FRAXINUS IN A GREAT LAKES URBAN STREET TREE COMMUNITY, KALAMAZOO, MICHIGAN

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ABSTRACT

Biodiversity is of increasing concern in urban systems because it impacts both sustainability of the environment and perception of aesthetics within an urban area. The recent spread of the emerald ash borer and its impact on the genus *Fraxinus* in the Great Lakes region has increased local concern for the health of urban ecosystems. In this study we examine an urban street tree dataset for Kalamazoo, Michigan using richness, diversity, and evenness metrics. Hierarchical cluster analysis results indicate five types of tree communities in Kalamazoo’s neighborhoods. *Fraxinus pennsylvanica* is a dominant species in nearly every neighborhood, making up between 2 and 6 percent of individuals. Northside neighborhood is unique, with the lowest number of dominant species and lowest species richness in the city. Northside also has the highest percentage of *F. pennsylvanica* in the city. These characteristics make Northside especially vulnerable to the emerald ash borer. Because Northside also has the lowest socio-economic status of Kalamazoo’s neighborhoods, assistance should be given to residents for replanting purposes if the overall tree diversity of the city is to be maintained or increased.

INTRODUCTION

The study of street trees and their role in the ecology of a cityscape has become a topic of increased discussion in the field of biogeography. Roadside tree species contribute to the overall community diversity and biomass in urban systems (Jim 1999; Savard et al. 2000; Chen & Jim 2003) while providing a historical record of landscape zonation with regard to past land use and urban development (Clare & Bunce 2006). Particular heritage specimens or cohorts of heritage trees may have additional religious, spiritual, symbolic, or other emotional value to a community (Jim 2004).

Similar to the epidemics of chestnut blight and Dutch elm disease in the 20th century, emerald ash borer (*Agrilus planipennis* Fairmaire) is currently causing the widespread removal of a common tree species from urban forests in the Great Lakes region of the United States. Emerald ash borer (EAB) is an invasive species in the U.S. that was first detected in 2002 in southeast Michigan. EAB larvae feed on the inner bark of ash trees (genus *Fraxinus*), interfering with the transport of water and nutrients within the tree (Haack et al. 2002; Poland & McCullough 2006). Both green ash (*F. pennsylvanica* Marsh.) and white ash (*F. americana* L.) have been popular street trees in cities throughout the U.S. (MacFarlane & Meyer 2005; Poland & McCullough 2006). The EAB infestation has spread to include more than 40,000 square miles (10,360,000 hectares) in
Michigan, Ohio, Indiana, Illinois, Maryland, Pennsylvania, West Virginia, and Ontario and more than 20 million ash trees are estimated to have been killed in the core area of the infestation (Poland 2007; USDA et al. 2008). Quarantine on movement of wood and nursery stock has slowed but not stopped the spread of the EAB (Muirhead et al. 2006).

Emerald ash borer has recently been found in Kalamazoo, Michigan and is expected to cause the removal of the ash trees within the city as the infestation spreads (MSU Extension, Public Meeting, 2006). The city of Kalamazoo is the largest city in Southwest Michigan and the county seat of Kalamazoo County. It is approximately halfway between Detroit and Chicago. Kalamazoo had a population of 77,145 as of the 2000 Census and an area of 25.18 square miles (65.22 square kilometers) (U.S. Census Bureau 2000). The city lies on the Kalamazoo River, but much of the city is west of the river on the rolling plains of the Kalamazoo moraine. The soils of the city are characterized by deep well-drained loams (USDA 1979). The city’s climate is moderated by the “lake effect” from Lake Michigan 35 miles to the west with milder summer and winter extremes, and enhanced snowfall. The average yearly precipitation is 37”, including 70” of snowfall (Kalamazoo County Convention and Visitor’s Bureau 2008).

The purpose of this paper is to characterize an urban street tree community in the Great Lakes region. While the flora of Kalamazoo County has been well cataloged (Hanes & Hanes 1947; McKenna 2004), we are focusing specifically on the City of Kalamazoo. The species composition, neighborhood patterns, and biodiversity of the street trees maintained by the city of Kalamazoo, Michigan are examined. Trees maintained by the city, or street trees, are those trees that are planted in the city’s easement between the sidewalk and the street. The city is responsible for pruning and hazard maintenance of these trees, but recent budget cuts limit the amount of resources available for this work. We examine the importance of Fraxinus pennsylvanica and F. americana within the city’s street tree population and the probable impacts of emerald ash borer. Removal of ash species and decisions regarding replacement planting and city budget allocations for such work will have implications with regards to urban biodiversity and regional susceptibility to further epidemics.

