

# **An Analysis of Street Tree Benefits for Toledo Ohio**

**By**

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## EXECUTIVE SUMMARY

An inventory of public trees larger than 6 inches in diameter is maintained by the Toledo Division of Parks and Forestry by Craig Schaar and Patrick O'Brien (now with the City of Sylvania). This information was shared with and then analyzed by The Ohio State University's School of Environment and Natural Resources. A total of 84,782 street trees were inventoried. This inventory does not contain trees less than 6-inch diameter which are the most recently planted but, because of their small size, provide the smallest environmental benefits. Most importantly, Toledo has a tree inventory that can be used to better manage the tree resource of the community. Benefits mentioned above do not include the value of the subsequent analysis and report provided through Ohio State Extension.

Analysis of the inventory data was done using iTree, a software suite distributed by the USDA Forest Service. The specific program in the iTree suite used to identify benefits was Shade Tree Resource Analysis Tool for Urban forest Managers (STRATUM) and is available at no charge should this be desired. This program allows individuals interested in making informed decisions about the community tree resource and to explore many aspects including biodiversity and the value of environmental services.

A long standing rule of thumb for biodiversity is the 10–20–30 guideline which suggests that no more than 10% of trees should be from the same species, no more than 20% should be from the same genera, and no more than 30% should be from the same family. In Toledo, Norway maples exceeds the limit for specie and genus at 22%. In aggregate, maples greatly exceed the family limit at 48%. Care should be taken to limit all maples, regardless of size, in future plantings. Ash plantings represented 8% prior to the recent removals. A devastating pest of maples would have five times the impact of EAB if one were to emerge. Large trees should be used where possible as larger trees produce markedly more environmental benefits than small ones as will be seen later. A resident preference survey in Toledo, OH confirms that residents prefer larger trees over smaller ones.

Under ideal conditions tree numbers among smaller size classes should be stable and then decline as tree size increases and older trees die. Looking at the citywide totals (Table 2) suggests that Toledo does have an active tree planting program with trees of a variety of sizes in the inventory.

Trees are variable at present with more than 25% of the trees larger than 24-inch diameter. Importance values as detailed in (Table 4) show that 13,424 larger growing silver maples have a greater importance value (a measure of canopy cover) than 18,260 somewhat smaller growing Norway maples. This demonstrates the need for planting larger statured trees whenever possible as the importance value is a measure of the overall contribution of the species to the total environmental benefits delivered.

A major benefit of urban trees is their ability to intercept rainfall and reduce storm water runoff (Table 5). Storm water runoff is a major cost for many communities. Columbus, OH is about to embark on a multi-billion dollar sewer and storm water upgrade for the community. Trees on Toledo streets intercept more than

254,060 hundred cubic feet (CCF) of storm water annually at a savings to residents of 5.1 million dollars per year in contrast to running that water into the sewer system.

Carbon sequestration, as reported here, represents the carbon removed from the air and stored in the ground's trees (Table 6). More than 665 pounds or 332,934 tons of carbon have been stored by 84,782 trees over time. Toledo's trees currently sequester and avoid nearly 78 million lbs of CO<sub>2</sub> annually (Table 7) and would represent carbon credits worth \$569,216 per year if a carbon trading system were in place and if a system for accounting for them were available for community trees. These are net gain figures and include deductions for tree losses and maintenance. Annual CO<sub>2</sub> benefits vary by species and size. Smaller Norway maples sequester and avoid \$96,488, while a smaller number of larger silver maples sequester and avoid \$193,564.

Energy savings by trees are exceptionally important in view of the citizenry's increasing concern over the nation's energy dependency. Planting trees in our communities may well be more cost effective than building power plants to as an alternative to meeting our energy needs. Energy is saved by shading structures, evaporating water (evapotranspiration) and reducing wind speed around structures (Table 8). Annually, Toledo street trees save \$1,428,117 in electricity and \$2,526,028 in natural gas for a total savings of nearly 4 million dollars or an average of \$47 per tree.

Annual air quality savings (reduced ozone, nitrous and sulfur oxides as well as particulate matter) for Toledo street trees is \$673,535 (Table 9). This includes both direct savings (\$171,933) from the trees and avoided pollution which is much greater at (\$559,496). Avoided pollution is pollution not generated at a power source because energy was not required by Toledo consumers. The total annual air quality benefits are discounted by \$57,894 for the volatile emissions from the trees themselves.

