What Could We Lose?
Economic Values of Urban Forest Benefits

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ABSTRACT

Losses of trees and green space are the consequence of the urban forest being managed on a site-by-site basis. Comprehensive planning and stewardship activities are needed to optimise the forest resource and potential benefits. Yet public perceptions of urban forest values may not incorporate all of the scientifically confirmed public goods and services they provide. Economic valuation methods have been used to derive forest values at all landscape scales - entire cities, neighbourhoods or districts, and individual parcels. Valuation information may convince decision-makers to make strategic and efficient public investments in trees. Valuation data repositions the status of urban forests in municipal government, to assure that adequate resources are allocated for forest planning and management.

Key Words: urban forest, economics, public goods, valuation, urban forest benefits

INTRODUCTION

Scientific understanding about how urban trees, forests and green space benefit people has expanded substantially in recent years, to include social, environmental and economic development benefits. Despite increasing scientific evidence, there is a lag in policy response in many municipalities. Local government policy, regulations and even departmental activities regarding trees and green space are often premised on urban planning and design traditions that regard urban nature as the "parsley around the pig." Consequently, valuable stands of trees are being lost to land conversion; in other instances opportunities for additional tree planting are being neglected. There are notable exceptions, but few local governments have developed citywide, comprehensive

frameworks for planning and managing urban green to achieve specific purposes or functions.

Budgets for municipal agencies and departments are limited, and must address many public needs. Urban forest or parks managers are often called upon to provide a full accounting of both the benefits and costs of urban green spaces. While costs can be readily tallied, calculations of benefits returns are far less straightforward. Nonetheless, economic strategies and techniques for valuing nature and ecosystem services have emerged (Dwyer et al. 1992). Scientific valuation data can inform public debate about municipal programs and budgets, perhaps repositioning the urban forest as a higher priority (Moore 1995).

ECONOMICS AND URBAN FOREST BENEFITS

Use values can be calculated in traditional forestry when trees are grown for harvest and products. Market dynamics of supply and demand establish prices, and revenues from sales of wood commodities are compared to costs to determine profits. A few cities in North America have initiated waste wood utilization programs so that trees cut for disease control or for hazard management are made available for furniture and crafts, or firewood. These harvest practices generate only modest revenues.

Few cities plant or conserve trees with the intention of future harvest. In the urban context trees and forests are public goods, providing non-market values (Daly and Farley 2004). Multiple "owners," such as city managers, citizens and non-profits, invest in urban natural capital, generating "products" in the form of intangible benefits for each city visitor and resident. The experience of these benefits by any single person does not exclude others from experiencing similar benefits, both immediately and indefinitely.

Although this situation is complex, economists have developed theory and methods for capturing public goods values. Many approaches were first developed to assess the economic value of wildland recreation activities. More recently, ecological economists have derived measures of the environmental services that are provided by the world's forests, wetlands, oceans and other natural areas (Daily 1997).

There is growing interest in adapting such economic valuation approaches to the urban nature systems that are more directly intertwined with human systems. Human response and behavior are an important component of valuation equations. The value of forests can be calculated at a range of scales from entire regions or cities, to neighborhoods or communities, to individual parcels and properties. This article presents some initial science-based valuations of urban forests, as well as additional valuation opportunities.

Regional or City Scale

Environmental benefits modeling is often based on deferred costs, that is, if trees are not present, property owners or government would have to invest in additional engineered infrastructure or equipment to remedy environmental problems or provide environmental services throughout a city or region. For instance, tree canopy intercepts rainwater, thereby reducing the amount of water falling to the ground and running off into stormwater collection systems, thus saving the construction costs of greater capacity pipes and storage facilities.

