

Understanding Washington, DC's Urban Forest through GIS

by Holli Howard, Director of Data Gathering and Analysis, Casey Trees

With a mission to restore, enhance, and protect the tree canopy of Washington, DC, Casey Trees has a set of ambitious goals, and to achieve them, we must use the most efficient tools available. One of those tools is Geographic Information Systems, or GIS.

Since 2001, Casey Trees has used GIS:

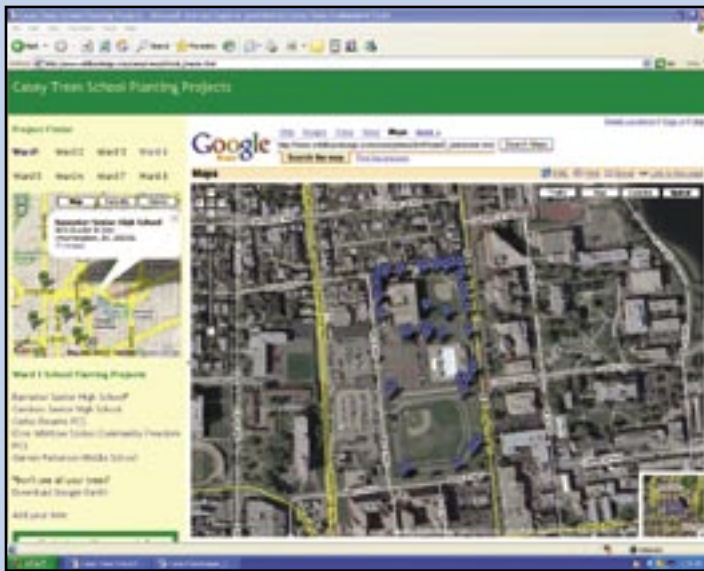
- for inventories and surveys including neighborhood analysis
- to share information with District and federal government partners, citizens, business improvement districts, and other organizations

- for canopy analysis to set objectives for programs and strategic planning
- to measure success and track performance

Established programs that are supported by GIS, using the ESRI ArcGIS suite, include the Community Tree Planting program, GreenTech education program, and the Casey Trees interactive Tree Map. Recently we have begun looking at the use of GIS in our long-range strategic planning—in particular, analyzing and setting tree canopy goals district-wide. The following highlights these efforts.



Using GIS to Find Street Tree Canopy Opportunity



DC Green Infrastructure Beta Site

Inventory

In 2001, the street tree inventory used by the District’s Urban Forestry Administration (UFA) was DOS-based, over 20-years-old, and very difficult to use and update. Casey Trees’ first major activity therefore was to develop a state-of-the-art inventory of DC’s street trees to provide the city updated data in a more useable format. This updated street tree data set would form the baseline for setting goals and objectives, developing methods, and implementing tree management programs.

The UFA has since taken this data and converted it to fit their own GIS system and data collection methods. By maintaining an inventory of the city’s trees, both Casey Trees and UFA have an efficient management system that helps to coordinate activities between their organizations and other city agencies. With a reliable, comprehensive data set, the analyses that can be performed are extensive. The i-Tree toolset is an excellent example of employing the data available. We can see trends in the street tree data that we would have only been able to estimate a few short years ago.

Based on the 2002 inventory findings, the City set an objective to fill the 23,000 empty tree spaces in ten years. There are essential but strict guidelines for planting street trees in DC based on safety, tree health, and civic character. Historically, trees were planted by species by block or avenue. Having the GIS inventory of the tree box locations and attributes—including tree species, overhead wires, and tree box size—helps identify planting opportunities. That cuts back on time and effort spent in the field.

The City is well on its way to fulfilling its street tree planting goal ahead of schedule. With UFA focusing on street trees, Casey Trees has turned its efforts towards the District schools and parks, private partnerships, and community green-

ing efforts—using the assistance of GIS. However, we continue to use street tree data for research and analysis.

Analysis from the street tree inventory data compares tree box size and tree size (DBH) to determine which tree species are growing well in smaller tree spaces and in the paved conditions of DC’s downtown area. Preliminary findings indicate that many downtown trees are larger than would be expected based on literature predictions of tree size based on soil volume. With further study, we expect to find that some larger trees may have found their way outside the confines of the tree box.

Sharing Information

As we all know, planting the tree is the easy part – education and stewardship of the newly planted trees to limit mortality is the more difficult piece of any successful urban forestry program. Educating the community on the benefits of trees and in turn, creating advocates for the urban forest can only make the job easier. Again, we’ve found that GIS can play a critical role in meeting these needs.

Throughout the school year, our GreenTech program provides DC high school students with the knowledge to become tree advocates. The students use GIS to inventory their school’s trees to learn the tree’s environmental and economic value as well as to locate planting opportunities. After students have mapped their school grounds and learned about the importance of its greenspace and how to utilize a GIS, they finish the year by planting trees and learning how to care for them.

