Illinois Arborist Association
Arborist Certification Training
Chapter 14 - Urban Forestry

September 1, 2015

Presented by:
Ben Reynoso & Eva Saunders
Natural Path Urban Forestry Consultants
Chicago, IL
Definition

Arboriculture is the practice and study of the care of trees. Its primary concern is the individual tree and our practices.

Urban Forestry is the management of naturally occurring and planted trees in urban areas. Its primary concern is whole systems and policies.
Benefits of Trees

Part of the heightened exposure of urban forestry is the increasing understanding of the benefits of trees.

- Many of these benefits have only recently become quantified—thus validated in the public eye.
- This quantification has also provided us with a tool to convey these benefits easier.
The environmental benefits of trees are substantial:

- Enhanced air quality
- Carbon sequestering
- Energy conservation
- Reduction of storm water runoff and erosion
- Noise attenuation
- Wildlife habitat
Benefits of Trees - Environmental

Enhanced Air Quality

- Intercepting particulate matters
- Absorbing gaseous contaminants through stomata
Benefits of Trees - Environmental

Enhanced Air Quality
Atmospheric contaminants

- Sulfur dioxide
- Nitrogen oxides
- Ozone
- Smog
- Particulates

Some trees produce pollutants known as biogenic volatile organic compounds (BVOC)
Carbon Sequestering

- Through photosynthesis, trees remove carbon dioxide ($\text{CO}_2$) and stores the carbon component as sugars.
- Trees accumulate atmospheric carbon in the form of wood (sequestering)
- Carbon is released once the tree begins to decompose.
Benefits of Trees - Environmental

Energy Conservation

- Direct Benefits (Building heating and cooling)
- Indirect Benefits (Heat Island Effect)
- Deferred Costs of Energy Production
Benefits of Trees - Environmental

Stormwater Runoff and Erosion Control

Tree canopies intercept rain, snow and other forms of precipitation.

- Divert precipitation
- Decrease the impact velocity of a raindrop
- Most effective during low-intensity storms
- Reduces the intensity of stormwater runoff
Benefits of Trees - Environmental

Noise Reduction

Effective noise reduction from plants occurs when the planting is:

- Dense
- Tall
- Wide

Planting close to the noise source is more effective than further away.
Valuation and Appraisal

The value of a tree or group of trees can be calculated in a number of ways—either environmental value or dollar value.

- Real Estate
- Environmental Value
- Appraised Value
- Extended Life of Pavement
Valuation and Appraisal

iTree is a suite of software applications developed by the USFS to determine a range of environmental benefits.

