

Environmental Benefits Analysis of Trees for Cedarville, Ohio

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An Analysis of Tree Benefits for Cedarville, Ohio

EXECUTIVE SUMMARY

An inventory of public trees on the streets and in the parks of the City of Cedarville, Ohio was conducted by Ohio State Extension and its Greene County Master Gardeners. A total of 367 trees were inventoried during this period. A common bid price for this service is \$4.00 per tree and thus the inventory represents a value of \$1,470. Most importantly, however, is that the community now has a tree inventory in a form that can be used to better manage the tree resource of Cedarville. Benefits mentioned above do not include the value of the subsequent analysis and report by The Ohio State University's School of Environment and Natural Resources which would conservatively add another \$11,500. 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 iStreets. This program allows community leaders interested in making informed decisions about Cedarville's green infrastructure or to explore many aspects including biodiversity and values of environmental services such that environmental benefits can be enhanced to reduce costs and the carbon footprint of the community.

A long standing rule of thumb for taxonomic biodiversity is the 10–20–30 guideline which suggests that no more than 10 percent of trees should be from the same species, no more than 20 percent should be from the same genera, and no more than 30 percent should be from the same family. In Cedarville, maple trees exceed genus and family guidelines and ashes exceed the genus guideline (Table 1). We recommend against any further plantings of maple until guidelines are met. Ash plantings represent 51 individuals or 14 % of the public trees and 12% of the canopy (Table 3). This represents a loss of 1/8th of the canopy if emerald ash borer (EAB) should destroy all American ash as predicted. Ash removal and/or treatment costs will need to be addressed by informed community leaders. Ohio State Extension can assist in developing considered plans including costs and probabilities of treatment vs. no treatment. There is no single answer for communities facing this problem. Based on the inventory and estimates, ash removal costs in Cedarville would likely exceed \$36,000. Replacement costs adds another \$15,000 more.

Larger growing deciduous trees constituting 2.5% or less of Cedarville's canopy cover that could be used to replace the ash include the Kentucky coffeetree; Shumard, swamp white, and chinquapin oaks; American sycamore, buckeye, basswood, and elms.

Under ideal conditions tree numbers among various size classes should be stable and then decline as trees reach their mature size and older trees die. Smaller sized trees are under-represented generally. Crabapples and cherries are present in smaller size classes while maples and hackberries are concentrated in mature sizes (Tables 2 and 3).

Dominant maples produce a percentage of canopy cover that is consistent with their importance value (Table 4). Smaller growing crabapples and cherries (plums) often produce fewer benefits per tree than their larger growing counterparts. This reinforces the need for planting larger statured trees such as preferred in a Toledo, OH resident preference survey whenever possible although maples should be avoided for reasons of biodiversity. The importance value is a measure of the overall contribution of the species to the sum of 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 Ohio communities. Columbus, OH is embarking on a multi-billion dollar sewer and storm

water upgrade for the community. Public trees, alone, in Cedarville intercept nearly 671,000 gallons of storm water annually at a savings to the community of \$18,000 dollars per year. This could be could be increased with strategic plantings of larger growing trees.

Carbon sequestration, as reported here, represents the carbon removed from the air and stored in the trees (Table 6). More than 1,900,000 pounds or 950 tons of carbon have been stored by the 367 trees over time. Cedarville's trees currently sequester and avoided nearly 249,000 lbs of CO₂ yearly (Table 8) and would represent carbon credits worth \$1,867 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 CO₂ benefits vary by species and size but average \$5 per tree per year while larger honeylocusts average \$11.20 per tree per year or 2.2 times as much. Strategic plantings could increase this substantially and be a significant tool in reducing Cedarville's carbon footprint.

Energy savings by trees are particularly important in view of the citizenry's increasing concern over the nation's energy dependency. Energy is saved by shading structures, evaporating water (evapotranspiration) and reducing wind speed around structures (Table 7). Cedarville trees save the community \$6,290 in electricity and \$10,900 in natural gas for a total savings of \$17,200 or an average of \$47 per tree per year. Recent interest in strategic plantings of large trees to enhance energy savings has real potential for savings.

Annual air quality savings (reduced ozone, nitrous and sulfur oxides as well as particulate matter) for the public trees is nearly \$3,000 (Table 9). This includes both direct savings (\$688) from Cedarville's trees and avoided pollution which is much greater at \$2,458. Avoided pollution is pollution not generated at power source because energy was not required (avoided) by the community. The total annual air quality benefits are discounted by \$167 for the volatile emissions (BVOC) from the trees themselves.