Aesthetic and miscellaneous benefits from trees contribute \$4,758,290 annually to the community in the form of increased property values and enhanced community identity among other things (Table 10). This is an average of \$56.12 per tree per year. Research in public housing has shown that areas with trees facilitate interaction among residents and lead to reduced domestic violence and more sociable environments. Customer surveys suggest that customers prefer to spend their money and time in commercial streetscapes with trees and are willing to spend up to 11% more in commercial settings with trees.

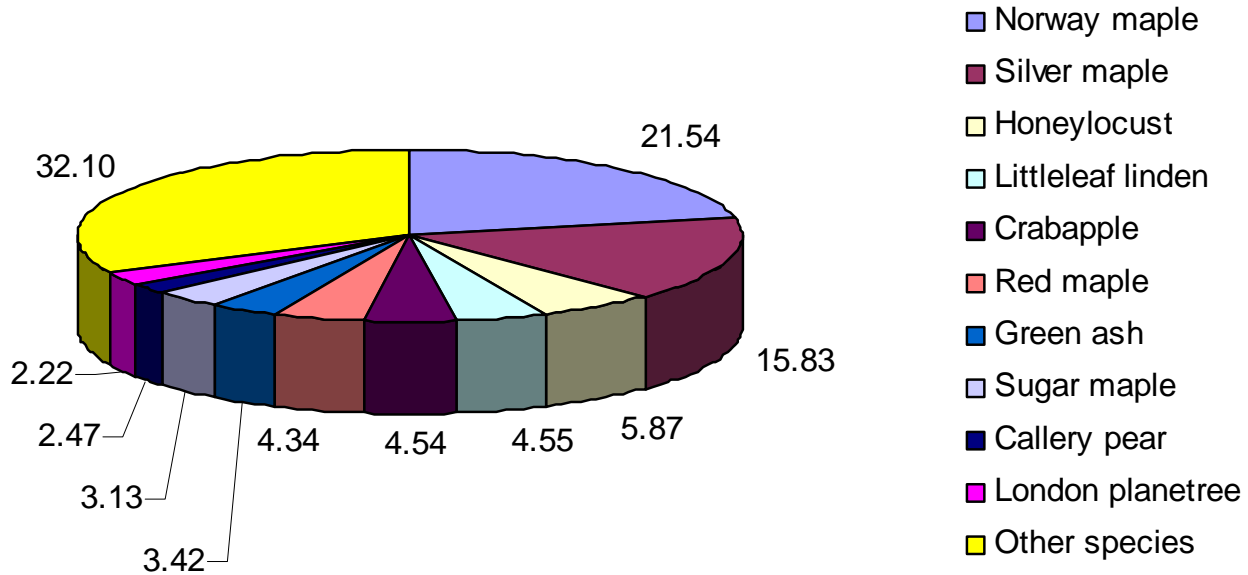
When all benefits are included, Toledo's street trees contribute more than 15 million dollars annually to the community (Table 11). Species vary in their annual benefits but mature size, longevity, and maintenance costs are but some of the factors determining annual benefits. Thus Toledo's 84,782 trees contribute an average of \$178 per tree. This would be well in excess of their maintenance and planting costs.

The Toledo Urban Forestry budget for 2008 is \$4,763,965 and includes a special appropriation of \$1.3 million for ash removal. Even including the special appropriation the return on Toledo's investment in the urban forest would be \$15,105,546 from storm water abatement, CO<sub>2</sub> avoidance and storage, energy savings, air quality, aesthetic benefits, and the like. This is an annual return on investment of 317%. If we consider the 2008 urban forestry budget less the special appropriation (\$3,463,965) the return on investment increases to 436%. Irrespective of how you consider it, Toledo's street trees are truly a contributing part of the community. Unlike most community infrastructure, tree benefits per tree continue to increase over a tree's lifetime as initial installation and maintenance costs are spread over more time.