METHODS

For the 18 neighborhoods in Kalamazoo for which street trees are actively maintained by the city, various diversity and evenness metrics were calculated. The Kalamazoo Street Tree Inventory was carried out under contract by the Davey Tree Expert Company, an urban forestry consulting division of Davey Resource Group that does GIS-based public tree inventories. Four certified arborists were responsible for tree inventory and identification. The Kalamazoo Street Tree Inventory as completed in 2002 was used without modification for this research.

Dominant and abundant species were identified for the city of Kalamazoo and examined spatially. Dominant species are those species contributing greater than 2 percent of individual trees in an area, while abundant species contribute less than 2 percent but greater than 1 percent of individual trees (Jim 2004). Species richness, or the number of species represented in an area, was compared with size of tree population and size of neighborhood. Shannon’s diversity index was used to describe the distribution of individuals across species and Shannon’s equitability index was used as a metric of evenness in those distributions. Each of these metrics is common in biogeography and
treescape studies (Chen and Jim 2003; MacDonald 2003). Finally, the prevalence of Fraxinus species was compared among neighborhoods.

Hierarchical cluster analysis (SPSS, SPSS Inc.) was used to group similar neighborhoods using a standardized set of parameters. Neighborhood values for dominant species, species richness, species diversity, equitability, percentage of population F. pennsylvanica, and percentage of population F. americana were standardized on a scale of 0–1, where the zero value was assigned to the neighborhood with the lowest value and one was assigned to the neighborhood with the highest value. The remaining neighborhoods were assigned values according to their relationship to the highest and lowest neighborhood values. The standardization allowed neighborhoods to be clustered based upon their relative similarity in a series of parameters with very different initial ranges in value.

RESULTS

Kalamazoo’s urban street tree community is composed of approximately 112 tree species (Appendix A). More than 80 percent of the 26,046 individuals belong to 11 dominant and five abundant species (Table 1). Fifty percent of individuals belong to the single genus Acer, which is represented by ten species. These include four dominants, A. platanoides L. (Norway maple), A. saccharinum L. (silver maple), A. saccharum Marsh. (sugar maple), A. rubrum (Red maple), Platanus × acerifolia (London plane tree), Fraxinus pennsylvanica (Green ash), Malus spp. (Apple spp.), Pyrus calleryana (Callery pear), Ulmus pumila (Siberian elm), and Tilia cordata (Small-leaved linden). The genus Fraxinus comprises 4.5 percent of the city’s individual street trees and is represented by three species, the dominant F.

<table>
<thead>
<tr>
<th>TABLE 1. Dominant and abundant species of street trees in the city of Kalamazoo, Michigan.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dominant Species</td>
</tr>
<tr>
<td>Acer platanoides (Norway maple)</td>
</tr>
<tr>
<td>Acer saccharinum (Silver maple)</td>
</tr>
<tr>
<td>Acer saccharum (Sugar maple)</td>
</tr>
<tr>
<td>Gleditsia triacanthos (Honey locust)</td>
</tr>
<tr>
<td>Acer rubrum (Red maple)</td>
</tr>
<tr>
<td>Platanus × acerifolia (London plane tree)</td>
</tr>
<tr>
<td>Fraxinus pennsylvanica (Green ash)</td>
</tr>
<tr>
<td>Malus spp.</td>
</tr>
<tr>
<td>Pyrus calleryana (Callery pear)</td>
</tr>
<tr>
<td>Ulmus pumila (Siberian elm)</td>
</tr>
<tr>
<td>Tilia cordata (Small-leaved linden)</td>
</tr>
<tr>
<td>Abundant Species</td>
</tr>
<tr>
<td>Picea pungens (Blue spruce)</td>
</tr>
<tr>
<td>Quercus rubra (Northern red oak)</td>
</tr>
<tr>
<td>Prunus serrulata (Japanese cherry)</td>
</tr>
<tr>
<td>Quercus palustris (Pin oak)</td>
</tr>
<tr>
<td>Juglans nigra (Black walnut)</td>
</tr>
<tr>
<td>¹Dominant species are those comprising more than 2% of total individuals.</td>
</tr>
<tr>
<td>²The genus Malus was not subdivided in the database.</td>
</tr>
<tr>
<td>³Abundant species are those comprising 1–2% of total individuals.</td>
</tr>
</tbody>
</table>

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pennsylvanica (green ash) and two minor species, *F. americana* (white ash) and *F. nigra* Marsh. (black ash).