Aesthetic and miscellaneous benefits from trees contribute \$14,000 annually to Cedarville in the form of increased property values and enhanced community identity among other things (Table 10). 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 such an environment.

When all annual benefits are included the 367 trees contribute an average of \$148 per tree 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. This would be well in excess of their maintenance and planting costs for Cedarville's trees.

The Cedarville budget for trees maintenance was estimated to be \$7,700 based on the budget of \$2 per capita required for Tree City USA status by the National Arbor Day Foundation and Cedarville's population of 3,828. Thus while the 367 trees on the grounds require relatively little care per year they deliver \$54,300 in annual benefits from storm water abatement, carbon sequestration, energy savings, air quality, aesthetic benefits, and the like. This is a 700% return on investment. Returns here may seem high but Ohio communities studied routinely discover returns on their tree maintenance dollars of 2-300% and Toledo had a 436% annual return with one of the larger tree maintenance budgets in Ohio. Further, unlike most community infrastructure, annual tree benefits per tree continue to increase over a tree's lifetime.

**Table 1. Species Distribution of the Most Common Trees in Cedarville, Ohio
Arranged from Most to Least Commonly Seen**

Species	Percent
Maple	34.60
Ash	13.90
Black walnut	8.17
Callery pear	6.27
Eastern cottonwood	5.72
Elm	4.90
Black locust	3.27
Mulberry	3.00
Cherry plum	2.72
American sycamore	2.45
OTHER SPECIES	14.99
Total	100.00

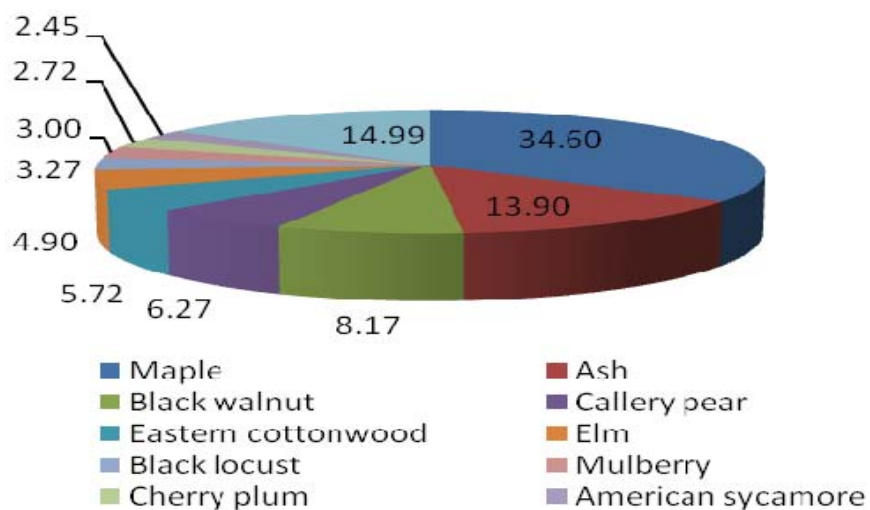
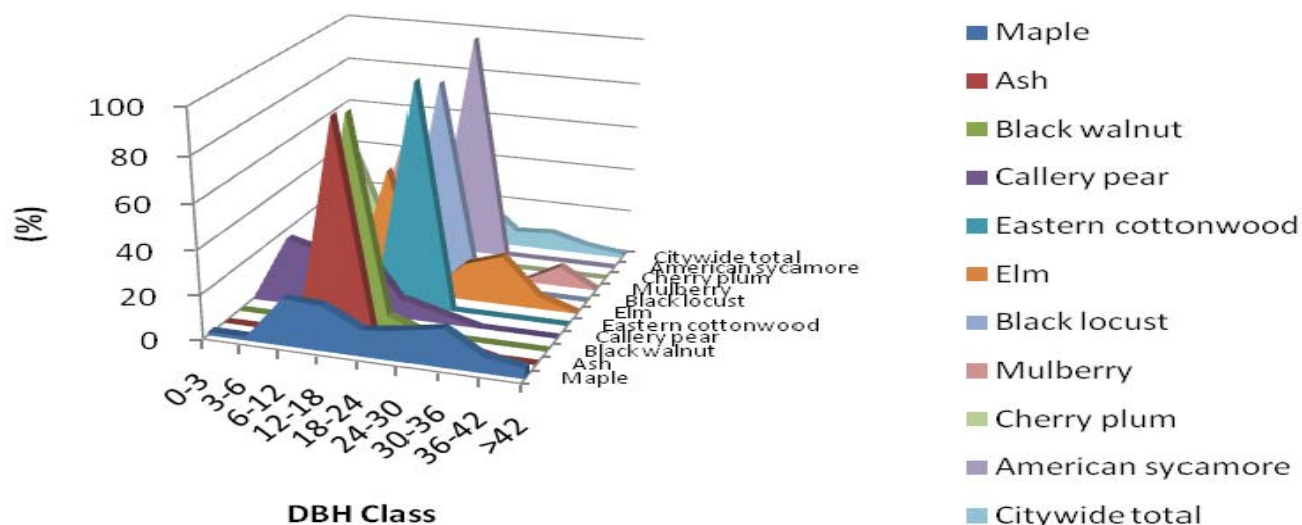