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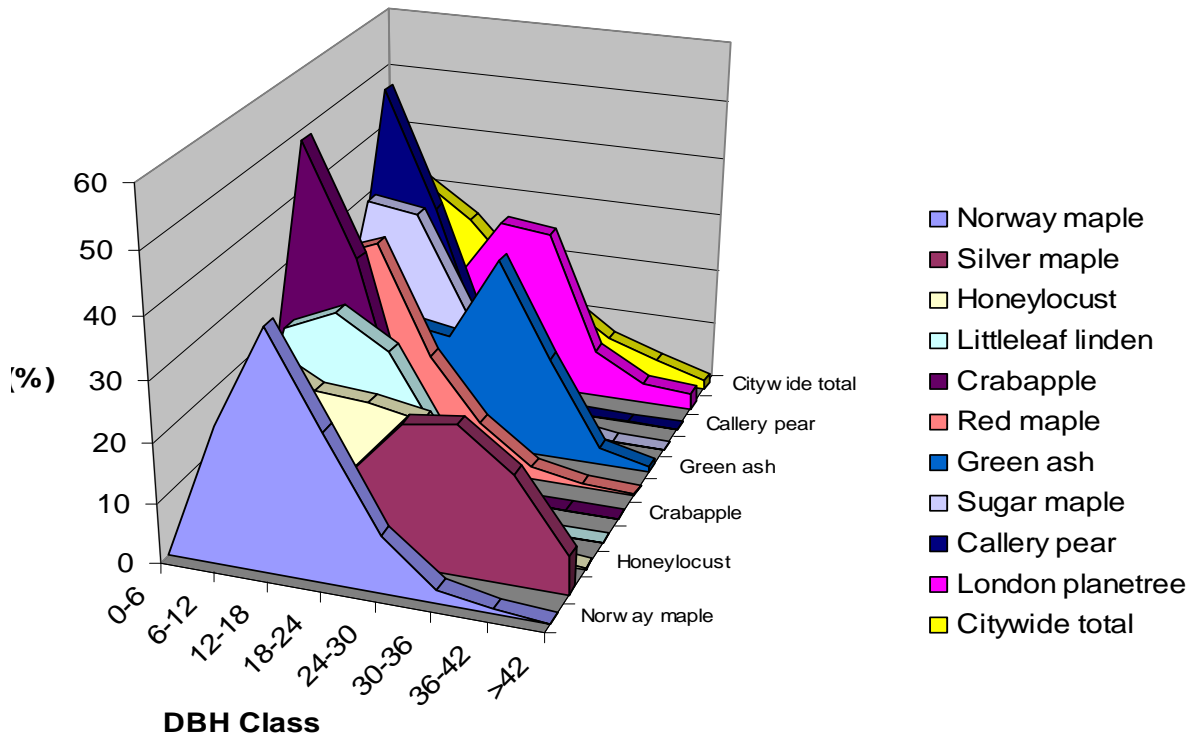
**Table 1. Percent Species Distribution of Toledo's Ten Most Common Street Trees**

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Species	Percent
Norway maple	21.54
Silver maple	15.83
Honeylocust	5.87
Littleleaf linden	4.55
Crabapple	4.54
Red maple	4.34
Green ash	3.42
Sugar maple	3.13
Callery pear	2.47
London planetree	2.22
Other species	32.10
<b>Total</b>	<b>100.00</b>

**Table 2. Relative Age Distribution of the Top 10 Most Commonly Planted Toledo Street Tree Taxa (%)**



Species	DBH class (in)							
	0-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Norway maple	0.0	22.8	39.9	24.8	9.5	2.3	0.7	0.0
Silver maple	0.0	5.2	7.5	14.0	23.7	24.9	18.2	6.5
Honeylocust	0.0	27.1	22.6	22.0	20.4	7.3	0.7	0.0
Littleleaf linden	0.0	28.0	32.0	26.6	12.4	0.9	0.1	0.1
Crabapple	0.0	55.4	37.4	6.5	0.7	0.0	0.0	0.0
Red maple	0.0	33.6	36.8	18.7	8.5	2.0	0.4	0.1
Green ash	0.0	6.6	20.3	18.8	33.2	17.3	3.0	1.0
Sugar maple	0.0	37.0	35.6	19.6	6.4	1.2	0.2	0.0
Callery pear	0.0	53.2	33.4	10.6	2.7	0.0	0.0	0.0
London planetree	0.0	10.9	17.4	29.2	28.3	8.2	3.3	2.8
<b>Citywide total</b>	<b>0.0</b>	<b>31.6</b>	<b>25.8</b>	<b>17.0</b>	<b>12.7</b>	<b>7.2</b>	<b>4.1</b>	<b>1.5</b>

