ATTACHMENT A

URBAN FOREST **MANAGEMENT PLAN**

CLAREMONT,
CALIFORNIA
2019

Urban Forest Management Plan

- CLAREMONT, CA -

Acknowledgements

- CITY OF CLAREMONT -

City Council

Community & Human Services Commission

Tree Committee

Community Services Department

Citizens of Claremont

Sustainable Claremont

Claremont Heritage

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- PLANIT GEO, LLC -

Plan adoption ______________________

Cover photo source City of Claremont
All other photos unless noted are from the City of Claremont

Vision Statement

To maintain a healthy and sustainable urban forest while preserving Claremont's long-standing heritage.

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Photo Source: Discover Claremont

EXECUTIVE SUMMARY

Over the past decade, the City's tree canopy has suffered due to deferred maintenance and budget constraints. Additionally, our trees suffer from the rigors of urban life, including pests and diseases, the extremes of Southern California's current and changing climate, air pollution, compacted soils, and limited growing spaces. Through increasing environmental awareness and sustainability efforts, the City has grown to realize the value of green infrastructure and the important benefits that are uniquely provided by trees. This realization has led to a revitalized emphasis on the City's urban forest.

This long-term Urban Forest Management Plan (UFMP) brings together existing policy guidelines, best management practices, and community planning. The Plan enforces the City's commitment to sustainability, carbon sequestration, storm water runoff reduction, preservation and enhancement of wildlife habitats, water conservation, safe and healthy communities, and adapting to climate change. The plan must be regarded as both a long-range policy guide and a living document that will respond to changing conditions over its life.

The three primary goals and objectives of the Urban Forest Management Plan are:

1. Increase the City's urban tree canopy cover and maximize the benefits of trees:

    a. Obtain and maintain a comprehensive understanding of our urban forest.
    b. Preserve and grow the urban tree canopy cover.
    c. Sustain program funding for preserving and growing urban tree canopy cover.

2. Maximize the efficiencies in maintaining the benefits of trees:

    a. Continue to implement best management practices (BMPs) for all tree care activities.
    b. Foster community support for the urban forest by engaging, educating, and involving the community in urban forestry efforts.
    c. Promote efficient and cost-effective management of the urban forest.

3. Minimize the risk of trees in the urban environment:

    a. Improve the health of the urban forest with superior tree care and maintenance.
    b. Mitigate infrastructure and hardscape damage caused by trees.
    c. Develop a holistic approach to pest and disease management to protect the urban forest.

INTRODUCTION

Claremont's Tree Policies and Guidelines Manual, the Municipal Code, and the General Plan all provide direction on how the urban forest should be enhanced and maintained. The Plan discusses trends and issues that affect the urban forest and provides a framework to develop a unified and holistic approach to the urban forestry program. In order to promote consistency, these policies should be reviewed and revised simultaneously. In order to implement the UFMP and maintain the urban forest, consistent adequate funding is required.

This Plan is meant to be a working document that will be continually implemented and monitored throughout the next 40 years. It is designed to be a flexible, working document that will evolve as needed. Goals identified in the plan can only be accomplished by a collaborative effort between public and private partnerships. Progress will be made continually, but the rate at which it progresses will rely heavily on available resources, City priorities, and community involvement.

Recommendations for this Plan were based on input received through a community input process. The process included City staff, members of the community, and various community groups. Benefits of trees, desires for more trees in City neighborhoods, issues relating to tree care, conflicts with trees and hardscape, and the community's willingness to invest in trees were discussed.

The success of this plan relies on an engaged community that will support urban forest activities. Engaged community members are necessary to continue reforestation efforts, act as tree stewards, participate in education and outreach efforts, and advocate for the future of the City's urban forest.

Why Plan for the Urban Forest?

What is an Urban Forest?

Any inhabited area that has trees and vegetation is considered an urban forest. The urban forest includes trees on both public and private property. It is essentially an entire ecosystem created by all the plants and animals in an urban environment. During the last three decades, urban forestry has evolved as researchers and practitioners learn more about the structure and function of trees and their unique role in providing environmental, economic, and social benefits. Urban forestry methods can provide insight into infrastructure needs, desired design and development styles, and ways to encourage efficient and productive economic development. In city environments, the urban forest is sometimes the only day-to-day interaction with nature that many residents enjoy.

Benefits Provided by Trees

Trees make a vital and affordable contribution to the community by creating pedestrian-friendly neighborhoods, energy savings, and better air quality. The urban forestry program is critical to meeting the City's commitment to climate change, carbon sequestration, stormwater reduction, wildlife habitat enhancement, and water conservation. Trees are one of the few infrastructure investments that grow in value over time.

Trees benefit us because they:

Influence Climate to Ensure Sustainability

Trees absorb carbon dioxide and store carbon in wood, which helps to reduce greenhouse gases. Carbon emissions from vehicles, industries, and power plants are a primary contributor to increased air temperatures in metropolitan areas.

Clean Air

Trees reduce pollution and return oxygen to the atmosphere. In addition to carbon dioxide, leaves and needles absorb pollutants such as ozone, nitrogen dioxide, sulfur dioxide, and some particulate matter.

Save Energy and Lower Energy Costs

As natural screens, trees can insulate homes and businesses from extreme temperatures, keep properties cool, and reduce energy consumption. By planting shade trees on sunny exposures, residents and businesses can save up to 50 percent on hot-day energy bills.

Reduce the Need for Street Maintenance

Shaded streets last longer and require far less maintenance, reducing long- term costs. Shade from tree canopies diminishes pavement fatigue, cracking, rutting, and other damage.

Raise Property Values

Trees are sound investments for businesses and residents alike, and their value increases as they grow. Sustainable landscapes can increase property values up to 37 percent. The value of trees appreciates over time, because the benefits grow as they do. Businesses see higher revenues as shoppers are attracted by leafy promenades that frame storefronts.

Conserve Water and Soil

A tree's fibrous roots are premier pollution filtration and soil erosion prevention systems. Intensely urbanized areas are covered with many impermeable surfaces. In contrast to an impervious hardscape, a healthy urban forest can reduce annual storm water runoff up to 7 percent. Highly efficient trees utilize or absorb toxic substances such as lead, zinc, copper, and biological contaminants.

Diminish Urban Heat Islands

Broad canopy trees lower temperatures by shading buildings, asphalt, and concrete. They deflect radiation from the sun and release moisture into the air. The urban heat island effect is the result of higher temperature of areas dominated by buildings, roads, and sidewalks. Cities are often 5° to 10°F warmer than undeveloped areas, because hot pavement and buildings have replaced cool vegetated land. In addition, high temperatures increase the volatility of automobile oil on street surfaces, releasing the fumes into the atmosphere. Shade trees can reduce asphalt temperatures by as much as 36°F, which diminishes fumes and improves air quality.

Protect Wildlife and Restore Ecosystems

Planting and protecting trees can provide habitat for hundreds of birds and small animals. Urbanization and the destruction of valuable ecosystems have led to the decline in biodiversity. Adding trees, particularly native trees, provides valuable habitat for wildlife.

Build Safe Communities and Decrease Crime

Police and crime prevention experts agree that trees and landscaping cut the incidence of theft, vandalism, and violence by enhancing neighborhoods. Thriving trees on well-maintained streets indicate pride of ownership.

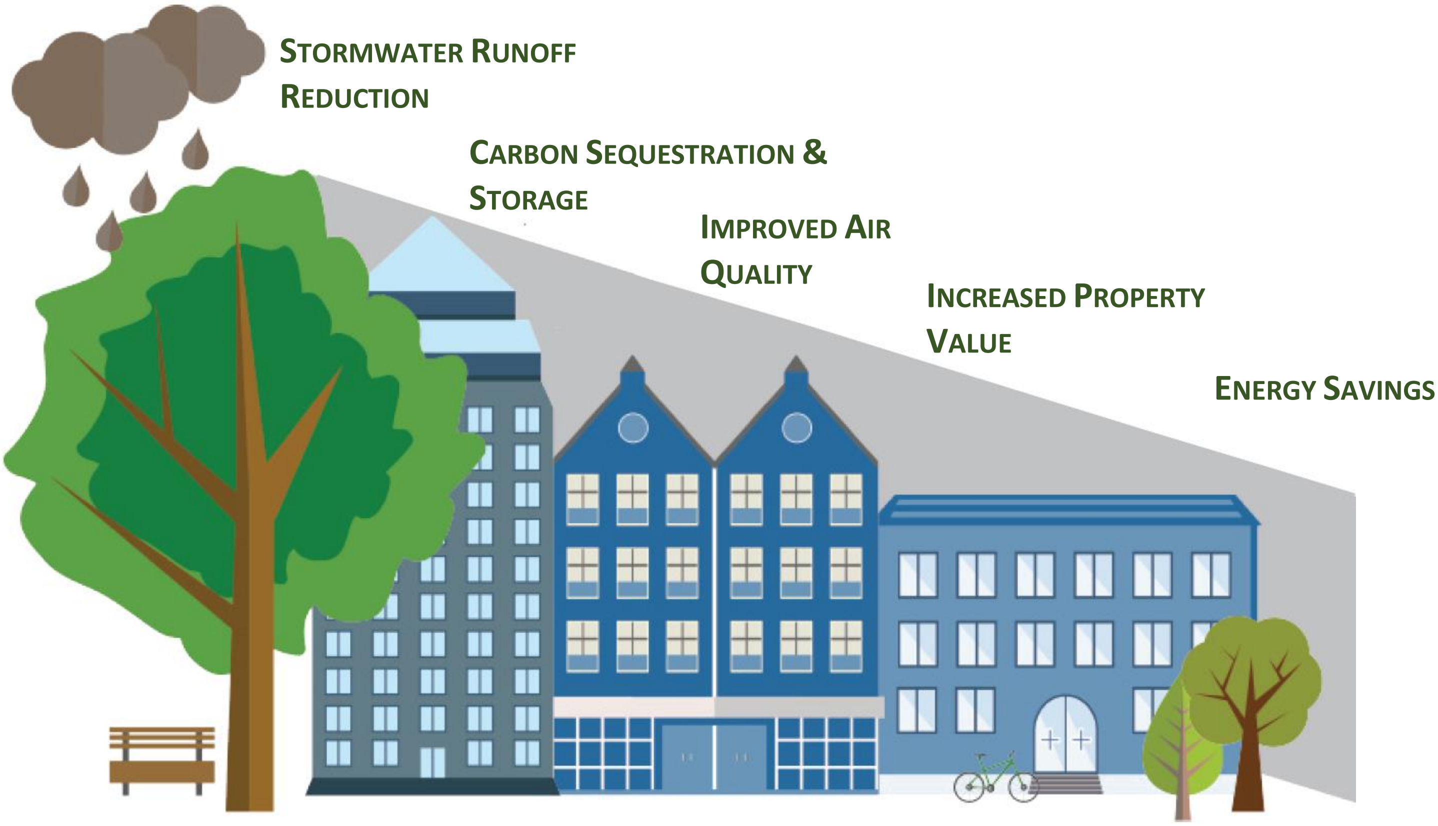
Calm Traffic and Make Neighborhoods Safer and Quieter

People drive more slowly and carefully through tree-lined streets, because trees create the illusion of narrower streets. Additionally, trees reduce noise pollution, buffering as much as half of urban noise.

Reduce Stress and Improve the Quality of Life

Neighborhoods with generous tree canopies uplift the spirit and are good for public health. Greater contact with natural environments correlates with lower levels of stress, improving performance. Concentration levels go up when students are able to look out onto a green landscape. A green environment improves worker productivity. Residents of areas with the highest levels of greenery are more likely to be physically active.

Figure 1. Overview of the ecosystem services provided by urban trees



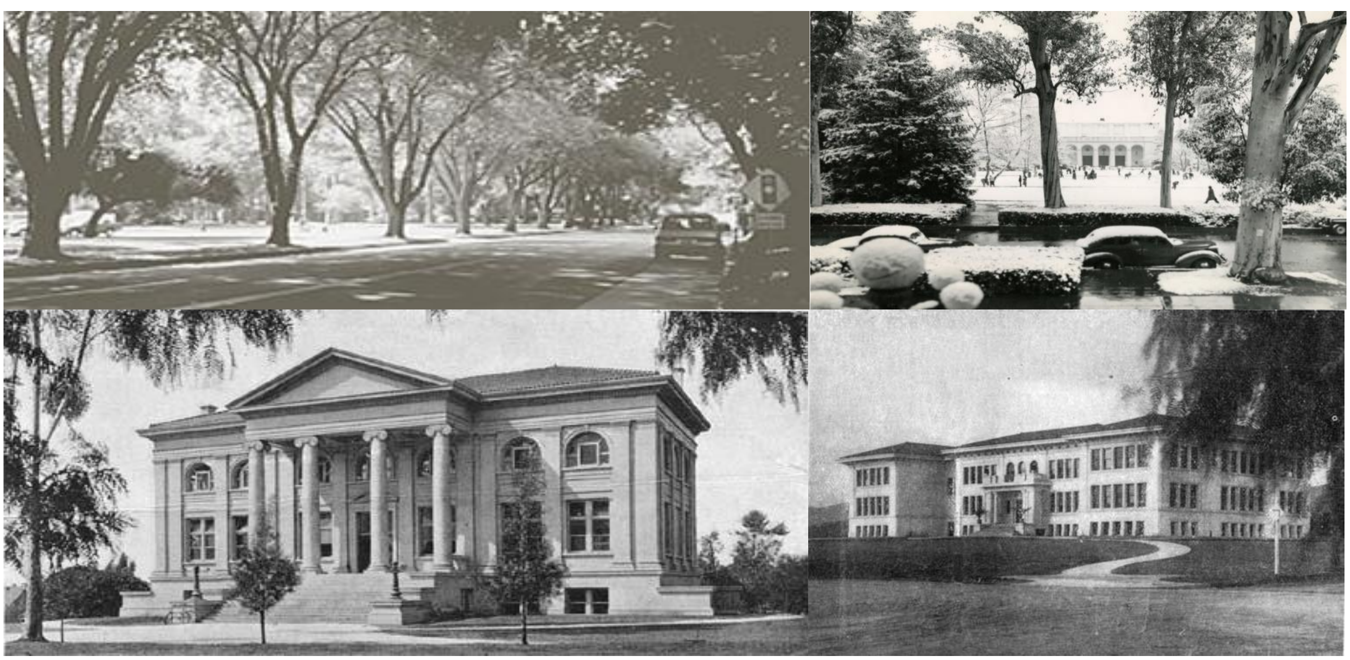
Background and History of Urban Forestry in Claremont

Trees have played a significant role in the history of Claremont, as has been well-documented and archived by Claremont Heritage. Claremont's residents have always had a high regard for trees; before it had a City Council, the City had a Tree Committee. Today the town is known as the 'City of Trees and PhDs,' a nod to its tree-lined streets, parks and the eight colleges situated within Claremont.

Claremont is located at the base of the San Gabriel Mountains. Established during the land boom of the 1880s, the land consisted mainly of sagebrush and rocks dotted with occasional live oak or sycamore trees.

Early in its history, Claremont's residents worked to improve the village and make it attractive. The town quickly gained a reputation for having excellent roads lined with street trees and sidewalks. Early in 1889, volunteer labor was organized from the town to plant trees and shrubs around college buildings. There was much to be done to clear homesites including removing cactus and sagebrush and the omnipresent rocks. A committee on shade trees was appointed. Natural artesian wells were common in Claremont and buckets of water from them served as a source of irrigation for newly planted trees. As street tree chairman, Frank Brackett helped plant eucalyptus trees along College Avenue, many of which still stand today.

Historical listings of trees in the City began in 1925 when Mrs. George Turner's book, 'Trees of Claremont', showed 154 different species growing within City limits. In March 1933, she estimated there were 248 different tree species growing within the City limits. In 1955, Dr. C. Burnell Olds catalogued more than 1,000 trees and shrubs throughout Claremont. To date the City has over 26,000 trees including 139 unique genera.

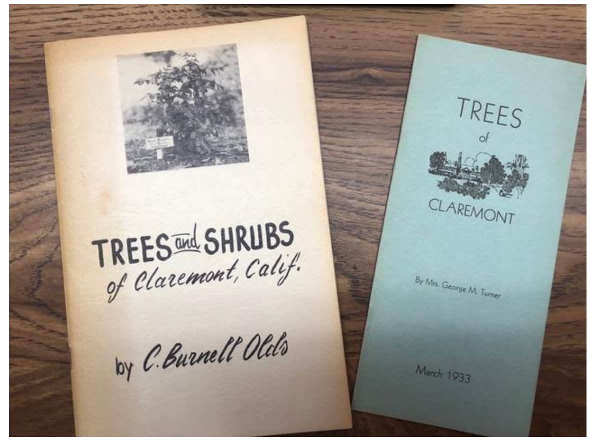


Left to right: Historic elms on Indian Hill Blvd, snow on Pomona College's Marston Quad (1948), Claremont Public Library (1913), Claremont High School (1913)

Photos courtesy of County of Los Angeles Public Library, Claremont Heritage, and the City of Claremont

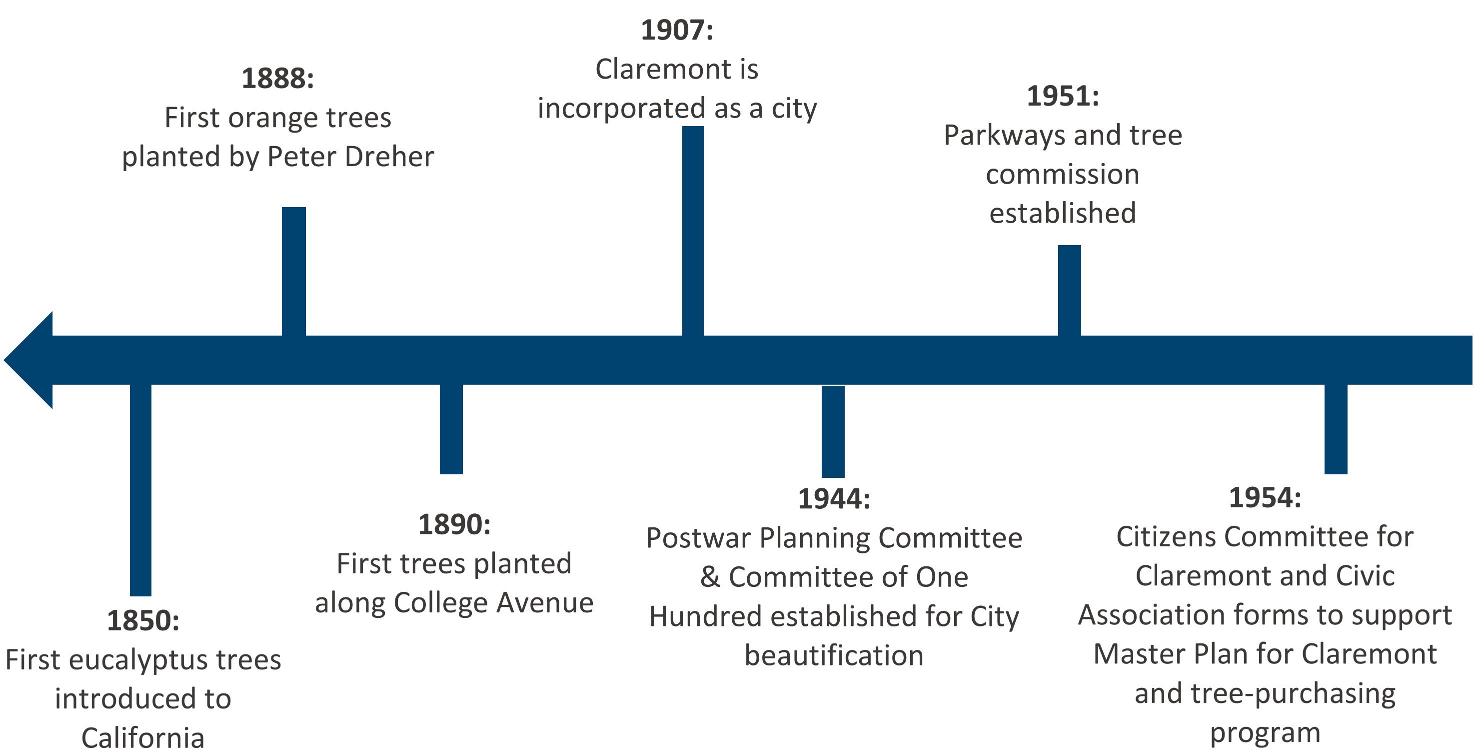
CLAREMONT HISTORY AND TREE EVENT TIMELINE

In 1944, Claremont's Chamber of Commerce formed the Postwar Planning Committee to influence Claremont's growth and development through planning, tree planting, and overall beautification. At the same time, the Claremont Civic Association and the Citizens Committee for Claremont helped to establish the character of the City and to support a master plan for Claremont. Mary Ilsley as chair of the planting committee of the Citizens Committee, led the tree planting program until the City Council created a commission on parkways and trees in 1951. She served on that commission until July 1958. The work of the commission continues to the present day.