Table 2. Relative Age Distribution of the 10 Most Commonly Planted Trees in Cedarville, Ohio as a Percentage (%) of each Tree by Common Names



Species	DBH class (in)								
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Maple	1.6	1.6	21.3	20.5	11.8	14.2	17.3	7.1	4.7
Ash	0.0	0.0	0.0	96.1	0.0	0.0	3.9	0.0	0.0
Black walnut	0.0	0.0	0.0	93.3	6.7	0.0	0.0	0.0	0.0
Callery pear	0.0	30.4	26.1	30.4	8.7	4.3	0.0	0.0	0.0
Eastern cottonwood	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Elm	0.0	0.0	0.0	55.6	0.0	16.7	22.2	5.6	0.0
Black locust	0.0	0.0	0.0	0.0	91.7	8.3	0.0	0.0	0.0
Mulberry	0.0	0.0	18.2	72.7	0.0	0.0	0.0	9.1	0.0
Cherry plum	0.0	50.0	10.0	40.0	0.0	0.0	0.0	0.0	0.0
American sycamore	0.0	0.0	0.0	0.0	100.0	0.0	0.0	0.0	0.0
Cedarville total	0.5	5.4	12.0	40.6	20.7	7.1	8.2	3.8	1.6



Table 3. Population of Cedarville Trees by Common Name, Tree Type and Size (DBH) Class.

Species	DBH Class (in)									
	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42	Total
Broadleaf Deciduous Large (BDL)										
Maple	2	2	27	26	15	18	22	9	6	127
Black walnut	0	0	0	28	2	0	0	0	0	30
Eastern cottonwood	0	0	0	0	21	0	0	0	0	21
American sycamore	0	0	0	0	9	0	0	0	0	9
Black maple	0	0	0	0	8	0	0	0	0	8
Northern hackberry	0	0	3	4	0	0	1	0	0	8
Oak	0	0	0	0	5	0	0	0	0	5
Hickory	0	0	0	4	0	0	0	0	0	4
Tulip tree	0	0	0	0	0	0	0	1	0	1
Total	2	2	30	62	60	18	23	10	6	213
Broadleaf Deciduous Medium (BDM)										
Ash	0	0	0	49	0	0	2	0	0	51
Callery pear	0	7	6	7	2	1	0	0	0	23
Elm	0	0	0	10	0	3	4	1	0	18
Black locust	0	0	0	0	11	1	0	0	0	12
Broadleaf Deciduous Medium	0	1	1	4	0	1	0	0	0	7
Honeylocust	0	0	0	0	2	2	1	0	0	5
Zelkova	0	0	0	2	0	0	0	2	0	4
Ginkgo	0	1	0	0	0	0	0	0	0	1
Total	0	9	7	72	15	8	7	3	0	121
Broadleaf Deciduous Small (BDS)										
Mulberry	0	0	2	8	0	0	0	1	0	11
Cherry plum	0	5	1	4	0	0	0	0	0	10
Flowering crabapple	0	4	0	0	0	0	0	0	0	4
Total	0	9	3	12	0	0	0	1	0	25
Conifer Evergreen Large (CEL)										
Pine	0	0	1	3	1	0	0	0	0	5
Spruce	0	0	3	0	0	0	0	0	0	3
Total	0	0	4	3	1	0	0	0	0	8
Cedarville Total	2	20	44	149	76	26	30	14	6	367

Table 4. Cedarville, Ohio Trees Listed by Common Name from Greatest to Least Importance Value.

