The Value of Urban Trees During Climate Change

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ABSTRACT
Trees are significant components of urban infrastructure. The economic value of shade provided by trees and their role in mitigating urban heat island effects are recognised. However, the role of shade from trees in prolonging the life of bitumen and the trees' role in sequestering carbon and in saving water in Australia's arid climate are often under-estimated.

It is concerning that at a time of climate change, high density housing and inner city renewal are leading to a significant reduction in the tree cover in parts of major cities. This loss of tree cover, particularly in private open space, comes at a significant economic cost to urban infrastructure. It significantly reduces the environmental services provided by vegetation and urban trees in particular. It also places the future economic and environmental sustainability of such suburbs at risk.

INTRODUCTION

Southeastern Australia recorded below-average rainfall for 14 years, and there have been major storm events annually (often described as one-in-a-century or one-in-50-year events). Sometimes such events have occurred two or three times annually in most states in each of the past five years (2005-2010). There has not been a similar dry period in recorded history, and the frequency of major storm events has increased. These events may be a part of natural cycles of perhaps five hundred years or more, but current meteorological data are too recent to reveal such patterns. However, the current dry period and recent storm events are entirely consistent with climate change models and they are likely to become a permanent part of our environmental conditions (Moore 2009).

The question that might be asked is: What is the value of the benefits that are provided by trees? Or perhaps, what does society get in return? The paper deals with a number of functions or services that are provided by urban trees, and calculates the economic value of the function or service. All values have been calculated in Australian dollars (AUD). At the time of writing, an Australian dollar was worth approximately one United States dollar (AUD$1.00 =US$1.00).

SHADE

The shade provided by trees can lower temperatures by up to 8°C. One of the major economic benefits of shade in the context of the Australian climate is a reduction of air temperatures that then reduces use of air conditioners. This not only saves on electricity use, but since much of the power in Australia is generated by coal, it also reduces carbon emissions (Fisher 2007).

CARBON SEQUESTRATION

Mature trees are significant sinks of carbon and sequester atmospheric carbon dioxide for very long periods of time. It is not easy to accurately determine the amount of carbon sequestered in a mature urban tree, but estimates can be made (McPherson; 1998). Moore (2006) estimated the amount of carbon in a mature tree of 100t total fresh weight for foliage, trunk, and root system at approximately 10t. The current value of carbon per tonne on the Australian carbon exchange is approximately AUD$20 per tonne, and this value has been used in the modeling undertaken in this paper.

PRUNING FOR OVERHEAD UTILITY WIRES

The calculations used to determine the value of carbon sequestered can be applied to the effects that pruning mature trees for construction or utility services, such as power lines or communication cables, might have on carbon sequestered. This changes the economic paradigm and algorithms affecting the undergrounding of services.

PROLONGING THE USEFUL LIFE OF PAVEMENTS

Bitumen is a super cooled liquid, like glass. It is mixed with solvents that can evaporate under the hot and sunny conditions typical of southeastern Australia. This renders the surface of the tarmac crumbly as the asphalt degrades quite rapidly, and reduces the useful life of the pavement substantially (McPherson and Muchnick, 2005). In this paper, the value of shade from trees in prolonging the life of bitumen under Australian conditions is estimated, but it is conceded that small patches of shade do not represent real savings. It is only when extensive contiguous shade occurs that the savings are realized.

LAND STABILIZATION

After the recent fires in the State of Victoria, a large number of trees were cleared from building sites. On at least one site, when it came to rebuilding after the fire, insurance companies would not insure the site, because it was now classed as unstable due to possible landslip. The value of trees in stabilizing land has been calculated.

VALUE OF SHADE IN SCHOOLS AND OTHER PUBLIC BUILDINGS

After the 2009 wild fires in Victoria, the government moved to take action in schools located in designated bush fire regions of the state to make them more fire safe. The guidelines required the removal of trees that were closer than 30m to school buildings. On the first hot and sunny days of late October and November, it became obvious that without the trees there was no shade. Under the Australian summer sun, this posed serious health risks, such as sunburn, heat stroke, and skin cancer.

EXTRA DEATHS/HOSPITAL COSTS

It is well known that death rates among the elderly and chronically unwell rise during prolonged periods of high (>30°C) temperatures. The number of deaths that occur above the usual base rate during a heat wave is described as excess deaths. Recent studies (Tapper 2010) have suggested that the wise use of water and vegetated urban landscapes can reduce excess deaths during heat waves.

CONCLUSION

The economic algorithms and paradigms that have applied to the management of trees and public open space in urban environments are changing rapidly. As a consequence, the

economic imperatives that apply to managing trees will change under a thorough cost/benefit analysis. The full range of environmental, human health, social, and urban infrastructure benefits that vegetation – and trees in particular – provides must be identified and properly evaluated by economists.

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