USDA

United States
Department of
Agriculture

Forest Service

Pacific Southwest
Research Station

General Technical
Report PSW-GTR-199

November 2006

Midwest Community Tree Guide

Benefits, Costs, and Strategic Planting

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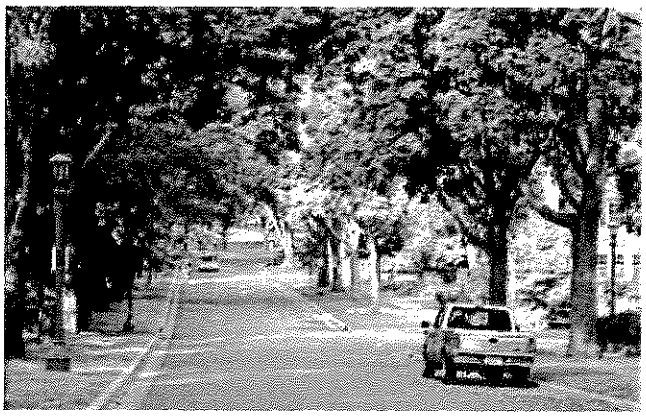
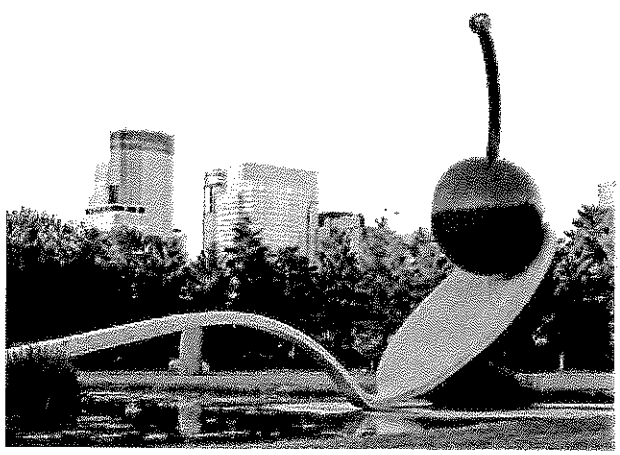




Executive Summary

Benefits and costs quantified

This report quantifies benefits and costs for typical small, medium, and large deciduous (losing their leaves every autumn) trees: crabapple, red oak, and hackberry (see "Common and Scientific Names" section). The analysis assumed that trees were planted in a residential yard or public site (streetside or park) with a 60 percent survival rate over a 40-year timeframe. Tree care costs were based on results from a survey of municipal and commercial arborists. Benefits were calculated by using tree growth curves and numerical models that consider regional climate, building characteristics, air-pollutant concentrations, and prices.

Given the Midwest region's large geographical area, this approach provides first-order approximations. It is a general accounting that can be easily adapted and adjusted for local planting projects. Two examples are provided that illustrate how to adjust benefits and costs to reflect different aspects of local planting projects.

Average annual net benefits

Average annual net benefits (benefits minus costs) per computer-grown tree for a 40-year period were:

- $3 to $15 for a small tree
- $4 to $34 for a medium tree
- $58 to $76 for a large tree

Environmental benefits alone, such as energy savings, stormwater-runoff reduction, and reduced air-pollutant uptake, were three to five times the tree care costs for small, medium, and large trees.

Net benefits summed for 40 years

Net benefits for a residential yard tree opposite a west wall and public street or park tree were substantial when summed over the entire 40-year period:

- $600 (yard) and $160 (public) for a small tree
- $1,360 (yard) and $640 (public) for a medium tree
- $3,040 (yard) and $2,320 (public) for a large tree

Yard trees produced higher net benefits than public trees did, primarily because of lower maintenance costs.

Costs

The average annual cost for tree care 20 years after planting ranged from $8 per yard tree to $36 per public tree.

- Small tree: $8 (yard) and $27 (public)
- Medium tree: $13 (yard) and $33 (public)
- Large tree: $15 (yard) and $36 (public)

Tree pruning was the single greatest cost for trees ($5–$20/year per tree); annualized planting ($5–$10/year per tree) and removal ($4–$7/year per tree) costs were also important.

