



# City of Patterson Urban Forest Master Plan 2019



# City of Patterson

## Urban Forest Master Plan 2019



**Prepared for:**

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City of  
**PATTERSON**  
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# Executive Summary

## Scope & Purpose

The purpose of the Urban Forest Master Plan (UFMP) is to provide a guide for managing, enhancing, and growing Patterson’s community tree resource over the next 25 years. The plan also includes objectives for long-range planning to promote sustainability, species diversity, and increased canopy cover.

Community trees are the publicly-managed trees along streets, in parks, and at City facilities. Recognizing the significance of environmental and socioeconomic benefits provided by trees and their relationship with community values and high quality of life, the Plan aims to:

- Quantify the value and benefit of the urban forest
- Ensure that policies and regulations support the protection, preservation, and sustainability of the urban forest
- Ensure interdepartmental cooperation and communication about urban forestry related activities and maintenance operations

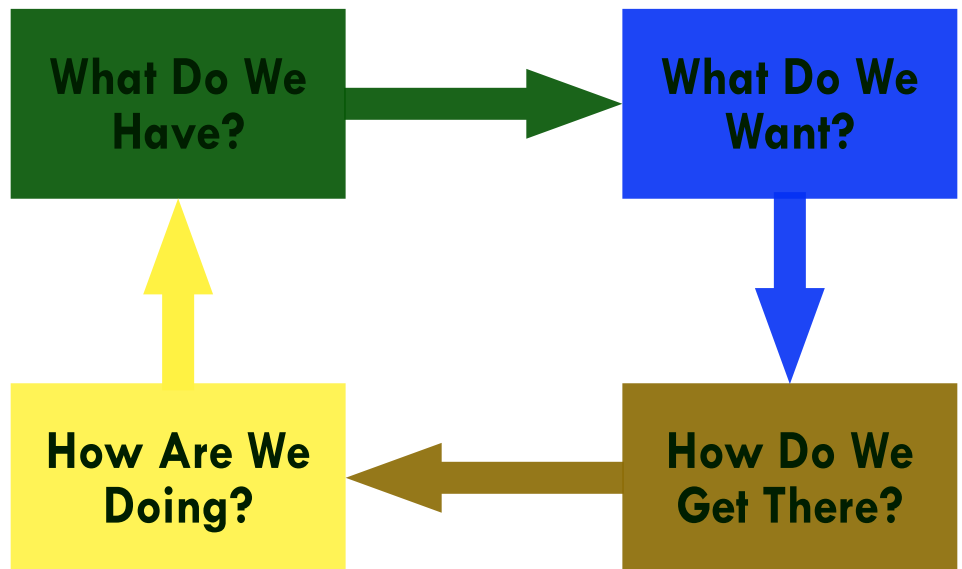
- Promote community engagement and appreciation for the urban forest
- Encourage and facilitate collaboration between the City and nonprofit organizations, educational institutions, utilities, neighborhood and business groups, volunteers, and other local and regional organizations
- Ensure cost-efficient programming

The UFMP provides specific objectives and strategies for managing community trees, as well as preserving and enhancing canopy cover across Patterson on public property.

As of a 2014 public tree inventory, Patterson’s community urban forest includes an estimated 12,647 publicly-managed trees on streets, in parks, and at City facilities. Along with their aesthetic contribution, these trees provide valuable and critical services to the community. These services include benefits to air quality, water quality, energy savings, carbon management, socioeconomics, public health, and wildlife habitat.

The structure and organization of the UFMP are based on the understanding of what we have, what we want, how we get there, and how we are doing. This structure, referred to as adaptive management, is commonly used for resource planning and management (Miller, R.W., 1988) and provides a good conceptual framework for managing community forest resources.

The Plan development process involved a comprehensive review and assessment of the existing community tree resource,



including composition, value, and environmental benefits. The process explored community values, existing regulations, and policies that protect community trees.

In addition to forestry staff, there are multiple stakeholders, internal and external, who play a role in the planning, design, care, and advocacy of the community forest. Stakeholders include local businesses, nonprofit and volunteer groups, and community members. Specifically, outreach focused on the stakeholders that are likely to be most affected by the UFMP, including the City Council, Chamber of Commerce, Patterson Recreation & Community Services, local businesses, Patterson Joint Unified School District, and the Patterson Historical Society. Each of these stakeholders contributed to the development of this Plan.

## What Do We Have?

With a current population of 20,875, Patterson is a rural, small town surrounded by agricultural land. With agriculture as a primary economic base, the relationship with nature plays a significant role in Patterson's history. The original urban layout of Patterson is unique to the area because the town was modeled after globally famous cities like Washington D.C. and Paris, using a series of circles and radiating streets. Major streets were planted with Palm, Eucalyptus and Sycamore trees. This beautiful urban structure provides the perfect foundation for a beautiful and successful population of street trees.

Currently, the city of Patterson has four maintenance workers on the urban forestry crew, and one full-time urban forestry supervisor.

The City wishes to cultivate an even stronger urban forestry program. Recently, the City collected data to fully understand the present state of the urban forest. The City commissioned a public tree inventory, and in 2017, evaluated the resulting data with a Resource Analysis. In 2017, an Urban Tree Canopy Assessment quantified canopy and other land covers based on aerial imagery. Input from community

stakeholders revealed some of the biggest challenges facing the urban forest today. The primary themes for biggest challenges included: community apathy and lack of tree care, the long-term use and care of Modesto ash trees, the lasting effects of drought, and the lack of regular and attentive care for newly planted trees. With these tools and a healthy, established community forest, Patterson is poised to realize increasing environmental benefits and value from its publicly-managed trees.

**Table 1: Benchmark Values**

<b>Public Urban Forest</b>	
Number of Public Trees	12,647
Replacement Value of Public Trees	\$ 27,550,046
Average Public Trees Per Acre	2.5
<b>Public Tree Species Diversity</b>	
Total Number of Unique Species	157
Prevalence of Top Ten Species	66.5%
Species Exceeding Recommended 10%	1
<b>Most Common Public Trees as % of All Public Trees</b>	
Chinese pistache ( <i>pistacia chinensis</i> )	17.5%
London planetree ( <i>platanus X acerifolia</i> )	8.1%
Japanese zelkova ( <i>zelkova serrata</i> )	7.7%
<b>Citywide Tree Canopy Cover</b>	
Tree Canopy Cover	21.3%
Impervious Surfaces	33.6%
Maximum Urban Tree Canopy	33.4%
<b>Annual Benefits from Public Trees</b>	
Property Values	\$ 925,536
Avoided Stormwater Runoff	\$ 50,203
Carbon Dioxide Reduced	\$ 13,485
Energy Saved	\$ 138,837
Air Quality Benefits	\$ 144,572
<b>Total Annual Benefits</b>	<b>\$ 1,272,632</b>

## What Do We Want?

The city of Patterson intends to support the growth, well-being, and sustainability of the community by preserving and enhancing natural resources, as well as improving the overall resilience of the urban forest. Patterson's community vision places a focus on preserving natural resources and promoting sustainability and a high quality of life for residents and visitors. The community's urban forest plays a vital role in this vision. 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. This includes the proactive identification of risk and mitigation measures to promote public safety and reduce liability.

Trees are living organisms, constantly changing and adapting to their environment

as well as 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 when they become over-mature. 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 and existing funding, along with reorganizing staffing.

## How Do We Get There?

The UFMP identifies three (3) guiding principles and ten (10) goals for preserving the health, value, services, and sustainability of Patterson's community urban forest. Each of these goals is

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 success of the UFMP will be measured through the realization of objectives and demonstrated through increased value and environmental benefits in the community tree resource and enhancement of tree canopy throughout the city of Patterson. The UFMP identifies methods of measurement and a target date for each of the strategies. The greatest measurement of success for the UFMP will be how successful it is in meeting community expectations for the care and preservation of the community tree resource.



# Guiding Principles

## Sustainable and Resilient Urban Forest

## Clear Policies and Strong Outreach

## Optimize Program Organization and Funding

### Goals

### Goals

### Goals

1. Foster a sustainable urban forest resource
2. Continue to build a comprehensive urban forest planting strategy
3. Promote tree preservation and protection

1. Establish comprehensive, user-friendly regulations and policies
2. Preserve and enhance tree canopy
3. Rebrand trees as community infrastructure
4. Increase outreach, engagement, and education to the community

1. Optimize funding and identify new opportunities
2. Increase training resources for the urban forestry group
3. Review and measure attainment of the Urban Forest Master Plan



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# Introduction

Trees play an essential role in Patterson, providing numerous tangible and intangible benefits to residents, visitors, neighboring communities, and wildlife. Research demonstrates that healthy urban trees can improve the local environment and lessen the impacts of urbanization and industry. Trees improve air quality, reduce energy consumption, help manage stormwater, reduce erosion, provide critical habitat for wildlife, and promote a connection with nature.

In addition to these direct improvements, healthy urban trees increase the overall attractiveness of a community and have been proven to increase the value of local real estate by 7 to 10% (Dwyer, et al, 1992). Trees in retail districts promote longer and more frequent shopping and greater sales (Wolf, 2007). Urban trees support a more livable community, fostering psychological health and providing residents with a greater sense of place (Ulrich, 1986; Kaplan, 1989). Community trees, both public and private, soften the urban hardscape by providing a green sanctuary and making Patterson a more enjoyable place to live, work, and play.

First recognized in 2016 by the National Arbor Day Foundation as a Tree City USA, Patterson has demonstrated that public trees

are a valued community resource, a key component of the urban infrastructure, and a part of the City's identity. To demonstrate this valued resource, the City celebrates California Arbor Week annually during the second week of March.

## Community

The city of Patterson is located in Stanislaus County, in the northern region of the San Joaquin Valley. It is bounded by Interstate-5 and Diablo Grande Open Space to the west, with State Highway 33 running through the eastern side of the City. Patterson grows nearly 95,000 tons of apricots annually. As the apricot capital of the world, downtown Patterson hosts the Apricot Fiesta on the first weekend every June. Agriculture is the primary economy for the City, with apricots, walnuts, and almonds as the primary crops (Patterson Tourism, 2017).

The City has an average summer high of about 94 degrees Fahrenheit (F) in July, and a winter low of about 38 degrees F. Spring and autumn seasons are usually milder, with temperatures reaching an average high of about 80 degrees F. The area experiences a Mediterranean climate, with warm, dry summers and cool, wet winters. Average annual rainfall is approximately eleven (11) inches (Patterson, 2017).

Patterson's population, as of the 2010 Census, included 20,413 people. The population is diverse in age, with 34% under the age of 18, 11% aged 18 to 24, 50% aged 25 to 64, and 5% aged 65 years of age or older. The median age is 30 years. Of the 6,328 housing units, 68% are owner-occupied and 32% are occupied by renters.

Patterson has a rich history, gaining its name from John D. Patterson, who willed over 18,000 acres of land to his sons Thomas and William in 1902. This land was sold to the Patterson Ranching Company in 1908 and subdivided into ranches. This division gives the City its characteristic spoke-and-wheel street pattern, with the City's historic Plaza Center Building (built 1909-10) still standing in the center of the circle.

Determined to make Patterson different from most, its founder modeled the town after the cities of Washington D.C. and Paris, France, using a series of circles and radiating streets. Major streets were planted with eucalyptus, sycamore and a variety of palm trees. One of the most dominating palm species is the Canary Island date palm. The city of Patterson has a long history with the Canary Island date palm as they line the two main entrances into the city.

Stanislaus County incorporated the City in 1919. Patterson is a community which remembers and celebrates its history as it progresses into the future (Patterson, 2017).

## Mission Statement

The Mission Statement of the City is:

*“The city of Patterson is dedicated to preserving and enhancing our quality of life, maintaining our small town atmosphere, providing a high level of responsive local government services, promoting inclusive public participation, and responsibly planning our future while embracing our heritage.”*

The mission of the Public Works Department is:

*“To provide the highest level of service to the residents of Patterson while maintaining the community’s infrastructure in the most cost-effective manner possible. We constantly strive to improve our customer service and efficiency.”*

With this Plan, the city of Patterson intends to advance these missions by supporting the health, quality of life, and sustainability of the community. This will be accomplished by providing high quality services through cost-effective management strategies to strengthen the urban forest.



## Benefits of Urban Trees & Canopy Cover

Trees and urban forests 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, often producing more leaf surface and canopy cover area each year. The amount and distribution of leaf surface area are the driving forces behind the urban forest’s ability to produce benefits for the community (Clark et al, 1997). Benefits include:

### Air Quality

Urban trees improve air quality in five fundamental ways:

- Reducing particulate matter (e.g., dust and smoke)
- Absorbing gaseous pollutants
- Providing shade and transpiration
- Reducing power plant emissions
- Increasing oxygen levels

Urban trees protect and improve air quality by intercepting particulate matter (PM10), including dust, ash, pollen, and smoke. The particulates are filtered and held in the tree canopy where they are eventually washed harmlessly to the ground. Trees and forests absorb harmful gaseous pollutants like ozone

(O<sub>3</sub>), nitrogen dioxide (NO<sub>2</sub>), and sulfur dioxide (SO<sub>2</sub>). Shade and transpiration reduce the formation of O<sub>3</sub>, which is created during higher temperatures. In fact, scientists are now finding that some trees may absorb more volatile organic compounds (VOCs) than previously thought (Karl, T. et al 2010; Science NOW, 2010). VOCs are a class of carbon-based particles emitted from automobile exhaust, lawnmowers, and other human activities.

By reducing energy needs, trees also reduce emissions from the generation of power. Through photosynthesis, trees and forests increase oxygen levels.

### Energy Savings

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

- Shading dwellings and hardscape
- Transpiration
- Wind reduction

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. Through shade and transpiration, trees and other vegetation within an urban setting modify the environment and reduce heat island effects.

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 reduce wind speeds by up to 50% and influence the movement of warm air and pollutants along streets and out of urban canyons. 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).

Reducing energy needs has the additional bonus of reducing carbon dioxide (CO<sub>2</sub>) emissions from fossil fuel power plants.

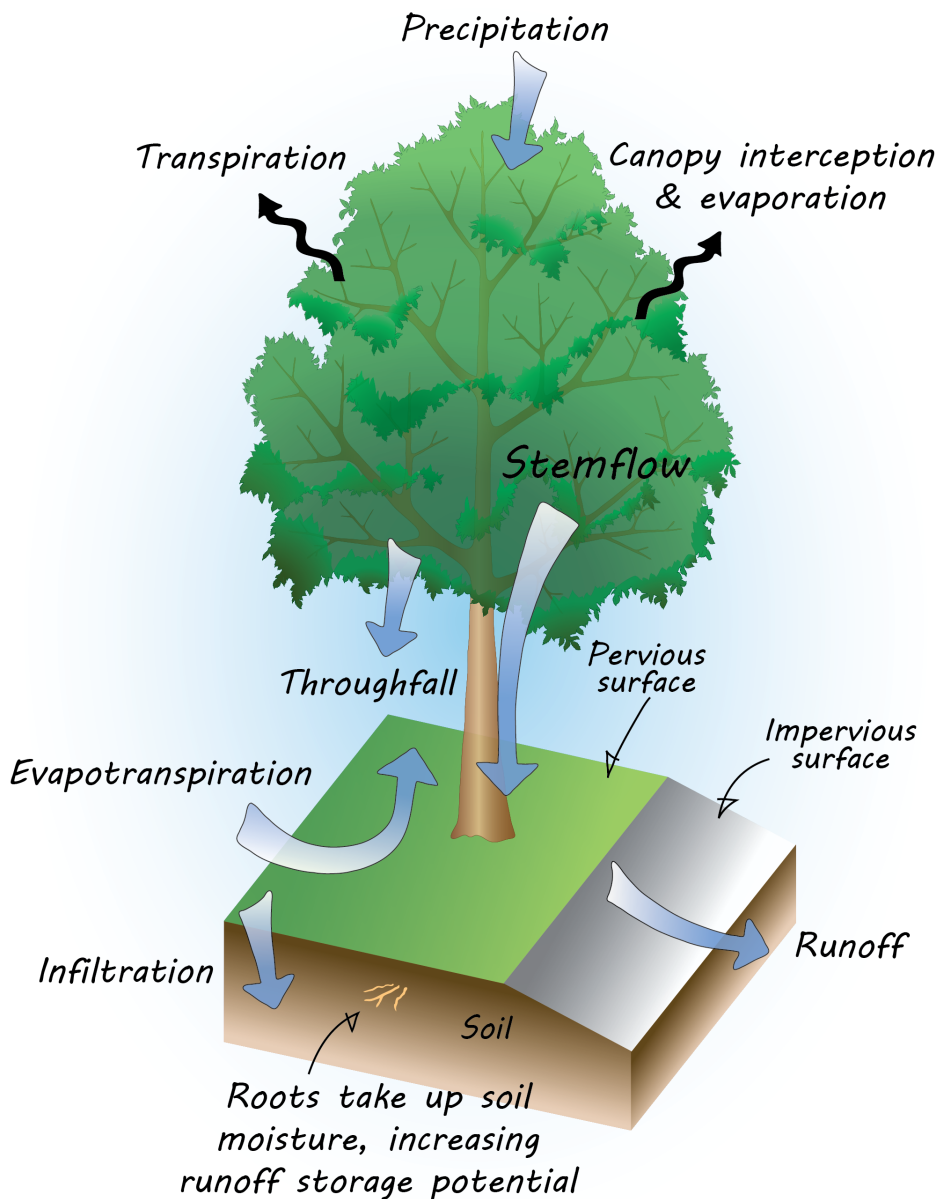
## Water Quality

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. California communities adhere to the Municipal Storm Water Program, which regulates storm water discharges from municipal separate storm sewer systems (MS4s) throughout California. Storm water permits are required for discharges from



an MS4 serving a population of 100,000 or more.

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.

## Carbon 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<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>), 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<sub>2</sub>, have increased by 25% (U.S. Energy Information Administration).

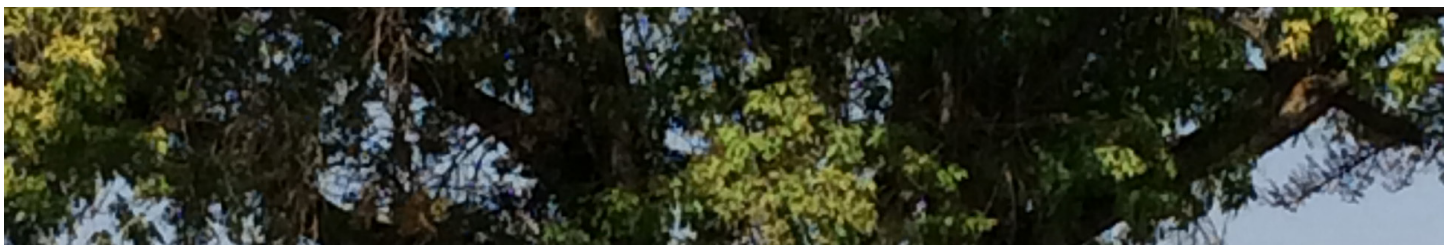
California's Global Warming Solutions Act (AB 32) passed in 2006 set the 2020 GHG emissions reduction goal into law. In December 2007, the California Air Resources Board (ARB) approved the 2020 emission limit of 427 million metric tons of carbon dioxide equivalent (CO<sub>2</sub>e). As of 2007, regulations 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<sub>2</sub>) in two ways:

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

Trees and forests directly reduce CO<sub>2</sub> in the atmosphere through growth and sequestration of CO<sub>2</sub> in woody and foliar biomass. Indirectly, trees and forests reduce CO<sub>2</sub> by lowering the demand for energy and reducing the CO<sub>2</sub> emissions from the consumption of natural gas and the generation of electric power.



## Aesthetic, Habitat, Socioeconomic, and Health Benefits

While perhaps the most difficult to quantify, the aesthetic and socioeconomic benefits from trees are among their greatest gifts, including:

- Beautification, comfort, and aesthetics
- Shade and privacy
- Wildlife habitat
- Opportunities for recreation
- Reduction in violent crime
- Creation of a sense of place and history
- Human health
- Reduced illness and reliance on medication and quicker recovery from injury or illness

Some of these benefits are captured as a percentage of property values, through higher sales prices where individual trees and forests are located.

While some of the benefits of forests are intangible and/or difficult to quantify (e.g., the impacts on physical and psychological health, crime, and violence), empirical evidence of these benefits does exist (Kaplan, 1989; Ulrich, 1986). Exposure to nature, including trees, has a healthy impact on humans, such as increased worker productivity, higher test scores, reduced

symptoms of attention-deficit hyperactivity disorder (ADHD), and faster surgery recovery times. In addition, trees and forests have positive economic benefits for retailers. There is documented evidence that trees promote better business by stimulating more frequent and extended shopping as well as a willingness to pay more for goods and parking (Wolf, 2007).

In addition, trees and forests provide critical habitat (e.g., foraging, nesting, spawning, etc.) for mammals, birds, fish, and other aquatic species, along with limitless opportunities for recreation, offering a healthful respite from the pressures of work and everyday stress.



## 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. This 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 the National Tree Benefit Calculator ([www.treebenefits.com/calculator](http://www.treebenefits.com/calculator)) or with i-Tree Design ([www.itreetools.org/design](http://www.itreetools.org/design)).



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# What Do We Have?

## History of Urban Forestry in Patterson

The history of the Patterson Township began with a Mexican land grant given to two brothers in 1844. The town was entirely sold to T.W. Patterson and family by 1908. Patterson decided to build his town in the same way as Paris and Washington D.C., laying out a series of circles with radiating streets. Over the coming years Patterson became a vibrant farming community in California's Central Valley.

The Patterson Colony map was filed with the Stanislaus County Recorder's Office on December 13, 1909. Sales of the ranch properties and city lots commenced. Patterson was the third city in Stanislaus County to incorporate on December 22, 1919.



## Recreation Department

- Department was created in 1970.
- Department had a full-time director. It was funded 50% with the school district. Once the agreement went away, the director position became part-time.
- Director position became full-time once again in 1997 when Adrienne Chaney was hired.
- In 2003, the department became the Parks and Recreation Department.
- In 2012, Public Works took over the Parks division and the Recreation Department became Recreation and Community Services.

## Foundation of Public Works Department

- Department was created in the 70s.
- For many years, a single crew took care of all the streets, garbage, trees and water services. The street sweeping

division and a garbage/solid waste crew were the only ones that were separate. These last services later got contracted out.

- In 2006, a reorganization occurred within the department and more divisions were created and still exist today. Water Operations, Urban Forestry, Streets & Collections, and Water Quality Control Facility.
- In 2012, Public Works took over the Parks division again.
- Although he is no longer the supervisor for the Urban Forestry Division, Parks Supervisor Will Barrera is the only certified arborist on staff.

The Urban Forestry Division was created in 2006 as part of a Public Works Department reorganization.

In 2013, the city of Patterson received a grant award from the Department of Forestry and Fire Protection (CalFire) to conduct a citywide tree inventory. The purpose of the grant program was to fund the creation and implementation of early state urban forestry projects or programs. This grant award was made possible by two different funding sources. The first was Proposition 84: The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act

of 2006, and the second was the city of Patterson.

The inventory of publicly-maintained trees was completed in 2014, and includes approximately 12,647 trees on streets, in parks, and at City facilities. Community trees provide a substantial portion of the overall urban forest canopy benefits, and residents rely on the city of Patterson's Public Works Department to protect and maintain this vital resource. Within the Department, the

Urban Forestry Division is responsible for the maintenance and care of street trees. The Parks Division oversees trees within the parks and streetscapes.

In February 2016, the city of Patterson, was awarded the prestigious award of Tree City USA for the first time by the Arbor Day Foundation.

From 2017 to 2019 the city will plant more than 700 trees while maintaining water conservation goals, thanks to a partnership

with CalFire and the Greenhouse Gas Reduction Fund. It is expected that this grant will fully fund the planting of these trees. This CalFire Tree Planting project examined the 2014 citywide tree inventory and determined there were approximately 350 vacant tree sites. It is the city's goals to fill in those vacancies and remove and replace all dead trees by 2019. These trees will be planted in the rights of way, in parks, and in schools. The city of Patterson has 480 trees left to plant.



# Community Tree Resource

Patterson’s community urban forest includes 12,647 public trees on streets, in parks, and at city facilities. It would cost over \$27.6 million to replace these trees with trees of similar size, species, and condition (Resource Analysis, 2017).

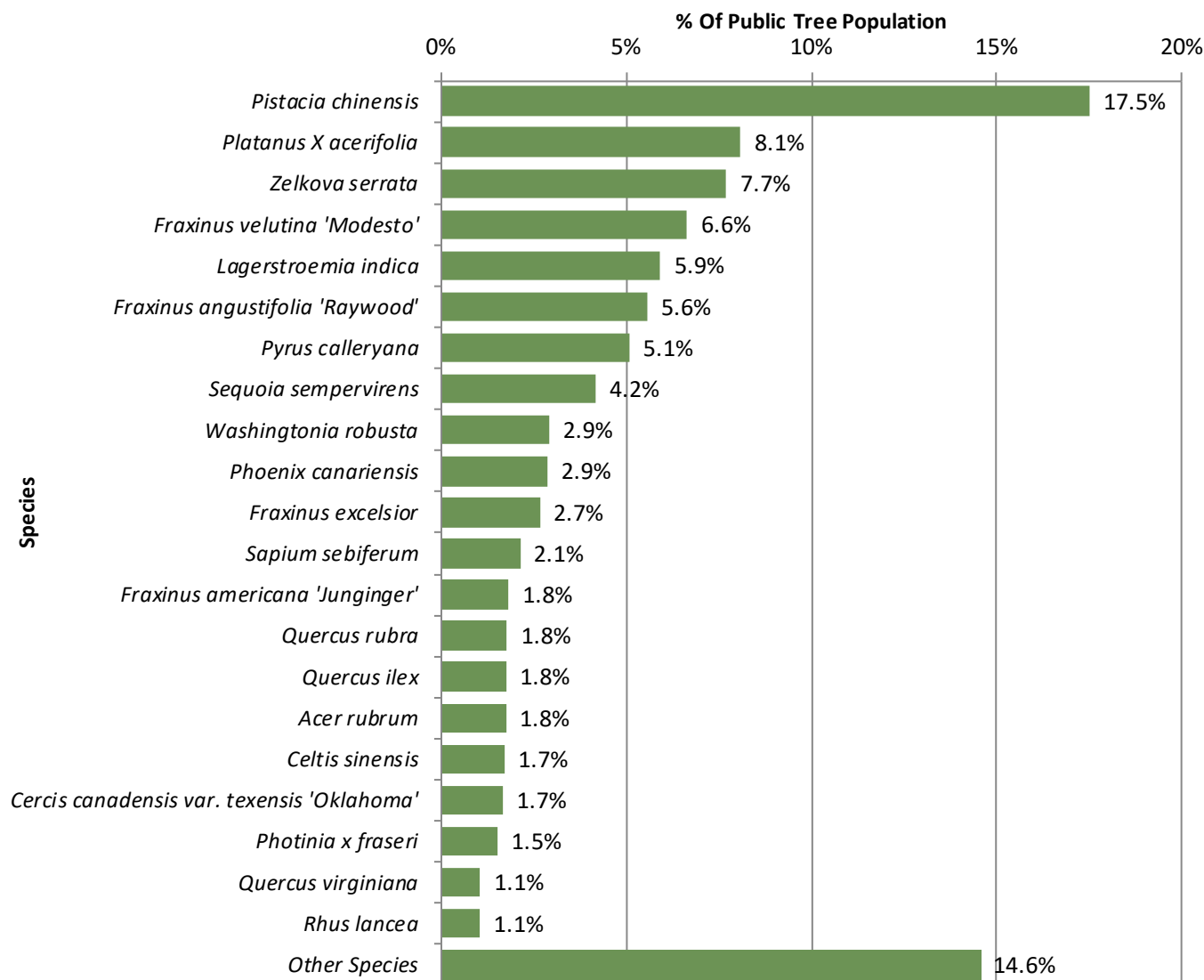
## Composition

Understanding the structure, composition, and condition of an urban forest resource is

essential to developing effective management strategies. The Urban Forest Resource Analysis (2017) found the following characteristics define Patterson’s community urban forest.

- Tree resource includes 12,647 public trees.
- More than 158 unique tree species were identified in the inventory.
- The predominant tree species are Chinese pistache (*Pistacia* chinensis, 18%), London planetree (*Platanus acerifolia*, 8%), and Japanese zelkova (*Zelkova serrata*, 8%). These three trees comprise 34% of the total population.
- More than half of the trees are under eight inches (8”) DBH (54%) and 8% are over twenty-four (24”), indicating a mix of young, established populations along with a mature

**Chart 1: Most Prevalent Public Tree Species**



population providing maximum benefits.

- 56% of trees are in good condition.
- Community trees are providing 164 acres of canopy cover, about 3% of the overall land area in Patterson.
- The current stocking level is 97.8%, based on 12,932 planting sites, including 12,647 trees and 285 vacant sites and stumps.

gross value of nearly \$1.3 million per year. These benefits include:

- The benefits from Patterson’s community trees to property value, health, aesthetics, and socioeconomics is \$925,536, an average of \$73 per tree.
- Community trees reduce electricity and natural gas use through shading and climate effects for an overall benefit of \$138,837, an average of \$11 per tree.
- Each year, community trees sequester a net total of 899 tons of atmospheric CO<sub>2</sub> tons for a net value

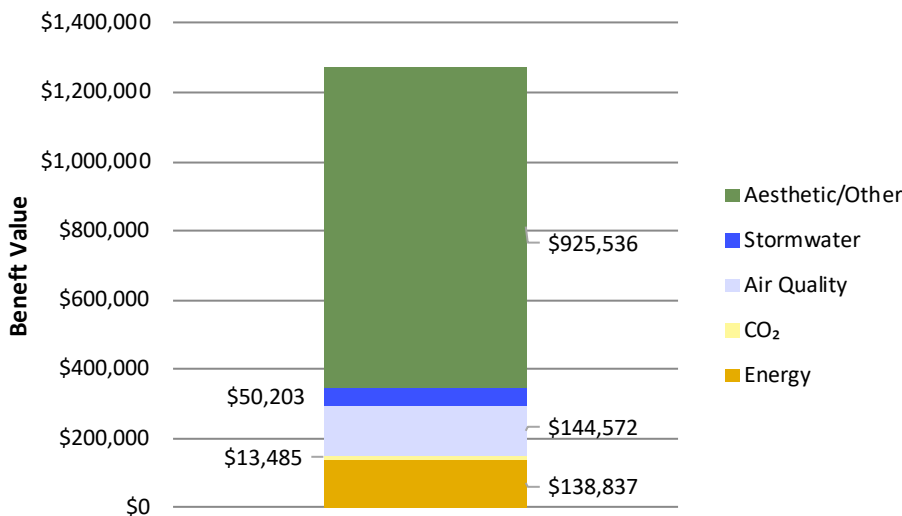
of \$13,485 and a net average of \$1.07 per tree.

