



# Urban Forest Research

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

## STRATUM in Action

Proving once again that national borders can't limit the flow of great ideas, STRATUM software, a street tree assessment tool, was recently exported north to help a small Canadian city identify the benefits of its urban forest.

The City of North Vancouver, just a 15-minute ferry ride from Vancouver, British Columbia, is going through a period of rapid redevelopment. It is small in size—less than 5 miles in area—with a population of about 45,000 people that is expected to increase by 50 percent over the next 20–30 years. This type of “densification” can lead to environmental problems due to the increase in pavement, roofs, and other hardscape.

### Challenges into opportunities

City officials saw the opportunities presented by redevelopment to expand their urban forest and the benefits that come from it. Strategic tree planting and stewardship of existing trees can counter some of the adverse environmental effects of growth by helping to reduce stormwater runoff, conserve energy and water, sequester CO<sub>2</sub>, attract wildlife, and provide other aesthetic, social, and economic benefits.

The City lacked an urban forest plan, so before embarking on a tree planting program they wisely took time to investigate the benefits the urban forest provides to their community, survey public attitudes and desires regarding street trees, and plan an educational outreach program. The goal was to develop an Urban Forest Master Plan that could guide the City street-tree planning effort for the next 10–20 years.

The Urban Forest Master Plan has multiple steps. The first phase was a street tree inventory, accomplished in 2001, and the establishment of overall criteria for street trees. Phase II is the Street Tree Master Plan, currently in progress.



*City of North Vancouver*

### STRATUM to the rescue

North Vancouver winters are gray. Unlike residents of many warmer cities to the south, people who live in North Vancouver are much more interested in sun than shade. According to Dave Hutch, project manager for the Street Tree Master Plan, “You can't just say ‘we want to plant trees because they look nice.’” To sell the need for street trees to the public, it was necessary to actually demonstrate objectively that trees provide environmental benefits.

The City put out a request for methodology to get data to support the goals and objectives of their Urban Forest Plan. The best proposal came from LANARC Consultants, who partnered with the Center for Urban Forest Research (Center) to provide that data. LANARC, a firm of

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landscape architects and environmental planners, was interested in exploring the role of the urban forest in environmental sustainability.

Their proposal was based on the use of the Center's STRATUM software. Designed to model the benefits and costs of urban street tree populations, this sophisticated computer program can be customized for specific regions. This is the first use in Canada.

## Customizing the software

STRATUM was customized specifically for the City of North Vancouver by Center staff. To estimate the street tree benefits, all the street trees were categorized by species and dbh (diameter at breast height) using the city's tree inventory. Major species were matched with species with similar characteristics from a study in Washington; minor species also were grouped by type. Local prices then were assigned to each benefit; electricity and gas savings, atmospheric CO<sub>2</sub> reductions, air quality improvement, stormwater runoff reductions, and property value increases. These were applied to each tree.

Costs of street tree management included expenditures for planting, pruning, tree and stump removal and disposal, pest and disease control, irrigation, repair/mitigation of infrastructure damage, litter/storm cleanup, litigation and settlements for tree-related claims, program administration, and inspection/answer service requests.

North Vancouver also has unique local issues that need to be considered in urban forest planning. The City has some amazing views of Burrard Inlet so any planting must be sensitive to avoid impact on those. While the number of street trees in North Vancouver is relatively small (5,350), the city is enclosed by a huge coniferous forest.

## Summary of street tree benefit:cost ratio for North Vancouver

- 5,350 street trees
- Average annual benefits: \$501,000/year; \$94 per tree/year
- Approximately \$25,000,000 in benefits over 50 years
- Annual costs: \$94,000 in 2003
- Benefit:Cost ratio: greater than 5:1

There is also a significant remnant native forest in a number of ravines and parks within the city. Adding the forest and park trees would easily increase the number of city trees to over 20,000. The STRATUM analysis was limited to the street trees but future phases of the City's Urban Forest Master Plan will include parks and woodlands.

## Benefits to the City

The analysis showed large benefits to the city from its urban forest. The largest came from increased property values while the second highest was from the role of the urban forest in stormwater management. In warmer climates, trees provide larger cooling benefits, but this is not such an important issue in North Vancouver where energy is still cheap. However, the report acknowledged that it is impossible to quantify all the benefits and costs from trees; rather, the analysis is a general accounting of the benefits of the urban forest.

STRATUM software was universally praised by those involved in the project. According to David Reid, principle at LANARC, "the experience of the Center staff and the STRATUM software were ideally suited for this project. Support from the staff was really quite excellent." The whole process went smoothly,

he reported. "A couple of minor problems that came up were identified early on and fixed within a day."

Dave Hutch also appreciated the consultant's use of STRATUM and the results of the benefit/cost analysis. "We learned we can plant trees with amazing benefits for the future."

## Lessons for the future

The North Vancouver Urban Forest Master Plan is in its early stages. The benefit data were presented to the City Council and a public outreach program is currently underway. A website questionnaire will soon provide information on what the public wants in their street tree program. Next will be the development of guiding principles and a 10-year master plan.

The STRATUM software also can be used for future planning. Darcy Bertram, city arborist, pointed out that as the tree inventory changes "you can continually run the software and see where you're going." Just plug in the new inventory data and the software generates the dollar value.

