August 2018

Street Tree Supplemental Analysis

Green Infrastructure: Urban Forestry
City of Eugene

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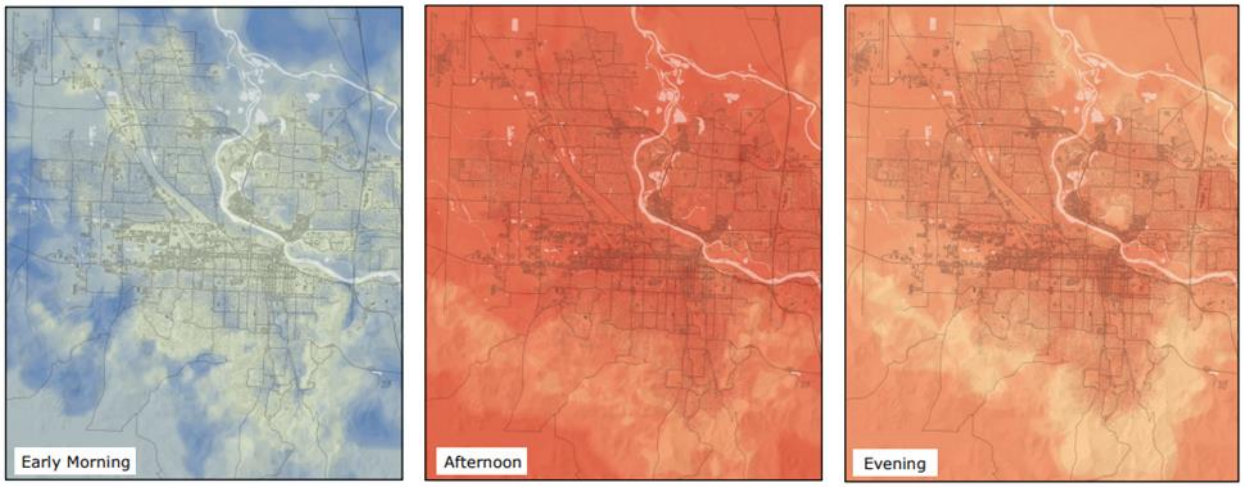
Overview

For more than a decade, the Urban Forestry team of Green Infrastructure / Parks and Open Space has been maintaining and updating a database of City of Eugene owned trees. This process has evolved over time from using pencils and maps printed on paper, to modern mobile apps powered by real-time cloud-hosted data. Resulting from the cumulative efforts to catalogue our street tree inventory, we now have a comprehensive dataset of over 64,000 data points across all 24 neighborhoods to serve as the baseline for continued support of our urban forest and our staff in the field. Combined with datasets including the Urban Heat Index dataset created by Portland State University, buildings

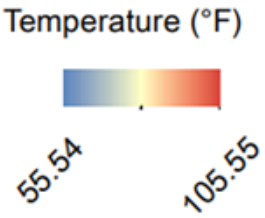
Data Collection Methodology

Data was collected by Urban Forestry interns, seasonal contractors, field crews and staff with assistance from volunteers with Friends of Trees and other members of the community. In recent years, this has been performed using the Urban Forestry Collector app, where surveyors tagged the geolocation of each tree and included pertinent data including: species common name, measurements of diameter at breast height (DBH), height and spread, proximity to existing utilities and hard infrastructure, and an assessment of overall vegetative health. Also included is the notation of the presence of damage from disease or interaction with humans, and structural defects. Measurements of grow space and empty potential planting sites were also included.

