



Urban Forest Research

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Center for Urban Forest Research • Pacific Southwest Research Station • USDA Forest Service

Invest in Investment Potential

A New Way to Manage Your Urban Forest

“Investment potential” is usually a term we use when talking with bankers or investment counselors. Imagine “investment potential” turning out to be your most important ally when fighting the annual budget battle. Our latest research gives some insight into how it could help you.

Costs are a Painful Reality, or are they?

In recent years, many communities have faced budget problems. In an effort to control budgets, city officials have leaned heavily on tree budgets. This has forced many tree managers to focus on cutting costs. The result is a proliferation of small-stature trees and inadequate main-

tenance practices that jeopardize the quality of life residents are seeking from their urban forests.

So, how do you turn this “lemon” into lemonade? The key is return on investment, or investment potential. Don’t settle for managing your community forest by just cutting costs. Persuade leadership to think spending dollars for trees is the right thing to do.

Which Species have the Highest Benefit/Cost Ratios?

We conducted research in four western cities and found that in each city there were some species that had a significantly higher benefit-to-cost ratio than other species. This suggests to us that the more species with high benefit/cost ratios (BCRs) a city has, the greater their return on investment of city budget dollars. This doesn’t mean that you need to rush out and get rid of all of the species with a low BCR, but this information can be used to persuade leadership to maintain your tree budget by “investing” more wisely in your community’s trees.

Seeking the Answer

To determine investment potential of individual species, we analyzed 34,000 tree work records for a three-year period (1996-1998) for ten of the most abundant species in

Show city leadership that large-stature trees can be a wise investment.

Modesto, CA (McPherson 2003).

Each of the work records described the type of activity performed, time spent to the closest 0.1 hour, date the work was performed, tree species, planting date, and location. After an initial analysis, each of the 240 activity codes was put into one of six activity areas: pruning, removal, plant/water/re-stake, root-related work, liability/storm cleanup, integrated pest management (IPM)/other.

What We Found

We found that pruning was the single greatest cost-category for every species, accounting for more than 73% of total per tree costs for every species except ginkgo (49%). Species with the highest percentages of total costs spent for pruning were Modesto ash, sweetgum, pistache, hackberry and pear.

Benefits

The population of London plane, Modesto ash, and hackberry had many old large trees, with annual benefits ranging from \$175 to \$186

(continued next page)



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per tree. Benefits for species with more young, medium-sized trees ranged from \$83 (camphor) to \$124 (zelkova). Annual benefits were lowest for the small pear trees (\$55).

Costs

Annual costs per tree ranged from \$7.7 for London plane to \$54.3 for sweetgum. Other high-cost species were Modesto ash (\$48.8) and hackberry (\$32.7). Low cost species were camphor (\$11.4) and ginkgo (\$13.3).

As expected, species with large numbers of big trees cost the most to manage. London plane tree was the exception. Although 60% of all London plane were greater than 24 inches dbh, per tree management expenditures were remarkably low (\$7.7).

Net Benefits

Annual net benefits (benefits minus costs) were greatest for London plane (\$178), hackberry (\$148), and Modesto ash (\$126) and least for pear (\$33), pistache (\$65), camphor (\$71), and Southern magnolia (\$73).

The Modesto municipal arborist confirmed that London plane rarely require pruning, have high establishment rates, rarely heave sidewalks, and are not prone to storm damage. Unfortunately, this species accounts for only 2.7% of the street tree population.

Modesto ash and Chinese hackberry are rarely planted anymore due largely to high costs required to maintain older trees and high loss rates for hackberry due to root rot disease. Of the ten species we evaluated, London plane was clearly the outstanding performer. It combines

Downsizing is NOT the Answer

Cities that are using the downsizing approach to reduce costs may achieve some short-term savings, but over the long term, they have destined themselves to a future with fewer and fewer benefits as the large trees are replaced with small trees. Shade will be far less, parking lots and schoolyards will be hotter, air quality will diminish, and storm water runoff will increase – driving up costs in other city budgets. And a lot of the other benefits that large trees produce will also be lost.

We recognize that, on some restricted sites, a small stature tree may be the best choice.

maximum benefits with minimum costs.

Ginkgo and camphor were the next best performers. They may be slow to establish and prone to early losses, but they are worth the wait. Once trained and established, they required very little care. Their benefits did not rival those produced by the larger London plane and hackberry, but were nonetheless substantial.

We did not find this for zelkova, hackberry, and Modesto ash, however. They are large shade trees that grow relatively rapidly and produce sizable annual benefits, but management costs are somewhat high because many trees are at the end of their functional lifecycle.