Elm, American (ID: CA-0668-100)		
Scientific Name: <i>Ulmus americana</i>		Tree Value: \$ 4,584
Condition Rating: Condition 1 - 2		
Height: 40 feet	Diameter at Breast Height: 17 inches	Crown Radius: 20 feet
Leaf Area: 490.51 m ²	Leaf Biomass: 33.41 kg	Leaf Area Index: 4.20
SITE INFORMATION:		
Overhead Wires: None	Tree Grate: None	
Curb: Permanent	Sidewalk: Permanent	Tree Box: Potential Plant
TREE CONDITION INFORMATION: Condition 1 - 2		
Tree has <5% deadwood and is leaning <5 degrees.		
Foliage is normal.		
Wounds/Cavity = <10% circumference. No decay in wounds/cavity.		
No borer holes.		
Cracks are absent.		
Stem conks are absent and root conks are absent.		
Stem girdling roots = <15% stem circumference.		
ENVIRONMENTAL AND ECONOMIC VALUE:		
Carbon Storage:	371.72 kg	
Carbon Sequestration:	12.71 kg/year	
Carbon Monoxide Removed:	50.069 g/year	
Ozone Removed:	435.950 g/year	
Nitrogen Oxide Removed:	145.232 g/year	
Particulate Matter Removed:	305.458 g/year	
Sulfur Dioxide Removed:	144.741 g/year	
Total Pollution Removed:	\$ 5,5864 /year	
Tree Value:	\$ 4,584	

Casey Trees Tree Map: Displays UFORE Findings



Arbor Day 2007: Wilkinson Elementary School:
Paul Egleton and Mike Alonzo, Casey Trees Staff



There are several different ways to go about the greening effort, but the UTC method efficiently breaks the process into three steps: understand the existing canopy, locate the opportunity, then strategize to establish what is realistic within that opportunity. These methods have served as a starting point for discussions with key agencies and partners.

To ensure setting tree cover goals, we must answer the question, *what will increased canopy cover provide?* A significant part of that is stormwater runoff reductions. In April, 2007, Casey Trees released the results of the Green Build Out Model, a research project between Casey Trees and LimnoTech engineering firm, under an Environmental Protection Agency Water Quality Cooperative Agreement. The Model is a planning tool that quantifies stormwater benefits of trees and green roofs and calculates potential reductions in stormwater runoff within the District's separate and combined sewer systems. The Model integrates GIS land cover data in a similar way as the UTC model.

However, because DC has such extensive street tree and impervious surface data (provided by the District's GIS department, DCGIS) a more detailed analysis was done to model the impacts of street trees over impervious streetscapes. The methods are based on models and data for the District of Columbia though easily transferable to other municipalities interested in quantifying the relationship between tree canopy and stormwater runoff.

Next Steps

Setting and implementing the Urban Tree Canopy (UTC) goals for the District will be a priority for Casey Trees in the coming years. Along with this, Casey Trees will focus on long term organizational goal setting. How can we track our progress in fulfilling our mission, and how can we work with partner agencies to ensure the City is able to move the greening initiative forward? By using GIS technologies, Casey Trees has made a significant impact, not only in terms of collecting and sharing important data for our organization and our partners, but also in raising public awareness about the importance of trees in the urban forest. 🌿

For more information about Casey Trees and its programs, please visit www.caseytrees.org or contact Holli Howard at hhoward@caseytrees.org or (202) 349-1905.

In March 2004, Casey Trees launched its interactive Tree Map (www.caseytrees.org), accessible to the general public and targeted at DC residents. The site allows anyone to find the street tree in front of their home or apartment (or anywhere else in the city) and view information about that tree including its species, size, and the benefits it provides. It also shows current data on all of the Casey Trees plantings. The environmental and economic benefits are taken from i-Tree/UFORE, and the site is programmed by the Community Mapping Assistance Project (CMAP) in NYC modeled after Open Accessible Space Information System (www.oasisnyc.net).

An innovation we are currently working on uses Google Earth to allow anyone to map out his or her own greening initiative. Residents can identify and map where they've planted a tree, established a garden, cut down invasive vines, or any other community-based greening activity in the city. We hope this site will attract and foster more community activities in the district by allowing advocates to showcase their work.

Goal Setting and Analysis

Urban Tree Canopy (UTC) goals and Forest Opportunity Spectrum (FOS) models are used widely in the Mid-Atlantic region, particularly in the Chesapeake Bay Watershed. These models enable jurisdictions of all sizes to set tree canopy goals and facilitate greening strategies on a broad scale. Casey Trees has begun working with partner organizations to set similar tree canopy goals for Washington, DC, and we've begun this process by analyzing the existing canopy and what opportunities there might be to increase tree canopy.