Impervious Surfaces and the Urban Heat Island



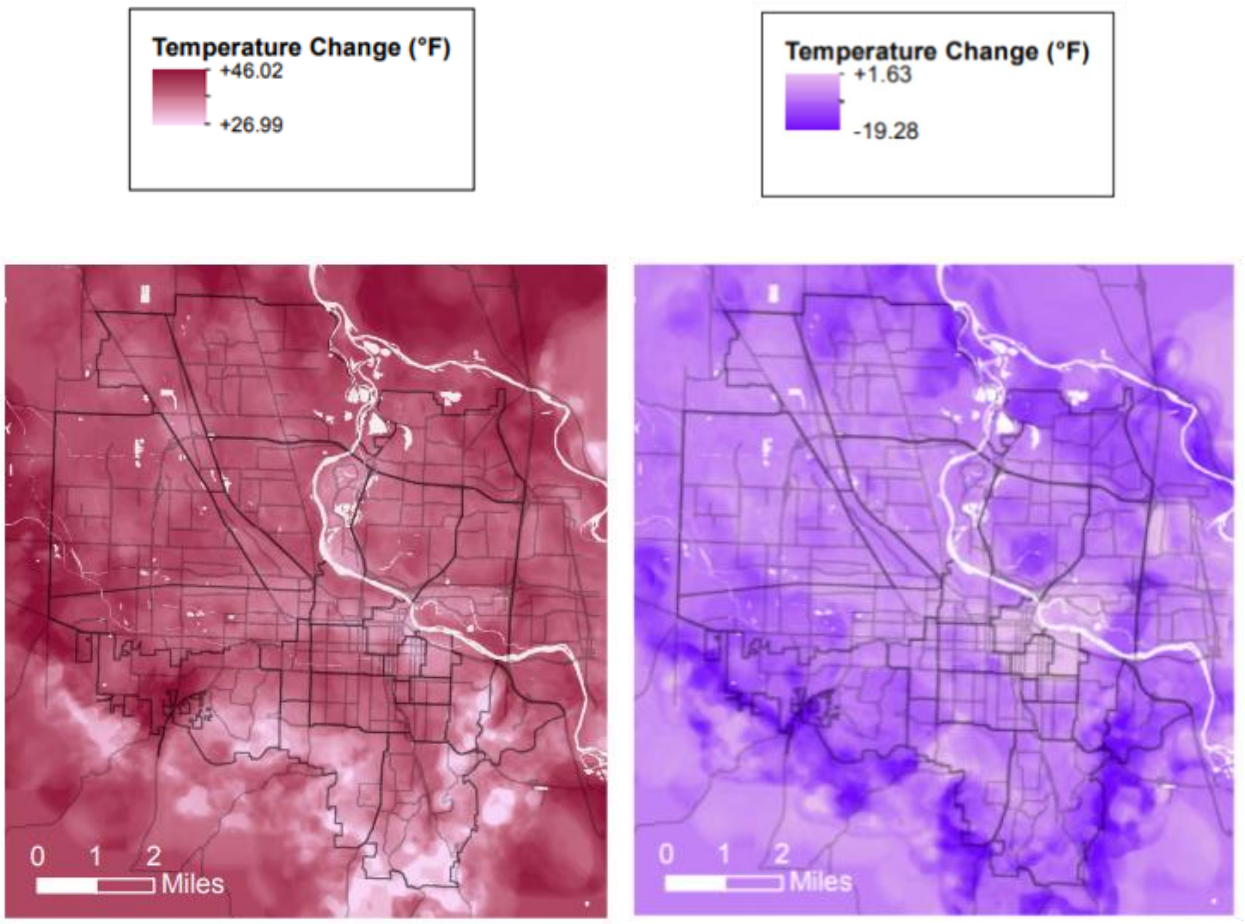
Urban Heat island effect in Eugene, OR on August 19, 2016.
Data: SUPR, Portland State University



On August 19, 2016, temperatures in the Eugene and Springfield area reached a sweltering 105 F. On this day, the Sustainable Urban Places Research (SUPR) Lab of Portland State University and the Urban Forestry team mapped the change in temperatures in the region across three time periods: early morning (6am-7pm), afternoon (3pm-4pm), and evening (7pm-8pm). The spatial resolution (i.e. pixel size) of the data is 3 feet.

TIME	MIN °F	MAX °F	RANGE °F	MEAN °F
EARLY MORNING	**55.54**	**68.75**	**13.21**	**61.23**
AFTERNOON	**91.57**	**105.55**	**13.98**	**100.38**
EVENING	**82.05**	**100.63**	**18.58**	**93.45**

Through the course of the day, temperatures ranged from 55 °F to 68 °F in the morning and were between 91 °F and 105 °F at its highest point, before falling between 82 °F and 100 °F in the evening. Locations with less built infrastructure remained cooler while those with higher concentrations of roads, buildings, and other imperious surfaces saw the hottest temperatures. As of 6 am, the within city temperature was already up to 13 °F warmer, and evening temperatures within the city remaining up to 18 °F warmer.

