Cool School Planting Report – C.F. Carr Elementary School

Cool Schools connect students and teachers to nature by planting trees and creating fun and engaging outdoor experiential learning areas. These spaces cultivate children's knowledge and awareness of the natural environment.

Dallas-Fort Worth has one of the most challenging urban climates in the United States and has been ranked 17th by the American Lung Association for the worst ozone pollution in the nation (American Lung Association 2020). This air quality situation affects over 89,000 children throughout the Dallas Independent School District. School campuses in Dallas are some of the hottest and least shaded urban heat islands in North Texas (Texas Trees Foundation, 2015).

Texas Trees Foundation launched the Cool Schools program to enhance the health and well-being of Dallas ISD students and to provide solutions to mitigate the effects of the urban heat island effect throughout Dallas. Presently, 70% of Dallas area elementary schools have less than seven percent tree canopy cover and are in dire need of improved tree canopies according to the Texas Trees Foundation's State of the Dallas Urban Forest Report.

Research shows outdoor time can result in academic and health benefits for children; kids who spend more time outside end up paying more attention inside. Trees and nature lower aggression and symptoms of ADHD, and students are better able to concentrate, complete tasks, and follow instructions (Kuo, Barnes, & Jordan, 2019). Cool Schools promotes hands-on outdoor environmental activities with a TEKS aligned STEM-based curriculum, so no child is left inside!

C. F. Carr Elementary School, located in Dallas, TX, received 58 new trees as part of their involvement with the Cool Schools program. New trees were furnished by the City of Dallas via the Article X Tree Mitigation Fund. In this report, the C.F. Carr campus is analyzed before and after planting and estimated future benefits from these new trees are presented. Present and future tree benefits were calculated using the iTree software suite and TreePlotter inventory software.

Highlights

- New trees on the C.F. Carr campus are projected to add 18% more tree canopy at maturity, bringing total canopy cover to 25%
- New trees will provide $7,192 of benefits over the next 25 years, and $20,740 over the next 50 years
- New trees provide a myriad of non-monetary benefits such as education, cultural connections, and aesthetics

New Trees Planted
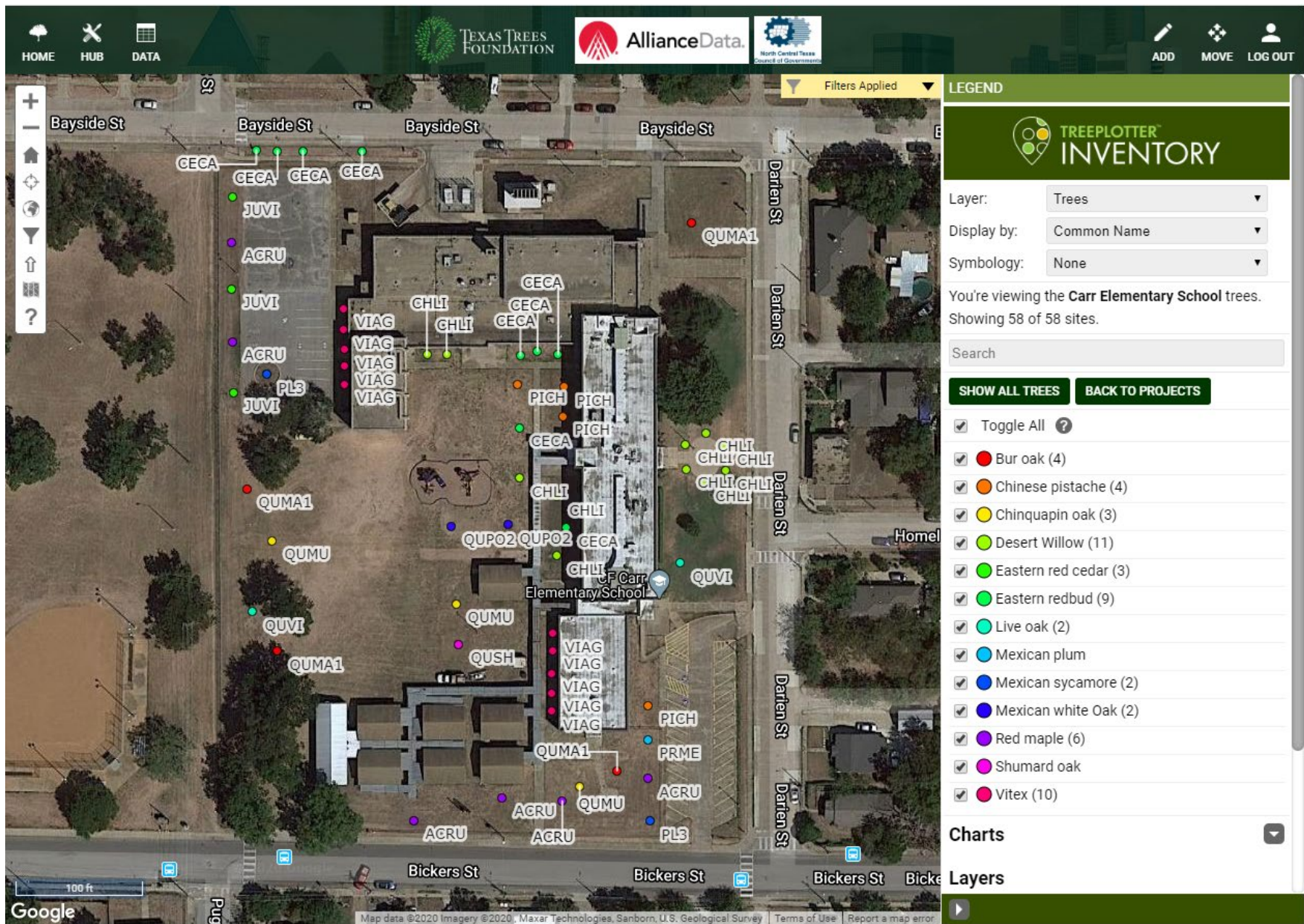
58 new trees comprised of 13 different species were planted on the campus to achieve multiple goals, including increasing canopy cover, adding diversity, improving aesthetics, and providing other ecosystem services to students, faculty, staff, and surrounding neighborhoods.