In 1997, the Community Services Department developed a <u>Tree Policies and Guidelines Manual.</u> This has been routinely updated since then, with the most recent update in 2015. The purpose of the manual is to define the policies and procedures used by City staff to manage and care for all the trees located on City property or in the City's rights-of way. During this process, the City also revised the Designated Street Tree List. The list revised the previous list that included one designated species per street to now include three to six species rather than one to add diversity to the urban forest.

Figure 2. History and tree event timeline (Courtesy of Claremont Heritage and City of Claremont)

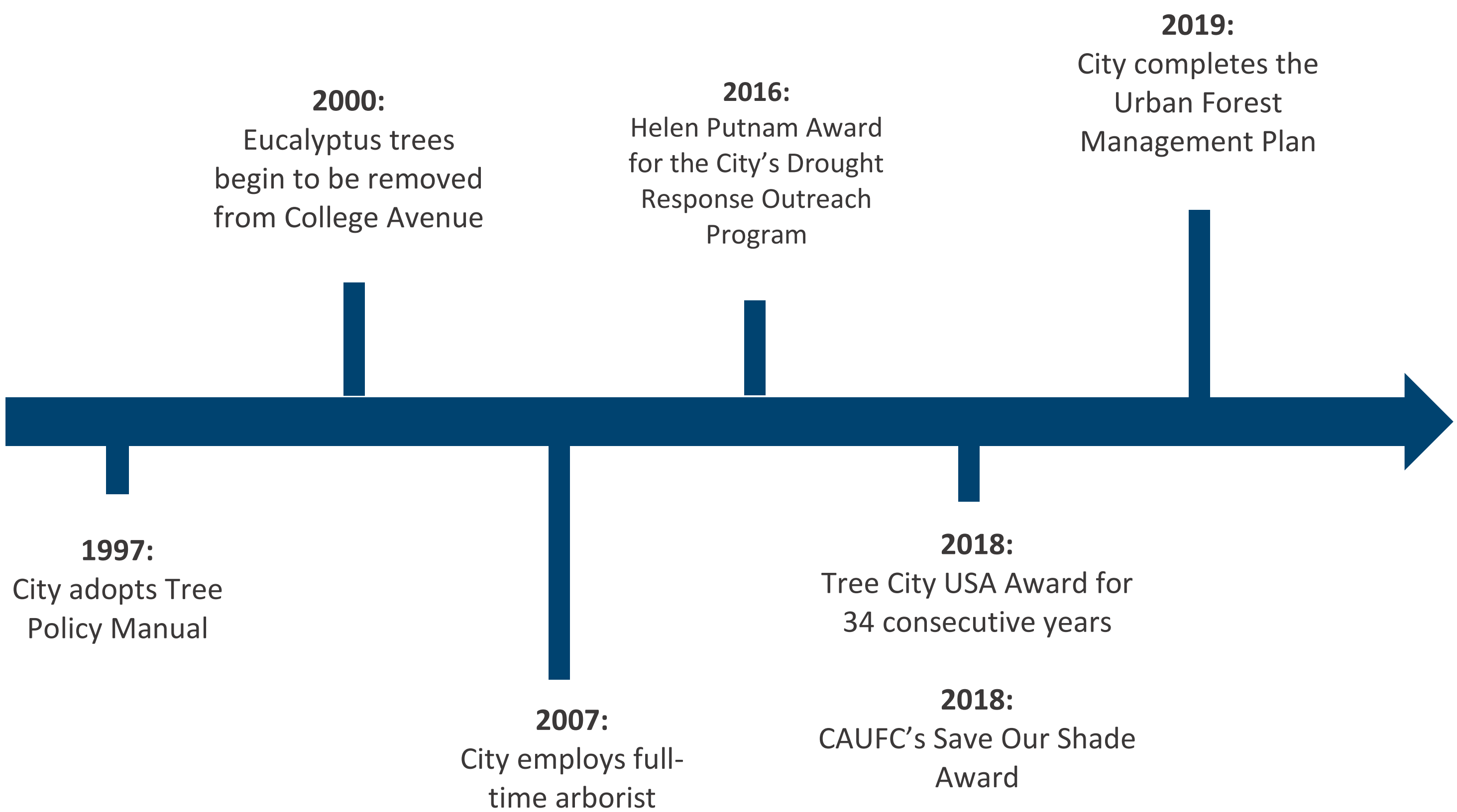


In 2007, Claremont hired a full-time arborist to oversee the public urban forest. Currently, City staff maintains a tree inventory of approximately 26,000 trees.

The City's urban forest program has won several awards over the past few years. In 2016, after facing several years of drought, staff developed an award-winning Drought Response and Outreach Program, which won the League of California Cities Helen Putnam Award. The California Urban Forest Council recognized the City in 2018 for treating sycamores and oaks with an experimental treatment for protection against invasive shot hole borer. Also, in 2018, the City received Tree City USA recognition for its 34th consecutive year.

The City recently approved two master plans that designate approved species for planting: first, the Foothill Boulevard Master Plan, which allows for preservation of heritage eucalyptus trees and introduces new species to provide diversity; second, the College Avenue Master Tree Plan which provides for preservation of existing heritage trees, while adding new species of different size and structure to complement the neighborhood.

For more information regarding the relationship of this Urban Forest Management Plan to other City plans, initiatives, and resources, see Appendix G.



Privately Owned Urban Forest

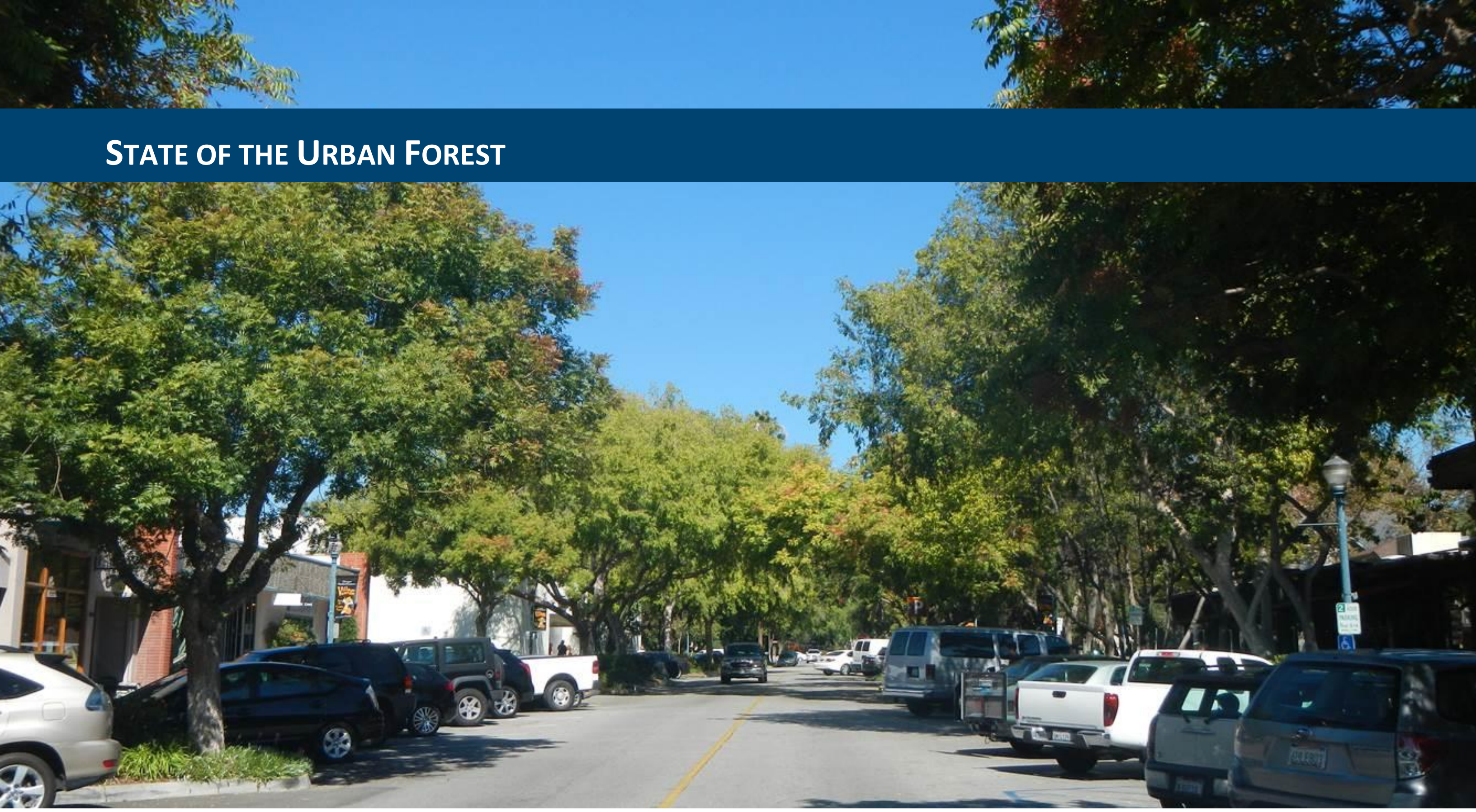
The privately-owned urban forest refers to the trees and vegetation that are on private property within the City, but not owned or maintained by the City. This Plan outlines the measures that the City can take to care for and improve the part of the urban forest it owns. However, the City-owned urban forest does not exist in a vacuum, and its health is influenced by that of the vegetation surrounding it. It is important that the Claremont community is aware of the benefits provided to them by the parts of the forest on their property and of how they can maximize those. Much of the following information in this management plan about City-owned trees is also relevant to privately-owned ones.

The City is limited in what it can require private landowners to do, but it should continue to provide as much information as it can about sustainable landscaping and about how to choose, water, prune, and generally care for trees. This will involve working with local community groups to develop informational materials, awards programs, and plans for improving and preserving private portions of our urban forest. Although the City has no jurisdiction over private property, they can however, recommend maintenance and tree health standards. The City's Tree Policies and Guidelines Manual should be followed when performing work on privately-owned trees.

The community and the City should identify and consider planting opportunities in areas such as schools and other government-owned properties; commercial and industrial properties, especially parking lots; and private residential properties, including front and back yards. Several of the goals in Table 3 in the Goals and Objectives relate to privately-owned trees. In addition to those, the City should move forward with updating the Heritage Tree program and investigate the possibility of creating a tree ordinance.

It should be noted, when moving through this Plan the "City's urban forest" or "urban forest" refers to the City-owned portion of the urban forest not the privately-owned urban forest, unless otherwise specified.

STATE OF THE URBAN FOREST



VALUE AND BENEFITS OF THE URBAN FOREST

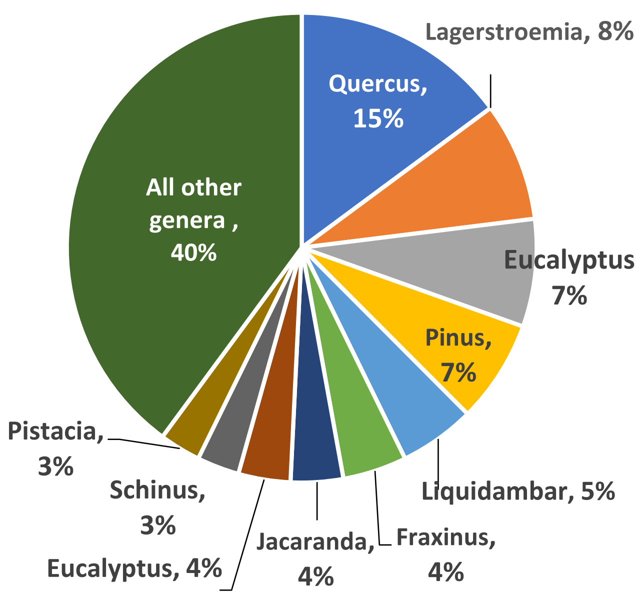
Value of Claremont's Trees

As part of the 2018 street tree inventory, tree valuation was calculated for each tree surveyed. A total value of approximately $88 million was calculated for the 26,164 trees surveyed. The value of trees is based on size, location, and species rating. The City's top three valuable genus are the Coast live oak (*Quercus agrifolia*), Canary Island pine (*Pinus canariensis*), and California sycamore (*Platanus racemosa*). These three account for $24,313,750 approximately 30% of the total value of the urban forest, although they make up less than 20% of the urban forest.

Tree Diversity

Knowing the diversity of trees that compose the urban forest is essential. The types of trees present in a community greatly affect the benefits produced, tree maintenance activities, and budgets. Based on the inventory data there are 139 unique genera (includes "Other") with the top five being oak (*Quercus*), crape myrle (*Lagerstroemia*), eucalyptus, pine (*Pinus*), and sweetgum (*Liquidambar*). These make up approximately 40% (11,500 trees) of the total street tree population.

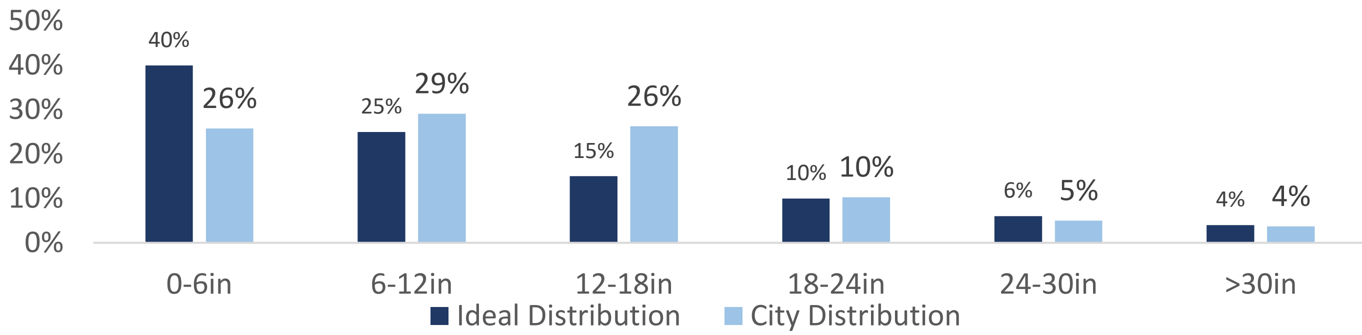
Figure 3. Tree genus diversity



Size and Age Distribution

Tree size is measured as diameter at breast height (DBH), or 4.5" from the base of the tree. Size of a tree helps to determine its age, and the distribution of ages influences the structure of the urban forest as well as the present and future costs of maintenance. An uneven-age urban forest offers continued flow of benefits and a more uniform workflow allowing managers to more accurately allocate annual maintenance funds. Twenty-nine percent of the City's urban forest falls in the 6-12" range while only 4% is greater than 30", meaning about 40% percent of the urban forest is younger than the ideal standard. An ideal age/size distribution allows for more uniformity in annual budgeting and assures continuity in overall tree canopy coverage.

Figure 4. Claremont's tree diameter distribution compared to the U.S. Forest Service ideal distribution



To optimize the value and benefit of trees, the community forest should have a high percentage of large canopy trees to provide more ecosystem benefits. At the same time, there must be enough younger, smaller trees in the population to account for the loss of trees over time or suddenly from pests and diseases. In traditional forest management, this is similar to an uneven-aged stand of trees.

For a detailed summary of Claremont's tree population (2019) see Appendix I.

Operation and Structure of the City's Urban Forest Program

The City of Claremont is only responsible for managing the part of the urban forest that is on public land, including trees planted along streets and highways, parks, and around public buildings.

Tree Policies and Guidelines Manual

"The Tree Policies and Guidelines Manual defines and illustrates the policies and procedures that shall be utilized by City staff in the management and care of all trees located on City property or within the City's public rights-of-way. The Tree Policy and Guidelines Manual describes the City of Claremont's official guidelines for the planting, pruning, removal, preservation, and protection of all City-owned trees; Claremont's community forest. The policies are based upon the highest nationally accepted standards set for tree care, and act as the source reference by City staff for the implementation of the duties, authorities and regulations delineated in Chapter 12.26 of the Claremont Municipal Code (Appendix D). These policies have been established to address the specific needs of Claremont's community forest and should be considered as a whole."

The Tree Policies and Guidelines Manual is available on the City of Claremont website at City of Claremont Tree Policy.

