

Annual Energy Benefits of Roanoke Park Trees by Species

11/4/2012

Species	Total Electricity (MWh)	Electricity (\$)	Total Natural Gas (Therms)	Natural Gas (\$)	Total (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Northern hackberry	85.5	6,490	12,567.7	12,316	18,807	32.9	38.1	27.22
Tree of heaven	17.8	1,352	2,666.9	2,614	3,965	7.9	8.0	24.03
American elm	10.3	784	1,300.4	1,274	2,059	6.1	4.2	16.09
Eastern redbud	3.9	294	656.9	644	938	5.5	1.9	8.15
American basswood	10.9	824	1,534.4	1,504	2,328	5.2	4.7	21.16
Eastern hophornbeam	2.6	198	446.6	438	635	4.8	1.3	6.29
Chinkapin oak	15.0	1,138	1,969.0	1,930	3,067	4.2	6.2	34.86
Red mulberry	9.9	748	1,443.1	1,414	2,163	3.8	4.4	27.03
Green ash	4.6	350	627.3	615	965	3.4	2.0	13.59
Black walnut	9.5	725	1,265.7	1,240	1,965	3.1	4.0	30.70
Hickory	2.5	193	342.6	336	529	2.4	1.1	10.58
Siberian elm	5.3	405	688.3	674	1,080	2.0	2.2	26.33
Norway maple	1.5	110	233.5	229	339	1.7	0.7	9.42
American sycamore	8.0	608	1,074.9	1,053	1,661	1.5	3.4	51.91
Black cherry	1.1	81	184.7	181	262	1.5	0.5	8.20
Northern red oak	5.6	425	787.4	772	1,197	1.5	2.4	37.41
Honeylocust	4.9	374	672.6	659	1,034	1.3	2.1	36.91
Mulberry	1.9	143	302.9	297	440	1.1	0.9	19.12
Boxelder	2.4	178	310.3	304	483	1.1	1.0	21.94
OTHER STREET TREES	25.7	1,954	3,569.5	3,498	5,452	9.1	11.0	28.55
Park-wide total	228.9	17,376	32,644.9	31,992	49,368	100.0	100.0	23.51

Annual Energy Benefits: The Energy report presents the contribution of the urban forest toward conserving energy in terms of reduced natural gas use in winter (measured in therms or gigajoules) and reduced electricity use for air conditioning in summer (measured in kilowatt-hours or gigajoules). (Source: i-Tree Streets Manual)



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Visit www.roanokeparkkc.org/plans/tree-inventory for more information. A portion of the funding for this project was made available through the Missouri Department of Conservation's Tree Resource Improvement and Maintenance (TRIM) program.

Annual Stormwater Benefits of Roanoke Park Trees by Species

12/4/2012

Species	Total rainfall interception (Gal)	Total (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Northern hackberry	544,653	14,761	32.9	33.1	21.36
Tree of heaven	104,174	2,823	7.9	6.3	17.11
American elm	68,556	1,858	6.1	4.2	14.52
Eastern redbud	13,319	361	5.5	0.8	3.14
American basswood	65,776	1,783	5.2	4.0	16.21
Eastern hophornbeam	8,305	225	4.8	0.5	2.23
Chinkapin oak	125,705	3,407	4.2	7.6	38.71
Red mulberry	62,368	1,690	3.8	3.8	21.13
Green ash	29,827	808	3.4	1.8	11.39
Black walnut	77,081	2,089	3.1	4.7	32.64
Hickory	16,656	451	2.4	1.0	9.03
Siberian elm	42,649	1,156	2.0	2.6	28.19
Norway maple	6,280	170	1.7	0.4	4.73
American sycamore	79,656	2,159	1.5	4.8	67.46
Black cherry	3,568	97	1.5	0.2	3.02
Northern red oak	56,778	1,539	1.5	3.5	48.09
Honeylocust	41,174	1,116	1.3	2.5	39.85
Mulberry	8,049	218	1.1	0.5	9.48
Boxelder	16,416	445	1.1	1.0	20.22
OTHER STREET TREES	274,825	7,448	9.1	16.7	39.00
Park-wide total	1,645,814	44,605	100.0	100.0	21.24

Annual Stormwater Benefits: The Stormwater report presents the reductions in annual stormwater runoff due to rainfall interception by trees (measured in gallons). (Source: i-Tree Streets Manual)



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Annual Air Quality Benefits of Roanoke Park Trees by Species

