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i-Tree Final Project: Melody Park and Columbine Park Assessment
7/12/19

The City of Boulder, Colorado, is a lively community of over 107,000 people, attracting tourists from all over the world to visit well known destinations such as Chautauqua Park and the Flatirons. Tourists and residents also benefit from an additional 45 acres of City managed open space, over 150 miles of hiking trails, 60 maintained urban parks, and 51,000 inventoried public trees that provide them with numerous recreation activities. Essentially a green oasis in an otherwise high plains ecosystem along the Colorado Front Range Urban Corridor, Boulder's residents not only rely on the green belt surrounding the city for recreation and solitude, but they also depend on their urban green spaces and trees within parks, medians, streets, and the public right of ways to reduce summer temperatures, sequester carbon and reduce urban heat island effects, mitigate storm water run-off, and to clean the air.

Melody park and Columbine Park are urban parks near elementary schools. These parks are used daily by residents, students, and their families. While the community's focus may typically fall on the higher profile destinations in Boulder, it is now possible to convey the ecological benefits of our urban parks to our community and allow residents to begin to understand the value of their local green spaces and their importance to not only their health and happiness, but also in reducing Boulder's over-all carbon footprint.

Boulder's urban tree canopy stands to lose an estimated 70,000 ash trees over the next several years due to emerald Ash Borer (EAB). This number equates to approximately 20% of the existing urban tree canopy. The loss of these trees will make a significant impact on our community and we will lose their associated tree benefits. It is more important than ever before to evaluate our urban forest and plan for future sustainability. Understanding and communicating the importance of urban trees to our recreational pursuits, economic vitality, human health, and to the overall livability of our community is the purpose of our pilot i-Tree Eco V6 project.

Melody Park Overview

Melody Park is a 1.3-acre neighborhood park featuring open turf and a playground (Image 1). It contains a picnic shelter, tables, and 45 trees managed by Boulder Forestry. The top three most common tree species within the park are European crabapple (28.9 %), callery pear (11.1%), and pin oak (8.9%). 44.4% of the trees in Melody Park are under 6-inch Diameter at Breast Height (DBH). This park, due to its 1.3-acre size and open turf in the center for recreation, has limited planting area.

While the top three tree species by abundance are European crabapple, callery pear, pin oak, in that order, the most dominant tree species in terms of leaf area are European Crabapple (28.9 percent abundance and 34.6% of total leaf area), Pin oak (8.9% abundance and 20.2% of total leaf area), and American basswood (4.4% abundance and 19.0% of total leaf area). Large statured trees have a high leaf area and therefor are provide more benefits per tree over the long term compared to the smaller statured trees in the park such as European crabapple and callery pear (11.1% abundance but only 1.4 % total leaf area). Large trees have greater leaf

area and greater wood mass for carbon sequestration than smaller statured trees, allowing them to store more carbon and maximize pollution and storm water mitigation.

Melody park has many small trees, with 44.4 % of the tree population being under 6" DBH. These trees are the future of Melody Park and will eventually form the dominant tree canopy. Since these trees are species that are large at maturity, this park has great potential for providing long term benefits to our community. The distribution of tree diameter classes at melody shows us that we have both very large old trees and very young trees. This describes a successional gap at this park that may reduce consistent ecological benefits from being obtained through these trees until the young trees mature into the dominant canopy.

A concern for Melody Park is the threat of disease and insects in the large maturing trees. kermes scale and drippy blight are present in Boulder and is often lethal. The mature pin oak trees are not only the tallest in the park, but they are the largest diameter trees in the park. Losing these trees to kermes scale and drippy blight would leave the park with only young trees and small statured mature trees to take their place. Losing these oaks would constitute a loss of approximately \$15,000 ins structural value as the pin oaks make up 8.9% of the total tree population and 20.2% of the total percent leaf area. See Table 1 for more information on i-Tree statistics.

Melody park Management Strategies

Based on the i-Tree assessment of Melody Park, we need to prioritize the preservation and maintenance our large statured, mature trees in order to retain ecological benefits over time. This will include integrated pest management and sound tree care practices. Since space is a concern, focusing attention on retaining what we have and preserving and enhancing their benefits over time and during development projects will allow this park to continue to provide increasing benefits to our community until the young trees mature. Maintaining large, healthy trees will allow for increased carbon storage sequestration. The larger the tree and the healthier and more vigorous its growth is, the more carbon will be annually sequestered. Sound pruning and tree care practices must be prioritized at this park to allow the young trees to fully develop int replacement trees for the large, mature trees. We can also incorporate more coniferous trees into Melody Park, in order to maintain particulate and gaseous pollution mitigation throughout the autumn and winter seasons.

Columbine Park Overview

Columbine park is a newly renovated 4.3-acre park directly adjacent to Columbine Elementary school (Image 2). This park features a natural playground, tennis court, and a large, open rectangular field. Columbine Park has 57 trees managed by Boulder Forestry with the most common species by abundance being American basswood (10.5%), European crabapple (8.8%), and blue spruce (8.8%). 29.8% of the trees in this park are under 6-inch DBH. Columbine Park has an even distribution of tree diameter classes, showing us that the very large mature trees will be consistently succeeded by the next generation of trees and maintain the benefits associated with large statured trees into the future. This large park has ample space for tree planting; however, a challenge is that residents do not want trees (current and future) to block their view of the nearby Flatirons.

