City of Tracy
Urban Forest Management Plan

TRACY

Think Inside the Triangle™

City of Tracy
Urban Forest Management
Plan 2022

Prepared for:

CITY OF TRACY
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Think Inside the Triangle™

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Acknowledgements

Scope & Purpose

The purpose of the Urban Forest Management Plan (UFMP) is to provide a guide for managing, enhancing, and growing Tracy's community tree resource over the next 20 years. The plan also includes goals for long-range planning to promote sustainability, species diversity, and greater canopy cover.

Community trees are publicly managed trees along streets, in parks, and at City facilities. The UFMP also provides some consideration for private trees because they contribute significantly to Tracy's livability and environmental quality.

Therefore, the UFMP aims to:

- Identify best management practices that support tree health, benefits, and community safety

- Increase health and resiliency of the urban forest by improving species diversity, and by managing pests and invasive species

- Develop a cohesive organizational structure to facilitate collaboration among all urban forest managers

- Nurture an ethic of stewardship for the urban forest among City staff, community organizations, businesses, and residents

- Identify baseline metrics and clear goals for urban forest managers

- Promote community engagement and advocacy for the urban forest

The UFMP includes both long and short-term actions in support of these ends. The plan provides specific goals and actions for managing community trees, preserving and increasing canopy cover, and improving community outreach.

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Executive Summary

What do we have?

The review process established that Tracy has built a strong foundation for an exceptional urban forestry program. The community has made an outstanding commitment to planting, preserving, and promoting the care of trees and other natural resources.

Several factors contribute to Tracy having the tools and information necessary to make well informed and effective management choices. These factors include:

- The support of local non-profits that advocate for the urban forest and provide a volunteer base;

- An Urban Tree Canopy Assessment that includes GIS mapping of the location and extent of Tracy's entire tree canopy (public and private);

- An inventory of public trees in parks, medians, streets, and City facilities;

- A Resource Analysis that defines the composition, benefits, and benefit versus investment ratio of the public tree resource;

- Tree protection regulations that promote the preservation and protection of community trees; and

- A well-trained, dedicated urban forestry staff.

With these tools and a relatively young urban forest, in good condition, Tracy is poised to enjoy increasing environmental benefits and value from its public trees.

Tracy's Urban Forest Benchmark Values

Urban Tree Canopy Cover (Public and Private, 2016)		
Overall Canopy Cover	7.4%	
Land Use Canopy Cover (Residential & Parks)	12.8%	
Impervious Surfaces	37.9%	

Canopy Benefits (Public and Private, 2016)		
Carbon Stored to Date	10,633 tons	$159,500

Annual Canopy Benefits (Public and Private, 2016)		
Annual Carbon Benefits	1,078 tons	$36,095
Annual Air Quality Benefits	25,598 pounds	$368,567

Community Urban Forest (Public Tree Resource)		
Inventoried Trees (2018)	35,561 trees	

Community Tree Benefits		
Annual Carbon Benefits	2,967 tons	$44,502
Annual Air Quality Benefits	31,172 pounds	$469,360
Annual Energy Benefits		$947,243
Annual Stormwater Management	23.3 million gallons	$181,658

Species Diversity (Inventoried Trees, 2018)		
Total Number of Unique Species	191	
Prevalence of Top Five Species	41.6%	
Species exceeding recommended 10%	1	
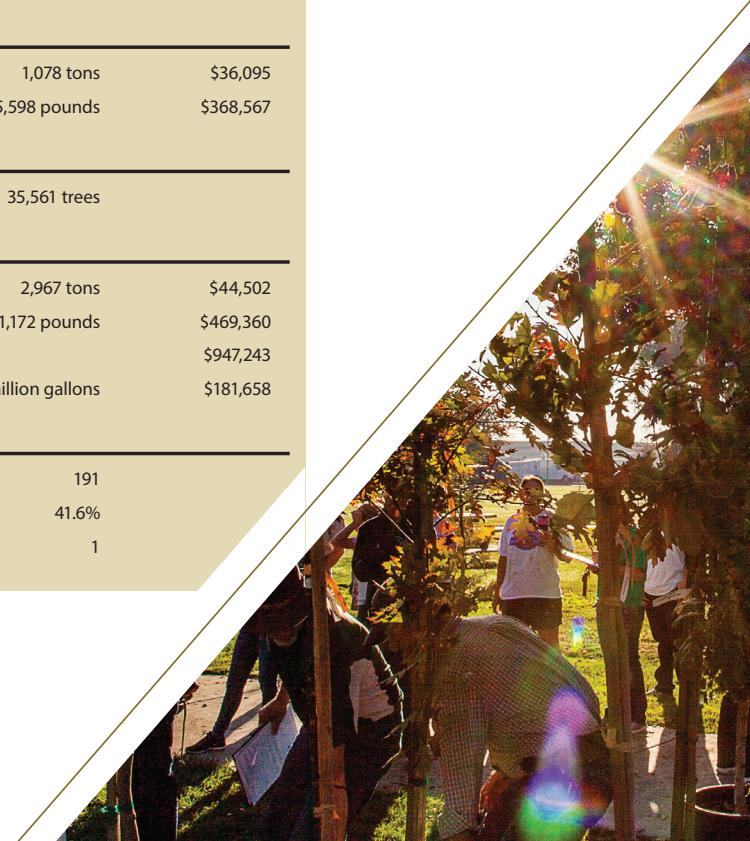
What do we want?

A primary emphasis for the UFMP is to identify adequate resources to ensure that critical tree care needs can be addressed in a timely, cost-effective, and efficient manner. Trees are living organisms, constantly changing and adapting to their environment and increasing in size over time. Because of this, trees have specific needs at various life stages, including training for proper structure when they are young and increased monitoring and proactive risk management as trees age.

Deferring maintenance can have a significant effect on the overall health, structure, value, and lifespan of a tree. In addition, deferred maintenance often results in higher costs and less beneficial results, including increased risk potential. As a result, the UFMP identifies goals for optimizing urban forest programming, existing funding, staffing, and urban forest policy.

How do we get there?

The UFMP identifies three guiding principles, five goals, and eight existing policies that support preserving the health, value, services, and sustainability of Tracy's community urban forest. Each of these goals and existing policies are supported by comprehensive objectives and actions. Recognizing that community engagement is integral to success, the UFMP includes solid objectives for engaging the community and encourages partnership and collaboration.

How are we doing?

The long-term success of the UFMP will be measured through the realization of Plan goals and demonstrated through increased value and environmental services from the urban forest. The Plan identifies methods of measurement, priorities, potential partners, and estimated costs. Since the UFMP is intended to be a dynamic tool, it can and should be updated in response to available resources and opportunities. One of the greatest measures of success for the UFMP will be its level of success in meeting community expectations for the care and preservation of Tracy's urban forest.
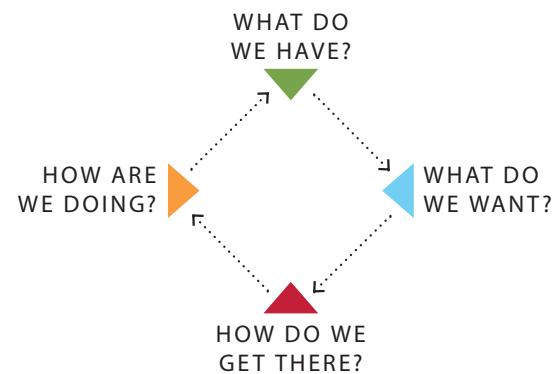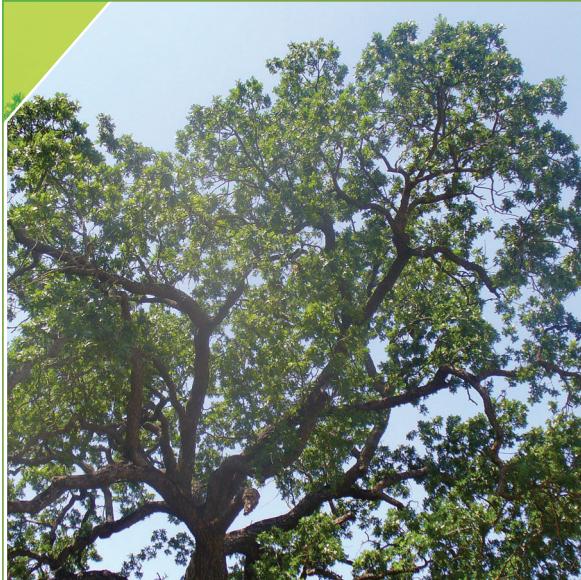
WHAT DO WE HAVE?

HOW ARE WE DOING?

WHAT DO WE WANT?

HOW DO WE GET THERE?

Grow, maintain, preserve, and enhance a sustainable urban forest.

Goal 1: Preserve trees whenever possible.

Goal 2: Reach 40% canopy cover by 2040.

Existing Policy 1: Plan for trees.

Existing Policy 2: Foster current partnerships with local non-profits and continue to explore opportunities with additional non-profit groups.

Existing Policy 3: Promote the longevity of trees as a public resource.

Optimize the environmental, social, economic, and public health benefits of trees and canopy.

Goal 3: Engage the community to increase support for the urban forest.

Goal 4: Encourage the planting of trees on private property.

Existing Policy 4: Manage risk.

Existing Policy 5: Expand the tree canopy through tree plantings on public property.

Align urban forest management policy with community expectations and promote efficiency within the Department of Public Works.

Goal 5: Revise Municipal Code to respond to community needs.

Existing Policy 6: Ensure policy documents communicate a shared vision.

Existing Policy 7: Provide emergency response to ensure accessibility for emergency responders and restoration of regular operations.

Existing Policy 8: Maintain a fire safe community.

Primary Objectives:

- Develop a Private Protected Tree or Heritage Tree Ordinance to protect specific species, native trees, specimen trees, or trees of historic value from damage or unpermitted removal.

- Greater preservation of trees on public property.

- Ensure all newly planted trees have the necessary resources to be maintained throughout the lifetime of the tree.

- Explore alternative designs to avoid removals during construction or renovations.

- Encourage preservation of trees on private property.

- Improve everyday care of trees, to prevent future removals.

- Greater and more equitable distribution of environmental benefits from trees.

- Invest in trees for the long-term environmental benefits they provide to the community.

- Allow for flexibility in planting considerations for new development.

- Continue to provide support for local non-profit organizations.

- Encourage new industries within the City to expand the tree canopy.

- Continue to explore partnerships with non-profit and environmental advocacy groups.

- Provide water to trees to encourage establishment of newly planted trees, as well as, prolong the life of mature trees.

- Educate the community about property owner responsibilities for the care of City trees.

Primary Objectives:

- Engage the community in urban forestry activities and educational events.

- Improve diversity of Tracy's urban forest through plantings on private property.

- Provide sustainable and adequate resources to sustain the urban forest for future generations.

- Use a variety of methods to provide tree related information to the community.

- Continue to distribute information about the urban forest to the community.

- Increase canopy cover through tree plantings on private property.

- Maintain trees throughout their lifetimes to improve structure in maturity and reduce the likelihood of structural failures in the future.

- Improve the diversity of the urban forest on public property, to create a more resilient urban forest.

Primary Objectives:

- Review and revise Municipal Code to address the challenges facing the urban forest.

- Unify guiding documents to transcend departmental changes and address inefficiencies and reduce confusion.

- Optimize interdepartmental communication and coordination.

- Restore operations and public safety as efficiently and as quickly as possible following storm or other emergency events.

- Focus fire mitigation efforts on Tracy Hills and other areas of vulnerability.

Introduction

Tracy is in San Joaquin County, within an hour of San Jose, San Francisco, and Sacramento. Although Tracy is generally considered a bedroom community, the City is currently experiencing significant growth in the industrial and commercial employment sectors. In fact, Tracy has the largest industrial park in the country (Prologis, 2019). Tracy is located inside a geographic triangle formed by Interstate 205, Interstate 5, and Interstate 580, which contributes to the City's motto of "Think Inside the Triangle". In addition to the laid back and friendly character of Tracy, the City is close to numerous recreational opportunities, such as, Lake Tahoe, Yosemite, and the San Francisco Bay.

Tracy has a semidesert climate with an average annual precipitation around 13.3 inches, which is less than other communities in the San Joaquin Valley. With the average temperature in winter hovering around 46.8°F and summers with an average temperature of 75.1 (U.S. Climate Data, 2018). The average annual wind speed for Tracy is 7.6 MPH from April to September, with average wind speeds in the summer of 9.4 MPH (Weather Spark, 2018).

Community

Tracy prides itself on being a friendly small City; the kind of place where traditional values of faith, family, education, and the arts are highly valued by all who live there. In addition to close proximity to popular California attractions, Tracy offers a vibrant entertainment scene with numerous festivals and community events throughout the year, as well as live theater, art shows, and music concerts.

History

Tracy's history follows a similar story to much of the history of the Central Valley of California, where the major drivers of the population are tied to railroads and agriculture.

1700s

The Yokuts were the first peoples to call the area that is now Tracy, home. Where the livelihood of the native peoples revolved around the water from the river and food from the acorns of the native valley oak trees (Tracy History, 2018). After the arrival of European settlers, most of the Yokuts were displaced or died from the introduction of new disease.

1800s

In the mid-nineteenth century, the building of an expansive railroad system across California, led to the foundation of Tracy, where the Southern Pacific and the Central Pacific intersected in 1878. Tracy was named for Lathrop J. Tracy, a grain merchant and railroad director from Mansfield, OH (Tracy History, 2018).

1900s

Up until the turn of the century, Tracy grew into a major railroad hub and was incorporated in 1910. The railroad industry declined in the beginning half of the 20th century and Tracy evolved into a thriving agricultural center (Tracy Magazine, 2017).

First sheep herders moved down from the hills into the valley with the seasons, then later cattle ranching, and later crops, such as barley, tomatoes, asparagus, nuts, fruit were grown, and processing plants to follow. Agriculture and the railroad were the main avenues of commerce up until the 1970s, then the growth of the Bay Area extended beyond the Altamont Pass and into Tracy.

Today, Tracy continues to attract people who are seeking an affordable lifestyle in close proximity to the Bay Area. Along with being an attractive place to live, many companies are taking note of Tracy as an optimal distribution location and are choosing to be located in the small City, including, companies like Amazon and most recently DHL.
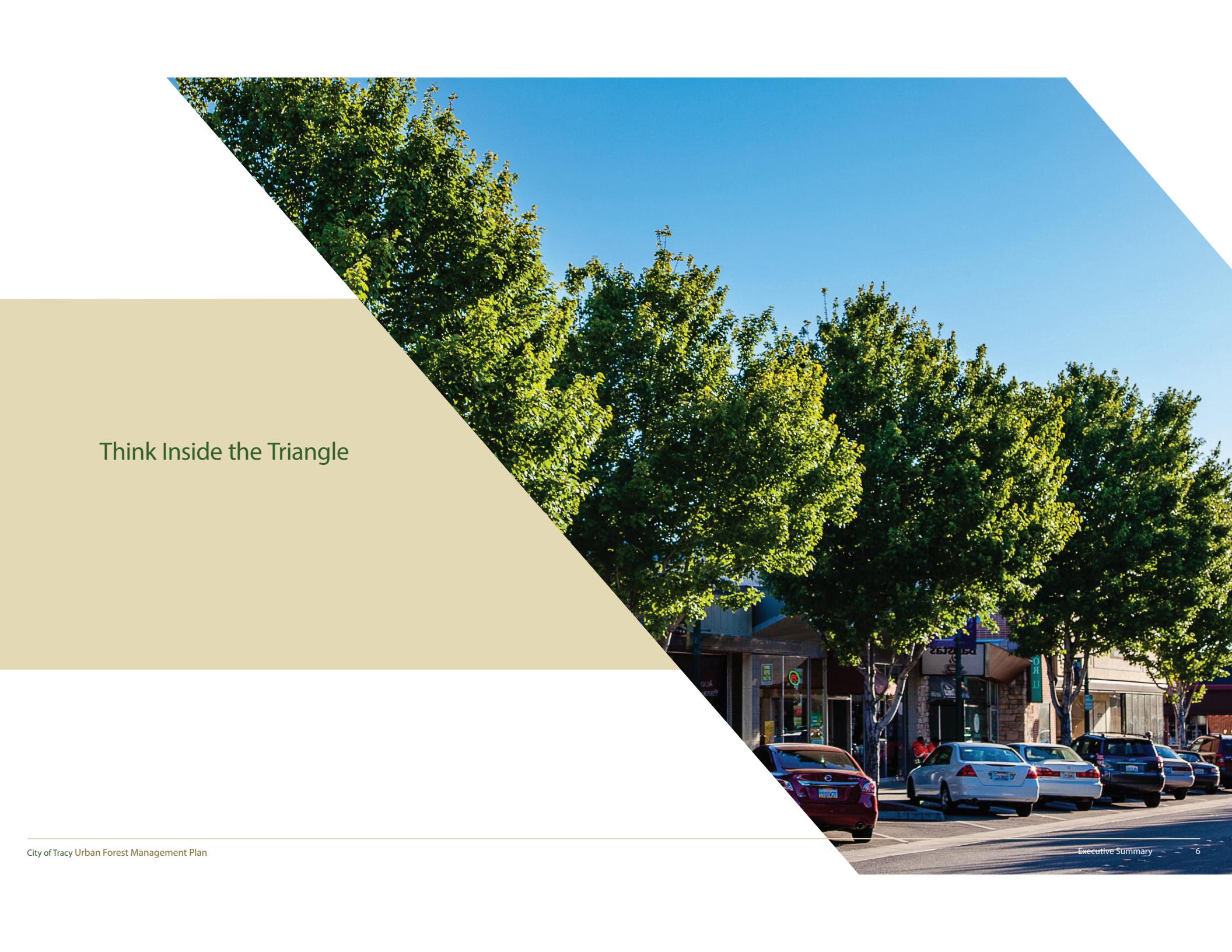
Think Inside the Triangle

Benefits of Urban Trees

Research has linked the presence of urban trees to...

The Nature Conservancy

PROTECTING BIODIVERSITY
including habitat for migrating
birds and pollinators

REDUCING OBESITY LEVELS
by increasing physical activity
including walking and cycling

REDUCING RATES
of cardiac disease, strokes, and
asthma due to improved air quality

MANAGING STORMWATER,
keeping pollutants out of waterways,
and reducing urban flooding

COOLING city streets by 2-4° F,
reducing deaths from heat and
cutting energy use

INCREASING
neighborhood property values

FILTERING up to a third of fine
particle pollutants within
300 yards of a tree

REDUCING STRESS by helping
interrupt thought patterns that
lead to anxiety and depression

Tree and Canopy Benefits

Trees in the urban forest work continuously to mitigate the effects of urbanization and development and protect and enhance lives within the community in many ways. Healthy trees are vigorous, producing more leaf surface and canopy cover area each year. The amount and distribution of leaf surface area are the driving force behind the urban forest's ability to produce services for the community (Clark et al, 1997). Services (i.e. benefits) include:

- Energy savings
- Air quality improvements
- Carbon dioxide reductions
- Water quality improvements
- Aesthetics & socioeconomics
- Health benefits
- Wildlife

The Urban Canopy provides numerous benefits, including reducing summer peak temperatures, the reduction of air pollutants, enhancement of property values, provides habitats for different wildlife, aesthetic value to the community, and improves social ties among neighbors. (Hilton, 2017)

Energy Savings

Urban trees and forests modify climate and conserve energy in three principal ways:

- Producing shade for dwellings and hardscape reduces the energy needed to cool the building with air conditioning (Akbari et al, 1997)

- Tree canopies engage in evapotranspiration, which leads to the release of water vapor from tree canopies and cools the air (Lyle, 1996)

- Trees in dense arrangements may reduce mean wind speed and solar radiation below the top of the tree canopy by up to ~90% compared to open areas (Heisler and DeWalle, 1988)

An urban heat island is an urban area or metropolitan area that is significantly warmer than its surrounding rural areas due to human activities.

Trees reduce energy use in summer by cooling the surrounding areas and shading-built environments. Shade from trees reduces the amount of radiant energy absorbed and stored by hardscapes and other impervious surfaces, thereby reducing the heat island effect, a term that describes the increase in urban temperatures in relation to surrounding locations. Transpiration releases water vapor from tree canopies, which cools the surrounding area. Evapotranspiration, alone or in combination with shading, can help reduce peak summer temperatures by 2 to 9°F (1 to 5°C) (Huang et al 1990). The energy saving potential of trees and other landscape vegetation can mitigate urban heat islands directly by

shading heat-absorbing surfaces, and indirectly through evapotranspiration cooling (McPherson, 1994). Individual trees through transpiration have a cooling effect equivalent to two average household central air-conditioning units per day or 70 kWh for every 200 L of water transpired (Ellison et al, 2017). Studies on the heat island effect show that temperature differences of more than 9°F (5°C) have been observed between city centers without adequate canopy cover and more vegetated suburban areas (Akbari et al, 1997).

Trees also reduce energy use in winter by mitigating heat loss. Trees reduce wind speeds by up to 50% and influence the movement of warm air and pollutants along streets and out of urban canyons. Urban canyons are streets flanked by dense blocks of buildings, which can affect local conditions, including temperature, wind, and air quality. By reducing air movement into buildings and against conductive surfaces (e.g., glass and metal siding), trees reduce conductive heat loss from buildings, translating into potential annual heating savings of 25% (Heisler, 1986).

Three trees properly placed around the home can save $100-$250 annually in energy costs. Shade from trees significantly mitigates the urban heat island effect – tree canopies provide surface temperature reductions on wall and roof surfaces of buildings ranging from 20-45°F and temperatures inside parked cars can be reduced by 45°F. Reducing energy use has the added bonus of reducing carbon dioxide (CO_2) emissions from fossil fuel power plants.

