Our Urban Forest

A REPORT ON TREES & COMMUNITY COLLABORATION IN NORTHERN NEW CASTLE COUNTY AND WILMINGTON, DELAWARE

A VISION FOR MOVING FORWARD
In pre-colonial days, Delaware was covered with a dense canopy of trees. As our population grew, this rich forest of maple, oak, beech, and other varieties supported industry, agriculture and the environment. Eventually these mature forests were cleared. The mix of native trees and introduced species that now exists in our cities, towns or suburbs is known as our urban forest.

Today urban forests across the country are in decline. Trees are lost to new construction as well as to factors such as inadequate tree care and replacement. Over the last twenty years, tree cover (also known as tree canopy) in urban areas east of the Mississippi River has decreased by 30%, while the footprint of urban areas has increased by 20%.

Delaware's urban tree canopy is well below the national average. The tree cover goal recommended by the nonprofit American Forests, for metropolitan areas east of the Mississippi River, is 40%. The national average is 23%. Since 1990, urban land in Delaware has increased by 14%, leaving only 16% tree canopy cover in Wilmington and 19% in the greater New Castle County metropolitan area.

Urban forests provide measurable environmental, societal and economic benefits. A decline in the urban forest eventually causes a significant increase in energy costs and requires building new infrastructure for air and water management. By contrast, maintaining a robust tree canopy provides more than 2.5 times the return on investment, and – unlike other city infrastructure – benefits provided by a properly managed urban forest increase over time.
RESEARCHING THE DECLINE IN OUR URBAN FOREST

In 2004 the Delaware Center for Horticulture initiated a two-year study to assess the state of the urban forest, in an area encompassing Wilmington, Newark, Elsmere, New Castle and Newport.

The study used the Urban Forest Effects Model (UFORE). It was designed by the U.S. Forest Service, and has been employed to quantify urban forest structure and urban forest effects in numerous cities around the world.

This map illustrates the scope of the study area. Note that some of the data in this report refers to the NCC Metropolitan Corridor as a whole (including Wilmington) and some information relates only to the City of Wilmington.

The UFORE methodology analyzes three major aspects of urban forest:

- **Structure** – the diversity of tree species, density of trees, forest health, etc.
- **Functions** – services that trees provide, such as energy conservation and air pollution removal.
- **Value** – economic benefits of the forest for pollution removal, carbon storage, and energy savings, as well as the estimated worth of each tree that exists in the landscape.

Results of the study are outlined in this report, providing insight for management steps that will increase the environmental, economic, and social benefits of northern Delaware’s urban forest. This and other research (see pp. 27–28) provides the foundation for the facts and statistics quoted.
BUILDING A COALITION TO IMPROVE OUR URBAN FOREST

In 2005 the U.S. Forest Service awarded the Delaware Center for Horticulture a grant to create a coalition-building model for urban forest sustainability and comprehensive planning. The Delaware Department of Natural Resources & Environmental Control (DNREC) also provided substantial support for this project through Community Environmental Penalty Funds.

By 2006 the Trees for Wilmington coalition was up and running. This group is composed of a variety of stakeholders, including city residents, policy-makers, government agency representatives, and municipal employees. The focus of the coalition is to improve the urban forest in Wilmington and promote more sustainable management techniques. The formation, lessons learned, and future goals of Trees for Wilmington offer a potential model for creating similar initiatives in other communities.

In 2007 the Delaware Center for Horticulture, in partnership with the City of Wilmington, received a major grant from the Home Depot Foundation to support the work of Trees for Wilmington, and to improve the City’s urban forest resources. This grant also included recognition of Wilmington as the National Winner in the Small City Category of “Awards of Excellence for Community Trees and Urban Forestry.” The award and the grant were presented at the U.S. Conference of Mayors in Los Angeles.

PURPOSE OF THIS REPORT

This report describes the process of building a broad-based coalition to support urban trees, introduces research on the status of our urban forest and initiatives to improve it, and outlines next steps and a vision for the future.

This report will:

• Explain why trees are necessary infrastructure for healthy communities, and highlight the environmental, social, and economic benefits of the urban forest.

• Summarize research on the current state of the urban forest and urban forest management in the New Castle County Metro Corridor (NCCMC) and the City of Wilmington.

• Describe the process that created Trees for Wilmington and provide tips for other municipalities interested in starting an urban forest initiative.

• Serve as a resource for citizens, decision-makers, government officials, agencies, and businesses, to make the case for the urban forest and its role in greener, more livable cities.

• Highlight the need for a comprehensive, sustainable urban forest, and make general recommendations to achieve this goal.
Trees enhance our quality of life in fundamental ways. They are good for the environment, good for business, good for health, and ultimately good for people. Urban forests provide important services and reduce urban infrastructure costs. The benefits of a healthy urban forest far outweigh the costs of tree planting and maintenance. Trees are essential to sustaining a strong local economy and minimizing the negative impacts of suburban sprawl.

Note: Unless otherwise noted, the sources of the statistics referenced are the Delaware UFORE study and STRATUM analysis. Additional statistics are drawn from research that has been conducted around the country. For a complete list of sources, see References, page 27.

Benefits of a well-managed urban forest

**Water** – Controls runoff and flooding, reducing stormwater facility costs and water pollution

**Air** – Removes air pollution that causes human health concerns and global climate change

**Energy** – Moderates temperatures and reduces energy consumption for heating and cooling

**Economy** – Enhances community economic viability and increases property values

**Society** – Improves quality of life by reducing stress levels, enhancing social cohesion, reducing crime and decreasing demand for social services

**WATER**

Trees have a positive effect on water quality. Their roots hold soil in place, and their canopies prevent erosion by slowing the force of falling raindrops. Trees intercept and store rainwater, delaying runoff volume, and reducing peak flows and flooding. Tree root growth and decomposition improve compacted soils, enabling the ground to absorb more water and replenish groundwater.

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**Trees can improve stormwater management more cost-effectively than traditional engineering solutions.**

Stormwater runoff from impervious surfaces such as parking lots, streets and roofs has an enormous negative impact on water quality. Removing asphalt and installing an alternative like grass or gravel is the most effective stormwater management and groundwater recharge technique. When that is not practical, planting trees is always an excellent option. Planting and maintaining healthy trees over impervious surfaces slows runoff and helps to prevent polluted water from reaching our streams and rivers. Local and nationwide studies demonstrate that trees can improve stormwater management more cost-effectively than traditional engineering solutions.
New Castle County Metro Corridor

The Christina River Basin encompasses much of the New Castle County Metropolitan Corridor (NCCMC), including the Brandywine and Christina Rivers and the Red Clay and White Clay Creeks. The watershed is an important resource for New Castle County and is the direct source of drinking water for more than 400,000 people. The NCCMC is highly urbanized, with 25% of the land covered in impervious surface (Nowak, Greenfield, et al., 2009). This level of impervious surface puts an enormous strain on the watershed.