**Table 3. Populations of More Common Toledo Streets Trees by Common Name and Size Class.**

Species	DBH Class (in)							Total
	6-12	12-18	18-24	24-30	30-36	36-42	>42	
<b>Broadleaf Deciduous Large (BDL)</b>								
Silver maple	697	1,013	1,877	3,176	3,338	2,445	878	13,424
Red maple	1,234	1,351	689	311	72	15	4	3,676
Green ash	191	587	544	961	500	86	28	2,897
Sugar maple	982	946	520	169	33	5	1	2,656
London planetree	205	328	550	533	155	63	52	1,886
Sweetgum	270	657	547	255	18	0	0	1,747
Horsechestnut	24	66	324	480	193	48	2	1,137
Northern red oak	123	200	222	200	101	71	31	948
BDL OTHER	2,159	1,017	807	867	608	457	274	6,189
<b>Total</b>	<b>5,885</b>	<b>6,165</b>	<b>6,080</b>	<b>6,952</b>	<b>5,018</b>	<b>3,190</b>	<b>1,270</b>	<b>34,560</b>
<b>Broadleaf Deciduous Medium (BDM)</b>								
Norway maple	4,168	7,287	4,526	1,738	416	119	6	18,260
Honeylocust	1,346	1,122	1,092	1,015	362	35	2	4,974
Littleleaf linden	1,081	1,234	1,026	479	33	3	2	3,858
Callery pear	1,112	699	221	57	1	0	0	2,090
Ginkgo	688	230	50	16	5	1	0	990
Hedge maple	793	107	13	3	0	0	0	916
BDM OTHER	2,753	1,107	598	324	178	78	26	5,064
<b>Total</b>	<b>11,941</b>	<b>11,786</b>	<b>7,526</b>	<b>3,632</b>	<b>995</b>	<b>236</b>	<b>36</b>	<b>36,152</b>
<b>Broadleaf Deciduous Small (BDS)</b>								
Crabapple	2,130	1,439	252	26	1	0	0	3,848
BDS OTHER	4,452	791	180	68	31	16	1	5,539
<b>Total</b>	<b>6,582</b>	<b>2,230</b>	<b>432</b>	<b>94</b>	<b>32</b>	<b>16</b>	<b>1</b>	<b>9,387</b>
<b>Broadleaf Evergreen Small (BES)</b>								
BES OTHER	80	34	5	0	0	0	0	119
<b>Total</b>	<b>80</b>	<b>34</b>	<b>5</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>119</b>
<b>Conifer Evergreen Large (CEL)</b>								
Norway spruce	418	449	122	36	4	0	0	1,029
CEL OTHER	1,302	635	181	62	16	4	0	2,200
<b>Total</b>	<b>1,720</b>	<b>1,084</b>	<b>303</b>	<b>98</b>	<b>20</b>	<b>4</b>	<b>0</b>	<b>3,229</b>

Species	DBH Class (in)							Total
	6-12	12-18	18-24	24-30	30-36	36-42	>42	
<b>Conifer Evergreen Medium (CEM)</b>								
Blue spruce	297	500	76	6	2	0	0	881
CEM OTHER	48	42	11	2	0	0	0	103
<b>Total</b>	<b>345</b>	<b>542</b>	<b>87</b>	<b>8</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>984</b>
<b>Conifer Evergreen Small (CES)</b>								
CES OTHER	270	73	6	1	0	1	0	351
<b>Total</b>	<b>270</b>	<b>73</b>	<b>6</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>0</b>	<b>351</b>
<b>Toledo Totals</b>	<b>26,823</b>	<b>21,914</b>	<b>14,439</b>	<b>10,785</b>	<b>6,067</b>	<b>3,447</b>	<b>1,307</b>	<b>84,782</b>

**Table 4. Toledo's Most Abundant Street Trees by Species Common Name and Listed by Decreasing Importance Values**

Species	Number of Trees	% of Total Trees	Leaf Area (ft <sup>2</sup> )	% Total Leaf Area	Canopy Cover (ft <sup>2</sup> )	% Total Canopy Cover	Importance Value
Norway maple	18,260	22	46,343,776	15	16,770,355	19	18
Silver maple	13,424	16	107,762,992	35	26,972,636	30	27
Honeylocust	4,974	6	25,020,088	8	6,757,486	8	7
Littleleaf linden	3,858	5	10,264,066	3	2,815,063	3	4
Crabapple	3,848	5	2,047,199	1	1,916,019	2	2
Red maple	3,676	4	9,093,259	3	3,436,246	4	4
Green ash	2,897	3	16,762,824	5	4,273,917	5	5
Sugar maple	2,656	3	6,311,805	2	2,225,610	2	3
Callery pear	2,090	2	3,111,576	1	1,383,681	2	2
London planetree	1,886	2	8,516,319	3	2,222,336	2	2
Sweetgum	1,747	2	5,700,831	2	1,795,537	2	2
Horsechestnut	1,137	1	7,751,738	3	1,807,952	2	2
Norway spruce	1,029	1	2,475,219	1	401,729	0	1
Ginkgo	990	1	504,317	0	377,879	0	1
Northern red oak	948	1	3,176,757	1	913,353	1	1
Hedge maple	916	1	864,434	0	494,765	1	1
Blue spruce	881	1	1,703,387	1	356,058	0	1
Other trees	19,565	23	47,585,068	16	14,778,792	16	18
<b>Total</b>	<b>84,782</b>	<b>100</b>	<b>304,995,744</b>	<b>100</b>	<b>89,699,408</b>	<b>100</b>	<b>100</b>