Introduction

Air Quality

Trees improve air quality in five fundamental ways:

- Lessening particulate matter (e.g., dust and smoke)
- Absorbing gaseous pollutants
- Providing shade and transpiring
- Reducing power plant emissions by decreasing energy demand among buildings
- Increasing oxygen levels through photosynthesis

Trees protect and improve air quality by intercepting particulate matter (PM_{10}), including dust, pollen, and smoke. The particulates are filtered and held in the tree canopy until precipitation rinses the particulates harmlessly to the ground. Trees absorb harmful gaseous pollutants like ozone (O_3), nitrogen dioxide (NO_2), and sulfur dioxide (SO_2). Shade and transpiration reduce the formation of O_3, which is created at higher temperatures. Scientists are now finding that some trees may absorb more volatile organic compounds (VOCs) than previously thought (Karl, T. 2010; Science Now, 2010). VOCs are carbon-based particles emitted from automobile exhaust, lawnmowers, and other human activities.

Carbon Dioxide Reduction

As environmental awareness continues to increase, governments are paying particular attention to global warming and the effects of greenhouse gas (GHG) emissions. As energy from the sun (sunlight) strikes the Earth's surface, it is reflected into space as infrared radiation (heat). Greenhouse gases absorb some of this infrared radiation and trap this heat in the atmosphere, increasing the temperature of the Earth's surface. Many chemical compounds in the Earth's atmosphere act as GHGs, including methane (CH_4), nitrous oxide (N_2O), carbon dioxide (CO_2), water vapor, and human-made gases/aerosols. As GHGs increase, the amount of energy radiated back into space is reduced and more heat is trapped in the atmosphere. An increase in the average temperature of the earth may result in changes in weather, sea levels, and land use patterns, commonly referred to as "climate change." In the last 150-years, since large-scale industrialization began, the levels of some GHGs, including CO_2, have increased by 25% (U.S. Energy Information Administration).

California's Global Warming Solutions Act (AB 32) passed in 2006 set the 2020 GHG emissions reduction goal into law. In December 2007, the California Air Resources Board (ARB) approved the 2020 emission limit of 427 million metric tons of carbon dioxide equivalent (CO_2). As of 2007, regulations require that the largest industrial sources of GHG must report and verify their emissions. In 2011, the ARB adopted the cap-and-trade regulation. Under a cap-and-trade system, an upper limit (or cap) is placed on GHG emissions. This cap can be applied to any source, industry, region, or other jurisdictional level (e.g., state, national, or global). Regulated entities are required to either reduce emissions to required limits or purchase (trade) emission offsets to meet the cap. In 2011, the ARB approved four offset protocols for issuing carbon credits under cap-and-trade, including the Forest Offset Protocol (ARB, 2011). This Protocol recognizes the key role forests play in fighting climate change. The USDA Forest Service Urban Ecosystems and Social Dynamics Program (EUP) recently led the development of an Urban Forest Project Reporting Protocol.

The Protocol, which incorporates methods of the Kyoto Protocol and Voluntary Carbon Standard (VCS), establishes methods for calculating reductions, provides guidance for accounting and reporting, and guides urban forest managers in developing tree planting and stewardship projects that could be registered for GHG reduction credits (offsets). The Protocol can be applied to urban tree planting projects within municipalities, campuses, and utility service areas anywhere in the United States. Trees and forests reduce atmospheric carbon dioxide CO_2 in two ways:

- Directly, through growth and carbon sequestration
- Indirectly, by lowering the demand for energy

Trees and forests directly reduce CO_2 in the atmosphere through growth and sequestration of CO_2 in woody and foliar biomass. Indirectly, trees and forests reduce CO_2 by lowering the demand for energy and reducing CO_2 emissions from the consumption of natural gas and the generation of electric power.

Stormwater Management and Water Quality

Trees and forests improve and protect the quality of surface waters, such as creeks and rivers, by reducing the impacts of stormwater runoff through:

- Interception

- Increasing soil capacity and rate of infiltration

- Reducing soil erosion

Trees intercept rainfall in their canopy, which acts as a mini-reservoir (Xiao et al, 1998). During storm events, this interception reduces and slows runoff. In addition to catching stormwater, canopy interception lessens the impact of raindrops on barren soils. Root growth and decomposition increase the capacity and rate of soil infiltration by rainfall and snowmelt (McPherson et al, 2002). Each of these processes greatly reduces the flow and volume of stormwater runoff, avoiding erosion and preventing sediments and other pollutants from entering streams, rivers, and lakes. Urban stormwater runoff is a major source of pollution for surface waters and riparian areas, threatening aquatic and other wildlife as well as human populations. Requirements for stormwater management are becoming more stringent and costly. Reducing runoff and incorporating urban trees in stormwater management planning has the added benefit of reducing the cost of stormwater management, including the expense of constructing new facilities necessary to detain and control stormwater as well as the cost of treatment to remove sediment and other pollutants.

MANAGING STORMWATER,
keeping pollutants out of waterways,
and reducing urban flooding

▲ Introduction

Health Benefits

Exposure to nature, including trees, has a positive impact on human health and wellness through improvements in mental and physical health, reductions in crime, and academic success.

A study of individuals living in 28 identical high-rise apartment units found residents who live near green spaces had a stronger sense of community and improved mental health, coped better with stress and hardship, and managed problems more effectively than those living away from green space (Kuo, 2001). In a greener environment, people report fewer health complaints, more often rate themselves as being in good health, and having better mental health (Sherer, 2003). Other research has revealed lower incidence of depressive symptoms in neighborhoods with greater access to green space (Jennings et al, 2016).

Tracy is susceptible to heat waves, which cause the most deaths worldwide out of any weather-related-natural disaster, with an estimated 12,000 deaths annually. Trees shade impervious surfaces and prevent the sun's rays from hitting them, thus reducing heat storage and later release, which contribute to the urban heat island effect. Tall trees that create a large shaded area are more useful than short vegetation. Trees also contribute to cooler temperatures through transpiration, increasing latent heat storage (the sun's energy goes to converting water from its liquid to vapor form), rather than increasing air temperature (sensible heat). According to a study conducted by the Nature Conservancy, it is estimated that trees have the potential to reduce summer maximum air temperatures by 0.9 to 3.6° F. Trees help to address public health concerns for both heat and air quality. Globally, an annual investment of $100 million in planting and maintenance costs would give an additional 77 million people a 1° C (1.8° F) reduction in maximum temperatures on hot days (McDonald et al, 2016).

A number of studies have examined the relationship between urban forests and crime rates. Park-like surroundings increase neighborhood safety by relieving mental fatigue and feelings of violence and aggression that can occur as an outcome of fatigue (American Planning Association, 2003). Research shows that the greener a building's surroundings are, the fewer total crimes. This is true for both property crimes and violent crimes. Landscape vegetation around buildings can mitigate irritability, inattentiveness, and decreased control over impulses, all of which are well established psychological precursors to violence.

Residents who live near outdoor greenery tend to be more familiar with nearby neighbors, socialize more with them, and express greater feelings of community and safety than residents lacking nearby green spaces (American Planning Association, 2003). Public housing residents reported 25% fewer domestic crimes when landscapes and trees were planted near their homes (Kuo, 2001). Two studies (one in New Haven, CT and the other in Baltimore City and County, MD) found a correlation between increased tree coverage and decreased crime rates, even after adjusting for a number of other variables, such as median household income, level of education, and rented versus owner-occupied housing in the neighborhoods that were studied (Gilstad-Hayden et al, 2015; Troy et al, 2012).

A 2010 study investigated the effects of exposure to green space at school on the academic success of students at 101 public high schools in southern Michigan (Matsuoka, 2010). The study found a positive correlation between exposure to nature and student success measured by standardized testing, graduation rate, percentage of students planning to go to college, and the rate of criminal behavior. This trend persisted after controlling for factors such as socioeconomic status and race or ethnicity. Conversely, views of buildings and landscapes that lacked natural features were negatively associated with student performance.

REDUCING RATES
of cardiac disease, strokes, and asthma due to improved air quality

Wildlife

Trees provide important habitat for birds, insects (including bees), and other animal species. Their greatest contributions include:

- Preservation and optimization of wildlife habitat
- Natural corridors for increased movement and dispersal

Furthermore, trees and forest lands provide critical habitat (for foraging, nesting, spawning, etc.) for mammals, birds, fish, and other aquatic species. Trees can offer pollinators a valuable source of flowering plants. By including an array of flowering trees that provide pollen and nectar in the urban forest, bees are provided with additional food sources. Increasing tree species diversity and richness contributes to greater numbers of bird species among urban bird communities (Pena et al, 2017). Wooded streets potentially function as movement corridors, allowing certain species—particularly those feeding on the ground and breeding in trees or tree holes— to fare well by supporting alternative habitat for feeding and nesting (Fernandez-Juricic E. 2000). Greater tree density also contributes to bat activity in urban environments and improves outcomes for birds and bats (Threlfall et al, 2016).

Restoration of urban riparian corridors and their linkages to surrounding natural areas have facilitated the movement of wildlife and dispersal of flora (Dwyer et al, 1992). Usually habitat creation and enhancement increase biodiversity and complement many other beneficial functions of the urban forest. These findings indicate an urgent need for conservation and restoration measures to improve landscape connectivity, which will reduce extinction rates and help maintain ecosystem services (Haddad et al, 2015).

Calculating Tree Benefits

Communities can calculate the benefits of their urban forest by using a complete inventory or sample data in conjunction with the USDA Forest Service i-Tree software tools (itreetools.org). This open-source, state-of-the-art, peer-reviewed software suite considers regional environmental data and costs to quantify the ecosystem services unique to a given urban forest resource.

Individuals can calculate the benefits of trees to their property by using i-Tree Design (www.itreetools.org/design).

If a London plane tree were planted and lived for 20 years, it would provide numerous environmental benefits including sequestering 4,023 lbs of CO_2 ($93.56), preventing 4,543 gallons of rainfall runoff ($40.59), and intercepting 20.7 lbs of air pollutants. If it were planted next to a building, it would save 1,923 kWh of electricity ($298.01).

I-TREE DESIGN

▲ What do we have?

History of Urban Forestry in Tracy

In the late 1960's, the Public Works Department was established, which assumed responsibility for the care of street trees in Tracy. To address the cost of tree care and landscape needs for public landscaped areas throughout the City, Landscape Maintenance District (LMD) zones were established in 1985.

Storm events and periods of drought have had a noticeable impact on City trees. In 1968, nearly 324 trees were lost in a single storm, which resulted in clean-up efforts that lasted 24 hours a day for nearly a month. Tree losses also occurred during extreme wind and heavy rain events in 1997 and 2007. While Tracy continues to experience strong wind events, with improved routine maintenance and structural training of young trees, fatalities from storm events generally do not exceed 10 trees in any given storm event. Along with the increased maintenance needs for trees following strong wind events, persistent westerly winds cause a noticeable lean in many of Tracy's trees. In addition, trees have been widely used for windbreaks.

Drought has also made trees more prone to pests over the years. Most notably, Raywood ash (Fraxinus oxicarpus) have been more susceptible to Raywood Ash Canker (Botryosphaeria stevensii), which has contributed to the decline and removal of numerous City trees (Raywood Ash Canker and Decline, 2017).

Public Works is on track to plant more than 300 trees in 2019; however, tree plantings have mostly been sporadic and primarily done by request following removals. Over the years, numerous community groups have hosted tree planting events. However, Tracy did not experience consistent tree plantings until the first Arbor Day Celebration in 2015 where 15 trees were planted. In the following years, tree plantings at Arbor Day celebrations increased to well over 100 trees per year. In fact, in 2018, 156 trees were planted.

In 2016, a former council member and other community members collaborated with City staff to form the Tracy Tree Foundation (TTF). TTF aims to enhance, protect, and sponsor a healthy, beautiful, and safe urban and community forest. The importance of trees is noticeable through considerations for the inclusion of trees in the Community Character Element in the City's General Plan. In recognition of Tracy's commitment to trees, Tracy was officially recognized as a Tree City USA in 2015 and has sustained that status ever since.

Managers can regularly assess, evaluate, and indicate the current performance levels of the urban forest through a Sustainable Urban Forest Assessment Matrix. The current assessment can be found in Appendix G.

Urban Forest Resource

The development of the UFMP included an urban tree canopy (UTC) assessment. Tree canopy is the layer of leaves, branches, and stems of trees and other woody plants that cover the ground when viewed from above. Understanding the location and extent of tree canopy is critical to developing and implementing sound management strategies that will promote the smart growth and resiliency of Tracy's urban forest and the invaluable services it provides. The UTC assessment provides a bird's-eye-view of the entire urban forest and includes consideration of tree canopy along with other primary land cover, including impervious surface, bare soils, and water. This information helps managers better understand tree canopy in relation to other geospatial data, including:

- Distribution of tree canopy within the community

- Geopolitical patterns in canopy distribution

- Identification of potential planting areas

The analysis does not distinguish between trees on public and private property since the benefits of trees extend beyond property lines. The information can be used by urban forest managers to explore tree canopy in conjunction with other available metrics, including geography, land use, and community demographics. This information also establishes a baseline for assessing future change.

Tree Canopy

Land Cover Summary

The City encompasses approximately 26 square miles (16,615.9 acres). Excluding impervious surface (6,299.8 acres) and open water (123.2 acres), Tracy contains approximately 9.7 square miles (6,233.8 acres) which has the potential to support tree canopy. The following characterizes land cover within Tracy:

- 7.4% (1,233.1 acres) tree canopy, including trees and woody shrubs.

- 12.8% (1,123 acres) tree canopy on residential and park land use parcels.

- 37.9% (6,299.8 acres) impervious surface, including roads; parking lots, and structures.

- 79.4% of the urban forest canopy is in fair or better condition.

- A maximum potential canopy of 44.9%.

- Since 1993, canopy cover increased from 4.2% to 6.2% in 2010, or a 47.6% increase in canopy cover.

Pie chart: Grass/Low-lying Vegetation 10.6%, Tree Canopy 7.4%, Open Water <1%, Bare Soil 43.3%, Impervious Surfaces 37.9%

Legend:
- Project Boundary
- Grass/Low-Lying Vegetation
- Bare Soil
- Open Water
- Impervious Surfaces
- Tree Canopy
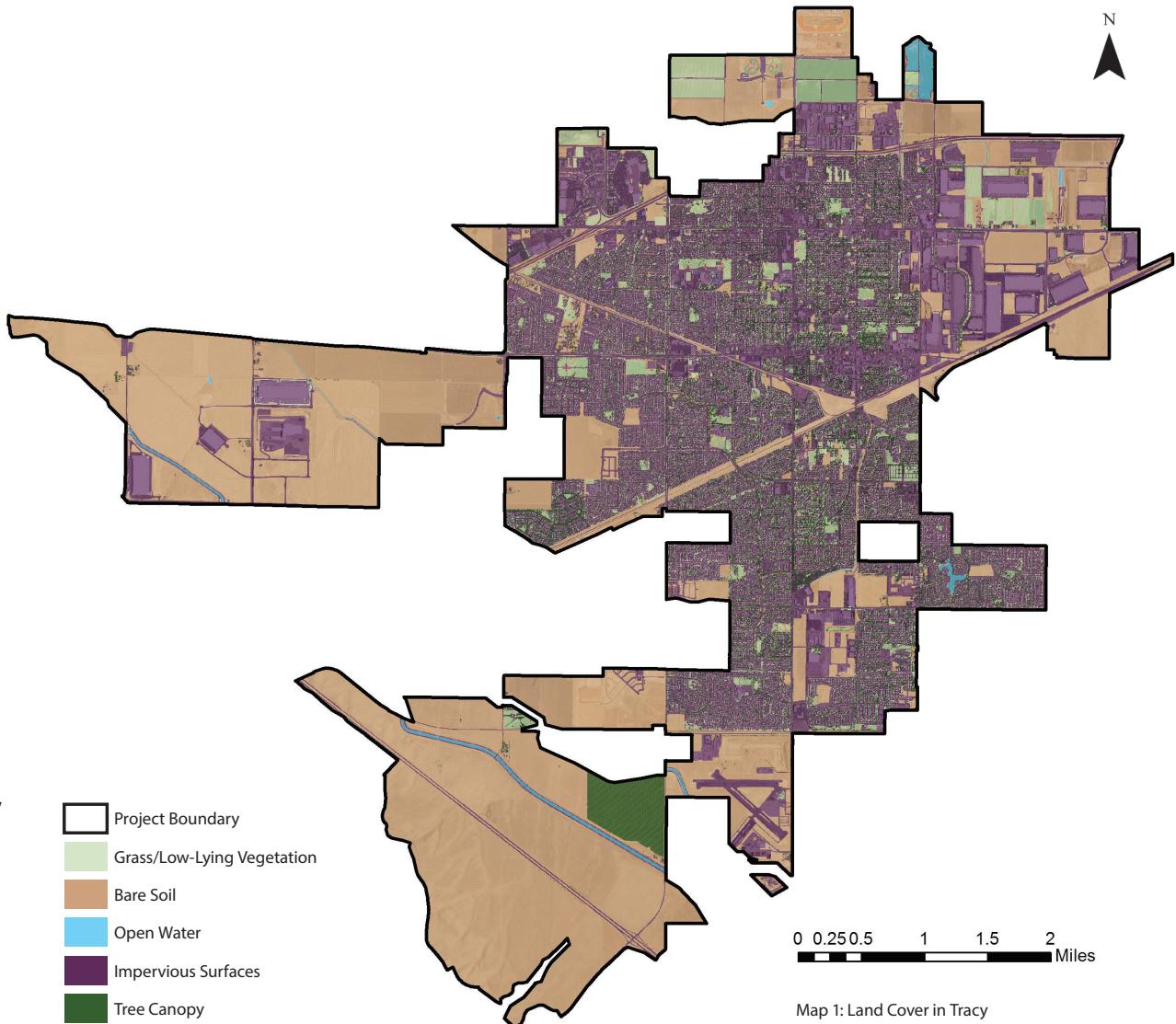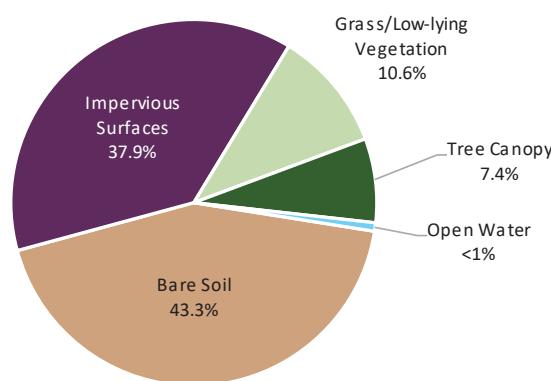
Map 1: Land Cover in Tracy

▲ What do we have?

Tree Canopy by Land Use

The significant development of previous agricultural land and intensity of industrial and commercial properties misrepresents the percentage of tree canopy throughout the City, specifically the urban core. The urban core typically has a greater tree canopy coverage than the overall 7.4% throughout the City. The following divides the community into four land use classifications to help gauge the canopy cover in the central urban core of Tracy. If industrial and commercial areas and some select previously agricultural land is excluded, residential areas and parks combined make up nearly 9,080 acres with nearly 1,123 acres or 12.8%.

Legend:
- □ Project Boundary
- ■ Commercial
- ■ Industrial
- ■ Park
- ■ Residential

Map 2: Land Use Classes in Tracy

Bar chart:
- Residential: 12.8%
- Industrial: 1.4%
- Commercial: 7.8%
- Park: <1%
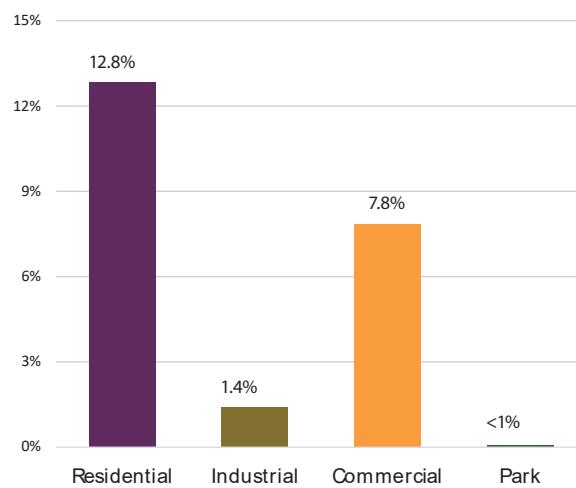
Tree Canopy by Parks

Tracy's 73 parks encompass over 248 acres. Among the top ten largest parks by acreage, Tracy Sports Complex and Plasensia Fields, the two largest parks, combined include 47.6 acres of land with 5.4% of tree canopy. The maximum potential UTC for both parks is lower than the next six parks, largely because Tracy Sports Complex and Plasensia Fields are primarily covered with ball fields.

The third largest park, Veterans Park; however, contrasts with the first two parks in that it encompasses 15.8 acres with 2.31 acres of tree canopy cover, or 14.6%, and a potential canopy cover of 65.8%. Ceciliani Park has the highest canopy cover among the top 10 largest parks, with 30.2% canopy cover (2.5 acres).

Overall, tree canopy covers 6.9% of parks. The assessment identified an additional 105.7 acres that could potentially support tree plantings, for a potential canopy cover of 49.4%.

Park Name	Acres	Canopy Acres	Canopy %	Potential Canopy %
Ceciliani Park	8.2	2.5	30.2	64.1
Lincoln Park	13.7	2.9	21.2	80.9
Dr. Powers Park	8.6	1.8	21.1	78.0
Gretchen Talley Park	6.7	1.3	19.8	83.4
El Pescadero Park	13.8	2.7	19.3	78.8
Veteran's Park	15.8	2.3	14.6	65.8
Clyde Bland Park	8.6	0.9	9.9	60.0
Tracy Sports Complex	26.8	1.5	5.4	5.8
Plasensia Fields	20.8	1.1	5.4	12.9
Tracy Ball Park	7.3	0.1	1.1	1.7
All other parks	118.0	23.8	20.1	73.8
All parks total	248.3	17.0	6.9	49.4

N

☐ Project Boundary

▇ Parks

0 0.25 0.5   1   1.5   2
Miles

Map 3: Tree Canopy by Parks

What do we have?

