
Valuing urban forests can help us plan for the future. One value of trees is their ability to store carbon, which makes them useful for fighting climate change. In London, poplars store the most, suggesting planting more could maximise this benefit



SOURCE: VALUING LONDON'S URBAN FOREST

## Big up the trees

The biggest trees provide us with the most benefits, from shade to absorbing pollution. But cities have few of these giants. Increasing their number could boost our environment and wellbeing



Around the same time, David Nowak was developing a piece of software that catalogued the benefits of trees in more detail than ever. Nowak, who works for the United States Forest Service in Syracuse, New York, released iTree in 2006. Unlike CAVAT, with its focus on amenity value, iTree attempts to price up the environmental services trees provide. It combines local weather and pollution data with tree metrics – including trunk girth, species type, canopy size and sunlight exposure – to calculate the value of the services the trees provide. These range from the pollution they remove from the air to the carbon they store, and the run-off into the sewage system they prevent by soaking up rain. Where it is relevant, more data can be

included in those calculations, for example to take account of where ultraviolet radiation is highest, and which trees are best able to filter it out and reduce the risk of skin cancer.

Nowak imagined iTree would only be used by forest managers, but it seems to have caught the public imagination. In Milwaukee, an influential 2011 advertising campaign included billboards that put iTree-generated price tags on trees, challenging passers-by to think differently about their surroundings. These days there is a version of iTree that anyone can use to estimate the value of any tree in the US (see “Price my tree”).

Over the past few years, Nowak has helped value the trees in many US cities, with armies of volunteers measuring trunks and recording species. But his most recent work is more ambitious. It used algorithms to crunch data from satellites and aerial photography and estimate the value of all the trees in the US.

## Urban forests

Many cities qualify as forests, under the UN definition of a contiguous area with greater than 10 per cent tree cover

City	London	Glasgow	Toronto	Barcelona	Washington DC
Coverage	14%	15%	20%	25%	28%
Most common	Sycamore English oak Silver birch	Ash Hawthorn Alder	Norway maple Sugar maple Manitoba maple	London Plane Monterey cypress Chinese privet	American beech Callery pear Tulip tree

The study focused on four core benefits trees provide: soaking up air pollution, storing carbon, saving money on energy by shading buildings in summer and cooling them in winter, and avoiding the emissions associated with the production of that energy. Totting these up, Nowak found the grand total was \$18.3 billion a year – about \$3 a tree on average. One reason the figure is rather low is that rural trees provide less valuable benefits to humans, simply because there are fewer people around.

Elsewhere, it is a different story. Back in Hyde Park, Rodger and I are joined by Kenton Rogers, a consultant at Treeconomics, a social enterprise based at the University of Exeter, UK. He pulls a report out of his satchel. Working with Forest Research, part of the UK’s Forestry Commission, Treeconomics has used iTree and CAVAT to calculate the worth of urban trees across the UK and Rogers has got the results for Hyde Park.

A crew of park staff and volunteers spent weeks during the three summers to 2015 auditing the park’s 3174 trees, including 1188 planes, the dominant among 104 species. According to the iTree estimates, their environmental services are worth £208,916 per year. The bulk of this – about £183,000 – is the “social damage” cost of the pollution the trees prevent, a standard metric that accounts for trees’ benefits to human health and the environment.

## “Tree valuations can help us plan the urban forests of the future”

But that is before you include the CAVAT valuations. Because the park is in such a densely populated area, and because the trees are large, visible and highly suited to their setting, the

amenity value of all the trees there is huge: £52,378 on average for each London plane. “And it’s worth every penny,” says Rodger as he looks up.

Tree valuations are starting to spread. As well as several cities in the UK, groups akin to Treeconomics have used iTree to value urban trees in Toronto, Barcelona and Mérida in Mexico among other places. This is giving us a richer picture of urban trees than ever before (see “It grows on trees”).

The next step, says Nowak, is to use the valuations as a way to forecast the value of services different trees will provide in the future. That gives us a tool to help plan tomorrow’s forests.

This is already possible, to an extent. An offshoot of Nowak’s program, called iTree Species, allows an urban forester to rank the environmental services desired in a new planting scheme, including reducing air pollution, wind and ultraviolet light. After plugging in these characteristics, alongside the hardiness required to cope with local geography and weather, and the predicted mature size of the tree, the software produces a ranked list of recommended species. “It’s becoming a more intelligent system,” says Nowak.

Taken further, systems like this could be used to ensure any new planting scheme delivers a clear return on investment. Get that right, and disputes over the value of trees like the ones in Sheffield could be a thing of the past.

In the meantime, arborists hope that tools like this will improve trees’ status. “If a lamp post falls down or is damaged, people expect it to be replaced – it should be the same for a tree,” says Kieron Doick, head of the Urban Forest Research Group at the UK Forestry Commission. The difference between the two is that trees get larger and provide more value as they get older, meaning they need to be preserved, not replaced.

In Hyde Park, where the £52,000 planes cast long shadows over tourists cycling past, Rodger knows that not everyone likes the idea of valuing nature. “I do think it’s a sad indictment of today’s society that everything seems to have a value,” he says. Trees have been his professional passion for 25 years. But like the other tree lovers seeking to evaluate them, he has come to believe in the practice.

“You can talk about the loveliness of trees until you’re blue in the face,” says Neilan. “But it doesn’t get you extra money when some wretched contractor trenches through the root system.”