Tree Planting at C.F. Carr Elementary

Trees were planted at the Carr campus by students from all grade levels, school staff and faculty, and the Texas Trees Foundation with assistance from Groundwork Dallas, a local non-profit organization. In total, 58 trees were planted around the campus in order to add to the campuses canopy, with the intention of raising the total canopy cover above 20%. Locations and species were selected by the Texas Trees Foundation based on planting space, maximizing benefits, and increasing the aesthetic appeal of the campus. Trees were purchased by the City of Dallas via the Article X mitigation fund.

Canopy Cover

The pre-planting land cover at Carr Elementary was classified using 300 random sample points across the 5.4-acre campus. The pre-plantings tree canopy was determined to be 8.70 ±1.63%. Tree canopy was confirmed to be 7.7% through assessment in ESRI's ArcMap. Much of the campus is impervious surfaces (approximately 41%) or turf grass (approximately 50%).

C.F. Carr Land Cover (Via iTree Canopy)

Cover Class	Description	% Cover
Tree	Tree, non-shrub	8.70 ±1.63
Grass/Herbaceous	Grass, herbaceous ground covers	49.2 ±2.89
Impervious Buildings	Buildings, roofs	25.1 ±2.51
Impervious Pavement	Roads, sidewalks, parking areas	16.4 ±2.14
Bare ground/Soil	Bare, unpaved ground	0.67 ±0.47
Water	Water	0.00 ±0.00

An abundance of impervious surfaces, such as pavement, sidewalks and buildings, can add to what is known as the "Urban Heat Island" affect. Surfaces like buildings and concrete can absorb and hold heat throughout the day, later releasing it and increasing ambient air temperatures. This increase in temperature and be drastic, as urban areas of Dallas are on average as much as 12 degrees Fahrenheit hotter than rural areas according to the 2017 Dallas Urban Heat Island Effect report. Removing impervious surfaces on school campuses is difficult, as removing vital infrastructure, such as buildings and sidewalks, is not possible. However, by adding tree canopy we can reduce ambient temperatures and shade surfaces that would normally hold heat.

C.F. Carr Elementary School Tree Inventory Pre-Planting

Tree Inventory Post Planting

LEGEND

TREEPLOTTER™ INVENTORY

Layer: Trees

Display by: Common Name

Symbology: None

You're viewing the **Carr Elementary School** trees. Showing 79 of 79 sites.

Search

SHOW ALL TREES | BACK TO PROJECTS

☑ Toggle All ?

