The University of Arizona Campus Arboretum Tree Benefits Assessment - 2012

The landscaped grounds of the University of Arizona, Tucson, are rooted in the research and educational missions of the land grant institution. As a cultural connection to Arizona's history and as a living laboratory, the more than 7000 trees on the UA campus from arid regions of every continent, provide a resource for outreach and service both to the state and to other arid, regions globally. The value of the campus is appreciated for its role in defining a unique sense of place, for its beauty and rich connection to the State and University history. They may further be appreciated as a restorative setting in which to work and play, or to recruit and retain faculty, staff, students and visitors. However this urban campus landscape also has a valuable role to play through its contributions to environmental, economic and human health. Trees serve as part of the University's green infrastructure providing unaccounted services that improve air quality, reduce atmospheric pollutants and greenhouse gas emissions, mitigate urban heat islands, conserve energy, filter water, reduce municipal costs for flood control and contribute to offsetting climate changes. In essence, trees serve as a source of natural capital that is the currency fundamental to the ecosystem processes sustaining the health of all life on earth. As a land grant institution, the University of Arizona has an important responsibility to apply its research expertise so as to model natural resource stewardship by judicious planning and efficient management. Our natural capital is foundational to all other endeavors and it can and should be accounted for and managed just as we would our financial or human capital.

To promote environmental and economic sustainability and provide decision support for campus administrative units responsible for campus planning and management, the UA Campus Arboretum collected quantitative data using the latest models and urban forestry research to define in numerical and monetary terms the value of the campus trees. This benefits assessment quantified the structure of the university's urban forest and calculated the environmental services that trees provide. This baseline data can be used to demonstrate value and guide priorities for more effective decision-making and ultimately, to link campus activities with environmental quality and community livability.

Total value of ecosystem services: The total value of these ecosystem services provided by the campus forest is $272,997 each year with an average of $44.95 in benefits/tree. Collectively, a conservative estimate of the total replacement value of all campus trees is $28,217,339, without consideration for additional value resulting from positive impacts on university recruiting/retention or state historical and cultural significance. Species with greatest ecosystem services contributions have been ranked to support prioritization of future tree selection.

Link to Replacement Value Data.

In addition to providing overall estimate of the replacement cost of the campus trees, reports were generated to define forest structure, character and canopy coverage as well as impacts of campus trees on energy conservation, CO2 sequestration, stormwater management, air quality and landscape aesthetics. Summaries of these reports are included in this document.

Annual Benefits of All Trees by Species ($/tree)