The non-profit organization American Forests (2004) uses environmental services modeling to conduct Urban Ecosystem Analyses. Using digital satellite imagery and aerial photographs, the extent of historic and current levels of urban forest canopy cover have been calculated for thirty North American cities. Annual values of urban forest services are estimated based on modeling of air pollution and stormwater mitigation, and energy impacts. For instance, the analysis of the Washington D.C. metro area concluded that tree cover had reduced stormwater storage costs by $4.7 billion USD and generated annual air quality savings of $49.8 million.

Studies conducted by the Center for Urban Forest Research focus on street tree costs and benefits. Costs include tree planting, irrigation, pruning and other maintenance. Calculated benefits include energy savings, reduced atmospheric carbon dioxide, improved air quality, reduced stormwater runoff and aesthetics. The economic data is mathematically combined to generate per tree net benefits figures. For instance, a 2002 analysis of western Washington and Oregon (U.S.A.) cities indicated that per tree

average annual net benefits were $1 to $8 USD for a small tree, $19 to $25 for a medium tree, and $48 to $53 for a large tree (CUFR 2002).

Valuation models are incrementally including additional environmental functions. Dysfunctional urban natural systems impact the lives of millions of people. Tree planting and management can be used to stabilize soils, reduce erosion, prevent floods, reduce particulate air pollutants and improve groundwater recharge. Each of these environmental services has economic consequences for both private and public landowners.

Neighborhood or District Scale

Studies of trees in retail business districts employ contingent behaviour and contingent valuation methods (CVM) to assess correlations between variations in urban forest character and shopper behaviour (Wolf 2003). Consumers claim they are willing to pay about 9 to 12 percent more for products in downtown shopping districts having trees, versus comparable districts without trees. Customer service, merchant helpfulness, and product quality are all judged to be better by shoppers in places with trees.

Site or Land Parcel Scale

Hedonic or amenity pricing is a measurement of a price increment that correlates to a desirable condition or situation. Appraised values of residential properties having trees are generally 3 to 10 percent more than comparable parcels that are not wooded (Laverne and Winson-Geideman 2003). Other studies conclude that a quality forest or green space has a positive economic ripple effect on proximate or nearby properties (Crompton 2001). Appraised property values of homes that are adjacent to well-maintained, passive use parks and open spaces are typically priced about 8 to 20 percent more than comparable properties elsewhere. These values are capitalized by a municipality when property taxes are assessed, or when taxes are paid on a property sale.

Another study found that rental rates of commercial office properties were about 7 percent higher on sites having a quality landscape, including trees that shaded buildings

(Laverne and Winson-Geideman 2003). Design and management of the plant materials is important. A high quality landscape is correlated with the higher rental rates. Vegetation that impedes views into the commercial property was associated with slightly reduced rental rates.

FUTURE OPPORTUNITIES – HUMAN FUNCTIONING AND HEALTH

Valuation of urban resources is an incremental scientific process, often involving multiple studies and investigators (Figure 1).

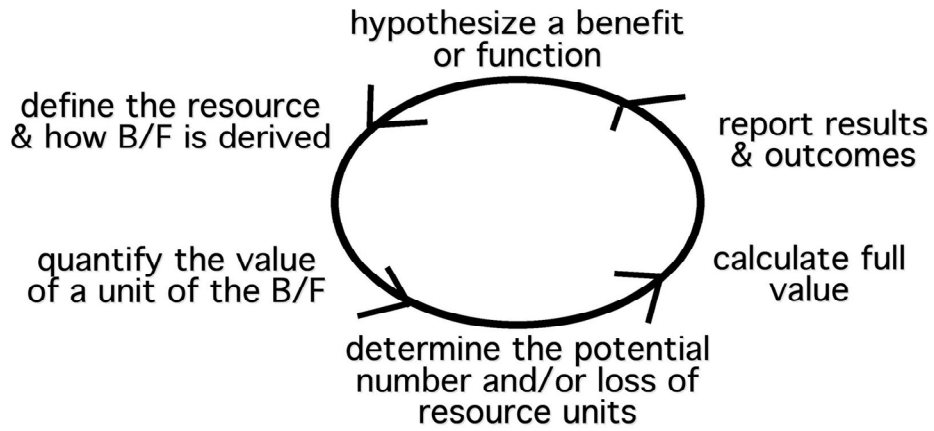

Figure 1: Research process valuation of for urban forest benefits and functions

A forest benefit or function must be first hypothesized and confirmed, followed by quantification of the resource unit and benefit value. The final step is to extrapolate the value across a geographic scale (site to region), which often leads to additional conjecture and investigation of benefits and values.