11/4/2012

Species	Deposition (lb)				Total Depos. (\$)	Avoided (lb)				Total Avoided (\$)	BVOC Emissions (lb)	BVOC Emissions (\$)	Total (lb)	Total (\$)	% of Total Trees	Avg. \$/tree
	O ₃	NO ₂	PM ₁₀	SO ₂		NO ₂	PM ₁₀	VOC	SO ₂							
Northern hackberry	55.7	9.7	34.0	2.5	320	416.6	60.1	57.2	388.0	2,576	0.0	0	1,023.8	2,896	32.9	4.19
Tree of heaven	12.7	2.2	7.6	0.6	72	87.2	12.6	11.9	80.8	538	-3.8	-14	211.8	596	7.9	3.61
American elm	4.2	0.7	3.0	0.2	26	48.2	7.1	6.8	46.8	303	0.0	0	117.1	329	6.1	2.57
Eastern redbud	1.9	0.3	1.2	0.1	11	19.6	2.8	2.6	17.5	119	0.0	0	46.0	130	5.5	1.13
American basswood	5.2	0.9	3.4	0.2	30	52.4	7.6	7.2	49.3	325	-5.7	-21	120.5	334	5.2	3.04
Eastern hophornbeam	0.7	0.1	0.6	0.0	4	13.2	1.9	1.8	11.8	80	0.0	0	30.0	85	4.8	0.84
Chinkapin oak	11.9	1.9	6.4	0.5	65	70.8	10.4	9.9	67.9	443	0.0	0	179.7	508	4.2	5.78
Red mulberry	8.8	1.5	4.9	0.4	49	48.0	6.9	6.6	44.7	297	-2.4	-9	119.5	337	3.8	4.21
Green ash	1.3	0.2	1.1	0.1	8	21.9	3.2	3.1	20.9	137	0.0	0	51.7	145	3.4	2.04
Black walnut	6.8	1.1	3.8	0.3	38	45.2	6.6	6.3	43.3	282	0.0	0	113.3	320	3.0	5.00
Hickory	0.7	0.1	0.6	0.0	4	12.1	1.8	1.7	11.5	75	0.0	0	28.5	80	2.4	1.60
Siberian elm	4.9	0.8	2.7	0.2	27	25.1	3.7	3.5	24.2	157	0.0	0	65.0	184	2.0	4.49
Norway maple	0.3	0.0	0.3	0.0	2	7.3	1.0	1.0	6.6	44	-0.2	-1	16.4	46	1.7	1.27
American sycamore	9.0	1.4	4.5	0.4	49	38.0	5.6	5.3	36.3	237	0.0	0	100.5	286	1.5	8.94
Black cherry	0.4	0.1	0.3	0.0	2	5.4	0.8	0.7	4.9	33	0.0	0	12.6	36	1.5	1.11
Northern red oak	11.9	2.1	5.8	0.5	64	26.9	3.9	3.7	25.4	167	-17.1	-64	63.1	167	1.5	5.22
Honeylocust	7.3	1.2	3.5	0.3	39	23.5	3.4	3.3	22.3	146	-5.4	-20	59.4	165	1.3	5.89
Mulberry	2.2	0.4	1.1	0.1	12	9.4	1.3	1.3	8.5	57	0.0	0	24.3	69	1.1	3.01
Boxelder	1.3	0.2	0.8	0.1	7	11.1	1.6	1.6	10.6	69	-0.7	-3	26.5	74	1.0	3.36
OTHER STREET TREES	39.0	6.5	20.7	2.2	215	123.3	17.9	17.1	116.7	767	-21.4	-80	322.0	902	9.1	4.72
Park-wide total	186.2	31.4	106.1	8.8	1,047	1,105.1	160.1	152.4	1,038.2	6,856	-56.7	-213	2,731.7	7,690	100.0	3.66

Annual Air Quality Benefits: The Air Quality report quantifies the air pollutants (O₃, NO₂, SO₂, PM10) deposited on tree surfaces and reduced emissions from power plants (NO₂, PM10, VOCs, SO₂) due to reduced electricity use (measured in pounds or kilograms). Also reported are the potential negative effects of trees on air quality due to BVOC emissions. (Source: i-Tree Streets Manual)



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Annual CO₂ Benefits of Roanoke Park Trees by Species