7/16/2012

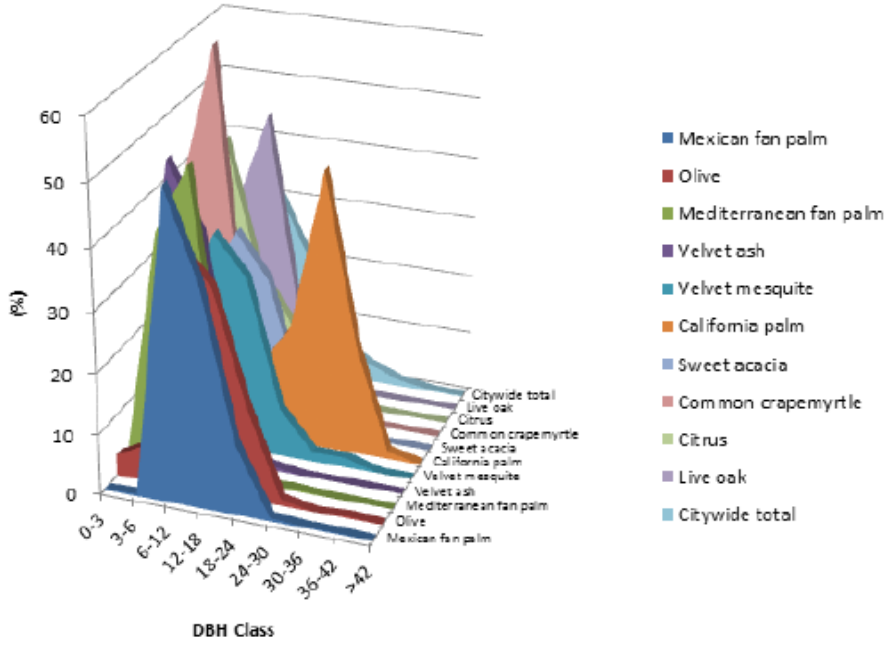
Species	Energy	CO_2	Air Quality	Stormwater	Aesthetic/Other	Total ($)	Standard Error
Mexican fan palm	1.90	0.25	-0.15	0.62	9.76	12.38	(N/A)
Olive	8.48	0.73	3.53	2.25	11.85	26.84	(N/A)
Mediterranean fan pali	7.13	0.56	2.64	1.90	23.10	35.33	(N/A)
Velvet ash	7.43	0.74	2.40	1.31	31.69	43.57	(N/A)
Velvet mesquite	18.17	1.63	6.56	4.48	65.87	96.71	(N/A)
California palm	14.17	0.79	2.48	0.33	0.08	17.85	(N/A)
Sweet acacia	8.50	1.04	2.94	1.82	18.42	32.73	(N/A)
Common crapemyrtle	3.00	0.35	0.68	0.59	12.87	17.48	(N/A)
Citrus	5.95	0.47	2.28	1.60	22.03	32.34	(N/A)
Live oak	9.46	1.48	-3.86	2.41	44.78	54.28	(N/A)
Canary Island date pali	23.30	1.42	0.54	4.55	2.69	32.50	(N/A)
Aleppo pine	18.80	1.82	5.70	7.27	76.41	110.00	(N/A)
Blue paloverde	16.89	1.50	5.60	3.36	54.28	81.63	(N/A)
Argentine mesquite	8.26	0.83	2.01	2.73	22.23	36.05	(N/A)
Italian cypress	8.19	0.90	1.85	2.95	58.99	72.88	(N/A)
Desert willow	6.80	0.56	1.05	0.77	17.35	26.52	(N/A)
Coolibah tree	20.89	2.89	1.22	7.23	86.45	118.68	(N/A)
Mesquite	20.24	1.83	7.38	4.97	71.79	106.22	(N/A)
Texas Red Oak	4.87	0.38	1.83	1.34	21.22	29.64	(N/A)
Parkinsonia	11.13	1.04	3.60	2.61	53.20	71.58	(N/A)
Acacia	3.47	0.74	1.03	1.39	35.11	41.73	(N/A)
Afghan pine	9.98	0.87	3.74	2.76	25.28	42.63	(N/A)
Algarrobo	15.16	1.38	4.87	3.33	61.37	86.11	(N/A)
Date palm	4.99	0.38	-0.11	0.94	4.16	10.36	(N/A)
Chinese pistache	9.54	0.75	0.74	1.60	30.70	43.33	(N/A)
Mescalbean	2.14	0.17	0.67	0.64	19.20	22.83	(N/A)
OTHER STREET TRI	7.11	0.76	1.58	2.08	32.90	44.43	(N/A)

Forest structure: An inventory of 6070 trees on main campus revealed 44% of the collection is represented by 10 species. 39% are broadleaf evergreen, 33% deciduous, 20% palms and 9% conifers. Relative age distribution, as estimated by trunk diameter, revealed 13%-37% of trees are newly planted compared with 63%-77% of trees that have reached maturity. Tree canopies cover 12.9% of campus. **Link to Population Summary and Importance Values.**

Tucson

Relative Age Distribution of Top 10 All Tree Species (%)