Street tree species richness within the city is shown in Figure 1. Areas of relatively high species richness are clustered throughout the city, most apparently in large neighborhood areas south of the city center. By contrast ash trees are most common in the lower richness central city districts and southward along the Westnedge Road corridor (Figure 2). The 18 neighborhoods in Kalamazoo for which street trees are actively maintained by the city vary in size and tree diversity (Table 2, Figure 3). Milwood is by far the largest neighborhood at just over 12 km². Edison, South Westnedge, Oakland/Winchell, Burke Acres and Northside are also relatively large, each over 4 km². While these large neighborhoods do have the most individual trees, the smaller neighborhoods of Oakwood, Stuart and Vine have the highest tree densities.

Density of city street trees ranges from 148 (Knollwood) to 1054 (Oakwood) trees per km². Total number of species per neighborhood range from 31 (Stuart) to 87 (Edison), and the number of dominant species range from 8 (Northside) to 14 (South Westnedge). In every neighborhood except South Westnedge, *F. pennsylvanica* is a dominant species. *F. americana* is much less prevalent and is not dominant in any neighborhood, but is considered an abundant species in five of the neighborhoods. Neighborhood diversity ranges from 3.454 in Stuart to 4.992
in South Westnedge. Equitability, or the equalness of the distribution between species, is highest at 1.143 in Knollwood and lowest at 0.916 in Edison.

Hierarchical cluster analysis results indicate five distinct tree community types in the city of Kalamazoo (Figure 3). Northside neighborhood is unique and does not cluster with any other neighborhoods. It has both the lowest number of dominant species and lowest species richness, and subsequently has very low diversity and equitability. Northside is of interest botanically because it contains the highest percentage and by far the greatest number of *F. pennsylvanica* in the city.

The neighborhood cluster including Edison, Milwood, Oakwood, Eastside, and West Douglas are similar to Northside in that they have low richness values. These neighborhoods also have low to moderate species richness, diversity, equitability and number of dominant species. They also have low numbers of *F. pennsylvanica*, but have the largest *F. americana* populations. This cluster is the largest in area, making up more than 30 percent of the city’s area.

Burke Acres, Westnedge, Central Business, Vine, West Main Hill, Westwood and Arcadia make up the cluster including the largest number of neighborhoods. While *F. pennsylvanica* is a dominant in each of these neighborhoods, *F. americana* is present only in low numbers. While not the largest neighborhoods, the number of dominant species, diversity and equitability are near the city average at these locations.

The remaining two community types contain only two neighborhoods each,

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FIGURE 2. Ash trees (*Fraxinus sp.*)) maintained as street trees by the city of Kalamazoo, Michigan.
TABLE 2. Neighborhood characteristics of Kalamazoo, Michigan's street tree community.