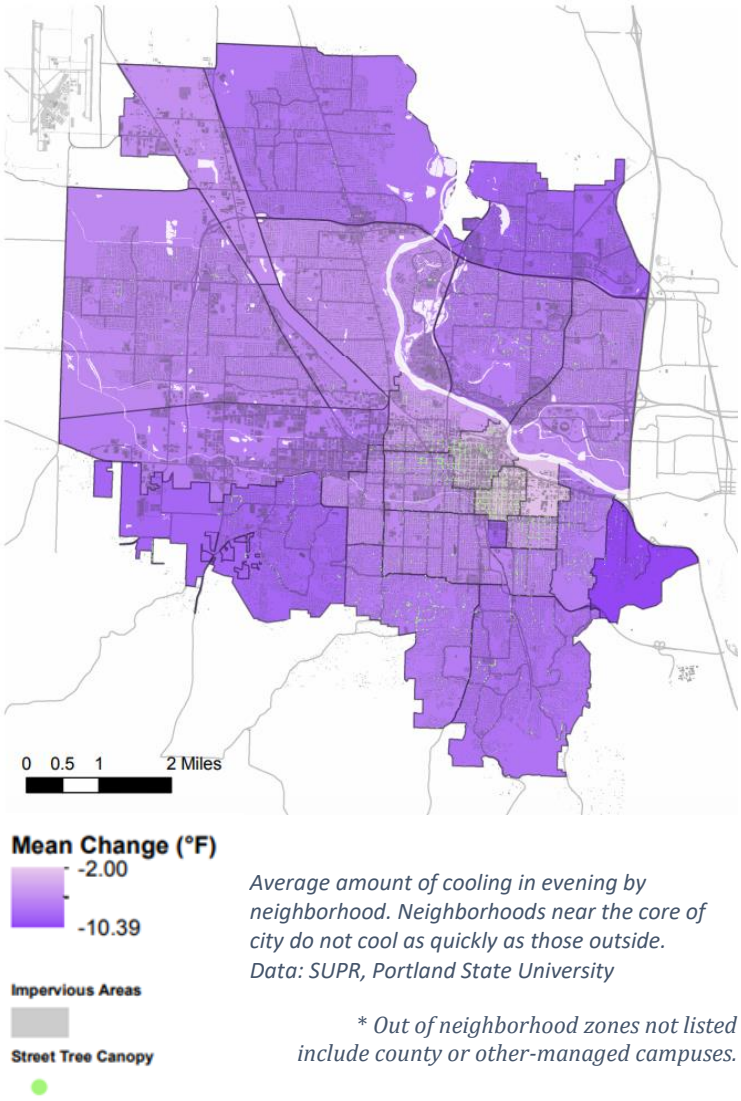


Change in temperature through morning (left) into evening (right). Dark magenta indicates increased warming while dark violet indicates higher amounts of cooling.
Data: SUPR, Portland State University.

Of particular interest, the amount of change between times varies across the landscape. Specifically, as we enter evening, portions of Eugene continue to increase in temperature, while much of the city cools off a slight amount. The most amount of cooling occurs on the outer edges of the city. Broken into neighborhoods, we can see the average change in temperature across their spatial extent.

West University, UO Campus, and Downtown have the least ability to cool in the evening, with an average temperature loss well below the average cooling of neighborhoods of 5.81 °F. Higher density, building rooftops above canopy, increased activity could explain these readings. In contrast, neighborhoods which saw the most cooling from afternoon to evening include Southeast, Northeast, Churchill, and Laurel Hill. These neighborhoods reside on the border of city limits, show lower density, and are characterized as lower activity and are primarily residential. Geographic features such as hills or aspect may be contributing to this effect.

NEIGHBORHOOD / AREA*	AVERAGE COOLING (°F)
W. UNIVERSITY	2.00
UO CAMPUS	2.41
DOWNTOWN	3.08
S. UNIVERSITY	5.06
WHITEAKER	5.08
GOODPASTURE	5.72
JEFFERSON	5.75
RIVER ROAD	5.79
INDUSTRIAL	5.91
FAR WEST	6.16
HARLOW	6.21
TRAINSONG	6.31
FRIENDLY	6.39
ACTIVE BETHEL	6.40
AMAZON	6.57
CAL YOUNG	7.04
W. EUGENE	7.04
FAIRMOUNT	7.13
S. W. HILLS	7.20
SANTA CLARA	7.52
SOUTHEAST	7.80
NORTHEAST	8.64
CHURCHILL	8.71
LAUREL HILL	10.39



Average amount of cooling in evening by neighborhood. Neighborhoods near the core of city do not cool as quickly as those outside. Data: SUPR, Portland State University

** Out of neighborhood zones not listed include county or other-managed campuses.*

Utilization of Street Tree Inventory in Work Order Tracking

The Urban Forestry crew and contractors have an unparalleled and intimate interaction with our street trees. In the last two fiscal years, our arborists and friends have serviced over 10,000 trees including plantings, removals, stump grinding, pruning, and storm response activities. Despite the losses our urban forest suffered during the 2016 ice storm, we have planted 1.3 trees for every tree removed. By thoroughly updating data records as part of the work orders process, we can continue to modernize and expand this dataset.