Tree Canopy by Landscape Maintenance District

Tracy maintains 49 mini parks, over 220 acres in landscaping, over 28,000 trees, landscaped channel ways, and bike trails through a Landscape Maintenance District (LMD). The LMD consists of 41 zones, which are funded through an assessment that property owners pay with their property tax bill (Landscape Maintenance District, 2018).

Of these zones, Zone 36 has the highest canopy cover of 28.9%, followed by Zone 25 at 25.7%. Zone 33 is the largest with 941.4 acres and 11.0 acres of tree canopy, or 1.17%, and a potential canopy cover of 52.6%. Zone 41 encompasses 1.0 acres with nearly 0.2 acres of tree canopy, or 14.7%.

N

Project Boundary

Under 10%

10% – 20%

20% – 25%

Over 25%

0 0.25 0.5   1   1.5   2
Miles

Map 4: Tree Canopy by Landscape Maintenance District

Tree Canopy by Disadvantaged Communities

California SB 535 targets disadvantaged communities for investment of proceeds from the state cap-and-trade program. Funding is aimed at improving public health, quality of life, and economic opportunity while reducing pollution that causes climate change. Disadvantaged communities are identified using the CalEnviroScreen tool (About CalEnviroScreen, 2019) to rank each of California's 8,000 census tracts with data on 20 indicators of pollution, environmental quality, and socioeconomic and public health conditions (Disadvantaged Communities, 2019). Disadvantaged communities are defined as the top 25% scoring areas from CalEnviroScreen along with other areas with high amounts of pollution and low populations (SB 535 Disadvantaged Communities, 2019).

Four census tracts in northeast Tracy have been identified as disadvantaged communities: 6077005302, 6077005305, 6077005308, and 6077005202. The UTC assessment analyzed canopy cover in conjunction with sensitive populations (health status and age) and socioeconomic factors (income) for these four census tracts. No correlation was found between those population characteristics and tree canopy cover.

Even though there were no correlations found, evidence shows that some of the pollution burdens that CalEnviroScreen considers in its analysis, like air quality, are positively impacted by trees.

6077005305

6077005302

6077005202

6077005308

6077005202

N

0 0.25 0.5 1 1.5 2
Miles

Project Boundary

Disadvantaged Communities

Map 5: Disadvantaged Communities as identified by CalEnviroScreen
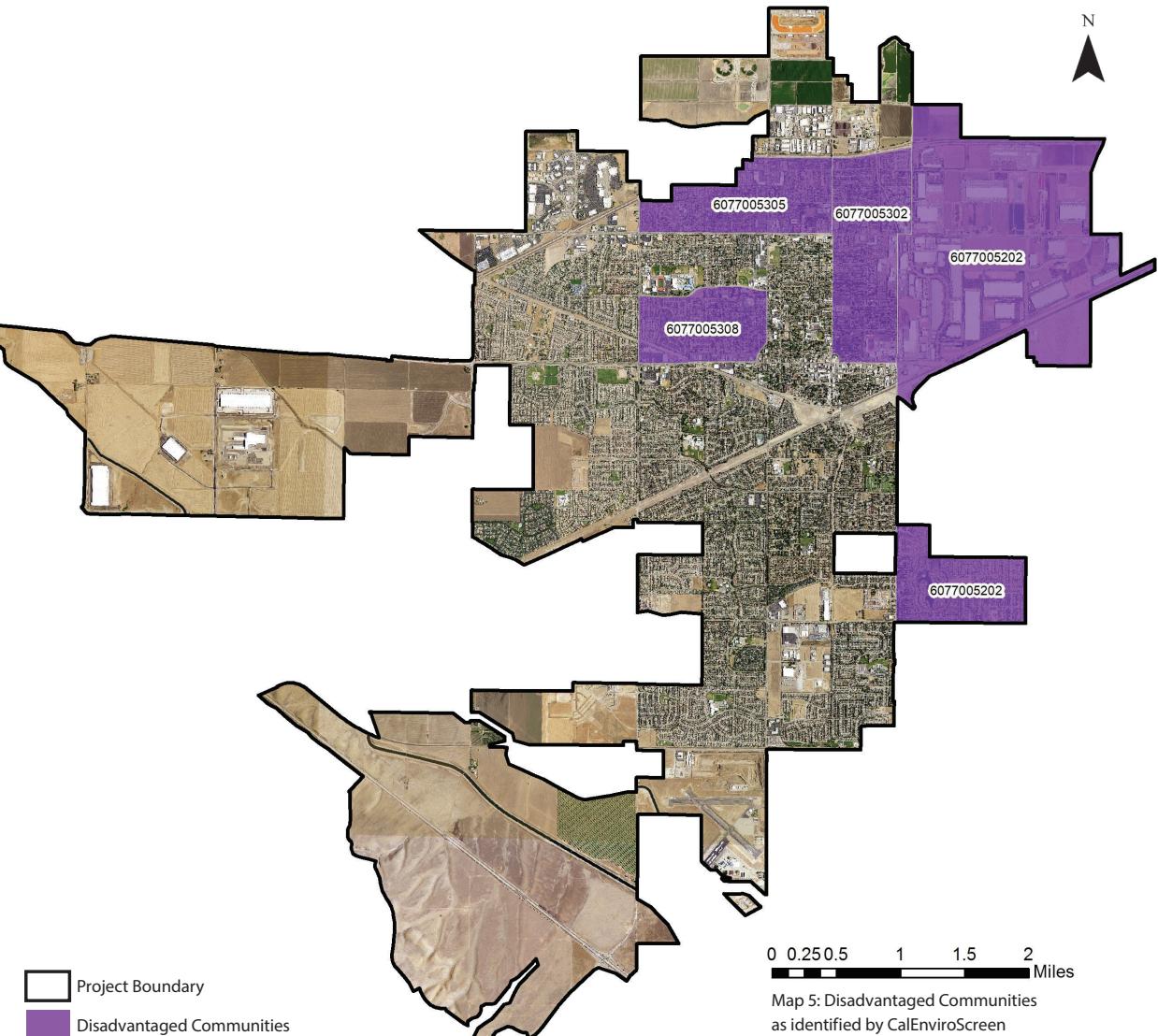
What do we have?
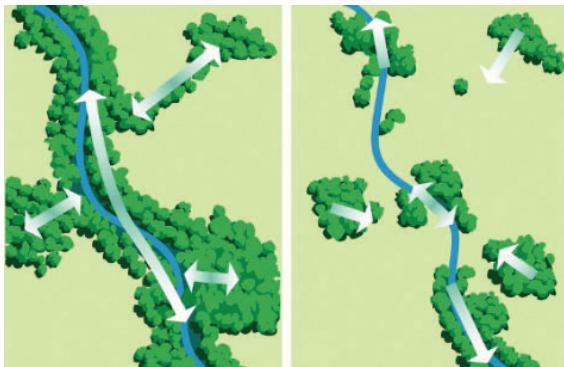
Figure 1: Canopy Fragmentation Comparison[1]

Figure 2: Historic change for tree canopy, impervious surface, and population

Forest Fragmentation

Forest fragmentation analysis can help managers understand the spatial distribution and connectivity of urban forests. Fragmented forests can significantly affect plant and wildlife populations, forest biodiversity and health (Nowak et al, 2005). Most of Tracy's urban forest is patch forest. This finding is logical because Tracy is located in the San Joaquin Valley, which originally had minimal tree presence. Like many cities in the valley, the arrival of humans and urban development led to an increase in trees.

Strategic planting near core areas can greatly benefit forest ecosystem function and increase wildlife habitat and corridors. The analysis found that Tracy's urban forest includes the following:

- 178.5 acres of Core Canopy (14.5%): Tree canopy that exists within and relatively far from the forest/non-forest boundary (i.e., forested areas surrounded by more forested areas).
- 0 acres of Perforated Canopy (0.0%): Tree canopy that defines the boundary between core forests and relatively small clearings (perforations) within the forest landscape.

[1]Wildlife corridors (far left) link habitats while fragmented

- 1,039.7 acres of Patch Canopy (84.3%): Tree canopy of a small-forested area that is surrounded by non-forested land cover.
- 15.02 acres of Edge Canopy (1.2%): Tree canopy that defines the boundary between core forests and large core forests and large non-forested land cover features. When large enough, edge canopy may appear to be unassociated with core forests.

The wildlife of Tracy requires especially careful attention because the native wildlife is originally adapted to the historical prairie environment.

Historic Change

Historical change in tree canopy was assessed using a point sampling of canopy data derived from 1993 and 2010 imagery to determine change in canopy cover over 17 years. Land cover was visually inspected at each point for both years simultaneously and was identified as one of five classes: tree canopy, impervious surfaces, grass/shrub, bare soil, and open water. Tree canopy

cover was analyzed using a "top-down" or "birds'-eye" approach, therefore where tree canopy visibly overlaps another land cover class, tree canopy was recorded at the point location.

From 1993 to 2010, tree canopy cover increased from 4.2% to 6.2%, which is a 47.6% increase (Figure 2). As identified in this analysis canopy cover for the overall community identified in this analysis is 7.4%. In comparison to 1993 the estimated canopy cover from the point sampling is 4.2%, this is a 76.3% increase over a 17-year period. Contributing factors to the increase in tree canopy include:

- Trees have been added to the community resource through tree plantings.
- New construction included new trees on public and private parcels.
- Community members have planted new trees on private property.
- Existing trees and new trees continue to increase in size and leaf surface.

Priority Planting

To identify and prioritize planting potential, DRG assessed environmental features. It could be assumed that all pervious areas, including grass, shrubs, low-lying vegetation, and bare soil (10,728 acres) are potential tree planting locations. Realistically, not all of these areas are suitable planting sites due to intended site uses (e.g., agricultural fields, sports fields, developments) and because some of these areas are not appropriate for tree planting. Potential plantable areas can be determined by excluding pervious areas that are unsuitable for planting and including impervious areas where trees could feasibly be added, such as in parking lot islands, along sidewalks, and near road edges.

The UTC analysis considered site design and environmental factors, including proximity to hardscape, canopy fragmentation, soil permeability, slope, and soil erosion factors to prioritize planting sites on both public and private property for the greatest potential return on investment. The analysis identified 6,207 acres of potential planting areas in Tracy, where 249 of these acres are high or very high priority planting areas. This analysis provides a snapshot of current conditions, where some existing young trees may not be fully accounted for. The UTC analysis prioritized potential planting areas with GIS remote sensing. Site visits are necessary to determine suitability and the actual number and location of planting sites. The potential canopy cover for Tracy is estimated to be 44.9%, which considers potential planting area (6,207 acres) and existing canopy (1,233 acres).

Priority Planting Close-Up

Planting Priority Metrics

PRIORITY LEVEL

- Very Low
- Low
- Moderate
- High
- Very High
- Project Boundary

0 0.25 0.5 1 1.5 2 Miles

Map 6: Planting Priority in Tracy
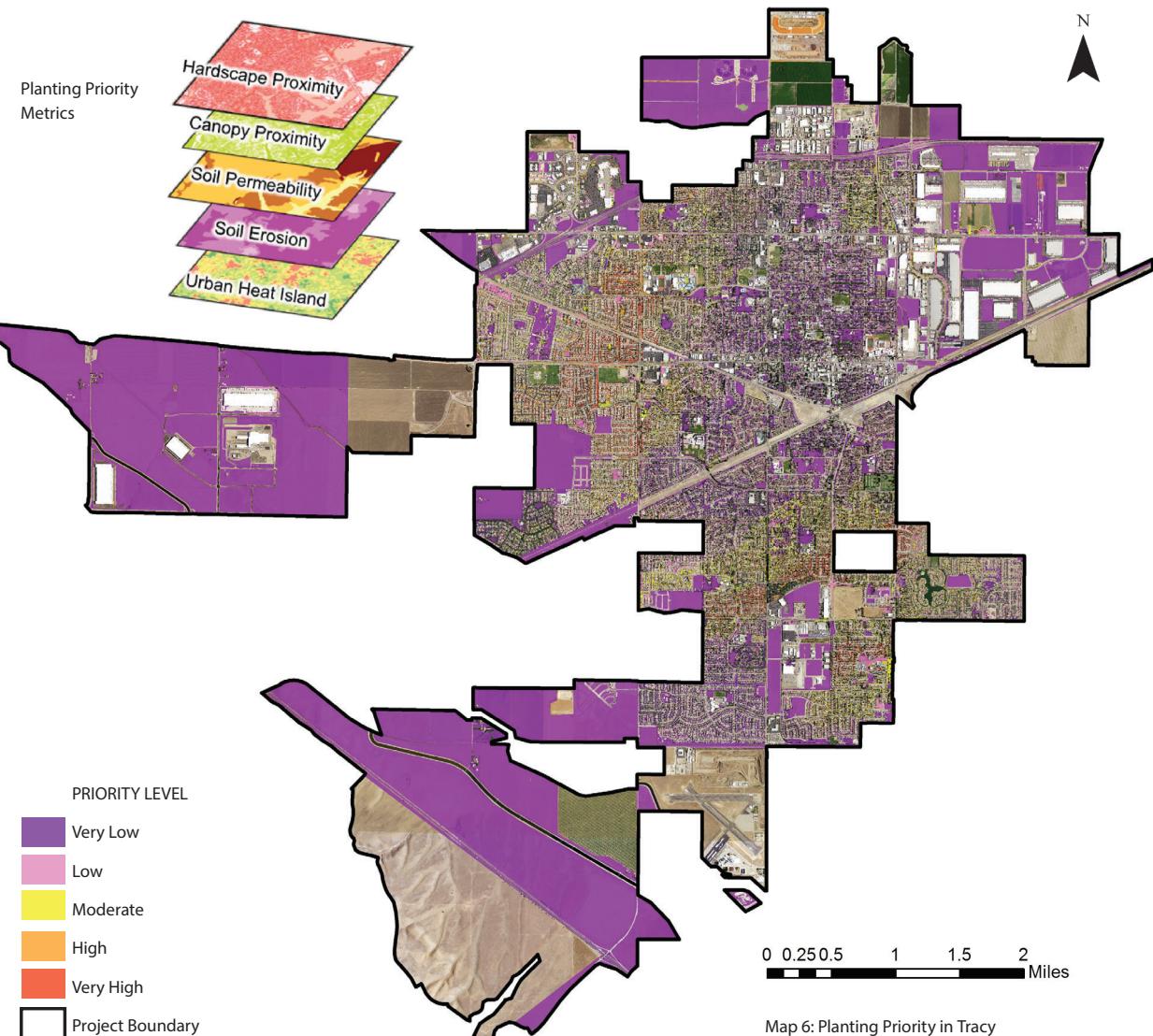
What do we have?

Community Tree Resource

Community trees (publicly managed trees along City streets and in City parks) play a vital role in Tracy. They provide numerous tangible and intangible benefits to residents, visitors, and neighboring communities.

The City recognizes that public trees are a valued resource, a vital component of urban infrastructure, and part of the City's identity. As of 2018, the public inventory includes 35,561 trees on streets and parks, although many trees were not included in the original inventory and more trees have been planted since its completion.

Structure

A structural analysis is the first step towards understanding the benefits provided by these trees as well as their management needs. As of 2018, Tracy's community tree resource includes 35,561 trees and 191 unique species. Considering species composition and diversity, relative age distribution (diameter at breast height, DBH[2]), canopy coverage, and replacement value, DRG determined that the following information characterizes the community tree resource:

- Among all trees, the predominant species are flowering pear (Pyrus calleryana, 10.1%), Chinese pistache (Pistacia chinensis, 9.3%), and Raywood ash (Fraxinus angustifolia, 8.1%).
- 71.0% of trees are less than 12-inches in diameter.

- 5.3% of trees are larger than 24-inches in diameter.
- 82.5% of trees are deciduous broadleaf, while broadleaf evergreens are the second most prevalent at 10.0%.
- Replacement of the 35,561 public trees with trees of equivalent size, species, and condition, would cost nearly $60.1 million.

[2]   DBH: Diameter at Breast Height. DBH represents the diameter of the tree when measured at 1.4 meters (4.5 feet) above ground (U.S.A. standard).

● Tracy Tree Inventory

▢ Project Boundary

Map 7: Inventoried trees in Tracy

0 0.25 0.5   1   1.5   2 Miles
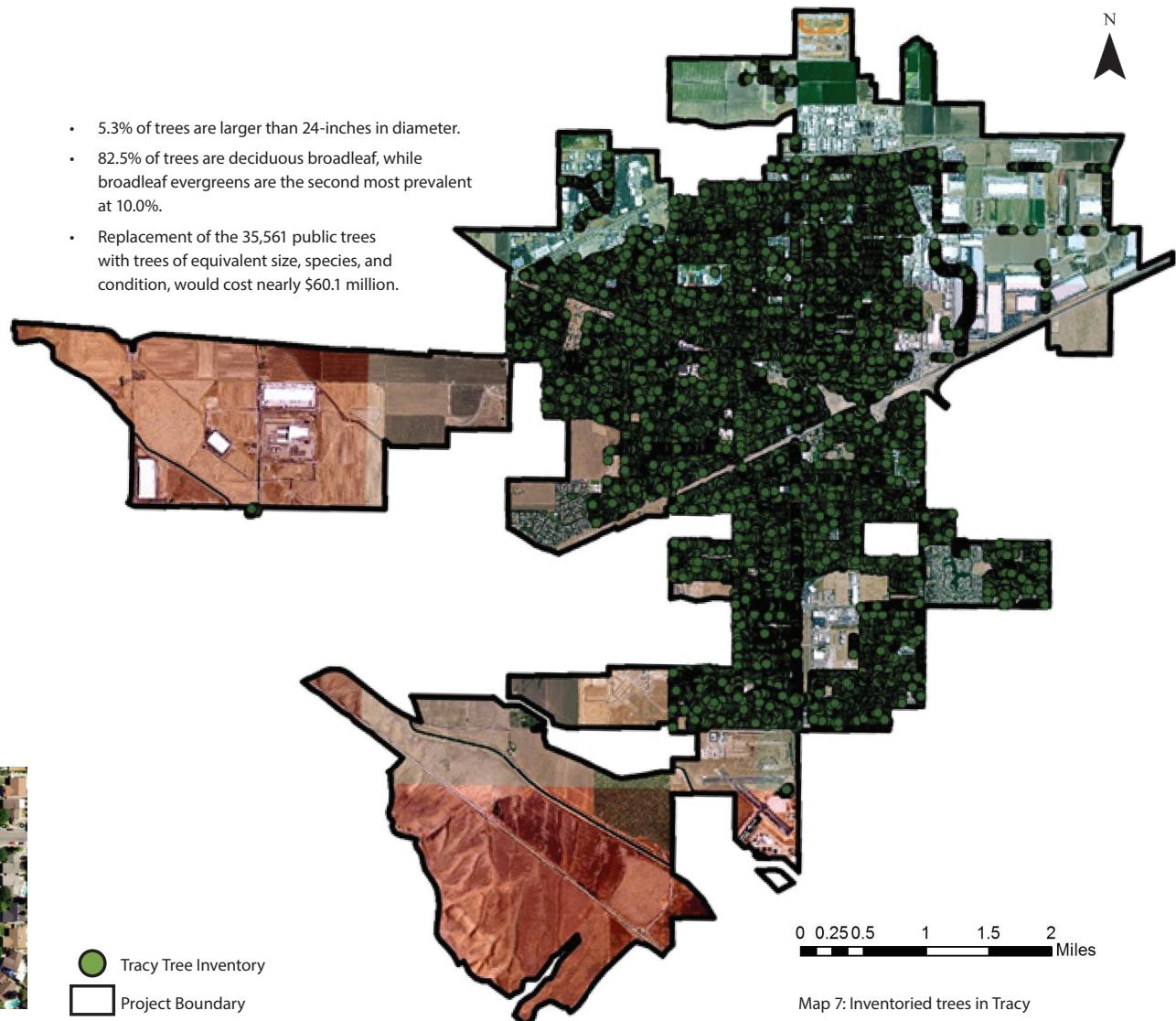
Species Diversity

Maintaining diversity in a public tree resource is important. Dominance of any single species or genus can have detrimental consequences in the event of storms, drought, disease, pests, or other stressors that can severely affect a public tree resource and the flow of benefits and costs over time. Catastrophic pathogens, such as Dutch elm disease (Ophiostoma ulmi), emerald ash borer (Agrilus planipennis), Asian longhorned beetle (Anoplophora glabripennis), and sudden oak death (Phytophthora ramorum) are some examples of unexpected, devastating, and costly pests and pathogens that highlight the importance of diversity and the balanced distribution of species and genera. In addition to these pests there is growing concern for polyphagous shot hole borer (PSHB) (Euwallacea sp.), a new pest that has devastated urban areas in Southern California due to its wide host range, including avocado (Persea americana) and boxelder (Acer negundo) (Eskalen, 2015).

The 10-20-30 rule of thumb is a widely used standard that states that an urban tree population should consist of no more than 10% of any one species, 20% of any one genus, and 30% of any one family (Clark et al, 1997). The rule encourages greater genetic diversity, and thus, greater resilience. Considering significant pests and diseases, many cities are now opting to increase diversity to improve resilience.

The top five most prevalent species in Tracy represent more than 41.6% of the overall population, including: flowering pear (Pyrus calleryana, 10.1%), Chinese pistache (Pistacia chinensis, 9.3%), Raywood ash (Fraxinus angustifolia, 8.1%), London planetree (Platanus x acerifolia, 7.8%), and crape myrtle (Lagerstroemia indica, 6.3%). The prevalence of flowering pear exceeds the 10% genetic diversity rule.

