GREEN IS THE NEW GOLD: THE VALUE OF URBAN TREES

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Introduction

Urban trees and other vegetation are valuable to the community although most of the benefits they generate are not financial. They provide attractive spaces for recreation and relaxation, thereby contributing to health and wellbeing; they provide habitat for wildlife; they provide some mitigation of urban heat; they sequester carbon; and so on.

Environmental economists are interested in the value of trees and have made various efforts to quantify this value. What I mean by "value" in that sentence is the importance that people place on trees. The value can include financial and non-financial aspects, but one of the aims of environmental economists is to be able to express all aspects of the value in monetary-equivalent terms.

Values

The way that economists approach value is very much through a human lens. The values might relate to benefits to non-human life, but the values we measure reflect how people feel about those benefits. Some people believe that non-human species have intrinsic values, independent of humans, but we don't know how to quantify such values, and in any case, there is a diversity of views about this in the community. In practice, we observe that some people hold very strong environmental preferences while others are largely indifferent or oblivious to the environment. Economists do not pass judgement about which view is correct – they aim to measure the diversity of values and how frequently different values occur in the community.

The most common way of representing an individual's monetary-equivalent value for an environmental benefit (or environmental good) is their "willingness to pay" for the good. This is the highest price that the individual would be willing pay and still voluntarily purchase the good, assuming that the good was only able to be acquired by purchasing it. The attraction of this way of measuring the benefit is that it quantifies the trade-offs that people are prepared to make between the environmental good and other goods. Their willingness to pay for an environmental good indicates that they would be willing to give up other goods to that monetary value in order to obtain the good.

The value of urban trees

As noted earlier, trees generate benefits of various types, including for health, recreation, water quality, heat mitigation and biodiversity. The value of a tree is the sum of the values of these component benefits.

The magnitudes of these benefits is highly context-specific. It depends on factors such as:

- The tree's size and shape.
- The tree's location – in a back yard, on a front verge, in a park, by a roadside, in a carpark, etc.
- The availability of substitutes – an additional tree in an area already well supplied with trees is probably not valued as highly as it would be in an area with few trees (other things being equal).
- Housing density – people in high-density areas likely have relatively low access to their own vegetated areas, meaning that they rely on public areas. In other words, they value an additional tree relatively highly because they lack access to substitutes.
- The need for specific benefits – flood mitigation is valued in areas where there is a flood risk, or heat mitigation where it is relatively hot.

For any type of benefit, including non-financial ones, willingness to pay tends to be higher for people who are relatively wealthy. Of course, this is also true for market goods.

There are a number of advantages in measuring environmental and social benefits in monetary terms.

- To allow comparisons of different types of environmental and social benefits. We need some sort of common currency to be able to compare benefits related to, say, recreation and water quality, and using money as this common currency is a natural and effective choice.
- To allow comparisons of environmental or social benefits with benefits from market transactions. Sometimes this is important to ensure that environmental and social benefits are given due weight by decision makers.
- To allow environmental and social benefits to be included in a Benefit: Cost Analysis (BCA) of a project or policy. A BCA allows us to judge whether the overall benefits of a project outweigh the overall costs. Without including monetised values for environmental and social benefits, some good projects may fail a Benefit: Cost Analysis test.
- To make a persuasive business case for investment in a project that generates environmental and social benefits.

Techniques for monetising values

Economists use a variety of techniques to estimate people's willingness to pay for urban trees and vegetation. The different techniques have different strengths and weaknesses. Here I will outline the three main methods that have been used for valuing trees.

"Hedonic Pricing" is often used to unpack the different values associated with land and property. Data for many property sales, with different characteristics, are collected. Some properties that are sold have positive environmental characteristics (e.g. they have a large tree on the front verge) while others don't. Statistical methods are used to tease out how much people actually pay for the environmental characteristics (e.g. Hamilton, 2005). This is only useful for a subset of environmental values – those that can be enjoyed as a result of buying land or property. The benefits measured are only for the landowners. If there are additional benefits for others, they would not be picked up by this technique.

The other two methods are based on surveys. "Contingent Valuation" is the most widely applied of these techniques (e.g. Epstein, 2003). There are various flavours of contingent valuation, but they all involve people responding to hypothetical questions about their willingness to pay for environmental benefits, or the compensation they would require in order to be willing to tolerate adverse environmental changes. For example, one version asks people whether they would be willing to pay at least $X for a particular environmental change. You vary X for different people, and ask lots of people the same questions, generating a distribution of values.

The other survey-based approach is called "Choice Experiments" (Hoyos Ramos, 2010; Gillespie and Kragt, 2012). It doesn't actually involve experiments in the physical sense, just hypothetical ones. People are offered sets of options and asked to choose the one they prefer. The options include various levels of environmental benefits, and usually include different costs of obtaining those benefits. If you design it well, and ask enough people, you can again use statistics to infer the dollar values that people assign to the environmental assets in question.