What this Means

By converting the benefits and costs to a ratio for each species, a tree's true worth to a community is quickly revealed. For example, in Modesto, the benefit-cost ratio for the London plane is 24:1, or more than three times greater than the

next closest species: ginkgo and camphor (7:1). Species with the lowest benefit-cost ratio are sweetgum and pear (2:1), and pistache and Modesto ash (3:1). This analysis quickly reveals where you want to continue spending city dollars.

Potential for Controlling Costs

By incorporating benefits as well as costs into your analysis, relative return on investment (investment potential) can be calculated by species. One way to reduce costs and increase urban forest sustainability is to increase the proportion of tree species with relatively high benefit-cost ratios and reduce those that are low.

Information on cost components can help target management activities with cost-cutting potential.

According to the 2000 California State of the Urban Forest Report, California cities spend an average of \$19 per tree annually.



Urban Forest Research is a publication of the Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service. For more information, contact the Center at the Department of Environmental Horticulture, University of California, 1 Shields Ave, Suite 1103, Davis, CA 95616-8587. (530) 752-7636

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Editor: Jim Geiger

Production: Laurie Litman, InfoWright

For example, relatively high rates of establishment-related mortality for ginkgo and camphor indicate need for further study of causes and possible solutions, such as planting of larger or smaller size stock, more frequent watering, and different staking/protection.

Another technique would be to combine information on tree numbers and benefit-cost ratios by size class, and estimate how net benefits will change as trees move into larger size classes. This information may influence budgeting for tree removal and replacement, pruning, planting, and sidewalk repair.

Invest in Investment Potential

By documenting future benefits and costs associated with maturing street tree populations municipal foresters have a new way to justify investment in tree health and longevity. Data can be used to indicate how failure to invest in management will result in reduced net benefits, as costs increase relative to benefits. Alternatively, the consequences of targeting management actions to increase benefit-cost ratios can be easily described and readily understood by decision-makers and the public.

Setting appropriate tree canopy cover targets provides measurable goals for urban forest planning and management. However, the type of tree cover is just as important as the amount of tree cover. Accounting for the benefits and costs of different tree species over the long-term should be one aspect of good stand management.

Benefit-Cost of Tree Species

Species	Benefit-Cost Ratio
London plane	24.3
Ginkgo	7.4
Zelkova	5.9
Hackberry	5.5
Modesto ash	3.6
Chinese pistache	3.3
Pear	2.6
Sweetgum	2.4

Obtaining Benefit-Cost Information

Two key elements are necessary when determining investment potential by species—tree benefits and cost of maintenance.

To calculate costs you will need a work record history for each tree. If your community doesn't have one you may be able to create one from the records you do have, or start now to record tree work for each species.

To calculate benefits, your tree inventory data is required along with our newest software program—STRATUM (Street Tree Resource Analysis Tool for Urban Forest Managers). The software program will use both your tree inventory data and work records to calculate the benefits and costs by species, along with other key management information. See the update of our release of STRATUM on page 4. Also visit our website for a more detailed discussion of STRATUM.

—Jim Geiger



Are Your Tree Roots Tripping You Up?



Reducing Infrastructure Damage by Tree Roots: A Compendium of Strategies is available to help you with your tree root problems. The Compendium offers solutions in three categories—tree, infrastructure, and root zone.

The Compendium identifies and describes key strategies used to prevent or mitigate damage to sidewalks, curbs, and gutters by tree roots. Strategies include the use of root barriers, structural soil, species selection, alternative design, soil management techniques, and many others. Each strategy is described in terms of objective(s), methods, materials, and limitations.

Dr. Larry Costello and Katherine Jones have compiled information that will serve as a quick and complete reference for all professionals interested in reducing infrastructure damage. Literature citations are included and field photos are used to illustrate techniques whenever possible.

You can obtain a copy from the Western Chapter ISA at 530-892-1118 or through their website at www.wcisa.net. Cost is \$15 per compendium plus \$8 for shipping and handling in the U.S.



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Send comments or suggestions to Jim Geiger, Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service, c/o Department of Environmental Horticulture, University of California, 1 Shields Avenue, Suite 1103, Davis, CA 95616-8587 or contact jgeiger@fs.fed.us.



Where do you get STRATUM Software?

Pilot Testing Beginning

Beginning this fall (2003) we will “pilot test” STRATUM (Street Tree Resource Analysis Tool for Urban Forest Managers) in California via contracts with cooperating tree inventory companies. The companies will offer a customized STRATUM analysis. Cities can contract for a sample inventory or complete street tree inventory. Either inventory will include an analysis of tree benefits by species.

Customized Results

Results will be customized for each community to account for local growing conditions, tree management practices, data such as air quality, climate, and residential sales prices, and local benefit prices for electricity, natural gas, O₃, and CO₂. This ability to provide customized results was made possible by our research in a reference city within a climate region where we collected data on leaf area, crown projection area, tree height by species, air pollution concentrations, etc.