The City Council

The City Council provides leadership to ensure that the urban forest remains a priority in Claremont. They oversee the funds which support the maintenance and preservation of the urban forest through policies and ordinances that pertain to tree care.

The Community and Human Services Commission

The Commission is made up of citizen representatives that are appointed by the City Council. The Commission appoints an advisory board that is responsible for reviewing tree-related issues and determining the needs of the City with respect to urban forest activities. This Committee is known as the Tree Committee. More specifically, the Tree Committee makes recommendations that pertain to the care and protection of urban trees, species selection, outreach and education, and promotes the value of trees to the community.

Management of Public Trees

The City of Claremont's Community Services Department is responsible for managing and coordinating the work effort of the City's urban forest. Community Services has a defined function to provide care, preservation, and maintenance of the urban forest. Private contractors perform the majority of the tree maintenance which includes trimming, pest control, and the removal/replacement of trees throughout the City.

Urban Forest Budget

The City's budget is not just a financial document but serves as a work plan for staff and guiding document for the City's operations. More information about the City's budget can be viewed at www.ci.claremont.ca.us/living/city-budget.

Claremont Municipal Code

The City's trees are protected and enhanced through policies approved in the City's Municipal Code. The Urban Forest Program operates under the following guidance:

Claremont Municipal Code, Title 12 Trees and Sidewalks, Chapter 12.26 "City Trees"

The Claremont Municipal Code is available at http://qcode.us/codes/claremont/ and Title 12 is available in Appendix D.

Claremont's Historic & Specimen Trees

The Heritage Tree Program identifies trees of significance across the City. Two specific groups of trees are especially significant in the City's history: the American elms along Indian Hill Boulevard and throughout the Village and the College Avenue and Foothill Boulevard eucalyptus trees.

American Elms

Claremont boasts one of the oldest and healthiest groves of American elms in California. Only six days after the first town meeting in February 1889, a three-member committee on sidewalks and shade trees reported a gift of 250 trees. Among this first batch of trees were several American elms (*Ulmus americana*); the majority of these were planted along what is now Indian Hill Boulevard. Many of these trees remain standing and in good health to this day. The most notable of them form the high canopy on Indian Hill Boulevard near Memorial Park.

Because of the lethal Dutch Elm Disease (DED), a quarantine on importing American elms into California has been in effect for nearly 50 years. Luckily, DED has never been reported in Claremont. In February of 1991, 28 experimental American elms (including three cultivars) bred for resistance to DED were planted on 11th Street just west of Indian Hill Boulevard. To date, the experimental elms have remained healthy and vibrant. The City of Claremont remains dedicated to preserving the distinctive character of Indian Hill Boulevard.

Mature and young elms on Indian Hill Boulevard

Eucalyptus

In 1898 a group of *Eucalyptus viminalis*, or manna gum, was planted along College Avenue. Many of these original eucalyptus trees remain standing today. One of the oldest of these trees was measured at almost 50 inches in diameter. The tallest eucalyptus standing on College Avenue has been measured at 130 feet. Claremont continually monitors the health of these trees and keeps them maintained using only the highest accepted standards of tree care. Recently, the College Avenue Master Plan was completed which should serve as a model plan for other streets.

Other Notable Trees

Other notable trees in Claremont include white sapote (*Casimiroa edulis*), which typically thrives in frost-free areas; dawn redwoods (*Metasequoia glyptostroboides*), a deciduous conifer; fern-leaf Catalina ironwood (*Lyonothaumus floribundus*), native to Catalina Island; bigleaf maple (*Acer macrophyllum*), one of the few maples native to the Western US; and the giant redwood (*Sequoiadendron giganteum*) on College Avenue.

The Heritage Tree Program

In 2015, California State Polytechnic University (Cal Poly Pomona) students used the City's existing Heritage Tree list to establish a set of identifying characteristics and surveyed the City to locate other trees that fit the Heritage Tree criteria. Through this project, 80 trees were identified that should be considered for the program. This Plan and the Tree Policies and Guidelines Manual should serve as guides for the designation of heritage trees.

American elm

Lemon-scented gum

Giant Sequoia

Potential Heritage/Historic Trees (Cal Poly Pomona and the City of Claremont)

Partners & Existing Programs

Effective urban forestry depends ultimately on the public policy supporting it—financially, administratively, and legally. Tree-related advocacy groups can marshal volunteer support and voices for urban forestry programs. Tree planting volunteers can join professional arborists on the front lines. Citizens can provide the political support to sustain public investment in green infrastructure and the urban forest.

The Green Crew, a program of Sustainable Claremont, works with the City of Claremont to support ecological landscaping on City-owned land and community health through hands-on volunteering. The Green Crew organizes individual, family, school, and non-profit volunteers interested in contributing to the urban forest, assisting with tree plantings, and attending the Walk the Town Program to spread environmental education. The Green Crew applies for California ReLeaf grants to support tree plantings. If the City does not receive funding for tree planting, this partnership with California ReLeaf is even more essential to growing Claremont's canopy. The Green Crew is actively conducting outreach and fostering tree stewardship throughout the City. This relationship should be fostered to continue community involvement to assist with funding opportunities.

Existing programs benefiting the urban forest include Arbor Day events, the Heritage Tree Program, the free mulch program, Sustainable Claremont's Green Crew of tree planting volunteers, and our continuing Tree City USA status (34 years). These programs will continue to be vital in implementing actions in this Urban Forest Management Plan.

The City should continue seeking partnerships to foster and advocate for the City's urban forest. Some groups to consider seeking partnerships to advocate for the urban forest are, but are not limited to, community groups, local non-profits, the Claremont Unified School District, Claremont Colleges, and CalFire. Relationships such as these will be beneficial to promoting the actions in this Urban Forest Management Plan.

Any updates to the design guidelines for architecture, landscape architecture, and/or designation of City neighborhoods with recommended design features should include the City's urban forest program. For example, a Claremont Heritage project completed by a Cal Poly landscape intern developed plant palettes for certain styles of architecture i.e., Spanish Colonial, Mid-century Modern, Victorian, and Craftsman. Incorporating urban forest elements into the landscape and design of neighborhoods is an action item of this UFMP.

Understanding the Tree Inventory and Current Canopy Cover

In 2017, the City received grant funding through the California Department of Forestry and Fire Prevention (CalFire) for a City-wide street tree inventory update and tree canopy study. Combined, this information will allow the City to understand the full value of the urban forest and guide future planning of the urban forest.

Tree Inventory

In order to effectively manage the urban forest, we must know the current tree inventory, including a current record of what condition the urban forest is in. In 2018, the City went through an inventory update. The inventory process collected the species, size, and condition of each City-owned tree throughout the City. Also, noted was the exact location of each tree. This database allows staff to plan for maintenance activities, plantings, and treatments.

Tree Canopy Cover

Canopy cover is defined as the layer of leaves, branches, and stems of trees that cover the ground when viewed from above. It is a very important measure of the urban forest as a resource. Realizing the extent of the City's canopy cover will help inform a strategic approach to preserving the existing canopy and identify future planting areas.

Monitoring canopy changes over time will illustrate the effect rigors of the urban environment have on the tree canopy, but also any impact the City has on reducing overall tree canopy decline. To date, a 2012 urban tree canopy assessment has been completed and analyzed. The City is waiting of the 2018 CALFIRE land cover data to conduct our 2018 assessment and canopy change analysis. Once these data are collected and analyzed they will be released to the community and included in the UFMP.

URBAN FOREST PROGRAM

The City's Urban Forestry Program includes planning and policy for tree preservation, maintenance, and planting while also addressing risk management and emergency response.

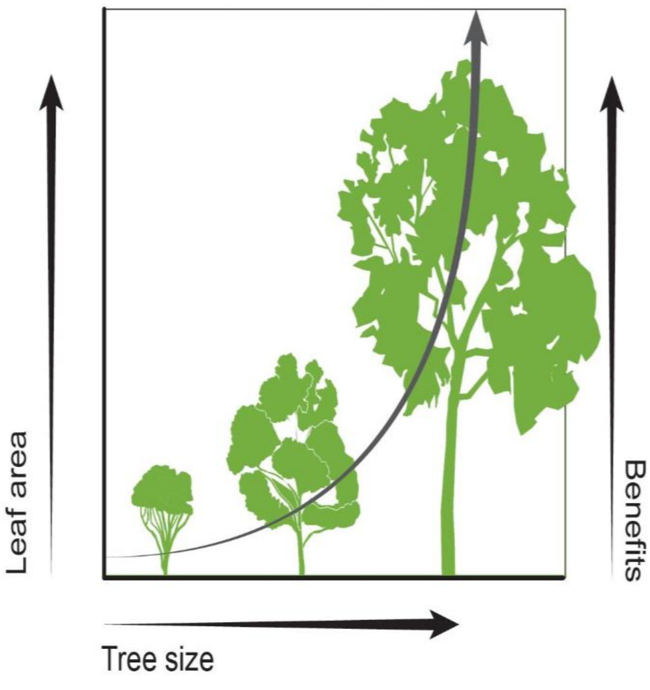
Figure 5. Urban Forest Program Flow Chart

Planning and Policy are essential to urban forest management. Planning sets the course of action and coordination; policy sets the priorities and enacts the planned actions for a desirable outcome.

Tree Preservation is the protection of existing trees from disease, insects, drought, and development. As trees mature, the environmental benefits they provide increase, and generally the largest mature trees provide the greatest benefits (see figure 7).

Maintenance is the watering, pruning, and treatment of trees to promote their continued survival and growth. Efficient maintenance is necessary when managing a large population of trees and starts with communication, coordination, and documentation.

Figure 6. Tree Preservation



Planting is critical to maintaining a sustainable urban forest, as the addition of new trees is necessary to replace the natural senescence. By focusing on planting the right tree in the right place for the right reason, there is a greater likelihood that trees will grow to their full potential and provide the greatest amount of benefits.

Risk Management is the applied policy, procedures, and maintenance practices to monitor and mitigate tree risk. Tree risk is the combination of the likelihood of a conflict or failure occurring and impacting a target with the severity of the resulting consequences like property damage, disruption of services, injury, or death. It is impossible to maintain trees free of risk; however, trees can be managed to balance the risk they pose with the environmental benefits they provide.

Emergency Management is the coordinated effort of various departments in response to emergencies like downed limbs and trees; often in the context of a greater disaster, due to flooding, fire, or wind. In a time of crisis, it is imperative to have a plan for timely response and recovery to address emergencies systematically. Sound protocols expedite an efficient response, accelerate recovery, and avoid unnecessary tree removal.

PROGRAM CHALLENGES AND OPPORTUNITIES

The following are challenges and opportunities within the Urban Forest Program that were identified during the community input process, staff interviews, and data research. The following outlines the program challenges and presents recommendations to address the challenges.

CLAREMONT URBAN FORESTRY

Planning and Policy

The City has numerous planning and policy documents that relate to urban forest activities. In order to be consistent and strengthen the program a detailed review and revision of plans, policies, codes and priorities should be conducted. This review and revision should include members of each department so that all aspects of urban forestry - preservation, maintenance, risk management, and development – are considered.

Consistent planning and policies documents will ensure that all City departments have a clear and concise vision and understanding of the Urban Forest Program between all City departments.

Preservation

Approximately, 26,000 trees are City-owned and maintained. The 2012 canopy assessment determined that the City has a total of 11% tree canopy cover, or 972 acres. It should be noted the 11% canopy cover includes all trees within the City, not only City-owned trees. The results of the 2018 canopy assessment are currently being analyzed and should be available in the next year. In order to meet the City's goal of increased tree canopy cover, preservation of the urban forest must be a priority.

It is the City's policy to protect and preserve healthy trees that provide valuable benefits to our environment and the quality of life in Claremont whenever possible. The Tree Policies and Guidelines Manual states that a tree may be removed if it is hazardous, dead, or diseased. Additional reasons that could warrant removal are structural building damage that cannot be corrected without removing the tree, required root pruning that could jeopardize the stability of a tree, or hardscape damage that cannot be repaired without jeopardizing the health and stability of the tree.

Tree preservation must become a priority both internally as staff and as a community. Existing trees should be accounted for early in the planning process of new developments. Competing policies, plans, and codes require more attention and analysis to reduce infrastructure, hardscape, and solar panel conflicts. Conflicting and unnecessary tree removal can be minimized, or even avoided, if trees are considered during the planning phase of projects.

Protecting the trees by enforcing polices should become a greater priority. The Claremont Municipal Code aims to prevent unauthorized pruning and removal, vandalism, or damage due to insufficient watering but, due to a lack of resources, enforcement actions are on a lower priority than maintenance activities. More proactive and responsive enforcement should be incorporated into our current operations.

Maintenance

Proper tree maintenance increases the longevity of trees, reduces premature failures, and maximizes the benefits trees provide. Currently, City tree maintenance is primarily performed reactively, except for routine grid pruning. The City should work towards becoming more proactive in addressing drought, pests, and diseases.

While City staff can address some urgent conditions, such as minor tree pruning or raising, or removing small hangers in trees, the City depends heavily on contract crews for tree care. The City works off an eight-year grid pruning system, which is completed by contract crews. At the time of pruning the tree is also inspected for overall tree condition. This ensures that every City tree is inspected every eight-years.

An Integrated Pest Management Program should be developed to address known pest and diseases that threaten the urban forest. Proper resources should be allocated to this program, so that the City can proactively address issues as they arise along with those that are currently known. An Integrated Pest Management health care program will protect and preserve trees for many years to come.

Tree Trimming Cycle

Sound management practices aimed at improving tree health, public safety, and community support require a routine trimming or pruning cycle. Currently, the City has an eight-year grid system for conducting a trimming cycle of trees in the public rights-of-way intended to adequately and routinely maintain trees across the City. In some cases—due to variables such as a species growth habits or frequency of pedestrian and vehicle travel—certain trees may require maintenance at varying frequencies. The trimming cycle is established to provide equitable tree care across the City, though an ideal trimming cycle would more closely examine the tree species composition and prune according to growth habits and other factors.

Ideally, each tree should be trimmed every five-years which would shift trimming costs from reactive impromptu pruning to proactive planned pruning. More frequent attention can help trees adapt better to the rigors of life in an urban environment. Trees that are trimmed less frequently can develop significant structural defects, and this may require such significant pruning to reduce risk that the tree will develop a poor form that is difficult to correct. Urban forests are more prone to damage during storms if they are trimmed outside a five-year trim cycle. The more time that lapses between pruning, the larger the pruning wounds. The more time that lapses between pruning, the larger the pruning wounds, increasing the risk of failure due to cracks and decay.

Over the past several years, the City has seen significant increase in hazardous tree conditions that can be reduced by a more frequent pruning cycle. The City should work towards a five-year pruning cycle to reduce this liability and create a healthier urban forest.

Community Services Personnel

To maintain a healthy and safe urban forest, adequate staffing levels within the urban forest program are necessary. Generally, an urban forest program has both supervisory and operational employees who are supported by administrative and other management employees within the department. Administrative staffing of the City's urban forest consists of the Community Services Director, Community Services Manager, Management Analyst, Office Assistant, and Senior Administrative Assistant. The maintenance staffing consists of a staff arborist, maintenance workers, and a Landscape Maintenance Supervisor. It should be noted that the listed employees are not dedicated to the urban forest program. To supplement Claremont's urban forest program, consulting arborists shall be used.

It is recommended that the City maintain the current administrative staffing level and add one additional maintenance worker, dedicated to the urban forest, to support the urban forestry staff.

Planting

The City of Claremont is home to over 26,000 street trees, and many additional planting opportunities exist in City facilities, parks, medians, and parkways; through turf reduction programs and green streets development; and in new development projects on private land.

Trees that are acclimated to Claremont's climate, resilient to urban environments, and have few pest problems or unwanted characteristics are essential to the health and growth of the urban forest. The City's Designated Street Tree List is updated as necessary to maintain a diverse species list exhibiting these characteristics. A principal goal of the list is to avoid catastrophic losses in the urban forest from invasive pests and diseases. This is done by promoting a diverse palette of trees for planting. Generally, a designated street tree list strives not to exceed 30 percent from a single family, 20 percent from a single genus, and 10 percent from a single species. The list also includes species of different sizes and growth characteristics that can accommodate varying growing spaces and overhead utility lines. Although the City has increased the number of species that are on the list, particular care has been given to preserving certain neighborhood and street characteristics.

Policies and best management practices need to be implemented to ensure that the appropriate tree is planted in the right place for the right reason. There is a need to have nurseries supply trees to the City that meet minimum nursery stock standards as specified in the Tree Policies and Guidelines Manual. The long-term health of the City's trees starts in the nursery. Only good quality nursery stock should only be accepted.

The spacing of street trees should allow for trees to grow without root crowding and soil compaction. Soil should be loosened to optimize growing conditions. The root structures of trees are often in the rights-of-way, in spaces that must also accommodate underground utilities. Trees should be integrated into the planning process in order to successfully coexist with underground utilities.

Planting invasive trees in proximity to native open space increases the chances of those species invading open space and their seeds reaching waterways. The City should work towards establishing buffer adjacent to native open space in the City wherein only non-invasive trees are planted. In addition, the City should discontinue planting invasive trees in the City.

Tree planting opportunities on City-owned properties that should be continued to increase tree canopy coverage are:

1. Streets and parkways.
2. Parks, City facilities, and other public properties.

Tree planting opportunities on non-City properties that could be pursued to increase the City's tree canopy are:

1. Schools, Colleges, and other government owned properties.
2. Commercial and industrial properties, especially parking lots.
3. Private residential properties, including front and back yards.

Trees should be planted in every viable planting space throughout the City. However, careful consideration should be taken when determining a viable planting site. For every tree removed a new tree should be planted, unless the site is no longer considered viable. The Tree Policies and Guidelines Manual describes the criteria for a viable planting site: adequate planting space, traffic clearance, maintenance resources, and funding availability. Generally, the City should always consider the right tree in the right place for the right reason. The City should work closely with property owners to ensure property owners can provide adequate water to the newly planted tree. If proper watering is not agreed upon, the site should be considered invalid.

Larger trees should be favored, as they provide greater canopies and sequester more carbon. Larger canopy trees should be considered to cover public land and properties that are currently vacant to provide coverage over streets, buildings, and parking lots. Target tree planting numbers should be adjusted to meet canopy coverage goals.

In order for new trees to establish proper root systems they require adequate water for the first two to three years after planting. The Municipal Code places watering of City trees in the hands of the property owner. However, because early establishment is crucial to the health of the tree, the City should provide water to every newly planted tree for the first three months after planting. Although this increased water use could generate concern, it is important to remember that the water conservation benefit will exceed the upfront water use over time. Ensuring the irrigation of young trees after they are planted is challenging. It is recommended the City provide education and outreach to property owners with newly planted trees to emphasize the necessity of adequate watering. Additionally, the survival rate should be monitored as part of the planting program.