7/16/2012



	DBH class (in)								
Species	0-3	3-6	6-12	12-18	18-24	24-30	30-36	36-42	>42
Mexican fan palm	0.19	0.39	50.58	36.24	11.63	0.58	0.19	0.19	0.00
Olive	3.50	6.29	39.51	33.92	15.38	1.05	0.00	0.35	0.00
Mediterranean fan palm	3.08	38.85	50.00	7.69	0.00	0.38	0.00	0.00	0.00
Velvet ash	8.06	48.39	37.50	5.24	0.81	0.00	0.00	0.00	0.00
Velvet mesquite	3.23	20.97	35.48	29.03	8.06	1.61	1.61	0.00	0.00
California palm	0.84	0.00	1.67	12.13	19.67	46.03	18.41	1.26	0.00
Sweet acacia	15.52	21.98	31.90	24.57	5.17	0.86	0.00	0.00	0.00
Common crapemyrtle	37.23	59.74	3.03	0.00	0.00	0.00	0.00	0.00	0.00
Citrus	21.21	42.93	21.72	13.64	0.51	0.00	0.00	0.00	0.00
Live oak	10.77	30.26	45.64	12.31	1.03	0.00	0.00	0.00	0.00
Citywide total	12.65	24.53	31.53	20.20	6.57	3.13	1.00	0.26	0.12

Energy savings: By consuming solar energy in the process of evapotranspiration and blocking winter winds, campus trees help reduce energy use by 433MWh, valued at approximately $55,065. Through direct shade, the trees provide even greater energy conservation benefits.

Tucson

Annual Energy Benefits of All Trees By Species

7/16/2012

Species	Total Electricity (MWh)	Electricity ($)	Total Natural Gas (Therms)	Natural Gas ($)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Mexican fan palm	7.6	919	63.5	60	979	(N/A)	8.5	1.8	1.90
Olive	19.0	2,293	139.6	131	2,424	(N/A)	4.7	4.4	8.48
Mediterranean fan palm	14.5	1,751	107.7	101	1,853	(N/A)	4.3	3.4	7.13
Velvet ash	14.4	1,741	107.2	101	1,841	(N/A)	4.1	3.3	7.43
Velvet mesquite	35.5	4,289	230.4	217	4,506	(N/A)	4.1	8.2	18.17
California palm	26.5	3,196	203.2	191	3,387	(N/A)	3.9	6.2	14.17
Sweet acacia	15.4	1,866	112.5	106	1,972	(N/A)	3.8	3.6	8.50
Common crapemyrtle	5.4	650	45.4	43	692	(N/A)	3.8	1.3	3.00
Citrus	9.2	1,114	67.8	64	1,177	(N/A)	3.3	2.1	5.95
Live oak	14.5	1,752	98.5	93	1,844	(N/A)	3.2	3.4	9.46
Canary Island date palm	35.0	4,224	240.7	226	4,450	(N/A)	3.2	8.1	23.30
Aleppo pine	27.4	3,316	153.2	144	3,460	(N/A)	3.0	6.3	18.80
Blue paloverde	20.0	2,411	130.6	123	2,534	(N/A)	2.5	4.6	16.89
Argentine mesquite	9.2	1,108	59.2	56	1,164	(N/A)	2.3	2.1	8.26
Italian cypress	7.2	865	47.2	44	910	(N/A)	1.8	1.7	8.19
Desert willow	5.6	680	42.4	40	720	(N/A)	1.8	1.3	6.80
Coolibah tree	17.2	2,076	102.7	97	2,173	(N/A)	1.7	4.0	20.89
Mesquite	15.8	1,909	100.4	95	2,004	(N/A)	1.6	3.6	20.24
Texas Red Oak	3.4	410	25.3	24	434	(N/A)	1.5	0.8	4.87
Parkinsonia	7.4	897	52.3	49	946	(N/A)	1.4	1.7	11.13
Acacia	2.3	277	15.9	15	292	(N/A)	1.4	0.5	3.47
Afghan pine	6.5	781	39.9	37	819	(N/A)	1.4	1.5	9.98
Algarrobo	9.8	1,181	65.7	62	1,243	(N/A)	1.4	2.3	15.16
Date palm	3.0	362	24.1	23	384	(N/A)	1.3	0.7	4.99
Chinese pistache	5.4	651	38.6	36	687	(N/A)	1.2	1.3	9.54
Mescalbean	1.2	139	9.5	9	148	(N/A)	1.1	0.3	2.14
OTHER STREET TREES	94.5	11,416	643.6	606	12,022	(N/A)	27.9	21.8	7.11
Citywide total	432.7	52,273	2,967.1	2,792	55,065	(N/A)	100.0	100.0	9.07