1/12/2013

Species	Sequestered (lb)	Sequestered (\$)	Decomposition Release (lb)	Maintenance Release (lb)	Total Released (\$)	Avoided (lb)	Avoided (\$)	Net Total (lb)	Total Standard Error (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Northern hackberry	73,255	549	-3,864	-831	-35	143,436	1,076	211,996	1,590 (N/A)	32.9	30.1	2.30
Tree of heaven	35,126	263	-1,137	-191	-10	29,871	224	63,669	478 (N/A)	7.9	9.1	2.89
American elm	13,202	99	-784	-134	-7	17,337	130	29,622	222 (N/A)	6.1	4.2	1.74
Eastern redbud	6,476	49	-210	-82	-2	6,498	49	12,682	95 (N/A)	5.5	1.8	0.83
American basswood	17,736	133	-959	-131	-8	18,215	137	34,860	261 (N/A)	5.2	5.0	2.38
Eastern hophornbeam	4,363	33	-111	-63	-1	4,365	33	8,554	64 (N/A)	4.8	1.2	0.64
Chinkapin oak	33,502	251	-1,892	-154	-15	25,143	189	56,600	425 (N/A)	4.2	8.0	4.82
Red mulberry	17,941	135	-755	-104	-6	16,536	124	33,617	252 (N/A)	3.8	4.8	3.15
Green ash	10,466	78	-259	-63	-2	7,742	58	17,886	134 (N/A)	3.4	2.5	1.89
Black walnut	21,376	160	-1,091	-101	-9	16,015	120	36,199	272 (N/A)	3.1	5.1	4.24
Hickory	6,012	45	-142	-39	-1	4,270	32	10,102	76 (N/A)	2.4	1.4	1.52
Siberian elm	9,022	68	-622	-59	-5	8,951	67	17,292	130 (N/A)	2.0	2.5	3.16
Norway maple	3,570	27	-66	-22	-1	2,434	18	5,916	44 (N/A)	1.7	0.8	1.23
American sycamore	18,549	139	-1,416	-81	-11	13,430	101	30,483	229 (N/A)	1.5	4.3	7.14
Black cherry	1,746	13	-52	-23	-1	1,799	13	3,470	26 (N/A)	1.5	0.5	0.81
Northern red oak	6,172	46	-1,247	-74	-10	9,400	70	14,251	107 (N/A)	1.5	2.0	3.34
Honeylocust	9,968	75	-454	-41	-4	8,272	62	17,746	133 (N/A)	1.3	2.5	4.75
Mulberry	1,978	15	-177	-31	-2	3,160	24	4,930	37 (N/A)	1.1	0.7	1.61
Boxelder	4,296	32	-152	-26	-1	3,944	30	8,063	60 (N/A)	1.1	1.2	2.75
OTHER STREET TREES	48,187	361	-5,138	-326	-41	43,190	324	85,913	644 (N/A)	9.1	12.2	3.37
Park-wide total	342,944	2,572	-20,528	-2,574	-173	384,009	2,880	703,851	5,279 (N/A)	100.0	100.0	2.51

Annual Carbon Dioxide Benefits: The Carbon Dioxide report presents annual reductions in atmospheric CO₂ due to sequestration by trees and reduced emissions from power plants due to reduced energy use (in pounds or kilograms). The model accounts for CO₂ released as trees die and decompose and CO₂ released during the care and maintenance of trees. (Source: i-Tree Streets Manual)



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Stored CO₂ Benefits of Roanoke Park Trees by Species

1/12/2013

Species	Total Stored CO ₂ (lbs)	Total (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Northern hackberry	789,481	5,921	32.9	18.7	8.57
Tree of heaven	230,259	1,727	7.9	5.4	10.47
American elm	154,664	1,160	6.1	3.7	9.06
Eastern redbud	43,742	328	5.5	1.0	2.85
American basswood	199,848	1,499	5.2	4.7	13.63
Eastern hophornbeam	23,068	173	4.8	0.6	1.71
Chinkapin oak	394,119	2,956	4.2	9.3	33.59
Red mulberry	154,272	1,157	3.8	3.7	14.46
Green ash	53,975	405	3.4	1.3	5.70
Black walnut	227,267	1,705	3.1	5.4	26.63
Hickory	29,522	221	2.4	0.7	4.43
Siberian elm	127,578	957	2.0	3.0	23.34
Norway maple	8,747	66	1.7	0.2	1.82
American sycamore	294,936	2,212	1.5	7.0	69.13
Black cherry	10,800	81	1.5	0.3	2.53
Northern red oak	259,836	1,949	1.5	6.1	60.90
Honeylocust	93,592	702	1.3	2.2	25.07
Mulberry	36,804	276	1.1	0.9	12.00
Boxelder	30,657	230	1.1	0.7	10.45
OTHER STREET TREES	484,413	8,010	9.1	25.2	41.94
Park-wide total	4,231,116	31,733	100.0	100.0	15.11