To assist with tree planting efforts the City should actively apply for grant funds. Grant funds are beneficial in providing funds for planting, new tree watering, young tree care, and education and outreach activities.

Risk Management

The benefits of trees increase as the age and size increase. However, as trees mature they are more likely to shed branches and limbs or develop conditions that increase the likelihood of failure. While it is impossible to entirely avoid the risk of trees in an urban environment, it is possible to minimize the risk through sound planting, routine inspection and maintenance, and proper risk management protocol.

Risk management should focus on the prevention and correction of high-risk defects and provide a written systematic procedure for inspecting and evaluating potentially high-risk trees and implementing corrective actions as outlined in the current industry standards. This should include training and certification for key staff in the International Society of Arboriculture Tree Risk Assessment Qualification.

Emergency Management

Severe weather can result in a significant number of tree emergencies in a rather short period of time, and this can easily overload the capacity of the City. Wind and rain events seem to be the leading cause of emergency response in the City. Initial response to emergencies is the responsibility of the Community Services Department and in-house crews. When the demand of the event exceeds the resources of in-house crews, contract crews are necessary to assist with response activities.

Tree emergencies involve (most urgent first):

1. Life and Safety (e.g., trees on occupied homes or cars, trees blocking roads)
2. Property Preservation (e.g., trees on unoccupied homes and trees on cars)
3. Quality of Life (e.g., trees down on streets, sidewalks, driveways, or parks)

It is recommended that the City has a written policy that outlines emergency response procedures and the role of contract crews in an emergency. Proper methods of establishing priorities, carrying out responses, monitoring, and documentation should be outlined in the policy. Additionally, the City should discuss with contract crews what their responsibilities are during an event and incorporate these in written policies and agreements.

Overview of Invasive Pests & Diseases

Invasive species are pests that are not native to areas in which they cause problems. They are considered invasive because they invade and establish large populations in new areas and the resulting spread causes economic or environmental loss.

The City of Claremont deals with pest threats on a case-by-case basis and employs Integrated Pest Management (IPM) to solve problems while minimizing risks to people and the environment. IPM is an ecological approach that focuses on prevention and suppression of undesirable pests through a combination of techniques that include: habitat manipulation, modification of cultural practices, biological control, use of pest-resistant plant varieties, and selective applications of least toxic pesticides that minimize exposure to the public and non-target organisms. Claremont is committed to reducing the use of pesticides, and applications are only performed as a last line of defense, after all other forms of control are exhausted or no other viable alternatives exist to mitigate the economic or environmental losses expected if no action were taken.

Preventing the introduction and establishment of invasive species is always the best and least costly method of control. The City should judiciously follow a sound IPM program by monitoring the City's urban forest to detect existing and potential threats to tree populations. A fully implemented IPM program can reduce surges in maintenance costs by effectively preventing, suppressing, or eliminating economically significant pests and diseases affecting City trees. An IPM program further allows the City to make informed decisions about the urban forest while considering existing and future costs. The City can strategically determine which trees affected by pests to treat with the appropriate IPM control steps, remove altogether, or monitor if the pest population is below actionable thresholds. This integrated approach spreads tree care costs out over time ensuring the economics of the Urban Forest are sustainable while upholding the community's values.

A Snapshot of Current Threats

Invasive Shot Hole Borer

The Invasive Shot Hole Borer (ISHB), *Euwallacea* sp. is an invasive beetle that attacks dozens of common native and landscape trees. The beetle tunnels into host trees and spreads Fusarium Dieback (FD), a disease known to infect over 110 tree species. FD is caused by *Fusarium euwallaceae*, a fungus that disrupts the transport of water and nutrients in the tree, leading to branch dieback and overall decline. For Claremont, the tree species of most concern are the more than 1,500 (6%) California sycamores, 1,900 (7%) coast live oaks, 400 (2%) London plane trees and the 150+ historic American elms in the City.

For more information, visit www.ucanr.edu/sites/pshb, contact a certified pest control service provider, or view Appendix H.

Potential Impacts to Claremont's Urban Forest – Invasive Shot Hole Borer

In September 2019, Claremont's tree inventory data for all trees managed by the City were analyzed to identify host trees for ISHB and the benefits provided by these trees. This analysis determined the potential impacts to Claremont's urban forest from shot hole borers if the City does not continue to treat these trees.

The inventory analysis includes 8,184 trees susceptible to ISHB of which 48 unique host species exist. The five most common susceptible tree species include coast live oak (7%), California sycamore (6%), jacaranda (4%), American sweetgum (4%), and London plane (2%).

The following table provides a summary of the ecosystem benefits provided by all tree species that are potential hosts for ISHB. Over $40 million in benefits are provided by the 8,184 trees. This information can be used to compare the cost of treatment with the benefits provided to the community.

Table 1. Value and benefits of Claremont's trees susceptible to ISHB

# of Species	Count	Carbon Storage	Gross Carbon Sequestration	Avoided Water Runoff	Air Pollution Removal	Structural Value	Total Value
48	8,184 trees	$693,440 annually	$24,646 annually	$5,964 annually	$9,904 annually	$39.6 million total	**$40 million**

The five most common potential tree hosts for ISHB comprise 73% of all susceptible trees and provide over $35 million in benefits ($652,000 annually, $34.4 million in structural value). Comparing this value to the cost of treatment and routine tree maintenance illustrates the value of the City maintaining an Integrated Pest Management program that actively and strategically manages trees and the tree pest and disease issues.

Figure 7. Invasive Shot Hole Borer identification and signs

Size of ISHB

Stains from the PSHB

Entry-holes are round and less than a mm wide

Glassy-Winged Sharpshooter & Bacterial Leaf Scorch

The glassy-winged sharpshooter (*Homalodisca vitripennis*) or GWSS, is a large leafhopper insect that feeds on plant fluids. The feeding rarely causes significant plant damage, although the insects do excrete copious amounts of liquid. The excrement, often referred to as honeydew, is not necessarily damaging, but becomes an issue when a street tree is infested, causing surfaces below the canopy to become spotted.

The main concern as it relates to landscape trees is that it can transmit the plant-pathogenic bacterium *Xylella fastidiosa* ("xylella") from one plant to another. The bacterium causes bacterial leaf scorch in a wide range of shade trees such as sycamores, elms, maples, olives, and oaks. This is a concern for Claremont's urban forest. The bacterium colonizes the tree's water-conducting tissue where it disrupts water movement causing reduced water availability to the tree. Once the GWSS acquires the bacterium, adults are infective immediately, and they remain so for the rest of their life.

Potential Impacts to Claremont's Urban Forest – Xylella

Without treating Claremont's trees, there is a potential impact that is substantial in terms of the environmental, economic, and social benefits provided by trees. Based on the tree inventory data, a total of 1,010 trees are susceptible to xylella, specifically, American sweetgum. These sweetgums provide over $4.79 million in benefits by preventing 87,000 gallons of stormwater runoff, storing 206 tons of carbon, and removing close to 1,000 pounds of pollutants annually.

For more information, visit www.ipm.ucanr.edu/PMG/PESTNOTES/pn7480.html.

Table 2. Value and benefits of Claremont's trees susceptible to Xylella

Species	Count	Carbon Storage	Gross Carbon Sequestration	Avoided Water Runoff	Air Pollution Removal	Structural Value	Total Value
American Sweetgum	1,010 trees	$35,084 annually	$1,480 annually	$777 annually	$1,290 annually	$4.75 million	**$4.79 million**

Figure 8. Glassy-winged sharpshooter identification, signs, and symptoms

Other Notable Pests and Diseases in Claremont

Other notable pests and disease in Claremont are listed below. Details about each can be found in Appendix I.

Eucalyptus Redgum Lerp Psyllid

Figure 9. The redgum lerp psyllid and nymphs

Eucalyptus Longhorned Borer

Figure 10. Adult eucalyptus longhorned borers

Bark Beetles of Conifers

Figure 11. Redhaired pine bark beetle

Potential Pest and Disease Threats

Potential pests and disease in Claremont are listed below. Details about each can be found in Appendix I.

Asian Citrus Psyllid

Figure 12. Asian citrus psyllid

Goldspotted Oak Borer

Figure 13. Goldspotted oak borer

American Palm Weevil

Figure 14. South American palm weevil

CLIMATE CHANGE AND WATERING

The Claremont Municipal Code places the responsibility of watering City trees planted in City easements with the residents of the community. Newly planted trees, including drought-tolerant species, are dependent upon supplemental irrigation until the tree is established, typically two to three years. During periods of extreme heat, wind, or drought, trees may require more or less water than during non-drought conditions. Recommendations for appropriate watering can be found in the Tree Policies and Guidelines Manual or at the link provided below.

Watering responsibly during periods of drought will have positive effects on the urban forest, allowing more trees survive. Significantly reducing tree watering during periods of drought will lead to loss, a very costly problem, not only in expensive tree removal, but also in the loss of all the benefits trees provide.

- Trees improve air and water quality.
- Trees provide shade to the landscape and reduce water needs.
- Trees help keep your home cooler.
- Trees slow stormwater runoff and help recharge groundwater.
- Trees reduce soil erosion.
- Trees add value to homes and neighborhoods.

For tree irrigation guidelines, visit www.ci.claremont.ca.us/home/showdocument?id=1600.

Section 12.26.110 of the Claremont Municipal Code allows the City to enforce the watering of City trees. The City should take a more proactive approach to enforcement of tree failure due to lack of water. Working with and educating residents on the benefits of trees and responsible watering should be the first course of action followed by the imposition of penalties. The City should continually provide responsible water tips and techniques to residents.

A well-functioning urban forest can help mitigate the effects of climate change in many different ways. The physical shade and transpiration of water from trees in an urban environment can reduce the overall temperature or heat-island effect by upwards of 10 degrees F. Reduced temperatures in turn lead to lower energy consumption which reduces greenhouse gases.

Actively growing trees also sequester and store atmospheric carbon in their wood which is a leading contributor to climate change, while at the same time releasing oxygen back into the atmosphere. In addition to capturing carbon, trees are also great at absorbing other common air pollutants including nitrogen oxides, ammonia, sulfur dioxide and ozone. In one year, an acre of mature trees absorbs the same amount of CO2 produced when a car is driven 26,000 miles.

The City acknowledges the changing climate and is proactively planting climate-adapted tree species that require less watering. In addition, the City has developed professional videos and educational material regarding trees and drought. Research is being conducted at UC Davis to identify underused species that can tolerate the extremes of future climates. This effort will hopefully shift the palette of trees planted to species that will make urban forests healthier and more resilient (www.climatereadytrees.ucdavis.edu).

VISION STATEMENT AND GOALS

Vision Statement

To maintain a healthy and sustainable urban forest while preserving Claremont's long-standing heritage.

Goals and Objectives

The three primary goals and objectives of the Urban Forest Management Plan, are:

1. Increase the City's urban tree canopy cover and maximize the benefits of trees:

    a. Obtain and maintain a comprehensive understanding of our urban forest.
    b. Preserve and grow urban tree canopy cover.
    c. Sustain program funding for preserving and growing urban tree canopy cover.

2. Maximize the efficiencies in maintaining the benefits of trees:

    a. Continue to implement best management practices (BMPs) for all tree care activities.
    b. Foster community support for the urban forest by engaging, educating, and involving the community in urban forestry efforts.
    c. Promote efficient and cost-effective management of the urban forest.

3. Minimize the risk of trees in the urban environment:

    a. Improve the health of the urban forest with superior tree care and maintenance.
    b. Mitigate infrastructure and hardscape damages caused by trees.
    c. Develop a holistic approach to pest and disease management to protect the urban forest.

The table on the following pages summarizes the goals and objectives of the Urban Forest Management Plan. Goals and objectives for the first five-Year Urban Forest Management Plan were identified during research, plan development, and community outreach. Each goal is linked to a year(s) intended for action and the collaborators responsible for the item. Collaborators are departments, Commissions, or Committees that have a role in the Urban Forest Program. Each collaborator is assigned a Lead "L" or Support "S" role for each goal. The City should use this as a guide to share the importance of each action and to determine which measure and milestone should be utilized to assess progress.

Table 3. Goals, objectives, and actions for Claremont's urban forest

GOAL 1: Increase the City's urban tree canopy cover and maximize the benefits of trees.	COLLABORATORS L-lead S-support					Year
Objective 1A: Obtain and maintain a comprehensive understanding of the urban forest.	**Community Services Department**	**Tree Committee**	**Community & Human Services Commission**	**Community Development Department**	**Sustainable Claremont**	**2020 – 2025**
Maintain tree inventories, risk assessments, pest/disease inspections and treatments through routine tree maintenance activities and completion of new developments.	L	S	S	S	S	Year 1, 5
Conduct an urban tree canopy assessment using the LiDAR data to calculate the current tree canopy cover and identify spatial characteristics.	L	S	S	S	S	Year 1, 5
Calculate the environmental benefits of the City's current urban forest with an i-Tree Streets Analysis.	L	S	S	S	S	Year 1, 5
Monitor existing and potential threats that may affect the City's urban forest.	L	S	S	S	S	Year 1
Define a standard of care for trees with the public rights-of-way and parks.	L	S	S	S	S	Year 5
Conduct bi-annual public surveys to gather awareness, support, issues, and questions.	L	S	S	S	L, S	Year 2

GOAL 1: Increase the City's urban tree canopy cover and maximize the benefits of trees.	COLLABORATORS L-lead S-support					Year
Objective 1B: Preserve and grow urban tree canopy cover.	**Community Services Department**	**Tree Committee**	**Community & Human Services Commission**	**Community Development Department**	**Sustainable Claremont**	**2020 – 2025**
Sustain the City arborist position to oversee project design, construction, and tree protection; manage the urban forest, and address citizen concerns.	L	S	S	L	S	Year 1-5
Enforce the Tree Policies and Guidelines Manual and Municipal Code in relation to the City's trees.	L	S	S	L	S	Year 1-5
Develop citywide and small-scale tree planting and canopy goals based on the tree inventory data and Urban Tree Canopy.	L	S	S	S	S	Year 1
Revise the Tree Policies and Guidelines Manual to emphasize tree planting criteria.	L	S	S	S	S	Year 2
Review and revise the Designated Street Tree List to include climate, appropriate native species, sizes, and varieties for a more resilient urban forest.	L	S	S	S	S	Year 2
Replace all trees removed by planting 2 trees for every 1 tree removed.	L	S	S	S	S	Year 1
Complete the 2018 Urban Tree Canopy assessment or secure funding to complete alternative if CALFIRE data is unavailable.	L	S	S	S	S	Year 1

GOAL 1: Increase the City's urban tree canopy cover and maximize the benefits of trees.	COLLABORATORS L-lead S-support					Year
***Objective 1C: Sustain program funding for preserving and growing urban tree canopy*.**	**Community Services Department**	**Tree Committee**	**Community & Human Services Commission**	**Community Development Department**	**Sustainable Claremont**	**2020 – 2025**
Use the tree inventory data and Urban Tree Canopy data to determine maintenance and planting needs to inform budget decisions. Use the ecosystem benefit calculations to build support.	L	S	S	S	S	Year 1
Foster support for the urban forestry program by promoting the Tree Fund as a dedicated funding source for the urban forest.	L	S	S	S	S	Year 2
Continue to promote and encourage tree donations, memorial trees, the Resident-Pay program, and awards programs.	S	S	S	S	L	Year 1-5
Actively pursue grant opportunities to support urban forest activities.	L	S	S	S	L, S	Year 1-5
Increase pest and disease treatment funding. Show the importance of treatment by using the tree inventory data, costs for surge of removals, and public health risks.	L	S	S	S	S	Year 2
Maintain and extend partnerships that increase funding sources, project opportunities, and stewardship.	L	S	S	S	S	Year 2
Require 1% of cost for new development be applied to the Urban Forestry Program.	L	S	S	S	S	Year 4

GOAL 2: Maximize efficiencies in maintaining the benefits of trees.	COLLABORATORS L-lead S-support					Year
Objective 2A: Continue to implement best management practices (BMPs) for all tree care activities.	**Community Services Department**	**Tree Committee**	**Community & Human Services Commission**	**Community Development Department**	**Sustainable Claremont**	**2020 – 2025**
Continue to protect trees with tree preservation specifications and enforcement during construction and maintenance contracts.	L	S	S	S	S	Year 1
Inform City departments and personnel of any changes to the Tree Policies and Guidelines Manual.	L	S	S	S	S	Year 1-2
The staff arborist should continue to be included in site design, plan reviews, and construction activities to protect trees.	L	S	S	S	S	Year 1-5
Work with Claremont Heritage and Cal Poly students to update and integrate the landscape palette developed for the various types of architectural styles found in the City's 31 neighborhoods.	L	S	S	S	S	Year 2-3
Maintain defined roles and responsibilities for divisions, departments, and staff involved in the care of trees.	L	S	S	S	S	2020 – 2025
Develop and maintain annual work plans to inform all staff of current and planned operations and budget requirements.	L	S	S	S		Year 1
Establish and maintain a communication structure that informs all departments and staff of current and planned operations. Ensure protocols are in place to deal with high risk trees and emergency situations.	L	S	S	S	S	Year 1-5

GOAL 2: Maximize efficiencies in maintaining the benefits of trees.	COLLABORATORS L-lead S-support					Year
Objective 2B: Foster community support for the urban forestry program by engaging, educating, and involving the community in urban forestry efforts.	**Community Services Department**	**Tree Committee**	**Community & Human Services Commission**	**Community Development Department**	**Sustainable Claremont**	**2020 – 2025**
Continue to partner with Sustainable Claremont in urban forestry support, outreach, and stewardship activities.	L	S	S	S	S	Year 1-5
Use the Plan and data to develop non-traditional partnerships such as business owners.	L	S	S	S	L	Year 1-5
Create an awards program for individuals, students, organizations, and businesses showing exceptional tree stewardship.	S	S	S	S	L	Year 3
Expand the Heritage Tree Program by using the tree inventory to identify potential heritage trees, conduct public surveys to find large trees, and use Sustainable Claremont and tree stewards to identify these heritage trees on all land uses. Establish criteria and protection standards for heritage trees and raise awareness.	L	S	S	S	L	Year 3
Increase the use of social media and update the City's website with urban forestry information and information included in this plan.	L	S	S	S	S	Year 1
Increase outreach to private property owners about the importance of monitoring for pests and diseases.	L	S	S	S	S	Year 2
Update and distribute educational materials regarding planting, pruning, irrigation, pests and diseases, and the urban forestry program. Engage Sustainable Claremont for support.	L	S	S	S	S	Year 1
Continue to work with the colleges and school district for resources, education, and proper tree care on their properties.	L	S	S	S	S	Year 1
Conduct annual Arbor Day celebrations and maintain Tree City USA status.	L	S	S	S	S	Year 1
Use public/private partnerships to conduct private tree inventories for a better understanding of the urban forest.	L	S	S	S	S	Year 3