CO2 sequestration and avoidance: Trees reduce the amount of carbon dioxide (CO_2) generated by energy production. As they grow, they also store CO_2 from the atmosphere. Together, these processes reduce CO_2, valued at $29,180 from permanently storing 3,890,698lbs of CO_2 and sequestering and avoiding 708,010lbs of additional CO_2 annually. This is equivalent to the reduction in CO_2 emissions that would result from decommissioning almost 300 automobiles now and an additional removal of 30 vehicles for each year of the trees' life.

Stored CO2 Benefits of All Trees by Species

7/16/2012

Species	Total Stored CO2 (lbs)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Mexican fan palm	345,547	2,592	(N/A)	8.5	8.9	5.02
Olive	223,369	1,675	(N/A)	4.7	5.7	5.86
Mediterranean fan pal	42,979	322	(N/A)	4.3	1.1	1.24
Velvet ash	71,438	536	(N/A)	4.1	1.8	2.16
Velvet mesquite	216,730	1,625	(N/A)	4.1	5.6	6.55
California palm	145,132	1,088	(N/A)	3.9	3.7	4.55
Sweet acacia	242,727	1,820	(N/A)	3.8	6.2	7.85
Common crapemyrtle	24,801	186	(N/A)	3.8	0.6	0.81
Citrus	30,309	227	(N/A)	3.3	0.8	1.15
Live oak	157,852	1,184	(N/A)	3.2	4.1	6.07
Canary Island date pa	100,229	752	(N/A)	3.2	2.6	3.94
Aleppo pine	314,953	2,362	(N/A)	3.0	8.1	12.84
Blue paloverde	76,822	576	(N/A)	2.5	2.0	3.84
Argentine mesquite	153,572	1,152	(N/A)	2.3	4.0	8.17
Italian cypress	47,950	360	(N/A)	1.8	1.2	3.24
Desert willow	2,943	22	(N/A)	1.8	0.1	0.21
Coolibah tree	345,201	2,589	(N/A)	1.7	8.9	24.89
Mesquite	97,092	728	(N/A)	1.6	2.5	7.36
Texas Red Oak	11,264	84	(N/A)	1.5	0.3	0.95
Parkinsonia	33,858	254	(N/A)	1.4	0.9	2.99
Acacia	31,988	240	(N/A)	1.4	0.8	2.86
Afghan pine	47,848	359	(N/A)	1.4	1.2	4.38
Algarrobo	40,205	302	(N/A)	1.4	1.0	3.68
Date palm	36,007	270	(N/A)	1.3	0.9	3.51
Chinese pistache	22,541	169	(N/A)	1.2	0.6	2.35
Mescalbean	1,788	13	(N/A)	1.1	0.1	0.19
OTHER STREET TR	465,184	7,692	(N/A)	27.9	26.4	4.55
Citywide total	3,890,698	29,180	(N/A)	100.0	100.0	4.81