Future plantings should focus on increasing diversity and reducing reliance on overused species. As over-predominant species are removed and replaced, new species should be introduced when possible. New species should be resistant to the known pest issues that currently pose a threat to the region.

Figure 3: Most Prevalent Species in Tracy

Species	% of Inventory
Flowering pear	10.1%
Chinese pistache	9.3%
Raywood ash	8.1%
London planetree	7.8%
Crape myrtle	6.3%
Sweetgum	5.3%
Chinese hackberry	4.4%
Cherry plum	3.7%
Coast redwood	3.0%
Japanese flowering crabapple	3.0%
Camphor tree	2.6%
Japanese zelkova	2.4%
Fruitless mulberry	2.3%
Modesto ash	1.8%
Evergreen pear	1.8%
Ash spp.	1.4%
White ash	1.2%
Northern red oak	1.2%
Tallowtree	1.1%
Red maple	1.0%
All other species	22.0%

% of Inventory

What do we have?

Age Distribution

Age distribution can be approximated by considering the range in diameter (DBH) of the overall inventory and of individual species. Trees with smaller diameters tend to be younger. It is important to note that palms do not increase in diameter over time, so they are not considered in this analysis. In palms, height more accurately correlates to age.

The urban forest's age distribution is a key indicator and driver of maintenance needs. With Tracy's public tree resource (excluding palms), the age distribution reveals that 38% of trees are 12 inches or less in diameter (DBH) and 5.3% of trees are larger than 24 inches DBH.

Trees greater than 24 inches DBH require more regular inspections and routine maintenance as they mature. Managers can gain a better understanding of the specific risks that individual mature trees pose with regular inspection and risk assessment.

6,881 trees (24.3%) in the inventory are young (<6 inches DBH) medium and large-stature tree species that still have a lot of growing to do before they reach maturity. Training, defined as the selective pruning of small branches to influence the future shape and structure of a young tree, is critical at this stage to prevent costly structural issues and branch failures as these young trees mature into their final size in the landscape.

61.8% in the inventory are of intermediate age with a diameter between 7 to 24 inches. Similarly, the younger trees would benefit from structural pruning.

A high proportion of young, large and medium-stature tree species is a positive indicator for future benefits from the urban forest, since large shade trees typically provide more shade, pollutant uptake, carbon sequestration, and rainfall interception than small trees.

5.3% of the inventory are mature with diameters greater than 24 inches. When trees reach mature stature, they provide the greatest benefits. However, mature trees should be regularly assessed for health and risk factors as they approach or reach the end of their natural lifespan. They may have higher maintenance needs or require removal to reduce risk and liability.

Canopy from Public Trees

The amount and distribution of leaf surface area are driving forces behind the public tree resource's ability to produce benefits for the community (Clark et al, 1997). As canopy cover increases, so do the benefits afforded by leaf area. Tracy covers an area of approximately 26 square miles (16,615.9 acres). i-Tree estimates that public trees are providing 0.7 square miles (424 acres) of canopy cover which accounts for 3.0% of total land area.

Benefits Versus Investment

Trees in Tracy's community trees (public trees) provide an estimated 424 acres of canopy, approximately 3.0%. To date, trees in the community tree resource have sequestered 1,580 tons of carbon (CO_2) is avoided through decreased energy use, valued at $23,698.

Annually, public trees provide nearly $5.4 million overall benefits to the community at an average value of $150.47 per tree. These benefits include:

- $727,347 in energy use (reduction, electricity and natural gas) through shading and climate effect, an average per tree benefit of $20.46 per tree.
- $16,171 trees in sequestered atmospheric CO_2 (1,078 tons), an average per tree benefit of $0.45.
- $368,567 in air quality improvements, an average of $10.37 per tree.
- $140,123 in intercepted stormwater (18 million gallons), an average of $3.94 per tree.
- $4.1 million (76.2%) are related to aesthetic and socio-economic benefits, an average of $114.70 per tree.

Considering the estimated annual budget of $1.4 million currently invested to manage the community tree resource, the net annual benefit (benefits minus investment) to the community is $43.4 million. In other words, for every $1 invested in the community trees, Tracy receives $3.81 in benefits.

If a cork oak were planted and lived for 20 years, it would provide numerous environmental benefits including sequestering 1,818 lbs of CO_2 ($42.27), preventing 1,480 gallons of rainfall runoff ($13.23), and intercepting 13.6 lbs of air pollutants. If it were planted next to a building, it would save 2,160 kWh of electricity ($333.71).
I-TREE DESIGN
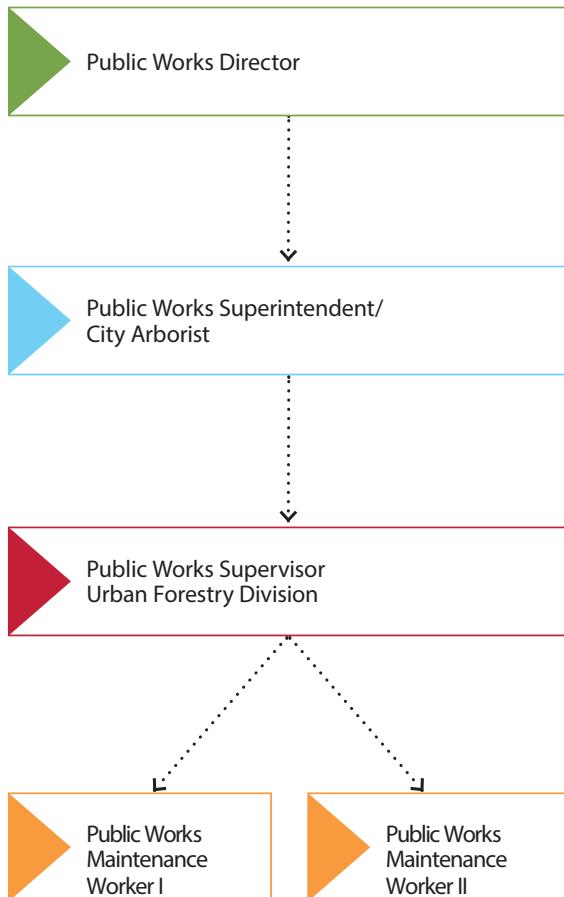
Urban Forestry Operations

Tracy's Urban Forestry Division operates under the direction of the Public Works Department. The Urban Forestry Division has been understaffed in recent years, which has resulted in a backlog of service requests.

Urban Forestry Division staff are responsible for the care of 35,561 trees funded by the General Fund and the Landscape Maintenance District (LMD). Services provided by the Urban Forestry Division include:

1. Tree Pruning
2. Tree Removals
3. Stump Grinding
4. Biomass Disposal and Utilization
5. Tree Planting
6. Tree Protection
7. Pest Management
8. Community Outreach and Engagement
9. Leaf Pickup (via Solid Waste and Recycling Division)
10. Emergency Response and Risk Assessment

Services

Tree maintenance involves the inspection, tree risk assessment, preservation, trimming, removal, stump grinding, and planting of trees along city streets and city property. Street tree staff estimate that nearly 70% of tree maintenance is performed by contractors.

Residents can request service for their City tree by contacting the Public Works Department by phone, in person, or through the City internet Government Outreach Program.

Requests are tracked through the City service management system and are addressed based on priority. Public safety concerns identified by staff or through service requests are prioritized first. Other service requests are addressed on a case-by-case basis and dependent on operational funding availability. Similarly, to street trees, park tree maintenance is prioritized by public safety concerns, service requests, and operational funding availability.

Appendix D summarizes the prioritization of tree maintenance tasks and associated courses of actions to maintain public safety as well as protect and preserve a tree whenever possible.

The City currently uses an inventory management program that is managed by City staff and operated through the City contractor. Field staff and contract crews update the inventory management program through mobile tablet devices.

Trees within the property boundaries of homeowner's associations (HOA) are cared for by the HOA. The City has no role in the care or the inspection of the work performed on trees within these areas, unless specifically identified in a separate agreement.

The Urban Forestry Division is working to expand plant health care operations to include fertilizer applications and expansion of the use of plant growth regulators to improve plant health and reduce hardscape conflicts with tree roots and canopy.

Organization Chart

- Public Works Director
  - Public Works Superintendent/City Arborist
    - Public Works Supervisor Urban Forestry Division
      - Public Works Maintenance Worker I
      - Public Works Maintenance Worker II

What do we have?

Tree Pruning

The City approaches tree maintenance from a public safety perspective and prioritizes clearance and visibility, followed by structural pruning. Tracy uses both contractors and a small in-house crew to maintain City trees. The Urban Forestry Division has a 60-foot boom truck with a tow behind chipper. Parks has another small chipper designated for parks use. The small tree crew primarily respond to initial service requests, small removals, hanging limbs, and sign clearance concerns. These two staff are supervised by the City Arborist.

The primary contractor has worked with the City for nine years and the work performed by the contractor is regularly inspected and reviewed by Street Tree staff to regularly communicate expectations and ensure the use of BPMs on City trees. Like the in-house forestry crew, contractors are scheduled based on priority, first addressing public safety concerns followed by preventive maintenance. In addition to regularly scheduled tree maintenance, contractors are available to support tree maintenance needs for emergency response or storm events.

Ideally, tree maintenance should be scheduled based on the City grid system. Grid pruning allows for efficient scheduling and ensures that all City trees are regularly inspected and pruned to promote tree health and prevent structural defects. Grid pruning primarily has been used for scheduling contractor pruning operations, but with revisions to grid pruning maps will provide structure for in-house crew operations, with the goal to provide tree maintenance for public trees on a five to seven-year cycle, depending on the availability of funding. To improve communication with property owners and increase the efficient use of resources, city staff are working to develop a grid pruning cycle, complete with mapping.

Tree Removals

Similarly, to pruning, tree removals are prioritized by public safety. Small removals can be managed by the in-house tree crew, but most large removals will be addressed by the City contractor.

Stump Grinding

Urban forestry has a stump grinder and performs approximately half of all stump grinding operations, with the other half conducted by the City contractor.

Biomass Disposal and Utilization

Whenever feasible, the City diverts wood chip debris from landfills by utilizing wood chips as mulch in City parks and around City facilities.

Tree Planting

Tracy's current tree planting budget is $30,000. Funds are used to plant trees on Arbor Day, as well as to replace trees upon request.

When trees are removed the City will replace the tree when funding is available. If a planting site is determined to be unsuitable for tree planting, an alternative location will be selected.

As a result of a prolonged period of drought, tree planting has been limited to new construction projects in the last seven years. Because of limited funding and staffing, only small planting projects can be coordinated through contractors and available City staff. Larger planting projects are made possible through collaboration with local nonprofits and through volunteers.

Recently, Tracy was awarded a grant, through Cal Fire, to fund the "Tracy Trees for Tomorrow" project to plant 634 trees over the next three years (CAL FIRE Urban and community Forestry CCI Grant Awards 2016/2017). As a result of the grant, the City has been working to plant 634 trees in areas designated within the City as populations that are disadvantaged.

Right Tree, Right Place

Some species were planted heavily at different periods in the history of Tracy's urban forestry program. A few of these species are costly to maintain and are often poorly suited to the local climate. Thus, some members of the public have developed a negative perception of trees.

Flowering pear (Pyrus calleryana) and Raywood ash (Fraxinus oxycarpa) are examples of high maintenance trees that were planted historically. Both species are prone to pest problems, as well as heaving sidewalks, and dropping nuisance fruit. With prolonged periods of drought, pests and storm events have exacerbated the maintenance needs for both species.

As a result of the high maintenance costs associated with these two species and their over representation in the public tree population (flowering pear, 10.1% and Raywood ash, 8.7%), the City has mostly stopped planting them. In addition to poor species selection, unsuitable planting locations have resulted in conflicts with overhead utilities, heaving sidewalks, water meters, and fire hydrants. In some cases, large stature trees were planted in spaces that prohibited canopy growth and often result in the removal of trees prematurely. Conversely, in some locations, small stature species were planted in sites that could have accommodated larger trees.

Going forward, the City has elected to plant tree species that are more appropriate for the region (i.e. drought-tolerant) and installing them in planting sites where trees are less likely to conflict with utilities and hardscape. Urban Forestry Division staff are actively seeking tree species that are well suited to the local climate. They are coordinating with the Engineering Division to review site plans and make recommendations to avoid planting trees where future conflicts with infrastructure may arise and to maximize the potential benefits of the tree through choosing the right tree species for the right planting site.
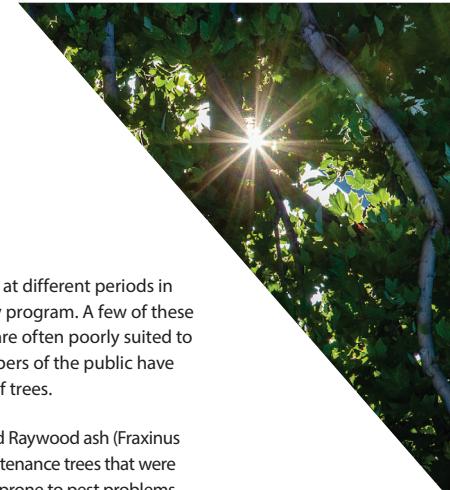
Irrigation

Although irrigation is not explicitly defined as required maintenance, water is critical to tree health. Despite recent relief from a few relatively wet winters, California is still considerably dry and the central valley in particular generally experiences low average rainfall (~14 inches per year in Tracy) and extended periods without precipitation. The effects of our most recent drought will have a noticeable impact on Tracy's trees for years to come. Supplemental irrigation will continue to be a necessity if trees are to remain healthy and robust.

While state regulations restrict the irrigation of turf during watering restrictions, many residents are unaware that trees are exempt from these restrictions except under the most extreme conditions (MWELO). It is important to provide adequate water to trees during periods of drought. Turf and other small plants can be more easily replaced once drought conditions subside. However, if a tree dies and needs to be replaced, it can take 10 to 20 years before mature tree benefits are restored by a newly planted tree. Trees that do not receive adequate water are also more likely to be attacked and succumb to pests and disease. Continued outreach and education about the responsibilities of property owners for the care of neighborhood trees and irrigating under water restrictions is crucial for supporting the health of trees.

City trees along major arterials, in center medians, at City facilities, and in parks are irrigated through irrigation systems with a valve that is separate from other landscape components. The separate irrigation system allows trees to be irrigated even when there are water restrictions.

Tree Protection Zones (TPZ)

Roots are a critical part of tree anatomy. They provide access and transport for water and other nutrients that support the growth of the tree. Roots also provide anchorage and foundational support for the above ground portion of the tree. Tree roots spread out over large areas and often well beyond the dripline and most roots are concentrated in the upper 12 to 36 inches of soil. As such, roots are vulnerable to disturbance, which can have an immediate and direct impact on tree health. Tree roots are especially at risk for damage during construction.

Construction and redevelopment are inevitable, but with foresight and planning trees can be preserved through Tree Protection Zones (TPZ). The TPZ is an area where the storage of construction materials and equipment, construction activities that may result in mechanical damage, and equipment
traffic are prohibited within the Critical Root Zone (CRZ). The CRZ according to Best Management Practices is defined at the area of soil extending from the tree trunk where roots required for future tree health and survival are located.

Pest Management

At this time, there are no major active threats to Tracy's urban forest. However, like any urban forest, Tracy has a few pest problems, which are primarily addressed and controlled on a case-by-case basis, but including:

Fire Blight

Fire blight (Erwinia amylovora) is a bacterial disease that can invade all parts of pear trees (Elkins et al, 2017). Symptoms include wilting, blackening, and death of shoots, flowers, and fruits. If infections on the plant are not removed, the disease can spread to the main branches, trunk, and roots. The bacteria can spread from rain, insects, and pruning cuts.

Street Tree staff identified fire blight as one of the most damaging pests, due to the species prevalence in the City tree inventory. Fire blight infestations are addressed on an individual tree basis and does not have a formal treatment program.

Raywood Ash Canker

Fraxinus oxycarpa 'Raywood' commonly is affected by Raywood ash canker. Although trees usually are not killed, severely affected ash are often removed because of unsightly dieback, reduced shading, and their potential limb drop hazard (Raywood Ash Canker and Decline, 2019). Raywood ash was originally believed to be drought tolerant but a canker causing fungus (Botryosphaeria stevensii) has been noticeably impactful on drought stressed trees. These trees are apparently less drought tolerant than previously believed. Watering and pruning to thin canopies and reduce transpiration demand may improve the performance of Raywood ash. The long-term management strategy for this pest is reduced plantings of the species and managing infested trees on a case-by-case basis, dependent on funding.

Mistletoe

Broadleaf mistletoe (Phoradendron macrophyllum) is an evergreen parasitic plant that grows on a number of landscape tree species in California (Perry, 2006). In Tracy, mistletoe is a common occurrence. The City does not have a specific management program for managing this pest. Management primarily is controlled through the removal of infested branches.

What do we have?

While there currently are no major pest or disease organisms impacting trees in Tracy, there are a few emerging concerns in other areas of California and the U.S that have the potential and likelihood to affect Tracy's urban forest (public and private trees) in the future. Because many pests and disease pathogens are species specific, it is critical to promote and maintain a high degree of species diversity. This ensures that when a major pest or disease outbreak occurs, overall tree loss is minimized along with the costs associated with treatment, tree removal, and the loss of environmental benefits.

For example, polyphagous shot hole borer (PSHB) and Kuroshio shot hole borer (KSHB) are two invasive, wood-boring beetles, which together are known to affect 110 species of trees (Avocado: Polyphagous Shot Hole Borer and Kuroshio Shot Hole Borer, 2017). Currently the closest known infestation of either insect is in Ventura County, which is over 300 miles away; however, research suggests that there is potential for the pest to spread to northern California (Distribution of PSHB/FD and KSHB/FD in California, 2019). Multiple tree species in Tracy are vulnerable to these invasive pests.

Similarly, Citrus Greening (Candidatus liberibacter asiaticus), a bacterial disease that causes bitter, hard fruit production, is very concerning as it threatens the viability of California's citrus crops. While citrus species represent less than 1% of Tracy's public tree population, there are many citrus trees on private property. Due to quarantines in place to protect California's citrus crop, infected trees must be destroyed and disposed of appropriately (Grafton-Cardwell et al, 2019).

Citrus greening, PSHB, and KSHB are all confirmed to be in California, but another pest of concern that is currently not found in California is the emerald ash borer (EAB) (Agrilus planipennis). As of October 2018, EAB has been detected in 35 states and has contributed to the death of hundreds of millions of ash trees in North America (Emerald Ash Borer Information Network, 2019). The closest state with EAB is Colorado, but with a highly mobile human population, movement of infested ash trees through firewood, logs, branches, nursery stock, chips, or other ash materials this pest could be a future problem for Tracy's urban forest. Considering that more than 8% of Tracy's community tree population (public trees) are Raywood ash, with other ash species included in the inventory of trees, EAB could easily contribute to the death of more than an eighth of the public tree population.

Although, most of these invasive pests and diseases are not currently a problem for Tracy's trees, it is likely that one or all of these pests will be a problem in the future. It is important to take steps now to reduce the potential impact of an infestation. The primary focus should be to increase the diversity of the urban forest through new tree plantings; especially avoiding the use of ash species to decrease the potential effects of EAB. Secondly, many pests target trees in poor health first. Best Management Practices for reducing the impacts of pest and disease focus on optimizing tree health and prompt removal of trees that are in decline. Through regular inspections of trees, infestation can likely be detected early, which can in turn prompt a quick response to manage the pest and avoid further movement of a pest, as much as possible.

What is honeydew?

Shade is highly coveted during hot 100-degree days in Tracy and residents park their cars in the shade of trees to manage the heat. It is not uncommon for car owners to return to their vehicle and find it covered in a sticky film. This substance, commonly called honeydew, is the excrement, or frass, of aphids, soft scale, or other soft-bodied insects. These insects feed on the phloem of plants (Cranshaw, 2018). The phloem is the part of the vascular system which moves sugars and other metabolites produced in the leaves down to the roots. Because these insects are primarily consuming sugar, the waste that is produced is also mostly made up of sugars. The honeydew from these insects drips off the leaves of a tree and onto anything beneath the canopy of the tree.

Aside from the nuisance of the sticky residue, honeydew also is strongly associated with black sooty mold. When honeydew drips onto sidewalks, spores of numerous species of fungi germinate on the honeydew producing black fungal strands (mycelial threads), which give a sooty appearance to the sidewalk or any other surfaces where the honeydew encouraged colonization (Cranshaw, 2018).

Generally, aphids and sooty mold do not harm trees, and more often than not are nuisance pests. In an effort to manage the undesirable aesthetics and mess from aphids and consequently, sooty mold, the Urban Forestry division has purchased a tree injector system to reduce aphid populations in street trees through chemical applications. In addition to setting regularly application schedules, trees with higher aphid populations are being avoided for future street tree plantings.

Leaf Pickup

In the fall, typically from November through January, the Public Works Department coordinates a City-wide leaf pick up program. Residents are asked to fill totes with yard waste and place the containers on the curb on scheduled days. When yard waste exceeds the capacity of the tote, excess leaves can be swept into a pile in the street (away from the gutter to allow water flow). Tracy Disposal will pick up the piles of leaves on the regular garbage collection day.

Community Outreach and Engagement

Community outreach and education are an important component of the urban forestry program. The engagement of residents in issues relative to public trees ensures that the community has an appreciation for the value and benefits of the urban forest. Engagement of residents also increases their understanding of the program and resources that are required to support its vitality and sustainability.

The Urban Forestry Division relies primarily on door hangers to communicate with residents about tree maintenance. The city website has a page that features information specific to trees and landscape maintenance. The page explains the differences in funding and maintenance between the General Fund and LMD Tree Divisions. In addition, the webpage features several links to resources, including the approved Street Tree Species list, Municipal Codes relevant to trees, tree care information for trees at planting and maturity, and additional information about the General Fund and LMDs.