GOAL 2: Maximize efficiencies in maintaining the benefits of trees.	COLLABORATORS L-lead S-support					Year
Objective 2C: Promote efficient and cost-effective management of the urban forest.	**Community Services Department**	**Tree Committee**	**Community & Human Services Commission**	**Community Development Department**	**Sustainable Claremont**	**2020 – 2025**
Use tree inventory data and software for a cyclical program of inspections, routine pruning (every 5 years), and young tree training. Use this information to inform and plan budgets.	L	S	S	S	S	Year 1
Establish and maintain an optimal level of age and species diversity. Use the tree inventory and UTC data to inform tree planting species and locations.	L	S	S	S	S	Year 1-5
Minimize urban tree risk by conducting routine inspections and proper tree care.	L	S	S	S	S	Year 1-5
Plant urban trees appropriately to maximize benefits and minimize risk, nuisance, water restraints, hardscape damage, and maintenance costs.	L	S	S	S	S	Year 1-5
Mitigate loss, increase benefits, reduce GHG's, lower pest and disease impacts by planting more trees than removed.	L	S	S	S	S	Year 1-5
In a web-based GIS, overlay and maintain tree inventory data with other City assets and layers for coordination of efforts and protection of trees.	S	S	S	L	S	Year 1
Use tree inventory data and software for a cyclical program of inspections, routine pruning (every 5 years), and young tree training. Use this information to inform and plan budgets.	L	S	S	S	S	Year 1-5

GOAL 3: Minimize the risk of trees in the urban environment.	COLLABORATORS L-lead S-support					Year
Objective 3A: Improve the health of the urban forest with superior tree care and maintenance.	**Community Services Department**	**Tree Committee**	**Community & Human Services Commission**	**Community Development Department**	**Sustainable Claremont**	**2020 – 2025**
Develop a comprehensive management program for trees designated as heritage trees.	L	S	S	S	S	**Year 3**
Review and revise tree planting specifications and guidelines.	L	S	S	S	S	Year 1-2
Improve nursery stock selection procurement procedures and selection to ensure quality trees are being planted.	L	S	S	S	S	Year 1
Check and monitor new tree plantings for quality.	L	S	S	S	S	Year 1
Implement Best Management Practices and industry standards from the International Society of Arboriculture (ISA) and American National Standards Institute (ANSI) for all tree contracts and monitor contractors for compliance.	L	S	S	S	S	Year 1
Develop a variety of programs to ensure adequate water for all public trees.	L	S	S	S	S	Year 2-3
Sustain regular tree pruning schedule for all City trees.	L	S	S	S	S	Year 1
Through non-government organizations establish a Tree Stewardship program that engages the public in watering and basic tree care.	L	S	S	S	S	Year 2
Incorporate tree establishment in planting that provides watering and structural pruning for newly planted trees.	L	S	S	S	S	Year 3

GOAL 3: Minimize the risk of trees in the urban environment.	**COLLABORATORS** L-lead S-support					**Year**
Objective 3B: Mitigate infrastructure and hardscape damages caused by trees.	**Community Services Department**	**Tree Committee**	**Community & Human Services Commission**	**Community Development Department**	**Sustainable Claremont**	**2020 – 2025**
Review and update the <u>Tree Policies and Guidelines Manual</u>. During this process, develop a decision and design matrix for tress, sidewalks, and infrastructure which will more clearly define requirements, options, and responsibility.	L	S	S	L	S	Year 1
A staff arborist shall oversee all development and infrastructure repair plans, design, and operation. Work closely with Engineering Division. Consider updating communication protocols and workflows.	L	S	S	L	S	Year 1

GOAL 3: Minimize the risk of trees in the urban environment.	**COLLABORATORS** L-lead S-support					**Year**
Objective 3C: Develop a holistic approach to pest and disease management to protect the urban forest.	**Community Services Department**	**Tree Committee**	**Community & Human Services Commission**	**Community Development Department**	**Sustainable Claremont**	**2020 – 2025**
Improve the health of the urban forest with proper tree care and continue pest and disease inspection.	L	S	S	S	S	Year 1-5
Create Tree Steward programs to assist with early detection of exotic pests. Dovetail these programs with additional education about urban forestry issues.	S	S	S	S	L	Year 2
Compile a comprehensive list of pests and diseases that threaten the majority of public trees and identify integrated pest management solutions that address them.	L	S	S	S	S	Year 1-5

Appendix A. The Urban Forest Management Plan Approach

Appendix B. Urban Forest Sustainability and Management Audit

Appendix C. Monitoring Guidelines for Plan Implementation

Appendix D. Claremont Municipal Code & Urban Forestry

Appendix E. Funding Opportunities to Implement the Plan

Appendix F. Plan Survey Response Summary

Appendix G. Plan Relationship to Other City Efforts

Appendix H. Invasive Shot Hole Borer Fact Sheet

Appendix I. Other Threats to the Urban Forest

Appendix J. 2019 Tree Inventory Analysis

APPENDIX A. THE URBAN FOREST MANAGEMENT PLAN APPROACH

The process for developing the Plan was a systematic process whereby the results of each step informed the next, leading to development of the goals, objectives, actions, and adaptive management measures. The City's urban forest program was carefully evaluated using a combination of information obtained through working group meetings, department interviews, community meetings, and public surveys. This information was augmented with an in-depth review of City policies related urban forestry efforts.

Information Discovery

The first step in developing the Urban Forest Management Plan involved an extensive review of existing plans, policies, ordinances, and practices, to establish a baseline using the U.S. Forest Service's Urban Forest Sustainability and Management Audit (UFSMA). This audit is an industry-accepted process and region-specific evaluation of 11 categories of urban forest sustainability and management as they relate to the City of Claremont. The categories include:

1. Management Policy and Ordinances
2. Professional Capacity and Training
3. Funding and Accounting
4. Decision and Management Authority
5. Inventories
6. Urban Forest Management Plans
7. Risk Management
8. Disaster Planning
9. Practices, Standards, and Best Management Practices
10. Community
11. Green Assets

This process also included City staff meetings to identify current workflows, issues and gaps, perceptions of urban forestry, and/or resources and information needed.

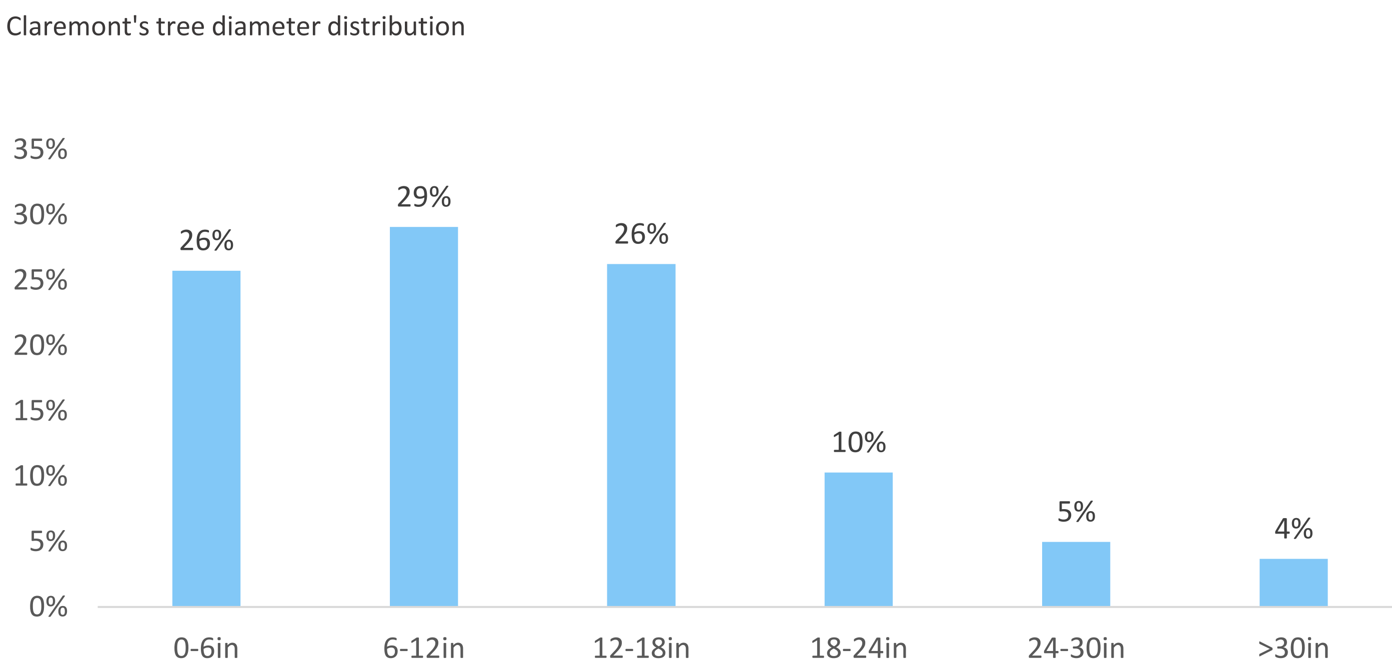
Data Collection & Analysis

Data pertaining to the City's urban forest such as the street and park tree inventory and Tree Canopy Assessment were gathered and analyzed to identify the urban forest structure, maintenance needs, and potential risks. Results from the analysis were then applied to the UFSMA and ultimately, to the Plan's goals and actions.

Tree & Planting Space Inventory

In 2018, the City hired a contractor to collect information about the City-maintained trees by performing a tree and planting space inventory. This information included the species, size, condition, and maintenance needs. This data describes the City's tree structure, diversity, and maintenance needs and informs future planting decisions.

Outputs from the City's tree management software were used in addition to other data analyses to guide the Urban Forest Management Plan. The information is provided to guide future maintenance and management and to better plan for the health and longevity of the City's urban forest. The summary of the tree analyses are provided in the State of the Urban Forest Resource section.



Community Meetings. A total of 6 meetings held with residents throughout the City.

Public Surveys. More than 50 responses were received providing insights into public perception of the importance of trees.

Sustainable Claremont. Meetings were held throughout the City linking urban forestry to sustainability.

Social Media. UFMP updates, announcements, and opportunities posted on Facebook and other social media.

Fliers & News Articles. Distributed to raise awareness and gather support.

Press Releases. Community meeting summaries shared in the Claremont Courier.

Canvassing of Homes. Reminding residents to water their trees and informing them of the UFMP project.

Email Listserv. Keeping the community up-to-date on the UFMP project.

Draft Plan. Open for public review and comment period.

Community Engagement & Plan Development

The plan development process included substantial outreach to the community. The process provided a broad perspective of the challenges that face Claremont's urban forest. Through public meetings, the City found an engaged set of residents with varying opinions on matters pertaining to the care of the urban forest. Connections and relationships that develop among the community are valuable outcomes of the urban forest outreach process. As community awareness and actions associated with urban forestry move forward, it will be the people of Claremont that ultimately realize the value of their contributions to their community in the trees that grow around them.

Community Outreach Meetings

The community engagement process consisted of six public meetings throughout the course of plan development. In addition, Sustainable Claremont hosted public meetings specifically for the UFMP but also linked the urban forest with other community meetings.

The community engagement began in March of 2018, shortly after the project began. The first two meetings provided the attendees with an overview of the City's urban forestry program, the current state of the urban forest, benefits of the urban forest, and an opportunity for discussion. The discussion was facilitated by a series of questions relating to the public's views on the benefits of trees and the program, issues facing trees, and issues caused by trees. They were asked, "Understanding the issues, how can we use the benefits identified to address the issues?" This afforded the opportunity to hear the public's ideas and opinions, but also for the City to describe current practices and procedures that might not have been understood by the public prior to meeting.

Subsequent meetings consisted of providing updates on project components such as the tree inventory and canopy assessment; receiving feedback from the attendees regarding their concerns; discussing current and optimal urban forestry budgets and maintenance; presenting the draft Plan and the final Plan.

Outreach & Education

In addition to the surveys and meetings, Sustainable Claremont canvassed homes as part of their tree planting program to inform residents of the Plan and upcoming meetings. Outreach also included fliers, social media posts, and articles in the newspaper.

Public Survey

A 7-question survey was publicly distributed at community meetings, via email, the City's website, and through the City's tree planting program. The survey was developed with the intention of understanding and benchmarking Claremont's community values and views on the urban forest to inform the Plan's goals, objectives, and actions. This survey was available for a 9-month period from March 2018 to January 2019. The following provides a summary of the results:

Top 3 benefits provided by trees:

#1 Clean the air by absorbing pollutants

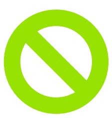
#2 Reduce greenhouse gases, temperatures, and address climate change

#3 Shade streets for walking and parks for playing

The stocking levels for Claremont:

68% Feel there are enough trees in the City

Top concerns regarding trees:



19% Roots damaging underground utilities

19% Sidewalk and pavement cracking due to tree roots

Community's willingness to support the urban forest:

25% (Majority) Support planting new trees, not just as replacements

Plan Targets & Implementation

Criteria and Performance Indicators or targets for urban forest management and sustainability were established for the City based on the Information Gathering, the Data Collection & Analysis, and the Public Engagement tasks. This process identifies where the City is currently on a management and sustainability spectrum and a description of indicators representing low to optimal urban forest management.

In 2011, Kenney, van Wassenaer, and Satel published a set of 25 Criteria and Indicators (C&I) for the assessment of a community's urban forest resource and its management program. Based on the work of Clark *et al*. (1997), this assessment methodology allows for a comparison of the current status of various criteria related to a community's urban forest resource, community and institutional framework, and resource management approach in relation to key objectives and indicators of success. For Claremont's Plan, a total of 32 criteria were developed for a more comprehensive analysis and planning process. An assessment using this framework can identify critical gaps in a community's urban forestry program, establish goals, and help to prioritize management activities and resource allocation. When utilized at the outset of the urban forest management planning process, a C&I assessment can also serve as a baseline for future monitoring efforts. This baseline can be referred to at the end of each of the Plan's management periods (e.g., every 5 years) to track progress towards program goals. The C&I approach, along with specific targets established in the Plan, is a critical component of the active adaptive management process. The U.S. Forest Service's Urban Forest Sustainability and Management Audit (description in Appendix B), Community meetings, and industry research were used to complete the Criteria and Indicators. A high-level summary of the types of criteria are provided below in Figure 15.

Figure 15. Example criteria for evaluating Claremont's existing urban forestry program

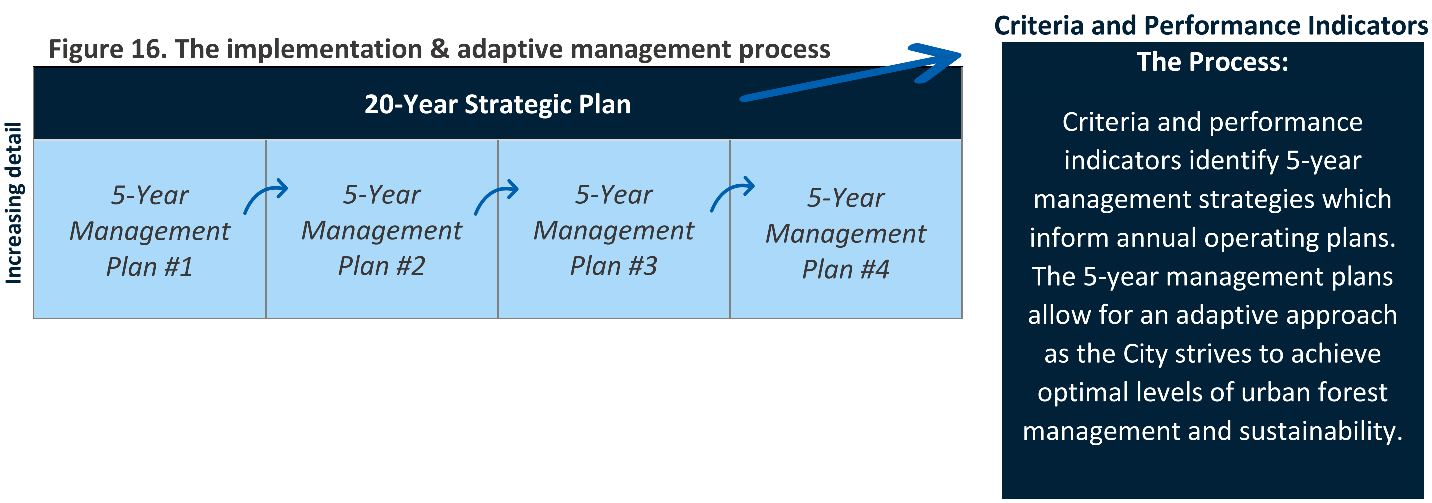
Urban Forest Goals, Objectives, & Actions

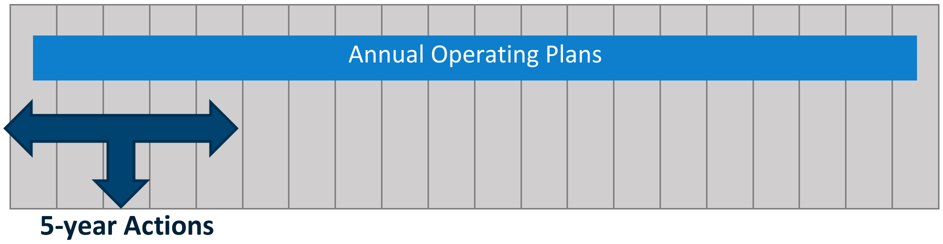
Based on the City's current status, goals and actions were developed to advance the City's existing urban forest and management program along the C&I spectrum. Each goal includes an objective and a series of actions along with the responsible entity and roles of the departments, the connection to the Sustainable City Plan, the Criteria & Indicators impacted, and the implementation timeframe. The number of Criteria and Indicators impacted by the goals and actions reflects the efficiency of each action.

Reassess & Adjust

Adaptive Management is a scientific approach to an urban forest management decision process. It promotes flexible decision-making that can be adjusted in the face of uncertainties as outcomes from management actions and other events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. Adaptive management does not represent an end, but rather a means to more effective decisions and enhanced benefits. Its true measure is in how well it helps meet environmental, social, and economic goals; increases scientific knowledge; and reduces tensions among the community.