- ☑ ● Bur oak (4)
- ☑ ● Callery pear
- ☑ ● Cedar elm (9)
- ☑ ● Chinese pistache (4)
- ☑ ● Chinquapin oak (3)
- ☑ ● Desert Willow (11)
- ☑ ● Eastern red cedar (3)
- ☑ ● Eastern redbud (9)
- ☑ ● Live oak (4)
- ☑ ● Mexican plum
- ☑ ● Mexican sycamore (2)
- ☑ ● Mexican white Oak (2)
- ☑ ● Pecan (8)
- ☑ ● Red maple (6)
- ☑ ● Shumard oak (2)
- ☑ ● Vitex (10)

Estimated Future Canopy of Newly Planted Trees in 50 years (via iTree Design)
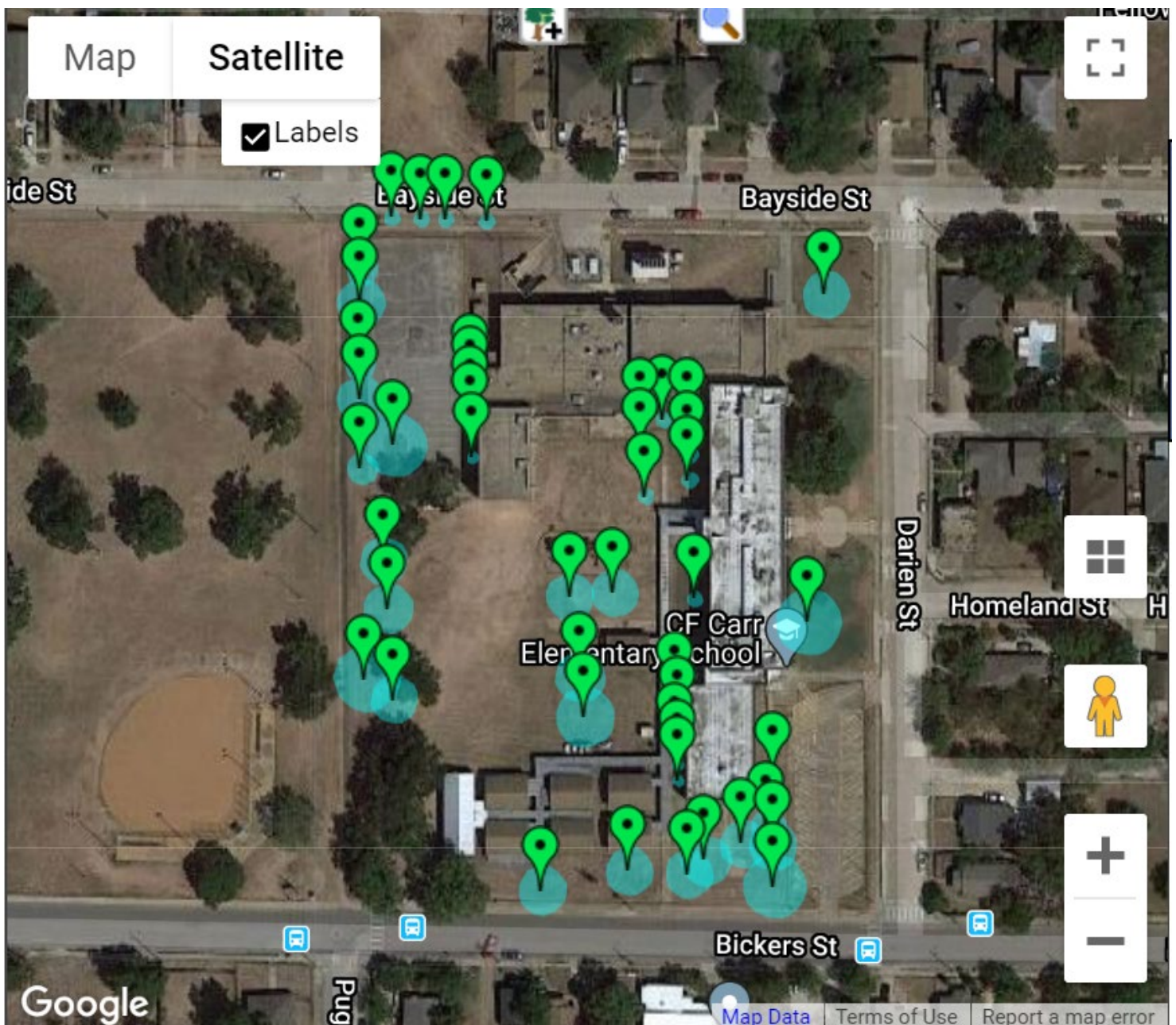
Future tree canopy cover was calculated based on average canopy width of each tree species at maturity. It is estimated that, at maturity, these new trees will add approximately 42,900 square feet or 18% tree canopy to the site, bringing to total tree canopy cover to approximately 25%.