Arbor Day events and other tree related events are advertised through the city's social media platform (e.g., Facebook, Twitter, Instagram, etc.).

> "The planting of a tree, especially one of the long-living hardwood trees, is a gift which you can make to posterity at almost no cost and with almost no trouble, and if the tree takes root it will far outlive the visible effect of any of your other actions, good or evil."

GEORGE ORWELL

What do we have?

The Federal Emergency Management Agency (fema.gov) recommends that an emergency response plan identify the goals and objectives for emergency response, define expectations for response team members, and identify any regulations that apply (e.g. OSHA, fire code, etc.) (2014). An Emergency Response Plan should include considerations to mitigate the potential for disasters, as well as define steps for preparedness and response.

According to Title 1, Division 4, Chapter 8, Section 3100 of California Government Code states that public employees are Disaster Service Workers and are subject to such disaster service activities as may be assigned by their superiors or emergency service commanders (2016). The term "public employees" includes all persons employed by the state or any county, city, city and county, state agency or public district.

Tracy's Municipal Code, Title 7, provides considerations for emergency maintenance of utilities in the event of conditions which endanger life or property.

Storm events and other natural disasters can result in damage to trees. Tracy is prone to destructive strong winds and other storm events that result in loss and damage to trees. During such events, high winds can dislodge small branches and limbs and have toppled whole trees. All of which can interfere with emergency crews and disrupt essential services. Forestry staff has a role in assisting with clearing hazards, debris, and ensuring timely restoration of essential services. When storm events result in downed trees and limbs, Public Works staff are responsible for clearing debris from streets, sidewalks, and facilities to ensure safe passage for emergency vehicles and responders. Following storm events, forestry staff respond to other downed trees and limbs in less critical areas (e.g. parks) and visually inspect trees for damaged and/or hanging branches.

In preparation for future emergencies and natural disasters, Tracy has identified numerous funding mechanisms to support response efforts, including:

- Clearance of channel ways and utilities is funded through solid waste

- Approximately 15% of LMD and General Fund provide additional support for cleanup efforts

In readiness, Public Works staff are on a rotational, stand-by schedule for emergency response. For events that occur outside of normal operations, the person on stand-by is the lead. If events occur during normal operation, leadership defaults to normal managerial hierarchy. Stand-by or on-call personnel can call additional staff as needed. Public Works has established an after-hours crew that has been trained in the use of chainsaws, chippers, and aerial lifts. All after-hours crew members are trained on necessary equipment. During emergency events, all staff are considered mandatory reporters. In
some circumstances, communications may be down. Staff are equipped with cell phones and some city vehicles have radio systems which are more reliable and generally unaffected. Policy for catastrophic events dictates that city staff ensure their own personal safety and the safety of their family and then report to the Public Works corporation yard. The responsibility for coordination of resources during storm and emergency response falls under the assigned Superintendent. During multi-day events, supervisors work to schedule relief to improve worker safety and allow for adequate rest. While emergency response policies are generally understood, the Department would benefit from an emergency response handbook that clearly communicates protocol, responsibilities, and practices to promote compliance and provide a reference for staff.

Initial staging for storm and emergency events is conducted at the Public Works corporation yard where maintenance equipment is readily available. During events, debris is taken directly to the City waste facility or temporarily stored at other City facilities. Following emergency response, temporary storage areas are cleared as quickly as possible.

Storms are variable and impacts on the urban forest can range from minimal to severe. In most instances, in-house crews are able to manage the workload. However, in severe storm events, when very large trees are involved, or where there is significant potential for damage to property, the City uses contracted services to assist. When fallen trees and branches are in contact with overhead or downed power lines, the City notifies the affected utility and contracts with specially trained, line-clearance contractors when appropriate. Field staff prioritize safety and are responsible for determining which activities are contracted out during emergency events. Historically, approximately 60% of emergency related activities have been performed by contractors.

Residents can report non-emergency tree damage through the City's non-emergency phone line, online service request program, or call Public Works and submit a service request during normal operating hours. Forestry staff will inspect trees for risk and respond accordingly during regular operational hours.

Emergency responders (e.g., fire, police) communicate through emergency dispatchers for downed trees and limbs affecting emergency response. Main arterial roadways and emergency facilities receive the highest priority. To better facilitate future response, Public Works is coordinating with the Fire Department to prioritize critical areas and to develop corresponding community-wide maps. At times, the City's non-emergency phone line is overwhelmed with calls. Procedures to handle high-call volumes are currently under review to improve efficiency and response times.

To increase resilience in the urban forest to wind and other storm events, forestry staff address structural issues during regular maintenance cycles. Reducing weight on extended branches, removing dead wood, and correcting poor branching structure reduces the likeness of limb and tree failure in high winds and major storms.

Funding

Summary of Annual Operations and Funding

Currently, tree maintenance is funded through the General Fund and Landscape Maintenance Districts (LMDs).

Tree Operations Budget

Annual Planting	$30,000
Annual Pruning	$500,000
Tree Removals, Stump Grinding, and Disposal	$300,000
Irrigation and Establishment	$1,000
Annual Price of Repair/Mitigation of Infrastructure Damage	$30,000
Annual Price of Litter/ Storm Clean-up	$180,000
Average Annual Litigation and Settlements due to Tree-Related Claims	$2,753
Annual Expenditure for Program Administration	$200,000
Annual Expenditure for Inspections/ Answer Service Requesters	$150,000

General Fund and the Landscape Maintenance Districts

In 2019, the General Fund experienced cuts, which resulted in the loss of funds for tree maintenance. This loss of funds reduced contractor pruning operations for grid pruning, which is critical for maintaining public safety and sustaining public tree health and benefits. The General Fund is subject to increases and decreases with economic fluctuations and instances where there is a loss of funds for tree care, not all cyclical maintenance can be addressed. The General Fund is not typically used to supplement tree maintenance in the LMD.

Tracy has 42 LMD zones, which fund 49 mini parks, 220 acres of landscaping, landscaped channel ways, bike trails, and high-use arterial roads. Currently there are 25,842 trees within the LMD.

The LMD is funded through assessments, paid by property owners through property taxes and similarly to the General Fund are vulnerable to changes in the economy. In the past, some LMD zones were not established with sufficiently high assessments, resulting in disparities in funding and in the level of maintenance between neighborhoods. In addition, high maintenance trees, such as, flowering pear (Pyrus calleryana) and Raywood ash (Fraxinus oxycarpa) are more heavily planted in some zones, putting a considerable strain on the budget for those areas.

Many trees along main arterial roadways are maintained through the LMD. However, these areas are broadly used by the community and forestry managers are evaluating the feasibility of other funding mechanisms.

Landscaped channel ways are historically underfunded. As a result, tree maintenance is often deferred and many trees are overgrown or are encroaching on adjacent properties. It is important to maintain these channels to ensure they are free of debris and plant material that would hinder stormwater flows and increase the potential for flooding in the event of heavy precipitation. Dedicated funding for channel way maintenance, can help ensure that clearance and flow potential are maintained.

▲ What do we have?

Partners

Interdepartmental

Parks Division

The Parks Division is responsible for the maintenance of turf and landscaped areas. Trees within parks are cared for by the Urban Forestry Division.

Parks and Community Services Commission

The Parks and Community Services Commission, a council-appointed membership of seven residents with Tracy city limits, communicates with the Public Works Department to address public safety concerns and other maintenance tasks for trees within City parks both in the General Fund and the LMD.

"The UFMP can help by establishing clear standards for species selection, replacement, maintenance, planting, locations both throughout the City and where on each lot/parcel"

UNKNOWN STAKEHOLDER

Development Services Department - Engineering Division

The Engineering Division in coordination with the Urban Forestry Divison, is responsible for the approval and final inspection of the installation of trees and other landscape material within the public right-of-way and for Capital Improvement Projects. Specific plans outline the specific design specification for subdivisions. Engineering also ensures compliance with the Americans with Disabilities Act and coordinating with Urban Forestry Division to address trees that are creating conflict with sidewalks.

Engineering coordinates with the City Arborist to identify tree related issues within construction projects, including identifying trees that are suitable for preservation and coordinating tree protection around those trees on construction sites. Engineering coordinates with the City Arborist to inspect design plans for the inclusion of different species. Upon review by the City Arborist, the City Engineer may approve the species selection and placement of those trees according to city design standards. In instances where species are not listed on the approved species palette list, the City Arborist can use their discretion for the approval of such species. Following installation of landscape, a City landscape inspector is responsible for inspecting if landscape materials were installed according to the design plan. However, Engineering staff report that while developers may install landscape material according to design plans, homeowners frequently alter the design after purchasing a property, including removing trees in the right-of-way.

In addition to reviewing and providing recommendations for designs, the City Arborist coordinates with Engineering staff to identify and inspect TPZs for construction projects.

Planning Division

The Planning Division is primarily responsible for enforcing zoning ordinances and reviewing and inspecting projects

on private property. While there is no Municipal Code that protects trees on private property, community members have prompted the protection of large trees on prominent construction projects. In such events, Planning Division staff has sought the recommendations of the City Arborist for solutions for tree protection.

Public Works Department- Street and Sidewalk Maintenance Division

Street and sidewalk repairs that involve street trees are coordinated with the City Arborist to inspect work to support tree health.

Fire Department

The Fire Operations Division's goal is to maintain a constant state of readiness to respond and protect against injury, loss of life, and/or property damage caused by fire, medical, and emergencies when needed.

The Department coordinates with the Public Works Department during storm or emergency events to manage debris from trees and to maintain accessibility for emergency response crews. In addition, the Department is prepared to respond to wildland urban interface (WUI) areas where residential development meets with open space and natural wilderness areas. Although Tracy does not currently have any neighborhoods that might be classified as WUI, the Tracy Hills development will require active management of the natural areas adjacent to homes. The Department coordinates with Public Works staff to manage ladder fuels in areas vulnerable to fire.

Community Partners

Pacific Gas and Electric

In California, all utility providers are subject to General Order 95; Rule 35 Vegetation Management (California Public Utilities Commission, revised 2012) and FAC-003-2 Transmission Vegetation Management (NERC) which outlines requirements for vegetation management in utility easements. These requirements include clearance tolerances for trees and other vegetation growing in proximity to overhead utilities.

Trees located under utility lines should be directionally pruned by trained, authorized line clearance personnel only to provide clearance and/or reduce height. Selecting small-stature tree species that are utility friendly for planting sites in utility rights-of-way can minimize the need for these maintenance activities.

The urban forest has an impact on every resident, visitor, property owner, and business in Tracy. The benefits of the community's trees extend beyond the City limits. The responsibility for their care and protection is shared by many individuals, volunteers, nonprofit organizations, City departments, and tree care professionals. The engagement and contribution of urban forest stakeholders was integral to the development of the Urban Forest Management Plan.

Non-profit Tree Advocacy

The Tracy Tree Foundation (TTF) was founded in 2016, with strong support from the City, to educate the public on the benefits of trees and coordinate tree plantings. They also encourage the preservation of trees within Tracy.

In response to community interest in hiking and biking, the Tracy Nature Park Advocates was founded by numerous community members. This group advocated and petitioned for the creation of a nature park, which would provide numerous hiking and biking trails.

Community non-profit groups, like the Tracy Tree Foundation and the Tracy Nature Park Advocates, are valuable partners for the City. Not only do community non-profit groups serve as strong advocates on the behalf of trees and green space, but they also provide a strong network of volunteers. Volunteers have been and will continue to be critical to the success of Arbor Day and other tree planting events. Furthermore, volunteer-led education and outreach activities will be critical for promoting the preservation of private trees and enhancing the urban forest. Tracy Nature Park Advocates

▲ What do we have?

Policy and Regulation

City policies and regulations provide the foundation for the Urban Forestry Division. They outline requirements and specifications for the planting, installation, and care of Tracy's public trees. They also provide the regulatory framework for the protection and preservation of the urban forest assets as well as the enforcement of activities and issues that impact the community's trees. The development of Tracy's Urban Forest Management Plan included a comprehensive review of City policies, development and construction standards, ordinances and other regulations that apply to the urban forest. The following provides a summary of the review process and key findings.

Federal and State Law

California Urban Forestry Act

Section 4799.06-4799.12 of the California Public Resources Code defines a chapter known as the California Urban Forestry Act. The act defines trees as a "vital resource in the urban environment and as an important psychological link with nature for the urban dweller". The act also enumerates the many environmental, energy, economic, and health benefits that urban forests provide to communities.

The purpose of the Act is to promote urban forest resources and minimize the decline of urban forests in the state of California. To this end, the act facilitates the creation of permanent jobs related to urban forestry and encourages coordination with state and local agencies to reduce or eliminate tree loss and prevent the introduction and spread of pests. The act grants the authority to create agencies and mandates that urban forestry departments shall provide technical assistance to urban areas across many disciplines. The Act also authorizes and recommends numerous funding tools to achieve these goals.

Public Park Preservation Act

In addition to the protections provided by the California Urban Forestry Act, the Public Park Preservation Act of 1971 ensures that any public parkland converted to non-recreational uses is replaced to serve the same community.

Migratory Bird Treaty Act

Passed by Congress in 1918, MBTA defines that it is unlawful to pursue, hunt, take, capture, kill, possess, sell, purchase, barter, import, export, or transport any migratory bird, or any part, nest, or egg or any such bird, unless authorized under a permit issued by the Secretary of the Interior.

The act can impact forestry operations during times when birds are nesting and may delay work in order to avoid violating the MBTA.

Endangered Species Act

Signed in 1973, the Endangered Species Act provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend.

The listing of a species as endangered makes it illegal to "take" (harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, collect, or attempt to do these things) that species. Similar prohibitions usually extend to threatened species.

Model Water Efficient Landscape Ordinance

To promote the conservation and efficient use of water and to prevent the waste of water, Model Water Efficient Landscape Ordinance (MWELO) was adopted in 2009 and later revised in 2015, requiring increases in water efficiency standards for new and retrofitted landscapes through the use of more efficient irrigation systems, greywater usage, and onsite stormwater capture, and by limiting the portion of landscapes that can be covered in turf.

California Senate Bill No. 606 and No. 1668

Approved by Governor Jerry Brown on May 31, 2018, these bills require cities and water districts to set permanent water conservation rules, even in non-drought years. Under the bills, each urban water provider will be required to set a target water use goals that must be approved by the State Water Resource Control Board by 2022, if agencies fail to meet these goals, potential fines as high as $10,000 a day may be issued. Standards are based on 55 gallons per person per day for indoor water use (later decreasing to 50 gallons by 2030) and regional based standards for outdoor use.

California Solar Shade Act

Passed in 1978, the Solar Shade Control Act supported alternative energy devices, such as solar collectors, and required specific and limited controls on trees and shrubs. Revised in 2009, the Act restricted the placement of trees or shrubs that cast a shadow greater than 10 percent of an adjacent existing solar collector's absorption area upon the solar collector surface at any one time between the hours of 10am and 2pm.

The Act exempts trees or shrubs that were planted prior to the installation of a solar collector, trees or shrubs on land dedicated to commercial agricultural crops, replacement trees or shrubs that were planted prior to the installation of a solar collector and subsequently died or were removed (for the protection of public health, safety, and the environment) after the installation of a solar collector, and trees or shrubs subject to city and county ordinance.

Tracy Municipal Code

The Tracy Municipal Code includes ten Titles that provide considerations for trees:

Title 2 Administration Provides definitions for professional or consultant services, including tree trimming.

Title 3 Public Safety Provides considerations for graffiti control as it relates to trees, as well as, removal of obstruction to traffic including by trees. Requires the reporting of damage to trees to Police following an accident.

Title 4 Public Morals, Welfare, and Conduct Prohibits the posting of handbills on trees along streets in the City.

Title 5 Sanitation and Health Provides important rules regarding leaf pickup that is provided by the City in the winter months.

Title 6 Business, Professions, and Trades Provides considerations for the Downtown Incentive Program for off-street improvements, following approval by the City, applicant agrees to make the improvement to street trees and tree wells/grates with are located in the public right-of-way fronting a property must meet City Standards.

Title 7 Public Works Establishes the Parks and Community Services Commission and authorizes provisions for violations of Title 7, but allows the City to seek additional relief, including recovering for the value of the damaged or removed tree.

Provides definitions for relevant terms for trees and tree maintenance activities and the role of the director and gives the director authority to inspect, maintain, remove, replace street trees, and require property owners to maintain privately planted trees that interfere with the growth and health of street trees, including the use of dust reducing agents that are hazardous or detrimental to the health of trees. Title 7 also defines the director's role and authority in the application process for tree removal permits.

Title 7 prohibits the mutilation or impairment, or destruction of City trees and provides that the City is not responsible for tree maintenance in areas not within the City. Prohibits the planting of trees in public areas without permission. Title 7 authorizes maintenance of trees if interfering with public utility and prior to maintenance on public utility, agencies are required to get permission from the director if a street tree may be damaged but provides exceptions for emergencies.

Title 8 Finance, Revenue, and Taxation Provides exceptions for cable providers to trim trees to prevent contact with wires, cables and other equipment on public and private property.

Title 10 Planning and Zoning Designates the type and number of trees that are approved by the director for parking areas and requires a certain number of trees with reasonable spacing per parcel. The Title refers to City of Tracy Specification Standards for planting standards. The Title establishes the vision clearance for corner lots for street trees at least eight feet above the established grade of the curb and requires the use of trees and other methods to shield visible parking areas of parking garages and around drill sites.

Title 11 Public Utilities Provides selection criteria for trees in landscape design plans and requires that where feasible, trees should be irrigated by separate valves from other landscaped areas.

Title 12 Subdivisions Requires that subdivisions should be designed to limit the removal of non-production (trees that do not produce fruit or nuts) and should be accurately denoted on development plans. Any recommendations to remove a tree due to defects or disease must be supported by a report from a licensed arborist, with additional recommendations for proposed grading within a certain number of feet within the dripline of any saved tree.

Design Standards

Revised every 5 years, Tracy's Design Standards provide landscape standards, including shade tree requirements, for sites adjacent to freeways, parking lots/areas, lighting, buildings over 50,000 square feet, outdoor spaces, and landscaped areas. The Design Standards also provide considerations for the use of trees for screening, large trees for shading, drought tolerant trees, and tree box filters for bioretention and redirection of runoff.

Guiding Documents

Tracy General Plan 2011

The General Plan provides a vision for the future and establishes a framework for how Tracy should grow and change over the next two decades. The Community Character Element within the General Plan includes language about the incorporation and inclusion of trees in the urban landscape. According to the General Plan, trees should be planted along all residential streets, along the I-205 Commercial Area, parking lots in Village Centers, areas within Corridors, on the south and west sides of new buildings or buildings being renovated, and riparian corridors.

Tracy Sustainable Action Plan 2011

Tracy's Sustainability Action Plan is a detailed, long-range strategy to achieve sustainability in the sectors of greenhouse gas (GHG) emissions, energy, transportation and land use, solid waste, water, agriculture and open space, biological resources, air quality, public health, and economic development. The Plan encourages the strategic placement of trees with the intent for cooling pavements. The municipal tree planting subsection within the Plan identifies the goal of planting 33 acres of healthy trees by 2020, with each acre consisting of 35 to 40 trees in order to encourage carbon sequestration.

Standard Specification (2008)

Title 10 refers to the City's Standard Specification for planting guidelines for the installation of parking lot trees; however, the document does not have any guidelines or standards for planting street trees.

What do we have?

Conclusions

The City currently has an inventory of 35,561 public trees, with more trees being removed or planted every day. The Resource Analysis summarizes the composition of this community resource. The urban tree canopy assessment provides a land cover layer that identifies the location and extent of existing canopy (public and private), establishes a baseline for monitoring overall tree canopy cover throughout the community, and augments the City's GIS database. Additional protections for private trees would promote the preservation and protection of some large or unique tree species. A well-trained and dedicated City Arborist and forestry staff provide leadership and expertise and promote stewardship of the urban forest. All of this provides the foundation and tools necessary to make meaningful and effective management choices and illustrates the investment that Tracy has made in its urban forest. The information provides a basis for developing community goals and urban forest policies and establishes benchmarks for measuring the success of long-term planning objectives over time.

The City has ample capacity to increase the urban forest given an existing canopy cover of 12.8% and a potential for nearly 45%. Areas slated for development (residential and commercial) will eventually represent a mixture of land cover that includes both hardscape (impervious surface) and tree canopy. It is important to recognize that impervious surfaces and canopy cover can co-exist in many instances, especially with the incorporation of appropriate design standards. Canopy that extends over hardscape features, including parking lots, streets, and structures can add to the overall amount of canopy cover and reduce the ratio between canopy cover and impervious surfaces. In addition, shade provided by tree canopy can demonstrably extend the lifespan of materials used in the construction of hardscape features (McPherson, et al, 2005). Another opportunity for expanding tree canopy cover is through private property, where trees can provide direct benefits to residents.

Stakeholder interviews and a review of operations identified a number of opportunities and challenges facing Tracy's urban forestry program over the next couple of decades. Potential issues include maintaining adequate resources (staffing, funding, and equipment), increasing forest resiliency, inventory management, revisions to Municipal Code, and the partnership with the Partnerships with local nonprofits.

The City aims to provide service to public trees through five to seven-year maintenance cycles. The City Arborist ensures that contractors and Urban Forestry Division staff follow best management practices and industry standards, including standards for safety and professional training.

The Urban Forestry Division has two staff and has experienced periods of time where positions with the division were vacant. As a result, the Division has been working to fulfill high volumes of open work orders. Therefore, preventative maintenance is largely restricted based on available funds. With a small in-house tree crew and a contract tree care company, the care of public trees is currently reactive, focused on clearance pruning and response to hazardous and emergency situations. However, the program pruning cycle that began in recent years is having a positive effect. Additionally, high maintenance trees are concentrated in LMD zones, some of which have fewer resources than the General Fund, and as such require more frequent maintenance to maintain clearance and minimize risk. Urban trees are a living resource that benefit from timely maintenance to address health and safety needs and encourage strong structure. Proactive inspection and maintenance promote tree longevity, maximizes benefits, and helps manage risk potential.