- Each year community trees remove 5.3 tons of air pollutants with a gross value of \$144,572.
- Patterson’s community trees intercept over 6.4 million gallons of stormwater annually for a total value of over \$50,203, an average of \$3.97 per tree.
- When the annual investment of \$710,753 for the management of the community urban forest is considered, the annual net benefit (benefits minus investment) for the community is \$561,879, an average of \$44.43 per tree. **In other words, for every \$1 invested in public trees, the community receives \$1.79 in benefits.**

## Benefits

Annually, Patterson’s community trees provide cumulative benefits to the community at an average value of \$101 per tree, for a total

**Chart 2: Annual Benefits from Public Trees**



**Table 2: Municipal Investments for Public Trees**

Investment	Total (\$)	\$/tree	\$/capita
Administration	\$83,614	6.61	3.70
Inspection/Service	\$7,500	0.59	0.33
Litter Clean-up	\$14,000	1.11	0.62
Other Costs	\$605,639	47.89	26.81
<b>Total Costs</b>	<b>\$710,753</b>	<b>56.20</b>	<b>31.46</b>

## Summary Benefits

- Total Annual Benefits: \$1.3 million
- Average Annual Benefit per Tree: \$100.63
- Annual Value of Benefits per Capita: \$56.34

## Benefit versus Investment Ratio

When the City's annual estimated expenditure (or investment) of \$710,753 in this resource is considered, the net annual benefit (benefits minus investment) to the City is \$561,879. The average net benefit for an individual community tree in Patterson is \$44.43 and the per capita net benefit is \$24.87. Thus, for every \$1 invested in community trees, Patterson is currently receiving \$1.79 in benefits.

## Maximizing Benefits

An urban forest is a living and dynamic resource, changing over time and in constant response to its environment. The health and stability of the urban forest can be influenced by many factors, including pruning, irrigation, climate fluctuations, emerging pests and disease, as well as development and new tree planting.

Annual benefits are based on many composition traits (e.g., size of trees, number of trees,

condition, and species) of the current inventory. Maximizing the use of available planting space by gradually increasing the stocking level will increase the overall benefits over time. Where space allows, every effort should be made to plant large-stature species as greater canopy cover and canopy density are the key drivers of environmental benefits. In addition to filling vacant planting sites, it is also important to plan for the replacement of existing mature trees and species that are being phased out of the inventory (e.g., Modesto ash).

## Sustainability

A sustainable urban forest is healthier, more resilient to pests, disease, and climate fluctuations and as a result, more cost-effective. As urban forests evolve over time, managers revise species recommendations based on past performance and emerging prospects. Because trees are relatively long-lived organisms, urban forests like Patterson's are often a combination of well-adapted, high-performance species mixed with some species that may have proved less desirable. Nevertheless, the vital benefits of tree canopy require the preservation of existing, healthy trees in most situations.

When appropriate, planting native and adapted species is a good strategy for building a sustainable urban forest. The urban environment presents many challenges to tree health, including restricted planting sites, poor and compacted soils, pollution, and water limitations. Selecting appropriate species



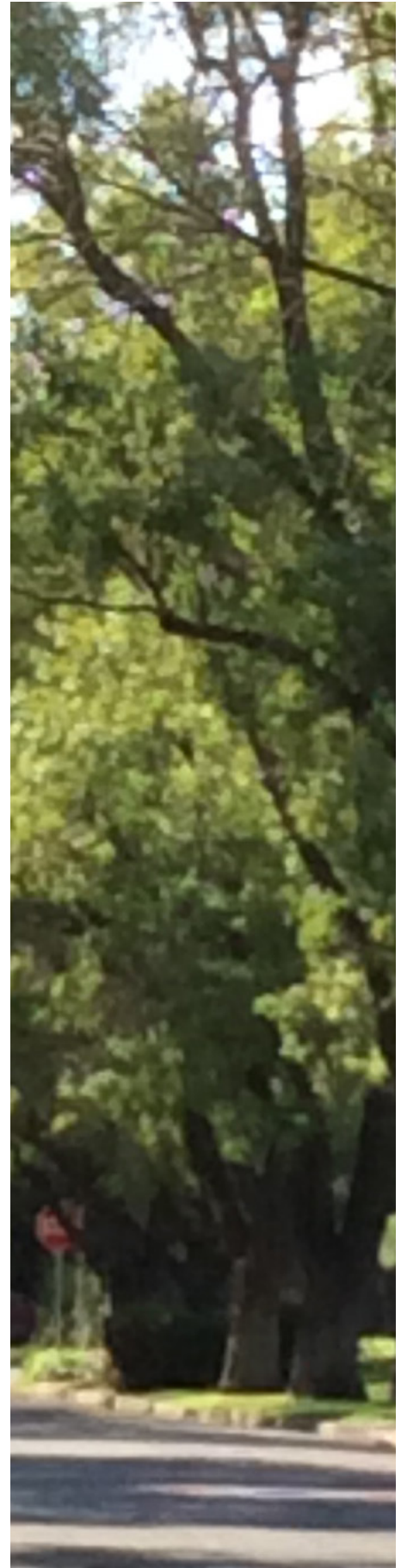
can help control maintenance costs, reduce damage to infrastructure, and manage the need for pest and disease control measures. A diverse population can significantly increase overall performance and resiliency in the urban forest.

While it may be assumed that native species are ideally suited to the local climate, it is important to recognize that urban environments are unique, with greater impervious surfaces and different hydrologic patterns. Selecting the “right tree for the right place” requires consideration of multiple factors, including site and soil characteristics, irrigation infrastructure, landscape objectives, and tree density.

A diverse population can help to minimize detrimental consequences in the event of storms, drought, disease, pests, or other stressors that can severely affect an urban forest and the flow of benefits and costs over

time. Catastrophic pathogens, such as Dutch elm disease (*Ophiostoma ulmi*), emerald ash borer (*Agrilus planipennis*), Asian long-horned beetle (*Anoplophora glabripennis*), and sudden oak death (SOD) (*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.

The widely accepted rule in forestry is that no single species should represent greater than 10% of the total population, and no single genus more than 20% (Clark et al, 1997). Future planning should promote tree diversity in neighborhoods so that an area will not lose all canopy if one species becomes susceptible to an emerging pest or disease or becomes undesirable for performance reasons.



## Tree Canopy Cover

A canopy assessment was completed in August 2017 using a heads-up digitizing approach and high resolution (4.8 inch), leaf-on aerial imagery. Both public and private trees are included. The assessment resulted in a Geographical Information Systems (GIS) map detailing the location and extent of existing tree canopy. This information establishes a benchmark to measure the success of long-term objectives and can be combined with GIS layers to determine:

- Changes in tree canopy over time and in relation to growth and development.
- Existing canopy at many levels, including land use, zoning, parking lots, parcels, etc.
- Locations of planting sites and strategies to increase canopy in underserved areas.

Understanding the location and extent of tree canopy is key to developing and implementing sound management strategies that promote the sustainability of Patterson’s urban forest resource and the benefits it provides. The data enables managers to strike a balance between urban development and tree preservation, and aid in identifying and assessing urban forestry opportunities. Spatial understanding of the past, present, and potential for tree canopy is a valuable tool to help managers align

urban forestry management with the community’s vision for Patterson’s urban forest. The Water Quality Control Facility located east of the main city was not included in the following maps.

## Canopy Cover Summary

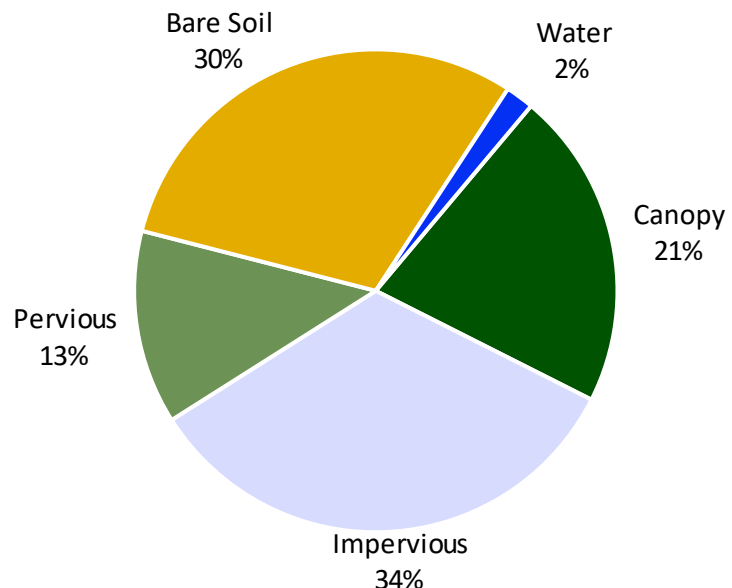
Patterson is a rural, small town surrounded by agricultural land with a history of ranching. Patterson’s land cover pattern is mainly comprised of bare soil, canopy, and pervious surfaces. Using remote image sensing and GIS analysis, Davey Resource Group (DRG) determined that the following information characterizes land cover within the city of Patterson:

- 21.3% (1,092 acres) overall tree canopy, including trees and woody shrubs
- 12% (616 acres) potential plantable area

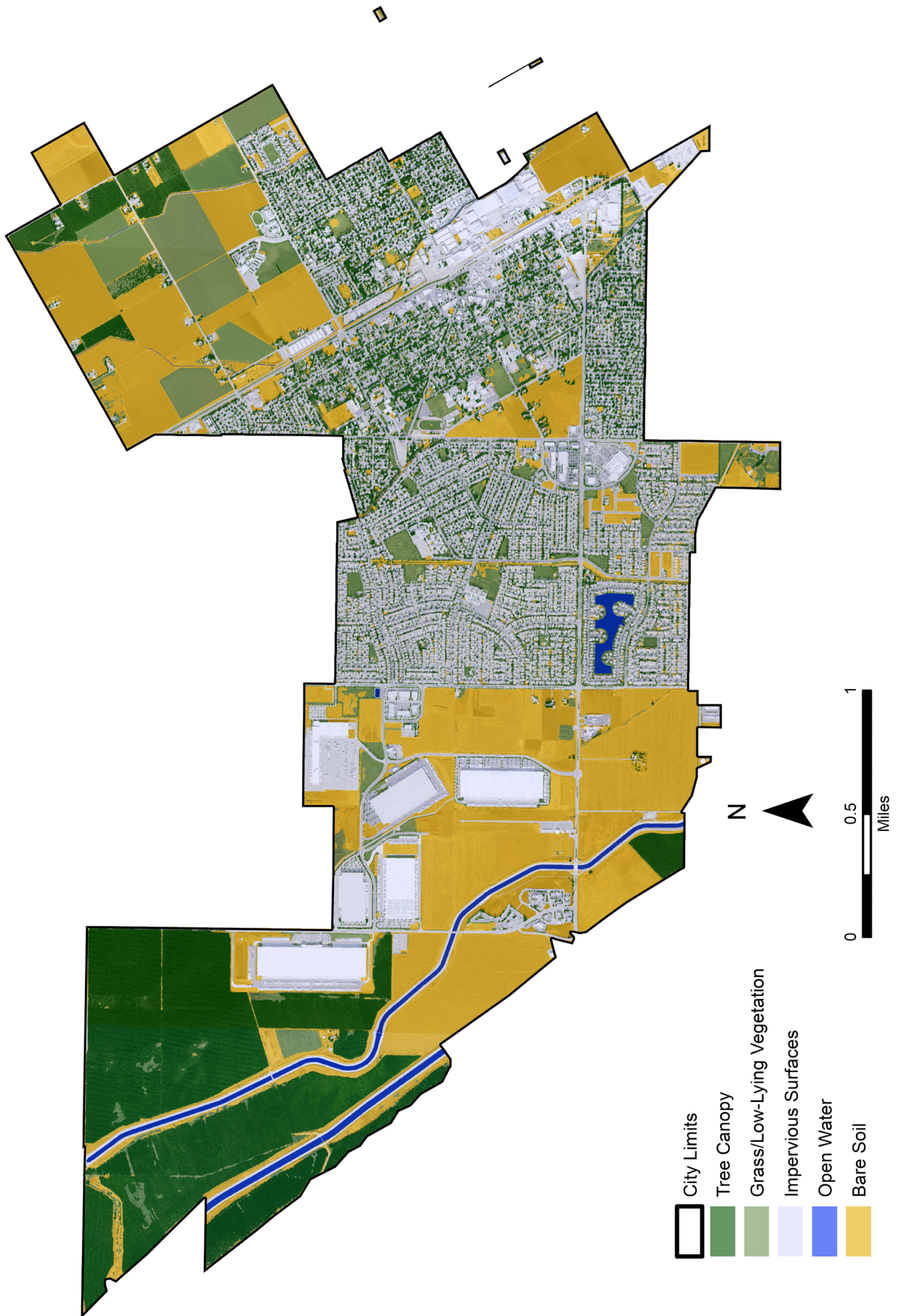
– this value excludes areas that preclude tree cover like sports fields

- 33.6% (1,718 acres) impervious surfaces, including roads, and structures
- 1.9% (97 acres) open water
- Removing 34.7 tons of air pollutants, including carbon monoxide (CO), nitrogen dioxide (NO2), ozone (O3), sulfur dioxide (SO2), and particulate matter (PM10) valued at \$141,257
- Reducing stormwater runoff by more than 2.9 million gallons, valued at \$22,839
- Removing (sequestering) 6,326 tons of carbon annually, valued at \$223,023

**Chart 3: Land Cover Type as Percent of City Area**



Map 1: Land Cover



## i-Tree Canopy Analysis

The amount and distribution of canopy cover are the driving forces behind the ability of the urban forest to produce benefits for the community (Clark et al, 1997). As canopy cover increases, so do the benefits afforded by leaf area. Overall, community trees provide approximately 164 acres of canopy cover, or 3% of the City's total area.

### Overall Tree Canopy Cover

The city of Patterson encompasses a total area of 8 square miles (5,118 acres) with 1,092 acres of tree canopy. There are an additional 616 acres (12% of all acres) available for tree canopy growth and additional

Chart 4: Zoning Type as Percent of City Area

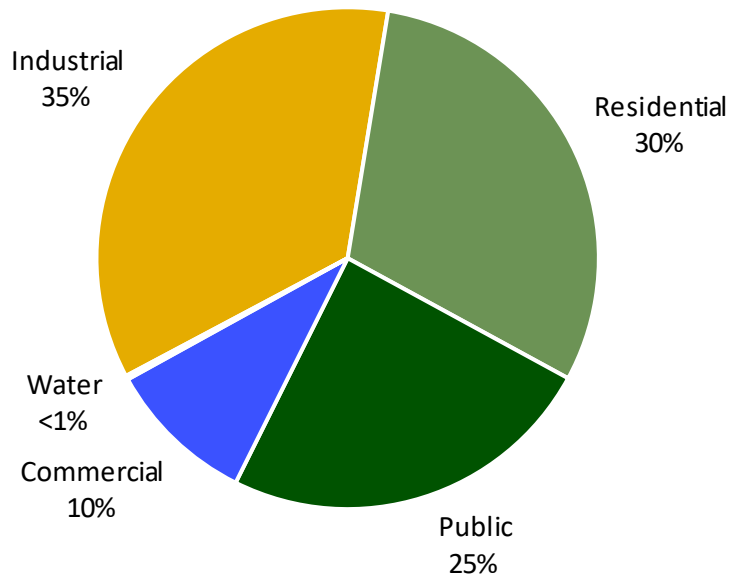
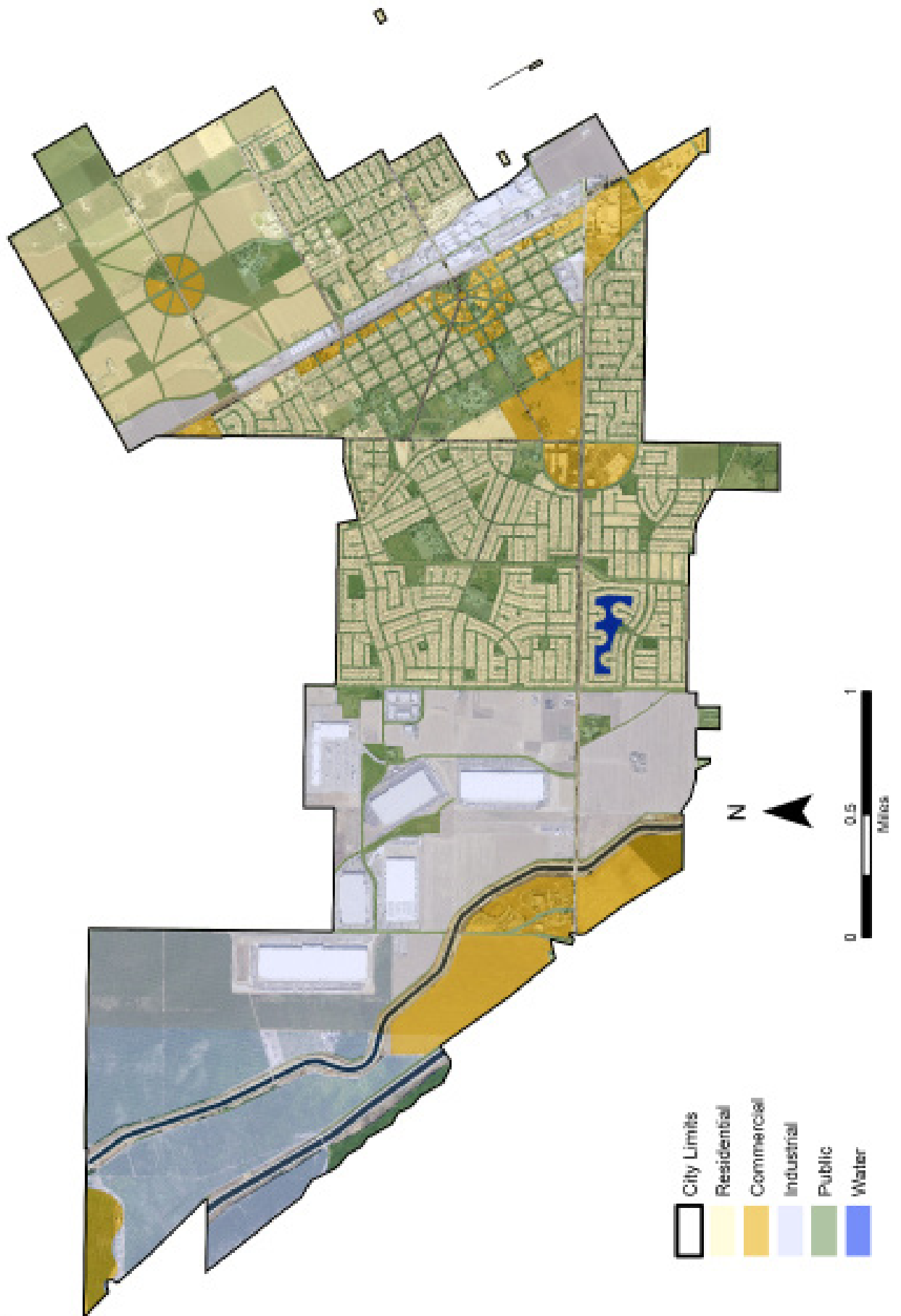


Table 3: Land Cover by Zone

ZONING	ACRES	CANOPY ACRES	IMPERVIOUS ACRES	PERVIOUS ACRES	BARE SOIL ACRES	WATER ACRES
Downtown Core	40.48	3.55	17.55	11.65	7.73	0.00
Downtown Residential	128.57	35.57	62.05	26.36	4.57	0.02
Estate Residential	1.48	0.04	0.69	0.24	0.52	0.00
General Commercial	370.40	61.05	84.46	12.94	211.90	0.04
Heavy Industrial	127.32	5.29	90.36	4.69	26.37	0.61
High Density Residential	45.95	6.48	15.16	6.89	17.34	0.08
Highway Service	45.32	2.37	18.74	3.00	21.20	0.00
Lake	11.96	0.00	0.00	0.00	0.00	11.96
Light Industrial	1,568.93	620.23	294.22	68.30	585.95	0.24
Low Density Residential	945.77	173.57	490.12	204.26	75.39	2.44
Medical Professional	4.97	0.51	3.30	0.52	0.64	0.00
Medium Density Residential	335.23	19.07	20.73	110.24	184.09	1.10
Parks/Open Space	162.13	12.58	8.32	67.51	73.47	0.25
Public/Quasi-Public	404.89	17.10	90.40	94.24	174.49	28.65
Right-Of-Way	603.94	120.02	370.68	41.37	70.60	1.27
<b>Total</b>	<b>4,797.35</b>	<b>1,077.44</b>	<b>1,566.78</b>	<b>652.22</b>	<b>1,454.26</b>	<b>46.66</b>

Map 2: Zoning Type



tree planting when impervious, open water, and unsuitable land uses are excluded, for a total overall potential tree canopy of 33.4%.

### Tree Canopy by Zoning

In Patterson, zoned areas encompass 4,797 acres of the city's 5,118 total acres. The 15

zoning types vary in size; light industrial is the largest across the city at 1,568 acres and estate residential is the smallest at 1.5 acres. Light industrial has the highest percent of canopy cover (39.5%), while the lake area has the lowest (0%), followed by estate residential at 2.5%.

### Tree Canopy in the Near Future

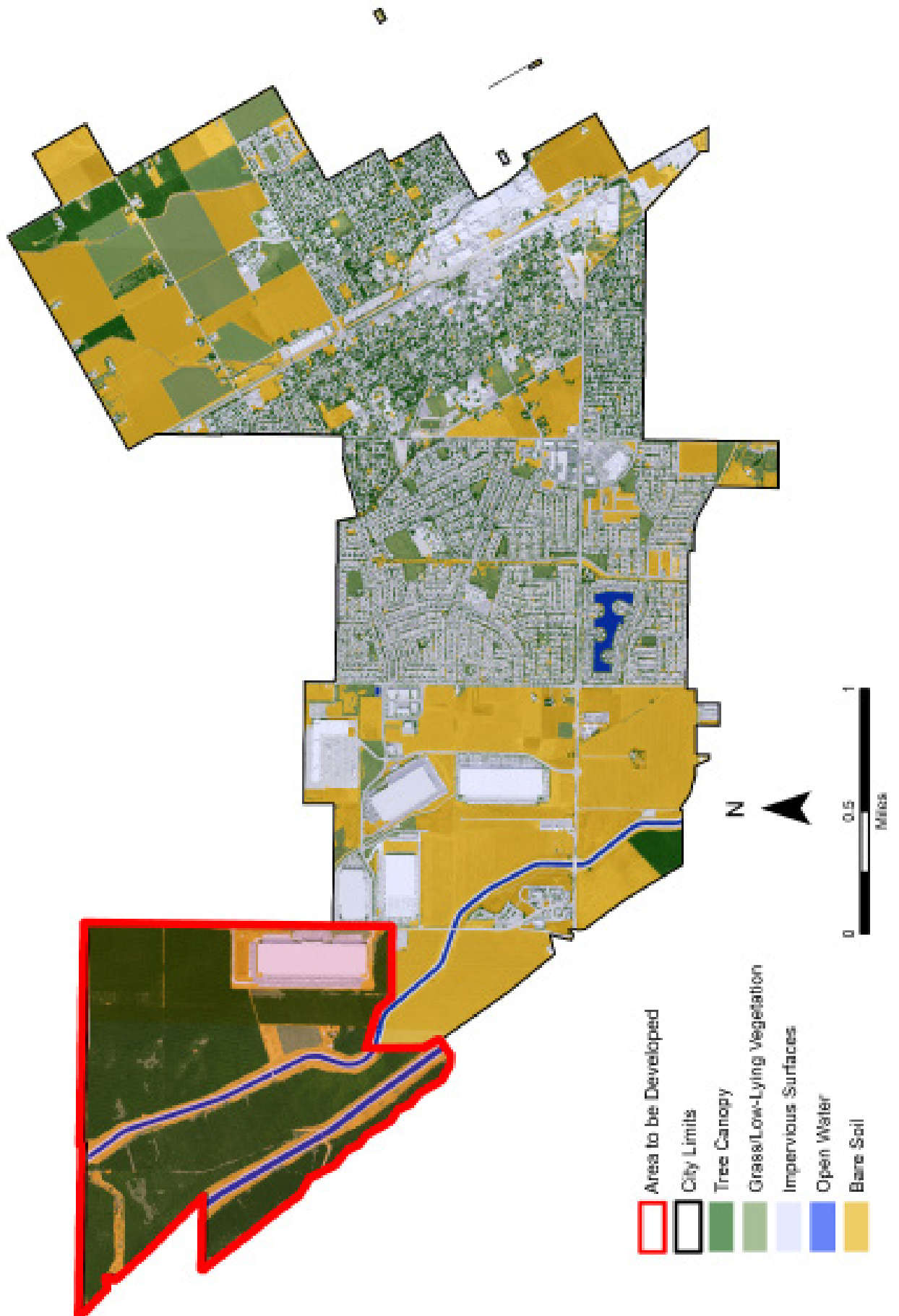
As seen in Map 2 (Zoning Classes), the north west portion of Patterson is mainly industrial. The area contains large amounts of tree canopy from when the area was agricultural. As such, many of the trees that currently exist in the northwest area of

**Table 4: Expected Land Cover Changes Due to NW Parcel Development**

Existing	
	Acres
Citywide Land Area	5,118
Citywide Canopy Area	1,092
Land Area within Boundary Parcel	892
Canopy Area within Boundary Parcel	668
Remove Boundary Parcel from City	
	Acres
New Citywide Land Area	4,226
New Citywide Canopy Area	424
Canopy Cover %	
	Acres
Existing Citywide Canopy % (Existing Canopy / Existing Land)	21.3%
New Citywide Canopy % (New Canopy / New Land)	10.0%



Map 3: Land Cover with Highlighted North West Parcel



Patterson will be removed due to the development of this area into industrial facilities (Map 3).

The canopy cover in the northwest area represents 61% of Patterson’s total canopy cover. Concerned with this impact, Patterson stakeholders requested DRG run a supplementary GIS canopy analysis where this parcel is removed from the calculations (Table 4).

When the northwest industrial area (892 acres) is removed from citywide calculations, the new canopy cover is ten percent (10%). This exercise demonstrates the importance of diversifying the urban forest across the city to distribute the benefits more evenly.

## Management Applications

Understanding the location and extent of tree canopy is key to developing and implementing sound management strategies that promote the sustainability of Patterson’s urban forest resource and the services it

provides. The data set, combined with existing and emerging urban forestry research, enables managers to strike a balance between urban growth and tree preservation and aids in identifying and assessing urban forestry opportunities. Spatial understanding of the past, present, and future potential for tree canopy is a valuable tool to help managers align urban forestry management with the community’s vision for Patterson’s urban forest.

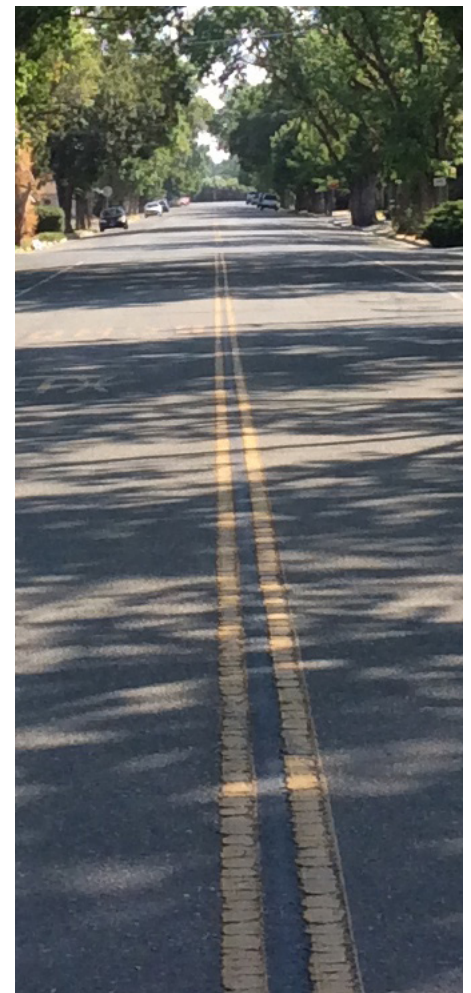
## Planting Priorities

It could be assumed that all pervious areas, including grass, shrubs, low vegetation, and bare soil (2,211 acres) are potential tree planting locations. Realistically, not all of these areas are suitable planting sites due to intended site uses (e.g., athletic fields) and because some of these areas are natural areas (without irrigation) that are not appropriate for tree planting.

Potential realistic plantable areas can be determined by excluding those pervious areas 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.