Figure 16. The implementation & adaptive management process





Using an adaptive management approach will require the consistent monitoring of all the City's criteria for urban forest sustainability. The City will be able to judge if its new approaches to urban forest conservation are effective, look for relationships between management actions and outcomes, and identify significant trends. This will allow the City to adjust management actions over time as changes occur both in the physical/biological environment and in the expectations of the City's residents.

Summary of the Planning Process

1. Assessment of relevant resource data where it exists
2. Identification of urban forest attributes
3. Creation of vision reflecting community values
4. Determination of the current status of various components
5. Identifying gaps between vision and current status
6. Implementation of actions to close the gaps
7. Formulation of operational plan incorporating vision and goals
8. Implementation and monitoring of the plan

Appendix B. Urban Forest Sustainability and Management Audit

Urban Forest Program Audit

The process of analyzing the urban forest was conducted using the U.S. Forest Service's Urban Forest Sustainability and Management Audit. This audit completed for Claremont involved extensive information and document gathering and research to identify policies, practices, programs, and standards pertaining to 11 categories of urban forest sustainability and management as defined by Clark et al. (1997), Kenney et al. (2011), and the U.S. Forest Service.

Table 4. Urban Forest Sustainability and Management Audit summary for the City program

Categories of the Urban Forest Sustainability and Management Audit and % Achieved	
- Management Policy and Ordinances:	82% Achieved
- Professional Capacity and Training:	50% Achieved
- Funding and Accounting:	67% Achieved
- Decision and Management Authority:	63% Achieved
- Inventories:	54% Achieved
- Urban Forest Management Plans:	58% Achieved
- Risk Management:	50% Achieved
- Disaster Planning:	57% Achieved
- Practices, Standards, and BMPs (Best Management Practices):	86% Achieved
- Community:	86% Achieved
- Green Asset Evaluation:	100% Achieved

Overall: **64.6% Achieved** (continue reading for a detailed summary of the Audit results)

This urban forest audit identified the gaps in the City's urban forest as it pertains to the Urban Forest Resource, the Resource Management, Community Framework, and Institutional Framework to inform the goals, strategies, and measures provided in this Plan. For more information on the U.S. Forest Service's Urban Forest Sustainability and Management Audit, visit https://www.interfacesouth.org. The process is summarized further in this section.

The U.S. Urban Forest Sustainability Management Audit was used for evaluating all categories and elements pertaining to Claremont's urban forest to inform Criteria and Performance Indicators, measures and milestones, goals, and actions.

1) Identify documents and resources pertaining to each of the categories

Category & Element	Count
Management Policy and Ordinances	30
Professional Capacity and Training	3
Funding and Accounting	4
Decision and Management Authority	3
Inventories	14
Urban Forest Management Plans	13
Risk Management	4
Disaster Planning	4
Practices, Standards, and BMPs	39

Community	28

2) Example of the resources and documents listed for Management Policy and Ordinances Category

Management Policy and Ordinances		
1.01	Approved Policy Statements	See below
1.02	Climate Change (Sustainability)	Tree Policies and Guidelines Manual General Plan Sustainable City Plan
1.03	No Net Loss	Tree Policies and Guidelines Manual
1.04	Risk Management	Tree Policies and Guidelines Manual
1.05	Tree Canopy Goals	Sustainable City Plan General Plan 2012 & 2018 UTC (in progress)

3) Rate the level at which the City is achieving the element

Management Policy & Ordinances			
Element	**Component Evaluated**	**Description or Criteria for Evaluation**	**Assigned Status***
1.00	Approved Policy Statements	Written policy statements approved by a governing body.	*Score: 2 "Adopted Common Practice"*
1.01	Climate Change (Sustainability)	Also referred to as Sustainability. With reference to urban trees. Addresses the long-term health and productivity of the natural resource.	*Score: 2 "Adopted Common Practice"*
1.02	No Net Loss	Can refer to trees, basal area, or canopy.	*Score: 2 "Adopted Common Practice"*
1.03	Risk Management	Should reference: ANSI A300 Part 9, ISA BMP, and prioritization funding mechanisms.	*Score: 2 "Adopted Common Practice"*
1.04	Tree Canopy Goals	Overall community/campus goal, or by designated "zone".	*Score: 1 "In Development*

*For each component that is evaluated, 0 points are attributed if the component doesn't exist or is not practiced; 1 point is given if the component is in development; 2 points are given if the component is routinely practiced; and 3 points are given if the practice is exceeded. The points can then be totaled for an overall score.

4) The level at which the City is attaining optimal levels for each category element is calculated

Management Policy & Ordinances Attainment	
Line Items Applicable (Count):	14
Category Goal (Sum):	28
Category Evaluation (Sum):	23
Category Percent Attained:	**82.1%**
Category Standard of Care (SOC) Count	
SOC Applicable (Count):	2
SOC Goal (Sum):	4
SOC Sum:	4
% Category SOC Attained:	**100.0%**
Category Base Practices (BP) Count	

BP Applicable (Count)	3
BP Goal (Sum):	6
BP Sum:	5
% Category BP Attained:	**83.3%**

5) Determines the level at which the City is achieving urban forest sustainability and management to inform criteria and performance indicators, measures and milestones, goals, and strategies

		Sum of Evaluations			
Category	Description	SOC (% Achieved)	Base (% Achieved)	Overall Rating	**Overall (% Achieved)**
1	Management Policy and Ordinances	100.0%	83.3%	23	**82%**
2	Professional Capacity and Training	100.0%	NA	8	**50%**
3	Funding and Accounting	75.0%	NA	8	**67%**
4	Decision and Management Authority	75.0%	50.0%	5	**63%**
5	Inventories	NA	43.8%	14	**54%**
6	Urban Forest Management Plans	NA	50.0%	14	**58%**
7	Risk Management	58.3%	50.0%	9	**50%**
8	Disaster Planning	NA	66.7%	8	**57%**
9	Practices, Standards, and BMPs	50.0%	50.0%	39	**65%**
10	Community	100.0%	NA	24	**86%**
11	Green Asset Evaluation (Observed Outcomes)	NA	NA	20	**100%**
	Total	**79.8%**	**56.3%**	**172**	**67.7%**

Appendix C. Monitoring Guidelines for Plan Implementation

Urban Forest Resource

V1) Tree species diversity
Measure: Tree inventory data in ArborAccess and/or MS Excel or Access.
V2) Diameter distribution of trees in the City
Measure: Tree inventory data in ArborAccess and/or MS Excel or Access.
V3) Street and park tree health (includes pest and disease)
Measure: Tree inventory data in ArborAccess and/or MS Excel or Access.
V4) Planting and stocking levels
Measure: Tree inventory data in ArborAccess and/or MS Excel or Access.
V5) Climate change resiliency
Measure: NOAA climate zones and the tree inventory data in ArborAccess and/or MS Excel or Access. Tree species list is updated accordingly. Trees are evaluated.

Resource Management

R1) Urban forest management plan (acceptance and implementation)
Measure: Review by the Community Services Department.
R2) Citywide funding
Measure: Annual review by the Community Services Department.
R3) City urban forestry staff funding
Measure: Annual review by the Community Services Department.
R4) Management of publicly and privately-owned natural areas
Measure: Annual internal review of public land management to include random sampling of resources and utilize the Wilderness Park 2016 Master Plan and other plans/studies.
R5) Urban forest protection policy development and enforcement
Measure: Semi-annual review of process by Community Services Department and review of street and park tree inventory data in tree management software relating to tree condition, observations, conflicts, etc.
R6) Urban forest inventory public-private
Measure: Semi-annual review of process by Community Services Department and review the street and park tree inventory data in tree management software and future inventory data.
R7) Tree planting and establishment on public and private land
Measure: Review of the street and park tree inventory data and future tree inventories and analysis. Gather data from Sustainable Claremont to determine private plantings.
R8) High risk tree maintenance
Measure: Internal review by Community Services Department by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.
R9) Public tree condition assessment and abatement citywide
Measure: Internal review by Community Services Department by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.
R10) Routine tree pruning
Measure: Internal review by Community Services Department by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.
R11) Young tree maintenance
Measure: Internal review by Community Services Department by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.
R12) Tree pest and disease management
Measure: Internal review by Community Services Department by field sampling and reviewing data in tree and work order management software to determine degree of pest and disease presence, risks, management, and costs.
R13) Tree site suitability

Measure: Internal review by Community Services Department by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.

R14) Invasive plant species management

Measure: Internal review of public and private lands using random sampling.

R15) Public tree condition assessment and abatement along emergency and evacuation routes

Measure: Internal review by Community Services Department by field sampling and reviewing data in tree and work order management software to determine degree of risk abatement and reduction annually.

R16) Canopy assessment and goals

Measure: The 2018 Urban Tree Canopy assessment is completed using the 2018 CALFIRE data or alternative. Goals are established by District and by land use based on resources, available planting space, and District needs. 5 to 10-year follow ups to determine canopy gains and losses.

R17) Tree preservation best practices

Measure: City arborist is on site for review of construction/repair of structures and utilities that may impact the trees within the right-of-way. Sample inventory and future inventories to see if in effect.

R18) Pest & disease treatment on private property and campuses

Measure: Community Services Department and/or Sustainable Claremont conducts survey to gather information from private property owners.

Community Framework

C1) General awareness of the urban forest as a community resource

Measure: Conduct a 2-year community survey.

C2) Neighborhood cooperation

Measure: Conduct a 2-year community survey.

C3) Citizen, municipal, business, commuter, interaction

Measure: Semi-annual review by Community Services Department.

C4) Support by private land holders

Measure: Semi-annual review by Community Services Department.

Institutional Framework

I1) City public agency cooperation

Measure: Semi-annual review by Community Services Department.

I2) Design and development industry and other government agency cooperation

Measure: Annual random sampling of site-specific designs and implementation of future tree inventories.

I3) Landscape and arboriculture industry cooperation

Measure: The green industry use of ANSI standards, state BMP's, state nursery grades and standards.

I4) Cooperation within the geographic region

Measure: Semi-annual review by Community Services Department.

12.26.040 Duties of private property owners.

The duties of any owner of private property whose property has a City easement on it for street purposes are as follows:

A. To accept, protect and provide adequate water to any City tree planted in the public easement over his or her property, and not to interfere with the City's provision of water to such trees, whether by water truck or other means;
B. To notify the Community Services Department of any suspected tree hazards or maintenance needs of any City tree on his or her property;
C. To remove any vines from City street trees planted in the easement over his or her property;
D. To remove all fallen leaves and other deadfall from any City tree planted in the public easement over his or her property, and to properly dispose of the deadfall in an appropriate waste receptacle. (14-07; 12-04; 09-06; 07-04)

12.26.050 Street trees.

No tree shall be planted within a parkway other than the species designated as the street tree for that particular street, or portion of a street, by the Community and Human Services Commission. No street tree shall be planted, except by the City, until a tree permit has been issued for it as provided in Section 12.26.070 of this chapter. (12-04; 07-04)

12.26.060 Tree planting in subdivisions.

Any subdivider of land shall install City trees in accordance with the requirements of Title 16 [Zoning] of this Code and any related resolutions. (07-04)

Title 16, Zoning, Chapter 16.300 Architectural Review

#9 Tree Preservation

The proposed development is designed to preserve and/or retain on-site significant mature trees to the greatest extent possible. Removal of significant trees shall be avoided, except where such trees have been determined to be of poor health or where retention is economically infeasible.

12.26.070 Permits.

A. No person shall plant or otherwise disturb any City tree without first obtaining a permit from the Director of Community Services.
B. Applications for permits must be made to the Community Services Department on forms provided by the department, and shall include such information as the Director deems necessary to review the application.
C. Work undertaken by the permittee or his or her agents may be stopped immediately and the permittee's permit may be revoked by oral or written order of the Director when the Director determines that the program of work or conditions outlined in the permit are not being complied with.
D. The Director's decision may be appealed to the Community and Human Services Commission if a written appeal, setting forth the grounds, is filed with the Community Services Department within ten days of the Director's decision. If no timely appeal is filed, the decision shall be final. (14-07)

12.26.080 Fees.

Fees for permits and appeals shall be established by resolution of the City Council. Any previously adopted resolution establishing fees in relation to prohibited activities shall be repealed. (07-04)

12.26.090 Protection of City trees.

A. It is unlawful for any person to injure, cut, damage, carve, transplant, prune, root prune or remove any public tree.
B. It is unlawful for any person to attach, cause to be attached or keep attached to any public tree, or to the guard or stake of a public tree, any rope, wire nails, tacks, staples, advertising posters, decorations,

ornaments, flags, toys, swings, lights or any other contrivance whatsoever without first obtaining a permit or explicit approval from the City.

C. It is unlawful for any person to cause or allow any poison or other substance harmful to tree life to lie, leak, pour, flow or drip upon or into the soil within the drip line of any public tree; or set fire or permit any fire to burn when such fire or heat thereof will injure any portion of any public tree; or to operate any equipment, such as mechanical weeding devices, in such a manner as to cause damage to a public tree in any way.

D. No person shall injure any public tree located within an easement or public right-of-way on his or her private property by neglecting to provide the necessary amount of water, as determined by the Tree Policy Manual and the terms of this chapter, required for said tree's continued good health and viability.

E. No person shall impact the drip line area of a City tree in a way that may reasonably be expected to damage the root system, compact the soil over the roots, or impede free passage of water, air or fertilizer to the roots of any public tree.

F. Special consideration shall be afforded public trees determined by the Community and Human Services Commission to be heritage trees. Such trees shall be removed only when public interest served by removal outweighs the interest in preservation and heritage status.

G. All trees of any species or variety of the genus Ulmus which are found to be infected with Ceratocystis ulmi (Dutch Elm disease) in the City are a threat and a hazard to all trees of the genus Ulmus in Claremont. This section requires that all aboveground portions of such infected trees be destroyed or properly disposed of as provided in this chapter.

H. No person shall possess, store or transport into the City all or any part of the trees of the genus Ulmus infected with Ceratocystis ulmi (Dutch Elm disease); provided, however, that wood, branches and roots of such trees may be transported either to a safe place for burning or burial, under a minimum of two feet of earth, within five days following the discovery of such infection, or to such sites, and under such conditions, as are approved by the Community and Human Services Commission for the processing and subsequent elimination of the disease hazard. Infected trees may be treated in a manner approved by the County Agriculture Commissioner to effect a cure for the disease if and when an effective cure becomes known.

I. During the construction, repair, alteration, moving or removal of any building, structure of any other type of construction in the City, no person in control of such work shall leave any public tree, shrub or plant in the vicinity of such activity without sufficient guards or protectors as identified in the tree policy manual to prevent injury to the tree, shrub or plant in connection with such construction, repair, alteration, moving or removal. The costs of any such protection shall be borne by the person responsible for the improvement. (12-04; 09-06; 07-04)

<u>12.26.100 Interference with Director of Community Services</u>.

No person shall hinder, prevent, delay or interfere with the Director or any of his or her agents while engaged in carrying out the execution or enforcement of this chapter. Provided, however, that nothing in this section shall be construed as an attempt to inhibit the pursuit of any remedy, legal or equitable, in any court of competent jurisdiction for the protection of property rights by the owner of any property within the City. (14-07)

<u>12.26.110 Violation—Penalty</u>.

A. Any violation of this chapter shall be a misdemeanor or infraction at the discretion of the City Attorney or district attorney.

B. Irrespective of and cumulative to any criminal conviction for a violation of this chapter, the City may, pursuant to Government Code Section 36901, impose a civil penalty in an amount not exceeding one thousand dollars on any person who commits a violation of this chapter. The City may recover the penalty either through an administrative hearing or a civil action brought either by the City Attorney or a designated employee of the City.

C. Irrespective of whether the City pursues criminal and/or civil action under this chapter, nothing in this chapter shall prevent the City from seeking restitution for damage to City property as an alternative to criminal action and/or civil action to recover a civil penalty in accordance with subsection B of this section. (07-04)

APPENDIX E. FUNDING OPPORTUNITIES TO IMPLEMENT THE PLAN

CALFIRE Urban & Community Forestry Grant Program

http://www.fire.ca.gov/resource_mgt/resource_mgt_urbanforestry_grants#

Grants are for activities including but not limited to: tree planting, comprehensive urban forest management plans, tree resource inventories, educational programs, green infrastructure, and innovative ideas that promote urban forestry in California. Proposals due in November, applications due in March. Begin in June.

Climate Change Investments Project Types:

- Urban Forest Expansion
- Improvement Urban Wood and Biomass Utilization

Proposition 68 Project Types:

- Urban Forest Expansion and Improvement
- Urban Forest Management Plans
- Urban Forest Education and Research

California Natural Resources Agency Environmental Enhancement and Mitigation Program (EEMP)

http://resources.ca.gov/grants/environmental-enhancement-and-mitigation-eem/

The EEMP encourages projects that produce multiple benefits which reduce greenhouse gas emissions, increase water use efficiency, reduce risks from climate change impacts, and demonstrate collaboration with local, state and community entities. Available Funding (2018-19): $7 million

Eligible Projects: Urban Forestry:

- Planting of trees and other plants along urban streets and medians.
- Greening existing public land, including school campuses and urban parks.
- Greening vacant lots and abandoned sites.
- Restoration of urban creeks.
- Proposals Due: Typically, from April – June

Inland Empire Resource Conservation District
www.iercd.org/application

Types of Projects Accepted: IERCD accepts applications for a wide variety of mission-focused projects types within the Santa Ana Watershed including, but not limited to:

- Community gardens, carbon farm plans, urban agriculture education, etc.
- Habitat restoration, native plant gardens, fencing for habitat protection, endangered species protection/education, etc.
- Forestry and Fire Preventions (chipping programs, fire prevention outreach, etc.)
- Education programs relating to the promotion of natural resources stewardship
- *Award Amounts:* Considered projects generally range from approximately $10,000-$75,000.

ACTIVITY	TIMEFRAME
IERCD Announcement and Promotion	January-April
Full Applications Deadline	May 15^{th}
Project Implementation	July 1^{st}-June 30^{th}

Cal-EPA 2016 Environmental Justice Small Grants
www.calepa.ca.gov/EnvJustice/Funding/?mc_cid=b68bc95390&mc_eid=b4c201d657

The California Environmental Protection Agency (CalEPA) Environmental Justice (EJ) Small Grants Program offers funding opportunities to assist eligible non-profit community organizations address environmental justice issues in areas disproportionately affected by environmental pollution and hazards

2019 Focus Areas:

1. Improve Access to Safe and Clean Water.
2. Address Climate Change Impacts through Community Led Solutions.
3. Reduce the Potential for Exposure to Pesticides and Toxic Chemicals.
4. Promote Community Capacity Building — Improve Communities' and Tribes' Understanding of the Technical and Procedural Aspects of Environmental Decision-Making and Increase Access to Funding Opportunities.
5. Promote the Development of Community-Based Research that Protects and Enhances Public Health and the Environment.
6. Addressing Cumulative Impacts through Collaboration between Community-Based Organizations and Local Government.
7. Promoting Pollution Prevention and Resource Conservation.
8. Developing Effective Partnerships with Schools.

