

# ESTIMATING THE VALUE OF URBAN FORESTS USING THE TRAVEL COST METHOD

by John F. Dwyer, George L. Peterson, Alexander J. Darragh<sup>1</sup>

**Abstract:** Municipal urban forestry programs are guided by the values that urbanites place on urban trees and forests. The willingness of users to pay for the use of urban forest areas is suggested as one useful measure of value to guide urban forestry programs. Travel cost models were developed for three urban forest sites in the Chicago area. The models estimated an average willingness to pay of \$4.54, \$8.68, and \$12.71 per visit. Suggestions are made for further use of the travel cost method to estimate changes in the willingness of users to pay for urban forest sites under various management options. This information can provide guidance for urban forest resource management programs that are short of funds.

Municipal programs for managing urban trees and forests are guided by the value of these resources to urbanites. Reliable estimates of these values are increasingly important because budgets for public agencies do not seem to keep up with program needs. Difficult choices must be made for allocating scarce funds, and those municipal program administrators with the most convincing documentation of the value of their programs to residents will have the competitive edge.

This paper outlines the basic ideas behind the travel cost method of estimating resource values, summarizes the results of its application to urban forest sites, and suggests future use of the method to guide municipal forestry programs.

The values individuals place on goods and services are reflected in their efforts to acquire, protect, and preserve them. Large expenditures for a home or automobile indicate the high values placed on the services they provide. The large cash outlays and substantial labor involved in landscaping their yards attest to the high values homeowners place on a green residential environment. Strong protests over the possible loss of urban forests to developments also reflect the high values that urbanites place on trees. The

value of trees and forests is also seen in the higher sale values for residential property that has trees or is close to parks (Kitchen and Hendon 1967; Weicher and Zerbs 1973; Gold 1973; Payne 1973, 1980; Payne and Strom 1975; Hammer et al. 1974; Morales et al. 1976; Correll et al. 1978; Driver et al. 1980; Schroeder 1982; Seila and Anderson 1982).

Travel behavior also reveals the values urbanites place on urban trees and forests. This includes travel to sites with trees and forests as destinations for outings; including arboreta, botanic gardens, conservatories, forest preserves, and parks. Some individuals travel long distances to reach these attractions. By analyzing user travel behavior it is possible to estimate the willingness of users to pay to use the site, i.e., the amount they would be willing to pay to avoid being excluded from the site.

## Willingness of User to Pay

When evaluating a site, the public's willingness to pay to use it can be compared to the cost of providing the opportunity. This is the essence of benefit-cost analysis. Benefits to users can be measured by their willingness to pay for use of the site, and costs can be measured by the expenses and foregone opportunities incurred in providing for that use. If benefits exceed costs, the site has passed the benefit-cost test for economic efficiency. It is not necessary for users to actually pay for the benefits received; but only to indicate that the benefits received are sufficient to justify the needed expenditure.

Some caution is necessary here. The willingness of users to pay for a site is only a part of the picture. Nonusers are also important because they often place significant values on just knowing that trees and forests are available for others or

1. The authors are Research Project Leaders with the USDA Forest Service, North Central Forest Experiment Station and the Rocky Mountain Forest Experiment Station, and Consultant with the Fantus Co. The research on which this paper is based was funded, in part, under a Cooperative Research Agreement between the Forest Service and Northwestern University.

their own use. In addition, numerous other reasons exist for providing urban trees and forests besides the benefits for on-site users. Consequently, estimates of willingness to pay for visiting a site should be used carefully when evaluating urban forest sites and associated programs because the values to on-site users is only part of the total site value.

### The Travel Cost Method

The travel-cost method of estimating the willingness to pay for site use is based on the assumption that individuals react in the same way to both entry fees and travel costs to a site. Individuals living at various distances from a site face different travel costs to the site. Those who live close face lower travel costs, and they are more likely to use the site and use it more frequently than those who live farther away. The travel cost model assumes that when individuals who previously used a site at no charge are faced with a site entry fee, they will reduce their use of the site to the level of those who live farther away and face a travel cost equivalent to the travel cost plus entry fee. For example, individuals who previously incurred a travel cost of \$5 and no entry fee will, when now faced with an entry fee of \$2, reduce the number visits to the level of individuals farther away who previously faced a travel cost of \$7 and were charged no entry fee. Applying this reasoning to all the users of the site, the level of use can be estimated with the (hypothetical) \$2 entry fee.