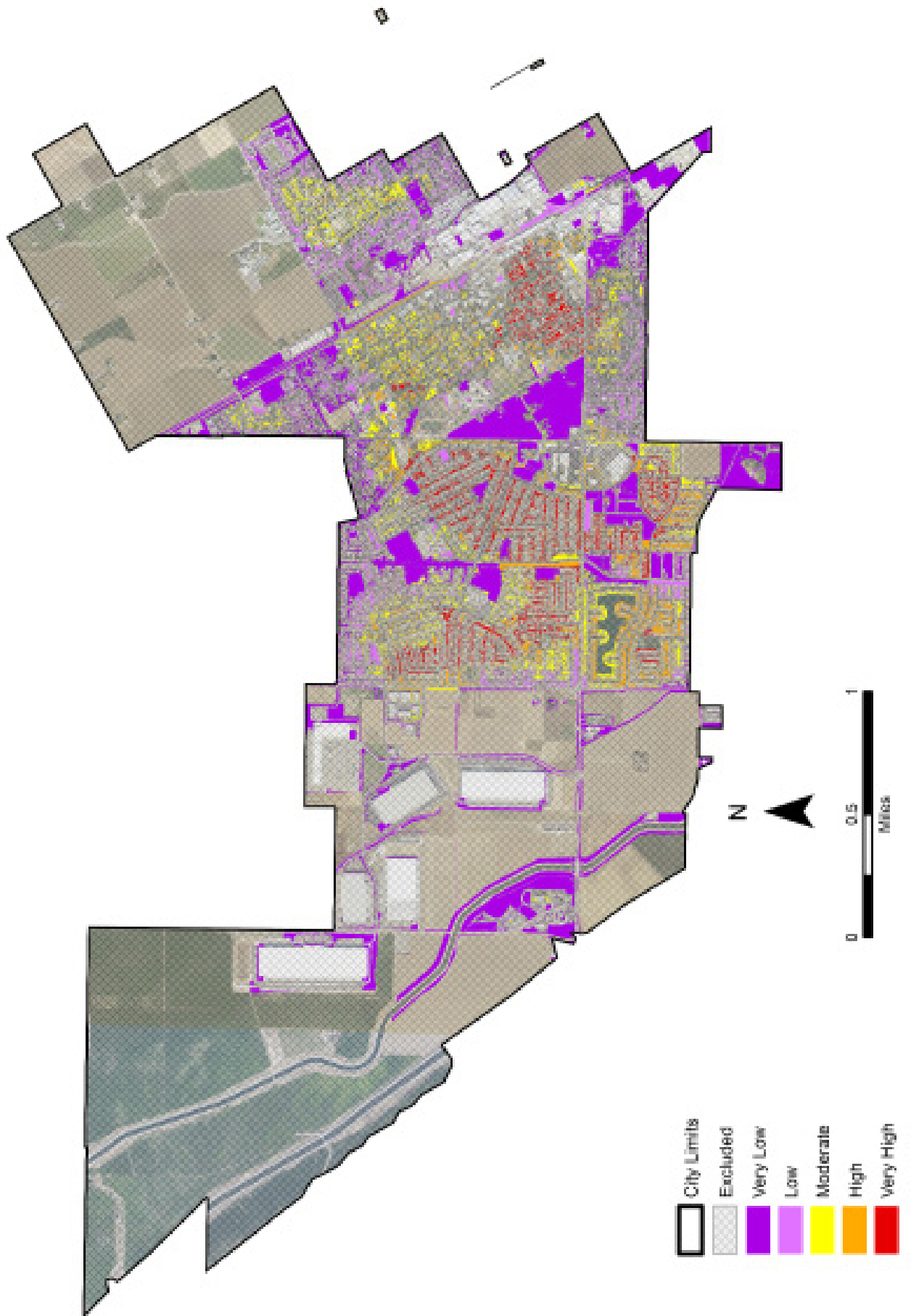
The Urban Tree Canopy analysis considered site design and environmental factors, including proximity to hardscape, canopy fragmentation, soil permeability, slope, and soil erosion factors to prioritize planting sites on both public and private property for the greatest potential return on investment. As young trees mature, they provide more substantial stormwater and environmental services. The analysis identified 612 acres of potential planting site in Patterson, where 101 of these acres are high or very high priority planting areas.



**Table 5: Priority Planting Areas**

Priority Level	Number of Planting Sites	Acres	%
Very Low	1,882	379.90	62.03
Low	1,888	65.11	10.63
Moderate	1,880	66.08	10.79
High	1,884	50.58	8.26
Very High	1,884	50.78	8.29
<b>Total</b>	<b>9,418</b>	<b>612.45</b>	<b>100%</b>

Map 4: Planting Priority Areas



## Urban Forestry Program

The Urban Forestry Division, operating within the Public Works Department, is responsible for the maintenance of approximately 12,647 public trees. Their maintenance activities include:

- Emergency and routine maintenance pruning
- Inspections
- Tree planting and tree removal
- Stump grinding
- Brush chipping
- Removal of mistletoe from all public trees
- Diagnosing and treating city trees for common diseases and pests

The city of Patterson fulfills these responsibilities through skilled employees, routine and emergency tree management, and coordination and cooperation among City departments, public agencies, nonprofits, contractors, and volunteer groups.

### Street Trees

Chapter 12.16 Trees, of the Patterson municipal code, establishes the responsibilities, jurisdictions, and authorities of street tree management. Street trees are planted in two (2) locations along City streets. Some street trees are planted in the landscape strip, which is the

open space that runs between the curb and the sidewalk. Where a landscape strip does not exist, street trees are planted behind the sidewalk and are located in the front yard of the property owner. Private property owners are prohibited from harming, pruning, or removing street trees without a permit.

### Training and Skill Development

Managing and caring for trees require a specialized set of skills and a sufficient level of arboricultural knowledge. While these skills are often under appreciated and taken for granted, research has proven that improper tree care can significantly reduce trees' life span, diminish appraised value, and increase the risk of failure in trees.

Training for Patterson's urban forestry staff has been limited in recent years because of funding challenges. Tree crew members are largely trained with hands-on experience while working with senior staff. For the first year, new tree crew members are on a probationary trial period. First year tree crew members are required to have a California Commercial Class B License so that they may legally and safely operate large vehicles. During their second year, tree crew members earn a California Qualified Applicator License from the Department of Pesticide Regulation. As experience allows, tree crew members become certified as ISA tree workers. There is currently no written, formal step-by-step timeline-based plan for the skill development of forestry staff.

Safety is a high priority for Patterson, where regular safety meetings are held once per month. These meetings are conducted by either supervisors or municipal mechanics at the equipment yard. When new equipment is added to the inventory, instructional safety classes are conducted by representatives of the equipment to train city staff. Municipal mechanics keep records when tree crew members complete equipment safety training. Mechanics are in the Fleet Maintenance division of Public Works. There is no official database; instead, there is a hard copy of records.

Ideally, urban forestry operations should include senior staff with advanced arboriculture skills who are able to assist the Arborist with tree inspection, risk assessment, and field supervision as well as participate in advanced tree care operations such as climbing and specialized pruning. Lacking senior staff with these advanced skill sets means that there is more responsibility placed on the Arborist to provide these services, in turn reducing time spent on program development and administration, including programming opportunities for staff development and lost grant opportunities.

### Tree Inspections, Care, and Maintenance Cycles

The tree crew trims, plants and removes dying, damaged, or diseased street trees. Private property owners are not permitted to trim street trees, but they are responsible for

watering young city trees for the first two (2) years. Street and park trees are trimmed on a five to seven (5-7) year cycle. Trees identified as critical or high priority are scheduled for service first. Trees may be trimmed more frequently depending on their species and growth rate. Exceptions are made for safety hazards.

Due to the persistent threat of mistletoe, the city of Patterson has a dedicated annual tree inspection for this pest. If mistletoe is not promptly removed, it spreads from tree to tree. Unfortunately, Modesto ash trees are especially vulnerable to mistletoe infestation. Mistletoe absorbs both water and mineral nutrients from its host trees. Healthy trees can tolerate a few mistletoe branch infections, but individual branches may be weakened or sometimes killed. Heavily infested trees may be reduced in vigor, stunted, or even killed, especially if they are stressed by other problems such as drought or disease. Every year, the city of Patterson surveys for mistletoe. Both city trees and private trees are inspected for growth. If mistletoe is found on city trees, removal is then scheduled. If mistletoe is found on a private tree, the property owner is notified and given adequate time to remove the mistletoe before the property is abated and a contractor removes the mistletoe at their expense. Most of the time, the property owner will choose to pay contractors directly to remove the mistletoe.

Canary Island date palms also present challenges to pruning cycles. There are approximately

150 Canary Island date palms lining the entrance on Sperry Avenue and another 85 lining the entrance on E. Las Palmas. The trees on the westside of Sperry Avenue are trimmed annually before winter. Due to previous cases of *Fusarium oxysporum* (*Fusarium wilt*), these trees must be trimmed with sterilized equipment to prevent possible contamination from one tree to the other.

On the east side of town, the palm trees lining E. Las Palmas Avenue are some of the oldest in town. The city maintains approximately eighty-five Palm trees lining both sides of E. Las Palmas. Due to the size of the trees, the city contracts out the maintenance. Maintenance is done approximately every two to three years depending on the need and budget. There is yet to be any cases of *Fusarium oxysporum* (*Fusarium wilt*) in these trees, making maintenance more tolerable and less invasive.

The primary maintenance strategy is to conduct tree care one neighborhood at a time. This allows crews to set up machinery and traffic management measures in one area. This strategy minimizes impacts to the everyday life of citizens and allows the team to efficiently perform tree work. Trees ranked as critical or high priority are scheduled for service first. Trees may be trimmed more frequently depending on the species and growth rate of the tree.

Historically, subdivisions in Patterson have planted the same species of tree per block. This facilitates tree management

because the trees grow at the same rate; however this does pose resiliency challenges because of the overreliance on a given species. Newer subdivisions have more diversity, with different tree species every couple of streets.

When tree replacements occur, the City will replace all trees in the area with one species. However, if a homeowner wants to replace a tree with a distinct species, the Urban Forestry Supervisor provides options for three (3) tree species. This planting pattern means there are minimal "cycle busters," trees that grow at a significantly different rate than the majority of trees in a given area.

## **Tree Planting and Replacement**

Recently, public tree planting has increased due to a Department of Forestry and Fire Protection (CAL FIRE) grant to replace trees that are removed due to death, failure, or risk of failure. Ideally, the City would like to install three (3) trees for every tree removal, a three to one (3:1) replacement ratio, to facilitate a faster recovery of previous benefits and to ensure sustainability of the overall resource. Patterson has the goal to strengthen the existing relationships with volunteers, nonprofits, and neighborhood groups to replace and plant new trees.

## **CAL FIRE Planting Program**

In partnership with CAL FIRE and the Green House Gas Reduction Fund, Patterson has planted over 700 trees and will be planting 300 more within the next two spring seasons, all while still maintaining its water conservation goals. This planting program, in collaboration with the 2014 citywide tree inventory, highlighted the locations of tree plantings sites where no tree was present. The intent is to fill these vacant planting sites with trees.

## **Emergency Response**

If an emergency tree-related problem occurs after normal business hours, work orders can be submitted through the phone or via the City website (<https://www.ci.patterson.ca.us/>). City tree removal requests are processed through a case-by-case basis which includes a site inspection. The decision is made by the City Arborist.

## **Other Aspects of the Program**

### **CAL FIRE Tree Inventory**

In 2013, the city of Patterson received a grant award from CAL FIRE to conduct a citywide tree inventory. The purpose of the grant program is to fund the creation and implementation of early state urban forestry projects or programs. The city of Patterson has approximately 12,800 public trees that were all inventoried and surveyed for a wide-range of attributes. These attributes included mapping coordinates,

location, species, condition, and age. This inventory data provides crucial information for future tree replacement projects and budgeting purposes. Further, the data collected from the tree inventory will be used to promote the management of the City's urban forest resources, its reforestation, and updates to the City's tree ordinance and protection measures. The grant award was made possible by Proposition 84: The Safe Drinking Water, Water Quality and Supply, Flood Control, River and Coastal Protection Bond Act of 2006 and the city of Patterson.

### **California Arbor Week**

Every March, Patterson celebrates California Arbor Week. This annual celebration recognizes the enrichment that trees bring to the community. During California Arbor Week, trees are planted, and educational opportunities are conducted. Every year, the City reaches out to schools and local groups for their participation in this celebration.

## **Summary of Annual Operations and Funding**

Stable and predictable funding is critical to the effective and efficient management of the urban forest. Trees are living organisms, constantly growing and changing over time in response to their environment. There are many factors that affect tree health and structure, including nutrition, available water, pests, disease, wind, and humidity. While it might seem like most changes to trees take a

long time to occur, some specific maintenance is critical at certain stages of life. For instance, young trees benefit greatly from early structural pruning and training. Minor corrections that are simple can be applied with low costs when a tree is young. However, left unattended, these corrections can develop into very expensive structural issues and increase liability as trees mature. At that point, it may be impossible to correct the issue without causing greater harm. Overmature trees often require more frequent inspection and removal of dead or dying limbs to reduce the risk of unexpected failure. A stable budget allows urban forest managers to program the necessary tree care at the appropriate life stage when it is most beneficial and cost-effective.

In Fiscal Year (FY) 2016/2017, the annual City budget for street urban forestry services was \$253,139 (excluding grants). This value represents 1.8% of the overall municipal budget of \$14.4 Million. This figure includes staff salaries and benefits, vehicle operations and maintenance, skill development, and more.

There are several funding sources for urban forestry; the General Fund, landscape maintenance districts, garbage funds. Grants can provide inconsistent and temporary funding. The General Fund is Patterson's primary operating fund and it accounts for all financial resources of municipal government, except resources that specifically require to be accounted for by other funding sources. Landscape maintenance districts are used to account for the costs

**Table 6: Patterson City Budget 2016-2017**

Patterson City Budget, General Fund: Fiscal Year 2016-2017	
Public Works	\$1,219,588
Transfers	\$263,667
Streets	\$632,365
Recreation	\$1,965,276
Police	\$4,450,556
Administration Services	\$2,319,004
Planning	\$508,148
Building and Engineering	\$481,021
Fire	\$2,598,595
<b>Grand Total</b>	<b>\$14,438,220</b>

related to the maintenance was formed. City stakeholders

**Table 7: Patterson Urban Forest Budget 2016-2017**

Urban Forestry Budget: Fiscal Year 2016-2017	
Total Salary & Benefits (General Fund)	\$160,003
Total Operation & Maintenance	\$71,636
Total Capital (vehicles and equipment)	\$21,500
<b>Grand Total</b>	<b>\$253,139</b>

Note: Salary benefits include three (3) full time tree maintenance workers, one (1) part time tree worker, and one (1) UF supervisor.

of parks and streetscapes of neighborhoods. Due to this special benefit, landowners in these special districts pay into the costs of the construction and/or maintenance of these improvements. The Garbage Fund generates municipal resources through financial transactions relating to the City's solid waste service. Services are on a user charge basis to residents and business owners located in Patterson.

Landscape maintenance districts (LMDs) are another source of funding for municipal tree care. Patterson currently has thirteen (13) different LMDs, with about half of those having some funding for tree maintenance. Funding is not equal among all LMDs. Each district has a unique funding mechanism based on an initial rate that was established when the district

report that only about four (4) of them are considered "well-funded." Only four (4) districts have specific mechanisms for tree funding. Moving forward, city stakeholders expect to move away from the use of LMDs except for one community facilities district for maintenance responsibilities. This district will continue to provide funding for future developments as they annex into this larger facilities district. City stakeholders report that the City is exploring the option for facility districts to include tree maintenance.

### Funding Mechanisms

Patterson has historically funded urban forest operations through the general fund, LMDs, and grants. However, other potential funding mechanisms also exist, and are viable options for supplementing funds.

### Taxes, Assessments, and Special Tax Districts:

Special assessments are one of the most reliable means of funding for urban forestry programs. California authorizes local communities to assess property owners for specific public benefits and services, such as stormwater and sewer systems, and public trees. The assessment can be levied as a fee per foot of right-of-way frontage or as a percentage of the property value.

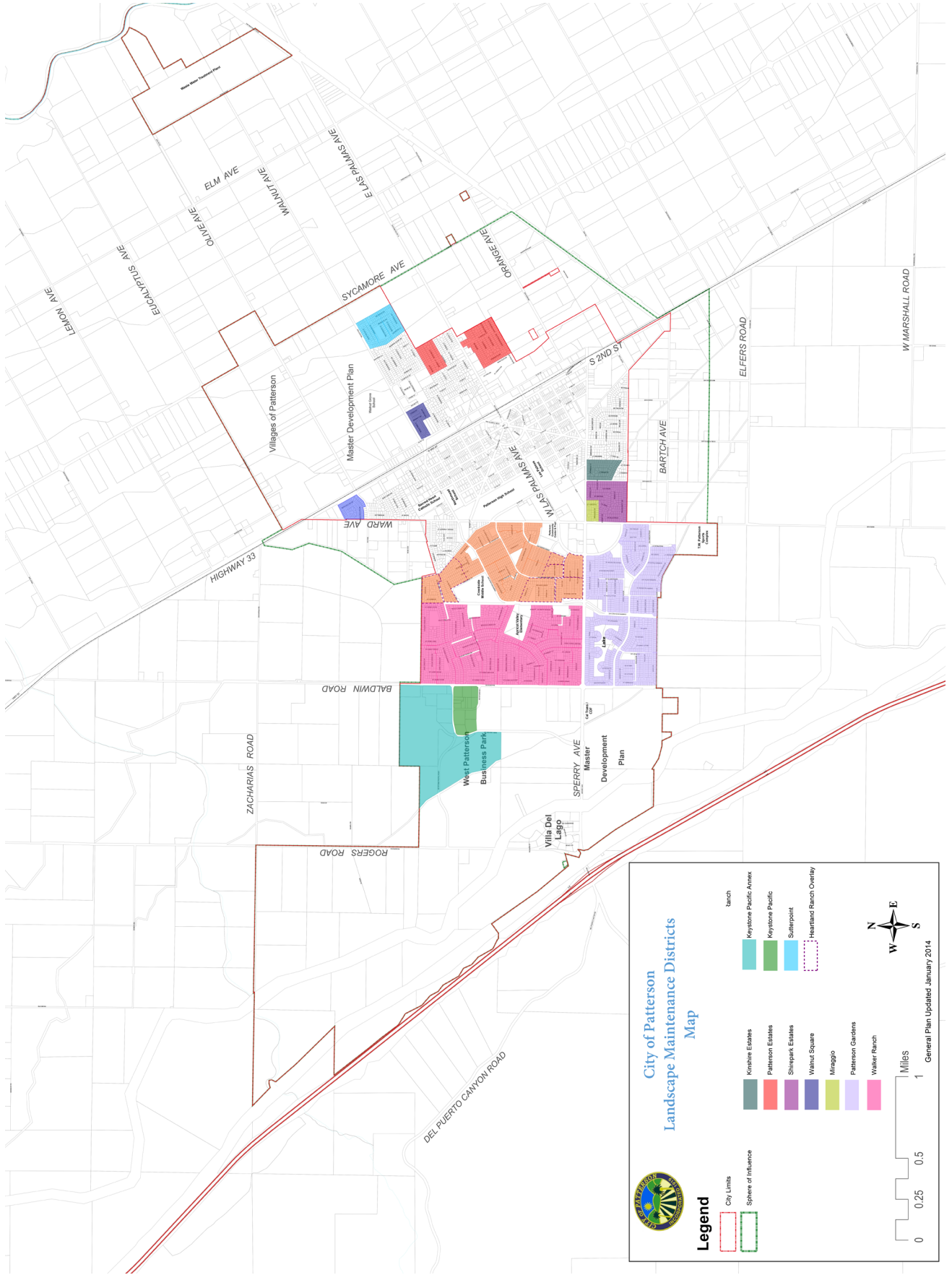
- Landscape and Lighting Assessment Districts:** Landscape and Lighting Assessment Districts (LLADs) are a form of special tax district that levies assessments to finance improvements to landscaping, lighting and open space, and open space acquisition. The Landscape and Lighting Act of 1972 authorizes municipal agencies in California to form and administer LLADs. The creation and management of a LLAD, as with all special assessments, requires the preparation of an Engineer's Report that demonstrates the distinct link between funds assessed and benefits provided by the entity for which the assessment is being conducted.

- **Park Districts:** A park district is a form of special-assessment district established to provide public parks and recreation within its geographic boundaries. Park districts sometimes obtain additional revenue by charging admission fees for some venues and through donations or voluntary memberships in a similar way to not-for-profit organizations.
  - **Maintenance Assessment Districts:** The Landscape and Lighting Act of 1972 authorizes Maintenance Assessment Districts (MADs), which are closely related to LLADs. The key difference is that charter cities, including San Francisco, can create MADs for the provision of services not specifically authorized under state law, thereby broadening their use. MADs are often created for sub-areas within a city with specific landscaping and/or open space maintenance needs, although the law does not preclude establishment of a citywide MAD.
  - **Community Benefit Districts:** Community Benefit Districts (CBDs) are used to finance neighborhood revitalization, commonly in commercial areas. Special benefits typically include public safety, economic development, beautification, and streetscape improvements.
- Formation of a CBD requires property owners to petition the appropriate local agency and demonstrate an interest in paying for additional services. A non-profit Board of Directors typically comprised of property owners, businesses, and government representatives administers a CBD. While CBDs may include street tree planting and maintenance, this is rarely the focus.
- **Mello-Roos Community Facilities Districts:** The Mello-Roos Act of 1982 authorizes local governments to create Community Facilities Districts (CFDs) and levy special taxes to finance a wide range of improvements and services. While special assessment districts have limited use for capital projects, CFDs can finance the construction of major improvements (e.g., new infrastructure), with the authority to issue bonds to generate additional revenue, if needed. This flexibility makes CFDs particularly suitable for large-scale projects developed over several phases. Assessments are levied on property owners within a CFD, which typically forms around a new development or existing neighborhood. CFDs require approval by two-thirds of residents.
- **Parcel Tax:** A parcel tax is a special tax levied for the provision of special benefits. Revenues from special taxes must be used for the specific purpose for which they are intended, so a parcel tax would create a dedicated funding stream for street trees. Similar to a special assessment, a parcel tax cannot be based on the value of property; however, the amount levied on each parcel need not be directly related to the benefits provided. Cities have the flexibility to levy parcel taxes as they see fit, but they are typically based on lot square footage or levied as a flat tax, with the same amount per parcel. Parcel taxes are designed to encompass entire cities and therefore, are good candidates for a citywide street tree program, as opposed to the district-level approach that often occurs under special assessments.


### Service Fees

Service Fees for Tree Work Permits, Development Permits, and Inspection Fees are common funding mechanisms used by public works agencies. These same mechanisms can be used for urban forest management. Charging for the time and arboricultural expertise needed to approve permit applications, review plans, and make site inspections is a viable option to support the salary and benefits of additional full- or part-time urban forestry positions.

# Map 5: Landscape Maintenance Districts



**City of Patterson  
Landscape Maintenance Districts  
Map**



**Legend**

- City Limits
- Sphere of Influence
- Keystone Pacific Annex
- Keystone Pacific
- Sunpoint
- Heartland Ranch Overlay
- Kestrel Estates
- Patterson Estates
- Shipshank Estates
- Walnut Square
- Miraggio
- Patterson Gardens
- Water Ranch
- West Patterson Business Park
- Villa Del Lago

0 0.25 0.5 1 Miles

General Plan Updated January 2014

## Modesto Ash Management

Patterson has an established population of 836 Modesto ash trees. The trees are fast growing and deciduous. This ash variety can grow to nearly 50 feet (50') tall and provide excellent shade. Modesto ash turns a bright goldenyellow in the fall and drops its leaves once per year during the winter months. Because of these factors, Modesto ash was a popular tree choice for municipalities. Unfortunately, the trees have high maintenance requirements and are especially vulnerable to mistletoe. Due to the special needs of these trees, Patterson has developed a special management plan for Modesto ash.

### Introduction to Current Modesto Ash Management

In February 2017, the city of Patterson contracted with DRG to develop an Urban Forest Master Plan, including a specific plan for managing Modesto ash trees in the public tree inventory. The goal of the Modesto Ash Management Plan is to maintain



Modesto ash trees through best management practices for as long as possible to preserve the benefits these mature trees provide. This plan outlines current conditions, existing management operations, and management recommendations. This plan also defines the resources required to achieve these recommendations.

A citywide inventory of all public trees was conducted in 2014 by DRG. As of 2017, the city of Patterson has a population of 836 Modesto ash trees. These trees are mainly sited in the downtown core, where they receive public maintenance, including annual inspection and removal of mistletoe.

- Existing public tree inventory data was

analyzed using Davey TreeKeeper 7.7 inventory management software to identify the number of Modesto ash along with their location, size (DBH), and condition:

- 836 Modesto ash trees exist, representing 6.4% of all public trees (12,979).
- 704 (84.2%) trees are in fair condition, 107 (12.8%) are in poor condition, 15 (1.8%) are in good condition, and 10 (1.2%) are in critical condition.
- 38.4% of trees are between 18 and 24 inches in diameter (DBH). 17.6% are smaller than 18 inches DBH, and

**Table 8: Average cost of removal (per tree)**

Item	Item Cost	Quantity	Hours	Total Cost
Labor - Maintenance Worker Level 2	\$37.27	3	6	\$670.86
Labor - Urban Forest Supervisor	\$45.24	1	1	\$45.24
Equipment				\$744.92
<b>Grand Total Cost:</b>				<b>\$1,461</b>

**Table 9: Average cost of routine tree maintenance (per tree)**

Item	Item Cost	Quantity	Hours	Total Cost
Labor - Maintenance Worker Level 2	\$37.27	3	2	\$223.62
Labor - Urban Forest Supervisor	\$45.24	1	1	\$45.24
Equipment				\$193.00
<b>Grand Total Cost:</b>				<b>\$461.86</b>

**Table 10: Total cost of annual mistletoe inspection, two days of labor**

Item	Item Cost	Quantity	Hours	Total Cost
Labor - Part Time Admin.	\$14.79	1	37	\$547.23
Labor - Management Analyst	\$48.77	1	37	\$1,804.49
Compact pickup	\$10.95	1	37	\$405.15
<b>Grand Total Cost:</b>				<b>\$2,757</b>

**Table 11: Cost of mistletoe removal (per tree)**

Item	Item Cost	Quantity	Hours	Total Cost
Labor - Maintenance Worker Level 2	\$37.27	2	1	\$74.54
Labor - Urban Forest Supervisor	\$45.24	1	1	\$45.24
Equipment				\$75.01
<b>Grand Total Cost:</b>				<b>\$194.79</b>

**Table 12: Cost of 4-year annual maintenance schedule**

	Per Tree	Trees	Total	4 Year Cycle
Cost	\$461.86	836	386,115	\$96,529
Labor	8	836	6,688	1,672

44% are larger than 24 inches DBH.

City staff reviewed past projects to determine the average number of hours, workers, projects, and rates needed for that management task (e.g., removals, maintenance). The following information summarizes the historical and existing policies, costs, and accomplishments of current management strategies:

- The average cost for the removal of one tree is \$1,461.
- Approximately 15 Modesto ash trees are removed annually, for an average annual expense of \$21,915.
- ◆ There is no set budget for these removals, and nearly all the funding comes out

of the General Fund due to the location of many Modesto ash in the downtown area.

- The City is currently inspecting and removing the ten (10) critical trees.
- The average cost for the routine maintenance of one (1) tree is \$462.
- The average cost for the annual mistletoe inspection is \$2,757.
- The average cost for the annual routine mistletoe removal treatment for one (1) tree is \$195.

The following strategies are recommended for managing the Modesto ash trees:

- Annually inspect trees for mistletoe. Remove mistletoe as necessary.

- Require three to five (3-5) year routine maintenance schedule for all (836) Modesto ash trees:

- ◆ Inspection should be incorporated into the routine maintenance schedule. An International Society of Arboriculture (ISA) Certified Arborist should be overseeing (or doing) the maintenance. This will require an additional (almost) full-time worker. If performed by in-house staff, this will require an annual average investment of \$96,529 which includes the cost of equipment.

## Patterson's Public Modesto Ash Composition

### Relative Age Distribution

The age distribution of Patterson's Modesto ash population is broken down as follows:

- 689 (82.4%) of all trees are larger than eighteen (18") inches DBH.
- 19 (2.2%) of trees are between three and twelve (3" and 12") inches or less DBH.
- 1 (<0.1%) tree is smaller than three (3") inches DBH.

**Table 13: DBH of Modesto ash**

Diameter	% of Trees
0-3	0.1
3-6	0.2
6-12	2.0
12-18	15.2
18-24	38.4
24-30	32.9
30-36	8.9
36-42	1.9
>42	0.4
<b>100%</b>	

Overall, the majority of Modesto ash trees are large, well-established, and mature trees.

### Condition

At the time of inventory (2014), the condition of each tree was determined and categorized according to a rating system established by the ISA:

- Excellent:** 100% to 90% condition class. The tree is nearly perfect in condition, vigor, and form. This rarely used category is generally applicable to small-diameter trees that have been recently transplanted and are well-established.
- Very Good:** 89% to 80% condition class. Overall, the tree is healthy and

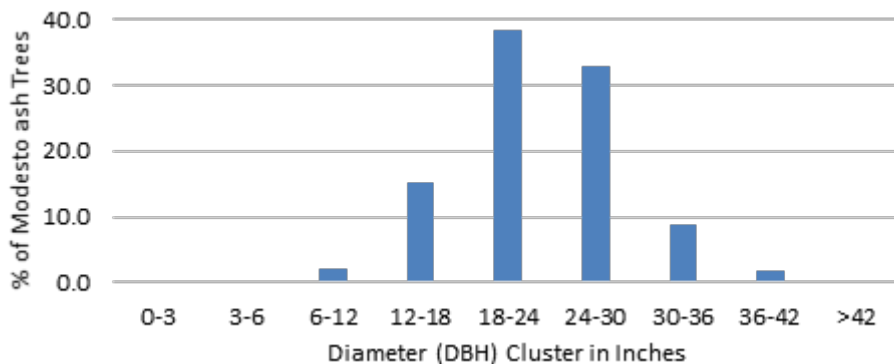
satisfactory in condition, vigor, and form. The tree has no major structural problems, no mechanical damage, and may only have insignificant aesthetic, insect, disease, or structure problems.