Wilmington

More than half of the land in the City of Wilmington is covered by impervious surface, creating vast amounts of fast-moving water during storms. The city is served by combined sewers that carry raw sewage and stormwater in the same pipe. These sewers are designed to overflow when they reach capacity during heavy rain. Combined sewer overflows occur in more than 40 separate locations with varying frequencies, polluting local rivers and streams with bacteria and other contaminants. Wilmington is actively working to minimize the volume and number of overflow points and mitigate their effects.

Minimizing the amount of stormwater entering the system is essential for reducing combined sewer overflows. Research in Wilmington shows that increasing the tree cover over impervious surface is the most effective way to reduce the flow of sewage into our water supply, especially during smaller rainstorms. Any water that flows into underground pipes that does not originate from toilets, sinks or industrial wastewater is called non-sanitary flow. Currently, more than 80% of the non-sanitary flow through Wilmington’s combined sewers is caused by stormwater runoff from impervious surfaces.

The good news is that planting a relatively small number of trees in the right places can have a dramatic impact on stormwater runoff. An analysis of Rattlesnake Run, a stream corridor running through the northwest part of the City, showed that existing tree cover is already
reducing non-sanitary flow through the combined sewer pipes in this area. Computer simulations estimate that increasing the tree cover by 25% – but ensuring that all of these new trees are planted in places that will shade paved surfaces – would reduce the water in the storm drains that flow into Rattlesnake Run by 48%.

AIR

Increasing the urban tree canopy can dramatically improve air quality. Trees absorb pollutants and intercept particulates such as dust, ash, pollen and smoke, while releasing oxygen into the air. Trees shade asphalt surfaces and parked cars, significantly reducing hydrocarbon emissions, and moderate air temperatures through shade and evaporation. They also reduce power plant emissions by decreasing energy needs in buildings.

Smog is created by chemical reactions between nitrogen, oxygen and volatile organic compounds (VOCs) in sunlight. Sources of VOCs include vehicle exhaust, gasoline vapors, solvents and emissions from industrial facilities. High summer temperatures increase the rate of this reaction and lead to ozone alert days. Automobile exhaust is a well-known source of air pollution. However, many people do not realize that plastics and vinyl in parked cars, unshaded and heated in the sun, are the source of 16% of hydrocarbon emissions, one of the principal components of smog (McPherson, et al., 2002).

As trees grow, they sequester more carbon in their trunks, branches, leaves, and roots. One hundred mature trees can remove 5 tons of carbon dioxide, 1,000 pounds of pollutants, 400 pounds of ozone and 300 pounds of particulates per year, including the compounds that cause acid rain. An acre of trees absorbs the amount of carbon produced by driving a car for 26,000 miles.

Large, healthy shade trees have the greatest potential for improving air quality and slowing global climate change.
# Annual Carbon and Pollution Removal Values

*Note:* Carbon storage refers to the amount of carbon currently held inside Delaware’s trees. Carbon sequestration measures how much new carbon is absorbed each year as trees grow.

## New Castle County Metro Corridor

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of trees</td>
<td>882,700</td>
</tr>
<tr>
<td>Amount of carbon stored by the urban forest in NCCMC</td>
<td>285,000 tons</td>
</tr>
<tr>
<td>Amount of carbon sequestered by new tree growth each year</td>
<td>10,000 tons</td>
</tr>
<tr>
<td>Total pollution removed by trees and shrubs in NCCMC</td>
<td>295 tons</td>
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<tr>
<td>Value of these pollution removal services</td>
<td>$1.9 million</td>
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<tr>
<td>Ratio of pollution removal value of trees versus shrubs</td>
<td>1.6 times higher</td>
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</table>

## Wilmington

<table>
<thead>
<tr>
<th>Metric</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of trees</td>
<td>136,000</td>
</tr>
<tr>
<td>Amount of carbon stored by the urban forest in Wilmington</td>
<td>46,000 tons</td>
</tr>
<tr>
<td>Amount of carbon sequestered by new tree growth each year</td>
<td>1,300 tons</td>
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<tr>
<td>Total pollution removed by trees and shrubs in Wilmington</td>
<td>45 tons</td>
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<tr>
<td>Value of these pollution removal services</td>
<td>$291,000</td>
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<tr>
<td>Ratio of pollution removal value of trees versus shrubs</td>
<td>5.2 times higher</td>
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</tbody>
</table>

## Services that trees provide annually to the City of Wilmington as of 2006:

- **Carbon storage equivalent to:**
  - Amount of carbon emitted in city in 38 days, or
  - Annual carbon emissions from 28,000 automobiles, or
  - Annual carbon emissions from 14,000 single-family houses

- **Nitrogen dioxide removal equivalent to:**
  - Annual nitrogen dioxide emissions from 90 automobiles, or
  - Annual nitrogen dioxide emissions from 60 single-family houses

- **Sulfur dioxide removal equivalent to:**
  - Annual sulfur dioxide emissions from 7,100 automobiles, or
  - Annual sulfur dioxide emissions from 100 single-family houses

- **Fine particulate matter removal equivalent to:**
  - Annual emissions from 31,200 automobiles, or
  - Annual emissions from 3,000 single-family houses

- **Carbon sequestration in new tree growth each year equivalent to:**
  - Amount of carbon emitted in city in 1.1 days, or
  - Annual carbon emissions from 800 automobiles, or
  - Annual carbon emissions from 400 single-family homes
ENERGY

Large and strategically placed trees in urban areas can effectively reduce energy costs and demands. Just three well-placed trees around a home can decrease utility bills by 50%, lower air conditioning bills by up to 30% and can save up to 25% on winter heating costs (SDDA, 2008). Neighborhoods with well-shaded streets can be up to 10 degrees cooler than neighborhoods without street trees.

In the summer, trees affect energy consumption by shading buildings, allowing air conditioning units to run more efficiently and providing evaporative cooling. Shade from large trees is more effective at cooling a building than window blinds because trees block sunlight that may heat a building and reduce air temperatures around the building. West-shading plants have the greatest ability to reduce cooling needs, especially during peak energy demands in the afternoon.