Species	Number of Trees	% of Total Trees	Leaf Area (ft2)	% of Total Leaf Area	Canopy Cover (ft2)	% of Total Canopy Cover	Importance Value
Maple	127	34.6	408085	39.6	138875	39.1	37.8
Ash	51	13.9	101231	9.8	42900	12.1	11.9
Black walnut	30	8.2	66145	6.4	25653	7.2	7.3
Eastern cottonwood	21	5.7	85564	8.3	26387	7.4	7.2
Elm	18	4.9	67327	6.5	20973	5.9	5.8
Callery pear	23	6.3	30700	3.0	13140	3.7	4.3
Black locust	12	3.3	46419	4.5	14957	4.2	4.0
Black maple	8	2.2	37668	3.7	11574	3.3	3.0
Honeylocust	5	1.4	44435	4.3	9566	2.7	2.8
American sycamore	9	2.5	30326	2.9	9675	2.7	2.7
Northern hackberry	8	2.2	17975	1.7	7866	2.2	2.0
Mulberry	11	3.0	8276	0.8	7004	2.0	1.9
Broadleaf Deciduous Medium	7	1.9	14141	1.4	5398	1.5	1.6
Oak	5	1.4	15600	1.5	4938	1.4	1.4
Cherry plum	10	2.7	3445	0.3	3486	1.0	1.3
Zelkova	4	1.1	17218	1.7	3962	1.1	1.3
Pine	5	1.4	13183	1.3	2159	0.6	1.1
Hickory	4	1.1	8366	0.8	3221	0.9	0.9
Flowering crabapple	4	1.1	143	0.0	377	0.1	0.4
OTHER TREES	5	1.4	14365	1.4	3010	0.8	1.2
Total	367	100.0	1030612	100.0	355121	100.0	100.0



Table 5. Annual Storm Water Benefits of Cedarville, Ohio Trees by Species Ordered by Decreasing Benefits/Tree

Species	Total Rainfall Interception (Gal)	Total (\$)	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
Honeylocust	19863	\$538	1.4	3.0	\$107.67
Black maple	22934	\$622	2.2	3.4	\$77.70
Eastern cottonwood	54401	\$1,474	5.7	8.1	\$70.21
Black locust	31034	\$841	3.3	4.6	\$70.09
Zelkova	10006	\$271	1.1	1.5	\$67.80
Elm	44203	\$1,198	4.9	6.6	\$66.55
American sycamore	19194	\$520	2.5	2.9	\$57.80
Maple	259552	\$7,034	34.6	38.7	\$55.39
Oak	10194	\$276	1.4	1.5	\$55.25
Pine	8180	\$222	1.4	1.2	\$44.34
Northern hackberry	12541	\$340	2.2	1.9	\$42.49
Ash	76569	\$2,075	13.9	11.4	\$40.69
Black walnut	44498	\$1,206	8.2	6.6	\$40.20
Hickory	5862	\$159	1.1	0.9	\$39.72
Broadleaf Deciduous Medium	10149	\$275	1.9	1.5	\$39.29
Callery pear	23240	\$630	6.3	3.5	\$27.38
Mulberry	7035	\$191	3.0	1.1	\$17.33
Cherry plum	3274	\$89	2.7	0.5	\$8.87
Flowering crabapple	275	\$7	1.1	0.0	\$1.86
OTHER STREET TREES	7964	\$216	1.4	1.2	\$43.17
CEDARVILLE TOTAL	670967	\$18,184	100.0	100.0	\$49.55



Table 6. Stored CO₂ Benefits in the Trees in Cedarville, Ohio by Species Ordered by Decreasing Benefits per Tree

Species	Total stored CO ₂ (lbs)	Total (\$)	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
Honeylocust	50220	\$377	1.4	2.6	\$75.33
Zelkova	37668	\$283	1.1	2.0	\$70.63
Black locust	101678	\$763	3.3	5.3	\$63.55
Eastern cottonwood	177611	\$1,332	5.7	9.3	\$63.43
Elm	150483	\$1,129	4.9	7.9	\$62.70
American sycamore	73962	\$555	2.5	3.9	\$61.63
Oak	41090	\$308	1.4	2.2	\$61.63
Black maple	63562	\$477	2.2	3.3	\$59.59
Maple	680587	\$5,104	34.6	35.7	\$40.19
Broadleaf Deciduous Medium	30096	\$226	1.9	1.6	\$32.25
Ash	206144	\$1,546	13.9	10.8	\$30.32
Hickory	14687	\$110	1.1	0.8	\$27.54
Black walnut	98526	\$739	8.2	5.2	\$24.63
Mulberry	32856	\$246	3.0	1.7	\$22.40
Callery pear	63673	\$478	6.3	3.3	\$20.76
Northern hackberry	21502	\$161	2.2	1.1	\$20.16
Pine	7110	\$53	1.4	0.4	\$10.67
Cherry plum	13945	\$105	2.7	0.7	\$10.46
Flowering crabapple	711	\$5	1.1	0.0	\$1.33
OTHER STREET TREES	17447	\$288	1.4	2.0	\$57.69
CITYWIDE TOTAL	1,904,575	\$14,284	100.0	100.0	\$38.92