Annual CO Benefits of All Trees by Species

7/16/2012

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
Mexican fan palm	12,965	97	-2,764	-481	-24	7,605	57	17,325	130 (N/A)	8.5	2.5	0.25
Olive	10,844	81	-1,787	-283	-16	18,973	142	27,747	208 (N/A)	4.7	3.9	0.73
Mediterranean fan palm	5,553	42	-344	-154	-4	14,491	109	19,546	147 (N/A)	4.3	2.8	0.56
Velvet ash	10,772	81	-572	-129	-5	14,402	108	24,473	184 (N/A)	4.1	3.5	0.74
Velvet mesquite	20,266	152	-1,734	-216	-15	35,487	266	53,804	404 (N/A)	4.1	7.6	1.63
California palm	29	0	-1,161	-167	-10	26,445	198	25,146	189 (N/A)	3.9	3.6	0.79
Sweet acacia	18,786	141	-1,942	-158	-16	15,437	116	32,123	241 (N/A)	3.8	4.5	1.04
Common crapemyrtle	5,726	43	-198	-64	-2	5,376	40	10,839	81 (N/A)	3.8	1.5	0.35
Citrus	3,572	27	-242	-99	-3	9,214	69	12,445	93 (N/A)	3.3	1.8	0.47
Live oak	25,393	190	-1,263	-118	-10	14,492	109	38,505	289 (N/A)	3.2	5.4	1.48
Canary Island date palm	2,255	17	-802	-213	-8	34,947	262	36,187	271 (N/A)	3.2	5.1	1.42
Aleppo pine	19,879	149	-2,520	-222	-21	27,434	206	44,572	334 (N/A)	3.0	6.3	1.82
Blue paloverde	10,838	81	-615	-105	-5	19,946	150	30,064	225 (N/A)	2.5	4.3	1.50
Argentine mesquite	7,853	59	-1,229	-123	-10	9,171	69	15,672	118 (N/A)	2.3	2.2	0.83
Italian cypress	6,658	50	-384	-81	-3	7,158	54	13,351	100 (N/A)	1.8	1.9	0.90
Desert willow	2,368	18	-24	-55	-1	5,630	42	7,919	59 (N/A)	1.8	1.1	0.56
Coolibah tree	25,786	193	-2,762	-120	-22	17,179	129	40,084	301 (N/A)	1.7	5.7	2.89
Mesquite	9,285	70	-777	-93	-7	15,799	118	24,214	182 (N/A)	1.6	3.4	1.83
Texas Red Oak	1,296	10	-90	-38	-1	3,390	25	4,558	34 (N/A)	1.5	0.6	0.38
Parkinsonia	4,635	35	-271	-50	-2	7,422	56	11,736	88 (N/A)	1.4	1.7	1.04
Acacia	6,229	47	-256	-30	-2	2,290	17	8,232	62 (N/A)	1.4	1.2	0.74
Afghan pine	3,470	26	-383	-68	-3	6,462	48	9,482	71 (N/A)	1.4	1.3	0.87
Algarrobo	5,692	43	-322	-60	-3	9,772	73	15,083	113 (N/A)	1.4	2.1	1.38
Date palm	1,298	10	-288	-54	-3	2,991	22	3,947	30 (N/A)	1.3	0.6	0.38
Chinese pistache	2,054	15	-180	-42	-2	5,384	40	7,216	54 (N/A)	1.2	1.0	0.75
Mescalbean	409	3	-14	-16	0	1,151	9	1,529	11 (N/A)	1.1	0.2	0.17
OTHER STREET TREES	86,945	652	-8,204	-985	-69	94,456	708	172,211	1,292 (N/A)	27.9	24.3	0.76
Citywide total	310,856	2,331	-31,126	-4,225	-265	432,505	3,244	708,010	5,310 (N/A)	100.0	100.0	0.87

Stormwater: Stormwater management reduces runoff and protects municipal water quality. Trees not only reduce runoff and protect water quality but also intercept rainfall and reduce soil erosion. The existing campus forest traps and filters nearly 2,867,671 gallons of stormwater each year, with an associated savings of $13,766 for municipal infrastructure and maintenance expenses.