The location of the trees, their size, and distance from the building affects the impact on energy use. Generally, trees affect building energy use when they are greater than 20 feet tall and within 60 feet of a building. Deciduous trees shading the southwestern sides of buildings in the summer will drop their leaves and allow the sun to provide warmth in the winter. Strategically placed trees also reduce winter heating costs by blocking cold winds.

ANNUAL REDUCTIONS IN COSTS AND POWER PLANT EMISSIONS PROVIDED BY THE URBAN FOREST

New Castle County Metro Corridor

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<table>
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<tr>
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<tbody>
<tr>
<td>Estimated savings in residential building energy costs</td>
<td>$403,000*</td>
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<tr>
<td>Reduction in carbon emissions from power plants</td>
<td>1,020 tons</td>
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<tr>
<td>Reduction in pollution cleanup costs</td>
<td>$21,000</td>
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</table>

Wilmington

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<tr>
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<tbody>
<tr>
<td>Estimated savings in residential building energy costs</td>
<td>$183,000*</td>
</tr>
<tr>
<td>Reduction in carbon emissions from power plants</td>
<td>475 tons</td>
</tr>
<tr>
<td>Reduction in pollution cleanup costs</td>
<td>$9,800</td>
</tr>
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*Calculations based on 2007 energy costs
Why large trees are better than smaller trees and shrubs

- Exponentially greater shade and cooling of air
- Greater impact on energy conservation – especially trees taller than 20 feet
- Better at mitigating urban heat island effects
- More effective at reducing costs of stormwater management, water treatment, and street maintenance
- Superior improvements in air and soil quality
- Mature large trees deliver an annual net benefit two to six times greater than mature small trees

ECONOMY

The economic benefits of a well-managed urban forest are well documented. Some communities consider trees to be part of the basic infrastructure of cities – as important as streets, sewer and electricity. Trees increase property values and attract business and tourism. They reduce the public dollars spent on energy for cooling and heating, stormwater management and air quality controls.

Trees and landscaping have a positive effect on real estate values. Properties adjacent to parks can have property values 8 to 20% higher than comparable properties elsewhere (ICLEI, 2006). Even basic improvements such as hedges along parking lots have been shown to add more than 25% to the value of a nearby home. In metropolitan areas, the economic impact can be dramatic. The value of condos in New York City that look out over the green space of Central Park is significantly higher than that of those with only a view of other buildings.

Properties with trees are valued at 5 to 15% higher than comparable properties without trees (Alexander, 2008).

Large trees are especially valuable to homeowners and municipalities. Each large front yard tree adds about 1% to a home’s resale value and an estimated increase of $100,000 in property tax values (ICLEI, 2006). Rental rates for commercial properties are about 7% higher in areas with quality landscaping and trees (Laverne, et al., 2003). Developers can maximize their final sale price by retaining existing trees and planting trees following construction.

A well-managed urban forest also has a measurable impact on economic development. In business districts with trees consumers are willing to pay 11% more for goods than in treeless districts (ICLEI, 2006).
Studies have shown that consumers will shop more often and longer in downtown business districts with street trees than in districts without landscaping.

Shoppers seek out shaded parking spots. Cars parked in the shade of a tree will have interior temperatures 20 to 30 degrees cooler than a vehicle parked in the sun (McPherson, et al., 2002). Studies have shown that consumers are willing to pay more for parking with shade and give 30% higher ratings to the quality of goods sold in businesses on tree-lined commercial streets (ICLEI, 2006).

Municipalities with street trees can save money on paving maintenance. Asphalt shaded by trees has a significantly extended life span. Repaving of shaded streets can be deferred 10 to 25 years beyond streets in full sun (ICLEI, 2006). Conversely, streets with little or no shade need to be re-paved twice as often as those with 30% tree cover.

**Structural value (replacement cost) of our urban forest**

The cost of replacing each tree in an urban forest with a similar tree is known as its structural value. Tree loss has a direct economic impact, analogous to the replacement or repair of any element of urban infrastructure. However, the services and economic benefits of large trees are exponentially greater than saplings or shrubs. Large trees must be replaced by a greater than 1:1 ratio to maintain the value of the urban forest.

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**Consumers will shop more often and longer in business districts with street trees, increasing sales by 11%.**

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**New Castle County Metro Corridor**

The structural value of the urban forest in the New Castle County Metro Corridor is estimated at $1.2 billion.

**Wilmington**

The structural value of all the trees in the City of Wilmington is $166 million.

The cost of replacing our urban trees would be huge, even though Delaware’s urban tree canopy cover is well below the national average of 23%. American Forest’s recommended tree cover for our area is 40% (American Forests, 2008b). Increasing urbanization since 1990 has resulted in 19% tree canopy cover in the greater New Castle County metropolitan area and only 16% in Wilmington (Nowak, Greenfield, et al., 2009).
Analyzing Wilmington's budget priorities

A huge discrepancy exists between Wilmington's annual investment in water and sewer relative to its investment in urban forestry. Although research shows that trees can improve stormwater management more cost-effectively than traditional engineering solutions, the ratio of expenditures between these two sections of the budget is 400:1.

In FY06 and FY07, water and sewer expenditures constituted a fourth of the total Wilmington operations budget. During the same time period, urban forest expenditures represented barely 0.1% – one tenth of one percent. In fact, this portion of the Department of Parks & Recreation budget was actually reduced by more than $10,000 in 2007.

Wilmington's tree canopy is shrinking. A history of flat allocations for maintaining trees and limited money for planting trees in the City budget has compounded this situation. At a time when city leaders are seeking ways to improve stormwater management while still reducing total expenditures, trees can offer a huge return on investment.