- Good:** 79% to 70% condition class. The tree has no major structural problems, no significant mechanical damage, may have only minor aesthetic insect, disease, or structure problems, and yet is in good health.
- Fair:** 69% to 50% condition class. The tree may exhibit the following characteristics: minor structural problems and/or mechanical damage,

**Table 14: Modesto ash condition**

Condition	# of Trees	% of Trees
Good	15	1.80
Fair	704	84.20
Poor	107	12.80
Critical	10	1.20
<b>Total:</b>	<b>836</b>	<b>100%</b>

**Chart 5: Distribution of DBH Classes of Modesto ash**



severe damage from non-fatal or disfiguring diseases, minor crown imbalance or thin crown, or stunted growth compared to adjacent trees. This condition also includes trees that have been topped but show reasonable vitality and show no obvious signs of decay.

- Poor: 49% to 30% condition class. The tree appears unhealthy and may have structural defects such as co-dominant stems, severe included bark, or severe trunk and/or limb decay. A tree in this category may also have severe mechanical damage, crown dieback, or poor vigor, threatening its ability to thrive. Trees in poor condition may respond to appropriate maintenance procedures, although these procedures may be cost-prohibitive to undertake.
- Critical: 29% to 1% condition class. The tree has a major structural problem that presents an unacceptable risk, has very little vigor, and/or has an insect or disease problem that is fatal and may threaten other trees on the property.
- Dead: 0% condition class. This category

refers only to dead trees.

The majority (86.0%) of Modesto ash are in fair (704 trees) or good (15 trees) condition. 107 trees (12.8%) are in poor condition and less than 2% (10 trees) are in critical condition. The City is currently focused on the removal of the ten (10) trees in critical condition.

### Maintenance Task

During the inventory, maintenance priorities were assigned based on the most critical issue identified for each tree, including:

- Priority 1 Removal. Trees designated for removal have defects that are not cost-effective or practical to treat. Most of the trees in this category have a sizable percentage of dead crown and pose an elevated level of risk for failure. Any hazards that were potential dangers to persons or property and/or seen as potential liabilities to the client are in this category. Large dead and dying trees

that are high liability risks are included in this category. These trees are the first ones that should be removed.

- Priority 2 Removal. Trees that should be removed but pose a liability less than "Priority One" trees. This category warrants attention as soon as "Priority One" trees are removed.
- Priority 1 Prune. Trees that require "Priority One" pruning are recommended for pruning to remove hazardous deadwood or broken branches. These trees have broken or hanging limbs, hazardous deadwood, and dead or dying limbs greater than four (4) inches in diameter.
- Priority 2 Prune. These trees have dead, dying, diseased, or weakened branches between two and four (2 and 4) inches in diameter and are potential safety hazards.

**Table 15: Modesto ash Priority Maintenance Task**

Action	# of Trees	% of Trees
Priority 1 Removal	6	0.7
Priority 1 Prune	28	3.4
Priority 2 Removal	13	1.7
Priority 3 Removal	22	2.6
Priority 2 Prune	160	19.1
Large Tree Routine Prune	603	72.1
Small Tree Routine Prune	3	0.4
Training Prune	1	0.1
<b>Total:</b>	<b>836</b>	<b>100%</b>

- Priority 3 Removal. These includes trees that should be removed, but that pose minimal liability to persons or property.
- Large Tree Routine Prune. These trees require routine horticultural pruning to correct structural problems or growth patterns that would eventually obstruct traffic or interfere with utility wires or buildings. Trees in this category are large enough to require bucket trucks or manual climbing.
- Small Tree Routine Prune. These trees require routine pruning for structural problems or growth patterns that would eventually obstruct traffic or interfere with infrastructure. These trees are small growing, mature trees that can be evaluated and pruned from the ground.
  - ◆ These trees require pruning to help develop their structure. While the pruning of these trees is not as imminent as the "Priority One" and "Priority Two" pruning, it should be performed within the trees' first three (3) years after planting

to prevent long-term structural defects and to help reduce future pruning costs.

The inventory data identifies 41 (5%) trees that are recommended for removal, of which six (6) trees are recommended for "Priority One" Removal. These removals also include the ten (10) trees in critical condition. 188 (22.5%) trees will require priority pruning within the next three to five (3-5) years, including twelve (12) trees that should be pruned within the next twelve (12) months or as soon as possible. Trees in good and fair condition can be scheduled for regular inspection and maintenance over the next three to five (3-5) years.

#### Location

Patterson's Modesto ash trees are concentrated in the downtown neighborhood area south of M street, west of 2nd street, north of Sperry avenue, and east of 9th street.

#### Mistletoe

The plan has dedicated content to mistletoe because Modesto ash trees are especially vulnerable to mistletoe infestation. The city of Patterson conducts an annual inspection for mistletoe. Sixty percent (60%) of private property owners who are contacted by the City choose to pay contractors directly for mistletoe management. Approximately 55 private property Modesto ashes afflicted with mistletoe are discovered annually.

## Recommendations

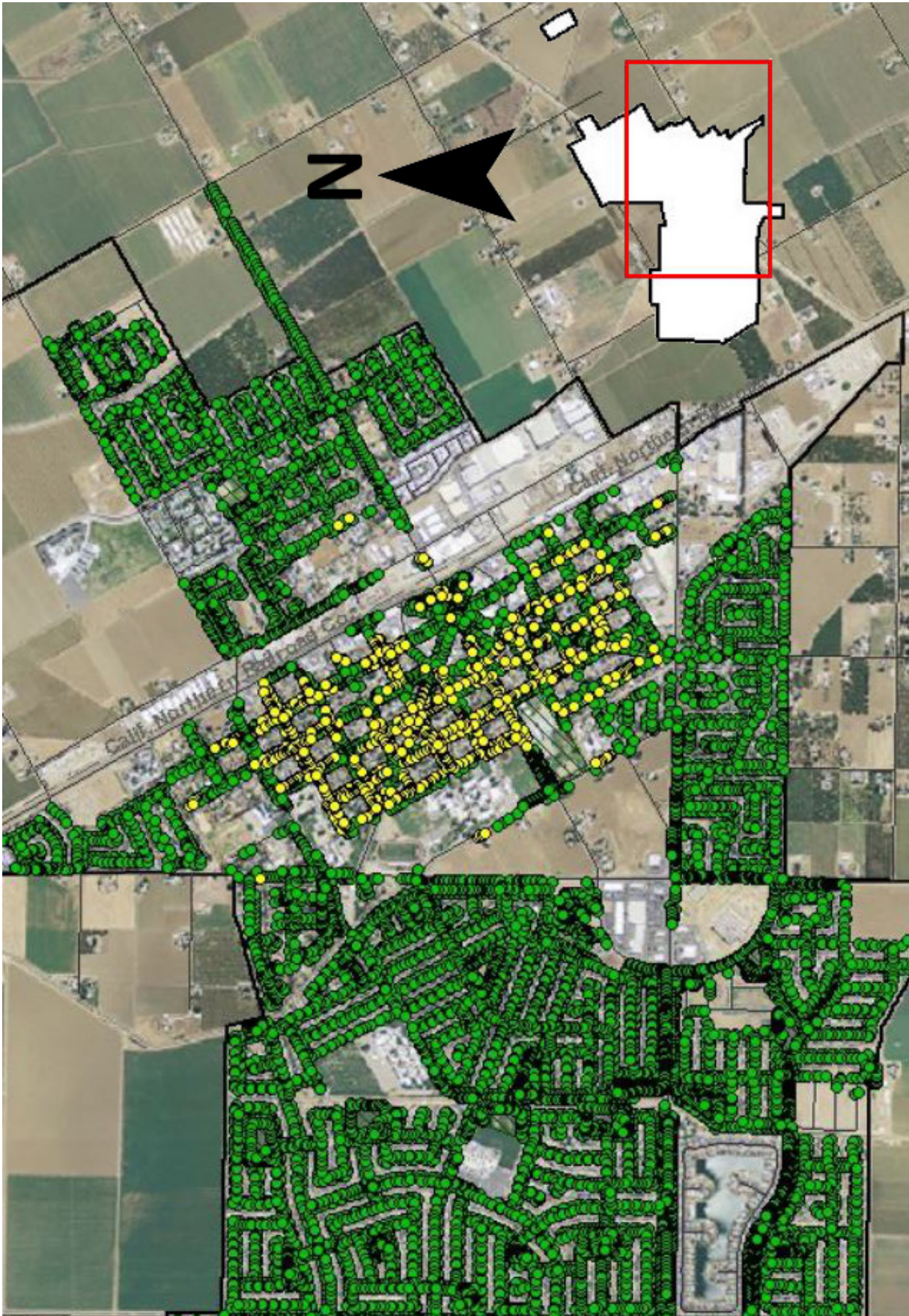
From the information summarized in this plan, DRG provides immediate and long-term recommendations for Modesto ash management. This includes prioritizing maintenance based on risk and keeping inventory data up to date.

### Immediate Plan

The ten (10) trees in critical condition are already being removed by the city of Patterson. The 107 trees in poor condition are likely to begin their decline next and should be observed. These trees should be monitored more thoroughly with up-close inspections and scheduled for removal as they become either unsafe or no longer provide any significant benefits to the community. The additional inspections should be conducted during the rotational maintenance pruning of trees by maintenance district, in addition to the current Modesto ash management practices.

Those in good condition are least likely to have any immediate need for removal but should still be assessed annually. As trees deteriorate with age and decline, those that create a hazardous condition should be prioritized for removal first. Those that are stable but have unstable or potentially hazardous parts should be prioritized second. Anything that does not pose any risk can be prioritized third.

Map 6: Modesto ash (yellow) among all inventoried trees (green)



## Long-term Action Plan

The city of Patterson should establish a three to five (3-5) year cycle for routine Modesto ash maintenance. The maintenance should be performed with at least one ISA-certified arborist per team. Tree inspection and maintenance will occur simultaneously. At the latest, every Modesto ash should receive routine tree maintenance every five (5) years. To ensure all (836) Modesto ash trees are on a three to five (3-5) year routine maintenance schedule, 209 trees will be inspected and maintained annually. At eight (8) hours of labor per tree for maintenance, this equates to 1,672 hours of labor annually. This will require the City to hire one additional tree worker. Including equipment, this routine tree maintenance schedule will cost \$96,529 per year. Maintenance will be conducted neighborhood-by-neighborhood.



The city of Patterson should continue the annual inspection for mistletoe. This annual expense of \$2,757 is well worth the investment, because it promotes healthier trees and mitigates risk. Trees that are scheduled for continuous, routine care will be monitored for mistletoe immediately after leaf drop. Those with observable mistletoe will be scheduled for winter mistletoe removal. The following spring, a windshield assessment will be performed to observe the health of the trees which were pruned in the previous winter. Those that have not changed will continue to be pruned. Those that have declined will be added to a monitoring list, unless their condition requires they be prioritized as a removal. It is important to monitor all Modesto ash for mistletoe each fall, not just those which were pruned the previous year, as controlling through removal may not completely prevent the spread. Those that are scheduled for continuous care will need to undergo mistletoe removal in years one and two (1 and 2) to help reduce the risk of their condition declining.

## Replacement Species

When Modesto ash trees are removed, three trees from the Patterson approved tree list are recommended as the best candidates for replacement. These trees were selected to provide similar or better properties as Modesto ash trees including height, shade, lifespans, soil tolerance, and drought resistance. These species are:

- Bigleaf maple (*Acer*

macrophyllum), a large, native, and deciduous tree.

- Holly oak (*Quercus ilex*), a large evergreen oak native to the Mediterranean region and well adapted to thrive in Patterson's climate.
- Village green sawleaf zelkova (*Zelkova serrata* 'Village Green'), a large deciduous tree.
- Chinese pistache (*Pistacia chinensis*), a medium, drought resistant, deciduous tree.
- Red maple (*Acer rubrum*), a large, drought resistant, deciduous tree.

## Tree Removal Priority Matrix / Decision-Making Flowchart

This process provides consistency in the determination of whether to remove or preserve a tree.

- 1. Resident or city staff requests tree removal.**
  - A. If tree is on city owned or controlled property, proceed to **STEP 3**.
  - B. If tree is a privately owned tree, then proceed to **STEP 2**.
- 2. No permit required. Patterson does not regulate private trees.**

### 3. Urban Forestry Supervisor conducts initial site visit.

- A. If tree is in a hazardous or dangerous condition and poses immediate threat to person or property, then proceed to **STEP 9**.
- B. If tree is not hazardous, but is dead or dying, then proceed to **STEP 8**.
- C. If tree appears healthy and is not causing excessive hardscape damage, then proceed to **STEP 7**.
- D. If hardscape damage is excessive:
  - i. If tree is otherwise healthy and repairs are feasible, then proceed to **STEP 7**.
  - ii. If tree health is questionable or hardscape repairs will require root pruning, then proceed to **STEP 4**.
  - iii. If tree is unhealthy or successful repair of hardscape is not compatible with tree preservation, then proceed to **STEP 8**.
- E. If tree appears unhealthy or shows signs of structural failure, then proceed to **STEP 4**.

### 4. An ISA Certified Arborist with TRACE/TRAQ credential conducts a risk

### assessment.

- A. If Arborist prescribes mitigation strategies to reduce risk, then proceed to **STEP 6**.
- B. If Arborist recommends removal due to excessive risk that cannot be practically mitigated, then proceed to **STEP 9**:

### 5. Initial appeals process.

- A. If tree is a street tree, then the appeal is considered by the Director of Public Works:
  - i. If Public Works grants an appeal for removal, then proceed to **STEP 9**.
  - ii. If Public Works denies appeal for removal, then proceed to **STEP 7**.

### 6. Tree is mitigated to reduce risk.

- A. If an ISA Certified Arborist with TRACE/TRAQ credential has conducted a risk assessment and made recommendations to reduce risk, then follow prescribed mitigation plan.
- B. If an ISA Certified Arborist with TRACE/TRAQ credential has not conducted a risk assessment, then proceed to **STEP 4**.

### 7. Tree removal is denied.

- A. If decision is appealed, then proceed to **STEP 5**.
- B. If decision is not appealed, and/or the appeals process has been exhausted, then:
  - i. If mitigation is recommended to reduce risk, then proceed to step 6.
  - ii. If no mitigation is required, then no action.

### 8. A street tree is recommended for removal.

- A. Prioritize and schedule removal. Replace tree, if possible.

### 9. Street tree is approved for emergency removal

- A. Emergency (e.g., if the tree is in a hazardous or dangerous condition and poses immediate threat to person or property) removal requires authorization by Public Works.
- B. Restrict access to high risk zone in proximity to tree.
- C. Remove tree as soon as possible. Replace tree, if possible.

## Policies and Regulations

City policies and regulations provide the foundation for the urban forestry program. They outline requirements and specifications for the planting, installation, and care of public trees and provide the regulatory framework for the protection and preservation of the urban forest assets as well as enforcement options. The development of the UFMP included a comprehensive review of existing policies, development and construction standards, ordinances, and other regulations that apply to the urban forest. This section summarizes the critical aspects as they relate to the urban forest. Proposed changes to policies and regulations are contained in the later section, "How Do We Get There?"

### State Law

#### California and Federal Clean Air Acts

The California and Federal Clean Air Acts establish air quality standards for several pollutants and require jurisdictions that violate these standards to prepare and implement plans to achieve the standards by certain deadlines.

#### 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 California. To this end, the act facilitates the creation of permanent jobs related to urban forestry, encourages the coordination of state and local agencies, reduces or eliminates tree loss, and prevents 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.

#### California's Model Water Efficient Landscape Ordinance

The purpose of MWELO is to promote the values and benefits of landscaping practices that integrate and transcend the conservation and efficient use of water. The ordinance also recognizes the need to invest water and other resources as efficiently as possible. The ordinance seeks to establish a structure for planning, designing, installing, maintaining and managing water efficient landscapes in new construction and rehabilitated projects by using a whole system watershed approach with cross-sector collaboration.

MWELO emphasizes soil conditions, species selection, and water-efficient designs throughout the landscape. The MWELO contains requirements for irrigation systems. Dedicated landscape water meters or submeters are required for residential landscapes over 5,000 square feet and non-residential landscapes over 1,000 square feet. Irrigation systems are required to have pressure regulation to ensure correct and efficient operation. All irrigation emission devices must meet the, American Society of Agricultural and Biological Engineers'/ International Code Council's 802-2014 "Landscape Irrigation Sprinkler and Emitter Standard." Flow sensors that detect and report high flow conditions due to broken pipes and/or popped sprinkler heads are required for landscape areas greater than 5,000 square feet. Master shut-off valves that prevent water waste in case of large failures of irrigation systems are required on all landscapes except where sprinklers can be individually controlled. The minimum width of areas that can be overhead irrigated was increased from eight (8) feet to ten (10) feet; areas less than ten (10) feet wide must be irrigated with subsurface drip or other technology that produces no over spray or runoff.

Patterson has automatically adopted the MWELO. The City applies these regulations for landscape requirements in new developments.

# City of Patterson Municipal Ordinance

## Tree Protection of Street Trees

Municipal regulations that provide for the preservation, care, and protection of Patterson's community are defined by City Code, **Chapter 12.16, TREES**. This section defines street trees as all trees planted or growing within public rights-of-way, public easements, streets, parking strips, roads and ways within the city. The physical sites where street trees are located are known as "street tree areas." The city planning commission is required to prepare and adopt a street tree plan, specifying a list of approved street trees and a uniform method of street tree planning, as well as designating certain streets or blocks of certain specimens of tree or trees. The plan is submitted to the city council for adoption, where it becomes the street tree plan of the City. Flexibility for the plan is allowed as the code authorizes the City to deviate from the designated tree for each block if circumstances warrant.

**Section 12.16.050** of the municipal code authorizes the City to prune, trim, clip, spray, maintain and care for the street trees, or private trees to the extent that they overhang or project within public rights-of-way, or public roads of the city, as needed, to remove or require the removal by the owner of the adjoining property of diseased or dead trees, and encourage planting of approved trees throughout the City. In addition to the street tree

maintenance provided by the City, private property owners or private property occupant are required to water street trees per 12.16.165. Finally, the city does not assume any liability upon the city, its officers, or employees, nor relieve the owner of any private property from the duty to prevent any tree, shrub, or plant upon any street tree area on his property or under his control from constituting a hazard or an impediment to travel or vision.

**Section 12.16.080** prohibits tree abuse or mutilation. It is unlawful for a person to abuse, destroy, mutilate or fail to water any street tree. Tree mutilation includes; topping, severe pruning, or other inappropriate pruning techniques. Directional pruning or other ISA-approved methods are allowed. Any person who abuses or mutilates a street tree to the extent that it must be removed and replaced, must remove and replace the tree according to City standards, at their expense. Failure to replace said tree within a reasonable time after notification by the City shall be considered a refusal. At that time, the City will replace the tree and charge the property owner for tree replacement and all associated costs.

**Section 12.16.140** allows public utilities to trim trees without permit in emergency cases where street trees are interrupting the service. The trimming or removal of tree branches is allowed only to the extent necessary to restore the service without first securing a permit. However, once the emergency has been corrected, the public utility must finish the trimming using directional pruning, v-pruning or other

approved methods to leave the tree with a correct structure and a balanced shape.

## Tree Removal and Replacement

Tree removal and replacement codes are described in **Section 18.78.050**. Tree removal is limited to trees that are in poor health, structurally distressed, or unsafe. Tree removal is the option of last resort, and prior to removal approval from the Public Works Director is required.

Tree replacement is required for all trees removed with or without director approval, based on DBH. 2" DBH trees shall be replaced with a 15" box, 4' DBH shall be replaced with a 24" box, and trees with 6" DBH or greater shall be replaced with a 36" box. Currently, this requirement is not actively enforced by Patterson.

**15.48.040** of the municipal code describes the plant and plant health requirements for landscaping to reach water efficiency goals. The chapter requires both evergreen and deciduous trees, shrubs and attractive erosion-preventing ground cover. It is required that at least ninety percent (90%) of the plants selected in non-turf areas be well suited to the climate of the region and require minimal water once established in the landscape. No more than ten percent (10%) of the plants may be of a non-drought-tolerant variety, so long as they are grouped together and can be irrigated separately. Plants shall be so spaced and sized that when mature they will fill the planter area. Mulches must

be a minimum of three inches thick when used as an interim measure.

Underground, automated irrigation systems are required. Plant materials must be maintained in a healthy condition. Unhealthy plants shall be replaced. Planters shall be kept free of all weeds, debris and trash. All planter areas should have a permanent border to prevent cars and pedestrians from damaging plant materials. All planters constructed adjacent to buildings or structures shall be so designed to avoid irrigation water intrusion into or on that adjacent building or structure. The minimum width of a planter bed shall be forty (40) inches measured from the inside of curbing or acceptable permanent border. Relevant to the long-term health of trees, prior to the planting of any materials, the compacted soils within the planting area shall be returned to a friable condition. This is a condition where the soil is easily crumbled or loosely compacted to allow the root structure of plants to spread unimpeded.

Further, an irrigation plan is required, and required elements of this plan include descriptions of backflow prevention and the minimum depth of soil coverage. The irrigation system shall be designed with water conservation as a priority but will also consider wind direction, surface drainage, soil type and application method.

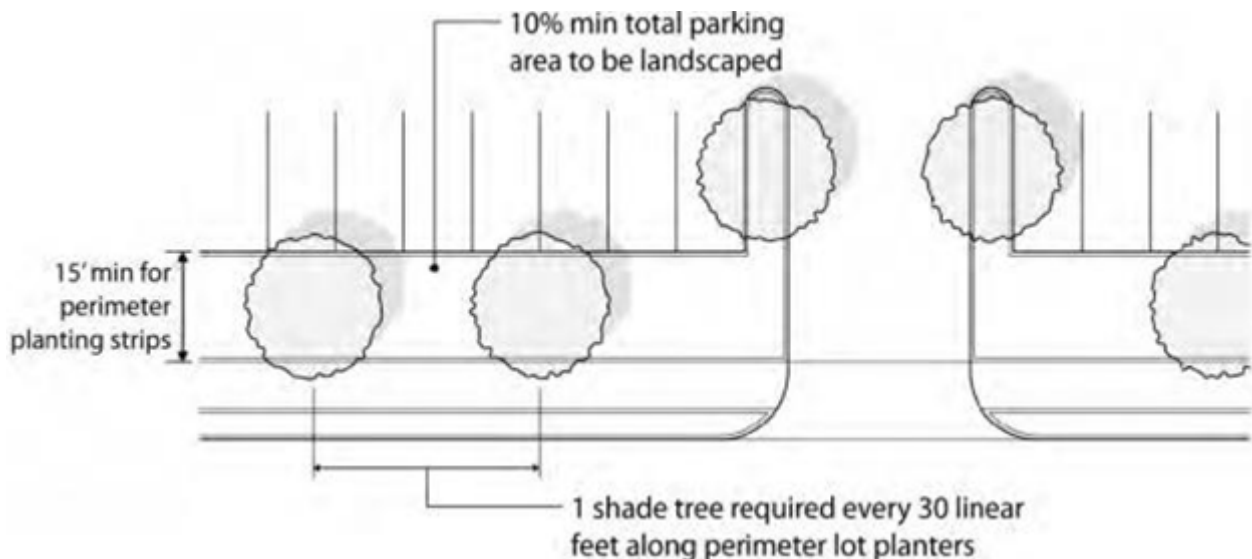
### Mistletoe Abatement

Mistletoe management and abatement duties are described in **Chapter 6.20 Mistletoe Abatement. 6.20.010** of the municipal code requires that every owner of property in the City must keep that property free and clear of all mistletoe. 6.20.030 allows City staff to enter private property to manage mistletoe under the authority of the city leadership.

### Zoning and Landscaping

The landscaping requirements for trees are described in **Chapter 15.48 Water-Efficient Landscape, and Chapter 18.78 Landscaping.**

**18.78.020** of the municipal code states that for all zones except single-family, trees are required for parking lots with special emphasis given to shade. Planting islands are required at the end of parking rows, and one shade tree is required for every ten (10) parking spaces. At least ten percent (10%) of the total parking area is required to be landscaped. The existing requirements (See Below) are as follows: along the rights-of-way, perimeter planting strips for trees must be fifteen (15) feet wide, perpendicular to the street. One shade tree is required for every thirty (30) linear feet along perimeter lot planters. Tree planting wells located at the front of parking stalls shall contain a minimum of twenty-five (25) square feet, and the smallest outside dimension shall not be less than five (5) feet.



## Community Outreach

Community outreach and education are vital components of the urban forestry program. Community engagement regarding public tree issues ensures that the community has an appreciation for the value and benefits of the urban forest and an understanding of the required program and resources. Currently, the urban forestry program supports public tree plantings, workshops, and other tree-related celebrations, most of which are conducted during California Arbor Week. The website (<https://www.ci.patterson.ca.us/200/Trees--Urban-Forestry>) covers information about the roles of Forestry, several major projects, and a helpful FAQ.

## Stakeholders

The benefits of community trees extend beyond the city limits. The responsibility for tree care and protection is shared by many different individuals, volunteers, city departments, and tree care professionals. The engagement

and contribution of stakeholders was integral to the development of the UFMP. While it may not be their primary focus, many individuals and departments within the City share some level of responsibility for community trees, including planning for, caring for, and/or affecting the policy of urban forest assets. DRG worked with Public Works staff to identify other departments and individuals who have a stake in the management of community trees. Stakeholders were invited to participate in online surveys and interviews to discuss about their role and perspective on the urban forest, as well as their views, concerns, and ideas for the UFMP. Internal stakeholders who contributed to the planning process included representation from the following:

## Public Works

The Patterson Department of Public Works is comprised of dedicated and hard-working employees committed to maintaining and enhancing the City's infrastructure and natural resources. Public Works is the

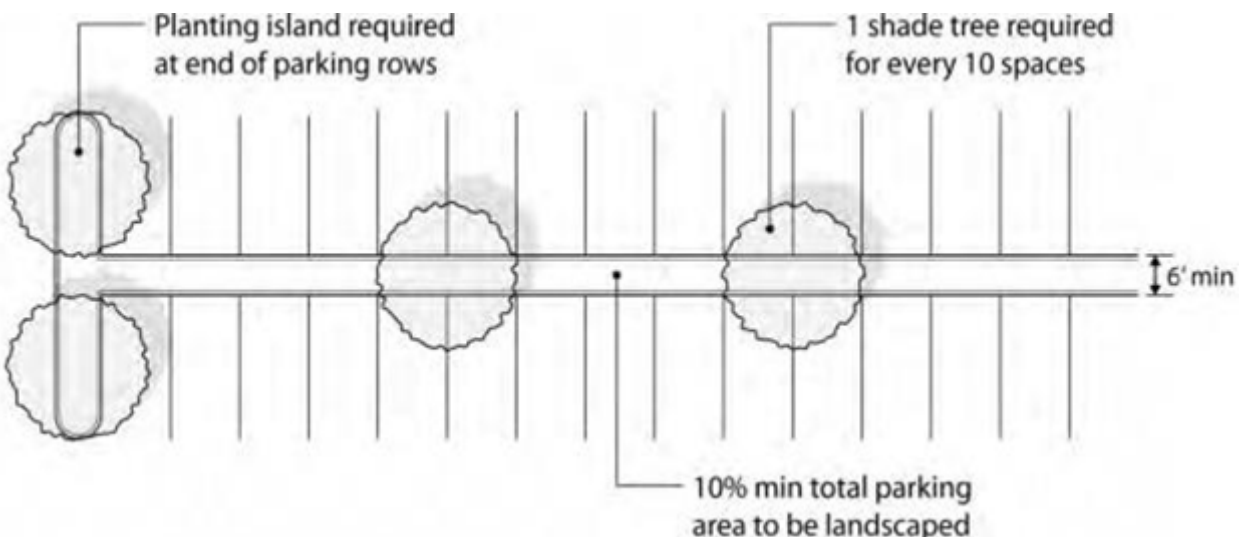
largest department in the City, dealing with basic infrastructure and providing vital City services through three main branches.

Because Public Works provides maintenance and implementation of municipal infrastructure, its operations are directly intertwined with management of the urban forest.

## City Council

The Mayor and City Council are elected officials that make the decisions that govern the city, with input from their constituents. Patterson's City Council consists of five representatives, the Mayor is elected along with four council members. The City Council appoints a city manager, who hires all City staff and manages the day-to-day business of the city.

Since the City Council is the decision-making body of the City, its decisions have a direct impact on the urban forestry program in Patterson.



## **Patterson Joint Unified School District**

Patterson Joint Unified is a K-12 school district located in Patterson. It is designated as a joint district because the district boundaries include portions of Stanislaus and Santa Clara counties, and it is a unified district because it has elementary and high schools. The district is governed by the Board of Education, which is composed of seven members. Members of the board are elected directly by voters within the district, which encompasses Patterson, Westley, Grayson, and unincorporated areas of Stanislaus and Santa Clara counties. Schools are excellent sites for trees and the school district is interested in the many benefits trees provide for students.

## **Patterson Recreation & Community Services**

The Department of Recreation and Community Services conducts programs for all age groups, manages scheduling, and prepares activities for

special events. Recreation and Community Services is a vital ally in community engagement and outreach. While the group does not have a sole focus on trees, opportunities for collaboration are numerous. It is especially important for the City to develop strong volunteer relations for tree-related events, such as planting parties.

## **Patterson Historical Society**

The purpose of the Patterson Township Historical Society is to preserve the history of the Patterson area. To accomplish this goal, the Society provides historical town information through a local museum. In addition, the Society publishes *The Gateway*, an informational publication released once a year for members. The urban design and landscaping of Patterson are among the Society's interests.

## **Chamber of Commerce**

The Patterson-Westley Chamber of Commerce is a group of volunteers and business leaders

striving to develop and enhance a business environment of prosperity and growth for the business community. A key challenge for the Chamber is developing a more vibrant and shaded downtown to generate economic activity. To meet this challenge, the Chamber has been an ardent supporter of street trees.