Annual Stormwater Benefits of All Trees by Species

7/16/2012

Species	Total rainfall interception (Gal)	Total ($)	Standard Error	% of Total Trees	% of Total $	Avg. $/tree
Mexican fan palm	66,958	321	(N/A)	8.5	2.3	0.62
Olive	134,311	645	(N/A)	4.7	4.7	2.25
Mediterranean fan palm	102,834	494	(N/A)	4.3	3.6	1.90
Velvet ash	67,506	324	(N/A)	4.1	2.4	1.31
Velvet mesquite	231,465	1,111	(N/A)	4.1	8.1	4.48
California palm	16,663	80	(N/A)	3.9	0.6	0.33
Sweet acacia	88,045	423	(N/A)	3.8	3.1	1.82
Common crapemyrtle	28,204	135	(N/A)	3.8	1.0	0.59
Citrus	66,109	317	(N/A)	3.3	2.3	1.60
Live oak	98,099	471	(N/A)	3.2	3.4	2.41
Canary Island date palm	180,885	868	(N/A)	3.2	6.3	4.55
Aleppo pine	278,570	1,337	(N/A)	3.0	9.7	7.27
Blue paloverde	104,881	503	(N/A)	2.5	3.7	3.36
Argentine mesquite	80,083	384	(N/A)	2.3	2.8	2.73
Italian cypress	68,307	328	(N/A)	1.8	2.4	2.95
Desert willow	16,911	81	(N/A)	1.8	0.6	0.77
Coolibah tree	156,616	752	(N/A)	1.7	5.5	7.23
Mesquite	102,540	492	(N/A)	1.6	3.6	4.97
Texas Red Oak	24,820	119	(N/A)	1.5	0.9	1.34
Parkinsonia	46,164	222	(N/A)	1.4	1.6	2.61
Acacia	24,272	117	(N/A)	1.4	0.9	1.39
Afghan pine	47,067	226	(N/A)	1.4	1.6	2.76
Algarrobo	56,948	273	(N/A)	1.4	2.0	3.33
Date palm	15,004	72	(N/A)	1.3	0.5	0.94
Chinese pistache	23,993	115	(N/A)	1.2	0.8	1.60
Mescalbean	9,160	44	(N/A)	1.1	0.3	0.64
OTHER STREET TREES	731,259	3,510	(N/A)	27.9	25.5	2.08
Citywide total	2,867,671	13,766	(N/A)	100.0	100.0	2.27

Air quality: Trees intercept and absorb atmospheric pollutants. The campus trees remove 1,474 lbs of air pollutants, with an estimated value of $13,675. After accounting for negative contributions to air quality, the net contribution of campus trees to air quality is estimated to be $12,450 with a net 632lb reduction in air pollutants. Trees also impact air quality indirectly through energy conservation and reduced power plant emissions.