Increasing interdepartmental coordination for planning and resource sharing promotes greater efficiencies for urban forestry operations. Collaboration with Engineering staff during revisions for Design Standards allows for considerations for planting sites. Greater consideration should be given to adequate soil volume, minimum dimensions, and alternative designs, all of which would improve environmental conditions for trees and support community canopy goals.

The urban forest is a living resource subject to environmental and cultural stressors, including pests, disease, extreme weather and climate change, pollution, and accidental damage. While it is impractical to protect and preserve every tree, actions and strategies that increase overall resilience can ensure that the community continues to receive a stable flow of benefits. Strategies for increasing forest resilience include increasing species diversity, planting the right tree in the right place, regular inspection and maintenance, and management of pests and disease. While the city must still contend with the planting decisions of the past, moving forward, forestry is focused on selecting species that are better suited to the local climate, drought tolerant, and more resilient to potential pest threats. It is also vital to provide sufficient funding to support the tree throughout its lifetime.

A complete inventory of public trees and a comprehensive inventory management system are vital components for urban forest management. Ideally, trees that were not included in the original inventory will be added and include the location, species, condition, and size (DBH). An updated inventory and updated data metrics for existing trees in the inventory will allow managers to track tree history, create work orders, and create grid-based pruning cycles. This will improve program efficiency and provide information to support funding requests and for programming work tasks.

In Tracy, according to Municipal Code, it is unlawful to damage or remove any tree planted or maintained by the City in right-of-way or planting easements, unless a person obtains a permit through the City. However, the fines for violations of Municipal Code are based on Street Tree Removal Criteria, which may not reflect industry's current standards for the true replacement value of a tree. Additionally, enforcement of the Municipal Code can be challenging. The urban forest webpage should continue to provide important links and fact sheets that summarize key messages for maintaining and preserving all trees.

Community support for the urban forest is critical for sustainable programming and the realization of long-term goals. Engaging community members through workshops, online resources, and volunteer projects engenders a greater sense of ownership and stewardship for the urban forest. In partnership with the Tracy Tree Foundation urban forestry staff have a great opportunity to promote the urban forest on private property through coordinated outreach activities and materials. While this partnership presents a great opportunity for facilitating community engagement and educational activities, leadership changes at TTF have led to some instability in the partnership and the City should continue to explore other opportunities with local non-profits.

Since 2015, Tracy has achieved Tree City USA status, reflecting the City's commitment to responsibly care for trees through tree care ordinances, dedicated funding, and annual observances of Arbor Day. Beyond this recognition, city staff are motivated to innovate the existing urban forestry program and ensure that the urban forest is preserved and protected for future generations. With prolonged periods of drought and an increasing risk of introduced pests and disease pathogens, park staff are acutely aware of the challenges and potential vulnerabilities that urban trees face. Because the urban forest is a dynamic, growing, and ever-changing resource, it requires sound and proactive management to fully realize its maximum potential.

▲ What do we want?

To better understand how the community values the benefits of the urban forest resource and to provide residents and other stakeholders an opportunity to express their views, The Tracy Tree Foundation and other community and City staff stakeholders were engaged through multiple outreach efforts to gather input on content and recommendations contained in the UFMP.

Stakeholder Outreach

While it may not be their primary focus, many individuals and departments within the City share some level of responsibility for the community urban forest, including planning for, caring for, and/or affecting the policy of urban forest assets. City Partners were invited to participate in an interview and discussion about their role and perspective for the urban forest as well as their views, concerns, and ideas for the UFMP. These interviews provided important information about the current functions of the Urban Forestry Division and potential areas for improvement. Concerns, requests, and suggestions from all stakeholders were of primary interest and were provided full consideration in the development of the UFMP.

Key stakeholders were invited to provide insight into the current state of the urban forest. Participants identified challenges and opportunities for the urban forest, as well as, helped to create a consensus for the goals of the UFMP.

Stakeholders included:

- Engineering Division
- Planning Division
- Parks Commission
- Public Works Staff
- Tracy Tree Foundation (TTF)
- Tracy Nature Parks Advocates

Challenges and opportunities identified through the stakeholder interview process include the following:

1. Additional outreach and engagement is needed
2. Forestry is underfunded, resulting in reactive maintenance
3. Increasing species diversity will lead to greater resilience in the urban forest
4. Future tree planting should focus on planting the right tree in the right place for greater benefits and cost savings
5. Review and revise Municipal Code to address the challenges facing the urban forest

"Educate civic leaders and citizens about the benefits of trees and to advocate for the urban forest."

UNKNOWN STAKEHOLDER

Community Meetings

A meeting was held on May 1, 2019 from 6:00 p.m. To 7:30 p.m. at the Tracy Transit Center. The meeting was advertised through social media, city emails, and the city website. The meeting was attended by 18 community members, six of which were city staff.

The meeting included a presentation about the community's urban forest and current program status. Following the presentation, attendees participated in a discussion and planning session to identify goals and objectives for the UFMP. Attendees were asked to provide their expectations for public tree maintenance and locations for additional tree plantings. Participants were also asked to share their opinions on the types of education and outreach, the best opportunities for providing educational materials and outreach activities, the professional licensing requirement for tree care providers within the city, protections for private trees, and collaboration opportunities.

Community meeting participants overwhelmingly expressed interest in learning more about the Sacramento Tree Foundation Greenprint Initiative to adopt a 35% canopy goal. They did not support a goal of no net loss (to maintain the current level of 12.8% canopy cover). Similarly, the majority favored additional plantings along streets and medians, parks and open space, commercial and industrial areas, but did not support opting for no additional plantings of trees.

Most participants indicated overall dissatisfaction with the current level of service provided to public trees and indicated a plant health care-based approach (cyclical maintenance, with regular inspection and pruning of public trees) or best possible care (structural training of young trees) are favored.

Questions posed to participants about the best methods of outreach and topics for education indicated that community members appreciate multiple methods of outreach and engagement and are interested in a wide range of educational topics; however, participants indicated disinterest in the use of door hangers for educational outreach. Participants also expressed support for the Tracy Tree Foundation as an avenue for outreach and education.

Community participants were asked about their level of support for ordinances that would provide protections for trees on public and private property. Most participants indicated support for protections for trees specific species and sizes, trees in parking lots, native trees, and public trees. Meeting attendants indicated opposition for requirements for professional licensing for tree care professionals on private property.

"The biggest challenge facing Tracy's city trees is to prevent existing trees from being cut down and/or be replaced when they die or are removed."

UNKNOWN STAKEHOLDER

▲ What do we want?

Plans, Goals and Actions

Based upon a review of the current Urban Forestry program and resources, and collaborative input from the community and other stakeholders, the UFMP identifies five goals and eight existing policies that support and represent what Tracy residents, stakeholders, and staff want for the future of Tracy's urban forest. These goals, and the strategies that support them, are intended to optimize the management of the city's community forest in an efficient, cost-effective, sustainable, and safe manner. The Plan identifies three major areas of focus:

1. Grow, maintain, preserve, and enhance a sustainable urban forest

2. Optimize the environmental, social, economic, and public health benefits of trees and canopy

3. Align urban forest management policy with community expectations and cost efficiency

Grow, maintain, preserve, and enhance a sustainable urban forest

The urban forest provides numerous benefits to the community. Although it might be tempting to plant as many trees as possible, it is important to grow and enhance the urban forest in a sustainable manner. It is important to ensure not only that trees are planted, but also that they can be maintained throughout their lifetimes.

Goal 1: Preserve trees whenever possible.

Trees take a long time to grow and the benefits that they provide increase as they mature. Therefore, tree removals should be avoided whenever possible to ensure all trees provide the maximum potential benefits. Trees that pose an unacceptable risk to public safety or the overall urban forest shall be removed and replaced with a suitable species.

Goal 2: Reach 40% canopy cover by 2040.

Tracy has the potential to support nearly a 45% canopy cover. However, with development and constraints on funding, the City should first work towards a goal of 40% canopy cover over the next 20 years.

Existing Policy 1: Plan for trees.

When proper consideration is given to planting trees, future removals can potentially be avoided. Selecting the right tree right tree for The right place increases the ability for a tree to reach maturity and ensures that it has ample space for canopy and root growth.

Existing Policy 2: Foster current partnerships with local non-profits and continue to explore opportunities with additional non-profit groups.

Growing, maintaining, and educating the greater community about the benefits of the urban forest are greatly enhanced through the partnership with local nonprofits.

Existing Policy 3: Promote the longevity of trees as a public resource.

Like all living things, trees have a finite lifespan, though some are longer lived than others. Managers have an important role in reducing mortality rates through proactive tree maintenance practices.

Optimize the environmental, social, economic, and public health benefits of trees and canopy

Trees are a valuable community asset and an integral part of the infrastructure. The environmental, social, economic, and public health benefits provided by trees and canopy are directly related to the distribution of leaf surface and tree canopy. As trees mature, the benefits that are provided to the community increase.

"As a comprehensive document, the UFMP can define and illustrate the course from the present state of the urban forest toward the ultimate goal of a well-appreciated, sustainable, enviable urban forest."

T. ROCHA

Goal 3: Engage the community to increase support for the urban forest.

The urban forest is more likely to be preserved and maintained by a community that understands the benefits that the urban forest provides to the community. Community members that are strong advocates on the behalf of the urban forest also improve the long-term viability of the urban forest.

Goal 4: Encourage the planting of trees on private property.

Private trees contribute significantly to the urban forest and the benefits that it provides to the community as a whole. While trees on public property are significant contributors to community benefits, private property provides an opportunity for additional planting sites and more direct flow of benefits to community members.

Currently park trees are maintained through both the General Fund and the Landscape Maintenance Districts (LMD). Because these resources are limited, care for park trees and trees in open space is prioritized based on public safety and dependent on available funding. Alternative funding sources to support the Urban Forestry program should continue to be explored and implemented as appropriate and/or available. Examples of these are: special assessments specific to urban forestry, parks and street-scaping; grants; recycling program funds; etc.

Existing Policy 4: Manage risk.

When trees are well-maintained throughout their lifetimes, the risks trees pose to the public are reduced.

Existing Policy 5: Expand the tree canopy of Tracy through the planting of trees on public property.

Public trees are a valuable component of infrastructure. Not only do trees reduce the rate of deterioration of asphalt and concrete, but also decrease the effects of urban heat islands.

Align urban forest management policy with community expectations and promote efficiency within the Public Works Department

Increasingly, there is more scientific data on the benefits that trees provide to communities, which promotes greater appreciation for the urban forest. Optimization of urban forestry funding and programming allows for the City to meet and exceed community expectations and increase efficiency.

Goal 5: Revise Municipal Code to respond to community needs.

As a community grows, its needs can change. Municipal Code should be periodically reviewed and revised to improve the benefits that trees provide to the environment and to the overall community.

Existing Policy 6: Ensure policy documents communicate a shared vision.

Inconsistencies across city policies, documents, and departments creates confusion between departments and the community. Uniformity promotes strong and efficient policy that aligns with community expectations.

Existing Policy 7: Provide emergency response to ensure accessibility for emergency responders and restoration of regular operations.

Following storm events or other emergency situations, trees may have been damaged and create problems for emergency responders, as well as, disrupt normal city operations. Emergency response is important for ensuring access for emergency crews and restoring normalcy following such events.

Existing Policy 8: Maintain a fire safe community.

In the last decade, California has experienced catastrophic losses as a result of wildfire. With prolonged periods of drought and a changing climate, wildfire is likely to continue to be a threat to communities that neighbor the wildland urban interface. The risk of living in these areas can be reduced through numerous wildfire mitigation strategies.

How do we get there?

The goals and actions proposed by the Urban Forest Management Plan (UFMP) are organized by area of focus:

1. Align urban forest management policy with community expectations and cost efficiency

2. Optimize the environmental, social, economic, and public health benefits of trees and canopy

3. Grow, maintain, preserve, and enhance a sustainable urban forest

Each area of focus is supported by measurable goals and specific actions that are intended to guide Tracy's urban forest programming over the next 20 years, providing a foundation for annual work plans and budget forecasts. Many goals and actions support more than one focus area.

For each action, the UFMP identifies a priority, a suggested timeframe for accomplishing the action, an estimated cost range, and potential partners. Priority is identified as:

• High – An action that is critical to protecting existing community assets, reducing/managing risk, or requires minimal resources to accomplish

• Medium – An action that further aligns programming and resource improvements that have been identified as desirable by the community, partners, and/or urban forest managers, but that may require additional investment and financial resources over and above existing levels

• Low – An action that is visionary, represents an increase in current service levels, or requires significant investment

The estimated cost is categorized in the following ranges:

• $ = less than $25,000

• $$ =$25,000–$100,000

• $$$ = more than $100,000

The UFMP is intended to be a dynamic tool that can and should be adjusted in response to accomplishments, new information and changes in community expectations, and available resources. In addition to serving as a day-to-day guide for planning and policy making, the UFMP should be reviewed regularly for progress and to ensure that the actions and sub actions are integrated into the annual work plan.

With appropriate care and planning, the urban forest is an asset that has the potential to increase in value over time. As young trees mature and their leaf surface and canopy grows, so too will the overall benefits and value from the community's urban forest. The objectives and strategies of the UFMP are intended to support this process in an appropriate manner that encourages the sustainable stewardship of community trees with consideration for, safety, cost efficiency, and community values. The UFMP includes strategies for measuring the success of the Plan over time.

Grow, maintain, preserve, and enhance a sustainable urban forest.

Goal 1: Preserve trees whenever possible.

Performance Measure: Reduced number of removals.

Rationale: Trees take a long time to grow. While the needs for land use change and sometimes trees are prohibitive of a desired use, there are often solutions and compromises that can be made to allow a tree to reach maturity and provide the maximum benefits to a community.

Risk: Removals that could have been avoided through alternative design solutions and repairs.

Benefit: The potential for all trees to reach maturity and provide the optimal amount of benefits to a community.

Objective:	Cost	Priority	Timeframe
Develop a Private Protected Tree or Heritage Tree Ordinance to protect specific species, native trees, specimen trees, or trees of historic value from damage or unpermitted removal.	$	High	1–5

Action:

1. Add "Protected Tree" definition to Municipal Code.

Objective:	Cost	Priority	Timeframe
Greater preservation of trees on public property.	$	Moderate	Ongoing

Action:

1. Revisit tree violation/mitigation fees.

2. Review and inspect Tree Protection Zones during construction projects.

Objective:	Cost	Priority	Timeframe
Ensure all newly planted trees have the necessary resources to be maintained throughout the lifetime of the tree.	$	Moderate	Ongoing

Action:

1. Have a mechanism that triggers additional funding for tree maintenance when new trees are planted.

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

How do we get there?

Grow, maintain, preserve, and enhance a sustainable urban forest.

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Risk: Removals that could have been avoided through alternative design solutions and repairs.

Benefit: The potential for all trees to reach maturity and provide the optimal amount of benefits to a community.

Objective:	Cost	Priority	Timeframe
Explore alternative designs to preserve valuable trees in the landscape.	$	Moderate	Ongoing

Action:

1. Explore alternative sidewalk designs to allow space for trees and compliance with the Americans with Disabilities Act.

2. Explore the use of alternative sidewalks designs to avoid tree removal.

3. Continue to protect valuable trees located in construction zones.

Objective:	Cost	Priority	Timeframe
Encourage preservation of trees on private property.	$	Moderate	Ongoing

Action:

1. Revisit Municipal Code to provide protection for native trees and heritage trees or trees of historical significance.

2. Revisit Municipal Code to prohibit the use of topping or other improper pruning practices for trees in parking lots.

Objective:	Cost	Priority	Timeframe
Improve everyday care of trees, to prevent future removals.	$	High	Ongoing

Action:

1. Include trees along main arterial roadways in the General Fund.

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

Grow, maintain, preserve, and enhance a sustainable urban forest.

Goal 2: Reach 40% canopy cover by 2040.

Performance Measure: Increased canopy cover.

Rationale: The benefits that an urban forest provides to the community are directly related to the expanse of tree canopy cover and leaf surface area. The greater the tree canopy cover, the greater distribution of benefits to the community.

Risk: No expansion or even loss of canopy cover may result in a loss or stagnation in the benefits provided to the community by the urban forest.

Benefit: Expansion of tree canopy increases the benefits provided by trees as well as equitable access to shade and other benefits across the community.

Objective:

Greater and more equitable distribution of environmental benefits from trees.

Action:

1. Continue to replace trees as they are removed.

2. Create a planting plan, which identifies specific planting priorities for different areas of the City.

   a. Consider planting priority areas in planting plans.

   b. Consider planting priorities identified by the community.

   c. Continue to plant trees in areas identified as Disadvantaged Communities.

   d. Utilize best management practices for planting and maintaining trees.

3. Conduct a Land Cover Assessment in 10 years to review progress towards meeting 40% canopy.

Cost	Priority	Timeframe
$	High	Ongoing

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

How do we get there?

Grow, maintain, preserve, and enhance a sustainable urban forest.

Performance Measure: Reduction in removals that are a result of a tree being planted in an inappropriate site.

Rationale: Trees take a long time to grow and are a long-term investment. If a tree is planted in a space that is too small or too large or is not well suited for the local climate and soil conditions, the potential benefits that the tree could have provided to the community are lost.

Risk: Premature death of trees.

Benefit: Fewer tree removals and maximum community benefit.

Objective:

Invest in trees for the long-term environmental benefits they provide to the community.

Action:

1. Practice right tree, right place.

2. Maintain and regularly update a tree species list that is suitable for a variety of site conditions.

   a. Include newly available nursery stock and omit species susceptible to pests and pathogens.

   b. Publish species palette list on the city website.

3. As design standards are updated, include standards for the following:

   a. Tree well sizes.

   b. Irrigation plans with separate valves for trees.

   c. Distances from utilities (water meters, fire hydrants, etc.).

4. Explore the use of expanding tree wells.

5. Incorporate innovative solutions for tree planting in areas where available soil volume is limited; also paying particular attention to appropriate species selections in these areas.

6. Formalize planting distances from water meters, fire hydrants, or other public utilities.

7. Develop minimum soil volume requirements for parking lots.

Cost	Priority	Timeframe
$	High	Ongoing

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

Grow, maintain, preserve, and enhance a sustainable urban forest.

Existing Policy 1: Plan for trees.

Performance Measure: Reduction in removals that are a result of a tree being planted in an inappropriate site.

Rationale: Trees take a long time to grow and are a long-term investment. If a tree is planted in a space that is too small or too large or is not well suited for the local climate and soil conditions, the potential benefits that the tree could have provided to the community are lost.

Risk: Premature death of trees.

Benefit: Fewer removal of trees and maximum community benefit.

Objective:	Cost	Priority	Timeframe
Allow for flexibility in planting considerations for new development.	$	Low–Moderate	1–10 Years

Action:

1. Have separate streetscape landscaping standards.

    a. Provide options for; park strips, meandering sidewalks, monolithic sidewalks.

    b. Set minimum widths for planting strips.

Objective:	Cost	Priority	Timeframe
Encourage new industries within the city to expand the tree canopy.	$	Low–Moderate	1–10 Years

Action:

1. Collaborate with companies to encourage tree planting on those properties.

2. Explore the use of tree planting funds for companies to offset their development.

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

▲ How do we get there?

Grow, maintain, preserve, and enhance a sustainable urban forest.   ▲

Existing Policy 2: Foster current partnerships with local non-profits and continue to explore opportunities with additional non-profit groups.

Performance Measure: Participation in forestry programming.

Rationale: Non-profit partners can coordinate planting events, including volunteers, and provide educational materials/activities.

Risk: Without non-profit partners, Urban Forestry Division staff have less time to manage and maintain city trees.

Benefit: Non-profit partners advocate for the urban forest and increase the protection and preservation of the benefits that the urban forest provides to the community.

Objective:	Cost	Priority	Timeframe
Continue to provide support for local non-profit organizations.	$	Moderate	Ongoing

Action:

1. Continue to set clear expectations for the role of non-profits in coordinating community outreach events and promote tree planting on private property.

2. Provide clearly defined expectations for funding designated to local non-profit organizations.

Objective:	Cost	Priority	Timeframe
Continue to explore partnerships with other non-profit and environmental advocacy groups.	$	Moderate	Ongoing

Action:

1. Identify passionate community members as tree-advocacy leaders.

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

Grow, maintain, preserve, and enhance a sustainable urban forest.

Existing Policy 3: Promote the longevity of trees as a public resource.

Performance Measure: Reduced mortality rates.

Rationale: Trees are a valuable component of the urban infrastructure, and when trees die prematurely, the investment in that infrastructure is lost.

Risk: If efforts are not made to reduce tree mortality, the investment in the time and labor to plant and care for a tree is lost.

Benefit: Reductions in tree mortality provide the opportunity for all trees to reach maturity and offer the most community benefits.

Objective:	Cost	Priority	Timeframe
Provide water to trees to encourage establishment of newly planted trees, as well as prolong the life of mature trees.	$	Low–Moderate	Ongoing

Action:

1. Continue to irrigate trees in accordance with California Senate Bill No. 606 and No. 1668.

2. Continue to select and plant drought-tolerant species.

Objective:	Cost	Priority	Timeframe
Educate the community about property owner responsibilities for the care of City trees.	$	Moderate	Ongoing

Action:

1. Increase education around watering trees even during drought.

2. Revisit appraisal fees for replacement of trees illegally removed.

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

▲ How do we get there?

Optimize the environmental, social, economic, and public health benefits of trees and canopy. ▲

Goal 3: Engage the community to increase support for the urban forest.

Performance Measure: Participation in forestry programming.

Rationale: An educated and engaged community is more likely to support and advocate on the behalf of the urban forest.