Perhaps the greatest opportunities for future valuations lie in the realms of human health and functioning. Human dimensions can be assessed for economic value in two domains – physical and mental conditions.

Considering mental health and functioning, scientific studies have confirmed that the presence of trees and "nearby nature" in human communities generates numerous

psychosocial benefits. Kuo and partners (2003) have found that the presence of trees within high density neighbourhoods lowers levels of fear, contributes to less violent and aggressive behaviour, and encourages better neighbour relationships and better coping skills. School children with ADHD show fewer symptoms and girls show more academic self-discipline if they have access to natural settings (Faber Taylor et al. 2001). Hospital patients recover more quickly and require fewer pain-killing medications when having a view of nature, and passive views of nature are associated with reduced physiological stress response (Ulrich 1986). Office workers with a view of nature are more productive, report fewer illnesses, and have higher job satisfaction (Kaplan 1993). These are important, but often unnoticed, beneficial effects for urban people who have views of trees and nature in the course of their normal, everyday activities and experiences. Each of these scientific findings could be translated to economic values; much work remains to be done.

Physical health is another domain of immense economic value. Urban people lead increasingly more sedentary lives, thus more urban dwellers are becoming overweight or obese. These conditions contribute (over the life of the average person) to increases in chronic disease, such as diabetes and heart disease, and traumatic diseases, such as cancer and stroke. National health organizations in North America have conducted baseline studies on personal activity levels, and how to motivate people to do basic physical activities, including walking and biking (CDC 2004). Other research explores how urban form (such as street layout, the presence of sidewalks and parks proximity) encourages activity.

Economic consequences of routine, mild exercise are enormous, when aggregated across entire cities or nations. Deferred costs are possible, as medical expenses are lower for people who do routine physical activities and exercise (Colman and Walker 2004). Based on the Canadian Community Health Survey the estimated annual cost of inactivity in the province of British Columbia is $422 million CAD (and does not include mental health treatment costs). 47% of British Columbians and 61% of Canadians in 1999 were too inactive to reap the health benefits of regular physical activity. More than 1,700 British Columbians die prematurely each year due to physical inactivity, accounting for 6.4% of

all premature deaths. While adequate access to quality sport and recreation programs is important, it is likely that the presence of trees and well-managed forests in cities contribute to walkable neighbourhoods and communities where one's daily activities can be conducted by walking and bicycling.

The science of city tree and forest economic valuation is in its infancy. Compared to valuations of wildland or rural nature, city settings are much more complex, making it more difficult—but not impossible—to isolate the specific effects of nature. Some valuation approaches focus on the defined benefits at the street or neighborhood level, and then results are aggregated across an entire city or region. Others utilize a city, state or national database (such as GIS or aerial photography) and extrapolate economic returns. With continued study, such approaches will be refined to provide greater scope and precision in estimating the value of urban landscapes.

A variety of studies, conducted by multiple research disciplines and scientists, have begun to reveal the subtle, yet important, contributions of trees to local and regional economics. These benefits, as well as the environmental services that are at the root of economic calculations, are important to the quality of life and human ecology of any city. All such services can be lost to communities through incremental, cumulative decline of the urban forest. Comprehensive and ongoing management of the urban forest resource is necessary to attain the highest level of benefits. Evidence of economic returns can favorably alter decision-makers' perceptions, and perhaps result in greater commitment to funding for urban forestry programs.

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