Stored Carbon Dioxide Benefits: Whereas the “Annual CO₂ Benefits” report quantifies annual CO₂ reductions, the Carbon Stored report tallies all of the carbon dioxide stored in the urban forest over the life of the trees as a result of sequestration (in pounds or kilograms). It should not be added to the “Annual CO₂ Benefits” value or double-counting will occur. (Source: i-Tree Streets Manual)



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Annual Aesthetic/Other Benefits of Roanoke Park Trees by Species

1/12/2013

Species	Total (\$)	% of Total Trees	% of Total \$	Avg. \$/tree
Northern hackberry	16,131	32.9	35.0	23.34
Tree of heaven	4,022	7.9	8.7	24.38
American elm	2,031	6.1	4.4	15.87
Eastern redbud	359	5.5	0.8	3.13
American basswood	1,670	5.2	3.6	15.18
Eastern hophornbeam	238	4.8	0.5	2.36
Chinkapin oak	3,380	4.2	7.3	38.40
Red mulberry	2,010	3.8	4.4	25.12
Green ash	1,542	3.4	3.3	21.72
Black walnut	2,263	3.1	4.9	35.37
Hickory	949	2.4	2.1	18.98
Siberian elm	991	2.0	2.2	24.18
Norway maple	477	1.7	1.0	13.26
American sycamore	1,629	1.5	3.5	50.91
Black cherry	96	1.5	0.2	3.01
Northern red oak	480	1.5	1.0	15.01
Honeylocust	2,216	1.3	4.8	79.14
Mulberry	111	1.1	0.2	4.85
Boxelder	601	1.1	1.3	27.34
OTHER STREET TREES	4,920	9.1	10.7	25.76
Park-wide total	46,120	100.0	100.0	21.96

Annual Aesthetic/Other Benefits: The Aesthetic/Other report presents the tangible and intangible benefits of trees reflected in increases in property values (in dollars). (Source: i-Tree Streets Manual)



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Annual Benefits of Roanoke Park Trees by Species (\$/tree) SUMMARY

1/12/2013

Species	Energy	CO ₂	Air Quality	Stormwater	Aesthetic/Other	Total (\$/tree)	
Northern hackberry	27.22	2.30	4.19	21.36	23.34	78.42	
Tree of heaven	24.03	2.89	3.61	17.11	24.38	72.03	
American elm	16.09	1.74	2.57	14.52	15.87	50.78	
Eastern redbud	8.15	0.83	1.13	3.14	3.13	16.38	
American basswood	21.16	2.38	3.04	16.21	15.18	57.97	
Eastern hophornbeam	6.29	0.64	0.84	2.23	2.36	12.35	
Chinkapin oak	34.86	4.82	5.78	38.71	38.40	122.58	
Red mulberry	27.03	3.15	4.21	21.13	25.12	80.65	
Green ash	13.59	1.89	2.04	11.39	21.72	50.63	
Black walnut	30.70	4.24	5.00	32.64	35.37	107.96	
Hickory	10.58	1.52	1.60	9.03	18.98	41.70	
Siberian elm	26.33	3.16	4.49	28.19	24.18	86.36	
Norway maple	9.42	1.23	1.27	4.73	13.26	29.91	
American sycamore	51.91	7.14	8.94	67.46	50.91	186.36	
Black cherry	8.20	0.81	1.11	3.02	3.01	16.16	
Northern red oak	37.41	3.34	5.22	48.09	15.01	109.07	
Honeylocust	36.91	4.75	5.89	39.85	79.14	166.55	
Mulberry	19.12	1.61	3.01	9.48	4.85	38.07	
Boxelder	21.94	2.75	3.36	20.22	27.34	75.61	
OTHER STREET TREES	28.55	3.37	4.72	39.00	25.76	101.40	
Park-wide Total	23.51	2.51	3.66	21.24	21.96	72.886	X 2,100 Trees = \$153,061 Annual Benefit Grand Total

Annual Benefits Summary: The Summary report presents the annual total of energy, stormwater, air quality, carbon dioxide, and aesthetic/other benefits. Values are dollars per tree. (Source: i-Tree Streets Manual)



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