### BUDGETED OPERATIONS EXPENDITURES FOR THE CITY OF WILMINGTON – FY06 AND FY07

<table>
<thead>
<tr>
<th></th>
<th>FY06</th>
<th>FY07</th>
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<tbody>
<tr>
<td>Total Budgeted Operations Expenditures</td>
<td>$161,974,906</td>
<td>$184,796,578</td>
</tr>
<tr>
<td>Water &amp; Sewer</td>
<td>$41,862,327</td>
<td>$45,663,489</td>
</tr>
<tr>
<td>Percentage of total budget</td>
<td>25.8%</td>
<td>24.7%</td>
</tr>
<tr>
<td>Urban Forestry</td>
<td>$185,704</td>
<td>$175,202</td>
</tr>
<tr>
<td>Percentage of total budget</td>
<td>0.1%</td>
<td>0.1%</td>
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SOCIETY & PUBLIC HEALTH

A healthy natural environment can have profound positive effects on society. Although the UFORE study did not specifically measure the social benefits of Delaware's urban forest, research has consistently shown that cities with a reduced demand for social services are also the ones that have the most tree coverage. Some of the direct social benefits of trees cited in these studies include: reduced noise levels; reduced human stress levels; stronger neighborhood ties; aesthetic improvements; enhanced traffic-calming measures; lower levels of violence, crime and aggression; and quicker hospital recoveries.

Research by scientists at the University of Illinois showed that residents living in greener surroundings report lower levels of fear, fewer incivilities and less violent behavior (Kuo and Sullivan, 2001b). Greener common areas facilitate stronger social ties by providing opportunities for people to interact and by promoting a greater sense of community. Those living close to green spaces enjoy more social activities, have more visitors, and know more of their neighbors by name.
Some people may be concerned that woods and underbrush create hiding places, allowing criminals to conceal illicit activity. However, research shows that inner city vegetation that is managed for visibility actually promotes safety. Widely spaced, high-canopy trees, flowers and low-growing shrubs do not shield crime or create the type of surroundings that promote fear.

**Crime rates decrease in areas with more greenery. Buildings with high levels of trees and landscaping have 52% fewer property and violent crimes than apartment buildings with little or no vegetation.**

Studies also show that trees have a role in calming traffic (reducing the speed and intensity of vehicles). Street trees near the road edge give the sensation of a narrower space, which encourages safer, slower driving speeds. They improve neighborhood environments by blocking winds, reducing dust and absorbing up to 50% of noise (ICLEI, 2006). Trees can screen views of harsh urban landscapes and herald seasonal changes in the city.

Children benefit from being around trees. Research has shown that children who have a view of greenery in their lives perform better in school (Taylor, et al., 2002). Increased exposure to nature enhances their ability to follow directions and relieves the symptoms of attention deficit/hyperactivity disorder (AD/HD), resulting in better concentration (Kuo and Taylor, 2004).

Trees and green space improve public health. Shade from trees reduces exposure to ultraviolet light, lowering the risk of skin cancer and cataracts. Hospital patients with a view of trees need less medication and have faster recovery times following surgery (Ulrich, 1984). People with views of nature from their desks report 23% fewer instances of illness (Home Depot Foundation, 2007). Employees who can see trees from their workspace are measurably less frustrated, more patient, have greater enthusiasm for their job, better health, and report an overall higher life satisfaction than those without views of nature.

**Aesthetic value of Wilmington’s trees**

Trees also have a measurable aesthetic value based on tangible and intangible increases to property values. A methodology developed by the U.S. Forest Service (STRATUM) shows that each street tree and park tree in Wilmington has an average aesthetic value of $37, resulting in $509,975 added to property values in the city. The analysis also calculates total net benefits by adding the values of energy savings, carbon dioxide removal, air quality improvements, stormwater mitigation and aesthetics, and subtracting the costs associated with tree maintenance. Total net benefits received from Wilmington’s public trees each year are worth $679,820.
In 2004 the Delaware Center for Horticulture (DCH) – with support from the Delaware Forest Service, the City of Wilmington and New Castle County – initiated a study to assess the current state of trees in an area encompassing Wilmington, Newark, Elsmere, New Castle and Newport.

The U.S. Forest Service has developed a suite of computer-based tools called i-Tree that has been used by cities around the world to quantify numerous aspects of urban forests including composition, benefits and value. The data collection and methodologies being used to study northern New Castle County include UFORE (Urban Forest Effects) and STRATUM (Street Tree Assessment Tool for Urban Forest Managers). The scope of this UFORE study included all trees in Wilmington and the New Castle County Metro Corridor (NCCMC). The scope of the STRATUM analysis was limited to public trees (i.e. street trees and city park trees) within the City of Wilmington. Results from the UFORE study and STRATUM inventory analysis provide insight towards the management steps that will increase the environmental, economic, and social benefits of our urban forest. Complete methods and findings are detailed in the official U.S. Forest Service report, which will be posted on the Delaware Center for Horticulture website, dehort.org.

Key findings from research in northern Delaware

Municipalities that manage their urban forest for growth and sustainability will see an exponential return on investment over time. The greatest benefits will be realized if urban forests are managed for the following specific factors: increased numbers of trees, a higher percentage of tree canopy, greater diversity of native species, minimal invasive species, and larger shade trees.

One of the most sobering discoveries from the research is the extent to which Wilmington is losing its tree canopy. Street trees in particular have a relatively short life span because of the urban stresses they endure such as reflected heat and compacted soils. They are also more vulnerable to diseases and insect infestations that attack specific species, because our street tree population is composed largely of just a few types. Even when a large tree dies naturally and is replaced, it still takes many years for that young sapling to generate an equal value in services that had been provided by its predecessor.
Fortunately, approximately 70% of trees within the NCCMC are native to Delaware. Native trees tend to be healthier, better adapted and less invasive than non-natives. However, there is little diversity. The 10 most common tree species in the NCCMC account for 64% of all trees. The top three species are red maple, sweet gum, and black cherry. All three are native species, but they make up 44% of the total trees. And these trees tend to be small: smaller trees, with a diameter of less than six inches, account for almost half of the entire tree population.

Only 19% of the NCCMC is covered by a canopy of trees. This is below the national average in eastern cities of 23% – and well below the 40% tree cover recommended by American Forests, a national nonprofit organization. By comparison, even New York City (21%) has more tree cover than New Castle County, and Washington, D.C., is significantly better than either metropolitan area with almost 30% tree canopy cover.

Since 1990, urban land in Delaware has increased by 14%, leaving only 16% tree canopy cover in Wilmington (Nowak, Hoehn, et al., 2009). Compared to the NCCMC, the City also has a higher percentage of small trees with trunk diameters of less than six inches.