**Table 5. Annual Storm Water Benefits for Toledo’s Street Trees by Species Listed by Decreasing Percentage of Trees**

<b>Species</b>	<b>Total Rainfall Interception (CCF)</b>	<b>Total (\$)</b>	<b>% of Total Tree Numbers</b>	<b>% of Total \$</b>	<b>Avg. /tree (\$)</b>
Norway maple	43,460	\$881,036	21.5	17.1	\$48.25
Silver maple	90,273	\$1,830,034	15.8	35.5	\$136.33
Honeylocust	16,560	\$335,710	5.9	6.5	\$67.49
Littleleaf linden	8,577	\$173,867	4.6	3.4	\$45.07
Crabapple	2,473	\$50,137	4.5	1.0	\$13.03
Red maple	8,109	\$164,397	4.3	3.2	\$44.72
Green ash	13,028	\$264,100	3.4	5.1	\$91.16
Sugar maple	5,310	\$107,650	3.1	2.1	\$40.53
Callery pear	3,212	\$65,116	2.5	1.3	\$31.16
London planetree	6,567	\$133,131	2.2	2.6	\$70.59
Sweetgum	4,877	\$98,871	2.1	1.9	\$56.59
Horsechestnut	5,491	\$111,306	1.3	2.2	\$97.89
Norway spruce	1,987	\$40,276	1.2	0.8	\$39.14
Ginkgo	635	\$12,880	1.2	0.3	\$13.01
Northern red oak	2,644	\$53,591	1.1	1.0	\$56.53
Hedge maple	954	\$19,332	1.1	0.4	\$21.10
Blue spruce	1,598	\$32,402	1.0	0.6	\$36.78
Other street trees	38,305	\$776,527	23.1	15.1	\$39.69
<b>Toledo total</b>	<b>254,060</b>	<b>\$5,150,362</b>	<b>100.0</b>	<b>100.0</b>	<b>\$60.75</b>

**Table 6. Stored CO2 Benefits of Toledo Street Trees by Species**

Species	Total stored CO2 (lbs)	Total (\$)	% Total Tree Numbers	% of Total \$	Avg. /tree (\$)
Norway maple	99,501,672	\$746,263	21.5	14.9	\$41
Silver maple	264,448,624	\$1,983,365	15.8	39.7	\$148
Honeylocust	29,306,982	\$219,802	5.9	4.4	\$44
Littleleaf linden	21,854,056	\$163,905	4.6	3.3	\$42
Crabapple	8,185,528	\$61,391	4.5	1.2	\$16
Red maple	14,922,773	\$111,921	4.3	2.2	\$30
Green ash	40,026,868	\$300,202	3.4	6.0	\$104
Sugar maple	12,022,189	\$90,166	3.1	1.8	\$34
Callery pear	6,341,389	\$47,560	2.5	0.9	\$23
London planetree	23,049,034	\$172,868	2.2	3.5	\$92
Sweetgum	11,807,100	\$88,553	2.1	1.8	\$51
Horsechestnut	15,806,280	\$118,547	1.3	2.4	\$104
Norway spruce	1,340,159	\$10,051	1.2	0.2	\$10
Ginkgo	1,118,926	\$8,392	1.2	0.2	\$8
Northern red oak	8,810,718	\$66,080	1.1	1.3	\$70
Hedge maple	1,387,740	\$10,408	1.1	0.2	\$11
Blue spruce	884,920	\$6,637	1.0	0.1	\$8
Other street trees	47,651,532	\$787,901	23.1	15.8	\$40
<b>Toledo total</b>	<b>665,868,288</b>	<b>\$4,994,016</b>	<b>100.0</b>	<b>100.0</b>	<b>\$59</b>