<table>
<thead>
<tr>
<th>Neighborhood</th>
<th>Area sq.km.</th>
<th># Trees</th>
<th>Density</th>
<th>Richness S</th>
<th>Domin. Species</th>
<th>Shannon Diversity</th>
<th>Equit.</th>
<th>F. pennsylvanica N</th>
<th>F. pennsylvanica %</th>
<th>F. americana N</th>
<th>F. americana %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arcadia</td>
<td>2.49</td>
<td>795</td>
<td>320</td>
<td>49</td>
<td>12</td>
<td>4.005</td>
<td>1.029</td>
<td>26</td>
<td>3.27%</td>
<td>1</td>
<td>41</td>
</tr>
<tr>
<td>Burke Acres</td>
<td>4.76</td>
<td>1062</td>
<td>223</td>
<td>56</td>
<td>10</td>
<td>4.065</td>
<td>1.010</td>
<td>40</td>
<td>3.77%</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>Central Business</td>
<td>1.24</td>
<td>951</td>
<td>766</td>
<td>37</td>
<td>10</td>
<td>3.765</td>
<td>1.043</td>
<td>61</td>
<td>6.41%</td>
<td>3</td>
<td>24</td>
</tr>
<tr>
<td>Eastside</td>
<td>2.43</td>
<td>1023</td>
<td>420</td>
<td>56</td>
<td>9</td>
<td>4.090</td>
<td>1.016</td>
<td>33</td>
<td>3.23%</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Edison</td>
<td>7.20</td>
<td>3278</td>
<td>455</td>
<td>87</td>
<td>10</td>
<td>4.092</td>
<td>0.916</td>
<td>90</td>
<td>2.75%</td>
<td>26</td>
<td>19</td>
</tr>
<tr>
<td>Knollwood</td>
<td>1.95</td>
<td>288</td>
<td>148</td>
<td>39</td>
<td>12</td>
<td>4.189</td>
<td>1.143</td>
<td>7</td>
<td>2.43%</td>
<td>3</td>
<td>16</td>
</tr>
<tr>
<td>Milwood</td>
<td>12.49</td>
<td>3114</td>
<td>249</td>
<td>86</td>
<td>11</td>
<td>4.058</td>
<td>0.911</td>
<td>65</td>
<td>2.09%</td>
<td>34</td>
<td>14</td>
</tr>
<tr>
<td>Northside</td>
<td>4.41</td>
<td>2612</td>
<td>593</td>
<td>55</td>
<td>8</td>
<td>3.711</td>
<td>0.926</td>
<td>198</td>
<td>7.58%</td>
<td>8</td>
<td>28</td>
</tr>
<tr>
<td>Oakland/Winchell</td>
<td>5.25</td>
<td>2558</td>
<td>487</td>
<td>83</td>
<td>13</td>
<td>4.777</td>
<td>1.081</td>
<td>71</td>
<td>2.78%</td>
<td>24</td>
<td>23</td>
</tr>
<tr>
<td>Oakwood</td>
<td>1.06</td>
<td>1121</td>
<td>1054</td>
<td>55</td>
<td>10</td>
<td>3.691</td>
<td>0.921</td>
<td>28</td>
<td>2.50%</td>
<td>12</td>
<td>17</td>
</tr>
<tr>
<td>South Westnedge</td>
<td>5.49</td>
<td>2541</td>
<td>462</td>
<td>83</td>
<td>14</td>
<td>4.992</td>
<td>1.130</td>
<td>34</td>
<td>1.34%</td>
<td>14</td>
<td>36</td>
</tr>
<tr>
<td>Southside</td>
<td>0.56</td>
<td>305</td>
<td>545</td>
<td>43</td>
<td>11</td>
<td>4.212</td>
<td>1.120</td>
<td>7</td>
<td>2.30%</td>
<td>3</td>
<td>21</td>
</tr>
<tr>
<td>Stuart</td>
<td>0.35</td>
<td>366</td>
<td>1033</td>
<td>31</td>
<td>10</td>
<td>3.454</td>
<td>1.006</td>
<td>15</td>
<td>4.10%</td>
<td>1</td>
<td>24</td>
</tr>
<tr>
<td>Vine</td>
<td>2.10</td>
<td>2129</td>
<td>1012</td>
<td>60</td>
<td>11</td>
<td>4.051</td>
<td>0.989</td>
<td>122</td>
<td>5.73%</td>
<td>12</td>
<td>25</td>
</tr>
<tr>
<td>West Douglas</td>
<td>1.31</td>
<td>444</td>
<td>338</td>
<td>44</td>
<td>11</td>
<td>3.959</td>
<td>1.046</td>
<td>13</td>
<td>2.93%</td>
<td>5</td>
<td>17</td>
</tr>
<tr>
<td>West Main Hill</td>
<td>0.78</td>
<td>733</td>
<td>944</td>
<td>56</td>
<td>11</td>
<td>4.316</td>
<td>1.072</td>
<td>36</td>
<td>4.91%</td>
<td>0</td>
<td>—</td>
</tr>
<tr>
<td>Westnedge Hill</td>
<td>2.66</td>
<td>1809</td>
<td>679</td>
<td>63</td>
<td>9</td>
<td>4.103</td>
<td>0.990</td>
<td>89</td>
<td>4.92%</td>
<td>7</td>
<td>28</td>
</tr>
<tr>
<td>Westwood</td>
<td>1.90</td>
<td>625</td>
<td>328</td>
<td>59</td>
<td>10</td>
<td>4.245</td>
<td>1.041</td>
<td>32</td>
<td>5.12%</td>
<td>1</td>
<td>38</td>
</tr>
<tr>
<td>City of Kalamazoo</td>
<td>58.45</td>
<td>25754</td>
<td>441</td>
<td>126</td>
<td>11</td>
<td>4.496</td>
<td>0.930</td>
<td>967</td>
<td>3.8</td>
<td>170</td>
<td>22</td>
</tr>
</tbody>
</table>
but these neighborhoods have the highest values in nearly every variable except frequency of ash. Knollwood and South Westnedge have the highest equitability values, a moderate to high number of species considered dominants and very low percentages of *F. pennsylvanica*. Oakland/Winchell and Southside neighborhoods are similar in terms of dominants, but have a lower equitability than Knollwood and South Westnedge and a lower frequency of ash. South Westnedge and Oakland/Winchell have the highest number of dominant species and highest diversity of any neighborhoods in the city.