As is the case with many cities, residential landscaping efforts in Wilmington have created a greater diversity of species than exists in the surrounding NCCMC area, but the majority of trees are now non-natives. And despite this increased diversity, the 10 most common species in Wilmington account for 70% of all trees. The top three tree species in Wilmington – Norway maple, northern white cedar, and ailanthus (also known as tree-of-heaven) – make up 41% of the entire tree population and occur primarily in areas that receive minimal maintenance. Two of these trees (Norway maple and tree-of-heaven) are non-native, invasive species.
Why a diversity of native species is important

A generation ago, many communities were devastated when chestnut blight and Dutch elm disease destroyed millions of stately street trees. Today, the emerald ash borer has killed more than 40 million ash trees in southeastern Michigan alone, with tens of millions more lost in Ohio, Illinois, Indiana, Pennsylvania, Maryland, West Virginia, Missouri, Wisconsin and Virginia. This growing infestation threatens to decimate ash trees throughout North America.

Healthy and resilient urban forests are managed for diversity and a high percentage of native trees. Native species are well adapted to the local climate and soils and require minimal water, fertilizer or mulching. They also help restore a fragmented ecosystem by offering habitat for migratory birds and other wildlife.

Urban forests are often more diverse than surrounding native landscapes, because they contain a mix of tree species that existed prior to the development of the city and the introduction of exotic species. Although increased tree diversity can minimize the overall impact of destruction by a species-specific pest, some exotic species can also out-compete and displace native trees. Invasive, non-native trees such as Norway maple reproduce quickly and can take over open space areas, creating a monoculture canopy that is once again vulnerable to a species-specific disease.
Wilmington is Delaware’s largest city. With a population of 73,000, it is the heart of a much larger metropolitan area stretching across New Castle County. One of the key responsibilities of municipal government is maintaining and improving the infrastructure – the physical framework of the city – for the welfare of its residents.

Urban infrastructure can be divided into green and gray. Green infrastructure refers to areas covered with trees, shrubs and grass; gray infrastructure includes buildings, roads, utilities and parking lots. Green infrastructure is porous, allowing rain to soak into soil, which recharges groundwater and naturally filters pollutants before entering rivers. Gray infrastructure is impervious, accelerating water runoff, which must be managed and cleaned before entering rivers.

**Greening the City**

Many communities around the country have implemented green infrastructure initiatives as a strategy for urban revitalization. In recent years, the Mayor and City Council of Wilmington have taken significant steps to improve the city’s environmental quality and raise public awareness about greening issues. In 1999 City Council convened an advisory group to recommend initiatives for enhancing the attractiveness of the urban landscape. By 2004 the Wilmington Beautification Commission (WBC) was chartered by official legislation.

Led by the Delaware Center for Horticulture, WBC membership includes representatives from City Council, government agencies, civic associations and a host of other environmental groups. In addition to a growing number of city parks improvements, the WBC launched “Think Green for a Change,” a campaign encouraging residents and businesses to make environmentally friendly lifestyle and development choices.

Wilmington has also committed itself to reducing the city government’s energy footprint. Stated goals include lowering greenhouse gas (GHG) emissions 20% from current levels by 2020, and meeting the Kyoto Protocol target of a 7% reduction in GHG emissions from 1990 levels by 2012. Green infrastructure investments and a sustainable urban forest will be crucial for Wilmington to successfully meet these ambitious goals.

**A model of community collaboration**

Building on this green momentum, the Delaware Center for Horticulture created Trees for Wilmington in 2006 as a working group of the WBC. Trees for Wilmington (TFW) is composed of a variety of stakeholders, including city residents, policy-makers, government agency representatives and municipal employees. Based on a framework with proven success in other cities, the focus of the TFW coalition is improving the urban forest in Wilmington and promoting more sustainable management techniques.

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**Trees for Wilmington**

**MISSION:** Engage city residents, public partners, local government and businesses in the shared responsibility of city tree planting, care and preservation.

**VISION:** Coordinated tree management and planning will enhance the regional quality of life by promoting the aesthetic, environmental, and social benefits of trees.
The Trees for Wilmington coalition got off to a strong start, because it emerged from the existing Wilmington Beautification Commission. The City Council's formal resolution of support that was received in 2007, a year after the coalition was up and running, also helped to legitimize TFW initiatives.

Probably the single most important factor in the success of TFW has been a central entity willing to lead the project – in this case, the Delaware Center for Horticulture. DCH assigned interns and staff members who were able to create supporting documents, handle administrative duties, conduct community outreach, identify skills within coalition members, and hire consultants to provide technical assistance.

Why a coalition approach is important

The TFW story is grounded in the best urban forestry management tools available plus years of anecdotal volunteer and funding successes. The coalition is broadening public support and making a strong case for positioning the City's tree resources and green infrastructure on equal footing with other public assets.

Wilmington's urban forest needs broad community support to reverse declining trends.

Wilmington relies on funds from a general operating budget to support forestry functions through the municipal Department of Parks and Recreation. In Wilmington urban forest management is not considered as high a priority as other operating needs, leading to chronic under-funding and making these line items vulnerable to reassignment in lean budget years. Although much had been accomplished before the formation of TFW to raise attention about the stewardship of Wilmington’s trees, municipal management continued to operate reactively. A comprehensive plan with broad-based support is required to address systemic issues.

One of the first acts of TFW was to draft a list of guiding principles. At the same time the group began developing a comprehensive urban forest strategy that would address the decades of deferred tree maintenance, educate leaders about the benefits of trees and why they are necessary to the vitality of the city, and propose strategies for long-term sustainability.

**ACCOMPLISHMENTS OF THE TREES FOR WILMINGTON COALITION**

**2006**
- Established a set of guiding principles for progressive city tree management to direct the coalition’s future goals and action steps.
- Hosted a public forum to promote awareness about urban forest policies, solicit public input and identify priority concerns about trees.

**2007**
- Received a City Council Resolution of Support for the group’s goals, for engaging the public and for promoting awareness of the need for city trees.
- Received national award and $75,000 Home Depot Foundation grant for community tree and urban forest excellence at the U.S. Conference of Mayors.
Guiding principles of Trees for Wilmington:

- **Recognize** community involvement and public participation as the driving force behind decision-making and achieving long-term goals

- **Promote** the environmental, economic, social and aesthetic benefits of trees as necessary elements of a thriving city and region

- **Increase** awareness of urban forest issues and TFW initiatives among Wilmington leaders and residents

- **Incorporate** professional tree care standards, best management practices and urban forestry research as integral components of progressive city planning and policy

- **Support** the tree care efforts of neighborhood groups, not-for-profit partners, public stakeholders, city agencies and economic development groups through enhanced coordination of projects and policies

- **Establish** goals and guidelines for increasing tree cover, species diversity and public safety

- **Develop** a comprehensive urban forest management plan that addresses both short- and long-term goals

- **Implement** this plan with diverse funding support that reflects the status of city trees as vital community assets

2008

- Made presentation to Wilmington City Council committee on Youth, Families and Education, which oversees public tree management.