By assuming successively higher entry fees, it is possible to estimate use for a whole range of entry fees. In this way a demand curve can be estimated for the site, i.e., a graph showing how many visits the site will receive for each possible entry fee. Procedures for estimating the site demand curve are detailed by Dwyer et al. (1977).

The total willingness of people to pay for use of the site is represented by the area under the site demand curve. The average value of a visit can be determined by dividing total willingness of users to pay for the site by the total visits. The site demand curve can also estimate use under alternative fees per visit. This information is becoming increasingly valuable because user fees are being given closer scrutiny as a management tool and a means of generating revenue.

### An Application to Urban Forest Resources

The travel cost method was used to estimate the willingness of people to pay for visiting three sites in the Chicago metropolitan area; Morton Arboretum, Lincoln Park Conservatory, and Garfield Park Conservatory. It is not appropriate to present details of the procedures here. For a discussion of data collection and model estimation, see Darragh et al. (in press). Those models were used to derive values according to the procedures outlined by Dwyer et al. (1977). Average willingness of users to pay for a visit were as follows:

Lincoln Park Conservatory	\$12.71
Garfield Park Conservatory	\$ 8.68
Morton Arboretum	\$ 4.54

These results are presented to indicate the substantial values generated by urban forest sites. In interpreting the specific estimates, it is important to note that a number of factors other than the characteristics of the site will influence the estimates of average willingness of users to pay. The Lincoln Park Conservatory is part of a cluster of attractions that include a zoo, a large park, and the shore of Lake Michigan. The availability of these nearby attractions is likely to increase the ability of the site to draw users from throughout the Chicago metropolitan area, and thus increase the estimated willingness of users to pay for a visit to the site. Consequently, \$12.71 is probably an overestimate of average willingness of users to pay for a visit to the Lincoln Park Conservatory. The lower estimated willingness of users to pay for a visit to Garfield Park Conservatory as compared to the Lincoln Park Conservatory is probably due, in part, to the lack of nearby attractions and the deteriorated condition of the surrounding neighborhood. Both the Lincoln Park and Garfield Park Conservatories are advertised as cultural attractions of Chicago, while the Morton Arboretum, some 30 miles west of downtown, is not; and this contributes significantly to the lower estimate of willingness of users to pay for a visit to the Arboretum.

### Needed Extensions

The values reported above indicate that urbanites place substantial values on the use of three urban forest sites. However, the analysis

provides no information about the influence of specific site attributes or management programs on the value of a visit. Trees, open grassy areas, recreation facilities, water, and many other site attributes may strongly influence the value of these sites to users. Furthermore, the spatial configuration of site resources, as well as the management of trees and forest resources, may strongly influence the value of a site. In many instances the important management question concerns the extent to which implementing management options will alter the willingness of users to pay for visiting a particular site.

Preliminary evidence suggests that the management of urban trees and forests can increase the desirability of a wide range of urban sites. For example, forest resources were a significant variable in models that predict which of 21 Chicago urban forest sites an individual will choose to visit. Those 21 sites include the three sites used in this study, a botanic garden, and a number of forest preserves (Peterson et al. in press). Diversity of vegetation along an urban trail is one of the important attributes that contributes to use and enjoyment of urban forest trails (Allton 1981). Trees and other vegetation in urban parks and forest preserves were the most frequently mentioned features contributing to high site quality as judged by observers viewing photographs of typical sites. (Schroeder in press). Trees ranked highest as an attractive feature in an on-site survey of users of the Forest Preserve District of Cook County. Nearby vegetation also contributes to residents' satisfaction with the quality of multifamily housing complexes—natural wooded settings were greatly preferred. (Kaplan 1982).

These research results strongly suggest that good management of forest vegetation in recreation sites will increase users' willingness to pay to visit the sites. If the amount of that increase can be estimated, it can be compared with management costs to determine the effectiveness of management efforts in meeting public needs.

To evaluate the effects of various urban forest resource management options on the willingness of users to pay for a site, it is necessary to gather information about the characteristics of urban forest sites that illustrate a wide range of management practices as well as information about where

users come from and the distances they travel. This would permit the estimation of a model or set of models that could predict changes in the willingness of users to pay for sites caused by changes in the management of those sites. This information could be a useful guide to selecting among options for managing urban forest resources.

Developing models to estimate the willingness of users to pay for sites is different but complementary to other approaches for evaluating user preferences and values. Site characteristics found to be important to users in other studies can be built into travel cost models.