Risk: Apathy towards the urban forest may result in loss in benefits provided by the urban forest to the community.

Benefit: A community that supports the urban forest protects the urban forest and the benefits that it provides to the city.

Objective:

Engage the community in urban forestry activities and educational events.

Action:

1. Continue to facilitate tree plantings with community groups on private property and in parks.

2. Develop a regular presence at various community events such as Earth Day, Arbor Day, Tracy Make a Difference Day, etc.

3. Coordinate engagement activities with local schools.

4. Offer workshops on a variety of tree care topics.

5. Continue to provide tree educational materials through the Trees and Landscape Maintenance webpage.

   a. Provide downloadable fact sheets.

   b. Regularly update responses to Frequently Asked Questions (FAQ).

   c. Provide a summary of tree ordinances.

Cost	Priority	Timeframe
$	Low–Moderate	Ongoing

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

Optimize the environmental, social, economic, and public health benefits of trees and canopy.

Goal 3: Engage the community to increase support for the urban forest.

Performance Measure: Participation in forestry programming.

Rationale: An educated and engaged community is more likely to support and advocate on the behalf of the urban forest.

Risk: Apathy towards the urban forest may result in loss in benefits provided by the urban forest to the community.

Benefit: A community that supports the urban forest protects the urban forest and the benefits that it provides to the city.

Objective:

Provide sustainable and adequate resources to sustain the urban forest for future generations.

Action:

1. Incorporate innovative solutions for tree planting in areas where available soil volume is limited; also paying particular attention to appropriate species selections in these areas.

2. Audit the LMDs to analyze the number of public trees versus funding (per tree cost) and explore opportunities to equalize funding levels and increase efficiencies.

    a. Identify adequate funding level.

    b. Explore inequities.

3. Include funding for trees in Capital Improvement Projects.

4. Explore funding opportunities through public health improvement.

5. Explore the use of carbon offset credits.

Cost	Priority	Timeframe
$–$$	High	Ongoing

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

▲ How do we get there?

Optimize the environmental, social, economic, and public health benefits of trees and canopy.   ▲

Goal 4: Encourage the planting of trees on private property.

Performance Measure: Increased canopy cover on private property.

Rationale: Trees on private property not only provide direct benefits to the property owner, but also to the overall community.

Risk: Loss in benefits provided to individual households.

Benefit: Direct benefits to residents.

Objective:	Cost	Priority	Timeframe
Increase canopy cover through tree plantings on private property.	$	Low–Moderate	Ongoing

Action:

1. Explore incentive programs for planting trees on private property.

    a. Track participation in incentive programs to estimate new tree plantings.

2. Explore opportunities to modify or extend the fall/winter leaf collection program as needed

Objective:	Cost	Priority	Timeframe
Improve the diversity of Tracy's urban forest through plantings on private property.	$	Moderate–High	Ongoing

Action:

1. Continue to publish the Tree Species Palette on the city website.

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

Optimize the environmental, social, economic, and public health benefits of trees and canopy.

Goal 4: Encourage the planting of trees on private property.

Performance Measure: Increased canopy cover on private property.

Rationale: Trees on private property not only provide direct benefits to the property owner, but also to the overall community.

Risk: Loss in benefits provided to individual households.

Benefit: Direct benefits to residents.

Objective:	Cost	Priority	Timeframe
Use a variety of methods to provide tree related information to the community.	$	High	2 Years

Action:

1. Utilize "tree tags" on trees to educate the public on various tree care topics, including: pest management, pruning, and water.

2. Continue to provide external resources on the Trees and Landscape Maintenance webpage.

3. Develop a regular presence at various community events such as Earth Day, Arbor Day, Tracy Make a Difference Day, etc.

Objective:	Cost	Priority	Timeframe
Continue to distribute information about the urban forest to the community.	$	High	Ongoing

Action:

1. Continue to distribute information to the community through the City website.

2. Continue to use social media to engage the community.

3. Conduct a State of the Urban Forest Report (at year one), then every two to five years to communicate progress on the Plan.

4. Report progress and challenges of the UFMP via The State of the Urban Forest Report.

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

How do we get there?

Optimize the environmental, social, economic, and public health benefits of trees and canopy.

Existing Policy 4: Manage risk.

Performance Measure: Reduction in service requests related to public safety.

Rationale: Trees can develop structural problems that can result in concerns for public safety, but through proactive management of trees, the risks associated with trees are greatly reduced.

Risk: Damage to property and loss of life as a result of tree or branch failures or conflicts with infrastructure.

Benefit: Increased public safety and reduced liability.

Objective:

Maintain trees throughout their lifetimes to improve structure in maturity and reduce the likelihood of structural failures in the future.

Action:

1. Use current Best Management Practices for tree care.

2. Finalize pruning cycle schedule and mapping.

    a. Communicate this schedule to the community.

3. Identify and repair or remove trees that pose a threat to life and property on an ongoing basis.

4. Update tree inventory as maintenance occurs and to include trees that were previously not included.

5. Update inventory to include all trees that are the responsibility of the City.

6. Replace problematic trees as soon as funding allows.

Cost	Priority	Timeframe
$	Low–Moderate	Ongoing

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

Optimize the environmental, social, economic, and public health benefits of trees and canopy.

Existing Policy 5: Expand the tree canopy through tree plantings on public property.

Performance Measure: Number of plantings of trees on public property.

Rationale: Trees are a valuable part of urban infrastructure and are the only infrastructure whose value increases over time. Trees even help to extend the lifespan of the hardscape.

Risk: Depreciation of the current community resource without replacement and new planting will result in loss of tree canopy and the benefits provided by that canopy to the community.

Benefit: Additional trees and tree canopy will help provide benefits to the community.

Objective:

Improve the diversity of the urban forest on public property, to create a more resilient urban forest.

Action:

1. Provide recommendations for species and placement for projects within the public right-of-way and Capital Improvement Projects.

Cost	Priority	Timeframe
$	Moderate–High	Ongoing

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

▲ How do we get there?

Align urban forest management policy with community expectations and promote efficiency within the Public Works Department.

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Goal 5: Revise Municipal Code to respond to community needs.

Performance Measure: A Municipal Code that clearly defines and addresses the vision of the community.

Rationale: Communities evolve and the rules and laws that govern that group should change to better meet community expectations.

Risk: If Municipal Code does not change, then the weaknesses in outdated rules leave the urban forest vulnerable.

Benefit: Municipal Code changes can better protect, preserve, and enhance the urban forest.

Objective:

Review and revise Municipal Code to address the challenges facing the urban forest.

Action:

1. Revisit 10.08.1770 and define "Reasonable spacing" for trees in a parcel.

2. Update Municipal Code to prohibit the use of "topping" or other improper pruning practices that are inconsistent with industry standards in parking lots.

3. Include protections for private trees that include specific species, native species, heritage trees or trees of historical significance, and specimen trees.

Cost	Priority	Timeframe
$	High	2–Year

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

Align urban forest management policy with community expectations and promote efficiency within the Public Works Department.

Existing Policy 6: Ensure policy documents communicate a shared vision.

Performance Measure: Consistent vision, direction, and goals between plans and policy documents.

Rationale: Having a uniform policy reduces confusion between departments and community members and transcends departmental changes.

Risk: When policies have inconsistencies, setting a high standard of care is difficult.

Benefit: Uniformity promotes a strong and efficient policy that aligns with community expectations.

Objective:

Unify guiding documents to transcend departmental changes, address inefficiencies and reduce confusion.

Action:

1. Collaborate with Engineering, as City of Tracy Standard Specifications are revised.

   a. Include planting standards and minimum site and soil volume requirements.

2. Provide a link to the Street Tree Species Palette on the Engineering Division webpage.

3. Ensure that UFMP goals are considered in all overarching planning and visionary documents as revisions and updates occur.

   a. General Plan as it is revised.

   b. Sustainability Action Plan as it is revised.

   c. Parks Master Plan as it is revised.

Cost	Priority	Timeframe
$	High	Ongoing

Objective:

Optimize interdepartmental communication and coordination.

Action:

1. Share the UFMP among City departments following completion.

2. Communicate internally to develop standards that all departments are subject to.

3. Participate in cross-training activities to create understanding of other departmental roles.

Cost	Priority	Timeframe
$	High	Ongoing

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

▲ How do we get there?

Align urban forest management policy with community expectations and promote efficiency within the Public Works Department.

▲

Existing Policy 7: Prepare for emergency response to ensure accessibility for emergency responders and restoration of regular operations.

Performance Measure: Recovery following storm or emergency events.

Rationale: Storm and emergency events can impact on city trees, which can result in disruption in normal city operations and obstructed mobility for emergency response crews. However, with planning, recovery from these events can happen more efficiently and quickly.

Risk: Inability to restore regular operations and slower emergency response times.

Benefit: Improved response during emergency or storm events.

Objective:

Restore operations and public safety as efficiently and as quickly as possible following storm or other emergency events.

Action:

1. Distribute standard operating procedures for emergency response to on-call staff and contractors.

    a. Provide specific trainings to ensure preparedness.

    b. Establish clear criteria for determining need for subcontractor assistance.

2. Establish relief duty periods for staff responding to emergency or storm events.

3. Identify priority zones through GIS mapping.

4. Review process for handling emergency calls and high call volumes during emergency response and identify improvements.

    a. Establish a matrix of the number and type of calls per hour that trigger a call for additional staff and/or contractor support.

Cost	Priority	Timeframe
$	High	Ongoing

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

Align urban forest management policy with community expectations and promote efficiency within the Public Works Department.

Existing Policy 8: Maintain a fire safe community.

Performance Measure: Improved defensible spaces around structures and reduction in ladder fuels.

Rationale: California has had historic fires over the last decade. Many of these fires were in urban areas. Tracy has identified areas that are vulnerable to fire. To reduce the risk of living in the wildland urban interface, the City is working to mediate the potential fire hazards that exist.

Risk: Given the right conditions and lack of premeditated response to fire, fire is a risk to the community. Fire can result in devastating losses to property and life.

Benefit: Reduced vulnerability to fire.

Objective:

Focus fire mitigation efforts on Tracy Hills and other areas of vulnerability.

Action:

1. Reduce ladder fuels in proximity to structures.

2. Plant trees so as to not interfere with emergency response.

Cost	Priority	Timeframe
$	High	Ongoing

$ = less than $25,000 $$ = $25,000–$100,000 $$$ = more than $100,000

▲ How do we get there?

Monitoring and Measuring Results

Through talking with community partners and those within the urban forestry program, a set of goals were created to meet the strong demand for protecting and enhancing the urban forest, as stated in the community vision. The success of these goals is largely dependent on creating objectives and strategies to meet the goals outlined in the UFMP, but also monitoring the progress of these action steps. Equally important to monitoring progress is finding ways to measure progress, so that success is clearly defined.

Annual Review

The UFMP is an active tool that will guide management and planning decisions over the next 20 years. The goals and actions will be reviewed annually for progress and integration into an internal work plan. The UFMP presents a long-range vision and target dates are intended to be flexible in response to emerging opportunities, available resources, and changes in community expectations. Therefore, each year specific areas of focus should be identified. This can inform budget and time requirements for Urban Forest Managers.

Resource Analysis

With the Resource Analysis, values on structure, annual benefits, replacement value, and benefit versus investment ratios Tracy has a baseline against which future progress and improvements to health (condition), species diversity, annual benefits, and overall resource value can be measured. A strategy of the UFMP is to complete this analysis every five years to illustrate progress and success towards Plan goals. A five-year Resource Analysis review is a possible way to monitor progress on efforts to increasing diversity through the creation of a diversified list of tree species appropriate for a variety of different spaces and landscapes.

Canopy Analysis

With the recent Urban Tree Canopy Assessment, Tracy has a baseline tree canopy for the entire urban forest, which allows for continued monitoring of trends in the canopy cover on private property.

State of the Community Forest Report

The purpose of the report is to provide structural and functional information about the urban forest (including the municipal forest) and recommend strategies for its proactive management, protection, and growth.

Community Satisfaction

Plan results will be measurable through increased benefits and value in the community tree resource and the preservation and eventual increase in canopy cover over time. Attainment of the objectives and strategies will support better tree health, greater longevity, and a reduction in tree failures. However, perhaps the greatest measurement of success for the UFMP will be its level of success in meeting community expectations for the care and preservation of the community tree resource. Community satisfaction can be measured through surveys and evidenced by public support for realizing the objectives of the Plan. Community satisfaction can also be gauged by the level of engagement and support for forestry programs.

Reporting

Completion of this Plan is the first step towards achieving the vision for Tracy's urban forest. Continual monitoring, analysis, and revisions will help forest managers keep stakeholders informed and engaged. By organizing data into specific components (for example; Urban Forest Reports, Community Satisfaction Surveys), it will be possible to revise specific areas of weakness and buttress areas of strength. Revisions to the Plan should occur with major events, such as newly discovered pests or diseases, or significant policy and regulation changes. A complete formal revision should occur in unison with major municipal projects, such as the comprehensive Master Plan. It is important to remember that Tracy's UFMP is a living document that should adapt to new conditions.

▲ Appendices

Appendix A: Terms and Definitions

American National Standards Institute (ANSI)

A Federation of United States industry sectors (e.g. businesses, professional societies and trade associations, standards developers, government agencies, institutes, and consumer/labor interest groups) that coordinates the development of the voluntary consensus standards system.

American Public Works Association (APWA)

An organization that supports professionals who operate, improve, or maintain public works infrastructure by advocating to increase awareness, and providing education, credentialing, as well as other professional development opportunities.

Arboriculture

The science, art, technology, and business of tree care.

Best Management Practices (BMP)

Management practices and processes used when conducting forestry operations, implemented to promote environmental integrity.

Capital Improvement Projects (CIP)

Infrastructure projects and equipment purchases identified by a government in order to maintain or improve public resources. Projects such as (1) constructing a facility, (2) expanding, renovating, replacing, or rehabilitating an existing facility, or (3) purchasing major equipment are identified, and then purchasing plans and development schedules are developed.

Climate Action Plan (CAP)

Government lead initiatives to decrease greenhouse gas emissions and prepare for the impacts of climate change.

Community Urban Forest

The collection of publicly owned trees within an urban area, including street trees and trees in parks and other public facilities.

Diameter Breast Height (DBH)

The diameter of the tree when measured at 1.4 meters (4.5 feet) above ground.

Drip Line Area

The area measured from the trunk of the tree outward to a point at the perimeter of the outermost branch structure of the tree.

Dutch Elm Disease (DED)

A wilt disease of elm trees caused by plant pathogenic fungi. The disease is either spread by bark beetles or tree root grafts.

Emerald Ash Borer (EAB)

The common name for Agrilus planipennis, an emerald green wood boring beetle native to northeastern Asia and invasive to North America. It feeds on all species of ash.

Greenhouse Gas (GHG)

A gas that traps heat in Earth's atmosphere.

Geographic Information System (GIS)

Computer-based tools designed to increase the organization and understanding of spatial or geographic data. Many different kinds of data can be displayed on one map for visualization and interpretation.

Integrated Pest Management (IPM)

Using pest and environmental information to determine if pest control actions are warranted. Pest control methods (e.g. biological control, habitat manipulation, cultural control, plant resistance, and chemical control) are chosen based on economic and safety considerations.

International Society of Arboriculture (ISA)

An international nonprofit organization that supports professionals in the field of arboriculture by providing professional development opportunities, disseminating applicable research findings, and promoting the profession.

i-Tree

A state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides urban and rural forestry analysis and benefits assessment tools.

Migratory Bird Treaty Act (MBTA)

A United States federal law adopted to protect migratory birds.

Natural Area

A defined area where native trees and vegetation are allowed to grow and reproduce naturally with little or no management except for control of undesirable and invasive species.

Open Space

A defined area of undeveloped land that is open to the public. The land can include native or naturalized trees and vegetation.

Plant Health Care (PHC)

A program that consists of (1) routinely monitoring landscape plant health and (2) individualized plant management recommendations in order to maintain or improve the vitality, appearance, and safety of trees and other plants.

Personal Protective Equipment (PPE)

Equipment worn to enhance workplace safety and minimize the risk to physical hazards (e.g. gloves, hard harts, bodysuits, and foot, eye, or ear protection).

Appendices

Appendix A: Terms and Definitions

Private Tree

Any tree located on private property, including residential and commercial parcels.

Public Tree

Any tree located in the public ROW, city park, and/or city facility.

Right Tree, Right Place

Careful planning for the planting of a tree. Considerations for whether a tree is the right tree and whether it is planted in the right place, include: mature height, canopy spread, deciduous/evergreen, form/shape, growth rate, soil requirements, light requirements, water requirements, fruit debris, and hardiness zone.

Street Tree

Any tree growing within the tree maintenance strip whether or not planted by the city.

Structural and Training Pruning

Pruning to develop a sound and desirable scaffold branch structure in a tree and to reduce the likelihood of branch failure.

Tree Canopy

The layer of leaves, branches, and stems of trees that cover the ground when viewed from above.

Tree City USA

A program through the Arbor Day Foundation that advocates for green urban areas through enhanced tree planting and care.

Tree Risk Assessment Qualified (TRAQ)

An International Society of Arboriculture qualification. Upon completion of this training, tree care professionals demonstrate proficiency in assessing tree risk.

Urban Forest

The collection of privately owned and publicly owned trees and woody shrubs that grow within an urban area.

Urban Forest Management Plan (UFMP)

A document that provides a comprehensive information, recommendations, and timelines to guide for the efficient and safe management of a city's tree canopy. The Plan uses adaptive management model to provide reasoned and transparent calls to action from an inventory of existing resources.

Urban Forestry

The cultivation and management of native or introduced trees and related vegetation in urban areas for their present and potential contribution to the economic, physiological, sociological, and ecological well-being of urban society.

Urban Tree Canopy Assessment (UTC)

A document based off of GIS mapping data that provides a birds-eye view of the entire urban forest and establishes a tree canopy baseline of known accuracy. The UTC helps managers understand the quantity and distribution of existing tree canopy, potential impacts of tree planting and removal, quantified annual benefits trees provide to the community, and benchmark canopy percent values.

Wildfire Urban Interface (WUI)

A transition zone where homes are located on the edge of fire prone areas, and are at an increased risk of personal injury or property damage resulting from a wildfire.

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▲ Appendices

Appendix C: Industry Standards

ANSI Z133 Safety Standard, 2017

Reviews general safety, electrical hazards, use of vehicles and mobile equipment, portable power hand tools, hand tools and ladders, climbing, and work procedures.

ANSI A300

ANSI A300 standards represent the industry consensus on performing tree care operations. The standards can be used to prepare tree care contract specifications.

ANSI A300 Pruning Standard-Part 1, 2017

ANSI A300 Soil Management-Part 2, 2011

ANSI A300 Support Systems Standard-Part 3, 2013

ANSI A300 Construction Management Standard-Part 5, 2012

ANSI A300 Transplanting Standard-Part 6, 2012

ANSI A300 Integrated Vegetation Management Standard-Part 7, 2012

ANSI A300 Root Management Standard-Part 8, 2013

ANSI A300 Tree Risk Assessment Standard a Tree Failure-Part 9, 2017

ANSI A300 Integrated Pest Management-Part 10, 2016

Includes guidelines for implementing IPM programs, including standards for Integrated Pest Management, IPM Practices, tools and equipment, and definition.

Best Management Practices (BMPs)

Integrated Pest Management, Second Edition, P. Eric Wiseman and Michael J. Raupp, 2016

Provides a comprehensive overview of the basic definitions, concepts, and practices that pertain to landscape Integrated Pest Management (IPM). The publication provides specific information for designing, planning, and implementing an IPM program as part of a comprehensive Plant Health Care (PHC) management system, including topics such as:

- IPM concepts and definitions

- Action thresholds

- Monitoring tools and techniques

- Preventive tactics

- Control tactics

- Documentation and recordkeeping

Integrated Vegetation Management, Second Edition, Randall H. Miller, 2014

A guide to the selection and application of methods and techniques for vegetation control for electric rights-of-way projects and gas pipeline rights-of-way. Topics included: safety, site evaluations, action thresholds, evaluation and selection of control methods, implementing control methods, monitoring treatment and quality assurance, environmental protection, tree pruning and removal, and a glossary of terms.

Managing Trees During Construction, Second Edition, Kelby Fite and E. Thomas Smiley, 2016

Describes tree conservation and preservation practices that help to protect selected trees throughout the construction planning and development process so that they will continue to provide benefits for decades after site disturbance, including planning phase, design phase, pre-construction phase, construction phase, and post-construction phase.

Root Management, Larry Costello, Gary Watson, and Tom Smiley, 2017

Recommended practices for inspecting, pruning, and directing the roots of trees in urban environments to promote their longevity, while minimizing infrastructure conflicts.

Special companion publication to the ANSI A300 Part 8: Tree, Shrub, and Other Woody Plant Management–Standard Practices (root Management)

Tree Planting, Second Edition, Gary Watson, 2014

Provides processes for tree planting, including site and species selection, planting practices, post-planting pruning, and early tree care. Other topics included are time of planting, nursery stock: types, selection, and handling, preparing the planting hole, planting practices, root loss and new root growth, redevelopment of root structure, pruning, palms, after planting, final inspection, and a glossary of terms.

Tree Inventories, Second Edition, Jerry Bond, 2013

Provides considerations for managing large numbers of trees considered as individuals rather than groups and serves as a guide for making informed decisions that align with inventory goals with needs and resources, including inventory goals and objectives, benefits and costs, types, work specifications, and maintaining inventory quality.

Tree Risk Assessment, Second Edition, E. Thomas Smiley, Nelda Matheny, and Sharon Lilly, 2017

A guide for assessing tree risk as accurately and consistently as possible, to evaluate that risk, and to recommend measures that achieve an acceptable level of risk, including topics: risk assessment basics, levels and scope of tree risk assessment, assessing targets, sites, and trees, tree risk categorization, risk mitigation: preventive and remedial actions, risk reporting, tree related conflicts that can be a source of risk, loads on trees, structural defects and conditions that affect likelihood of failure, response growth, description of selected types of advanced tree risk assessments.