- Hired tree ordinance consultant to draft new tree ordinance. The ordinance is intended to govern urban forest management and protection, create a new urban forest administrator position and establish a Tree Commission that can advise on urban forest management policy and settle enforcement disputes.

- Facilitated discussions with department heads to reorganize urban forest management responsibilities between city departments. Recommended that the Parks Department maintain trees in city parks, but that Public Works assume management of street trees and administration of updated tree ordinance.

- Garnered support from government leaders and department heads for revising the city’s urban forest legislation. Emphasized incorporating realistic planning, management, coordination and regular review mechanisms into municipal governance and administration.

- Hired a graduate student intern from the University of Delaware to assess current status of urban forest management in Wilmington and outline strategy to achieve successful improvements.

- Created maps that identify priority areas for tree planting. Parameters included median income and population density relative to number of trees.
Steps to Improve Urban Forestry in Wilmington

Wilmington’s Urban Forest Management Plan will outline steps to create a sustainable urban forest, and will address administrative, policy, educational and management objectives. The plan will propose a clear set of prioritized actions for the citizens, decision makers, and City employees, with short-term and long-term goals. The plan will propose a timetable for implementation and, where possible, will provide estimated costs. Eventually, it is intended to become a part of Wilmington’s Comprehensive Plan.

A fundamental element of the plan development process has been analyzing current management of urban forestry in Wilmington. Important challenges have been identified that must be addressed in order for the plan to be successful.

• Revising tree ordinance

Wilmington’s current tree ordinance (City of Wilmington Code, Chapter 46) was enacted in the early 1990s. It defines the authority of the municipality to protect the urban forest through forestry programs; a permitting process for planting, removal and pruning of all street trees; enforcement of safe vegetation on private property; and City responsibility for preserving park trees.

A proposed new ordinance is intended to govern urban forest management and protection, create a new Urban Forest Administrator position, and establish a Tree Commission to advise urban forest management policy and settle enforcement disputes. Specifically, it will define:

• Realistic expectations for protection of this important public asset.
• Provisions for establishment of planning and management standards.
• Accessibility and proactive communication of information to property owners.
• Coordination between departments vested with protection authority.
• A regular review mechanism built into legislation (i.e. inventory update and analysis to correspond with the dynamic character of a living resource).

• Recognizing green infrastructure values

In order for Wilmington to recognize trees as real assets within the city’s evaluation, the government must be able to generate financial account reporting of both green and gray infrastructure. The research summarized in this report and the Trees for Wilmington coalition will assist in quantifying the benefits as well as the maintenance costs for a sustainable urban forest.
Increasing per capita investment

Wilmington meets the $2.00 per capita expenditure requirement set by the National Arbor Day Foundation for Tree City USA recognition – but only barely. With our urban forest in decline, this investment is not even maintaining the current canopy, let alone enlarging it.

Wilmington’s funding for urban forestry is substantially less than other city infrastructure programs. For instance, spending on water and sewer infrastructure in 2007 comprised 25% of total budgeted operations expenditures – 400 times greater than spending on urban forestry activities. Tree planting and care accounted for only 0.1% of the city budget. An improved and sustainable urban forest in Wilmington will require an increase in investment.

Ensuring return on investment

Wilmington’s public trees provide $2.58 in benefits for every $1.00 invested – a return of more than 2 1/2 times. And unlike the majority of city infrastructure, benefits provided by the urban forest actually increase in value when properly managed. However, the converse is also true. Deferred maintenance and inadequate management of street and park trees can actually cost the city and residents more than was invested. Proper management is the key to reaping the benefits of our urban forest.

Diversifying funding sources

Trees for Wilmington is advocating for increasing the diversity of funding resources for our urban forest. This will help expand the public dollars available for capital improvement and maintenance, periodic tree inventory updates, and disaster management funds. DCH will continue to work directly with legislators to leverage Community Transportation Funds, as well as to encourage enforcement of Wilmington’s tree ordinance.

Expanding employee expertise

The City of Wilmington has no employees with forestry degrees or arboricultural certification. A survey of comparably sized communities indicates that 70% of cities with a population greater than 20,000 have at least one employee with a forestry degree although these persons may not be assigned to work full-time on tree-related activities (Treiman and Gartner, 2005).

Sharing maintenance responsibility

The street trees of Wilmington exist in a special category. Although the City has jurisdiction to regulate them, individual homeowners are fully responsible for their care. Some residents don’t want street trees because of the costs and potential liabilities. Vacant properties cause other concerns, because there is no one living in the house to take responsibility if a tree becomes a hazard. Consequently, the neighborhoods with the greatest need for green space often have the least resources for trees.

The Delaware Center for Horticulture works to coordinate funding from a variety of sources to help residents with tree planting, care and preservation. DCH also provides tree education, recruits neighborhood Tree Stewards, leads volunteer tree maintenance crews, and advocates for urban trees at all levels of government. An effective urban forestry program must involve city residents, organizational partners, the business community, and local government in the shared responsibility for tree care.

Tracking progress

The urban forest assessment and goal-setting process helped Trees for Wilmington identify information needed for a complete understanding of the urban forest in the future. Essential to achieving an ambitious canopy goal will be maintaining an up-to-date database that tracks tree plantings and management. Accurate data about Wilmington’s trees will greatly facilitate follow-up analyses.
Wilmington’s Tree Canopy Goal

SETTING TREE CANOPY or tree cover targets provides measurable goals for urban forest planning and management. A canopy goal also sets the stage for a public awareness and education campaign about tree planting. An inventory of all public trees along Wilmington’s streets and in the parks is maintained by DCH and city agencies. By comparing where the trees are to a matrix of factors that includes median income and population density, TFW has mapped priority-planting areas throughout Wilmington.

IN THE COURSE OF RESEARCH it was also discovered that Wilmington is one of the first small cities in the country to develop a canopy goal. We were able to identify only one other community our size (Annapolis, MD) that has collected the necessary urban forest data or completed a comparable proposal.