Ecosystem Services Provided by New Trees

The benefits that trees provide to the environment have been classified by The Economics of Ecosystems & Biodiversity (TEEB) into four categories: Regulating, Provisioning, Supporting, and Cultural services (TEEB, n.d.). With the help of tools, such as the USDA's iTree software suite, we can begin to quantify the value of some of these benefits. Regulating services are generally the most commonly quantified, and include things like local climate and air quality, carbon sequestration and storage, and Waste-water treatment.

On C.F Carr's campus, newly planted trees are projected to provide. Using iTree's Planting Calculator, benefits provided by planted trees over the next 25 and 50 years were assessed. Tree planting locations were exported to ESRI ArcGIS and buffers were drawn in order to calculate tree distance from school buildings to properly estimate tree benefits at 25 and 50 years after planting* in iTree's Planting Calculator. Directions from structures were recorded manually for each tree, as shown in appendix A.

Benefits provided by planted trees over 25 and 50 years

Ecosystem Service	Total at yr. 25	Total at yr. 50
CO2 Avoided (pounds)	42,279.50	107,819.10
CO2 Avoided ($)	983.29	2,507.53
CO2 Sequestered (pounds)	81,225.10	284,225.00
CO2 Sequestered ($)	1,889.02	6,610.22
Electricity Saved (kWh)	39,666.70	97,143.00
Electricity Saved ($)	4,506.11	11,035.42
Fuel Saved (MMBtu)	-63.20	-128.90
Fuel Saved ($)	-891.12	-1,815.80
Tree Biomass (short ton)	22.40	77.80
Rainfall Interception (gallons)	325,579.10	1,109,331.30
Avoided Runoff (gallons)	78,913.40	268,877.10
Avoided Runoff ($)	705.19	2,402.69
O3 Removed (pounds)	346.10	1,200.40
NO2 Avoided (pounds)	5.70	14.30
NO2 Removed (pounds)	48.10	167.90
SO2 Avoided (pounds)	77.80	198.60
SO2 Removed (pounds)	3.10	9.90
VOC Avoided (pounds)	3.30	8.40
PM2.5 Avoided (pounds)	4.00	10.00
PM2.5 Removed (pounds)	22.50	78.70
Total monetary benefits	**$7,192**	**$20,740**

*Note: iTree's Planting Calculator does not contain Desert Willow (*Chilopsis linearis*) and no appropriate substitution was available; Thus, it was excluded from benefit calculations.

Non-monetary benefits

In addition to these quantified regulating services, the new trees on campus also provide Supporting services such as animal habitat and soil formation, Provisioning services such as fresh water and potentially some raw materials (e.g. sticks for arts and crafts, etc.), as well as important cultural services. This last category is arguably the hardest to quantify and includes critical benefits to human mental and physical health, aesthetic value, and cultural, art, and design inspiration. In addition, for some, these trees may provide a connection with their own religion or spiritualism, as trees are seen as important in many cultures across the globe. These new trees were planted by students, staff and volunteers, and constitute a new and long-lasting connection between these people and their school, neighborhood, and community. (See http://www.teebweb.org/resources/ecosystem-services/ for a full list of ecosystem services provided by trees).

References

Dallas-Fort Worth, TX-OK. (2020). Retrieved April 15, 2020, from http://www.stateoftheair.org/city-rankings/msas/dallas-fort-worth-tx-ok.html#ozone

The Economics of Ecosystems & Biodiversity. (n.d.) Ecosystem services. http://www.teebweb.org/resources/ecosystem-services/

Kuo, M., Barnes, M., & Jordan, C. (2019). Do Experiences with Nature Promote Learning? Converging Evidence of a Cause-and-Effect Relationship. Frontiers in Psychology, 10. doi: 10.3389/fpsyg.2019.00305

Texas Trees Foundation. (2015). State of the Dallas Urban Forest. https://www.texastrees.org/wp-content/uploads/2019/04/Urban-Forest-report.pdf

Distance Buffer for iTree Planting Calculator Assessment

Tree locations in relation to structures on Carr Elementary campus.

Spp	TOTAL	0-19FT								20-39FT								40-59FT								60+
		N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW	N	NE	E	SE	S	SW	W	NW	
Bur Oak	4									1				1												2
Chinese Pistache	4		1			2									1											0
Chinquapin oak	3																					1				2
Desert Willow	11					2						4				2					3					0
E. Red cedar	3																									3
E. Redbud	9					3			1																	5
Live oak	2											1														1
Mexican plum	1										1															0
Mexican Sycamore	2																									2
Mexican white oak	2																							1		1
Red Maple	6										1									1	2					2
Shumard Oak	1																							1		0
Vitex	10							10																		0