### Des Plaines

<table>
<thead>
<tr>
<th>Species</th>
<th>Energy</th>
<th>CO₂</th>
<th>Air Quality</th>
<th>Stormwater</th>
<th>Aesthetic/Other</th>
<th>Total ($)</th>
<th>Standard Error</th>
<th>% of Total $</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acer platanoides</td>
<td>15,510</td>
<td>1,726</td>
<td>2,681</td>
<td>16,263</td>
<td>11,489</td>
<td>47,669</td>
<td>(±)</td>
<td>17.7</td>
</tr>
<tr>
<td>Acer saccharum</td>
<td>19,819</td>
<td>3,692</td>
<td>3,508</td>
<td>33,564</td>
<td>29,199</td>
<td>89,783</td>
<td>(±)</td>
<td>33.4</td>
</tr>
<tr>
<td>Fraxinus pensylvanica</td>
<td>7,577</td>
<td>1,041</td>
<td>1,277</td>
<td>9,523</td>
<td>7,685</td>
<td>27,103</td>
<td>(±)</td>
<td>10.1</td>
</tr>
<tr>
<td>Gleditsia triacanthos</td>
<td>6,087</td>
<td>969</td>
<td>1,002</td>
<td>7,206</td>
<td>18,580</td>
<td>33,845</td>
<td>(±)</td>
<td>12.6</td>
</tr>
<tr>
<td>Tilia cordata</td>
<td>2,945</td>
<td>454</td>
<td>485</td>
<td>3,376</td>
<td>4,242</td>
<td>11,503</td>
<td>(±)</td>
<td>4.3</td>
</tr>
<tr>
<td>Pyrus calleryana</td>
<td>1,610</td>
<td>193</td>
<td>254</td>
<td>1,308</td>
<td>1,528</td>
<td>4,892</td>
<td>(±)</td>
<td>1.8</td>
</tr>
<tr>
<td>Fraxinus americana</td>
<td>2,438</td>
<td>361</td>
<td>420</td>
<td>2,867</td>
<td>3,649</td>
<td>9,756</td>
<td>(±)</td>
<td>3.6</td>
</tr>
<tr>
<td>Acer saccharum</td>
<td>2,179</td>
<td>265</td>
<td>339</td>
<td>2,285</td>
<td>2,158</td>
<td>7,227</td>
<td>(±)</td>
<td>2.7</td>
</tr>
<tr>
<td>Acer negundo</td>
<td>1,794</td>
<td>331</td>
<td>305</td>
<td>2,612</td>
<td>2,119</td>
<td>7,162</td>
<td>(±)</td>
<td>2.7</td>
</tr>
<tr>
<td>Ulmus pumila</td>
<td>2,013</td>
<td>242</td>
<td>360</td>
<td>2,526</td>
<td>1,343</td>
<td>6,484</td>
<td>(±)</td>
<td>2.4</td>
</tr>
<tr>
<td>Acer rubrum</td>
<td>1,049</td>
<td>141</td>
<td>185</td>
<td>1,025</td>
<td>1,427</td>
<td>3,828</td>
<td>(±)</td>
<td>1.4</td>
</tr>
<tr>
<td>Ulmus americana</td>
<td>2,170</td>
<td>213</td>
<td>445</td>
<td>2,647</td>
<td>1,709</td>
<td>7,184</td>
<td>(±)</td>
<td>2.7</td>
</tr>
<tr>
<td>Pinus nigra</td>
<td>406</td>
<td>35</td>
<td>45</td>
<td>729</td>
<td>386</td>
<td>1,602</td>
<td>(±)</td>
<td>0.6</td>
</tr>
<tr>
<td>Celtis occidentalis</td>
<td>1,236</td>
<td>118</td>
<td>212</td>
<td>1,260</td>
<td>945</td>
<td>3,772</td>
<td>(±)</td>
<td>1.4</td>
</tr>
<tr>
<td>OTHER STREET TREES</td>
<td>2,190</td>
<td>255</td>
<td>338</td>
<td>2,518</td>
<td>1,773</td>
<td>7,075</td>
<td>(±)</td>
<td>2.6</td>
</tr>
<tr>
<td><strong>Citywide Total</strong></td>
<td>69,045</td>
<td>10,037</td>
<td>11,859</td>
<td>89,710</td>
<td>88,233</td>
<td>268,884</td>
<td>(±)</td>
<td>100.0</td>
</tr>
</tbody>
</table>
The Council of Tree and Landscape Appraisers (CTLA) has developed the most commonly used form of value appraisals used in the United States. The two primary methods used are:

Replacement Method
Trunk Formula Method
Replacement Method

Is used for trees that are of a size that is readily available from a nursery.

Photo Credits: Natural Path Urban Forestry, 2014
Trunk Formula Method

Is used to determine the value of a tree that is too large to obtain from a nursery.

Based on:
- Species
- Diameter
- Location
- Condition

Photo Credits: Natural Path Urban Forestry, 2014
Planning is a key process in creating and sustaining urban forests.
Sustainable Urban Forests

The long-term goal of the urban forester is sustainability. That is:

*The maintenance of ecological, social, and economic functions and benefits over time.*

Involves maximizing the benefits of urban forests and minimizing associated costs.
The Planning Process

1. What do we have?

2. What do we want?

3. How do we get what we want?

4. Are we getting what we want (Feedback)?
Regulatory and Legal Issues

Tree Ordinances
are legal regulations designed to protect and manage trees

Permits
a process that allows arboricultural work to occur on public and private trees

Tree Preservation Orders (TPOs)
a legal regulation that protects an individual or group of trees.
Regulatory and Legal Issues

Specifications
are detailed plans to guide and define work

Descriptive specifications

• Reference standards
• Performance specifications
• Proprietary specifications
Why Trees are Preserved

- Trees perform important environmental and social functions
- Trees add value to property
- The community demands it
- Part of a larger resource conservation program

Successful preservation requires inclusion during the initial stages of land planning and project development. Primary goal is to provide adequate space for root and crown development.
Tree Inventories

Inventories provide the basis from which day to day operations are facilitated and long-term policies derived.