## **Conclusion**

With a canopy cover of 21.3% (out of a total potential canopy cover of 33.4%), a relatively young community urban forest in good condition, and a Public Works Department in support of the Urban Forestry Division's management and maintenance of public trees, Patterson is poised to grow a more sustainable urban forest that provides optimal environmental and socioeconomic benefits. Over the years, the City has assembled a strong foundation and the tools necessary to make meaningful and effective management decisions over the next twenty-five (25) years, by collecting up-to-date information, including:



- Current inventory of city-managed trees
- Urban Forest Resource Analysis
- Urban Tree Canopy Assessment and GIS canopy layer
- An update to existing tree ordinances

This information establishes a baseline for monitoring progress towards tree canopy goals and benchmarks to measure the long-term success of the UFMP.

## Challenges and Opportunities

The community forest is a dynamic, growing, and ever-changing resource that requires consistent, proactive management to support tree health and fully realize its maximum potential. Anticipating challenges and recognizing opportunities are key to implementing strategies in a timely and efficient manner. Over the next twenty-five (25) years, Patterson will likely face many critical challenges and opportunities affecting the urban forest.

Unlike natural forests, urban forests require regular care and maintenance to ensure strong branch structure, provide clearance for visibility and travel, promote safety, and reduce the risks of tree and branch failure. At times, urban trees require pest and disease management to preserve their value in the landscape.

Timely and proactive care will help control and reduce the overall cost of maintaining an urban forest, improve the longevity of individual trees, and preserve the existing benefits that come from mature trees.

Of primary concern for all California urban forests is sustainability in the face of emerging pests and climate change. Mistletoe, emerald ash borer, and drought are threats that warrant special

attention. To improve resiliency in the community tree resource, Patterson should:

- Plan for and promote greater species diversity in the street tree inventory
- Increase annual inspections for pests, especially emerald ash borer



- Continue to replace Modesto ash with more suitable species
- Increase enforcement for private property watering of young trees
- Maintain and update the inventory database, including tracking tree growth and condition at the time of tree maintenance.

The City has limited resources when it comes to the urban forest, and currently has four (4) maintenance workers dedicated to the care of urban trees. To ensure adequate care and maintenance cycles, the City will

need to optimize funding from existing sources, as described in the "How Do We Get There?" section, as well as research and apply for grant funding and other new resources.

Ultimately, protecting and growing the urban forest require a commitment from the entire community. Resident engagement, combined with volunteer collaboration, is integral to the success of the UFMP and the urban forestry program. Increasing outreach and public education will help generate support and enthusiasm for growing tree canopy and maintain the community tree resource for maximum benefits and long-term sustainability.

It will be important to nurture relationships with volunteer groups to augment City resources and coordinate outreach efforts.

Ultimately, Patterson is poised to enjoy ongoing environmental and socioeconomic benefits from community trees. The UFMP will help to grow these benefits and help Patterson be a vibrant, healthy, and attractive community.





# What Do We Want?

## Community Participation

To better understand how the community values urban forestry, the development process for the UFMP included electronic questionnaires and individual stakeholder interviews.

## Stakeholder Interviews

Stakeholder interviews were conducted between July and November of 2017 through online questionnaires and one-on-one interviews. These interviews focused on the stakeholders who are likely to be most affected by the UFMP, including the City Council, Recreation and Community Services Department, the Patterson school district, the Historical Society, local businesses, and residents.

The main concerns of the involved stakeholders included:

- Aging and deteriorating conditions of Modesto ash trees
- Loss of big, beautiful trees and the corresponding shade, especially in the downtown core
- Insufficient city tree crew training which resulted

in less than ideal tree care

- California's drought and how it will continue to affect urban canopy
- Strained staffing due to fund limitations, which results in deficient tree maintenance
- Decreased interest and insufficient education about urban forestry and tree responsibilities from Patterson citizens and City staff

Patterson's stakeholders would like to see a robust strategy to plant and care for trees more sustainably, a cohesive, Citywide plan to properly support canopy, and the acquisition of more resources for the forestry division to strengthen the program. By far the two biggest areas of interest were an increase in shade and an increase in aesthetics, with special emphasis given to the downtown business core. These stakeholders believe there is much value in education and outreach to clearly define the roles and responsibilities of diverse groups and individuals. Stakeholders also saw value in collaborating with nonprofits and community groups and wish to work with the school district to engage the community's youth.

Based on a review of the current urban forestry program and resources (What Do We Have?), and input from the community and other stakeholders, the UFMP identifies ten (10) goals that support and represent what Patterson citizens, stakeholders, and staff want for the future of the community urban forest in Patterson. These goals, and the strategies that support them, are intended to optimally manage the city's community forest in an efficient, cost-effective, sustainable, and safe manner.

1. Foster a sustainable urban forest resource.
  - ◆ This goal is intended to improve the overall health and resiliency of the community urban forest, preserve existing benefits, and thereby provide the foundation for sustainability of the resource and maximization of benefits over time.
2. Continue to build a comprehensive urban forest planting strategy.
  - ◆ This goal is intended to organize tree plantings to maximize benefits. Smart tree planning promotes a stable benefit stream, and gradual replacement can reduce the impact of

tree loss. Planning also ensures that the right tree is planted in the right place. City leadership and department directors must collaborate to determine the appropriate amount of tree plantings based on community values and municipal resources.

3. Promote tree preservation and protection.

- ◆ This goal is intended to ensure an appropriate regulatory framework in support of the community's vision for the urban forest.

4. Establish comprehensive, user-friendly regulations and policies.

- ◆ This goal is intended to ensure an appropriate regulatory framework in support of the community's urban forest vision.

5. Preserve and enhance tree canopy.

- ◆ This goal is intended to increase canopy cover across Patterson on both public and private property. The primary source of environmental benefits from the urban forest is tree

canopy. The more tree canopy, the greater the benefits to the community in energy savings, carbon reduction, air and water quality, and socioeconomics. Patterson's tree canopy provides these critical benefits that support and improve the quality of life for residents, visitors, and the entire region. Preserving and growing those benefits are of vital importance.

6. Rebrand trees as community infrastructure.

- ◆ This goal is intended to communicate the many energy, carbon, air, water, and socioeconomic benefits that trees provide.

7. Increase outreach, engagement, and education to the community.

- ◆ This goal is intended to support the development of programs, activities, and materials that increase community awareness and appreciation for the urban forest and trees in general.

8. Optimize funding and identify new opportunities.

- ◆ This goal is intended to identify and secure funding, both short-term and long-term (sustainable), for the establishment, preservation, and maintenance inspection of public trees and canopy in Patterson.

9. Increase training resources for the urban forestry group.

- ◆ This goal is intended to optimize the acquisition and allocation of resources to provide the urban forestry group with the resources needed to effectively manage the urban forest. A successful urban forestry program requires that staff have the best knowledge and training to care for trees.

10. Review and measure attainment of the Urban Forest Master Plan.

- ◆ This goal and the objectives that support it will ensure that the UFMP remains current and representative of community goals and values.

# How Do We Get There?

The Urban Tree Canopy Assessment provides a spatial understanding of the current and future potential for tree canopy, and is a valuable tool to help managers align urban forestry management with the community's vision for Patterson's urban forest.

There are 615.8 acres of plantable areas in Patterson, and within that area, 101.4 acres are high or very high priority planting areas. These high and very high priority planting areas offer the highest return on investment.

Patterson will achieve this goal through smart planning, effective management, tree protection and community engagement. These four themes are explored in the following pages. The goals of the plan have three designations; finish date, cost, and priority.

The finish date designation shows the optimal end date to

implement the priority.

The cost designation represents the likely financial investment that the priority will require. The strategic plan includes four different brackets:

- \$ (\$0-\$25,000)
- \$\$ (\$25,001-\$50,000)
- \$\$\$ (\$50,001-\$75,000)
- \$\$\$\$ (\$75,001+)

The priority designation is ranked along three classifications:

- Low
- Medium
- High

Where possible, the highest priority goals should be accomplished first.



# Guiding Principles

## Sustainable and Resilient Urban Forest

## Clear Policies and Strong Outreach

## Optimize Program Organization and Funding

### Goals

### Goals

### Goals

1. Foster a sustainable urban forest resource
2. Continue to build a comprehensive urban forest planting strategy
3. Promote tree preservation and protection

1. Establish comprehensive, user-friendly regulations and policies
2. Preserve and enhance tree canopy
3. Rebrand trees as community infrastructure
4. Increase outreach, engagement, and education to the community

1. Optimize funding and identify new opportunities
2. Increase training resources for the urban forestry group
3. Review and measure attainment of the Urban Forest Master Plan



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## Sustainable and Resilient Urban Forest

**Finish Date: Ongoing**

**Cost: \$\$**


**Priority: Medium**

### **Goal 1: Foster a sustainable urban forest resource**

1. Develop a tree inspection policy.
  - A. Ideally, every public tree should be observed periodically by an experienced certified arborist to identify health and structural issues. A relatively quick visual assessment can provide a great deal of information to the trained eye and allow for the identification of serious issues and risks before problems become critical. This process can occur over several years, but it should be well-documented and organized by grids.
    - i. Develop a tree inspection policy to ensure that all trees are periodically inspected.
      - a. As trees are maintained during regular maintenance cycles.
      - b. In conjunction with service-related work orders, sidewalk repairs, utility upgrades, and treatments for disease/pests.
    - ii. Continue to train maintenance staff to recognize hazardous and unsafe conditions in trees.
    - iii. Identify and prioritize plant health care needs/requirements.
    - iv. Identify signs or symptoms of disease, pests, and abiotic disorders, including environmental stress (e.g., water management, soil conditions, and nutrient availability).
    - v. Schedule follow-up inspections when necessary.
    - vi. Identify obvious signs of decline and/or failing structure.
    - vii. Identify and assess risk and potential risk.
    - viii. Identify wildlife habitat and nesting cavities of endangered and/or protected species.
    - ix. Identify risk factors and mitigation strategies for mature, overmature, and declining trees.
    - x. Maintain inventory data (TreeKeeper® 7.7/Maximo).


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## Sustainable and Resilient Urban Forest

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- a. Update tree information in the inventory data every time the tree is inspected.
    - b. Ensure the inventory data for individual trees never exceeds 10 years between updates.
  - 2. Increase species diversity and plant health in the public tree resource.
    - A. Species diversity in an urban forest is an indicator of the overall health and stability of the resource. Greater diversity promotes greater resistance to pests, disease, and environmental stresses. High reliance on one or a few key species can result in devastating loss within the resource and to the benefits afforded to the community in the event of a major pest or disease outbreak (e.g., emerald ash borer, Dutch elm disease). Historically, subdivision developments in Patterson used one tree species for blocks at a time.
      - i. Ensure that there is a diversity of at least three (3) different tree species along new development blocks.
    - B. Climate change is expected to have a significant effect on all forests (including urban forests) through changes in temperatures (average, high, and low) and increases in pest and disease outbreaks. Some areas, particularly in northern and southern regions, are already experiencing these effects. Species that are marginal now may experience either an advantage or a disadvantage from these changes. Increasing species diversity in the overall population will be critical to preparing for these changes and promoting sustainability of both tree canopy and benefits.
      - i. Maintain a diverse palette of Approved Trees with native, adapted, and regional species that will thrive in the local climate.
        - a. The Public Works Department will maintain a list of approved trees approved for planting in tree wells, parkways, medians, and other rights-of-way.
        - b. Approved tree list should include a broad selection to encourage species diversity and provide for a variety of design options.

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## Sustainable and Resilient Urban Forest

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- ii. Recommended species should be proven resilient to the street tree environment and include consideration for:
    - a. Form
    - b. Water requirements
    - c. Native and adapted species
    - d. Maintenance requirements
    - e. Litter (e.g., seed pods, fruit, etc.)
    - f. Potential for hardscape damage
    - g. Minimum planter size requirements
    - h. Minimum spacing
    - i. Site visibility restrictions (business signage, vehicles, and pedestrian traffic)
  - iii. Reduce reliance on overused species:
    - a. Minimize future plantings of Chinese pistache (*pistacia chinensis*) until the population is less than 10% of the total public tree population (currently 18%).
    - b. Phase out Modesto ash with:
      - i. Bigleaf maple (*Acer macrophyllum*)
      - ii. Holly oak (*Quercus ilex*)
      - iii. Village green sawleaf zelkova (*Zelkova serrata* 'Village Green')
  - iv. Plan towards ideal diversity\*:
    - a. No single species represents >10% of the resource.
    - b. No single genus represents >20% of the resource.
    - c. No single family represents >30% of the resource.
    - d. \*Not applicable to open space or natural areas where native species predominate in a natural setting.
  - v. Select and plant tree species that do not have the same

## Sustainable and Resilient Urban Forest

**Finish Date: 2021-2022**

**Cost: \$\$**

**Priority: Medium**

pest and stress vulnerabilities as the current species.


- vi. Plant pest and disease resistant varieties when available.
- vii. Coordinate with GIS staff for geostatistical analysis of species diversity within the City.
- viii. Maintain trees in good health:
  - a. Proper training and pruning.
  - b. Integrated Pest Management (IPM).
  - c. Healthy environment (e.g., planter space, irrigation).

### **Goal 2: Continue to build a comprehensive urban forest planting strategy**

1. Develop a tree planting and replacement plan.
  - A. Planting new trees and replacing those that are removed are critical to the sustainability of the community urban forest. Planning this process promotes a stable benefit stream and gradual replacement can reduce the impact of tree loss, especially in older neighborhoods where there is often a greater percentage of mature trees. Planning also ensures that the right tree is planted in the right place.
    - i. Use GIS mapping data to identify and prioritize planting sites and to ensure coordination with planned improvements and construction.
    - ii. Classify and prioritize available planting sites based on:
      - a. Space and minimum planting setbacks
      - b. Soil characteristics
      - c. Irrigation infrastructure
      - d. Landscape objectives and tree density
      - e. Site constraints and existing infrastructure, including hardscape, utilities (overhead and underground), bridges, and culverts
    - iii. Place an emphasis on Right Tree Right Place.

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## Sustainable and Resilient Urban Forest

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- a. Reducing hardscape and utility conflicts.
  - b. Matching tree species to soil and water conditions.
  - c. Matching tree species to planter size and intended use.
  - iv. Develop a Shade Tree Program.
    - a. Optimize shade and environmental benefits by planting large stature trees where feasible.
    - b. Establish goals for trees and shade management over the next ten (10) years including developing strategies, identifying barriers and solutions, and prioritizing areas
    - c. Collaborate with Patterson School District to plant trees and provide shade for school campuses and the routes children take to access school.
    - d. Partner with tree nurseries and utility companies to educate the community on shade trees and offer rebates for the purchase of trees for shading to reduce energy demand.
  - v. Identify locations, neighborhoods, and other areas where tree planting will enhance overall canopy cover.
  - vi. Identify underserved neighborhoods with lower than average tree canopy, where increasing canopy can provide greater benefits to the health, social, and economic environment of residents.
  - vii. Identify locations where tree planting will improve stormwater management and protect existing natural resources.
    - a. Coordinate with stormwater managers and GIS staff to combine stormwater management goals and priority planting sites for additional analysis and consideration.
  - viii. Identify mature/overmature trees that have reached the end of their lifespan and plan for their gradual replacement.

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## Sustainable and Resilient Urban Forest

- a. Overmature trees in older, established neighborhoods.
  - b. Overmature Modesto ash in open space.
  - ix. At minimum, planting and replacement rates should be sufficient to support sustainability of the overall resource and environmental benefits. Ideally, planting rates will grow the resource, canopy cover, and associated benefits.
    - a. Set a replacement ratio of at least one (1) tree planted for every one (1) tree removed (1:1 ratio).
  - x. Collaborate and partner with nonprofits and neighborhood groups for tree replacement and improvements to streetscapes.
    - a. Partner with downtown businesses to develop a farmers' market and build a coalition to plant and maintain beautiful shade trees around the market.
  - xi. Consider that larger planting projects may qualify as mitigation strategies for meeting California Environmental Quality Act (CEQA) requirements.
2. Develop a Modesto ash Management Plan.
- A. Prioritize Modesto ash to be removed:
    - i. Critical condition trees to be removed first.
    - ii. Poor condition trees to be removed second.
  - B. Establish a three to five (3-5) year routine pruning cycle for Modesto ash maintenance.
    - i. Maintenance should be performed with at least one ISA Certified Arborist per team.
      - a. To ensure all (836) Modesto ash trees are on a three to five (3-5) year routine maintenance schedule, 209 trees will be inspected and maintained annually. At eight (8) hours of labor per tree for maintenance, this equates to 1,672 hours of labor annually.
    - b. This will require the city to hire one additional tree

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## Sustainable and Resilient Urban Forest

**Finish Date: 2022-Ongoing**

**Cost: \$**

**Priority: Low**

worker. Including equipment, this routine tree maintenance cycle will cost \$274,806.

- ii. Routine tree maintenance will be conducted neighborhood-by-neighborhood.
- iii. Conduct inspection and maintenance simultaneously.
- iv. Continue to conduct annual mistletoe inspections.

### **Goal 3: Promote tree preservation and protection**

1. Qualify and apply for Society of Municipal Arborists (SMA) Accreditation.
  - A. SMA Accreditation formally recognizes urban and community forestry programs that implement excellent and comprehensive management practices. Building on the Arbor Day Foundation's Tree City USA designation, the SMA Accreditation incorporates additional professional standards important for managing municipal trees.
    - i. Meet minimum standards for qualification for SMA Accreditation:
      - a. At least one ISA Certified Arborist on staff, with an ISA Certified Municipal Specialist preferred
      - b. A Local Forest Master Plan
      - c. Tree City USA status
      - d. A Tree City USA Growth Award within past five years
      - e. Preference to TCIA Accredited tree care companies when private arborists are contracted
      - f. Adherence to ANSI Z133.1 safety standards, and ANSI A300 tree care performance standards
      - g. A pledge of adherence to the SMA Code of Ethics and to promote SMA objectives
    - ii. Complete application for SMA Accreditation.

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## Clear Policies and Strong Outreach

**Finish Date: 2019-Ongoing**

**Cost: \$**

**Priority: High**

2. Gauge community support for the development of historic tree protection and preservations. If sufficient community and political support:
  - A. Create a Historic Tree List.
  - B. Define the preservation criteria for trees to receive historic protection status.
  - C. Apply new protection standards and violation remediation.
  - D. Follow industry best management practices.

### **Goal 4: Establish comprehensive, user-friendly regulations and policies**

1. Develop a Policy and Procedures Manual for the Urban Forestry Group.
  - A. The City Arborist should work with staff to develop a Policies and Procedures manual that outlines group operations and official policies and procedures that guide day-to-day urban forestry operations.
    - i. Define the structure and organization of the urban forestry group to provide easy on-boarding for new staff hires and serve as a community outreach too.
    - ii. Define staff responsibilities.
    - iii. Outline and specify Best Management Practices (BMPs) and policies for tree care operations.
    - iv. Define responsibility and procedures for record keeping.
    - v. Identify management strategies for trees in utility rights-of-way.
      - a. Coordinate with electric, natural gas, and environmental utilities managers.
    - vi. Define policies and procedures for tree removal.
    - vii. Identify policies and responsibilities for inspection, risk assessment, and risk management.
    - viii. Ensure that Urban Forest policies and procedures are

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## Clear Policies and Strong Outreach

incorporated into other City standards and management plans.

2. Develop an easy-to-understand summary (one to six pages) of the UFMP, policies, and operations to serve as an educational outreach tool.
  - A. Communicate basics of tree care, including planting, pruning, and irrigation.
  - B. Quantify benefits of trees and tree canopy, including environmental, social, and economic benefits.
  - C. Describe urban forest composition, health, and species diversity.
  - D. Share resources for mistletoe awareness and Modesto ash management.
  - E. Present recommendations for tree species for private property.
3. Update existing planning documents to reference the Urban Forest Master Plan (UFMP).
  - A. The UFMP is complementary and supportive of the City's other long-range plans. As planning documents are updated, they should be revised to reference the UFMP. The UFMP can serve as an important implementation measure to most elements in the General Plan and this should be reflected as revisions occur.
    - i. Revise the Park and Recreation Master Plan to reference and recognize the UFMP.
    - ii. Ensure that all specific plans reference the UFMP Tree Care Standards and include consideration for the establishment of public trees, including the construction of planting sites that support tree maturity.
4. Revise design and construction standards that apply to trees and planter sites to ensure appropriate tree needs are satisfied.
  - A. To reach full potential (e.g., a trunk diameter, height, and canopy spread typical of the species) and to provide the greatest benefits to the community, a tree must have

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## Clear Policies and Strong Outreach

enough soil volume to support healthy root growth and structure (Appendix A, Soil Volume & Tree Stature). This is particularly important in parking lots and other paved areas where the temperatures of surrounding asphalt can inhibit the natural spread of roots beyond planter boundaries. In addition to planter design, species selection is critical (e.g., right tree, right place) to ensuring that a tree will perform its intended role and function in the landscape in balance with other infrastructure.

- i. Maintain current Approved Tree List and Planting Standards in the Parks Construction Standards.
  - a. Update Approved Tree List every five (5) years.
- ii. Require construction sites to submit a Tree Protection Plan (TPP), which identifies all trees that will remain on the site, to the City for approval before construction begins.
- iii. To prevent root cutting, fracture soil with an air spade and backfill with sand prior to planting to promote deep rooting and improved drainage, where possible.
- iv. Supplement Planter Design Standards with options for increasing soil volume, where above ground area is restricted by impervious surfaces (Appendix, Alternative Planter Designs).
- v. Supplement Planter Design Standards with additional options for incorporating trees into stormwater management (Appendix, Alternative Planter Designs).
- vi. Supplement planter and pavement design options to reduce conflicts between trees and infrastructure (See Appendix, Alternative Planter Designs). Contact manufacturers to acquire specifications and best implementation practices for these technologies.
  - a. Structural soils
  - b. Suspended pavement
  - c. Pervious pavement/rubberized pavers
  - d. Flexible (e.g., rubber) sidewalks

## Clear Policies and Strong Outreach

**Finish Date: 2020-Ongoing**

**Cost: \$\$\$\$**

**Priority: High**

- vii. Supplement Planter Construction Specifications with additional options for implementing urban trees into stormwater management (Appendix A, Alternative Planter Designs).
  - a. Stormwater tree pits and drainage plans
  - b. Interconnected tree pits
- viii. Where feasible, trees shall be placed on separate irrigation valves from shrubs, groundcovers, and turf.
- ix. Where possible, encourage and incentivize the use of recycled water systems.
- x. In high-density, single-family developments, consider a greater buffer on the western side of homes to support shade trees and energy conservation.
- xi. Ensure policies, ordinances, and practices are compliant with California's Model Water Efficient Landscape Ordinance
- xii. Periodically review industry standards, at least every ten (10) years, for updates and revisions to design and construction options.

### **Goal 5: Preserve and enhance tree canopy**

1. Preserve and expand existing tree canopy.
  - A. The primary source of environmental benefits from the urban forest is tree canopy. The more tree canopy, the greater the benefits to the community in energy savings, carbon reduction, and air and water quality. Patterson's tree canopy provides these critical environmental benefits that support and improve the quality of life for residents, visitors, and the entire region. Preserving and growing those benefits are of vital importance. Develop and adopt canopy goals for Patterson.
    - i. Establish an overall canopy goal as well as individual goals for specific land use, based on community values and municipal resources.
      - a. Establish this canopy goal in the comprehensive plan.

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## Clear Policies and Strong Outreach

- ii. Consider canopy potential along with community values and vision (See UTC Assessment: Canopy Potential).
  - iii. Adopt a city policy of no net loss to the overall tree canopy.
  - iv. Identify parcels with high value canopy cover that are at risk for development and develop preservation strategies.
  - v. Conduct urban tree canopy (UTC) analysis every ten (10) years to determine changes and progress towards community canopy goals.
    - a. Add this objective to long-range planning documents.
  - vi. Develop outreach and incentives for increasing tree planting on residential and other private property (e.g., schools).
    - a. Coordinate with GIS staff to identify areas/population where outreach and incentives for tree planting will be most successful (e.g., demographics, consumer expenditure, lifestyle patterns).
    - b. Coordinate with GIS staff to develop visual aids (maps) to promote urban forest activities and benefits.
2. Ensure all inventoried trees are on a five to seven year (6 year) pruning and maintenance cycle.
- A. On a maintenance cycle, most issues can be addressed at relatively low costs. However, when untended, minor problems can evolve into very expensive structural issues and increase liability as trees mature. Over time, unresolved issues may become impossible to correct without causing greater harm.
- i. Hire an additional tree worker to bring the total tree maintenance worker count to 5. This additional employee is the same as referred to in Goal 2 under Modesto ash management.
  - ii. Incorporate trees at city facilities and parking lots into

## Clear Policies and Strong Outreach

regular maintenance and pruning cycles.

- iii. Incorporate significant trees and trees in proximity to trails and accessible open space areas into regular maintenance and pruning cycles
  - iv. Incorporate unfunded street trees (including those in assessment districts) into regular maintenance and pruning cycles.
  - v. Explore GIS coordination for routing and use of analytics for maintenance cycles (e.g., planning, scheduling, and routing).
  - vi. Inspect trees to identify structural and age-related defects, and manage/mitigate risk.
  - vii. Perform windshield surveys after storms that include heavy winds or snow that may increase branch loading.
- B. Update inventory data when trees are serviced (e.g., pruned or inspected):
- i. Inspect trees for structural, pest, and disease, then document findings.
  - ii. Verify species.
  - iii. Update condition rating.
  - iv. Update diameter (DBH).
- C. Apply principles of plant health care to publicly managed trees.
- i. Healthy environment (mulch, planter space, soil fertility and volume).
  - ii. Irrigation.
  - iii. Integrated Pest Management (IPM).

### **Goal 6: Rebrand trees as community infrastructure**

1. Quantify and monetize the benefits of the urban forest for all outreach and documents.

**Finish Date: Ongoing**

**Cost: \$**

**Priority: High**

**Finish Date: Ongoing**

**Cost: \$\$**

**Priority: Medium**

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## Clear Policies and Strong Outreach

2. In official City documents, plans, and outreach, begin discussion of urban forest by stating it is living community infrastructure.

### **Goal 7: Increase outreach, engagement, and education to the community**

1. Further develop Patterson's Urban Forest website (<https://www.ci.patterson.ca.us/200/Trees---Urban-Forestry>).
  - A. The urban forestry web page is the first-place residents and others look to for information about trees and urban forest programming. It should be engaging and user-friendly, as well as a comprehensive resource for everything about trees in Patterson.
    - i. Information and images that illustrate valuable information about the state of the urban forest and Patterson's canopy cover, including composition and benefits.
    - ii. Links to engaging private (not ROW) tree care articles for residents and property managers, including:
      - a. How to plant a tree
      - b. How to prune a tree
      - c. How to fertilize and mulch
      - d. How to irrigate
      - e. How to hire an arborist or tree care company
    - iii. Links to electric and natural gas utility websites that explain safety and Right Tree, Right Place concepts.
    - iv. Links to the City's tree protection regulations, requirements, policies, and necessary forms.
    - v. Create a homeowner's list of recommended tree species for Patterson.
    - vi. Information about volunteer and donation opportunities.
    - vii. Links to nonprofits and regional, state, and national tree

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## Clear Policies and Strong Outreach

- interests.
  - a. California Urban Forests Council
  - b. Arbor Day Foundation
- 2. Develop outreach materials that communicate information about trees and the community urban forest.
  - A. Develop outreach materials (pamphlets, articles, etc.) that communicate specific topics about trees, the urban forest, and environmental benefits.
    - i. Communicate basics of tree care, including planting, pruning, and irrigation.
    - ii. Illustrate benefits of trees and tree canopy, including environmental, social, and economic benefits.
    - iii. Provide benchmark information about the community urban forest, including composition, health, and species diversity.
    - iv. Present recommendations for tree species for private property.
    - v. Partner with utilities, other city departments, nonprofits, and other groups to incorporate shared information and outreach goals when possible. Possible examples include:
      - a. Right Tree Right Place – Power-line friendly tree species
      - b. Safety considerations related to trees near energized lines and underground utilities.
- 3. Develop and deliver an annual State of the Urban Forest Report.
  - A. Public support is critical to a successful and sustainable urban forest program. Keeping stakeholders well-informed is the best way to generate support and engagement. A State of the Urban Forest Report is the perfect way to communicate progress and accomplishments toward UFMP goals and objectives. It is also an opportunity to communicate any challenges or issues that may be holding

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## Clear Policies and Strong Outreach

up the Plan.

- i. Provide citizens with information on the overall condition of the community urban forest.
  - ii. Highlight services (e.g., number of trees pruned/replaced, service calls responded to, etc.).
  - iii. Update the community on progress towards canopy goals and trees planted (public and private).
  - iv. Update the community on accomplishment of UFMP objectives.
4. Partner with Patterson school district to deliver tree and urban forest information to residents.
- A. With a willing and proactive school district, the City can include educational and outreach materials during school events. The urban forestry program can use this opportunity to increase awareness and knowledge about trees and urban forestry issues.
    - i. Link sites together for education and outreach information.
    - ii. Include urban forest messages and valuable information at school events and PTA meetings.
  - B. Partner on Shade Tree Program and developing safer complete streets.

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## Optimize Program Organization and Funding

**Finish Date: Ongoing**

**Cost: \$\$**

**Priority: High**

### **Goal 8: Optimize urban forestry programming and funding**

1. Implement an annual work plan.
  - A. The City Arborist should work with staff to develop an annual work plan.
    - i. Develop a work plan to guide short-term management operations and objectives, including:
      - a. Pruning schedules for maintenance contract(s).
      - b. Tree planting and replacement plan.
      - c. Prioritizing risk mitigation actions and tree removals.
      - d. Identifying and prioritizing trees for inspection/risk assessment.
      - e. Prioritizing and revisiting objectives and strategies identified by the Urban Forest Master Plan.
    - ii. Will occur annually, with budget development.
    - iii. Refer to the UFMP to identify objectives for the current year.
2. Develop a policy and responsibility for keeping inventory data current (TreeKeeper software).
  - A. Ideally, the inventory system should be accessible in the field so that tree information can be updated as maintenance and/or inspections are completed (e.g., tablet computers).
    - i. Coordinate with GIS and Information Technology staff to evaluate how TreeKeeper, and GIS tools and data can be used together optimally and where the system of record for tree information should be maintained.
    - ii. Explore applications for smartphones/tablets to allow for updates to occur simultaneously as maintenance and/or inspections are completed.
      - a. Coordinate with GIS staff in Public Works to leverage existing mobile GIS research.