**DISCUSSION**

Both green ash (*F. pennsylvanica*) and white ash (*F. americana*) have been popular street trees in cities throughout the U.S. Removal of these species and decisions regarding replacement planting will have implications with regards to urban biodiversity and regional susceptibility to further epidemics.

Northside neighborhood is unique, with the lowest number of dominant species and lowest species richness in the city. Northside also has the highest percentage of *F. pennsylvanica* in the city. These characteristics make Northside especially vulnerable to the emerald ash borer. Because Northside also has the lowest socio-economic status of Kalamazoo’s neighborhoods (U.S. Census Bureau, 2000), assistance should be given to residents for replanting purposes if the overall diversity of the city is to be maintained or increased.

Our analysis of neighborhood street tree characteristics highlights the high variability in diversity, equitability, and role of individual species even within a
modest sized Midwestern city. In general, species richness and ash tree densities are lowest in the urban center where neighborhoods are older. The edges of the city, where new developments are taking place, have a general trend toward increasing species richness. It is our hope that as residents are forced to replant street trees due to the impact of EAB, they choose replacements with an eye to enhancing local biodiversity. With this in mind, we are using the data collected in this study to design and implement a prototype spatial decision support system to assist residents in replacing damaged street trees. For input home locations within the city, the system will examine the number of street trees of each species within 200 meters of the home location and compile a list of potential replacement tree species that are not already dominant in the area. The lists will specify and highlight native tree species and species that provide food and cover for wildlife.

ACKNOWLEDGEMENTS

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LITERATURE CITED

APPENDIX A. List of documented street trees in Kalamazoo, Michigan.

The list is arranged alphabetically by family, genus, and species.

**ALTINGIACEAE**

*Liquidambar styraciflua* L.  
*Sweetgum*

**ANACARDIACEAE**

*Cotinus coggygria* L.  
*Smoketree*

*Rhus aromatica* Aiton  
*Fragrant sumac*

**BETULACEAE**

*Betula nigra* L.  
*River birch*

*Betula papyrifera* Marsh.  
*Paper birch*

*Betula pendula* Roth.  
*European white birch*

*Betula populifolia* Marsh.  
*Gray birch*

*Carpinus caroliniana* Walter  
*Blue beech / Ironwood*

*Ostrya virginiana* (Miller) K. Koch  
*Hop hornbeam*

**BIGNONIACEAE**

*Catalpa speciosa* (Warder) Warder ex Engelm.  
*Northern catalpa*

**CANNABACEAE**

*Celtis occidentalis* L.  
*Hackberry*

**CERIDIPHYLLACEAE**

*Katsura tree*

**CORNACEAE**

*Cornus florida* L.  
*Flowering dogwood*

**CUPRESSACEAE**

*Juniperus communis* L.  
*Common juniper*

*Juniperus virginiana* L.  
*Red cedar*

*Metasequoia glyptostroboides* Hu & W.C. Cheng  
*Dawn redwood*

*Thuja occidentalis* L.  
*Northern white cedar*

**ELAEAGNACEAE**

*Eleagnus angustifolia* L.  
*Russian olive*

**FABACEAE**

*Cercis canadensis* L.  
*Redbud*

*Cladrastis kentukea* (Dum. Cours.) Rudd  
*Kentucky yellowwood*

*Gleditsia triacanthos* L.  
*Honey locust*

*Gymnocladus dioicus* (L.) K. Koch  
*Kentucky coffee tree*

*Robinia pseudoacacia* L.  
*Black locust*

*Sophora japonica* (L.) Schott  
*Japanese pagoda tree*

**FAGACEAE**

*Fagus grandifolia* Ehrh.  
*American beech*

*Fagus sylvatica* L.  
*European beech*

*Quercus acutissima* Carruth.  
*Sawtooth oak*
Quercus alba L. White oak
Quercus bicolor Willd. Swamp white oak
Quercus coccinea Münchh. Scarlet oak
Quercus imbricaria Michx. Shingle oak
Quercus macrocarpa Michx. Bur oak
Quercus palustris Münchh. Pin oak
Quercus prinus L. Chestnut oak
Quercus rubra L. Red oak
Quercus velutina Lam. Black oak