### Conclusion

Use of a travel cost model to estimate the willingness of users to pay for visits to urban forest sites has demonstrated that these sites provide substantial values to users. Ignoring these values is likely to lead to inadequate and inappropriate expenditures on urban forest resource management. When funds are scarce, information from travel cost models can provide valuable guidance for urban forest management. More useful guidance can be provided when models are developed to estimate changes in the willingness of users to pay over a range of management options. Preliminary studies indicate that the development of these models is feasible, and that the contribution of urban forest resource management to user values is substantial. Although most urban tree and forest managers cannot be expected to become sufficiently skilled in travel cost techniques to estimate the models, they should be aware of their existence and usefulness. The technique is well known among economists and recreation planners and will hopefully be applied more widely to urban forest sites.

### Literature Cited

- Allton, D.J. 1981. An experimental approach to modeling spatial choice in the urban recreation environment: a study of trails in the Chicago metropolitan region. PhD. Diss. Southern Illinois Univ. 179 pp.
- Correll, M.R., J.H. Lillydahl, and D. Single. 1978. *The effects of greenbelts on residential property values: some findings on the political economy of open space*. Land Econ. 54(2):207-217.
- Darragh, A.J., G.L. Peterson, and J.F. Dwyer. 1983. *Travel cost models at the urban scale*. J. Leis. Res. (in press).

- Driver, B.L., D. Rosenthal, and G.L. Peterson. 1980. Social benefits of urban forests and related green spaces in cities. *In: Proceedings of the National Urban Forestry Conference*. State University of New York, College of Environmental Science and Forestry. pp. 98-111.
- Dwyer, J.F., J.R. Kelly, and M.D. Bowes. 1977. Improved procedures for valuation of the contribution of recreation to national economic development. Water Resources Center Research Report 128. University of Illinois. 218 pp.
- Gold, S.M. 1973. *Urban Recreation Planning*. Lea and Febinger, Philadelphia. 333 pp.
- Hammer, T.R., R.E. Coughlin, and E.T. Horn IV. 1974. *The effect of a large urban park on real estate values*. J. Am. Inst. Plann. 40:274-277.
- Kaplan, R. 1982. Managing greenspace in multiple family neighborhoods. Proc. Soc. Am. For. Wash. D.C. (In Press).
- Kitchen, J., and W.S. Hendon. 1967. *Land values adjacent to an urban neighborhood park*. Land Econ. 43(3):357-360.
- Morales, D., B.N. Boyce, and R.J. Favsetti. 1976. *The contribution of trees to residential property value: Manchester, Conn.* Valuation 23(2):27-43.
- Payne, B.R. 1973. *The twenty-nine tree home improvement plan*. Nat. His. 82(9):74-75.
- Payne, B.R. 1980. Urban land values, trees, and urban forest management. *In: Proceedings of the National Urban Forestry Conference*. State University of New York, College of Environmental Science and Forestry. pp. 177-182.
- Payne, B.R., and S. Strom. 1975. *The contribution of trees to the appraised values of unimproved residential lots*. Valuation 22(2):36-45.
- Peterson, G.L., J.F. Dwyer, and A.J. Darragh. 1983. *A behavioral urban site choice model*. Leisure Sciences (in press.)
- Schroeder, H.W. 1982. *Preferred features of urban parks and forests*. J. Arboric. 8:317-322.
- Schroeder, T.D. 1982. *The relationship of local public park and recreation services to residential property values*. J. Leis. Res. 14(3):223-234.
- Seila, A.F., and L.M. Anderson. 1982. *Estimating costs of tree preservation on residential lots*. J. Arboric. 8(7):182-185.
- Weicher, J.C., and R.H. Zerbs. 1973. *The externalities of neighborhood parks*. Land Econ. 49(1):99-105.

---

## ABSTRACT

HAMILTON, D.F. and S.D. VERKADE. 1982. **The development and care of a healthy root system**. Am. Nurseryman 156(6): 73-80.

Problems with shoot growth of trees and shrubs in the landscape are often the result of inadequate root development. Roots fulfill a number of roles besides absorption, and their morphology varies widely, depending on the part they play in the life of the plant. The main root is often called the primary root, and its branches are secondary roots. Secondary roots may in turn bear branches termed tertiary roots. By dry weight, roots usually make up less than 50 percent of the plant, but their surface area is invariably much higher than that of the shoots when developing in a relatively unrestricted environment. Roots with an absorbing function tend to be near the surface of the soil. So the lateral spread of the root system is usually much greater than that of the aerial parts of the plant. It becomes apparent that an extensive root system is critical for the successful establishment and growth of woody plants transplanted into the landscape. Problems with poor shoot growth and development may often be traced to poor root development.