Work Orders

Planting	Planting Type	FY18	FY17	Total
	Friends of Trees	692	639	1331
	Special Projects	216	88	304
	PWE	55	39	94
		963	766	1729

Removal	Crew	FY18	FY17	Total
Storm Removal	UF	0	187	187
Storm Removal	Contractor	0	552	552
	MPZ	70	43	113
	Response	168	160	328
	PPP	0	26	26
	Contractor	110	7	117
	Totals	348	975	1323

Planting to Removal Ratio	
P:R 18	2.767241379
P:R 17	0.785641026
P:R All	1.306878307

Inventory

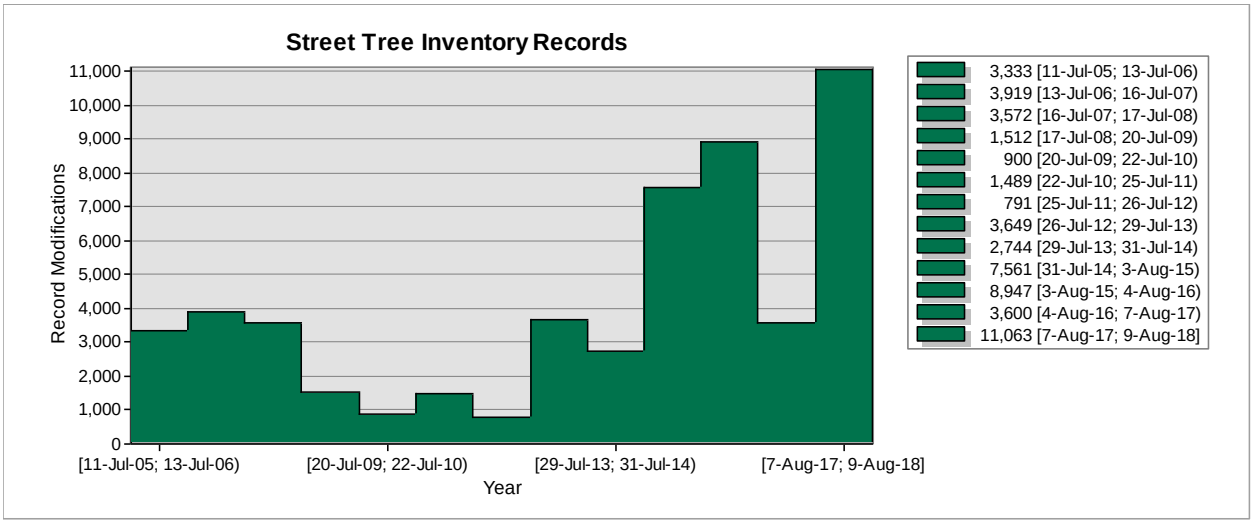
Inventory Type	Record Type	FY18	FY17	Total
Street Tree	Updated	17734	5022	22756
	New	8238	2020	10258
	All	25972	7042	33014
Park Tree	All	337	324	661
	Totals	26309	7366	33675

Street Tree Records From Previous	
FY18	2.218366153
FY17	1

Pruning/Abatemer	Crew	FY18	FY17	Total
Storm Abatement	UF	0	464	464
Storm Abatement	Contractor	0	1472	1472
	MPZ	1506	410	1916
	Response	874	1267	2141
	PPP	22	514	536
	Contractor	10	47	57
	Totals	2412	4174	6586

Stump Grind	Crew	FY18	FY17	Total
	Contractor	711	179	890

Summary of totals from FY17 and FY18 reports across park and street trees.



Histogram of 'modified' dates in street tree dataset. The majority of records were updated within last five years. Does not include records with no 'modified' field value (such as those imported from MMS and never revisited in Collector.)

Conclusion

With this baseline dataset of street trees, we can work to expand and update the city's tree inventory as work is being done. From planting to pruning, restoring to removal, as work is being done, the state of our forest will be available to all departments across the organization. With

further increase in scope to include parks with similar feature space, we can gain a richer understanding of our local ecosystem at multiple scales. Combined with currently accessible data sources like the urban heat island data, buildings and impervious surfaces layers among others, further investigations can be conducted to lend in arguments for de-paving and for greenification of new and existing development.

Source:

Voelkel, J., & Shandas, V. (2017). Towards Systematic Prediction of Urban Heat Islands: Grounding Measurements, Assessing Modeling Techniques. Climate, 5(2), 41. https://doi.org/10.3390/cli5020041

Voelkel, J., Shandas, V., & Haggerty, B. (2016). Developing High Resoultion Descriptions of Urban Heat Islands: A Public Health Imperative. Preventing Chronic Disease, 13. https://doi.org/10.5888/pcd13.160099

Map Data:

SUPR, Portland State University. (2017) Urban Heat Island Data.