To date we have completed four climate regions—Northern California (Modesto, CA), Subtropical (Santa Monica), Pacific Northwest (Longview, WA), and Northern Mountain and Prairie (Fort Collins, CO). This year we intend to complete the Southwest Desert climate region (Glendale, AZ).

Coming: New Software Package

In 2005 we plan to provide an even more complete software package for an urban forest inventory and assessment by integrating STRATUM with MCTI (Mobile Community Tree Inventory). MCTI is a street data collection, processing and reporting system that includes a PDA software interface. MCTI was developed at

the Northeastern Center for Urban and Community Forestry in Amherst, MA and is being used by several hundred communities.

Applied independently, these tools are limited to what they do best—MCTI's street tree data collection, processing, and reporting functions; and STRATUM's ability to generate information on the dollar value of annual benefits and program costs. But, together they can provide communities with an integrated assessment of their public trees.

Anyone Can Use It

This future product, STRATUM / MCTI, will be aimed at small to medium sized communities, as well as cities and towns that use trained volunteers to sample street trees.


Once released in 2005, city staff

or volunteers will be able to conduct inventories and analyses themselves or contract with a private firm.

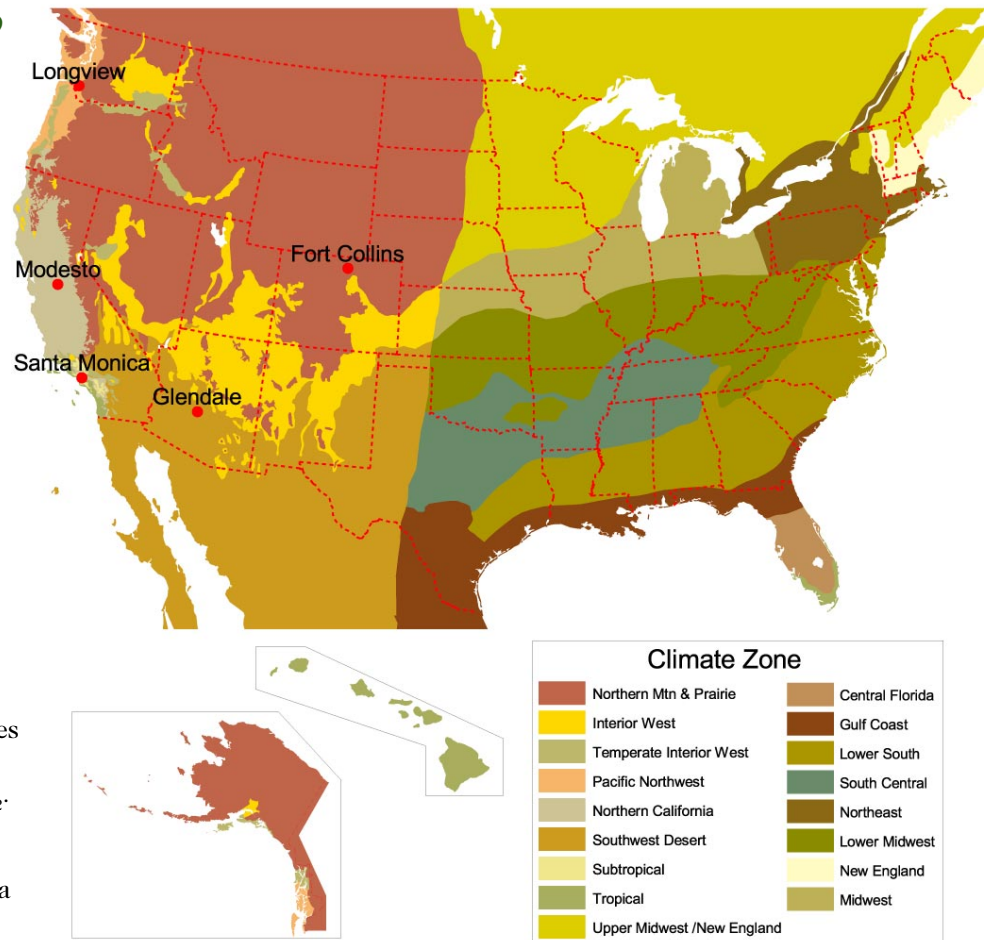
Customized Benefit Data

Our Center will provide customized benefit data to cities as well as private firms at a reasonable cost. However, these data will only be available in climate regions where we have collected and analyzed tree growth data, geographic factors, and benefit prices for reference cities.

Where We Still Need Reference Cities

We have benefit data for four climate regions, are working on one more, but need data for 12 more. See Climate Region Map above. Our goal is to have benefit data for all 17 climate regions in five years. 