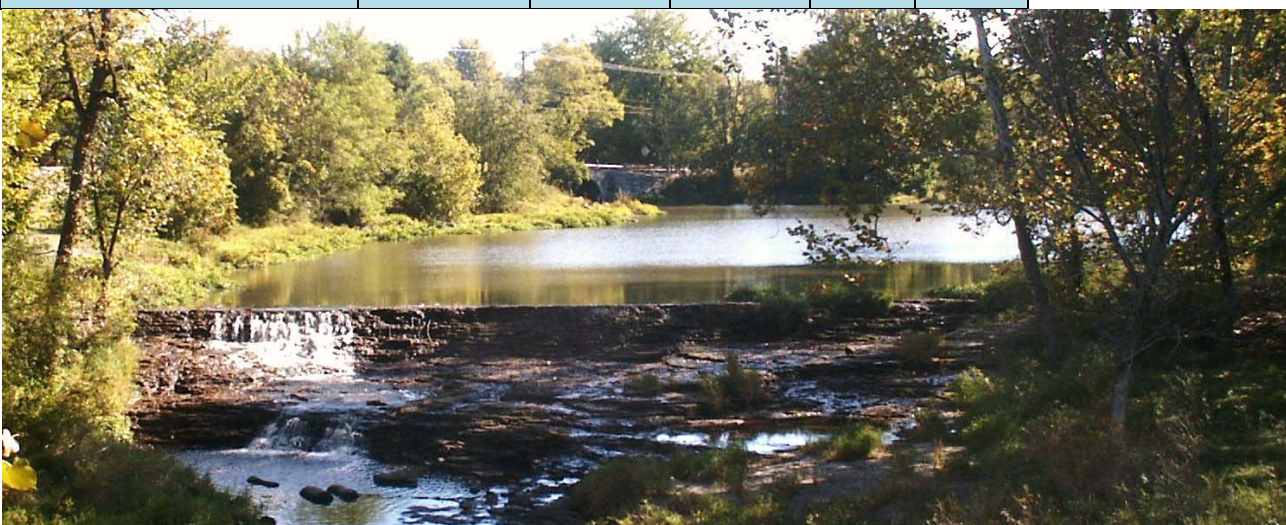


Table 7. Annual Energy Benefits of Cedarville, Ohio Trees by Common Name and Decreasing Dollars/Tree

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
Honeylocust	1.7	\$130	227	\$222	\$352	1.4	2.1	\$70.48
Black maple	2.3	\$173	319	\$313	\$485	2.2	2.8	\$60.68
Black locust	3.2	\$243	483	\$473	\$716	3.3	4.2	\$59.70
Elm	4.9	\$374	674	\$661	\$1,034	4.9	6.0	\$57.47
Eastern cottonwood	5.5	\$419	800	\$784	\$1,204	5.7	7.0	\$57.32
American sycamore	2.2	\$165	327	\$321	\$486	2.5	2.8	\$53.99
Zelkova	1.0	\$74	132	\$129	\$203	1.1	1.2	\$50.69
Maple	29.7	\$2,250	4032	\$3,951	\$6,202	34.6	36.1	\$48.83
Northern hackberry	1.9	\$141	252	\$247	\$388	2.2	2.3	\$48.46
Ash	12.2	\$925	1540	\$1,509	\$2,434	13.9	14.2	\$47.72
Black walnut	7.5	\$573	854	\$837	\$1,410	8.2	8.2	\$46.99
Oak	1.1	\$81	153	\$150	\$231	1.4	1.4	\$46.28
Hickory	0.9	\$71	108	\$106	\$177	1.1	1.0	\$44.23
Broadleaf Deciduous Med.	1.4	\$107	188	\$185	\$291	1.9	1.7	\$41.63
Mulberry	1.8	\$138	255	\$250	\$388	3.0	2.3	\$35.23
Callery pear	3.4	\$257	477	\$468	\$725	6.3	4.2	\$31.54
Pine	0.6	\$45	73	\$72	\$116	1.4	0.7	\$23.29
Cherry plum	0.9	\$70	130	\$128	\$198	2.7	1.2	\$19.77
Flowering crabapple	0.1	\$7	15	\$15	\$22	1.1	0.1	\$5.40
OTHER STREET TREES	0.6	\$45	88	\$86	\$131	1.4	0.8	\$26.27
CEDARVILLE TOTAL	82.8	\$6,288	11129	\$10,906	\$17,194	100.0	100.0	\$46.85