Average annual net benefits at age 40

Large trees provide the most benefits. Average annual benefits increased with mature tree size (approximate size 40 years after planting), and at age 40 the annual benefits were:

- $20–$32 for a small tree
- $25–$54 for a medium tree
- $81–$99 for a large tree

Benefits associated with energy savings and property value accounted for the largest proportion of total benefits. Rainfall interception (water held on tree leaves and the trunk surface, reducing stormwater runoff), atmospheric carbon dioxide (CO_2) reduction, and improved air quality were the next most important benefits.

Energy conservation benefits varied with tree location as well as size. Trees located opposite west-facing walls provided the greatest net heating and cooling energy savings. In addition, trees reduce stormwater runoff. A typical 20-year-old hackberry intercepts 1,394 gal of rainfall per year. After 40 years, this figure increases to 5,387 gal/year—valued at $25.

Reducing heating and cooling energy needs reduced CO_2 emissions and thereby reduced atmospheric CO_2. Similarly, cooling savings that reduced pollutant emissions at power plants accounted for important reductions in gases that produce ozone, a major component of smog. The magnitude of air quality benefits reported here reflects the relatively clean air in the Minneapolis region. Higher benefits are expected in regions with higher pollutant concentrations, such as Chicago, Detroit, and Cleveland. Net air-quality benefits were influenced to a small extent by tree emissions of biogenic volatile organic compounds (hydrocarbons produced by vegetation).

Adjusting for local planting projects

To demonstrate ways that communities can adapt the information in this report to their needs, two fictional cities interested in improving their urban forest have been created. The benefits and costs of different planting projects are determined. In the hypothetical city of Wabena Falls, net benefits and benefit–cost ratios (BCRs) were calculated for a hypothetical planting of 1,000 trees (1-in) assuming a cost of $100/tree, 60 percent survival rate, and 40-year analysis. Total costs were $1.26 million, benefits totaled $3.99 million, and net benefits were $2.73 million ($68/tree per year). The BCR was 3.17:1, indicating that $3.17 was returned for every $1 invested. The net benefits and BCRs by mature tree size were:

- $30,120 (1.62:1) for 50 small crabapple trees
- $252,902 (2.05:1) for 200 medium red oak trees
- $2.45 million (3.52:1) for 750 large hackberry trees

Energy savings (56 percent) and increased property values (24 percent) accounted for 80 percent of the estimated benefits. Storm-water-runoff reduction (9 percent), air quality improvement (7 percent), and atmospheric CO_2 reduction (5 percent) were the remaining benefits.

In the hypothetical city of Lindenville, long-term planting and tree care costs and benefits were compared to determine if a new policy that favors planting small trees will be cost-effective compared with the current policy of planting large trees where space permits. Over a 40-year period, the net benefit for a small crabapple was $659/tree, considerably less than $1,363/tree for the medium red oak, and $3,214/tree for the large hackberry.

Based on this analysis, the city of Lindenville decided to retain their policy. They now require tree shade plans that show how developers will achieve 50 percent shade over streets, sidewalks, and parking lots within 15 years of development.

Trees are energy saving, property value enhancing, carbon sequestering, runoff collecting machines! The following statistics provide testament to just how important trees for your home and community.

"The net cooling effect of a young, healthy tree is equivalent to ten room-size air conditioners operating 20 hours a day."—*U.S. Department of Agriculture*

"Landscaping can reduce air conditioning costs by up to 50 percent, by shading the windows and walls of a home." —*American Public Power Association*

"If you plant a tree today on the west side of your home, in 5 years your energy bills should be 3% less. In 15 years the savings will be nearly 12%." —*Dr. E. Greg McPherson, Center for Urban Forest Research*