BASED ON ALL THIS ANALYSIS, Trees for Wilmington is calculating a canopy goal that will identify an attainable number of trees to plant per year, and what it would cost. Maintenance and preservation of existing trees will be included in the projected expenditures, to address the concern that Wilmington’s urban forest is in rapid decline. In a parallel effort, the Delaware Forest Service is in the process of analyzing the statewide tree canopy cover. This analysis can eventually be used to help other municipalities establish their own canopy goals.
There are many resources available for people who want to improve the urban forest in their local community. Here are some tips for creating a successful initiative and broad-based collaboration.

Creating a plan and tracking progress

- Assess and document how the urban forest is currently managed in your community.
- Use the free i-Tree software available from the U.S. Forest Service to inventory your community’s urban forest, and update it regularly.
- Analyze the current structure and benefits provided by your existing urban forest.
- Research best practices across the country, and draft an initial attempt at an urban forest management plan.
- Organize a working group to address public input and adjust objectives. Solicit more public comments and then propose a final plan.
- Designate priority-planting areas in your community. As a coalition, determine the criteria that are the most important to consider.
- Utilize Geographic Information System (GIS) technologies to create maps that can inform planning and track progress.

Building community support

- Identify a credible non-profit entity to create the first draft of a plan before the public input process. Municipal government or city agencies may have conflicts of interest or inadequate public trust.
- Identify everyone who may be a stakeholder and hold a forum to gather information on community hot-button issues relating to trees.
- Engage residents in volunteer tree-planting activities. Consider creating a Tree Steward program to develop leadership volunteers.
- Launch a public awareness campaign once your group has achieved some success around tree issues at the city government level, to keep the momentum going.

Leveraging resources

- Assess what community tree initiatives are already happening in your area, and explore combining efforts.
- Join the Alliance for Community Trees, a national organization, and utilize their resources for local communities.
- Hire a legal consultant to draft a new city tree ordinance, and schedule meetings with various city departments to get their input.
Creating an effective coalition

- Designate a single project coordinator to do the initial research; consult coalition members on areas of individual expertise; review and revise the draft plan with the entire group.

- Prioritize recruitment of those who directly manage your urban forest (i.e. city forester or contractor who does this work, non-profits, state foresters, etc.).

- Recruit at least a few others with a background in urban forestry who can bring their expertise to committee discussions.

- Reach out to anyone with potential to be a tree supporter: individuals, civic organizations, city agencies, local/county/state decision-makers, legislators and aides, community leaders, businesses.

- Ask each person to answer a brief survey (before inviting them to join the coalition) to identify primary interests and potential level of commitment.

- Define roles and mutual expectations at the outset. Identify who can be depended on as an active participant and who is more comfortable simply responding to questions from the group when needed.

- Maintain focus on priority issues and initiatives.
Working with government

- Consult your state and regional Forest Service for technical assistance and advice on getting started. Invite them to join your coalition.

- Advocate for plantings as the automatic default when removing a hazard tree. Encourage enforcement of tree-friendly ordinances.

- Be aware of decisions affecting urban forestry that may need to be made by authorities not directly participating in the coalition (Department heads, Mayor's Office, City Council, etc.).

- Ask city departments what format would be most effective for presenting an urban forest strategic plan or management goals.

- Encourage line item funding for urban forest professionals to coordinate tree plantings, long-term care, and comprehensive forest management.

- Use the Brookings Institution study (Nelson, 2004) to challenge the low priority that green infrastructure often receives in the city budget process.

- Work directly with legislators to help them leverage funding.

Solving funding issues

- Develop an early funding plan to avoid over-promising as the project evolves.

- Advocate for a diversified and sustainable urban forestry budget. Sources might include Community Development Block Grants; federal, state or local transportation enhancement funds; state forestry grants; DNREC environmental penalty funds; city budget line items; U.S. Forest Service grants; corporate grants; stormwater mitigation; heat island mitigation; power companies; urban forest endowments, etc.

- Identify a stable source of funding for emergency street tree care.

- Coordinate funds for maximum impact. Identify new funding, or community initiatives, to fill in the gaps.
The current state of our urban forest gives reason to be hopeful and reason to take action. **Trees are essential** infrastructure components that provide many measurable benefits. The urban forest delivers an extraordinary return on investment but, as noted elsewhere in this report, if management issues are not addressed, our urban forest will continue to decline.
There are three main things that you can do to improve Wilmington’s urban forest:

1. **Make planting trees a priority**
   Each person can have a role in reaching Wilmington’s ambitious tree canopy goal. Whether you are a resident, a business leader or a government agency representative – you can join the growing effort to improve our urban forest. Plant a tree on your street, put trees in your budget, include trees in your long-range planning, or volunteer for tree-planting efforts. (Permits for planting are free and available through the DCH website.)

2. **Help secure adequate funding**
   Diverse and stable sources of funding are required for a sustainable urban forest. Add your voice to those who are working to leverage adequate funding for increased planting and tree maintenance.

3. **Advocate for better urban forest policies**
   The policies and structures we put in place today will determine the future health and sustainability of our urban forest. Help us advocate for legislation that will ensure more effective planning, planting, and management of trees.

** Collaboration is the key to success**

The creation of a sustainable urban forest in Wilmington will depend on a broad collaboration of residents, organizations, businesses, and government. With a concerted effort, we can improve the tree cover that beautifies our neighborhoods and increases the livability of our city.

**For the latest updates or to learn how you can get involved, log onto dehort.org.**
Canopy cover: the area occupied by the crowns of trees when viewed from above.

Carbon sequestration: the process through which trees absorb carbon dioxide (CO₂) and remove it from the atmosphere.

Carbon storage: carbon currently held within tree tissue (roots, stems, and branches). As trees grow, more carbon is absorbed and stored in their accumulated tissue. As trees die and decay, including use as firewood or mulch, this stored carbon is released back into the atmosphere.

Combined sewers: a sewer system that carries both raw sewage and stormwater runoff. Normally, its entire flow goes to a wastewater treatment plant, but during heavy rains high volumes of water may cause overflows of untreated stormwater and sewage into streams and rivers. Surface runoff may also carry toxic chemicals from streets or industrial areas into the sewer system.

CSO (Combined Sewer Overflow): discharge of a mixture of stormwater runoff and sewage when the capacity of a sewer system is exceeded during heavy rainstorms.

DCH (Delaware Center for Horticulture): environmental nonprofit that cultivates greener communities by enhancing urban forests, public roadsides and streetscapes; supporting community gardens; providing educational programs; and maintaining public demonstration gardens in Trolley Square.

DFS (Delaware Forest Service): agency within the Delaware Department of Agriculture. Provides services to help citizens manage and improve their forest resources in the areas of conservation, protection and education.