Table 8. Annual Carbon Dioxide Benefits of Cedarville, Ohio Trees by Common Name and Ordered by Decreasing Benefits per Tree

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maint Release (lb)	Total Release (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total (\$)	% Total Tree Numbers	% of Total \$	Avg. \$/tree
Honeylocust	4844	\$36	-241	-13.7	-\$2	2875	\$22	7464	\$56	1.4	3.0	\$11.20
Black maple	7387	\$55	-305	-21.8	-\$2	3816	\$29	10876	\$82	2.2	4.4	\$10.20
Eastern cottonwood	13854	\$104	-853	-57.3	-\$7	9269	\$70	22213	\$167	5.7	8.9	\$7.93
American sycamore	5375	\$40	-355	-24.6	-\$3	3645	\$27	8640	\$65	2.5	3.5	\$7.20
Black locust	5539	\$42	-488	-33.5	-\$4	5379	\$40	10396	\$78	3.3	4.2	\$6.50
Hickory	1781	\$13	-70	-7.8	-\$1	1571	\$12	3275	\$25	1.1	1.3	\$6.14
Ash	18912	\$142	-989	-104.1	-\$8	20433	\$153	38250	\$287	13.9	15.4	\$5.63
Oak	1910	\$14	-197	-13.7	-\$2	1800	\$14	3499	\$26	1.4	1.4	\$5.25
Elm	4970	\$37	-722	-51.5	-\$6	8259	\$62	12455	\$93	4.9	5.0	\$5.19
Black walnut	6887	\$52	-473	-60.1	-\$4	12660	\$95	19014	\$143	8.2	7.6	\$4.75
Broadleaf Deciduous Medium	2233	\$17	-145	-13.1	-\$1	2359	\$18	4434	\$33	1.9	1.8	\$4.75
Zelkova	1029	\$8	-181	-12.5	-\$1	1629	\$12	2464	\$18	1.1	1.0	\$4.62
Maple	30959	\$232	-3267	-275.0	-\$27	49734	\$373	77151	\$579	34.6	31.0	\$4.56
Northern hackberry	1650	\$12	-103	-15.6	-\$1	3119	\$23	4650	\$35	2.2	1.9	\$4.36
Callery pear	6024	\$45	-311	-33.7	-\$3	5690	\$43	11371	\$85	6.3	4.6	\$3.71
Mulberry	2369	\$18	-158	-21.5	-\$1	3051	\$23	5241	\$39	3.0	2.1	\$3.57
Pine	587	\$4	-34	-9.8	\$0	990	\$7	1533	\$12	1.4	0.6	\$2.30
Cherry plum	1374	\$10	-67	-11.9	-\$1	1544	\$12	2839	\$21	2.7	1.1	\$2.13
Flowering crabapple	152	\$1	-3	-2.3	\$0	149	\$1	295	\$2	1.1	0.1	\$0.55
OTHER STREET TREES	2114	\$16	-185	-9.2	-\$1	992	\$7	2913	\$22	1.4	1.2	\$4.37
CEDARVILLE TOTAL	119949	\$900	-9148	-792.5	-\$75	138964	\$1,042	248972	\$1,867	100.0	100.0	\$5.09



Table 9. Annual Air Quality Benefits of Cedarville, Ohio Trees by Species' Common Names and Ordered by Decreasing Total Air Pollution Benefits per Tree