Annual Air Quality Benefits of All Trees by Species

7/16/2012

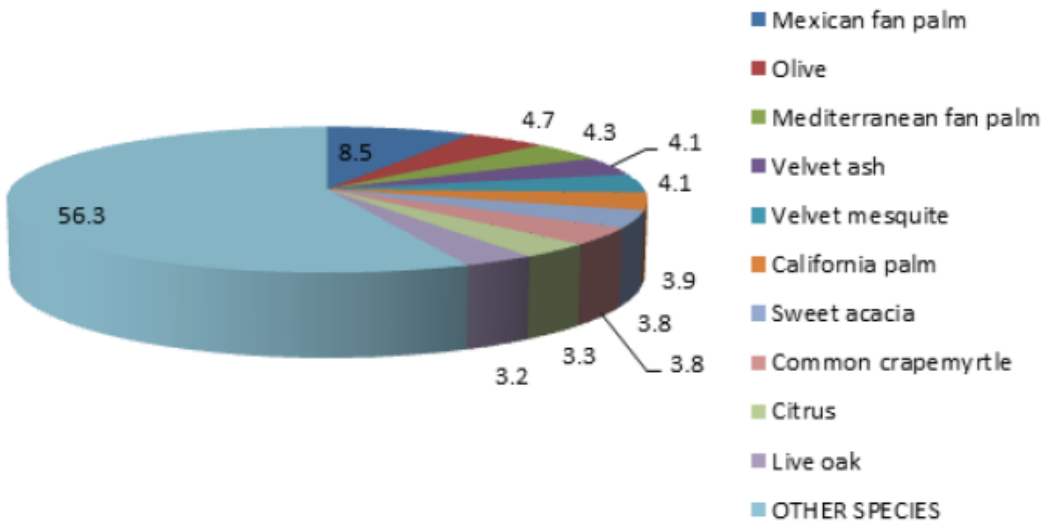
Species	Deposition (lb)				Total Depos. ($)	Avoided (lb)				Total Avoided ($)	BVOC Emissions (lb)	BVOC Emissions ($)	Total (lb)	Total ($) Standard Error	% of Total Trees	Avg. $/tree
	O_3	NO_2	PM_{10}	SO_2		NO_2	PM_{10}	VOC	SO_2							
Mexican fan palm	19.9	10.8	18.9	2.2	270	13.7	0.7	0.1	11.7	243	-147.2	-589	-69.2	-76 (N/A)	8.5	-0.15
Olive	34.0	18.5	34.1	3.7	474	33.6	1.7	0.3	28.7	597	-15.0	-60	139.7	1,010 (N/A)	4.7	3.53
Mediterranean fan palm	15.4	8.4	17.3	1.7	226	26.0	1.3	0.2	22.2	461	0.0	0	92.5	687 (N/A)	4.3	2.64
Velvet ash	10.5	4.1	10.7	0.8	136	25.9	1.3	0.2	22.1	460	0.0	0	75.8	596 (N/A)	4.1	2.40
Velvet mesquite	60.4	29.1	56.9	6.0	794	62.8	3.2	0.6	53.7	1,116	-70.7	-283	202.0	1,627 (N/A)	4.1	6.56
California palm	4.2	2.3	3.9	0.5	57	46.9	2.4	0.4	40.0	831	-74.0	-296	26.5	592 (N/A)	3.9	2.48
Sweet acacia	37.2	17.9	33.0	3.7	476	27.7	1.4	0.3	23.7	492	-71.4	-285	73.4	683 (N/A)	3.8	2.94
Common crapemyrtle	4.6	2.2	5.2	0.5	65	9.6	0.5	0.1	8.2	171	-19.6	-79	11.2	158 (N/A)	3.8	0.68
Citrus	11.1	6.0	12.0	1.2	160	16.5	0.8	0.1	14.1	293	0.0	0	61.9	452 (N/A)	3.3	2.28
Live oak	13.2	7.2	15.4	1.4	196	26.0	1.3	0.2	22.2	461	-352.5	-1,410	-265.6	-752 (N/A)	3.2	-3.86
Canary Island date palm	117.8	64.2	110.2	13.0	1,593	60.8	3.1	0.5	52.0	1,080	-642.4	-2,570	-220.8	103 (N/A)	3.1	0.54
Aleppo pine	34.4	18.8	37.1	3.8	495	48.6	2.5	0.4	41.7	865	-77.7	-311	109.6	1,049 (N/A)	3.0	5.70
Blue paloverde	31.6	15.2	30.1	3.1	417	35.6	1.8	0.3	30.5	633	-52.4	-210	95.8	840 (N/A)	2.5	5.60
Argentine mesquite	13.1	7.1	13.5	1.4	185	16.5	0.8	0.1	14.1	293	-48.7	-195	18.1	283 (N/A)	2.3	2.01
Italian cypress	3.1	1.7	4.7	0.3	53	12.8	0.7	0.1	11.0	228	-18.8	-75	15.6	205 (N/A)	1.8	1.85
Desert willow	7.6	2.1	5.3	0.5	78	10.1	0.5	0.1	8.6	179	-36.4	-145	-1.7	111 (N/A)	1.7	1.05
Coolibah tree	32.2	17.5	32.0	3.5	447	30.6	1.6	0.3	26.2	544	-215.7	-863	-71.8	127 (N/A)	1.7	1.22
Mesquite	27.4	13.2	25.6	2.7	359	28.0	1.4	0.3	24.0	498	-31.3	-125	91.2	731 (N/A)	1.6	7.38
Texas Red Oak	3.8	2.1	4.2	0.4	55	6.1	0.3	0.1	5.2	108	0.0	0	22.0	163 (N/A)	1.5	1.83
Parkinsonia	9.3	4.5	9.4	0.9	126	13.1	0.7	0.1	11.2	233	-13.3	-53	36.0	306 (N/A)	1.4	3.60
Acacia	2.4	1.3	2.7	0.3	36	4.1	0.2	0.0	3.5	73	-5.4	-22	9.2	87 (N/A)	1.4	1.03
Afghan pine	10.0	5.5	10.1	1.1	140	11.6	0.6	0.1	10.0	207	-10.0	-40	39.0	307 (N/A)	1.4	3.74
Algarrobo	11.3	5.4	11.5	1.1	153	17.5	0.9	0.2	15.0	311	-16.1	-64	46.6	399 (N/A)	1.4	4.87
Date palm	7.9	4.3	7.4	0.9	107	5.4	0.3	0.0	4.6	95	-52.5	-210	-21.8	-8 (N/A)	1.3	-0.11
Chinese pistache	10.5	4.0	8.5	0.8	122	9.6	0.5	0.1	8.2	171	-59.9	-240	-17.6	53 (N/A)	1.2	0.74
Mescalbean	0.6	0.3	0.9	0.1	10	2.1	0.1	0.0	1.8	36	0.0	0	5.8	47 (N/A)	1.1	0.67
OTHER STREET TREES	138.3	71.8	139.5	14.5	1,906	168.6	8.6	1.5	144.2	2,996	-558.2	-2,233	128.9	2,669 (N/A)	27.8	1.58
Citywide total	671.7	345.6	660.0	70.3	9,133	769.8	39.3	6.9	658.1	13,675	-2,589.2	-10,357	632.4	12,450 (N/A)	100.0	2.05