**Table 7. Annual Carbon Dioxide Benefits of Toledo's Street Trees by Species Listed by Decreasing Percentage of Trees**

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Release (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total (\$)	% Total Tree Numbers	% of Total \$	Avg. /tree (\$)
Norway maple	6,515,794	\$48,868	-477,608	-3,561	-\$3,609	6,830,375	\$51,228	12,865,000	\$96,488	21.5	17.0	\$5.28
Silver maple	19,390,420	\$145,428	-1,269,353	-2,618	-\$9,540	7,690,110	\$57,676	25,808,558	\$193,564	15.8	34.0	\$14.42
Honeylocust	3,333,794	\$25,003	-140,674	-970	-\$1,062	2,255,227	\$16,914	5,447,378	\$40,855	5.9	7.2	\$8.21
Littleleaf linden	2,221,380	\$16,660	-104,899	-752	-\$792	1,196,935	\$8,977	3,312,663	\$24,845	4.6	4.4	\$6.44
Crabapple	748,255	\$5,612	-39,291	-750	-\$300	801,765	\$6,013	1,509,979	\$11,325	4.5	2.0	\$2.94
Red maple	1,492,927	\$11,197	-71,629	-717	-\$543	1,331,429	\$9,986	2,752,009	\$20,640	4.3	3.6	\$5.61
Green ash	2,055,265	\$15,414	-192,129	-565	-\$1,445	1,442,698	\$10,820	3,305,270	\$24,790	3.4	4.4	\$8.56
Sugar maple	888,982	\$6,667	-57,707	-518	-\$437	879,082	\$6,593	1,709,839	\$12,824	3.1	2.3	\$4.83
Callery pear	643,752	\$4,828	-30,439	-408	-\$231	600,146	\$4,501	1,213,052	\$9,098	2.5	1.6	\$4.35
London planetree	1,417,080	\$10,628	-110,635	-368	-\$833	813,763	\$6,103	2,119,840	\$15,899	2.2	2.8	\$8.43
Sweetgum	945,587	\$7,092	-56,674	-341	-\$428	694,942	\$5,212	1,583,514	\$11,876	2.1	2.1	\$6.80
Horsechestnut	814,168	\$6,106	-75,870	-222	-\$571	583,047	\$4,373	1,321,123	\$9,908	1.3	1.7	\$8.71
Norway spruce	105,955	\$795	-6,433	-201	-\$50	179,166	\$1,344	278,488	\$2,089	1.2	0.4	\$2.03
Ginkgo	86,867	\$652	-5,371	-193	-\$42	166,844	\$1,251	248,147	\$1,861	1.2	0.3	\$1.88
Northern red oak	233,150	\$1,749	-42,291	-185	-\$319	339,429	\$2,546	530,102	\$3,976	1.1	0.7	\$4.19
Hedge maple	194,760	\$1,461	-6,661	-179	-\$51	200,885	\$1,507	388,806	\$2,916	1.1	0.5	\$3.18
Blue spruce	69,128	\$518	-4,248	-172	-\$33	157,877	\$1,184	222,585	\$1,669	1.0	0.3	\$1.89
Other street trees	6,389,853	\$47,924	-504,257	-3,815	-\$3,811	5,397,274	\$40,480	11,279,055	\$84,593	23.1	14.9	\$4.32
<b>Toledo total</b>	<b>47,547,112</b>	<b>\$356,603</b>	<b>-3,196,169</b>	<b>-16,533</b>	<b>-\$24,095</b>	<b>31,560,990</b>	<b>\$236,707</b>	<b>75,895,400</b>	<b>\$569,216</b>	<b>100.0</b>	<b>100.0</b>	<b>\$6.71</b>

**Table 8. Annual Energy Benefits for Toledo's Street Trees by Species  
Listed by Decreasing Benefits per Tree (\$/tree)**

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (MBtu)	Natural Gas (\$)	Total (\$)	% of Total Tree Number	% of Total \$	Avg. \$/tree
Norway maple	4,072.1	\$309,070	57229	\$560,849	\$869,919	21.5	22.0	\$47.64
Silver maple	4,584.6	\$347,973	60267	\$590,617	\$938,590	15.8	23.7	\$69.92
Honeylocust	1,344.5	\$102,048	17793	\$174,368	\$276,415	5.9	7.0	\$55.57
Littleleaf linden	713.6	\$54,161	9938	\$97,388	\$151,549	4.6	3.8	\$39.28
Crabapple	478.0	\$36,279	7165	\$70,216	\$106,496	4.5	2.7	\$27.68
Red maple	793.8	\$60,246	10451	\$102,417	\$162,663	4.3	4.1	\$44.25
Green ash	860.1	\$65,281	11791	\$115,550	\$180,831	3.4	4.6	\$62.42
Sugar maple	524.1	\$39,778	6856	\$67,186	\$106,964	3.1	2.7	\$40.27
Callery pear	357.8	\$27,156	5085	\$49,833	\$76,989	2.5	2.0	\$36.84
London planetree	485.1	\$36,822	6997	\$68,572	\$105,395	2.2	2.7	\$55.88
Sweetgum	414.3	\$31,446	5520	\$54,097	\$85,543	2.1	2.2	\$48.97
Horsechestnut	347.6	\$26,383	4762	\$46,663	\$73,045	1.3	1.9	\$64.24
Norway spruce	106.8	\$8,107	1393	\$13,650	\$21,757	1.2	0.6	\$21.14
Ginkgo	99.5	\$7,550	1318	\$12,918	\$20,468	1.2	0.5	\$20.67
Northern red oak	202.4	\$15,359	2787	\$27,311	\$42,670	1.1	1.1	\$45.01
Hedge maple	119.8	\$9,090	1695	\$16,607	\$25,697	1.1	0.6	\$28.05
Blue spruce	94.1	\$7,144	1229	\$12,045	\$19,188	1.0	0.5	\$21.78
Other street trees	3,217.7	\$244,223	45484	\$445,741	\$689,964	23.1	17.5	\$35.27
<b>Toledo total</b>	<b>18,815.8</b>	<b>\$1,428,117</b>	<b>257758</b>	<b>\$2,526,028</b>	<b>\$3,954,145</b>	<b>100.0</b>	<b>100.0</b>	<b>\$46.64</b>