Species	Deposit O3 (lb)	Deposit NO2 (lb)	Deposit PM10 (lb)	Deposit SO2 (lb)	Total Deposit (\$)	Avoid NO2 (lb)	Avoid PM10 (lb)	Avoid VOC (lb)	Avoid SO2 (lb)	Total Avoid (\$)	BVOC Emissions (lb)	BVOC Emissions (\$)	Total (lb)	Total (\$)	% of Total Tree Numbers	Avg. \$/tree
Honeylocust	3.9	0.6	1.8	0.2	\$21	8.1	1.2	1.1	7.8	\$51	-\$3	-\$11	21.6	\$60	1.4	\$11.97
Black maple	6.0	1.0	2.7	0.3	\$32	10.9	1.6	1.5	10.3	\$68	-\$2	-\$7	32.4	\$92	2.2	\$11.54
Black locust	6.3	1.1	3.1	0.3	\$34	15.7	2.3	2.1	14.5	\$97	-\$1	-\$6	43.9	\$125	3.3	\$10.44
Elm	9.1	1.6	4.5	0.4	\$49	23.6	3.4	3.3	22.3	\$147	-\$2	-\$8	66.0	\$188	4.9	\$10.44
Eastern cottonwood	5.6	0.9	2.9	0.2	\$30	26.8	3.9	3.7	25.0	\$166	\$0	\$0	69.0	\$196	5.7	\$9.34
Maple	62.9	10.7	29.3	2.8	\$335	141.1	20.6	19.6	134.3	\$880	-\$21	-\$79	400.4	\$1,136	34.6	\$8.95
Zelkova	1.8	0.3	0.9	0.1	\$10	4.6	0.7	0.6	4.4	\$29	-\$1	-\$3	12.5	\$35	1.1	\$8.82
Ash	12.4	2.1	6.5	0.6	\$68	57.2	8.4	8.0	55.3	\$359	-\$3	-\$12	147.3	\$415	13.9	\$8.14
Northern hackberry	1.5	0.3	0.9	0.1	\$8	8.9	1.3	1.2	8.4	\$55	\$0	\$0	22.5	\$64	2.2	\$7.97
Black walnut	2.7	0.5	1.9	0.1	\$17	34.5	5.1	4.9	34.2	\$219	\$0	\$0	84.0	\$235	8.2	\$7.84
American sycamore	2.1	0.4	1.1	0.1	\$12	10.7	1.5	1.5	9.9	\$66	-\$2	-\$7	25.2	\$70	2.5	\$7.78
Hickory	0.4	0.1	0.3	0.0	\$2	4.3	0.6	0.6	4.2	\$27	\$0	\$0	10.6	\$30	1.1	\$7.42
Broadleaf Deciduous Med	1.8	0.3	0.9	0.1	\$10	6.7	1.0	0.9	6.4	\$42	\$0	-\$2	17.7	\$50	1.9	\$7.13
Oak	2.1	0.4	1.0	0.1	\$11	5.2	0.7	0.7	4.9	\$32	-\$3	-\$11	12.2	\$33	1.4	\$6.50
Mulberry	2.2	0.4	1.0	0.1	\$12	8.7	1.3	1.2	8.2	\$54	\$0	\$0	23.1	\$66	3.0	\$5.99
Callery pear	3.8	0.6	2.0	0.2	\$21	16.3	2.4	2.3	15.4	\$102	-\$1	-\$4	42.0	\$119	6.3	\$5.16
Cherry plum	0.9	0.1	0.4	0.0	\$5	4.4	0.6	0.6	4.2	\$28	\$0	\$0	11.4	\$32	2.7	\$3.23
Pine	0.9	0.2	0.8	0.1	\$6	2.7	0.4	0.4	2.7	\$17	-\$3	-\$12	5.0	\$11	1.4	\$2.28
Flowering crabapple	0.0	0.0	0.0	0.0	\$0	0.4	0.1	0.1	0.4	\$3	\$0	\$0	1.0	\$3	1.1	\$0.71
OTHER STREET TREES	1.1	0.2	0.6	0.1	\$6	2.9	0.4	0.4	2.7	\$18	-\$1	-\$5	7.1	\$19	1.4	\$3.87
CITYWIDE TOTAL	127.6	21.7	62.7	5.7	\$688	393.7	57.5	54.8	375.6	\$2,458	-\$44	-\$167	1054.9	\$2,979	100.0	\$8.12



Table 10. Annual Aesthetic or Other Benefits of Trees by Species in Cedarville, Ohio

Species	Total (\$)	% of Total Tree Numbers	% of Total \$	Avg. \$/tree
Honeylocust	\$1,167	1.4	8.3	\$233.40
Black maple	\$873	2.2	6.2	\$109.08
Eastern cottonwood	\$1,211	5.7	8.6	\$57.69
American sycamore	\$428	2.5	3.1	\$47.53
Hickory	\$183	1.1	1.3	\$45.86
Black locust	\$505	3.3	3.6	\$42.09
Northern hackberry	\$304	2.2	2.2	\$37.97
Black walnut	\$1,132	8.2	8.1	\$37.74
Ash	\$1,919	13.9	13.7	\$37.62
Maple	\$4,170	34.6	29.7	\$32.83
Broadleaf Deciduous Medium	\$227	1.9	1.6	\$32.46
Pine	\$159	1.4	1.1	\$31.89
Callery pear	\$639	6.3	4.6	\$27.79
Zelkova	\$110	1.1	0.8	\$27.55
Oak	\$137	1.4	1.0	\$27.47
Elm	\$486	4.9	3.5	\$27.00
Mulberry	\$137	3.0	1.0	\$12.42
Cherry plum	\$79	2.7	0.6	\$7.86
Flowering crabapple	\$8	1.1	0.1	\$2.06
OTHER STREET TREES	\$168	1.4	1.2	\$33.69
CEDARVILLE TOTAL	\$14,043	100.0	100.0	\$38.26