A weakness of the survey-based methods is that they rely on people responding to questions about hypothetical scenarios. If people really had to respond to those scenarios, they might behave differently from what they say in the survey. Research has shown that this does result in some "hypothetical bias", although in my judgement the size of this bias is not so large as to greatly reduce the benefits of using these techniques. Hedonic pricing is based on data from real purchasing decisions, so it does not suffer from hypothetical bias.

A strength of the survey-based approaches is that they can provide evidence about any type of benefit and for any group in the community. This sets them apart from hedonic pricing, which is limited to measuring the benefits that accrue to house owners as a result of them purchasing a property.

Evidence

A number of studies from around the world using the Hedonic Pricing method have shown that trees are valued by home owners. These include studies in Athens, Georgia (Anderson and Cordell (1988), Boton Rouge, Louisiana (Dombrow et al. 2000), Salo, Finland (Tyrvainene and Miettinen 2000) and eight towns or regions in the Netherlands (LuttiK 2000). In addition, there have been studies of the value of public open space that includes trees, including in Phoenix, Arizona (Abbott and Klaiber (2010). Within Australia, there have been studies by Pandit et al. (2013), Pandit et al. (2014), Tapsuwan et al. (2009), Polyakov et al. (2017) and a new unpublished study by Doll (2021a).

The specific results vary in different studies, reflecting different contexts, different locations and different research methods. The value of an individual tree can be surprisingly high. For example, Pandit et al. (2013) found that a mature broad-leaved tree (usually a eucalypt) on the street verge in Perth increased the median property sale price by $16,889, while a palm tree did not. The same eucalypt within the property boundary did not increase the house price.

In a similar study for a different region in Perth, Pandit et al. (2014) confirmed the high value of a mature street tree ($14,500). Interestingly, their analysis indicated that a tree can actually decrease the value of a house when it is located on the block or on the adjacent private property within 20 m of property boundary. The mean reduction was $6,100. They suggest several possible reasons for these reductions: blocking views, dropping leaves, damage to pavement, the increased risk of damage to property in a storm, and the occupation of valuable private space. The fact that the overall effect is negative means that these negative impacts outweigh the positive effects, such as amenity and shade.

The other three Australian Hedonic Pricing studies are also for Perth, but they are for public open space rather than individual trees. Tapsuwan et al. (2009) investigated the value of living close to public open space that includes a wetland, in the western suburbs of Perth. Although not a focus of the study, these areas also include many trees, and they would have contributed to the estimated value. They found that the existence of an area of public open space, including a wetland, within 1.5 km of a property will increase the average sales price by $6976. The aggregate effect on surrounding property prices could be very large, calculated as $140 million for one example.

Polyakov et al. (2017) estimated the value of converting a grassed paddock with a straight concrete drain into a natural area with dense vegetation (including many trees) and a meandering stream, in the Perth suburb of Lynwood. They found that homes within 200 m of the restoration site increased in value by 4.7% once the restored area became fully established, with a possible range of 2.9% to 6.5% (the confidence interval). With an average house price of $404,000, this equates to a benefit of $19,000 per house.

Finally, in this look at Hedonic Price studies, Doll (2021a) found that the value of living close to a park varied depending on housing density, park size, and the area of irrigated grass versus non-irrigated areas, including areas with native vegetation. As would be expected, the value was higher for people who live in high-density residences. For these people, all types of parks were valued; values were highest for small parks with irrigated grass, but were also high for the non-irrigated components of both small and large parks. Interestingly, for people in low- and medium-density housing, only the irrigated grass component of parks made a significant contribution to property values.

Doll (2021b) also did a Choice Experiment on the value of parks, looking more explicitly at the value of trees. Her analysis identified four groups of people in the population with broadly similar characteristics and preferences.

Group 1: younger, male, concerned about future water scarcity (36.83% of the sample)

- Holds high values for trees.
- Is somewhat indifferent between three land uses beneath the trees: watered grass, non-watered grass and native vegetation. Prefers all three of those to mulch.

Group 2: older, with kids at home, not concerned about future water scarcity (28.73%)

- Holds extremely high values for trees
- At the ground level, strongly prefers watered grass. Is indifferent between mulch, non-watered grass and native vegetation.

Group 3: not concerned about future water scarcity (20.55%)

- No significant preferences for or against any of the options.

Group 4: Older, concerned about future water scarcity (13.89%)

- Holds very high values for trees.
- Strongly dislikes, otherwise indifferent between mulch, non-watered grass and native vegetation.

The optimal design of parks includes a mixture of different element, and the preferred mix is somewhat different across the four groups.

Conclusion

Lessons from this research include the following. The techniques used provide rich insights into the values of trees. The value of a tree is highly context-specific. It can be very high, but it can also be negative. Different people have widely different preferences and values in relation to trees and vegetation. It means that diversity in the urban landscape is likely to be a good strategy.

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