**Table 9. Annual Air Quality Benefits of Toledo's Street Trees by Species Listed by Decreasing Benefits per Tree Species**

Species	Deposit O3 (lb)	Deposit NO2 (lb)	Deposit PM10 (lb)	Deposit SO2 (lb)	Total Deposition (\$)	Avoided NO2 (lb)	Avoided PM10 (lb)	Avoided VOC (lb)	Avoided SO2 (lb)	Total Avoided (\$)	BVOC Emission (\$)	Net Total (lb)	Total (\$)	% Total Tree Number	Avg. \$/tree
Norway maple	6019	1038	3043	267	\$32,763	19613	2845	2710	18478	\$121,814	-\$5,499	52546	\$149,078	21.5	\$8.16
Silver maple	11743	1991	5748	521	\$63,266	21603	3163	3020	20737	\$135,181	-\$22,636	62489	\$175,811	15.8	\$13.10
Honeylocust	2307	380	1075	105	\$12,243	6353	929	887	6088	\$39,725	-\$6,428	16410	\$45,540	5.9	\$9.16
Littleleaf linden	1008	174	511	45	\$5,490	3428	498	474	3239	\$21,316	-\$1,888	8873	\$24,919	4.6	\$6.46
Crabapple	516	85	251	24	\$2,770	2338	336	320	2167	\$14,425	-\$10	6033	\$17,184	4.5	\$4.47
Red maple	1349	230	641	60	\$7,215	3749	549	524	3596	\$23,451	-\$1,757	10227	\$28,908	4.3	\$7.86
Green ash	1229	197	584	55	\$6,534	4108	598	570	3898	\$25,589	\$0	11240	\$32,123	3.4	\$11.09
Sugar maple	418	71	236	19	\$2,341	2471	362	346	2374	\$15,468	-\$1,318	5945	\$16,491	3.1	\$6.21
Callery pear	374	65	201	17	\$2,069	1728	250	238	1624	\$10,723	-\$369	4399	\$12,423	2.5	\$5.94
London planetree	628	107	317	28	\$3,410	2352	340	324	2201	\$14,572	-\$2,058	5748	\$15,924	2.2	\$8.44
Sweetgum	364	58	190	16	\$1,984	1965	287	274	1878	\$12,273	\$0	5032	\$14,257	2.1	\$8.16
Horsechestnut	554	94	273	24	\$2,989	1658	241	230	1574	\$10,329	-\$1,619	4217	\$11,699	1.3	\$10.29
Norway spruce	162	32	140	20	\$1,088	503	74	70	484	\$3,148	-\$2,239	888	\$1,997	1.2	\$1.94
Ginkgo	78	13	43	3	\$434	470	69	66	451	\$2,940	-\$110	1163	\$3,263	1.2	\$3.30
Northern red oak	414	71	202	18	\$2,234	966	141	134	917	\$6,018	-\$2,214	2274	\$6,038	1.1	\$6.37
Hedge maple	108	18	59	5	\$600	576	84	80	542	\$3,576	-\$167	1427	\$4,008	1.1	\$4.38
Blue spruce	147	29	126	18	\$984	443	65	62	426	\$2,773	-\$1,589	893	\$2,169	1.0	\$2.46
Other street trees	4283	718	2243	216	\$23,519	15489	2246	2139	14584	\$96,176	-\$7,993	39787	\$111,702	23.1	\$5.71
<b>Citywide total</b>	<b>31700</b>	<b>5373</b>	<b>15881</b>	<b>1460</b>	<b>\$171,933</b>	<b>89812</b>	<b>13077</b>	<b>12468</b>	<b>85258</b>	<b>\$559,496</b>	<b>-\$57,894</b>	<b>239590</b>	<b>\$673,535</b>	<b>100.0</b>	<b>\$7.94</b>