California Natural Resources Agency Urban Greening Grant Program
http://resources.ca.gov/grants/urban-greening/

Funds projects that reduce greenhouse gases by sequestering carbon, decreasing energy consumption and reducing vehicles miles traveled, while also transforming the built environment into places that are more sustainable enjoyable, and effective in creating healthy and vibrant communities.

This new program explicitly includes urban heat island mitigation projects and energy conservation efforts related to shade tree planting. The existing draft guidelines favor tree planting as the primary quantification methodology to reduce greenhouse gases.

California Department of Transportation Active Transportation Program (ATP)
http://www.catc.ca.gov/programs/atp/

The ATP provides funding to encourage increased use of active modes of transportation, such as biking and walking. Trees and other vegetation are significant components of several eligible projects under the ATP, including parks, trails, and safe-routes-to-schools. Public agencies, transit agencies, school districts, tribal governments and non-profit organizations are eligible. Available Funding (2018-19): $ 440 million for fiscal years 2019-20, 2020-21, 2021-22, & 2022-23.

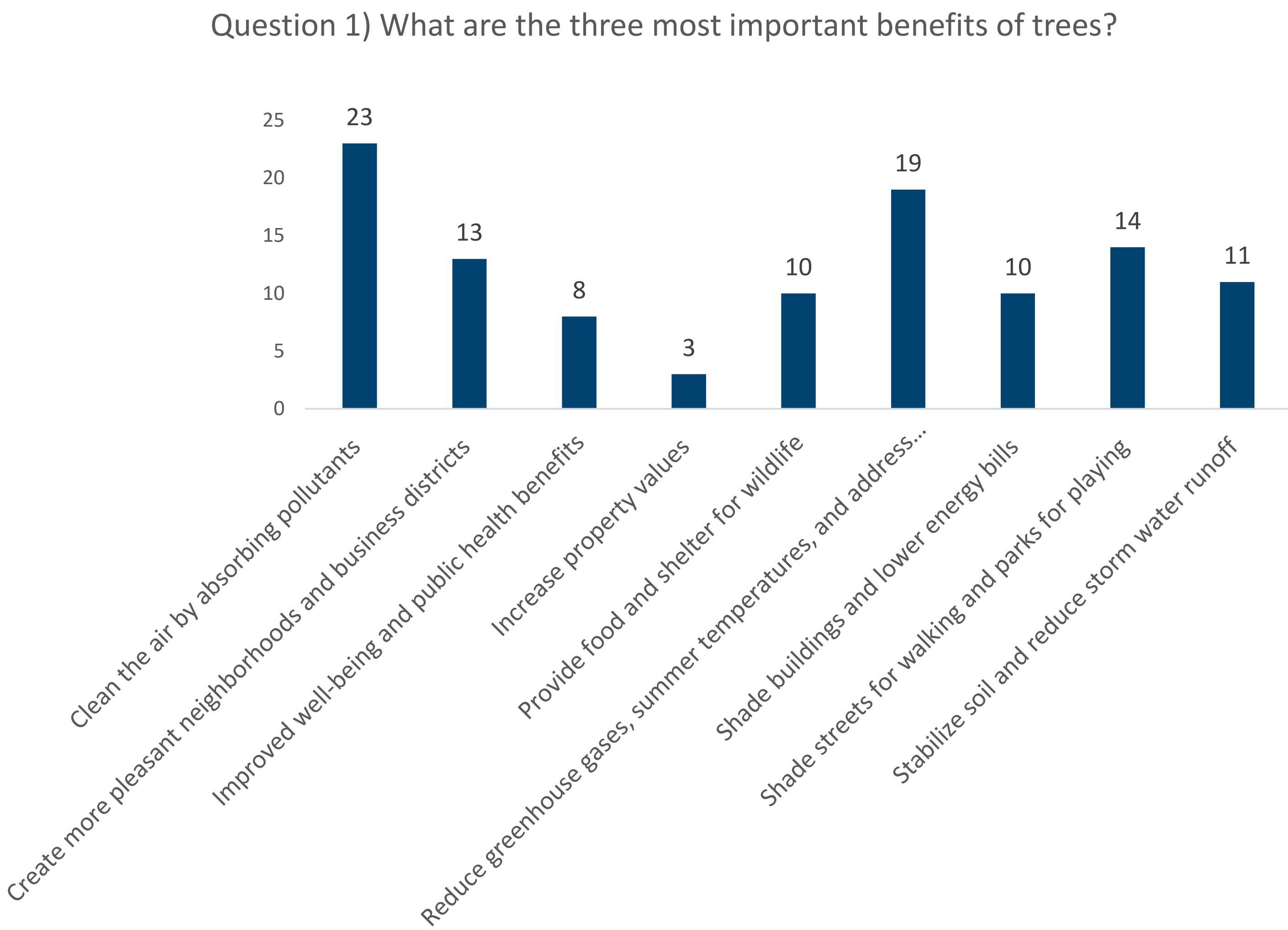
Strategic Growth Council's Affordable Housing and Sustainable Communities Program
http://sgc.ca.gov/programs/ahsc/

The SGC is authorized to fund land-use, housing, transportation, and land preservation projects to support infill and compact development that reduce GHG emissions. Urban Greening is a threshold requirement for all AHSC funded projects. Eligible urban greening projects include, but are not limited to, rainwater recycling, flow and filtration systems including rain gardens, stormwater planters and filters, vegetated swales, bioretention basins, infiltration trenches and integration with riparian buffers, shade trees, community gardens, parks and open space. Local agencies, Developers, Program Operators are eligible.

State Water Resources Control Board's Stormwater Management Program
https://www.waterboards.ca.gov/water_issues/programs/grants_loans/swgp/prop1/

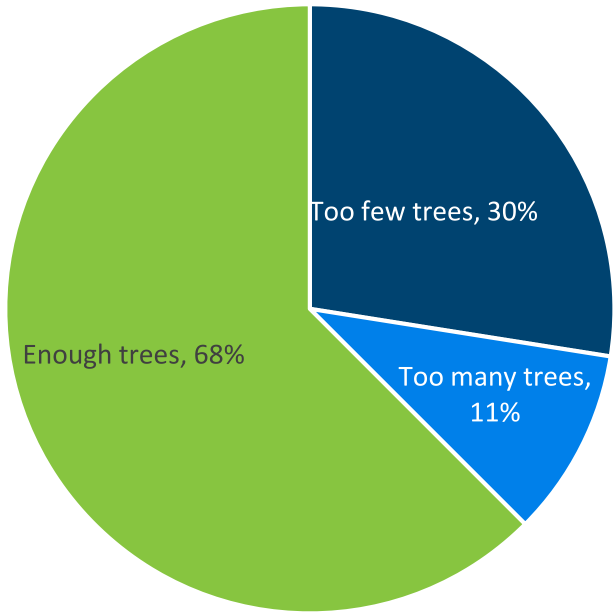
The Stormwater Management Program will provide funds for multi-benefit stormwater management projects that also contribute to local water supplies. This is a new program using funds from Proposition 1, which explicitly states eligible projects may include (but shall not be limited to) green infrastructure, rainwater and stormwater capture projects, and stormwater treatment facilities.

Appendix F. Plan Survey Response Summary



What are the three most important benefits of trees?	Total
Clean the air by absorbing pollutants	23
Create more pleasant neighborhoods and business districts	13
Improved well-being and public health benefits	8
Increase property values	3
Provide food and shelter for wildlife	10
Reduce greenhouse gases, summer temperatures, and address climate change	19
Shade buildings and lower energy bills	10
Shade streets for walking and parks for playing	14
Stabilize soil and reduce storm water runoff	11

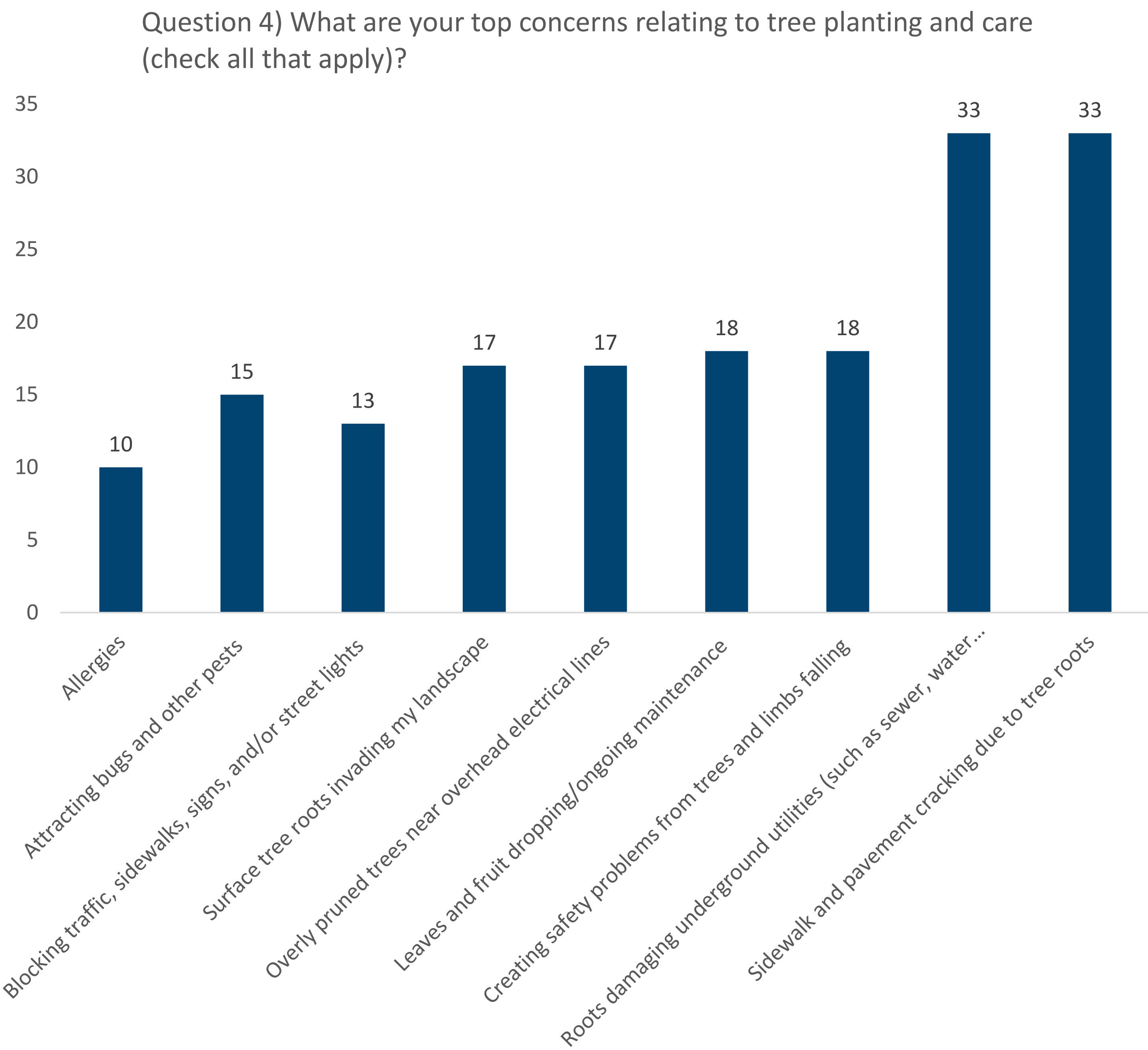
Question 2) In your neighborhood, are there too many or too few public trees?



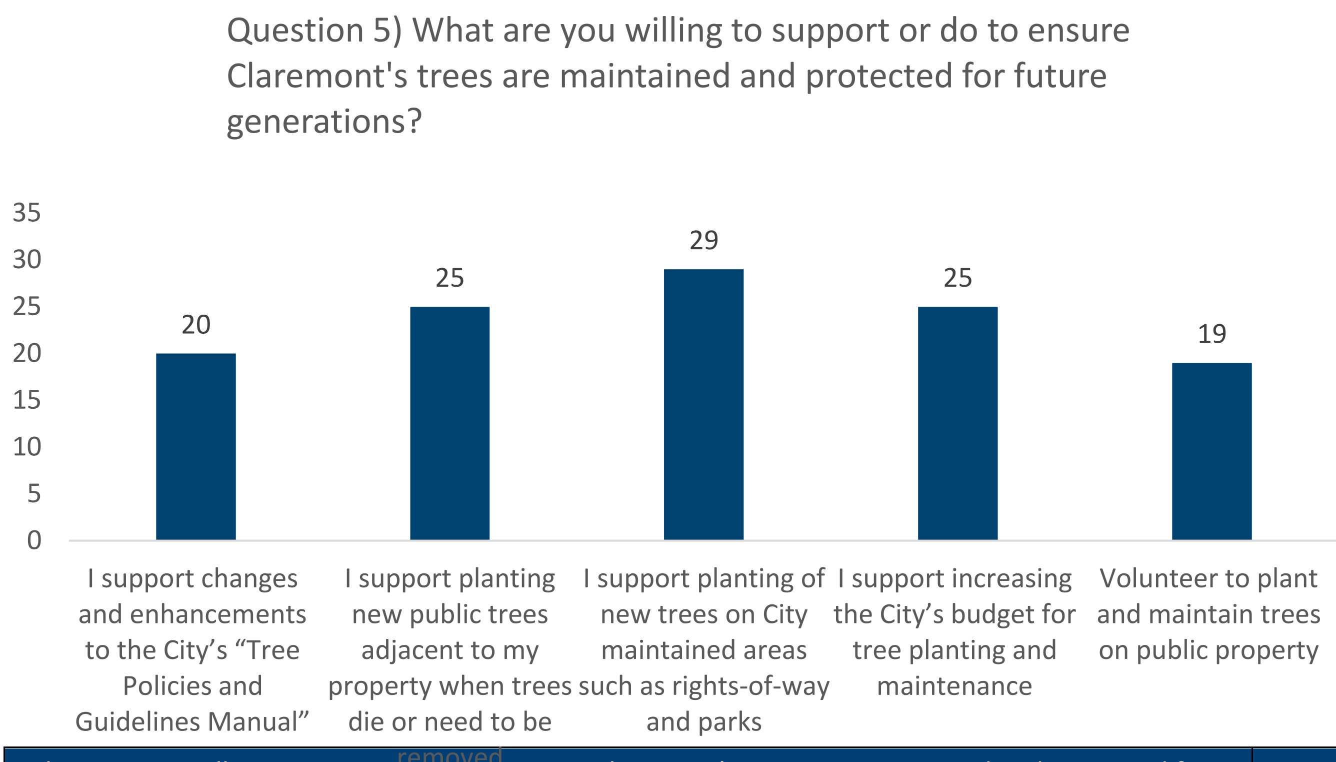
In your neighborhood, are there too many or too few public trees?	Total
Too few trees	11
Too many trees	4
Enough trees	25

Question 3) In your neighborhood, where do you think more trees should be planted?

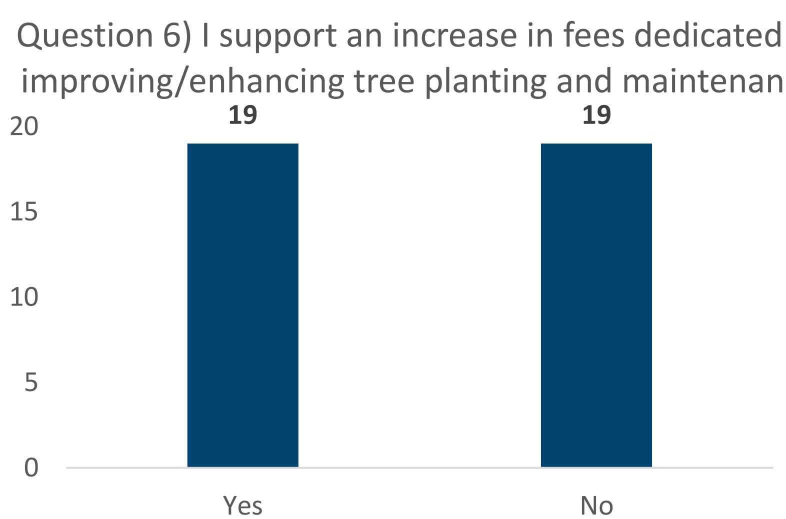
In your neighborhood, where do you think more trees should be planted? (Name the streets or areas)
Middle of Indian Hill Blvd - Divide
West side of Forbes in school lot
Back of La Puerta Park on Forbes
Kirkwood Ave - replacements
Foothill Blvd/Baseline need more trees to absorb high traffic pollutants
Along College Ave north of Arrow Hwy and south of Foothill
Piedmont Ave
Sweetbriar Dr, Armstrong Dr
Griffith Park, Towne Ave, Bike Path below 210
Blue Mountain Way
Mural Drive (N of Briarcroft)
Teasdale (2)
Shelter Grove, Teasdale (2)
1400 block of Mural Dr has dead trees not marked for replacement
1400 block of Mural Drive has dead/almost dead trees not marked for replacement
Cinderella Dr (2)
In yards where there are no trees
None (4)
No more trees until dying trees are trimmed



What are your top concerns relating to tree planting and care (check all that apply)?	**Total**
Allergies	10
Attracting bugs and other pests	15
Blocking traffic, sidewalks, signs, and/or street lights	13
Surface tree roots invading my landscape	17
Overly pruned trees near overhead electrical lines	17
Leaves and fruit dropping/ongoing maintenance	18
Creating safety problems from trees and limbs falling	18
Roots damaging underground utilities (such as sewer, water lines, natural gas)	33
Sidewalk and pavement cracking due to tree roots	33



What are you willing to support or do to ensure Claremont's trees are maintained and protected for future generations? Please rank the following (1-6) with your strongest support being "1"	Total
I support changes and enhancements to the City's "Tree Policies and Guidelines Manual"	20
I support planting new public trees adjacent to my property when trees die or need to be removed	25
I support planting of new trees on City maintained areas such as rights-of-way and parks	29
I support increasing the City's budget for tree planting and maintenance	25
Volunteer to plant and maintain trees on public property	19



I support an increase in fees dedicated to improving/enhancing tree planting and maintenance	Total
Yes	19
No	19

Question 7) Other comments

Homeowner and landscaper education regarding equipment damaging trees

With elms and liquidambars dying, need red push pistache as an option

7-year tree maintenance is not enough

Need options for elderly or disabled who can’t water their trees

Pick the appropriate trees by getting the neighborhood involved

Appendix G. Plan Relationship to Other City Efforts

The Urban Forest Management Plan is supported by and reinforces City policies outlined in the elements of Claremont's General Plan and in other planning documents that establish broad policies for the physical character of Claremont. Goals and objectives within these other plans, such as the Sustainable City Plan, would be supported by a strong urban forest program.