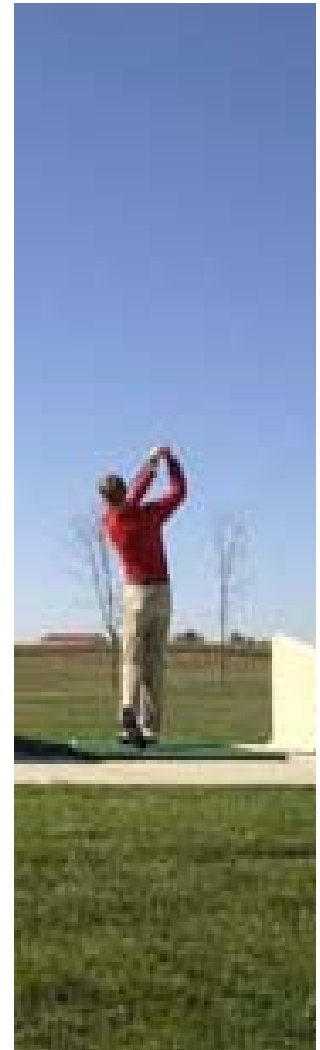


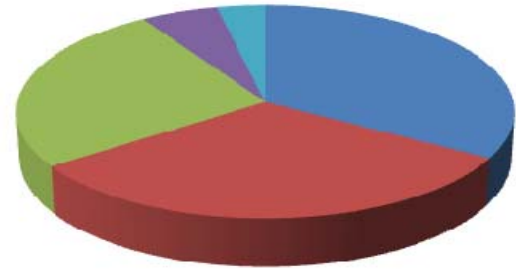
Table 11. Annual Benefits and Total Annual Benefits per Tree by Common Name for Cedarville Street Trees

Species	Energy	CO2	Air Quality	Stormwater	Aesthetic /Other	Total
Honeylocust	\$70	\$11	\$12	\$108	\$233	\$434.72
Black maple	\$61	\$10	\$12	\$78	\$109	\$269.19
Eastern cottonwood	\$57	\$8	\$9	\$70	\$58	\$202.49
Black locust	\$60	\$6	\$10	\$70	\$42	\$188.82
American sycamore	\$54	\$7	\$8	\$58	\$48	\$174.30
Elm	\$57	\$5	\$10	\$67	\$27	\$166.65
Zelkova	\$51	\$5	\$9	\$68	\$28	\$159.47
Maple	\$49	\$5	\$9	\$55	\$33	\$150.56
Hickory	\$44	\$6	\$7	\$40	\$46	\$143.36
Northern hackberry	\$48	\$4	\$8	\$42	\$38	\$141.23
Oak	\$46	\$5	\$7	\$55	\$27	\$140.75
Ash	\$48	\$6	\$8	\$41	\$38	\$139.80
Black walnut	\$47	\$5	\$8	\$40	\$38	\$137.52
Broadleaf Deciduous Medium	\$42	\$5	\$7	\$39	\$32	\$125.26
Pine	\$23	\$2	\$2	\$44	\$32	\$104.10
Callery pear	\$32	\$4	\$5	\$27	\$28	\$95.58
Mulberry	\$35	\$4	\$6	\$17	\$12	\$74.55
Cherry plum	\$20	\$2	\$3	\$9	\$8	\$41.87
Flowering crabapple	\$5	\$1	\$1	\$2	\$2	\$10.58
OTHER STREET TREES	\$26	\$4	\$4	\$43	\$34	\$111.37



Table 12 Environmental Benefits from Five Benefit Categories for Cedarville Street Trees

Benefits	Total (\$)	\$/tree
Stormwater	\$18,184	\$49.55
Energy	\$17,194	\$46.85
Aesthetic/Other	\$14,043	\$38.26
Air Quality	\$2,979	\$8.12
CO2	\$1,867	\$5.09
Total Benefits	\$54,267	\$147.87



■ Stormwater ■ Energy
■ Aesthetic/Other ■ Air Quality
■ CO2