Tree Guide Climate Zone Map



New Tree Guide Available

Our Center recently published its newest Tree Guide—*Northern Mountain and Prairie Tree Guide: Benefits, Costs and Strategic Planting*. The guide was designed for the Northern Mountain and Prairie climate region and is the fifth in a series of Tree Guides for the Western United States. View the guide at <http://cufr.ucdavis.edu/products.html>.

The climate region extends from Alaska, Western Washington and Oregon, and Northern California on the west, through Idaho and Montana, to the Dakotas and Nebraska on the east. The region extends south through Wyoming, Nevada, Utah and Colorado, to the mountainous areas in New Mexico, Arizona, and Northern California.

What it Does

The Guide identifies and describes the benefits and costs of planting trees in the cold and snowy climate region. It also answers a number of questions about the environmental and aesthetic benefits community trees provide:

- What is their potential to improve environmental quality, conserve energy, and add value to communities?
- Where should residential and public trees be placed to maximize their cost-effectiveness?
- Which tree species will minimize conflicts with powerlines, sidewalks, and buildings?

Results

Research results are reported for green ash, Norway maple, crab apple and Colorado spruce respectively, both street/park and yard trees. Data from these typical species were collected in Fort Collins, Bismarck,

and Cheyenne, and analyzed by computer models to determine the magnitude of benefits throughout the region:

- kWh and BTUs of energy saved through wind reduction or direct shading.
- tons of CO₂ sequestered.
- tons of air pollutants removed by dry deposition or through avoided

residential properties.

Results reveal a significant benefit for each of the typical species.

Estimated annual benefits for a street/park tree 40 years after planting:

Large Tree: 54 ft tall, 40 ft spread, 5,960 ft² leaf surface area

Total benefits – \$59

Total costs – \$18

Net benefits – \$41

Medium Tree: 43 ft tall, 36 ft spread, 3,905 ft² leaf surface area

Total benefits - \$36

Total costs - \$17

Net benefits - \$19

Small Tree: 28 ft tall, 34 ft spread, 2,350 ft² leaf surface area

Total benefits - \$27

Total costs - \$15

Net benefits - \$12

Conifer: 44 ft tall, 27 ft spread, 3,520 ft² leaf surface area


Total benefits – \$44

Total costs – \$18

Net benefits – \$26

At year 40 the largest single benefit for all trees was stormwater interception with large trees and conifers intercepting over 2000 gallons of water per year. Property value increase was the next largest benefit ranging from \$8 to nearly \$15 per year.

Annual costs are based on a survey of municipal and commercial arborists for planting, pruning, removal/disposal, pest and disease, infrastructure, irrigation, cleanup, liability/legal, and administration.

The next guide is planned for the Desert Southwest (Glendale, AZ). Tree guides for the Inland Empire, South Coast, San Joaquin Valley of California, and Western Washington and Oregon have been completed. 

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Net benefits – \$26

- emissions at power plants.
- gallons of water intercepted.
- property value increase.

The value of each benefit was calculated at 5 year intervals for 40 years using:

- regional market value for electricity and gas.
- regional cost of control for air pollutants.
- treatment and control costs for stormwater.
- effect of trees on sales price of

Fact Sheet #6: Species Investment Potential

How to Use “Species Investment Potential” to Your Advantage

“Investment potential” may turn out to be your most important advocate when fighting the annual community forest budget battle.

- Consider budget cuts a fact of life. But don't let them drive your tree management decisions. Downsizing is not the answer.
- Persuade city leaders and elected officials that making a wise investment in large-stature trees is the right thing to do. *For more information on the art of persuasion see our Market Research at: <http://cufcr.ucdavis.edu>.*
- Conduct benefit-cost analysis of your community forest by species to determine the distribution of benefit/cost ratios (BCRs) among the various species. See STRATUM on our website.
- Calculate the return on investment.
- Reduce costs and increase urban forest sustainability by increasing the proportion of tree species with relatively high BCRs and reducing those that are low.
- Demonstrate that targeting management activities with cost-cutting potential can save dollars.
- Estimate how net benefits will change as trees move into larger size classes to influence budgeting for tree removal and replacement, pruning, planting, and sidewalk repair.
- Document how failure to invest in tree care and management will result in reduced net benefits, as costs increase relative to benefits.
- Look at BCRs periodically because some trees are moving into higher size classes every year.

Why do some species have a higher BCR than others?

A number of things could be going on here from pruning schedules to poor locations. It will depend on the analysis of your community forest to determine what the right species are for your community.

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Cities using the downsizing approach to reduce costs may achieve some short-term savings, but over the long term they have destined themselves to a future with fewer and fewer benefits as the large trees are replaced with small trees. Shade will be far less, parking lots and schoolyards will be hotter, air quality will diminish, and storm water runoff will increase—driving up costs in other city budgets. And a lot of the other benefits that large trees produce will also be lost.

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