Tree Shrub Fertilization, Third Edition, E. Thomas Smiley, Sharon Lilly, and Patrick Kelsey, 2013

Aides in the selection and application of fertilizers for trees and shrubs, including: Essential elements, determining goals and objectives of fertilization, soil testing and plan analysis, fertilizer selection, timing, application, application area, rates, storage and handling of fertilizer, sample fertilizer contract for commercial/ municipal clients.

Soil Management, Bryant Scharenbroch, E. Thomas Smiley, and Wes Kocher, 2014

Focuses on the protection and restoration of soil quality that support trees and shrubs in the urban environment, including goals of soil management, assessment, sampling, and analysis, modifications and amendments, tillage, conservation, and a glossary of terms.

Utility Pruning of Trees, Geoffrey P. Kempter, 2004

Describes the current best practices in utility tree pruning based on scientific research and proven methodology for the safe and reliable delivery of utility services, while preventing unnecessary injury to trees. An overview of safety, tools and equipment, pruning methods and practices, and emergency restoration are included.

Appendices

Appendix D:
Tree Risk Decision Flow Chart

1. Resident or city staff recognizes a risk

   a. If tree is a city street tree, then, proceed to step 2.

   b. If tree is a private tree, then proceed to step 4.

   c. If tree is located on undeveloped property, then proceed to step 5.

2. The tree is a city tree. The City Arborist will conduct a limited visible assessment of the tree identified as a concern.

   a. City Arborist determines risk can be mitigated through pruning. City Arborist addresses concern immediately when possible or schedules safety mitigation work within fourteen (14) days. If work cannot be addressed immediately, City Arborist must take precautions to protect public safety (including signage and barriers to restrict foot traffic and parking within the target zone of the safety concern).

   b. City Arborist requires additional assessment to determine if risk can be mitigated through pruning, proceed to step 3.

   c. City Arborist determines risk cannot be mitigated through pruning, proceed to address safety risk immediately when possible or schedule safety mitigation work within fourteen (14) days. If work cannot be addressed immediately, City Arborist must take precautions to protect public safety (including signage and barriers to restrict foot traffic and parking within the target zone of the safety concern).

3. City Arborist conducts an aerial assessment.

   a. City Arborist determines risk can be mitigated through pruning. City Arborist addresses concern immediately when possible or schedules safety mitigation work within fourteen (14) days. If work cannot be addressed immediately, City Arborist must take precautions to protect public safety (including signage and barriers to restrict foot traffic and parking within the target zone of the safety concern).

   b. City Arborist determines risk cannot be mitigated through pruning, proceed to address safety risk immediately when possible or schedules safety mitigation work within fourteen (14) days. If work cannot be addressed immediately, City Arborist must take precautions to protect public safety (including signage and barriers to restrict foot traffic and parking within the target zone of the safety concern).

4. Tree is a private tree. City Arborist will conduct a limited visible assessment of the private tree identified as a concern.

   a. City Arborist determines that there is no risk to public safety and no action is required.

   b. City Arborist determines that the tree poses a risk to public safety and proceeds to notify the property owner of their violation and require mediation measures to be conducted within fourteen (14) days at the property owners' expense.

5. Tree is located on undeveloped property. City Arborist will conduct a limited visible assessment of the private tree identified as a concern.

   a. City Arborist determines that there is no risk to public safety and no action is required.

   b. City Arborist determines that there is no immediate risk to public safety but requires mediation measures as a condition for an approval for any building permit.

   c. City Arborist determines that the tree poses a risk to public safety and proceeds to notify the property owner of their violation and require mediation measures to be conducted within fourteen (14) days at the property owners' expense.

Appendix E:
Soil Volume and Tree Stature

Tree growth is limited by soil volume. Larger stature trees require larger volumes of uncompacted soil to reach mature size and canopy spread (Casey Trees, 2008).
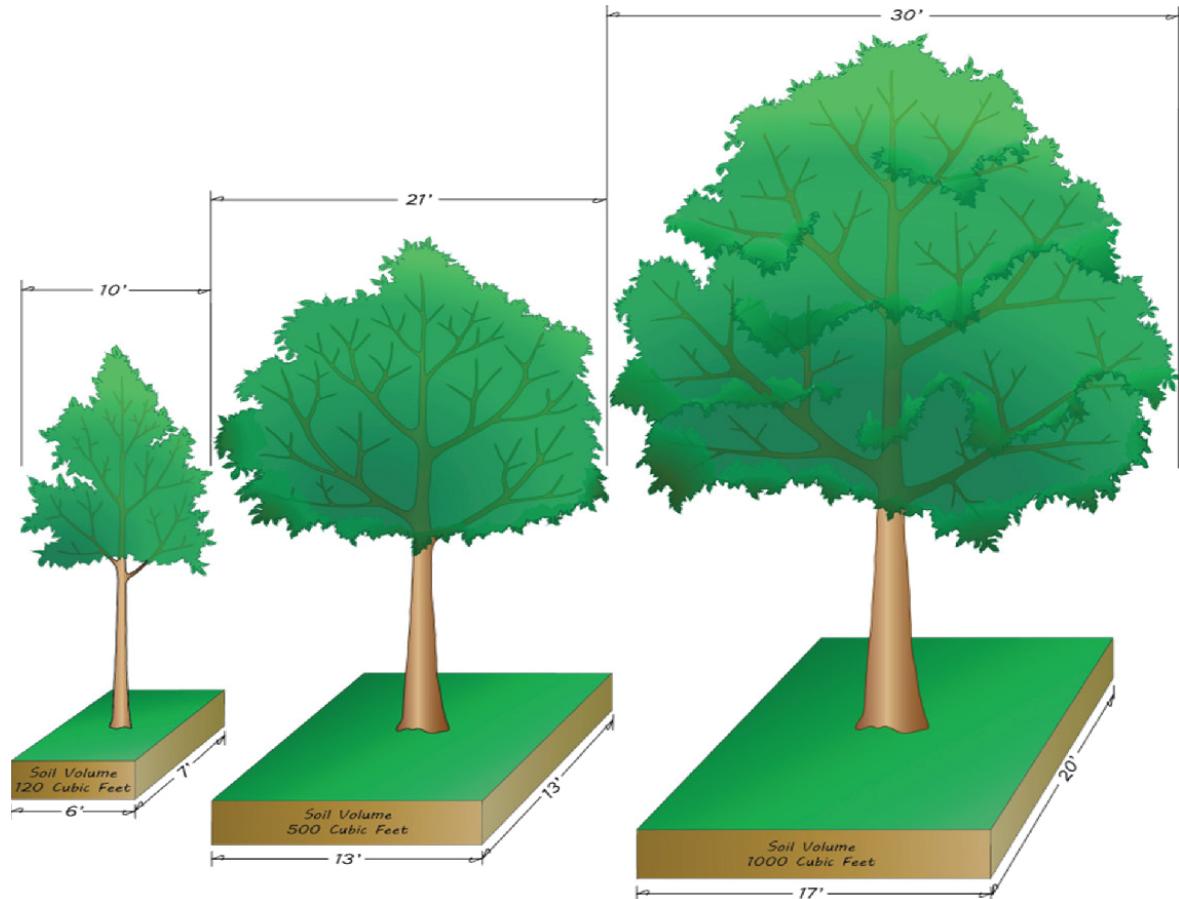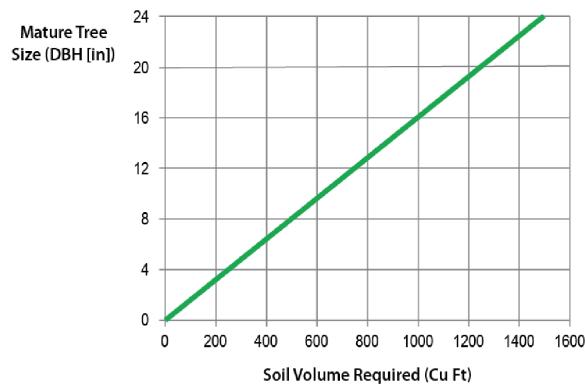
Appendices

Appendix F: Indicators of a Sustainable Urban Forest

Indicators of a Sustainable Urban Forest

	Assessed Performance Level		
The Trees	Low	Medium	High
Urban Tree Canopy		x	
Equitable Distribution		x	
Size/Age Distribution			x
Condition of Public Trees - Streets, Parks		x	
Condition of Public Trees - Natural Areas		x	
Trees on Private Property			x
Species Diversity		x	
Climate Resilience/Suitability		x	
Space and Soil Volume	x		
The Players			
Neighborhood Action		x	
Large Private & Institutional Landholder Involvement	x		
Green Industry Involvement	x		
City Department/Agency Cooperation			x
Funder Engagement	x		
Utility Engagement		x	
Developer Engagement		x	
Public Awareness		x	
Regional Collaboration	x		
The Management Approach			
Tree Inventory			x
Canopy Assessment			x
Management Plan			x
Risk Management Program		x	
Maintenance of Publicly-Owned Trees (ROWs)			x
Planting Program			x
Tree Protection Policy		x	
City Staffing and Equipment		x	
Funding		x	
Disaster Preparedness & Response			x
Communications			x
Totals	5	14	10

A Sustainable Urban Forest Indicators: The Trees

Indicators of a Sustainable Urban Forest	Overall Objective or Industry Standard	Performance Levels		
		Low	Medium	High
Urban Tree Canopy	"Achieve the desired tree canopy cover according to goals set for the entire city and neighborhoods. Alternatively, achieve 75% of the total canopy possible for the entire city and in each neighborhood."	"Canopy is decreasing. - AND/OR - No canopy goals have been set."	Canopy is not dropping, but not on a trajectory to achieve the established goal.	Canopy goal is achieved, or well on the way to achievement.
Location of Canopy (Equitable Distribution)	Achieve low variation between tree canopy and equity factors citywide by neighborhood. Ensure that the benefits of tree canopy are available to all, especially for those most affected by these benefits.	Tree planting and public outreach and education is not determined by tree canopy cover or benefits.	Tree planting and public outreach and education is focused on neighborhoods with low tree canopy.	Tree planting and public outreach and education is focused in neighborhoods with low tree canopy and a high need for tree benefits.
Age of Trees (Size and Age Distribution)	"Establish a diverse-aged population of public trees across the entire city and for each neighborhood. Ideal standard: 0-8" DBH: 40% 9-17" DBH: 30% 18-24" DBH: 20% Over 24" DBH: 10%"	"No current information is available on size. - OR - Age distribution is not proportionally distributed across size classes at the city level."	Size classes are evenly distributed at the city level, though unevenly distributed at the neighborhood level.	Age distribution is generally aligned with the ideal standard diameter classes at the neighborhood level.
Condition of Publicly-Owned Trees (trees managed intensively)	Possess a detailed understanding of tree condition and potential risk of all intensively-managed, publicly-owned trees. This information is used to direct maintenance actions.	No current information is available on tree condition or risk.	Information from a partial or sample or inventory is used to assess tree condition and risk.	Information from a current, GIS-based, 100% complete public tree inventory is used to indicate tree condition and risk.
Condition of Publicly-Owned Natural Areas (trees managed extensively)	Possess a detailed understanding of the ecological structure and function of all publicly-owned natural areas (such as woodlands, ravines, stream corridors, etc.), as well as usage patterns.	No current information is available on tree condition or risk.	Publicly-owned natural areas are identified in a sample-based "natural areas survey" or similar data.	Information from a current, GIS-based, 100% complete natural areas survey is utilized to document ecological structure and function, as well as usage patterns.
Trees on Private Property	Possess a solid understanding of the extent, location and general condition of trees on private lands.	No data is available on private trees.	Current tree canopy assessment reflects basic information (location) of both public and private canopy combined.	Detailed information available on private trees. Ex. bottom-up sample-based assessment of trees.
Diversity	Establish a genetically diverse population of publicly-owned trees across the entire city and for each neighborhood. Tree populations should be comprised of no more than 30% of any family, 20% of any genus, or 10% of any species.	"No current information is available on species. - OR - Fewer than five species dominate the entire tree population citywide."	No species represents more than 20% of the entire tree population citywide.	No species represents more than 10% of the entire tree population citywide.
Climate Resilience/ Suitability	Establish a tree population suited to the urban environment and adapted to the overall region. Suitable species are gauged by exposure to imminent threats, considering the "Right Tree for the Right Place" concept and invasive species.	"No current information is available on species suitability. - OR - Less than 50% of trees are considered suitable for the site."	50% to 75% of trees are considered suitable for the site.	More than 75% of trees are considered suitable for the site.
Space and Soil Volume	Establish minimum street tree soil volume requirements to ensure there is adequate space and soil for street trees to thrive. Minimum soil volumes by mature size: 1000 cubic feet for large trees; 600 cubic feet for medium trees; 300 cubic feet for small trees.	Minimum street tree soil volumes have not been established.	Minimum street tree soil volume has been established based on mature size of tree.	Minimum street tree soil volumes have been established and are required to be adhered to for all new street tree planting projects.

A Sustainable Urban Forest Indicators: The Players

Indicators of a Sustainable Urban Forest	Overall Objective or Industry Standard	Performance Levels		
		Low	Medium	High
Neighborhood Action	Citizens understand, cooperate, and participate in urban forest management at the neighborhood level. Urban forestry is a neighborhood-scale issue.	Little or no citizen involvement or neighborhood action.	Some active groups are engaged in advancing urban forestry activity, but with no unified set of goals or priorities.	The majority of all neighborhoods are organized, connected, and working towards a unified set of goals and priorities.
Large Private & Institutional Landholder Involvement	Large, private, and institutional landholders embrace citywide goals and objectives through targeted resource management plans.	Large private land holders are unaware of issues and potential influence in the urban forest. No large private land management plans are currently in place.	Education materials and advice is available to large private landholders. Few large private landholders or institutions have management plans in place.	Clear and concise goals are established for large private land holders through direct education and assistance programs. Key landholders and institutions have management plans in place.
Green Industry Involvement	The green industry works together to advance citywide urban forest goals and objectives. The city and its partners capitalize on local green industry expertise and innovation.	Little or no involvement from green industry leaders to advance local urban forestry goals.	Some partnerships are in place to advance local urban forestry goals, but more often for the short-term.	Long-term committed partnerships are working to advance local urban forestry goals.
City Department and Agency Cooperation	All city departments and agencies cooperate to advance citywide urban forestry goals and objectives.	Conflicting goals and/or actions among city departments and agencies.	Informal teams among departments and agencies are communicating and implementing common goals on a project-specific basis.	Common goals and collaboration occur across all departments and agencies. City policy and actions are implemented by formal interdepartmental and interagency working teams on all city projects.
Funder Engagement	Local funders are engaged and invested in urban forestry initiatives. Funding is adequate to implement citywide urban forest management plan.	Little or no funders are engaged in urban forestry initiatives.	Funders are engaged in urban forestry initiatives at minimal levels for short-term projects.	Multiple funders are fully engaged and active in urban forestry initiatives for short-term projects and long-term goals.
Utility Engagement	All utilities are aware of and vested in the urban forest and cooperates to advance citywide urban forest goals and objectives.	Utilities and city agencies act independently of urban forestry efforts. No coordination exists.	Utilities and city agencies have engaged in dialogues about urban forestry efforts with respect to capital improvement and infrastructure projects.	Utilities, city agencies, and other stakeholders integrate and collaborate on all urban forestry efforts, including planning, site work, and outreach/education.
State Engagement	State departments/agencies are aware of and vested in the urban forest and cooperates to advance citywide urban forest goals and objectives.	State departments/agencies and City agencies act independently of urban forestry efforts. No coordination exists.	State department/agencies and City agencies have engaged in dialogues about urban forestry efforts with respect to capital improvement and infrastructure projects.	State departments/agencies, City agencies, and other stakeholders integrate and collaborate on all urban forestry efforts, including planning, site work, and outreach/education.
Public Awareness	The general public understands the benefits of trees and advocates for the role and importance of the urban forest.	Trees are generally seen as a nuisance, and thus, a drain on city budgets and personal paychecks.	Trees are generally recognized as important and beneficial.	Trees are seen as valuable infrastructure and vital to the community's well-being. The urban forest is recognized for the unique environmental, economic, and social services its provides to the community.
Regional Collaboration	Neighboring communities and regional groups are actively cooperating and interacting to advance the region's stake in the city's urban forest.	Little or no interaction between neighboring communities and regional groups.	Neighboring communities and regional groups share similar goals and policy vehicles related to trees and the urban forest.	Regional urban forestry planning, coordination, and management is widespread.

A Sustainable Urban Forest Indicators: The Management Approach

Indicators of a Sustainable Urban Forest	Overall Objective or Industry Standard	Performance Levels		
		Low	Medium	High
Tree Inventory	Comprehensive, GIS-based, current inventory of all intensively-managed public trees to guide management, with mechanisms in place to keep data current and available for use. Data allows for analysis of age distribution, condition, risk, diversity, and suitability.	No inventory or out-of-date inventory of publicly-owned trees.	Partial or sample-based inventory of publicly-owned trees, inconsistently updated.	Complete, GIS-based inventory of publicly-owned trees, updated on a regular, systematic basis.
Canopy Assessment	Accurate, high-resolution, and recent assessment of existing and potential city-wide tree canopy cover that is regularly updated and available for use across various departments, agencies, and/or disciplines.	No tree canopy assessment.	Sample-based canopy cover assessment, or dated (over 10 years old) high resolution canopy assessment.	High-resolution tree canopy assessment using aerial photographs or satellite imagery.
Management Plan	Existence and buy-in of a comprehensive urban forest management plan to achieve city-wide goals. Re-evaluation is conducted every 5 to 10 years.	No urban forest management plan exists.	A plan for the publicly-owned forest resource exists but is limited in scope, acceptance, and implementation.	A comprehensive plan for the publicly owned forest resource exists and is accepted and implemented.
Risk Management Program	All publicly-owned trees are managed for maximum public safety by way of maintaining a city-wide inventory, conducting proactive annual inspections, and eliminating hazards within a set timeframe based on risk level. Risk management program is outlined in the management plan.	Request-based, reactive system. The condition of publicly-owned trees is unknown.	There is some degree of risk abatement thanks to knowledge of condition of publicly-owned trees, though generally still managed as a request-based reactive system.	There is a complete tree inventory with risk assesment data and a risk abatement program in effect. Hazards are eliminated within a set time period depending on the level of risk.
Maintenance Program of Publicly-Owned Trees (trees managed intensively)	All intensively-managed, publicly-owned trees are well maintained for optimal health and condition in order to extend longevity and maximize benefits. A reasonable cyclical pruning program is in place, generally targeting 5 to 7 year cycles. The maintenance program is outlined in the management plan.	Request-based, reactive system. No systematic pruning program is in place for publicly-owned trees.	All publicly-owned trees are systematically maintained, but pruning cycle is inadequate.	All publicly-owned trees are proactively and systematically maintained and adequately pruned on a cyclical basis.
Maintenance Program of Publicly-Owned Natural Areas (trees managed extensively)	The ecological structure and function of all publicly-owned natural areas are protected and enhanced while accommodating public use where appropriate.	No natural areas management plans are in effect.	Only reactive management efforts to facilitate public use (risk abatement).	Management plans are in place for each publicly-owned natural area focused on managing ecological structure and function and facilitating public use.
Planting Program	Comprehensive and regular y updated tree protection ordinance with enforcement ability is based on community goals. The benefits derived from trees on public and private property are ensured by the enforcement of existing policies.	Tree establishment is ad hoc.	Tree establishment is consistently funded and occurs on an annual basis.	Tree establishment is directed by needs derived from a tree inventory and other community plans and is sufficient in meeting canopy cover objectives.
Tree Protection Policy	Establish a tree population suited to the urban environment and adapted to the overall region. Suitable species are gauged by exposure to imminent threats, considering the "Right Tree for the Right Place" concept and invasive species.	No tree protection policy.	Policies are in place to protect trees, but the policies are not well-enforced or ineffective.	Protections policies ensure the safety of trees on public and private land. The policies are enforced and supported by significant deterrents and shared ownership of city goals.
City Staffing and Equipment	Adequate staff and access to the equipment and vehicles to implement the management plan. A high level urban forester or planning professional, strong operations staff, and solid certified arborist technicians.	Insufficient staffing levels, insufficiently-trained staff, and/or inadequate equipment and vehicle availability.	Certified arborists and professional urban foresters on staff have some professional development, but are lacking adequate staff levels or adequate equipment.	Multi-disciplinary team within the urban forestry unit, including an urban forestry professional, operations manager, and arborist technicians. Vehicles and equipment are sufficient to complete required work.
Funding	Appropriate funding in place to fully implement both proactive and reactive needs based on a comprehensive urban forest management plan.	Funding comes from the public sector only, and covers only reactive work.	Funding levels (public and private) generally cover mostly reactive work. Low levels of risk management and planting in place.	Dynamic, active funding from engaged private partners and adequate public funding are used to proactively manage and expand the urban forest.
Disaster Preparedness & Response	A disaster management plan is in place related to the city's urban forest. The plan includes staff roles, contracts, response priorities, debris management and a crisis communication plan. Staff are regularly trained and/or updated.	No disaster response plan is in place.	A disaster plan is in place, but pieces are missing and/or staff are not regularly trained or updated.	A robust disaster management plan is in place, regularly updated and staff is fully trained on roles and processes.
Communication	Effective avenues of two-way communication exist between the city departments and between city and its citizens. Messaging is consistent and coordinated, when feasible.	No avenues are in place. City departments and public determine on an ad-hoc basis the best messages and avenues to communicate.	Avenues are in place, but used sporadically and without coordination or only on a one-way basis.	Avenues are in place for two way communication, are well-used with targeted, coordinated messages.