## Price my tree

It's all very well hearing that trees in the abstract are worth a handsome sum. But what about those we see from our office windows or sit under to eat our lunch; how much are the individual trees that matter to us worth? If you live in the US, that's not so tough to answer.

Take the big old tree next to *New Scientist's* Boston office. To find out the value of its environmental services, the first step is to fire up MyTree, an app based on the same databases that power iTree, the software being used to value trees across the world. The program needs to know the tree's species and its trunk diameter at chest height. An internet search revealed the tree is probably a Norway maple. And wrapping it with a tape measure showed it had a diameter of about 110 centimetres.

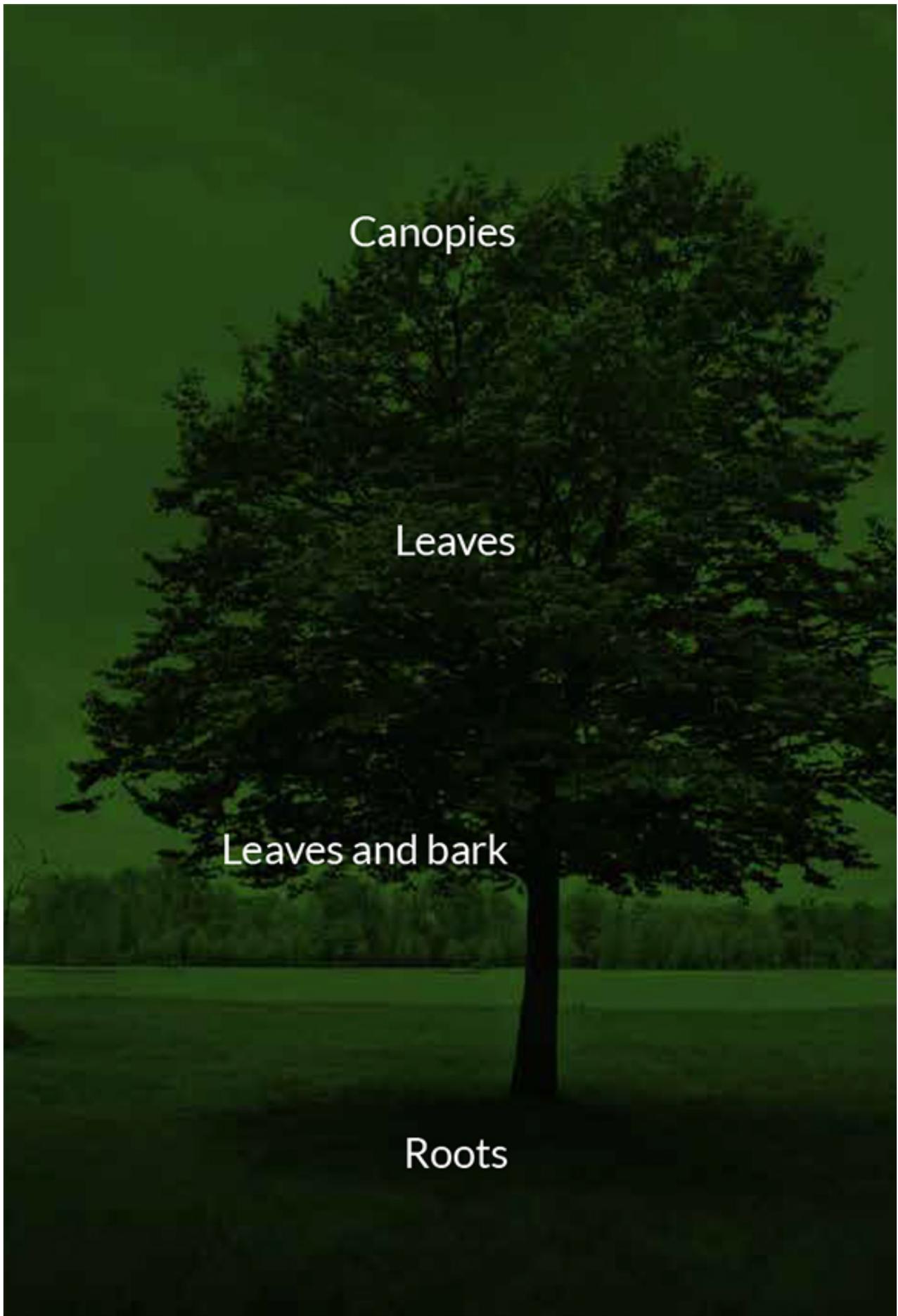
A little more information is needed, including the distance between the tree and any nearby buildings. When those estimates are in, the app flashes up a list of the tree's benefits. It turns out this maple intercepts more than 23,000 litres of rainwater a year, which would otherwise cost \$49 in sewer capacity. It also saves the area \$47 in energy costs by keeping buildings cool. And it removes almost 1.4 kilograms of pollution, such as ozone, nitrogen dioxide and sooty particulates, from the air each year, worth \$4.67. That adds up to about \$100 of benefits – and it looks pretty good too.

## It grows on trees

*They say you know a tree by its fruit, but perhaps its price tag is more instructive still. A recent report valued all the ways London's 8.4 million urban trees benefit us. Click on the image below to find out more*

*This article appeared in print under the headline "Treeconomics"*

Leader: "It is worth valuing trees, but all deserve our respect"



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