**Table 10. Annual Aesthetic or Other Benefits of Toledo Street Trees by Species Listed by Decreasing Percentage of Inventory**

<b>Species</b>	<b>Total (\$)</b>	<b>% Total Tree Numbers</b>	<b>% Total \$</b>	<b>Avg. \$/tree</b>
Norway maple	\$644,179	21.5	13.5	\$35.28
Silver maple	\$1,491,420	15.8	31.3	\$111.10
Honeylocust	\$764,856	5.9	16.1	\$153.77
Littleleaf linden	\$236,098	4.6	5.0	\$61.20
Crabapple	\$43,173	4.5	0.9	\$11.22
Red maple	\$200,988	4.3	4.2	\$54.68
Green ash	\$165,904	3.4	3.5	\$57.27
Sugar maple	\$105,636	3.1	2.2	\$39.77
Callery pear	\$67,839	2.5	1.4	\$32.46
London planetree	\$105,485	2.2	2.2	\$55.93
Sweetgum	\$87,317	2.1	1.8	\$49.98
Horsechestnut	\$83,370	1.3	1.8	\$73.32
Norway spruce	\$27,646	1.2	0.6	\$26.87
Ginkgo	\$8,677	1.2	0.2	\$8.76
Northern red oak	\$17,681	1.1	0.4	\$18.65
Hedge maple	\$32,129	1.1	0.7	\$35.08
Blue spruce	\$20,470	1.0	0.4	\$23.24
Other street trees	\$655,420	23.1	13.8	\$33.50
<b>Citywide total</b>	<b>\$4,758,290</b>	<b>100.0</b>	<b>100.0</b>	<b>\$56.12</b>

**Table 11. Average Annual Benefits of Toledo Street Trees by Most Common Species in Dollars per Species**

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic/ Other	Total (\$)	% of Total Dollars
Norway maple	\$869,919	\$96,488	\$149,078	\$881,036	\$644,179	\$2,640,699	17.5
Silver maple	\$938,590	\$193,564	\$175,811	\$1,830,034	\$1,491,420	\$4,629,419	30.6
Honeylocust	\$276,415	\$40,855	\$45,540	\$335,710	\$764,856	\$1,463,377	9.7
Littleleaf linden	\$151,549	\$24,845	\$24,919	\$173,867	\$236,098	\$611,277	4.0
Crabapple	\$106,496	\$11,325	\$17,184	\$50,137	\$43,173	\$228,315	1.5
Red maple	\$162,663	\$20,640	\$28,908	\$164,397	\$200,988	\$577,597	3.8
Green ash	\$180,831	\$24,790	\$32,123	\$264,100	\$165,904	\$667,747	4.4
Sugar maple	\$106,964	\$12,824	\$16,491	\$107,650	\$105,636	\$349,565	2.3
Callery pear	\$76,989	\$9,098	\$12,423	\$65,116	\$67,839	\$231,465	1.5
London planetree	\$105,395	\$15,899	\$15,924	\$133,131	\$105,485	\$375,833	2.5
Sweetgum	\$85,543	\$11,876	\$14,257	\$98,871	\$87,317	\$297,865	2.0
Horsechestnut	\$73,045	\$9,908	\$11,699	\$111,306	\$83,370	\$289,330	1.9
Norway spruce	\$21,757	\$2,089	\$1,997	\$40,276	\$27,646	\$93,764	0.6
Ginkgo	\$20,468	\$1,861	\$3,263	\$12,880	\$8,677	\$47,149	0.3
Northern red oak	\$42,670	\$3,976	\$6,038	\$53,591	\$17,681	\$123,957	0.8
Hedge maple	\$25,697	\$2,916	\$4,008	\$19,332	\$32,129	\$84,082	0.6
Blue spruce	\$19,188	\$1,669	\$2,169	\$32,402	\$20,470	\$75,900	0.5
Other street trees	\$689,964	\$84,593	\$111,702	\$776,527	\$655,420	\$2,318,206	15.3
<b>Toledo totals</b>	<b>\$3,954,144</b>	<b>\$569,216</b>	<b>\$673,535</b>	<b>\$5,150,362</b>	<b>\$4,758,287</b>	<b>\$15,105,546</b>	<b>100.0</b>