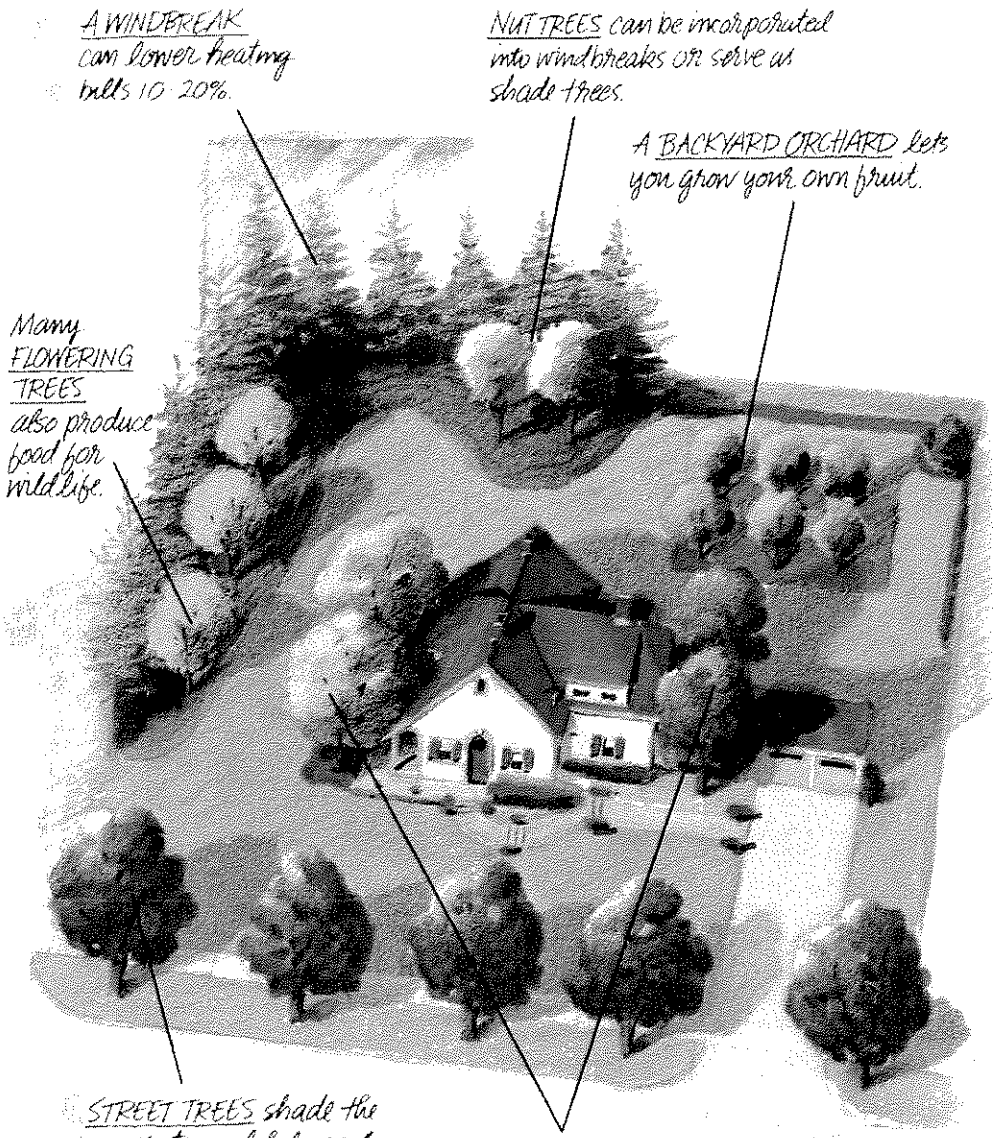
"A mature tree can often have an appraised value of between $1,000 and $10,000." —*Council of Tree and Landscape Appraisers*

"In one study, 83% of realtors believe that mature trees have a "strong or moderate impact" on the salability of homes listed for under $150,000; on homes over $250,000, this perception increases to 98%." —*Arbor National Mortgage & American Forests*

"Landscaping, especially with trees, can increase property values as much as 20 percent."—*Management Information Services/ICMA*

"One acre of forest absorbs six tons of carbon dioxide and puts out four tons of oxygen. This is enough to meet the annual needs of 18 people."—*U.S. Department of Agriculture*

TREES around your home can increase its value up to 15% or more. The trees you plant remove CO_2 from the air, produce oxygen and give songbirds a home. Trees provide many other benefits:



Arbor Day Foundation™

"There are about 60-to 200- million spaces along our city streets where trees could be planted. This translates to the potential to absorb 33 million more tons of CO2 every year, and saving $4 billion in energy costs."—*National Wildlife Federation*

"The planting of trees means improved water quality, resulting in less runoff and erosion. This allows more recharging of the ground water supply. Wooded areas help prevent the transport of sediment and chemicals into streams."—*USDA Forest Service*

To learn more, see www.arborday.org.