Species richness: 43.7% of the campus trees represent 10 species.

Tucson

Species Distribution of All Trees (%)

7/16/2012



Species	Percent
Mexican fan palm	8.5
Olive	4.7
Mediterranean fan palm	4.3
Velvet ash	4.1
Velvet mesquite	4.1
California palm	3.9
Sweet acacia	3.8
Common crapemyrtle	3.8
Citrus	3.3
Live oak	3.2
OTHER SPECIES	56.3
Total	100.0

Additional information: The campus forest offers many other environmental benefits that are less easily quantified including reduced evaporative emissions from parking surfaces that contribute significantly to poor air quality. It is estimated that 50% shade coverage over parking lots reduces evaporative emissions several tons per day. Tree shade also helps protect pavement by reducing wear and tear on asphalt[1]. A California study, estimated that unshaded streets required repaving more than twice as often over a 30-year period than shaded streets[1]. Finally, trees are primary producers, supporting a diverse ecosystem and sustaining biodiversity, central to environmental resilience. Relative performance and contributions of known species should be considered along with additional and deliberate trees selection to maximize biological diversity.

Campus Arboretum Future Work

There are a number of other ways that the forest can contribute to UA sustainability goals in the future. Tree benefits data will be added to the Campus Arboretum database, along with the life histories of all campus trees to support future strategic planning and plantings that not only enhance generation of natural capital but also guide management practices which increase the return on investment from the landscape. Planting priorities and species selection can be aligned with known tree benefits to maximize the ecological and economic benefits provided by various species.

The ecosystem services and environmental benefits as well as the cultural and aesthetic value of the existing campus forest are likely significant, but are currently undocumented. The social, cultural and human health benefits of green spaces on worker productivity, opportunities for recreation, impacts on recruiting, retention, illness and recovery time could all be documented to aid in improved landscape planning and performance.

[1]UCSD report (2009) http://aps-web.ucsd.edu/sustainability/FM/PDFs/Campus_Forest_Environmental_Benefits_Report_1-09.pdf