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## Optimize Program Organization and Funding

- b. Build inventory data updates into trimming contracts.
  - 3. Optimize funding for trees and planting sites in projects funded by Capital Improvement Funds (CIP).
    - A. Trees and landscaping are integral parts of most development and redevelopment projects. As such, adequate resources should be included for trees, as well as for constructing planting sites that support mature tree development. As an added benefit, shade from trees can help to extend the lifespan of infrastructure, including paving materials for streets, parking lots, and trails.
      - i. CIP-funded projects (Patterson Municipal Code, Chapter 3.40.030) should include adequate consideration of trees and planter space, including the construction of planters and pavements that support mature tree development and tree health (e.g., suspended pavement, structural soils).
- 4. Optimize support for urban forest operations from the General Fund.
  - A. The General Fund provides funding for the maintenance of public trees that are outside of assessment districts, including many parks, city facilities, and open space areas. Trees are important to the quality of life in Patterson and public trees are a valuable asset to the community. Maintaining tree health, preserving environmental benefits, and managing risk are essential public services that should be adequately reflected in the allocation of funding.
    - i. Increase the general funds allocated to the urban forestry budget (Appendix E. Proposed Budget Additions).
    - ii. The care and the preservation of public trees as community assets should be funded, in part, by general funds that are intended to support essential public services.
    - iii. Identify general funds for managing public trees not in assessment districts, including pruning and risk management.

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## Optimize Program Organization and Funding

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- a. Policy actions and City strategies will provide transparent budget and cost information
    - iv. Demonstrate and report the need and justification for funding the care and maintenance of public trees, including:
      - a. Annual work plan (pruning cycles, PHC, training, etc.)
      - b. Modesto ash management plan
      - c. Risk mitigation plan
      - d. Urban Forest Master Plan objectives
  - 5. Identify and apply for available grant funding.
    - A. The city of Patterson has the program essentials and a sturdy foundation to support an exceptional urban forest and urban forest management program, including an inventory of resources, an Urban Tree Canopy Assessment, an Urban Forest Master Plan, community support, a dedicated City Arborist, and a regional and state presence. These qualifications warrant top consideration for available grant funding to support the realization of the strategies and implementation measures identified in the UFMP.
      - i. Identify grant opportunities, including regional, state, national, special interest, and others, that may support urban forest program development and the objectives and strategies identified by the UFMP.
      - ii. Apply for all grants that support community needs, urban forest programming and/or the implementation of objectives and strategies identified by the UFMP.
  - 6. Identify and explore internal support for alternative funding mechanisms.
    - A. Taxes, Assessments, and Special Tax Districts
      - i. Landscape and Lighting Assessment Districts
      - ii. Park Districts
      - iii. Maintenance Assessment Districts

## Optimize Program Organization and Funding

Finish Date: 2019-Ongoing

Cost: \$\$

Priority: High


- iv. Community Benefit Districts
- v. Mello-Roos Community Facilities Districts
- vi. Parcel Tax
- B. Service Fees
  - i. Tree Work and Land Development Permit and Inspection Fees
  - ii. Stormwater Utility Fees
  - iii. Service Fees (Other)
- C. Other Funding Mechanisms
  - i. Compensatory Payment, Land Development Mitigation, and Environmental Fines
  - ii. Capital Improvement Project Budgets & General Obligation Bonds

### Goal 9: Increase training resources for the urban forestry group

1. Increase resources and staffing structure for the urban forestry group.
  - A. To provide the level of care and management necessary to protect and grow the public urban forest and the benefits provided by this resource, it will be necessary to increase resources along with the staffing structure of the urban forestry group.
    - i. Increase resources to achieve future staffing needs of Urban Forestry Group (Appendix E).
    - ii. Operations should include a Senior City Arborist to assist tree maintenance workers. Primary duties include:
      - a. Quality Assurance
      - b. Inspections and Risk assessment/Risk management
      - c. Sidewalk repair inspections and recommendations for Public Works/Engineering

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## Optimize Program Organization and Funding

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- d. Arborist reports, recommendations, and assessments (interdepartmental)
  - e. Tree inventory data collection input/update
  - f. Tree inspections
  - g. Issuing service requests and work orders
  - h. Volunteer coordination/Public outreach
  - iii. Operations should include the City Arborist to perform tree care operations throughout the city. Primary duties include:
    - a. Non-routine maintenance pruning
    - b. Emergency response
    - c. Plant Health Care (PHC)
    - d. Planting
    - e. Tree removals
    - f. Quality Assurance of field staff
    - g. Risk assessment
    - h. Inspections
  - 2. Adopt most current industry standards for all contractors and in-house crews engaged in tree care operations.
    - A. Current pruning and planting standards apply specifically to contractors engaged in tree care operations on public trees. The UFMP updates these standards and applies them to all individuals and agencies engaged in tree care operations affecting public trees in Patterson.
      - i. Patterson Tree Pruning Standards should adhere to current industry standards and best management practices (BMPs).
      - ii. The City Arborist shall be responsible for maintaining and updating these standards in accordance with current industry standards and BMPs.
      - iii. Every employee needs to be trained once every

## Optimize Program Organization and Funding

two (2) years. To compensate for high turnover, in-depth training programs will be held bi-annually, and condensed tailgate trainings will be held monthly.

- iv. Provide uniform training and education, especially for structural pruning.
  - v. Determine and devote a percent of the contract budget for training.
3. Develop an advanced training structure for in-house urban forestry staff.
- A. The City Arborist shall develop and implement a training program and structure to advance and improve the skills and knowledge of staff engaged in advanced tree care operations, including advanced pruning, inspections, and risk assessment procedures.
    - i. In-house tree crews should be fully trained and certified for bucket work.
    - ii. Training to be provided in-house, when possible by the City Arborist, including:
      - a. ISA DVD
      - b. Training workshops
      - c. CEUS

**Finish Date: Ongoing**

**Cost: \$\$\$**

**Priority: High**

### **Goal 10: Review and measure attainment of the Urban Forest Master Plan**

- 1. Annually, review the UFMP and the attainment status of goals and objectives.
  - A. The UFMP is intended to be an active tool that can and should be adjusted in response to available resources and changes in community expectations. In addition to serving as a day-to-day guide for planning and policy making, the Urban Forest Master Plan should be reviewed annually for progress and integration of objectives into the annual work plan.
    - i. Review the UFMP annually and adjust targets as


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## Optimize Program Organization and Funding

- necessary.
  - ii. Integrate current objectives and actions into the annual work plan.
  - iii. Review objectives and actions for attainment status and update the Objectives, Actions, and Targets table (Appendix H).
2. Align UFMP objectives and strategies with community expectations.
- A. One of the greatest measurements of success for the UFMP will be its level of success in meeting community expectations for the care and preservation of the urban forest resource.
    - i. Periodically review the UFMP for alignment with community values and expectations for the urban forest.
    - ii. Community satisfaction can be measured through surveys as well as evidenced by public support for realizing the Plan's objectives and actions.
    - iii. Community satisfaction can also be gauged by the level of engagement and support for urban forest programs, workshops, and issues.
3. Complete a resource analysis (i-Tree Streets) every five (5) years.
- A. With current tree inventory data (TreeKeeper® 7.7), Patterson can quickly and easily complete an updated resource analysis to quantify the updated environmental benefits and benefit versus investment ratio for the community's urban forest. Since benefits will increase with additional trees planted and as the urban forest matures, it is recommended that a resource analysis be completed every five (5) years.
    - i. Use i-Tree Streets to calculate the current composition, benefits, and benefit versus investment ratio of the community urban forest.
    - ii. Review changes and improvements to benefits, composition, and benefit versus investment ratio.

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## Optimize Program Organization and Funding

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- iii. Consider results with periodic review and alignment of UFMP goals, objectives, and actions.
      - iv. Report changes and progress in the State of the Urban Forest Report.
    - B. Add this objective to long-range planning documents.
  - 4. Complete a canopy analysis every ten (10) years.
    - A. Now that a baseline tree canopy cover analysis has been completed, overall canopy and canopy cover by neighborhood, land-use, and other boundaries can be measured periodically for change over time and attainment with community canopy goals. Canopy analysis should be completed every ten (10) years.
      - i. Use i-Tree Canopy or remote sensing (aerial imagery) to map the extent and location of tree canopy in Patterson.
      - ii. Review changes and improvements to overall canopy cover, land use, neighborhoods, etc.
      - iii. Consider results with periodic review and alignment of UFMP goals, objectives, and actions.
      - iv. Report changes in the State of the Urban Forest Report.
      - v. Add this objective to long-range planning documents.
  - 5. Update the UFMP every ten (10) years.
    - A. Incorporate updated information on the canopy cover, public tree resource, overall tree inventory, budgets, policies, and progress made on benchmark values.
      - i. Add this objective to long-range planning documents.

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# How Are We Doing?

## Monitoring and Measuring Results

With appropriate care and planning, the urban forest is an asset that has the potential to increase in value over time. Considering a well-established community tree resource in overall good condition, proactive management, planning, and additional tree planting to increase the stocking level, will further position Patterson to fully realize this potential. As young trees mature, and their leaf surface and canopy grow, so too will the overall benefit 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 also includes strategies for measuring the success of the Plan over time.

## Annual Review

The UFMP is an active tool that will guide management and planning decisions over the next 25 years. The objectives and strategies will be reviewed internally on a yearly basis for progress and integration into the annual Department work plan. The Plan also includes strategies for some long-range objectives. Target dates are intended to be flexible in response to emerging opportunities, available resources, and changes in community expectations.

## Resource Analysis

With up-to-date tree inventory data, Patterson can quickly and easily complete a resource analysis. The values on structure, annual benefits, replacement value, and benefit versus investment ratios can be used to demonstrate a baseline against which future progress and improvements to health (condition), species diversity,

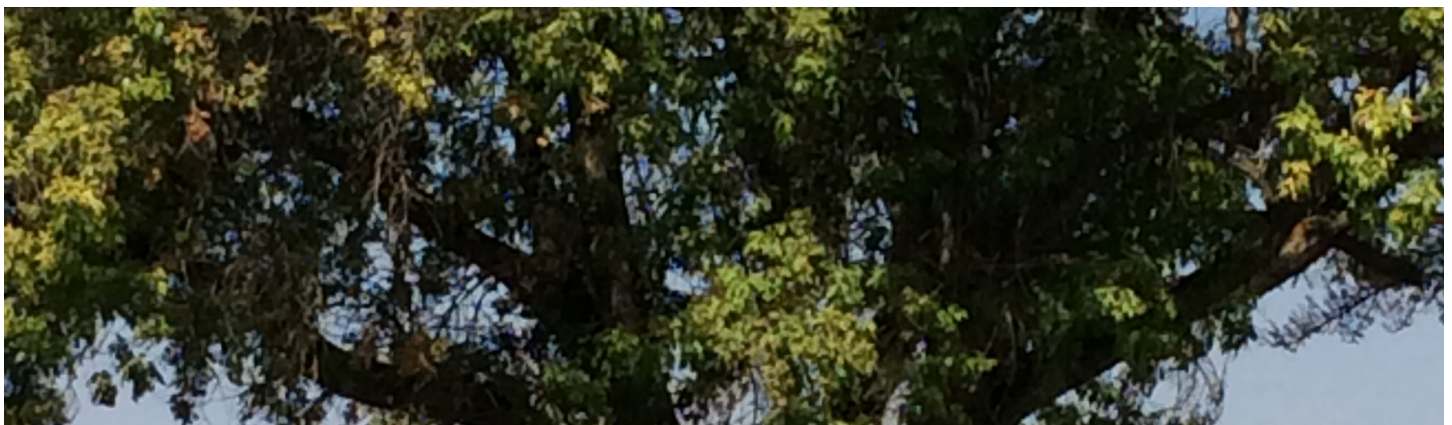
annual benefits, and overall resource value can be measured. A strategy of the UFMP is to complete this analysis every five years to illustrate progress and success towards Plan goals.

## Approved Tree List

Maintaining a diverse selection of regionally (and locally) compatible street trees species supports diversity and health in the urban forest. Forestry staff should collaborate with stakeholders (e.g., maintenance managers, experienced individuals) to periodically review and update the Approved Tree List. The City will evaluate existing species with consideration for their performance history and distribution within the overall urban forest and provide consideration for new cultivars and varieties that may provide solutions to emerging pests, disease, or climate issues. A strategy of the UFMP is to update this list every five years.

## Canopy Analysis

With an anticipated impervious surface layer (2017) and the development of a baseline tree canopy assessment, Patterson could monitor and illustrate



changes to the extent and location of tree canopy over time. Using GIS analysis, the City could measure changes in overall land cover as well as by neighborhood and zoning. This information can be used to inform canopy goals and monitor attainment. UFMP strategies include an update of canopy cover at least every ten (10) years.

DRG recommends two options for calculating progress towards canopy goals.

### Aerial Imagery Remote Sensing

With advanced GIS and remote sensing software capabilities and advances in image acquisition, a top-down canopy assessment approach is recommended to quantify the extent and location of tree canopy. DRG recommends an object-based image analysis (OBIA) semi-automated feature extraction method to process and analyze current high-resolution color infrared (CIR) aerial imagery to identify tree canopy and other land cover classifications. Remote sensing imagery analysis is cost-effective and provides a highly accurate approach to assessing existing tree canopy coverage.

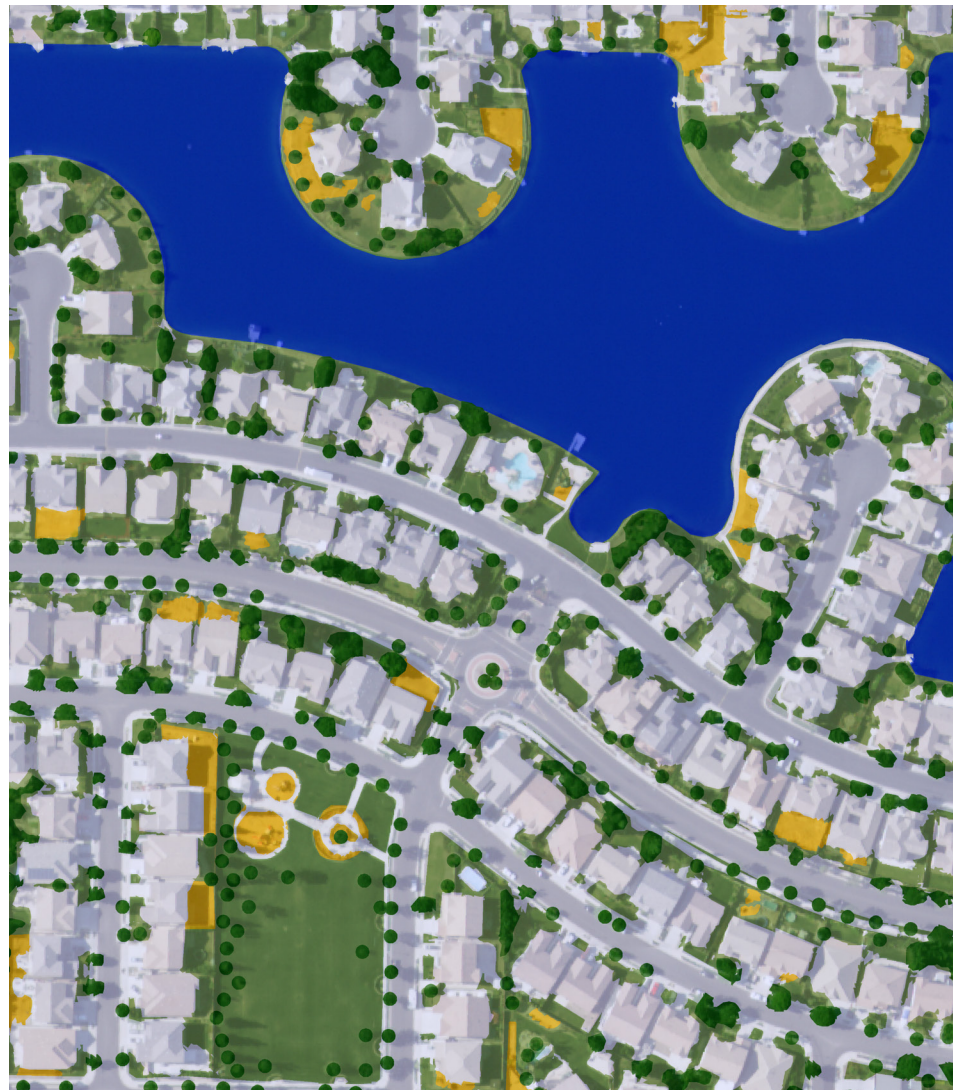
Four-band imagery acquired by the United States Department of Agriculture (USDA), through the National Agricultural Imagery Program (NAIP) is freely available. The NAIP, administered by the USDA's Farm Service Agency, acquires imagery at a one-meter ground sample distance (GSD) ([www.fsa.usda.gov](http://www.fsa.usda.gov)). Acquired during the agricultural growing season (or leaf on), NAIP imagery

can provide the base layer for object based image analysis.

Advanced image analysis software, such as Feature Analyst®, an extension of ArcGIS®, can be used to classify, or separate, land cover layers from the overall imagery. This semi-automated extraction process uses an object-oriented approach to cluster together objects with similar spectral (e.g., color) and spatial/contextual (e.g., texture, size, shape, pattern, and spatial association) characteristics. At a minimum, DRG recommends extracting the following five land cover classes:

- Tree canopy
- Pervious surface (e.g., turf, grass, and low shrubs)
- Impervious surface
- Bare soil
- Open water

Secondary source, high resolution aerial imagery used in conjunction with custom ArcGIS® tools can aid in final manual editing, quality checking and quality assurance processes (QA/QC). A manual QA/QC process can identify, define, and correct any misclassification or



omission errors in the final land cover layer.

With complete land cover analysis, the City can more easily prioritize planting space and assess contributions to stormwater management and heat island effects.

### **i-Tree Canopy**

For a quick and inexpensive measure of overall canopy and land cover change, DRG recommends using i-Tree Canopy. This methodology can provide an overall estimate of the percentage of tree canopy across Patterson by zoning and can be used to examine the relationship between tree canopy and other land cover classifications. However, unlike remote sensing, this methodology does not map the actual location or extent of tree canopy.

For i-Tree Canopy Analysis, DRG recommends the following protocol:

Develop a boundary layer for each of the zoning classifications in Patterson. Individually import each zoning boundary layer as well as the overall Patterson boundary layer into i-Tree Canopy ([www.itreetools.org/canopy/](http://www.itreetools.org/canopy/)) for point-based analysis. i-Tree Canopy uses default imagery from Google Maps to provide a base layer for analysis, but can be configured to use other current aerial imagery when available.

A qualified technician with aerial image experience should interpret the cover class at points randomly assigned by i-Tree Canopy as:

- Tree
- Pervious surface
- Impervious surface
- Water

Assign a land cover classification to 1,000-2,000 points in each zoning class to achieve a standard error of less than 1.5%. Once established, these points should be used for any future analysis to monitor change. A second technician should perform quality assurance testing on up to ten percent (10%) of the data set. Any points that do not receive the same interpretation by both observers in any year should be removed from the analysis.

The results of these analyses can be compared over time to monitor the baseline values for tree canopy and other land cover classifications.

### **State of the Community Forest Report**

The UFMP calls for the Urban Forestry Division to deliver a State of the Community Forest Report every five (5) years. This report, which includes updates on canopy change, numbers of trees planted and removed,

and changes to the overall community forest (e.g., structure, benefits, and value), will serve as a performance report to stakeholders and an opportunity for engagement. The report is also an opportunity to highlight the successful attainment of UFMP objectives as well as to inform stakeholders about any issues or stumbling blocks.

### **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, 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 public support for the Plan's objectives. Community satisfaction can also be gauged by the level of engagement and support for forestry programs.



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# Appendix

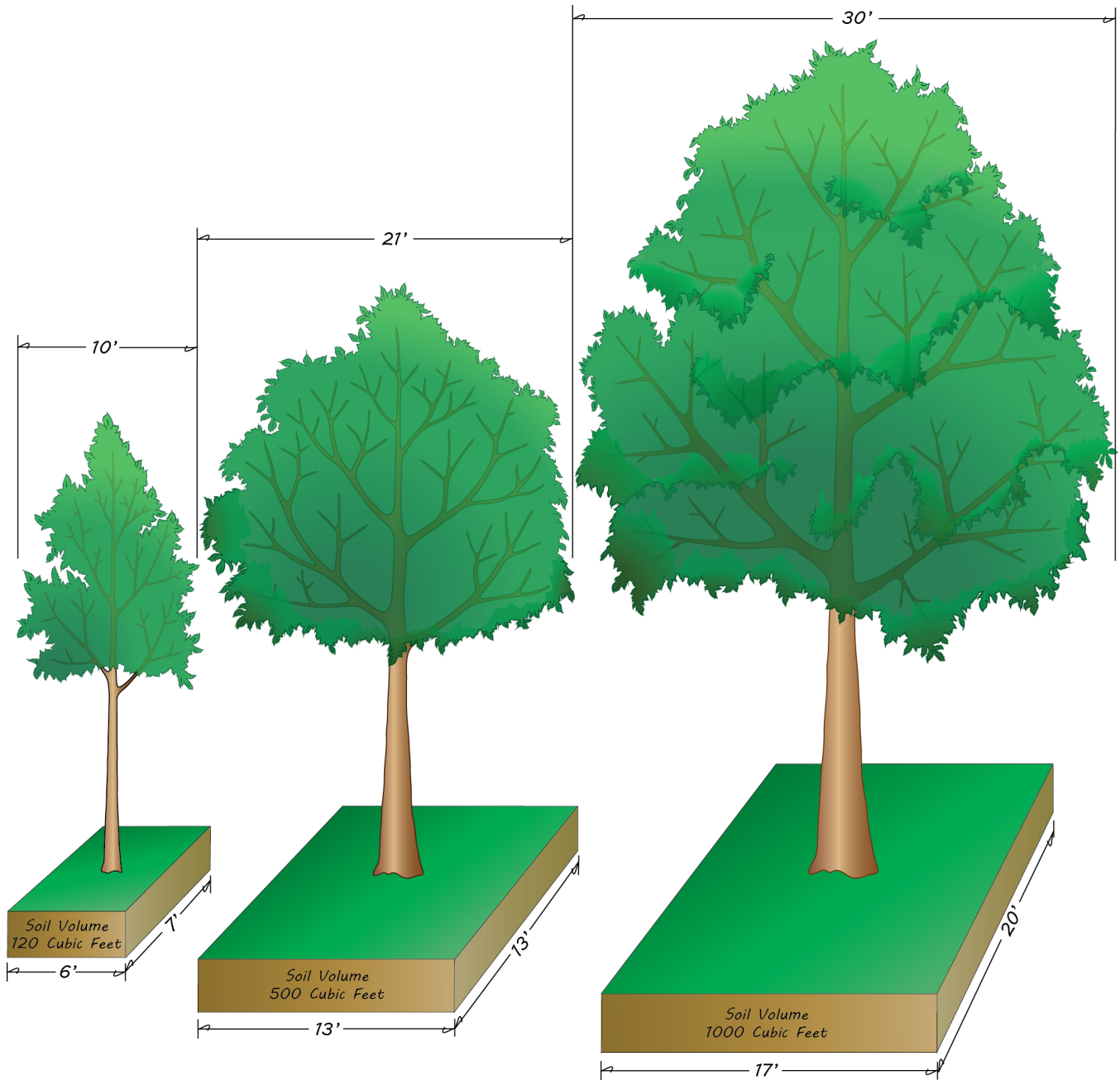
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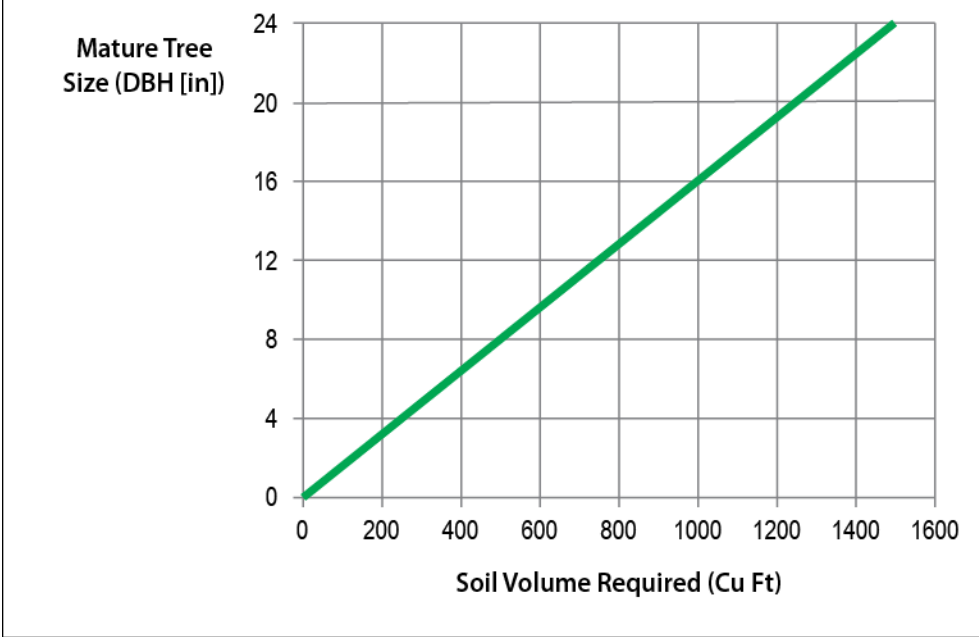
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## B. Soil Volume and Tree Stature

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).

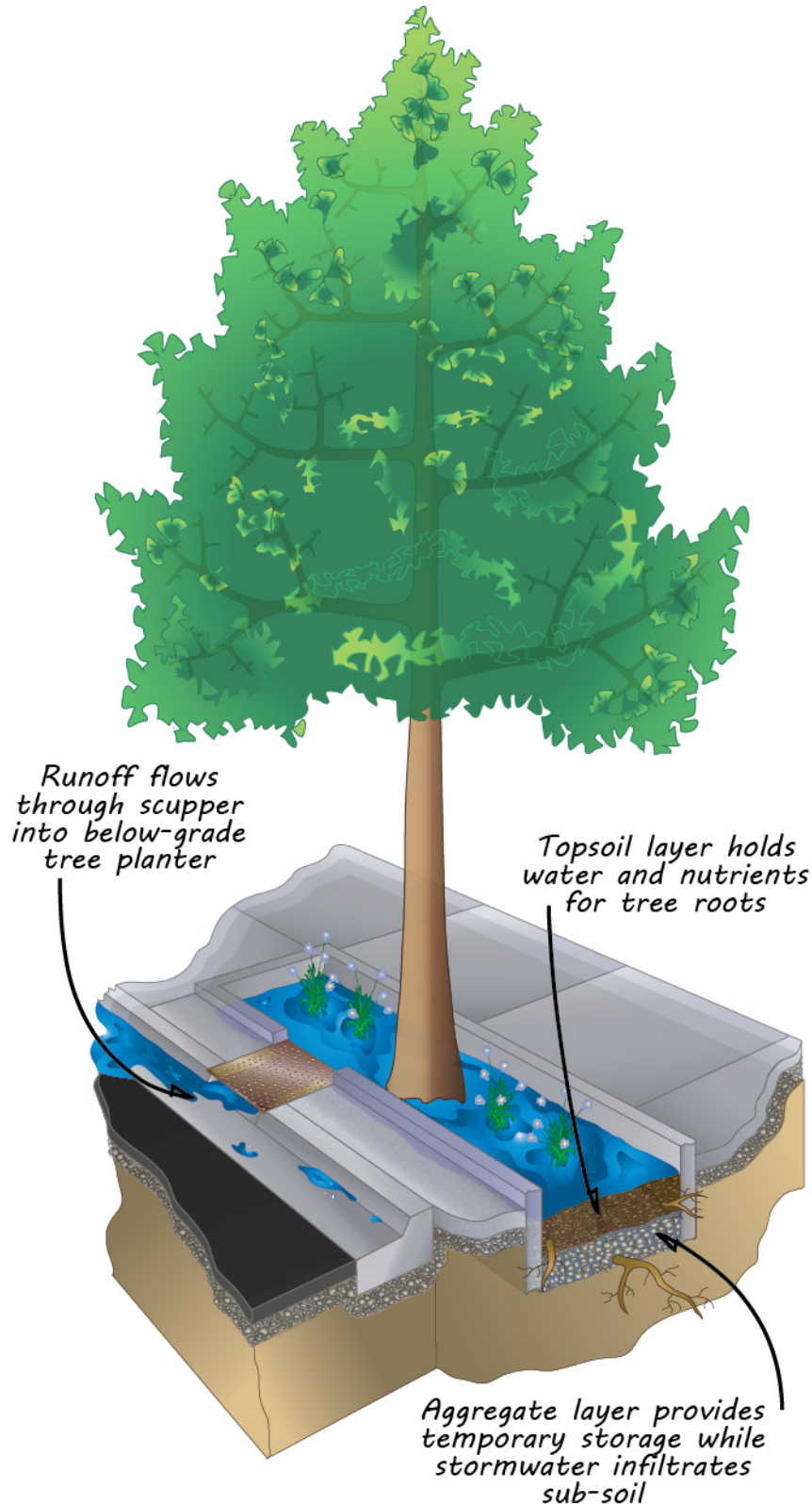


General relationship between soil volume requirements and mature tree size (James Urban, 1989).