GINKGOACEAE
Ginkgo biloba L. Ginkgo

JUGLANDACEAE
Carya cordiformis (Wangenh.) K. Koch Bitternut hickory
Carya glabra (Mill.) Sweet Pignut hickory
Carya ovata (Mill.) K. Koch Shagbark hickory
Carya tomentosa (Lam.) Nutt. Mockernut hickory
Juglans cinerea L. Butternut
Juglans nigra L. Black walnut

LAURACEAE
Sassafras albidum (Nutt.) Nees Sassafras

MAGNOLIACEAE
Liriodendron tulipifera L. Tulip tree
Magnolia acuminata (L.) L. Cucumber tree
Magnolia × soulangiana Soul.-Bod. Saucer magnolia

MALVACEAE
Tilia americana L. L. Basswood
Tilia cordata Mill. Small-leaved linden
Tilia tomentosa Moench Silver linden
Tilia × euchlora K. Koch Crimean linden

MORACEAE
Morus alba L. White mulberry

OLEACEAE
Fraxinus americana L. White ash
Fraxinus nigra Marsh. Black ash
Fraxinus pennsylvanica Marsh. Green ash
Syringa reticulata (Blume) H. Hara Japanese tree lilac
Syringa vulgaris L. Common lilac

PINACEAE
Abies balsamea (L.) Mill. Balsam fir
Abies concolor (Gordon & Glend.) Lindl. ex Hildebr. White fir
Picea abies (L.) H. Karst. Norway spruce
Picea glauca (Moench) Voss White spruce
Picea omorika (Pančić) Purk. Serbian spruce
Picea pungens Engelm. Blue spruce
Pinus nigra J. F. Arnold Black pine / Austrian pine
Pinus resinosa Aiton Red pine
Pinus strobus L. White pine
Pinus sylvestris L. Scots pine
Pseudotsuga menziesii (Mirb.) Franco Douglas fir
Tsuga canadensis (L.) Carrière Eastern hemlock

PLATANACEAE
Platanus occidentalis L. Sycamore

RHAMNACEAE
Rhamnus cathartica L. Common buckthorn

ROSACEAE
Amelanchier arborea (F. Michx.) Fernald Downy serviceberry
Crataegus crus-galli L.  Hawthorn / Cockspurthorn
Crataegus phaenopyrum (L. f.) Medik.  Washington hawthorn
Malus pumila Mill.  Apple
Prunus avium (L.) L.  Sweet cherry
Prunus cerasifera Ehrh.  Cherry plum
Prunus virginiana L.  Choke cherry
Prunus persica (L.) Batsch  Flowering peach
Prunus serotina Ehrh.  Black cherry
Prunus serrulata Lindl.  Japanese cherry
Pyrus calleryana Decne.  Callery pear
Sorbus americana Marsh.  Mountain ash

RUTACEAE
Phellodendron amurense Rupr.  Amur corktree

SALICACEAE
Populus balsamifera L.  Balsam poplar
Populus deltoides W. Bartr. ex Marsh.  Cottonwood
Populus grandidentata Michx.  Bigtooth aspen
Populus tremuloides Michx.  Quaking aspen
Salix babylonica L.  Weeping willow
Salix discolor Muhl.  Pussy willow
Salix matsudana Koidz.  Corkscrew willow

SAPINDACEAE
Acer campestre L.  Hedge maple
Acer griseum (Franch.) Pax  Paperbark maple
Acer negundo L.  Boxelder
Acer palmatum Thunb.  Japanese maple
Acer platanoides L.  Norway maple
Acer pseudoplatanus L.  Sycamore maple
Acer rubrum L.  Red maple
Acer saccharinum L.  Silver maple
Acer saccharum Marsh.  Sugar maple
Acer tataricum L. subsp. ginnala (Maxim.) Wesm. Amur Maple
Aesculus hippocastanum L.  Horse chestnut
Koeleretaeria paniculata Laxm.  Goldenrain tree

SCROPHULARIACEAE
Paulownia tomentosa (Thunb.) Steud.  Princess tree

SIMAROUBACEAE
Ailanthus altissima (Mill.) Swingle  Tree of heaven

TAXACEAE
Taxus canadensis Marsh.  Canada yew

THEACEAE
Stewartia pseudocamellia Maxim.  Japanese stewartia

ULMACEAE
Ulmus americana L.  American elm
Ulmus glabra Huds.  Scots elm
Ulmus parvifolia Jacq.  Chinese elm
Ulmus pumila L.  Siberian elm