DNREC (Delaware Department of Natural Resources & Environmental Control): state agency that works to protect and manage vital natural resources, protect public health and safety, provide quality outdoor recreation, and educate citizens of the First State about the wise use, conservation, and enhancement of Delaware's environment.

EPA (Environmental Protection Agency): a federal agency that conducts environmental science, research, education, and assessment efforts to protect human health and the environment.

Gray infrastructure: structures such as buildings, roads, utilities and parking lots. Gray infrastructure is impervious, forcing water to run off, which must then be managed and cleaned before entering rivers.

Green infrastructure: areas covered with trees, shrubs and grass. Green infrastructure is porous, allowing rain to soak into soil, which recharges ground water and naturally filters pollutants before entering rivers.

Greenhouse gas (GHG): compounds such as carbon dioxide (CO₂), methane (CH₄), nitrous oxide (N₂O), and ozone (O₃) in the Earth's atmosphere that trap energy from the sun.

Impervious cover: the amount of land in an area that cannot absorb rainwater due to paving and roofs.

i-Tree: a software suite from the U.S. Forest Service that provides urban and community forestry analysis and benefits assessment tools. i-Tree is in the public domain and available for free through the i-Tree website. The Forest Service, Davey Tree Expert Company, the National Arbor Day Foundation, Society of Municipal Arborists, and International Society of Arboriculture provide technical support and training for the software.

Non-sanitary flow: water, primarily from rain and carried by the combined sewers, that is not from residential or industrial sources.

NCCMC (New Castle County Metro Corridor): designated data area of the UFORE study representing the major metropolitan areas from Wilmington to Newark bound by Interstate 95, Route 2 (Kirkwood Highway) and Route 41.

STRATUM (Street Tree Management Tool for Urban forest Managers): part of the i-Tree collection of software tools. Developed by researchers at the Center for Urban Forest Research, this computer application uses tree inventory data to quantify the structure, function, value and management needs of any street tree resource.

TFW (Trees for Wilmington): a working group of the Wilmington Beautification Commission focused on improving the City's urban forest and promoting more sustainable management techniques. This coalition is composed of a variety of stakeholders, including city residents, policy-makers, government agency representatives, and municipal employees.

Tree Stewards: volunteers coordinated through the Delaware Center for Horticulture to preserve and restore Wilmington's urban forest. Stewards apply for tree-planting grants for their neighborhoods, attend community plantings, assist with tree maintenance, and act as advocates for the urban forest.

UFORE (Urban Forest Effects): computer model that calculates structure, functions, and values of urban forests. It was developed in the late 1990s by researchers at the U.S. Forest Service.
Urban Forest: the sum of all trees and associated vegetation in and around dense human settlements.

Urban heat island/heat island effect: phenomenon causing cities to be 6–8°F hotter than surrounding rural areas throughout the year. Asphalt and concrete in roads, buildings, and other structures absorb solar heat, causing surface temperatures and overall ambient temperatures to rise.

Volatile Organic Compounds (VOCs): molecules containing carbon and varying proportions of other elements such as hydrogen, oxygen, fluorine, and chlorine. These “precursors” react in sunlight and heat to form ground-level ozone.

WBC (Wilmington Beautification Commission): chartered by official City Council legislation in 2004. Led by the Delaware Center for Horticulture, WBC membership includes representatives from City Council, government agencies, civic associations, and a host of other environmental groups. In addition to a growing number of city parks improvements, WBC launched “Think Green for a Change,” a promotional campaign encouraging residents and businesses to make more environmentally friendly lifestyle and development choices.

FOOTNOTES & REFERENCES

1,2,3,4 These four maps were created using data from higher resolution (30m) tree canopy and impervious surface cover maps – from 2001 Landsat satellite imagery published in 2007 (Homer et al. 2007, U.S. Geological Survey, 2007) – in conjunction with 1990 and 2000 census and geological data – from 1:5,000,000 scale cartographic boundary files (U.S. Census Bureau, 2007) – to assess current urban and community forest attributes.


Davey Resource Group. 2002. Tree Inventory Management Plan for the City of Wilmington, DE.


This report was created by the Delaware Center for Horticulture (DCH) in partnership with Trees for Wilmington, a working group of the Wilmington Beautification Commission.

This project was funded in part through grants from the U.S. Forest Service by recommendation of the National Urban and Community Forestry Advisory Council (NUCFAC) and Community Environmental Penalty Funds of the Delaware Department of Natural Resources & Environmental Control (DNREC). Additional support was provided by the Carolyn Foundation, Center for Energy and Environmental Policy (CEEP) – University of Delaware, City of Wilmington, Delaware Forest Service, New Castle County, and the generous members of DCH.

Special thanks to: Erika Farris, Robert Hoehn, Vikram Krishnamurthy, Andrea Mosher, Martha Corrozi Narvaez, David Nowak, Henry Poole and Bonnie Swan.

We congratulate Dr. Nowak for his Nobel Prize in 2007 as a member of the Intergovernmental Panel on Climate Change, awarded in recognition for his many years researching and quantifying the environmental benefits of trees.

The UFORE Model was created by the U.S. Forest Service – Northeastern Research Station, State & Private Forestry’s Urban & Community Forest Program and the National Urban & Community Forestry Advisory Council. STRATUM was developed and funded by the U.S. Forest Service – Pacific Southwest Research Station, Center for Urban Forest Research and the State & Private Forestry’s Urban & Community Forestry Program.

The UFORE and STRATUM software is in the public domain and available at no cost to all interested individuals and organizations through http://www.itreetools.org/. For more information about community forestry, go to http://www.fs.fed.us/ucf/.

The official UFORE report that includes technical data and research results from the New Castle County Metropolitan Corridor and the City of Wilmington, can be downloaded from the Delaware Center for Horticulture website at dehort.org.

Members of the Trees for Wilmington coalition:

9th Ward Civic Association
11th Street Bridge Civic Association
City of Wilmington
Delaware Center for Horticulture – Staff members and volunteer Tree Stewards
Delaware Forest Service – Urban & Community Forestry Program
Kerns Brothers Tree Service
New Castle Conservation District
University of Delaware, Institute for Public Administration – Water Resources Agency
Wilmington Beautification Commission
Winterthur Museum and Country Estate

Unless otherwise noted, all photos are courtesy DCH archives.

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Cultivating a greener community; inspiring appreciation and improvement of our environment through horticulture, education and conservation.