Bertram was enthusiastic about the numbers. "The software found

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## Actions being considered for North Vancouver street trees:

- Improve maintenance of street trees, especially pruning and disease management.
- Sustain large coniferous trees in the City, either by stewardship of existing trees or planting new ones.
- Design planting so that the mix of species and tree types is resilient to disease.
- Improve tree planting design for overhead utilities, views, and space available.
- Plan for tree replacement, recognizing that living trees will eventually die.
- Create a “tree bank” or other financial vehicle to allow a balance of funding among developers, landowners, and taxpayers.
- Pursue government assistance, in particular related to the regional environmental benefits of street trees.
- Encourage community funding and planting of street trees.
- Plant more street trees in the City.
- Manage the street tree population with a 20–50 year horizon.

benefits of a half million dollars a year with annual costs of under \$100,000. I don't think a lot of people realize the benefits of street trees. It's huge actually. If you have something worth that much you should be maintaining it at a higher level.”

For more information about the City of North Vancouver Street Tree Master Plan, including methodology and results of the STRATUM study, go to <http://www.lanarc.ca/cnvsurvey/>. —L.L. 

# How many trees will offset transport of the Olympic torch?

A few months ago we received an unusual request from the Athens Environmental Foundation: to calculate the number of trees it would take to offset the emissions from the transport of the Olympic torch through 32 cities on five continents and the Greek Islands – an entourage of 100-200 people. During the 3-month odyssey, the torch will travel 78,000 km (50,000 miles) before returning to Athens, Greece on August 13<sup>th</sup> for commencement of the Athens 2004 Olympic Games.

The entourage will accompany the torch throughout its journey to provide security and logistical support to the torchbearers. In each city, the torch will be transported from the airport to the staging area. Approximately 100 torchbearers will each run 0.4 km (0.25 mile) along the route, escorted by police motorcycles. Members of the entourage also will lead and follow the runners along the route.

## Study purpose

Our purpose was to estimate the emissions of nitrogen dioxide (NO<sub>2</sub>) and carbon dioxide (CO<sub>2</sub>) associated with transport of the torch during its global journey, and calculate the number of trees required to offset these emissions on an annual basis.

## What we found

Using numerical models, aircraft emissions were found to be most




important, totaling 3,017 metric tonnes (t) CO<sub>2</sub> and 17.6 t NO<sub>2</sub>. Aircraft cruising activities accounted for about 95% of the emissions. Motor vehicle emissions were estimated to total 116 t CO<sub>2</sub> and 0.04 t NO<sub>2</sub>. Planting 122,000 trees would produce average annual uptake of NO<sub>2</sub> equivalent to emissions associated with aircraft and motor vehicle transport of the Torch Relay entourage in 2004.

Average annual uptake of CO<sub>2</sub> would be 5,445 t, or 75% greater than the estimated release of 3,133 t. These average annual benefits are estimated to accrue

over a 40-year period after planting, assuming that 25% of the trees will die. If judiciously selected, properly planted, and regularly maintained, these trees could provide a host of other benefits, and serve as a living legacy to the Athens 2004 Olympic Games.

## Footnote

The Athens Environmental Foundation has joined with the International Society of Arboriculture to promote tree planting as way to improve local environments, strengthen community, and enhance quality of life. They have already received pledges for more than 4,000,000 trees to offset emissions from the transport of the torch, far exceeding the number required to offset the emissions. 

## Meet the new kid on the block

A new computer model (to be named soon) is what you get when you combine three Forest Service inventory, analysis, and forecasting tools: UrbForest Effects Model (UFORE), Mobile Community Tree Inventory (MCTI), and Street Tree Resource Analysis Tool for UrbForest Managers (STRATUM). UFORE and STRATUM analyze the urban forest at the ecosystem and street-tree levels, respectively, while MCTI performs street tree inventories and record management.

### Who is developing the model?

Forest Service partners in the initiative are the Northeast Research Station, the Northeast Center for Urban & Community Forestry, and the Pacific Southwest Research Station's Center for Urban Forest Research. Industry cooperators include Davey Resource Group and Bluejay Software.

### What will it do?

- Facilitate street tree inventory and management tracking
- Facilitate urban forest structure, function and value analyses for both on- and off-street resources
- Generate reports consisting of graphs, charts, and tables to justify funding, create program enthusiasm and investment, and promote sound decision making and management.

The suite of software products will provide communities with a comprehensive analysis of the costs, benefits, and management needs of their urban forest using integrated computer tools.

### Who should use the model?

The new model is being developed for municipal foresters, non-profit



tree advocates, commercial arborists, environmental consultants, planners, and anyone else with a vested interest in their community's urban forest. It will provide affordable, easy-to-implement inventory and analysis tools for those who might not otherwise have the money and technical means to inventory and analyze their community trees.

### What makes it different?

The new model is intended for users who desire a low-cost option before investing in commercial management-oriented tools. It is all-inclusive and adaptable to user needs—a single street tree, a neighborhood, or the entire urban forest can be analyzed. Users can use an existing inventory or conduct a sample or full inventory by configuring protocols for data collection on a Pocket PC. Pilot testing will begin this summer in Minneapolis, Minnesota, in cooperation with the Tree Trust. Release is expected in the fall of 2005.

### Where can I go for more information?


A new site is coming soon...

<http://www.itreetools.com>.

Until then, visit:

UFORE - <http://www.ufore.org/extension>

MCTI - <http://www.umass.edu/urban/tree/mcti>

STRATUM - <http://cufp.ucdavis.edu/stratum.asp> 

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