Photo Credit: Natural Path Urban Forestry, 2014
Tree Inventories

The type of inventory selected, including its delivery system, must be compatible with the agencies capacity to access and maintain the data efficiently. Considerations include:

- Community size
- Amount of tree work to be processed
- Budget
- Staffing
Tree Inventories

Inventory Scope
Street Trees
Park Trees
Forest System
Sample

Photo Credits: Natural Path Urban Forestry, 2014
Tree Inventories

Data – Location

- Management Area
- Street
- Address
- Land use
- Utilities
- Parkway Width

Photo Credits: Natural Path Urban Forestry, 2014
Tree Inventories

Data – Tree

- Species
- Diameter
- Condition
- Spread
- Height
- Defects
- Maintenance Needs

Photo Credits: Natural Path Urban Forestry, 2014
Tree Inventories

Data – Site
- Vacant Planting Sites
- Parkway Width
- Parkway Type

Photo Credits: Natural Path Urban Forestry, 2014
Inventory Software

Numerous commercial systems exist on the market that are either stand alone tree systems or part of a larger public works asset management program.
Inventory Software

iTree – Streets (STRATUM) can conduct analysis using data from a complete or sample inventory.

The image on the right depicts street segments randomly selected through GIS to conduct a 6% sample of the streets for the rural town of Olney, Illinois.

Photo Credits: Natural Path Urban Forestry, 2014
Mapping

- Global Positioning System (GPS)
- Geographic Information System (GIS)
Using Inventory Information

Cyclic Pruning
## Using Inventory Information

### Cyclic Pruning – Contract Cost Estimates and Pricing

<table>
<thead>
<tr>
<th>Diameter Class</th>
<th>Number</th>
<th>Unit Price</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – 8 “</td>
<td>983</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9 – 15”</td>
<td>1,562</td>
<td>$26.20</td>
<td>$40,924</td>
</tr>
<tr>
<td>16 – 30”</td>
<td>1,487</td>
<td>$58.65</td>
<td>$87,213</td>
</tr>
<tr>
<td>31”+</td>
<td>269</td>
<td>$86.10</td>
<td>$23,161</td>
</tr>
<tr>
<td>Total</td>
<td>4,313</td>
<td></td>
<td>$151,298</td>
</tr>
</tbody>
</table>
Using Inventory Information

Monitor Trees

- Cabled Trees
- Monitor Trees
- Line of Sight Issues

Using the inventory and GIS, refine the inspection procedures for problematic trees or scenarios.
## Using Inventory Information

### Species Diversity

<table>
<thead>
<tr>
<th>Share of General Population</th>
<th>Species N=</th>
<th>Combined %</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;10%</td>
<td>3</td>
<td>36.5</td>
</tr>
<tr>
<td>5-10</td>
<td>2</td>
<td>16.4</td>
</tr>
<tr>
<td>1-5</td>
<td>9</td>
<td>23.0</td>
</tr>
<tr>
<td>0-1</td>
<td>14</td>
<td>9.5</td>
</tr>
<tr>
<td>&lt;1%</td>
<td>118</td>
<td>14.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>146</strong></td>
<td><strong>100.0</strong></td>
</tr>
</tbody>
</table>
Using Inventory Information

Species Diversity – Establishing long-term targets
Using Inventory Information

Species Diversity

Diameter Distribution for *Quercus macrocarpa* (Bur oak) in Oak Park

The Village of Oak Park identified Bur Oak (*Qercus macrocarpa*) as a species whose presence they wish to increase. The long-range target is to have about 5% of the total population of 19,000 trees be Bur Oak, or 950 trees. They currently have 123, or 0.6%
Management

Overall strategic objective is a healthy, safe, expanding, and sustainable urban forest.

The community receives optimal benefits when these objectives are maximized.
Management

Appropriate care from the time of planting to the eventual removal of the tree are the activities that allow this maximization to occur.
Management

Stages of Tree Development:

- Planting
- Young
- Mature
- Senescent

Each stage requires specific maintenance actions and policies
To meet our overall goal of an expanding and contributing urban forest, we need to maximize the length of time a tree exists in the mature phase.

<table>
<thead>
<tr>
<th>Immature</th>
<th>Appropriate selection, placement and care.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Semi-mature</td>
<td>Appropriate care.</td>
</tr>
<tr>
<td>Mature</td>
<td>Appropriate care.</td>
</tr>
<tr>
<td>Senescent</td>
<td>Remove and replace when the no longer contributes affectively or risk potential is too great. Caveats may exist for antiquity trees.</td>
</tr>
</tbody>
</table>
Urban Wood Utilization

The comprehensive recycling of wood waste in U.S. communities is still in its infancy. However, the advent of Emerald Ash Borer has provided opportunities to address the topic.
Urban Wood Utilization

There are four primary biomass products that can be produced from urban wood. They are:

- Compost
- Mulch
- Firewood
- Lumber
Urban Wood Utilization

- Removal of Tree
- Milling of Wood
- Construction of Products
- Final Product

Photo Credits: Natural Path Urban Forestry, 2014
Wildlife

The urban forest provides habitat and food for a wide range of wildlife. Trees are part of a larger ecosystem.