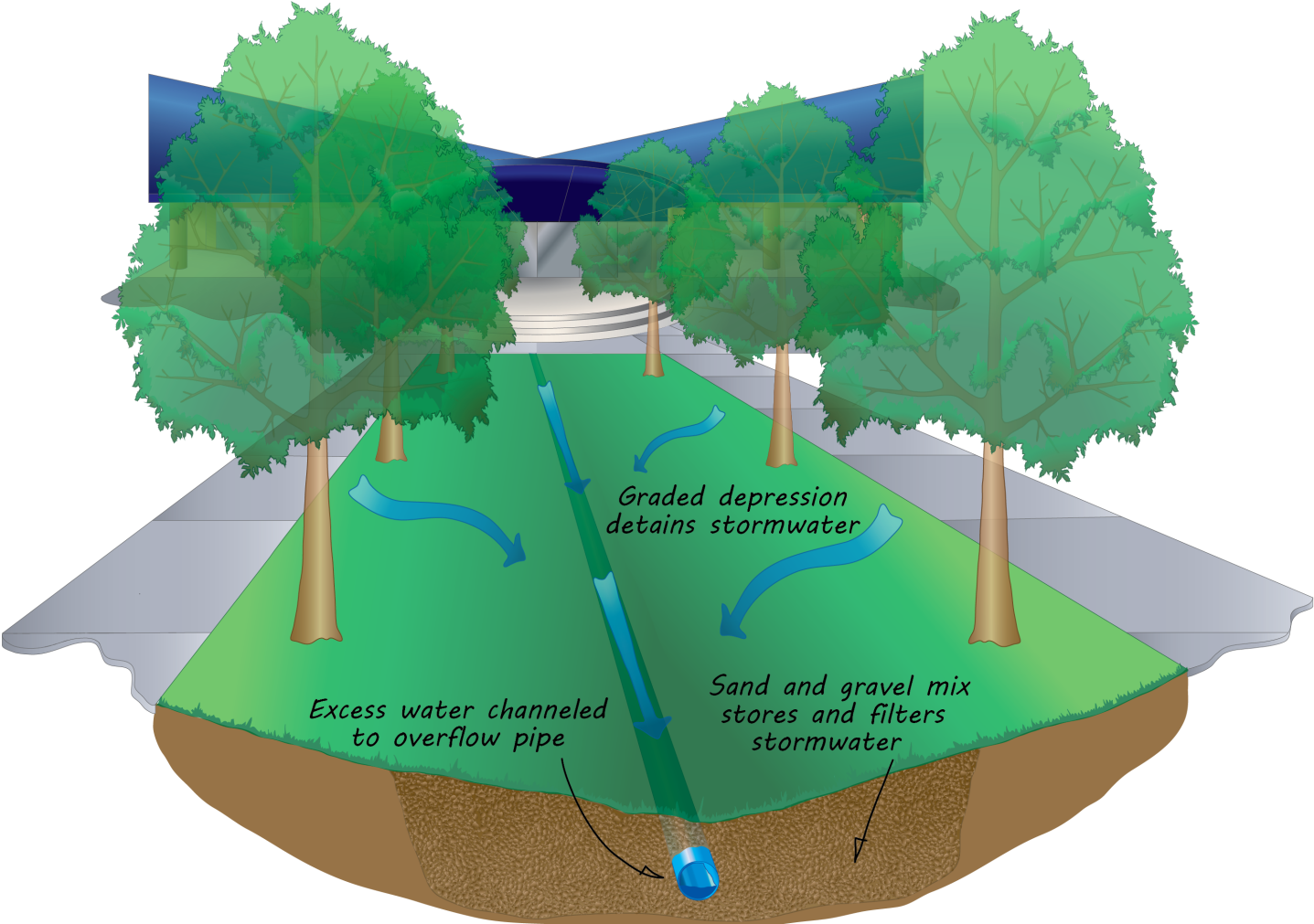


## C. Alternative Planter Designs

Stormwater tree pits are designed to collect runoff from streets, parking lots, and other impervious areas. Stormwater is directed into scuppers that flow into below-grade planters that then allow stormwater to infiltrate soils to supplement irrigation.

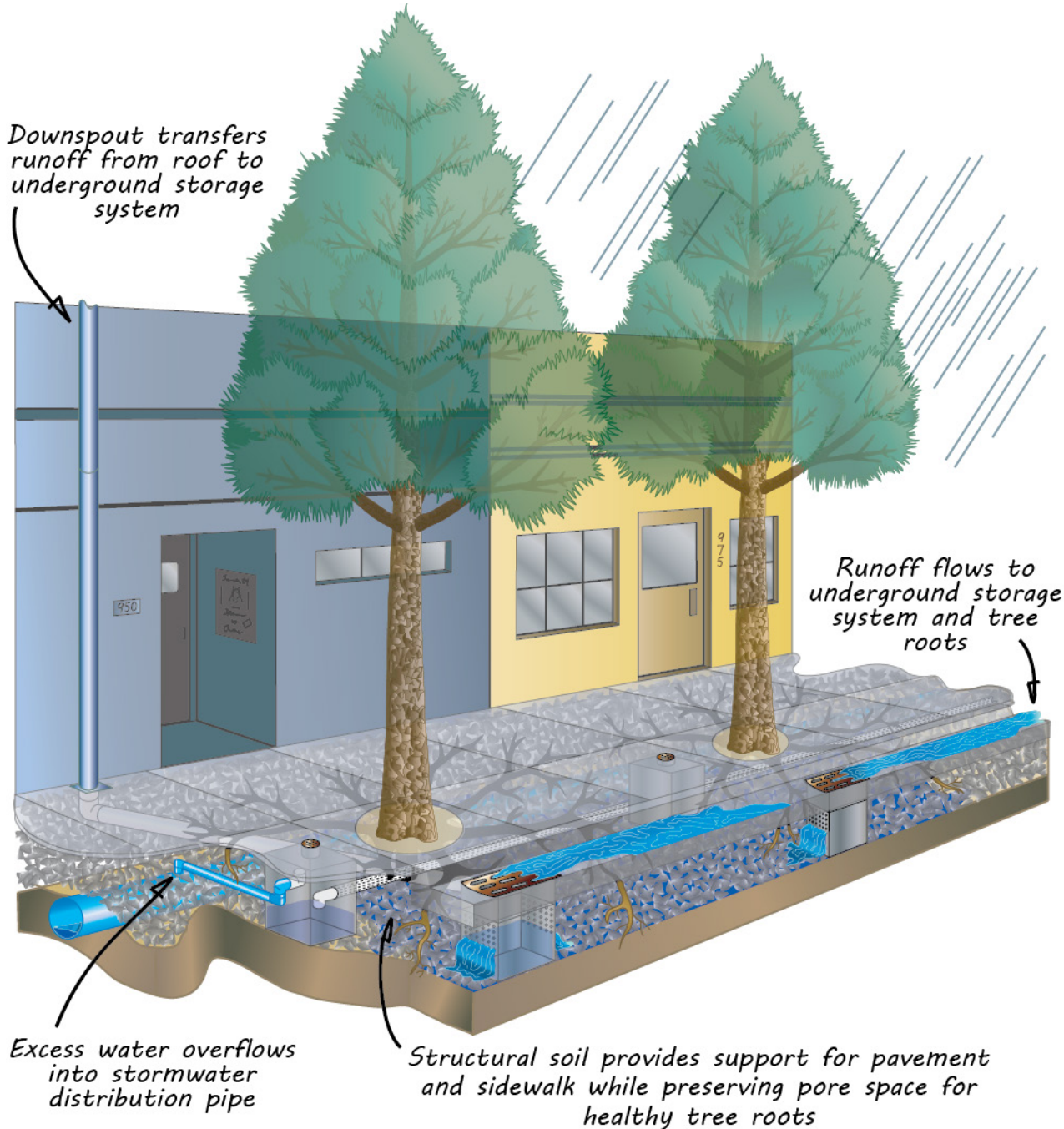


Bioswales are landscaped drainage areas with gently sloped sides designed to provide temporary storage while runoff infiltrates the soil. They reduce off-site runoff and trap pollutants and silt.

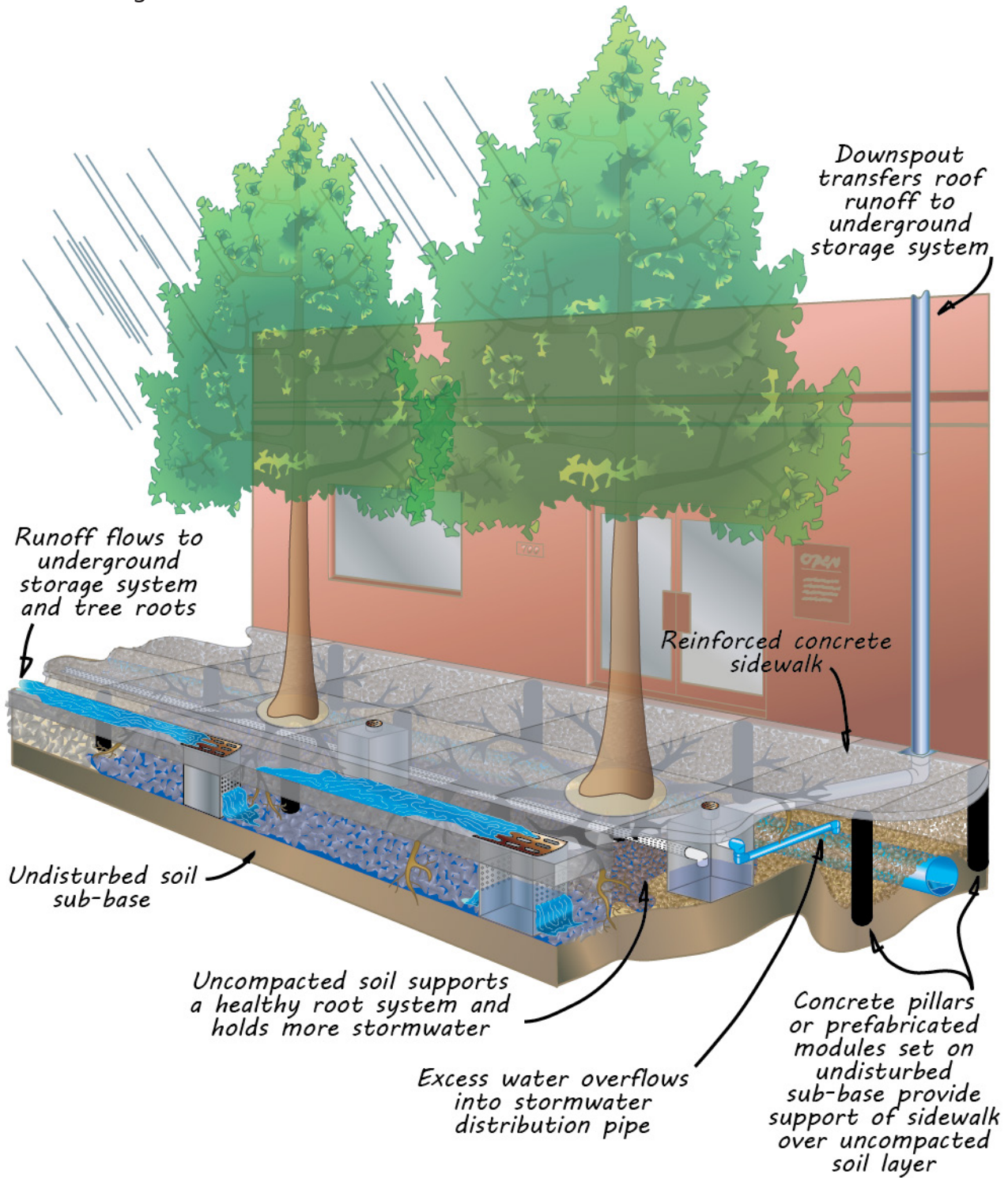


*Increased soil volume and vegetation, including trees, maximizes potential for absorption, bioremediation, and phytoremediation*

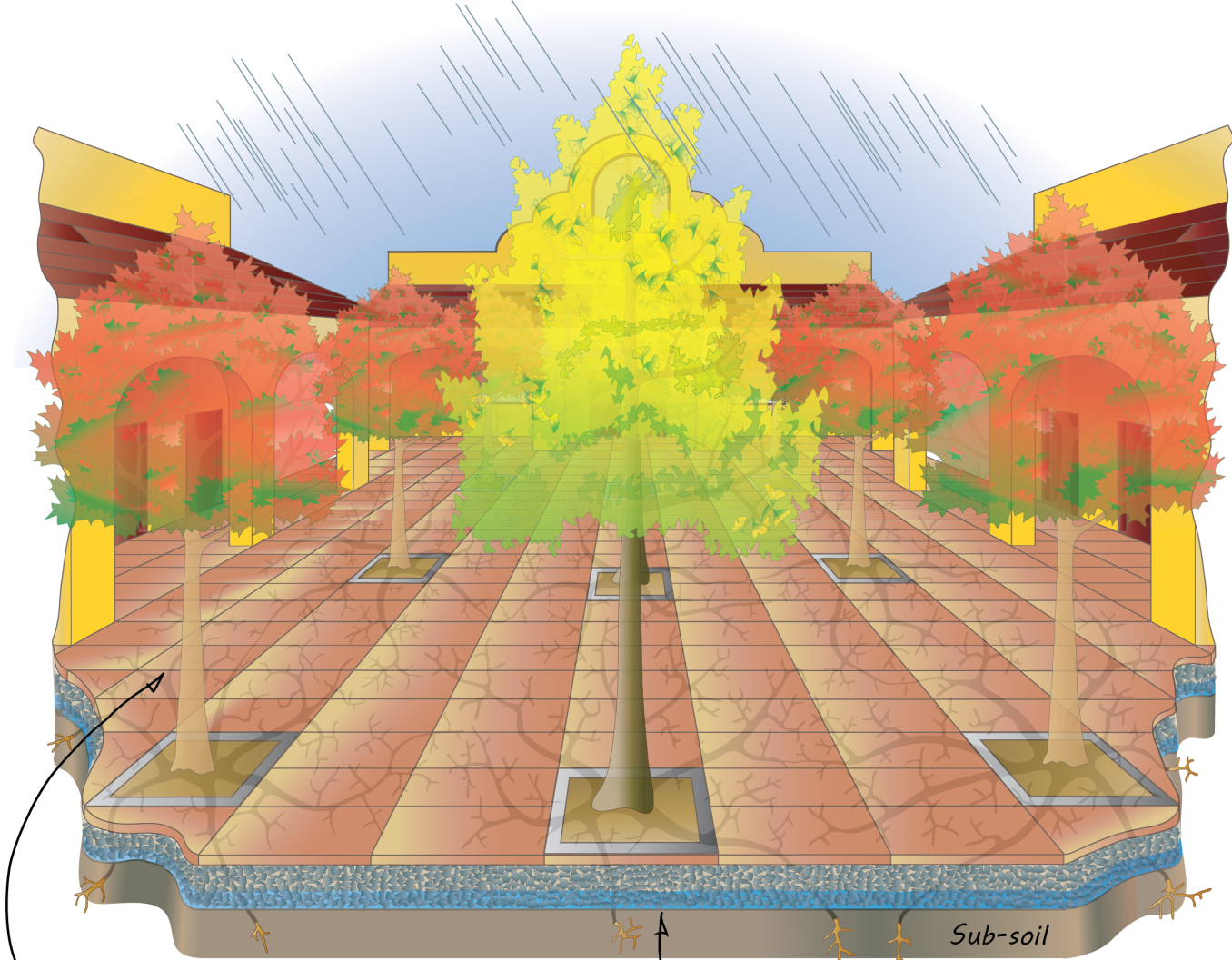
Structural soil is a highly porous, engineered aggregate mix, designed for use under asphalt and concrete as a load-bearing and leveling layer. Pore spaces allow for water infiltration and storage as well as root growth.



Suspended sidewalks use pillars or structured cell systems to support reinforced concrete, increasing the volume of uncompacted soil in subsurface planting areas and enhancing both root growth and stormwater storage.



Bioswales are landscaped drainage areas with gently sloped sides designed to provide temporary storage while runoff infiltrates the soil. They reduce off-site runoff and trap pollutants and silt.



*Permeable pavement allows stormwater to infiltrate surface, recharging sub-soil and irrigating trees*

*Aggregate layer provides temporary storage while stormwater infiltrates sub-soil*



## D. Maintenance Cycle and Pruning Matrix

The proposed maintenance cycle and pruning matrix (below) was developed through industry best management practices, existing block-pruning areas, and operational cost values provided by Patterson City staff. The schedule is measured in annual quarters (3 months) and the entire schedule will complete every 6 years, at which point the schedule starts over.

Each Tree Maintenance District (TMD) is composed of several geographic areas (often subdivisions) in Patterson. The TMDs were designed to combine geographically close areas. The TMDs were also designed to include approximately an equal number of trees.

The average cost of medium tree maintenance was calculated from historical performances

by Patterson tree crews. It is important to note that younger and/or smaller trees are less expensive and time intensive to maintain. As they grow and mature into larger trees, those costs increase. Therefore the maintenance cycle has dynamic costs.

Tree care costs in TMDs are supplemented by a property assessment. The assessment is drawn solely from properties within that specific TMD. For example, Heartland Ranch property assessments will directly fund the maintenance and pruning of trees in TMD 3.

With the proposed addition of an additional full-time, the urban forestry would have a total of five (5) tree maintenance workers. The amount of workers crosses a valuable threshold because

three (3) workers are required for regular tree maintenance. However, only two (2) workers are required to respond to tree service requests. Thus when a service call comes in, all regular pruning must cease while the team relocates to address the service call. By increasing the total team to five (5) tree maintenance workers, three (3) team members can continue with scheduled pruning for the TMD.

The estimated cost of conducting tree maintenance along this schedule is discussed in the proposed budget additions.

**Table 16: Proposed Maintenance Cycle and Pruning Matrix**

Tree Maintenance Areas (TMA)	# of Trees (estimate)	Service Hours per Tree (average)	Total Hours to Complete	From: Tree Maintenance Hours Assessment		# of Quarters	Status
				Weeks to Complete (32 hour week)	Maintenance Schedule		
FDES Hall	4			1	6/4/18-6/8/18		Done
Sutter Pointe	198	0.5	99	4	6/11/18-7/6/18	1	
Country Air	397	1	397	13	7/9/18-10/5/18	2	
Leverton Estates	371	1	371	12	10/8/18-12/28/18	1	
California Palms	205	1.5	308	10	12/31/18-3/8/19	1	
Walker Ranch	1325	1	1325	42	3/11/19-12/27/19	3	
Patterson Gardens	1005	0.5	503	16	12/30/19-4/17/20	1	
Heartland Ranch	1423	1	1423	45	4/20/20-2/26/21	4	
Kinshire/Shire Parks Estate:	650	1.5	975	31	3/2/21-10/1/21	3	
Downtown	1929	1.5	2894	91	10/4/21-6/30/23	7	
Brook Hollow	77	1.5	116	4	7/3/23-7/28/23	1	
Colony Park I & II	136	1.5	204	7	7/31/23-9/22/23	1	
Walnut Square	68	0.5	34	2	9/18/23-9/22/23	1	
Mirragio	30	0.5	15	1	9/25/23-9/29/23	1	
<b>Totals</b>	<b>7,818 Trees</b>		<b>8,664 Hours</b>	<b>279 Weeks</b>			

## E. Proposed Budget Additions

The proposed budget additions looks only at the general fund. The proposed budget does not take grants like CAL FIRE into consideration because grants are inconsistent and temporary. While they can be a great boon to urban forestry operations, they should not be considered when developing a sustainable model because of their inconsistency.

The proposed budget additions (Table 17) from the general fund is the baseline upon which the tree maintenance cycle and pruning matrix is built. However the general fund alone is not sufficient to conduct the maintenance cycle and pruning matrix. The TMDs are comprised of smaller areas that include landscape maintenance districts. Property taxes assessed on properties in these areas directly funds the maintenance of trees in those areas. However, the amount of taxation is dependent upon community support. City managers should conduct outreach to determine this level of support. Once this value is found City leadership can evaluate if the tax revenue, in combination with general

funds, is sufficient to conduct urban forestry operations. If not, further budget increases to the general fund may be necessary.

A significant portion of the proposed budget is devoted to increasing staff size. Stakeholders communicated their desire to hire an additional one (1) full-time tree maintenance worker. Public Works estimates the total annual cost of that hire to be approximately \$60,000. This cost was added to the proposed.

The added value of this additional worker is significant. As mentioned throughout the plan, at least three (3) tree workers are required to conduct regular tree maintenance and inspections. However only two (2) workers are required to respond to tree service calls. As such, the current practice is to halt all regularly scheduled pruning to go respond to service calls. This is a costly process with a significant time investment. All vehicles and equipment must be managed, traffic control measures must be stowed/deployed, and adjacent property owners and businesses are subject to more intrusion.

The UFMP. In addition, the regular tree maintenance will increase the health and value of the trees in the urban forest. This will increase the ecosystem services provided by these trees such as filtering air pollutants and managing storm-water. Further, healthier trees which are maintained regularly are much safer. This decreases the health risks of the community while also reducing liability and insurance settlements for the City. For all these reasons, hiring an additional tree maintenance worker would greatly increase the scope and efficiency of urban forestry operations in Patterson. The return warrants the investment.

Inflation averaged 2% in 2017. The proposed budget accounted for this inflation (and provided a modest cushion) by raising values 3%. Stakeholders did not identify any equipment issues that would require a significant investment.

**Table 7: Patterson Urban Forest Budget 2016-2017**

<b>Urban Forestry Budget: Fiscal Year 2016-2017</b>	
Total Salary & Benefits (General Fund)	\$160,003
Total Operation & Maintenance	\$71,636
Total Capital (vehicles and equipment)	\$21,500
<b>Grand Total</b>	<b>\$253,139</b>

Note: Salary benefits include three (3) full time tree maintenance workers, one (1) part time tree worker, and one (1) UF supervisor.

**Table 17: Proposed Patterson Urban Forest Budget**

<b>Urban Forestry Budget: Proposed</b>	
Total Salary & Benefits (General Fund)	\$224,003
Total Operation & Maintenance	\$73,785
Total Capital (vehicles and equipment)	\$22,145
<b>Grand Total</b>	<b>\$319,933</b>

Note: Proposed salary benefits include four (4) full time tree maintenance workers, one (1) part time tree worker, and one (1) UF supervisor.

## F. Guidelines for Tree Preservation in Construction Zones

### Construction Site Management

Preservation of existing mature trees before, during, and after new construction and redevelopment is beneficial for a number of reasons, including:

- To sustain both the function and value of existing trees and tree canopy.
- To promote public safety and reduce liability by carefully maintaining the health of preserved trees.
- To contain costs associated with site restoration.
- To reduce or avoid soil compaction and degradation as well as preserve soil volume.
- To avoid physical injury to existing trees.
- To avoid root injury to trees.
- To protect soils and the hydraulic integrity of the entire site.
- To protect existing irrigation, utilities, and underground drainage.
- To prevent sediment-laden and/or polluted runoff from entering drainage systems and water bodies (streams, wetlands, lakes, bays).

### Best Management Practices (BMPs)

#### Pre-Construction

- The Project Manager shall know and understand the development and building regulations concerning trees and vegetation in the area.
- The Project Manager shall ensure that irrigation and drainage systems are operable and adequate.
- The Project Manager shall ensure all temporary erosion sediment control measures are in place prior to groundbreaking.
- The Project Arborist will be responsible for decisions related to vegetation on site before, during, and after construction.
- The Project Arborist shall perform a site inventory of all existing trees in order to record the variety, location, size, and health of each tree. Site inventory includes determining size, species, numbers, and numbers of trees/plants on site.
- The Project Arborist shall submit a Tree Protection Plan (TPP) that identifies all significant trees that will remain on the project site.
- The TPP will indicate the Tree Protection Zone (TPZ) for each tree as (at a minimum) the greater of: six (6) feet. OR

- ◆ By multiplying each tree's diameter at 4.5 feet above existing grade (DBH) by a factor of one (1) to determine the diameter, in feet, of the area above and below ground to be protected.
- The TPZ may exceed the Critical Root Zone (CRZ), which is not less than half the distance between the trunk and the outer edge of the tree's canopy, or drip line, but the TPZ may not be smaller than the CRZ.
- The TPP will contain the expected tree protection techniques that will be used on the project.
- The TPP will also list a timetable for project meetings with the Project Team, including a pre-construction meeting and the schedule for the Project Arborist monitoring.
- Prior to approval of the TPP, the City shall collect a security device (cashier's check or bond) in the form of a deposit equal to the tree appraisal value of all protected trees as determined under the methods established by the Council of Trees & Landscape Appraisers Guide for Plant Appraisal (9th Edition or most current).
- Trees that require removal or pruning to accommodate future structures and construction equipment should also be identified and recorded.

### **Construction Site Preparation**

- Staging areas for equipment shall be established far enough from existing trees to ensure adequate protection of the root zone.
- Entry and exit routes shall be established and fenced off with chain link or construction fencing. When planning routes, avoid utility access corridors.
- Irrigation and drainage systems shall be protected from damage unless plans call for renovation of such systems.
- Prior to beginning construction activities, the Project Arborist will supervise and verify the following tree protection measures are in place and comply with the approved TPP:
  - i. A six-inch (6") layer of coarse mulch or wood chips is to be installed within the TPZ of protected trees. Mulch shall be kept twelve (12) inches away from the trunk.
  - ii. Trunks of trees shall be protected with a single wrap of Geocomposite. Geocomposite shall be double-sided, Geonet core will have non-woven covering (such as Tenax Tendrain 770/2), or equivalent. Tree trunks will be protected with wrap.
  - iii. Trees that have been identified in the site inventory as posing a health or safety risk may be removed or pruned by no more than one-third, subject to approval of the required permit by the Public Works Department. Pruning of existing limbs and roots shall only occur under the direction of the Project Arborist.
  - iv. A protective barrier shall be installed around the Tree Protection Zone (TPZ). The fence shall be constructed from six-foot (6-foot) high chain link. Posts shall be two (2) inches in diameter, driven two (2) feet into the ground. The distance between posts shall be not more than ten (10) feet. The enclosed area is the TPZ and shall have a warning sign displayed prominently at 20-foot (maximum) intervals along the fence. The warning sign shall be a minimum 8.5 inches x 11 inches and will clearly state the following: "WARNING

- Tree Protection Zone." Fencing may be moved within the TPZ if authorized by the Project Arborist and City Staff but may not be closer than the drip line from the trunk of any tree.
- v. Movable barriers of chain link fencing secured to cement blocks may be substituted for "fixed" fencing if the Project Arborist and City Staff agree that the fencing will need to be moved to accommodate certain phases of construction. Moving TPZ fencing shall be prohibited without authorization from the Project Arborist and City Staff.
  - vi. Should temporary access into the TPZ be approved, an additional layer of approved tree matting shall be placed over the Critical Root Zone (CRZ).
  - vii. Tree Growth Regulators (TGR) may be used as approved by the Project Arborist and City Staff. Paclobutrazol soil-applied tree growth regulator (Cambistat® or equivalent) shall be applied to indicated trees by a qualified applicator. Applications shall follow manufacturer's label and applicable laws. TGR reduces canopy growth and increases fibrous root system growth over two to three (2-3) years. This can increase tolerance to drought and stress, as well as improve absorption of nutrients and moisture during the stress recovery period.

### **During Construction**

During the Construction phase, the Project Arborist should inspect the site on a regular basis to ensure the TPP is being adhered to and report any conflicts or deviations to the City Arborist or City Representative. The Project Arborist also needs to be available at the site to monitor construction activities that require encroachment within the TPZ, such as grading or trenching. It may also be necessary to have other key project team members available to monitor these activities.

The Project Arborist shall specify to construction personnel that the following conditions shall be avoided:

- Allowing runoff or spillage of damaging materials into the area below any tree canopy.
- Storing construction materials or portable toilets, stockpiling of soil, or parking or driving vehicles within the TPZ.
- Cutting, breaking, skinning, or bruising roots, branches, or trunks without first obtaining authorization from the Project Arborist.
- Allowing fires under and adjacent to trees.
- Discharging exhaust into foliage.
- Securing cable, chain, or rope to trees or shrubs.
- Trenching, digging, or otherwise excavating within the CRZ or TPZ of the tree(s) without first obtaining authorization from the Project Arborist.
- Applying soil sterilizers under pavement near existing trees.

The Project Arborist shall provide periodic inspections during construction. Four-week intervals should be sufficient to access and monitor the effectiveness of the TPP and to provide recommendations for any additional care or treatment. Inspections that are more frequent may also be required based on the approved TPP.

It is the responsibility of the Project Manager to ensure compliance with the following activities:

- Construction shall be monitored regularly to ensure compliance with specifications. Work shall be stopped if construction site management BMPs are not being followed by the contractor.
- Cement washout pits and chemical holding areas shall be located away from tree protection areas, streams, and wetlands.
- Contractor parking and material storage shall be limited to already impacted areas away from tree roots.
- Site offices and equipment shall not encroach into tree protection areas.
- Refueling and maintenance areas shall be kept away from trees, native soils, water bodies, and drainage systems. Fuel spills will not be tolerated on construction sites.
- To the extent possible, construction equipment shall be kept away from all onsite vegetation, especially those within designated protection areas.