We see a similar trend in tree leaf area versus tree abundance in Columbine as we do in Melody Park. While the top three species in abundance are American basswood (10.5%), European crabapple (8.8%), and blue spruce (8.8%), the species with the most dominant leaf area are American basswood with 12.8% total leaf area, blue spruce with 10.9% leaf area, and white fir with 12.4% leaf area (in comparison to its 7.0 % abundance). This means that not only are large maturing deciduous trees providing more benefits over time than small maturing deciduous trees, but so are large maturing coniferous trees. Due to their on their high leaf area percentage that is derived from the narrow needle size, shape, and abundance.

The species of trees within a park and their leaf habit make a significant impact on pollution and air quality. Not only do the trees in Columbine Park mitigate air pollutants such as ozone (O₃), carbon monoxide (CO), Nitrogen dioxide (NO₂), and sulfur dioxide (SO₂), the trees in this park also mitigate a significant amount of particulate matter, more so even than gaseous air pollutants. Gaseous pollutants are absorbed through tree leaves, with heightened mitigation during the growing season and gradual tapering off as the leaves on deciduous trees fall in autumn. However, coniferous trees that retain needles year-round are not only able to absorb gaseous pollutants, but they also trap a significant amount of particulates on their abundant leaf surfaces.

The percentage of ash trees in the park is 3.5% of the overall number of trees and 10.1% of the overall tree canopy. These trees are susceptible to emerald ash borer (EAB), which is found in Boulder, CO. Losing these trees to EAB would constitute a total loss of \$21,200 in structural value. These trees due to their high structural integrity and canopy health are treated with emamectin benzoate, or Tree-Age, every 3 years. See Table 1 for more information on i-Tree statistics.

Columbine Park Management Strategies

Based on the i-Tree assessment of Columbine Park, there is ample space to plant more trees in this park. We need to be strategic in species selection by favoring longer lived, slower growing trees, that represent a genus that is less than 5% abundant within this park. This will help to build a sustainable urban park that is resilient to tree disease and insect pests over time. Tree location is very important. New trees to be planted can provide energy saving benefits to our community. There are opportunities to plant trees near impervious surfaces that will reduce urban heat island effects such as over playground areas, sidewalks, and parking lots. An increase in tree cover over impervious surfaces will reduce ozone formation, reduce temperatures, and prolong the useful life of the concrete or asphalt surface. Communicating to the public and residents nearby about why certain planting locations were selected, and the benefits associated with these trees to their community will be very important as viewsheds may be blocked over time due to an increase in tree size and canopy cover.

Next Steps

To better utilize this information as urban forest managers and to share it with the general public, we have developed three proposed outreach projects that can stem from this analysis.

GIS Online Dashboard

We plan on linking the i-Tree Eco data with our entire current tree inventory. This will allow Boulder Forestry to view the ecological benefits for each individual tree. To simplify this information for the general public, we would like to run an analysis for more parks in our system. From this we will create a simple online ArcGIS dashboard where users can select a park on the city map and specific iTree information on tree diversity and ecological benefits will graphically display. This project will be a partnership between the Forestry and GIS work groups within Boulder Parks and Recreation.

Social Media Opportunities

Working with the Marketing and Forestry teams within Boulder Parks and Recreation, we plan on using social media outlets such as facebook and Instagram to deliver simple iTree information to the public as part of an ongoing forestry marketing project. We can use the information from iTree to guide content and express the environmental benefits of the trees within our urban forest to garner appreciation and interest.

Tree Tags Project

We would like to create tree tags based on iTree information and use them at Melody and Columbine Parks. We would like to incorporate our volunteer Tree Tender group into this project to assist with tag creation and placement on the trees. To make this more interactive, we would like to create a self-guided tour or scavenger hunt related to these tags for the students at the nearby elementary schools to participate in during the school year.

iTree Eco Summary Statistics	Melody Park	Columbine Park
Number of Trees	45	57
Tree cover (thousand sq ft)	12.73	22.19
Pollution Removal (pounds/year)	13.33 (\$6.82/year)	31.04 (\$22.3/year)
Carbon Storage (tons)	8.432 (\$1.44 thousand)	25.151 (\$4.35 thousand)
Carbon Sequestration (pounds)	698.2 (\$59.5/year)	1131 (\$96.4/year)
Oxygen Production (pounds/year)	1862	1.508
Avoided Run-off (cubic feet/year)	244 (\$16.3/year)	570.8 (\$38.2/year)
Structural Values	\$73.1 thousand	\$212 thousand

(Table 1: Comparison of i-Tree Eco summary statistics for Melody Park and Columbine Park)

(Image 1: Melody Park and all inventoried tree locations)

(Image 2: Columbine Park and all inventoried tree locations)