Additionally, the following activities should be observed and inspected by the Project Arborist during the construction phase to ensure compliance with the approved TPP:

- Only excavation by hand or compressed air shall be allowed within the TPZ of trees. Machine trenching shall not be allowed.
- To avoid injury to tree roots, when a trenching machine is being used outside of the TPZ of trees, and roots are encountered smaller than two inches (2"), the wall of the trench adjacent to the trees shall be hand-trimmed, making clear, clean cuts through the roots. All damaged, torn, and cut roots shall be given a clean cut to remove ragged edges, which promote decay. Trenches shall be filled within 24 hours; where this is not possible, the side of the trench adjacent to the trees shall be kept shaded with four (4) layers of dampened, untreated burlap, wetted as frequently as necessary to keep the burlap wet. Roots two inches (2") or larger, when encountered, shall be reported immediately to the Project Arborist, who will decide whether the Contractor may cut the root as mentioned above or excavate by hand or with compressed air under the root. All exposed roots are to be protected with dampened burlap.
- Where possible, route pipes outside of the TPZ of a protected tree to avoid conflict with roots.
- Where it is not possible to reroute pipes or trenches, the contractor shall bore or tunnel beneath the TPZ of the tree. The boring shall take place not less than three feet (3') below the surface of the soil to avoid encountering "feeder" roots. All boring equipment must be staged outside of the TPZ.
- All grade changes adjacent to the TPZ of a significant tree shall be supervised by the Project Arborist. Cuts or fills of soil adjacent to the TPZ will have a retaining wall system installed as approved by the Project Arborist and City Staff.
- Any damage due to construction activities shall be reported to the Project Arborist and City Staff within six (6) hours so that remedial action can be taken.
- The Project Arborist shall be responsible for the preservation of the designated trees. Should the builder fail to follow the tree protection specifications, it shall be the responsibility of the Project Arborist to report the matter to City Staff as an issue of non-compliance.

## Post-Construction

Important follow-up monitoring of the protected trees will help ensure their survival and identify signs of early stress.

The applicant shall arrange with the Project Arborist for the long-term care and monitoring of preserved trees by complying with the following conditions:

- Complete post-construction tree maintenance, including pruning, mulching, fertilization, irrigation, and soil aeration where necessary.
- Remove, by hand, all soil and root protection material such as wood chips, gravel, and plywood.
- Provide for remediation of compacted soil by methods such as aeration or vertical mulching.
- In the absence of adequate rainfall, apply at least one inch (1") of water per week in the CRZ by deep watering.
- Fertilize trees with slow-released phosphorus, potassium, calcium, magnesium, and other macro- and micro-nutrients as indicated by a soil test, but wait at least one (1) year to apply any nitrogen.
- Fertilize lightly with slow-release nitrogen after one (1) year, and then make annual light nitrogen applications for the next three to five (3-5) years.
- Inspect trees annually for at least three (3) and up to five (5) years after construction to look for changes in condition and signs of insects or disease and to determine maintenance needs. Remove trees that are badly damaged or are in irreversible decline as determined by the Project Arborist and City Staff.
- Continue to protect not only the large, established trees on the site but also those newly planted in the landscape.
- Maintain TPP during the installation of new landscaping.
- Provide annual inspection reports to the City.
- Review TPP prior to the installation of landscaping and walkways/sidewalks.

## Mitigating Tree and Infrastructure Conflicts

Conflicts may occur when tree roots grow adjacent to paving, foundations, sidewalks, or curbs (hardscape). Improper or careless extraction of these elements can cause severe injury and instability to the roots or even death of the trees. The following alternatives must first be considered before root pruning within the TPZ of a tree.

### Removal of Pavement or Sidewalk

Removal of existing pavement over tree roots shall include the following precautions: break hardscape into manageable pieces with a jackhammer or pick and hand-load the pieces onto a loader. The loader must remain outside the TPZ on undisturbed pavement or off exposed roots. Do not remove base rock

that has been exploited by established absorbing roots. Apply untreated wood chips over the exposed area within one (1) hour, then wet the chips and base rock and keep moist until overlay surface is applied.

An alternative to the severance of roots greater than two inches (2") in diameter should be considered before cutting roots. If an alternative is not feasible, remove the sidewalk, as stated above, and cut roots with a sharp, clean saw, as approved by the Project Arborist. Then, replace sidewalk using #3 dowels at the expansion joint if within ten (10) feet of a protected tree. Use wire mesh reinforcement if within ten feet (10') of the trunk of a tree.

### **Alternative Methods to Prevent Root Cutting**

- Grinding a raised sidewalk edge.
- Ramping the walking surface over the roots or lifted slab with pliable paving.
- Routing the sidewalk around the tree roots.
- Installing boardwalk, flexible paving, or rubberized sections.
  - i. New sidewalk or driveway design should consider alternatives to conventional pavement and sidewalk materials. Possible substitute permeable materials for typical asphalt or concrete overlay, sub-base or footings are permeable paving materials (such as ECO-Stone or RIMA pavers), interlocking pavers, flexible paving, wooden walkways, and brick or flagstone walkways on sand foundations.
  - ii. Avoid tree and infrastructure conflicts and associated costs by the following planting practices:
    - Plant deep rooting trees that are proven to be non- or minimally-invasive.
    - Install a sidewalk with higher strength that has wire mesh and/or expansion slip joint dowel reinforcement over soil that shrinks or swells.
    - Fracture soil with an air spade and backfill with sand prior to planting to promote deep rooting and improved drainage.
    - Install root barrier only along the hardscape area of the tree and allow roots to use open lawn or planter strip areas.
    - Dedicate at least ten (10') linear feet of planting space for the growth of each new tree.
    - Provide a dedicated irrigation system or zone so the trees do not have to compete and are not dependent on the turf and shrub irrigation.
    - Avoid planting trees over underground drainage systems where root intrusion will impede function of the system.
      - i. Alternative Base Course Materials: When designing hardscape areas near trees, the Project Architect or Engineer should consider the use of recommended base course material, such as an engineered structural soil mix. An approved structural soil mix will allow for a long-term, cost-effective tree as well as infrastructure compatibility that is particularly suited for the following types of development projects:

- Repair or replacement of sidewalk greater than 40 feet (40') in length;
- Planting areas that are designed over structures or parking garages;
- Confined parking lot medians and islands, or other specialized conditions as warranted.

### **Training**

- The Project Arborist should provide training to all construction personnel to ensure they understand all construction site BMPs.
- The Construction Supervisor and Architect should have current training and education dealing with construction site management, including protecting trees and erosion control on construction sites.

An example Tree Protection Zone sign (below). Standard Detail of Tree Protection Measures (right).

## **WARNING** **TREE PROTECTION ZONE (TPZ)**

- No grade change, storage of materials, vehicles or equipment is permitted within this TPZ
- No cleaning of equipment near this TPZ
- No unauthorized entry
- This tree protection barrier must not be removed without the written authorization of the City of Mountain View and Supervision by the Project Arborist



# G. Revised Approved Tree List

## Revised Approved Tree List: Small Trees

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate		Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
					Slow (<12")	Medium (12"-24")							
<b>SMALL STATURE TREES</b>													
<i>Punica granatum</i> 'California Sunset'	California Sunset Pomegranate	<b>SMALL</b>	10-15	10		M	M	Fruitless. Develops a white flower in spring. Fall color is gold. Adapted to a variety of soil conditions.	Wet fruit litter issue.	Flat Mites, Leaf Rollers, Heart Rot		<b>x</b>	<b>x</b>
<i>Caesalpinia cacalaco</i> 'Smoothie'	Cascalote (thornless)	<b>SMALL</b>	15-20	15-25		M	L	Utility friendly. Use thornless variety. Heat and sun loving plant. Attracts humming birds.	Extra structural pruning needs.	White flies		<b>x</b>	<b>x</b>
<i>Vitex agnus-castus</i>	Chaste tree	<b>SMALL</b>	10-15	15-20		M	M	Utility friendly. Mid-summer flowering with blue or lavender flowers. Deciduous - fall color is not showy. Resistant to oak root fungus.	Branch strength rated as medium weak	N/A	<b>x</b>	<b>x</b>	<b>x</b>
<i>Chionanthus retusus</i>	Chinese fringe tree	<b>SMALL</b>	10-20	6-12		M	M	Utility friendly. Taller specimens may require minor height reduction if under wires. Fragrant white flowers. Dark purple drupes.	Wet fruit litter issue. Allergy Health Hazard.	N/A	<b>x</b>	<b>x</b>	<b>x</b>
<i>Chilopsis linearis</i>	Desert willow	<b>SMALL</b>	15-30	10-20		F	L	Utility friendly. California native. Drought tolerant. Attracts birds. Bright and colorful flowers.	Dry fruit litter issue. Allergy Health Hazard.	Root Rot	<b>x</b>	<b>x</b>	<b>x</b>

**Revised Approved Tree List: Small Trees (Continued)**

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate			Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
					Slow (<12")	Medium (12"-24")	Fast (>24")							
<b>SMALL STATURE TREES</b>													<b>SMALL STATURE TREES</b>	
<i>Cercis canadensis var. texensis</i> 'Oklahoma'	Oklahoma redbud	<b>SMALL</b>	15-20	15		M		M	Utility friendly. Taller specimens may require minor height reduction if under wires. Deciduous with gold fall color. Glossy, chordate leaves. Showy, pink flowers in spring. Persistent, purple seed pod in summer. Low potential for root damage. Resistant to wind damage.	N/A	Scales, Canker, Leaf Spot, Verticillium	x	x	x
<i>Dodonaea viscosa</i> 'Purpurea'	Purple hopseed	<b>SMALL</b>	15-20	10-15		F		L	Utility friendly. Drought tolerant. Grows in a variety of soil conditions. Attracts birds. Showy pink or white seed develops in summer or fall. Not Deer Palatable. None Known Health Hazard.	N/A	Scales, Phytophthora, Root Rot	x	x	x
<i>Cotinus coggygria</i> 'Royal Purple'	Royal Purple' smoke tree	<b>SMALL</b>	12-20	10-20		M		L	Utility friendly. Purple to red leaf color. Showy pink flowers.	Branches droop but resist breakage.	Leaf Rollers, Leaf Spot, Canker, Scab, Verticillium	x	x	x
<i>Heteromeles arbutifolia</i>	Toyon	<b>SMALL</b>	15-25	8-15		M		L	Utility friendly. Taller specimens may require minor height reduction if under wires. California native. Adapted to a wide variety of soil conditions. Dark green, oblong foliage. Evergreen. Showy, white flowers in summer. Drought resistant. Attracts birds and bees.	Wet fruit litter issue.	Scales, Thrip, Sudden Oak Death, Oak Root Rot, Root Rot	x	x	x

**Revised Approved Tree List: Medium Trees**

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate		Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape	
					Slow (<12")	Medium (12"-24")								Fast (>24")
<b>MEDIUM STATURE TREES</b>													<b>MEDIUM STATURE TREES</b>	
<i>Pistache chinensis</i>	Chinese pistache (male only)	<b>MEDIUM</b>	40-50	30-40	M		L	Low root damage potential. Tree is extremely durable and tolerant to both urban and rural conditions. It's also drought, heat, and wind tolerant. Long lived species provides much shade and produces spectacular fall colors in shades of orange, red-orange, and crimson.	Awkward shape when young. Requires some structural pruning. Female trees produce clusters of small round green berries which some consider messy.	Root Rot, Verticillium	x	x	x	
<i>Tristaniopsis laurina 'Elegant'</i>	Elegant water gum	<b>MEDIUM</b>	20-35	15-25	S		L	Utility friendly. Taller specimens may require minor height reduction if under wires. Can be trained as a multi-trunked tree.	Branch Strength Rated as Medium Weak. Dry fruit litter issue.	Scales	x	x	x	
<i>Magnolia liliiflora 'Nigra' x Magnolia sprengeri 'Diva'</i>	'Galaxy' Magnolia	<b>MEDIUM</b>	20-30	15-20	M		M	Low root damage potential ranch strength is medium with dense leaves. Longevity is medium. Tree blooms at a young age.	Low availability	Aphids, Scales, Spider Mites, Leaf Spot	x	x	x	
<i>Koelreuteria paniculata</i>	Goldenrain	<b>MEDIUM</b>	20-35	20-35	M		M	Low root damage potential Tolerates cold, heat, drought, wind and alkaline soil. Requires low to moderate maintenance.	Allergy Health Hazard. Low density leaf.	Beetle Borers, Plant Bug, Scales, Root Rot, Verticillium	x	x	x	

## Revised Approved Tree List: Medium Trees (Continued)

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate			Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
					Slow (<12")	Medium (12"-24")	Fast (>24")							
<b>MEDIUM STATURE TREES</b>													<b>MEDIUM STATURE TREES</b>	
<i>Lagerstroemia fauriei</i>	Japanese crape myrtle	<b>MEDIUM</b>	20-30	20-30	M			M	Low root damage potential. Tropical flowering tree is one of the most outstanding summer bloomers. Leaves are appealing as they turn red right before they fall in the winter.	Requires moderate maintenance to remove suckers and to prune for flowers. This trees provides little shade.	Aphids, Powdery Mildew, Sooty Mold	x	x	x
<i>Arbutus 'Marina'</i>	Marina Madrone	<b>MEDIUM</b>	40-50	40	M			L	Utility friendly. Taller specimens may require minor height reduction if under wires. Resistant to oak root fungus. Red, exfoliating bark. White to pink, bell-shaped flowers. Pom-pom-shaped red or yellow berries. Attracts birds. Evergreen.	Wet fruit litter issue.	Scales, Thrip, Anthracnose, Phytophthora, Root Rot, Rust		x	x
<i>Acer grandidentatum 'Schmidt'</i>	Rocky Mountain Glow Maple	<b>MEDIUM</b>	20-35	15-30	S			M	Lower water need than most maples. Canopy develops into a tight, oval shape.	N/A	Decay fungi	x	x	x
<i>Laurus nobilis 'Saratoga'</i>	Saratoga bay laurel	<b>MEDIUM</b>	15-40	15-30	M			L	California native. Usually does not grow above 20 ft. Utility friendly, but may need minor maintenance. Resistant to psyllid. Green, white, or yellow flowers in spring. Fragrant leaf can be used in cooking.	Dry fruit litter issue.	Scales		x	x
<i>Acacia stenophylla</i>	Shoestring acacia	<b>MEDIUM</b>	20-30	10-20	F			L	Columnar structure, evergreen foliage. Linear leaves with gray-green color. Showy, fragrant, yellow flowers in winter or spring. Long, brown seed pods. Drought tolerant.	Dry fruit litter issue. Allergy Health Hazard. Branch Strength Rated as Weak.	N/A		x	x

**Revised Approved Tree List: Medium Trees (Continued)**

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate Slow (<12") Medium (12"-24") Fast (>24")	Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
MEDIUM STATURE TREES						MEDIUM STATURE TREES						
<i>Arbutus unedo</i>	Strawberry madrone	<b>MEDIUM</b>	20-35	20-35	M	L	Utility friendly. Taller specimens may require minor height reduction if under wires. Resistant to oak root fungus. Gray bark exfoliates to reveal red-brown bark underneath. Showy, white, bell-shaped flowers. Orange or red pom-pom-shaped flowers. Attracts birds. Evergreen.	Allergy Health Hazard.	Scales, Thrip, Anthracnose, Phytophthora, Root Rot, Rust	x	x	x
<i>Olea europaea</i> 'Swan Hill'	'Swan Hill' Olive	<b>MEDIUM</b>	25-35	25-30	M	L	Fruitless. Evergreen with gray-green, ovate leaves. Attracts birds. Resistant to Texas Root Rot.	Root Damage Potential Rated as Moderate.	Scales, Anthracnose, Oak Root Rot, Phytophthora, Root Rot, Sooty Mold, Verticillium		x	x
<i>Ebenopsis ebano</i>	Texas ebony	<b>MEDIUM</b>	25-40	25-40	M	L	Branches don't droop, and resist breakage. Very hardy. Evergreen. Persistent, large, black or brown seed pod. Showy, fragrant, yellow flowers in summer.	Root Damage Potential Rated as High. Thorns.	N/A		x	x

## Revised Approved Tree List: Large Trees

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate		Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
					Slow (<12")	Medium (12"-24")							
<b>LARGE STATURE TREES</b>													
<i>Ginkgo biloba</i> 'Autumn Gold'	'Autumn Gold' ginkgo	<b>LARGE</b>	50-80	30-40		M	M	Has distinctive, green, fan-shaped leaves which turn yellow in the fall. Tolerates and adapts to a wide range of harsh growing conditions.	Allerget Health Hazard.	Canker Diseases (if trunk is repeatedly wounded)		<b>x</b>	
<i>Acer macrophyllum</i>	Bigleaf maple	<b>LARGE</b>	30-75	30-50		F	M	Resistant to oak root fungus. Attracts bees. Gold fall color. Native to western U.S. Fire Resistance is Favorable.	Root Damage Potential Rated as High.	Beetle Borers, California Flathead Borer, Caterpillars, Sudden Oak Death, Root Rot, Oak Root Rot, Annosus Root Disease, White Mottled Rot, Leaf Spot, Verticillium		<b>x</b>	<b>x</b>
<i>Quercus douglasii</i>	Blue oak	<b>LARGE</b>	50-65	40-50		S	L	California native. Slow-growing. Leaves are blue-green. Evergreen. Resistant to verticillium. Desirable Wildlife Plant. Branch Strength Rated as Strong.	Allergy and Poisonous Health Hazard.	Caterpillars, Insect Galls, California Oak Moth, Gall Wasp, Scales, Crown Rot, Mistletoe, Oak Root Rot, Brown Rot, Powdery Mildew, Root Rot		<b>x</b>	
<i>Pyrus calleryana</i> 'Bradford'	Bradford pear	<b>LARGE</b>	30-50	20-30		F	M	Tolerates most soil types and conditions, including wet soils or drought. Thornless tree produces snowy white flowers that appear in spring. Leaves turn mahogany red and sometimes bright orange-red in late autumn.	Moderate root damage potential. Requires regular structural pruning in early years to develop proper structural attachments. Has a short-to-medium life span, 25-30 years.	Thrip, White Fly, Sooty Mold		<b>x</b>	<b>x</b>

**Revised Approved Tree List: Large Trees (Continued)**

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate			Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
					Slow (<12")	Medium (12"-24")	Fast (>24")							
<b>LARGE STATURE TREES</b>													<b>LARGE STATURE TREES</b>	
<i>Quercus chrysolepis</i>	Canyon live oak	<b>LARGE</b>	40-70	25-35		M		M	California native. Can grow in conditions ranging from very wet to semi-arid. Erect or Spreading and requires ample growing space. Drought tolerant. Resistant to Verticillium.	Dry fruit litter issue. Allergy and Poisonous Health Hazard. Biogenic Emissions considered High.	Goldspotted Oak Borer, Aphids, Caterpillars, Coddling Moths, Insect Galls, California Oak Moth, Pacific Oak Teig Girdler, White Fly, Sudden Oak Death, Crown Rot, Mistletoe, Oak Root Rot, Root Rot		<b>x</b>	<b>x</b>
<i>Quercus suber</i>	Cork oak	<b>LARGE</b>	70-100	70-100		F		M	Trunk and principal limbs are covered with thick, corky bark. Its leaf underside is light gray. Tree is tolerant to gray and has a longevity of greater than 150 years. Resistant to Verticillium.	Moderate root damage potential. Gets chlorosis in alkaline soils.	Phytophthora, Root Rot		<b>x</b>	<b>x</b>
<i>Fraxinus excelsior 'hessei'</i>	Hesse Ash	<b>LARGE</b>	60-80	30-40		M		M	This tree is a broad spreading tree. It should be grown in full sun or partial shade and prefers moist, rich soil. The tree's tolerance to drought is moderate. It makes an attractive winter landscape element and is clean and beautiful with no dieback.	Moderate root damage potential. Requires careful training and pruning to develop a central leader with strong branch structure. Without pruning, branches originate at the same position on the trunk which makes them prone to breakage.	Scales, Ash borer, Carpenterworm, Sooty Mold		<b>x</b>	

**Revised Approved Tree List: Large Trees (Continued)**

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate			Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
					Slow (<12")	Medium (12"-24")	Fast (>24")							
<b>LARGE STATURE TREES</b>													<b>LARGE STATURE TREES</b>	
<i>Quercus ilex</i>	Holly oak	<b>LARGE</b>	40-70	40-70	M			M	Low root damage potential. This tree has a strong branch attachment and it's longevity is greater than 150 years. It tolerates wind and drought and can handle heavy pruning.	Requires moderate maintenance. Allergy health hazard	Scales, Spider Mites, Anthracnose, Root Rot		<b>x</b>	
<i>Dalbergia sissoo</i>	Indian rosewood	<b>LARGE</b>	45-65	30-40	M			M	Pale yellow to white flowers bloom in spring, usually fragrant though inconspicuous. Brown, persistent seed pod develops in summer. Evergreen.	Magnesium deficiency is common. Branches droop and are susceptible to breakage. Root Damage Potential Rated as High.	N/A		<b>x</b>	<b>x</b>
<i>Quercus wislizenii</i>	Interior live oak	<b>LARGE</b>	30-70	40-80	M			L	California native. Slow-growing. Adapted to hot, dry climates. Desirable Wildlife Plant. Attracts Birds and Squirrels.	Dry fruit litter issue. Allergy and Poisonous Health Hazard. Biogenic Emissions considered High.	Caterpillars, Coddling Moths, Insect Galls, White Fly, Crown Rot, Mistletoe, Powdery Mildew, Root Rot		<b>x</b>	
<i>Pinus edlarica</i>	Mondell pine	<b>LARGE</b>	30-80	15-25	F			L	Thrives in hot, dry climates and poor soils. Resistant to verticillium. Dark green, 2 to 3 needles per fascicle. Oblong cones 3-4 inches long. Desirable Wildlife Plant. Drought tolerant.	Root Damage Potential Rated as Moderate.	Aphids		<b>x</b>	

**Revised Approved Tree List: Large Trees (Continued)**

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate			Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
					Slow (<12")	Medium (12"-24")	Fast (>24")							
<b>LARGE STATURE TREES</b>														
<i>Acer rubrum</i>	Red Maple	<b>LARGE</b>	40-60	40-60	F			M	This tree tolerates the cold, salts, and the sun. It produces red flowers in dense clusters in late March to early April before leaves appear. In the fall, leaves turn an orange-red foliage color.	Moderate root damage potential. Does not tolerate strong winds.	Aphids, Beetle Borers, Scales, Oak Root Rot, Phytophthora, Root Rot, Verticillium		<b>x</b>	
<i>Quercus rubra</i>	Red oak	<b>LARGE</b>	50-70	40-50	F			M	Low root damage potential Longevity greater than 150 years. Resistant to Verticillium. Requires low maintenance. New leaves are red in spring turning to dark red in fall.	Moderate root damage potential. Allergy health hazard.	Aphids, Caterpillars, Insect Galls, Anthracnose, Phytophthora, Root Rot, Rust		<b>x</b>	
<i>Zelkova serrata</i> ( <i>'Village green'</i> and <i>'Green vase'</i> cultivars)	Sawleaf Zelkova	<b>LARGE</b>	50-60	45-50	M			M	Characteristic vase shape. Grows in a variety of soil conditions.	Branch Strength Rated as Weak.	Canker		<b>x</b>	

**Revised Approved Tree List: Large Trees (Continued)**

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate			Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
					Slow (<12")	Medium (12"-24")	Fast (>24")							
<b>LARGE STATURE TREES</b>														
<i>Quercus coccinea</i>	Scarlet oak	<b>LARGE</b>	40-50	35-40		F		M	Resistant to Verticillium. Produces brilliant foliage fall colors of glossy bronze, red, orange and medium green. It has a strong branch strength.	Moderate root damage potential. Allergy health hazard.	Caterpillars, Scales			<b>x</b>
<i>Quercus lobata</i>	Valley oak	<b>LARGE</b>	50-70	50		F		L	California native. Requires ample growing space. Resistant to oak root fungus and verticillium. Desirable Wildlife Plant. Fire Resistance is Favorable.	Dry fruit litter issue. Allergy and Poisonous Health Hazard.	Beetle Borers, Caterpillars, Insect Galls, Scales, Crown Rot, Mistletoe, Root Rot			<b>x</b>
<i>Fraxinus americana</i>	White Ash	<b>LARGE</b>	50-70	40-50		F		L	Medium strong branch strength produces dark green foliage in the summer and turns to yellow maroon in the fall. It is tall, stately, and long lived.	Moderate root damage potential. Allergy Health Hazard.	Caterpillars, Scales, White Fly, Anthracnose, Root Rot, Rust, Sooty Mold, Verticillium			<b>x</b>

**Revised Approved Tree List: Large Trees (Palms)**

Botanical Name	Common Name	Size Class	Mature Height (Ft)	Mature Spread (Ft)	Annual Growth Rate		Water Needs (Low, Moderate)	Description	Disadvantages	Pest & Disease Susceptibility	Residential & Street	Park	Landscape
					Slow (<12")	Medium (12"-24")							
(PALMS) LARGE STATURE TREES: ONLY IN EASEMENTS & PARKS													
<i>Washingtonia filifera</i>	California fan palm	LARGE	50-70	10-20	F		M	Drought tolerant. Fire Resistance is Favorable. Resistant to Texas Root Rot.	Dry fruit and leaves litter issue. Root Damage Potential Rated as Moderate. Allergy Health Hazard.	N/A	x	x	
<i>Phoenix canariensis</i>	Canary Island date palm	LARGE	50-60	15-20	S		M	Tree is large and massive producing dark green leaves that fade to a yellow stem. Branch strength is strong and has low to moderate leaf density.	Moderate root damage potential. Allergy health hazard.	Pigeons, Fusarium, Root Rot	x	x	
<i>Washingtonia robusta</i>	Mexican fan palm	LARGE	80-100	10-15	F		M	Drought tolerant. Fire Resistance is Favorable. Resistant to Texas Root Rot.	Dry fruit and leaves litter issue. Root Damage Potential Rated as Moderate. Allergy Health Hazard.	Beetle Borers	x	x	
<i>Phoenix dactylifera</i>	True date palm	LARGE	80-100	20-40	S		M	Resistant to Texas Root Rot. Branch Strength Rated as Strong. Flowers in Spring or Summer.	Dry fruit and leaves litter issue. Allergy Health Hazard. Biogenic Emissions considered High. Root Damage Potential Rated as Moderate.	N/A	x	x	

## H. Timeline for Goals & Objectives

## Gantt Chart

City of Patterson Urban Forest Master Plan – Goals, and Objectives															
Goals & Objectives	Estimated Cost	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Date of Completion	Priority	
<b>Goal 1: Foster a sustainable urban forest resource</b> Objective 1.1 Develop a tree inspection policy. Objective 1.2 Increase species diversity and plant health in the public tree resource.	\$\$												Ongoing	Medium	
<b>Goal 2: Continue to build a comprehensive urban forest planting strategy</b> Objective 2.1 Develop a tree planting and replacement plan. Objective 2.2. Develop a Modesto ash Management Plan.	\$\$												2021-2022	Medium	
<b>Goal 3: Promote tree preservation and protection</b> Objective 3.1 Qualify and apply for Society of Municipal Arborists (SMA) Accreditation. Objective 3.2 Gauge community support for the development of historic tree protection and preservations. If sufficient community and political support:	\$													2022-Ongoing	Low
<b>Goal 4: Establish comprehensive, user-friendly regulations and policies</b> Objective 4.1 Develop a Policy and Procedures Manual for the Urban Forestry Group. Objective 4.2 Develop an easy-to-understand summary (1-6 pages) of the UFMP, policies, and operations to serve as an educational outreach tool. Objective 4.3 Update existing planning documents to reference the Urban Forest Master Plan (UFMP). Objective 4.4 Revise design and construction standards that apply to trees and planter sites.	\$												2019-Ongoing	High	
<b>Goal 5: Preserve and enhance tree canopy</b> Objective 5.1 Preserve and expand existing tree canopy.policies, and operations to serve as an educational outreach tool. Objective 5.2 Ensure all inventoried trees are on a 5-year pruning and maintenance cycle.	\$\$\$\$													2020-Ongoing	High
<b>Goal 6: Rebrand trees as community infrastructure</b> Objective 6.1 Quantify and monetize the benefits of the urban forest for all outreach and documents. Objective 6.2 In official City documents, plans, and outreach, begin discussion of urban forest by stating it is living community infrastructure.	\$												Ongoing	High	

## H. Timeline for Goals & Objectives

## Gantt Chart

City of Patterson Urban Forest Master Plan – Goals, and Objectives														
Goals & Objectives	Estimated Cost	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Date of Completion	Priority
<p><b>Goal 7: Increase outreach, engagement, and education to the community</b></p> <p>Objective 7.1 Further develop Patterson’s Urban Forest website (<a href="https://www.ci.patterson.ca.us/200/Trees---Urban-Forestry">https://www.ci.patterson.ca.us/200/Trees---Urban-Forestry</a>).</p> <p>Objective 7.2 Develop outreach materials that communicate information about trees and the community urban forest.</p> <p>Objective 7.3 Develop and deliver an annual State of the Urban Forest Report.</p> <p>Objective 7.4 Partner with Patterson school district to deliver tree and urban forest information to residents.</p>	\$\$												Ongoing	Medium
<p><b>Goal 8: Optimize urban forestry programming and funding</b></p> <p>Objective 8.1 Implement an annual work plan.</p> <p>Objective 8.2 Develop a policy and responsibility for keeping inventory data current (TreeKeeper software).</p> <p>Objective 8.3 Optimize funding for trees and planting sites in projects funded by Capital Improvement Funds (CIP).</p> <p>Objective 8.4 Optimize support for urban forest operations from the General Fund.</p> <p>Objective 8.5 Identify and apply for available grant funding.</p> <p>Objective 8.6 Identify and explore internal support for alternative funding mechanisms.</p>	\$\$												Ongoing	High
<p><b>Goal 9: Increase training resources for the urban forestry group</b></p> <p>Objective 9.1 Adopt most current industry standards for all contractors and in-house crews engaged in tree care operations.</p> <p>Objective 9.2 Increase resources and staffing structure for the urban forestry group.</p> <p>Objective 9.3 Develop an advanced training structure for in-house urban forestry staff.</p>	\$\$												2019-Ongoing	High
<p><b>Goal 10: Review and measure attainment of the Urban Forest Master Plan</b></p> <p>Objective 10.1 Annually, review the UFMP and the attainment status of goals and objectives.</p> <p>Objective 10.2 Align UFMP objectives and strategies with community expectations.</p> <p>Objective 10.3 Complete a resource analysis (i-Tree Streets) every five (5) years.</p>	\$\$\$												Ongoing	High

# I. Charts, Maps, and Tables

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## Charts

## Maps

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