Claremont's 2009 General Plan & the Urban Forest

Chapter 2: Land Use, Community Character, and Heritage Preservation Element

Policy 2-12.4: "Encourage all new development to preserve the natural topography of a site and existing mature trees."

Policy 2-13.1: "Maintain and enhance the City's collection of street trees and improve Claremont's image of a 'City with trees'."

Policy 5-8.1: "Develop a tree planting policy that strives to accomplish 50% shading of constructed paved and concrete surfaces within five years of construction."

Chapter 5: Open Space, Parkland, Conservation, and Air Quality Element

Policy 5-8.2: "Provide adequate funding to manage and maintain the City's urban forest, including sufficient funds for tree planting, pest control, scheduled pruning, and removal and replacement of dead trees."

Policy 5-8.3: "Coordinate with local and regional plant experts (e.g. Rancho Santa Ana Botanic Garden) in selecting tree species that respect the natural region in which Claremont is located, to help create a healthier, more sustainable urban forest."

Policy 5-8.4: "Safeguard and enhance Claremont's community forest by protecting existing stands of trees and other plant material of substantial value."

Policy 5-8.5: "Continue to plant new trees (in particular native tree species where appropriate), and work to preserve mature native trees."

Policy 5-8.6: "Increase the awareness of the benefits of street trees and the community forest through a citywide education effort."

Policy 5-8.7: "Continue to manage and care for all trees located on City property or within the City's right of way."

Policy 5-8.8: "Provide information to the public on correct tree pruning practices."

Policy 5-8.9: "Encourage residents to properly care for and preserve large and beautiful trees on their own private property."

Policy 5-18.5: "Continue to require the planting of street trees along City streets and inclusion of trees and landscaping for all development projects to help improve airshed and minimize urban heat island effects."

Claremont's urban forest is acknowledged through Policy in the General Plan but there are areas for improvement which are addressed in this Plan's goals, objectives, and actions. As elements of the General Plan are updated and specific plans and other public landscape projects are implemented, they should be guided by the principles of this Management Plan. Periodic updates of this Plan will ensure the progression of a continuous improvement cycle.

Other Relating Plans, Initiatives, & Resources

During the information discovery phase of this Plan's development, other supporting plans, and resources were identified as having urban forestry components or an influence on urban forest management. As elements of these plans are implemented, they should be guided by the principles of this Management Plan.

Tree Policies and Guidelines Manual (1997, rev. 2015)	Defines and illustrates the policies and procedures that shall be utilized by City staff in the management and care of all trees located on City property or within the City's right-of-way.
Claremont Designated Street Tree List (rev. 9/2018)	Designated tree species by street. To avoid monocultures within neighborhoods, the City has designated more than one tree for each street.
Claremont Hills Wilderness Park 2016 Master Plan	Summarizes the existing conditions of the Wilderness Park, details the current usage of the park, and outlines a plan for balancing the preservation of the area with recreational use. Contains an action plan for the operation and management of the park.
Pomona College 2015 Campus Master Plan	*"Trees are the College's most important landscape resource, defining the campus character and its spatial attributes." (p.37).*
Claremont Village South Specific Plan	A community vision for the area south of the railroad tracks along Indian Hill Boulevard
City of Claremont Municipal Forest Assessment	Summary of the City's 2011 tree inventory providing urban forest structure and ecosystem benefits information.
Demographic Trends in Claremont California's Street Tree Population	A repeated measures survey (2000 and 2014) based on a stratified random sampling approach across size classes and for the most abundant 21 species was analyzed to calculate removal, growth, and replacement planting rates.

APPENDIX H. INVASIVE SHOT HOLE BORER FACTS

The City's Community Services Department currently has a program to monitor and manage ISHB. In 2017, City Council directed staff to set aside $300,000 to treat 2,100 trees—including oaks, sycamores, and American elms—with a trunk size greater than 12 inches in diameter, using a combination of an insecticide and fungus. City Council should be applauded for its support of this treatment effort because, at the time, there was no proven conclusion that the treatment would work. The City Council relied on the expertise of Community Services staff and the treatment has proven successful. Since the treatment is most effective when conducted every two years, in early 2019, City Council agreed to use $190,000 of the City's $5.4 million emergency reserves to protect more than 1,300 sycamore and American elm trees from the ISHB. The potential dramatic loss of trees, proven short term effectiveness of treatment, plus the fact that treatment costs less than tree removal, resulted in the approved use of funds. Less funds were used for treatment this round because oaks were excluded from the treatment due to field observations at the time indicated they were not being attacked at the rate other economically significant trees in the City were. The treatment was applied to sycamore and American elm trees greater than 12 inches in diameter because younger trees have a greater ability to fight off the borer. Those smaller trees that are lost due to the borer will cost less to remove because of their size. In summary, pest and disease funds need to be part of the annual budget and the City needs to address private property trees and the approach to quickly eliminate or treat trees.

Invasive Shot-Hole Borers + Fusarium Dieback
Identifying Symptoms and Look-Alike Pests

BACKGROUND

Adult female (Photo credit: Gevork Arakelian/LA County Dept of Agriculture)

Invasive Shot-Hole Borers (ISHB), *Euwallacea* spp., are invasive beetles that attack dozens of common native and landscape trees. The tiny insects tunnel into host trees and spread Fusarium Dieback (FD), a disease known to infect over 260 tree species. FD is caused by species of *Fusarium* fungi that disrupt the transport of water and nutrients in the tree, leading to branch dieback and overall decline. ISHB refers to two closely related, physically identical beetles: the **Polyphagous** (PSHB) and **Kuroshio Shot-Hole Borer** (KSHB). ISHB has been detected in Los Angeles, Orange, San Diego, Riverside, San Bernardino, Ventura, Santa Barbara, and San Luis Obispo Counties.

HOSTS

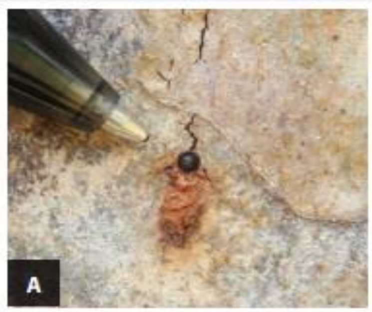
ISHB can reproduce and grow *Fusarium* in at least 50 known species, called reproductive hosts. Relative susceptibility among these species is dynamic and varied. Some of the more susceptible reproductive hosts appear to be box elder, avocado, coral, white alder, castor bean, valley oak, Engelmann oak, and several species of sycamore, cottonwood, and willow.

See the full list of known reproductive hosts at www.pshb.org.

EXTERNAL SIGNS + SYMPTOMS

Attack symptoms, a host tree's visible response to stress, vary by host species. Look for the beetle's entry-holes (A), which are ~0.85 mm in diameter, accompanied by staining (B, C), sugary exudate (D), gumming (E, F), and/or frass (G). The symptoms may be noticeable before the beetles—at 1.8-2.5 mm long, females are smaller than a sesame seed. The abdomen of the female beetle can sometimes be seen sticking out of the hole.

Species below: B. California sycamore, C. Fremont cottonwood, D. Avocado, E. Mimosa/Silk tree, F. Titoki, G. Box elder



A

B

C

D

E

F

G

INTERNAL DAMAGE

Beneath the bark, *Fusarium* causes dark discoloration of wood in and around the beetle galleries (H, I). Advanced infections lead to branch dieback (J) and tree mortality.

H

I

J

AUTHORS: Monica Dimson (UC Cooperative Extension) ; John Kabashima, Ph.D (UC Cooperative Extension); Akif Eskalen, Ph.D (UC Riverside). Images provided by Monica Dimson and Akif Eskalen unless cited otherwise.

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ISHB-FD LOOK-ALIKES

Western oak bark beetle + Foamy bark canker disease	
HOST TREES:	Stressed coast live oak, tanoak, CA buckeye
BEETLE SIZE:	1.7-2.3 mm long
ENTRY-HOLE:	Smaller than ISHB
SYMPTOMS:	Reddish frass/sap; disease causes wet discoloration and/or foamy liquid from entry-hole

Fruit tree shot-hole borer, *Scolytus rugulosus*	
HOST TREES:	Fruit and nut trees (e.g. stone fruits, apples, almonds), English laurel
BEETLE SIZE:	2-2.5 mm long
ENTRY-HOLE:	Larger than ISHB
SYMPTOMS:	Entry-hole oozes sap or frass; exit-holes are sap-free

Oak ambrosia beetles, common species: *Monarthrum scutellare*	
HOST TREES:	Stressed or dying oaks, tanbark oaks, CA buckeye
BEETLE SIZE:	3.5-4.1 mm long
ENTRY-HOLE:	Larger than ISHB
SYMPTOMS:	Bleeding, frothing, white boring dust from entry-hole

Secondary ambrosia beetle, *Xyleborinus saxeseni*	
HOST TREES:	Dying or stressed trees
BEETLE SIZE:	2-2.4 mm long
ENTRY-HOLE:	Smaller than ISHB
SYMPTOMS:	Reddish frass and/or sap; wet staining and/or dead tissue around entry-hole

Bacterial canker, *Xanthomonas campestris*	
HOST TREES:	Avocado
BEETLE SIZE:	N/A (Bacteria)
ENTRY-HOLE:	Cavity; no hole
SYMPTOMS:	White, sugary exudate and bleeding from cavity in the bark

Photo credit: (A) (C) (E) Jack K. Clark/ UC IPM <ipm.ucanr.edu>. (F) Pavel Svihra/ UC Regents. (G) Christoph Benisch <kerbtier.de>.

ISHB RESOURCES

Stay up to date on the latest ISHB-Fusarium Dieback research and news:
www.pshb.org - Invasive Shot-Hole Borer, UC Cooperative Extension central website
www.eskalenlab.ucr.edu - Eskalen Lab, UC Riverside
www.ipm.ucanr.edu - UC Statewide IPM Program (for information on look-alike pests)

REPORTING SUSPECTED ISHB

Please visit www.pshb.org for current reporting information.

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Appendix I. Other Threats to the Urban Forest

Other Notable Pests and Diseases

Glassy-Winged Sharpshooter & Bacterial Leaf Scorch

The glassy-winged sharpshooter (*Homalodisca vitripennis*) or GWSS, is a large leafhopper insect that feeds on plant fluids. The feeding rarely causes significant plant damage, although the insects do excrete copious amounts of liquid. The excrement, often referred to as honeydew, is not necessarily damaging, but becomes an issue when a street tree is infested, causing surfaces below the canopy to become spotted. The main concern is GWSS transmits the plant-pathogenic bacterium *Xylella fastidiosa* from one plant to another and there is no known cure.

There is no known cure for the disease although multiple species of small wasps were introduced for its control. By the late summer or early fall these wasps can cause upwards of 90% mortality of glassy-winged sharpshooter eggs. It is important to support biological control by avoiding the use of broad-spectrum insecticides that may kill parasitoids and beneficial insects and spiders that eat sharpshooters (UC Agriculture & Natural Resources).

For more information visit http://ipm.ucanr.edu/PMG/PESTNOTES/pn7492.html

Eucalyptus Redgum Lerp Psyllid

The redgum lerp psyllid (*Glycaspis brimblecombei*) was first found in Los Angeles in 1998 and has spread throughout much of California. The redgum lerp psyllid gets its name from the nymphs which form a cover called a "lerp," which is a small white cap composed of honeydew and wax.

Psyllid nymphs and adults feed by sucking plant phloem sap and high populations secrete copious honeydew and cause premature leaf drop. Honeydew causes dark sooty mold growth and fallen leaves dirty the surfaces beneath infested trees. Extensive defoliation can weaken the trees which increases tree susceptibility to damage from other insects and diseases.

Redgum lerp psyllid infests over two dozen Eucalyptus species. In California this psyllid prefers river red gum (*Eucalyptus camaldulensis*), flooded gum (*E. rudis*), and forest red gum (*E*. *tereticornis*).

The species of eucalyptus primarily determines whether psyllids will be abundant. Cultural practices and overall tree health also influence populations and the extent to which trees are damaged. Providing adequate irrigation and limiting nitrogen can reduce susceptibility to damage. An introduced, psyllid-specific parasitic wasp is providing substantial biological control on coastal area trees. Systemic insecticides have sometimes provided control, but efficacy has been variable.

For more information visit www2.ipm.ucanr.edu/Invasive-and-Exotic-Pests/Eucalyptus-pests/.

Eucalyptus Longhorned Borer

Two closely related species of longhorned borer beetles attack eucalyptus trees in California. *Phoracantha semipunctata*, which is native to Australia, was introduced into Southern California in the 1980s and now appears throughout the state. Natural enemies were introduced from Australia, and biological control combined with improved cultural care of eucalyptus have dramatically reduced the number of trees this borer kills each year.

In 1995, a second species of longhorned borer, *Phoracantha recurva*, was discovered in Southern California in Los Angeles, Riverside, Orange, and San Bernardino counties. This beetle has spread throughout much of California. Biological control has been less effective against this new borer.

Freshly cut wood, dying limbs, and trees suffering from stress, especially drought stress, attract both beetles.

More information can be found at www2.ipm.ucanr.edu/Invasive-and-Exotic-Pests/Eucalyptus-pests/.

Potential Pest and Disease Threats

Asian citrus psyllid

The Asian citrus psyllid is an efficient vector of the bacterial citrus disease *huanglongbing*, previously called citrus greening disease, which is one of the most destructive diseases of citrus worldwide. Efforts are underway to eradicate the psyllid in Southern California. If the psyllid and the disease were to become established in California, the disease would devastate the citrus industry. Though the Asian citrus psyllid has not reached Claremont, the City should continue the Integrated Pest Management program for early detection.

Goldspotted oak borer

The goldspotted oak borer (GSOB) is another pest that could be a threat to Claremont's urban forest. It has the potential to kill several oak species including the coast live oak and the California black oak. It has been detected in San Diego and Riverside counties and most recently in San Bernardino County. For more information, visit www.ucanr.edu/sites/gsobinfo/.

Two closely related species of longhorned borer beetles attack eucalyptus trees in California. Native to Australia, the beetle was introduced into Southern California in the 1980s and rapidly became a pest. It now appears throughout the state wherever eucalyptus trees grow. Natural enemies were introduced from Australia, and biological control combined with improved cultural care of eucalyptus have reduced the number of trees killed each year.

Several other introduced insects also attack eucalyptus. Many of these insects are now under effective biological control, including the bluegum psyllid, the eucalyptus snout beetle or gumtree weevil, and especially in Southern California the eucalyptus redgum lerp psyllid.

Potential Pests & Diseases of Palms

The South American palm weevil has been detected in Southern California. Feeding by weevil larvae in the crown of palm trees causes significant damage and results in the crown of the palm dying. This inability to produce new fronds gradually leads to palm death. While Claremont's palm population does not comprise a major portion of the urban forest, this is a significant threat worth monitoring.

Potential Pests & Diseases of Pines

The redhaired pine bark beetle feeds in the phloem of the basal portion of pine stems, large roots, or woody debris on the soil surface. However, the primary concern in western North America is that the beetle might become a highly effective vector of the pathogen for black stain root disease or other pathogens that can be devastating to pines in urban forests. Pitch canker is another disease threat that can affect many urban pine species. For more information visit www2.ipm.ucanr.edu/Invasive-and-Exotic-Pests/Redhaired-bark-beetle/.

Like the redhaired pine bark beetle, the California fivespined ips (CFI) beetle has not been found in Claremont. Continued monitoring will enable early detection. CFI prefers to infest fresh woody material, such as branches lying on the ground, and has the potential to overwhelm nearby healthy trees.
For more information visit www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev2_043567.pdf?hkhyxx.

CLIMATE CHANGE & WATERING

California suffered the most extensive and persistent droughts between 2011 and 2014. Due to the drought, the state required the City to shut off the irrigation systems to median trees and it took time for the City to install the drip irrigation systems. In addition, property owners responsible for trees in the rights-of-way reduced or discontinued watering of the trees. Many of Claremont's trees experienced drought stress and decline. Many species suffered from the drought, including a large percentage of tulip trees.

The City diligently and persistently conducts outreach and education about tree watering and the drought. For tree irrigation guidelines, visit www.ci.claremont.ca.us/home/showdocument?id=1600.

The City acknowledges the changing climate and is proactively planting climate-adapted tree species that require less watering. In addition, the City has developed professional videos and educational material regarding trees and drought. Research is being conducted at UC Davis to identify underused species that can tolerate the extremes of future climates. This effort will hopefully shift the palette of trees planted to species that will make urban forests healthier and more resilient (www.climatereadytrees.ucdavis.edu).

i-Tree Ecosystem Analysis

City of Claremont

Urban Forest Effects and Values

September 2019

SUMMARY

Understanding an urban forest's structure, function and value can promote management decisions that will improve human health and environmental quality. An assessment of the vegetation structure, function, and value of the City of Claremont urban forest was conducted during 2019. Data from 26,222 trees located throughout City of Claremont were analyzed using the i-Tree Eco model developed by the U.S. Forest Service, Northern Research Station.

- Number of trees: 26,222
- Tree Cover: 274.2 acres
- Most common species of trees: Common crape myrtle, Coastal live oak, California sycamore
- Percentage of trees less than 6" (15.2 cm) diameter: 25.3%
- Pollution Removal: 18,616 lbs/year ($25.7 thousand/year)
- Carbon Storage: 24,020,000 lbs ($2.05 million)
- Carbon Sequestration: 846,600 lbs/year ($72.2 thousand/year)
- Oxygen Production: 2,258,000 lbs/year
- Avoided Runoff: 231,200 cubic feet/year ($15.5 thousand/year)
- Structural values: $123 million

Monetary values $ are reported in US Dollars throughout the report except where noted. Ecosystem service estimates are reported for trees.

For an overview of i-Tree Eco methodology, see Appendix I. Data collection quality is determined by the local data collectors, over which i-Tree has no control.

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I. TREE CHARACTERISTICS OF THE URBAN FOREST

The urban forest of City of Claremont has 26,222 trees with a tree cover of Common crape myrtle. The three most common species are Common crape myrtle (8.1 percent), Coastal live oak (7.3 percent), and California sycamore (5.7 percent).

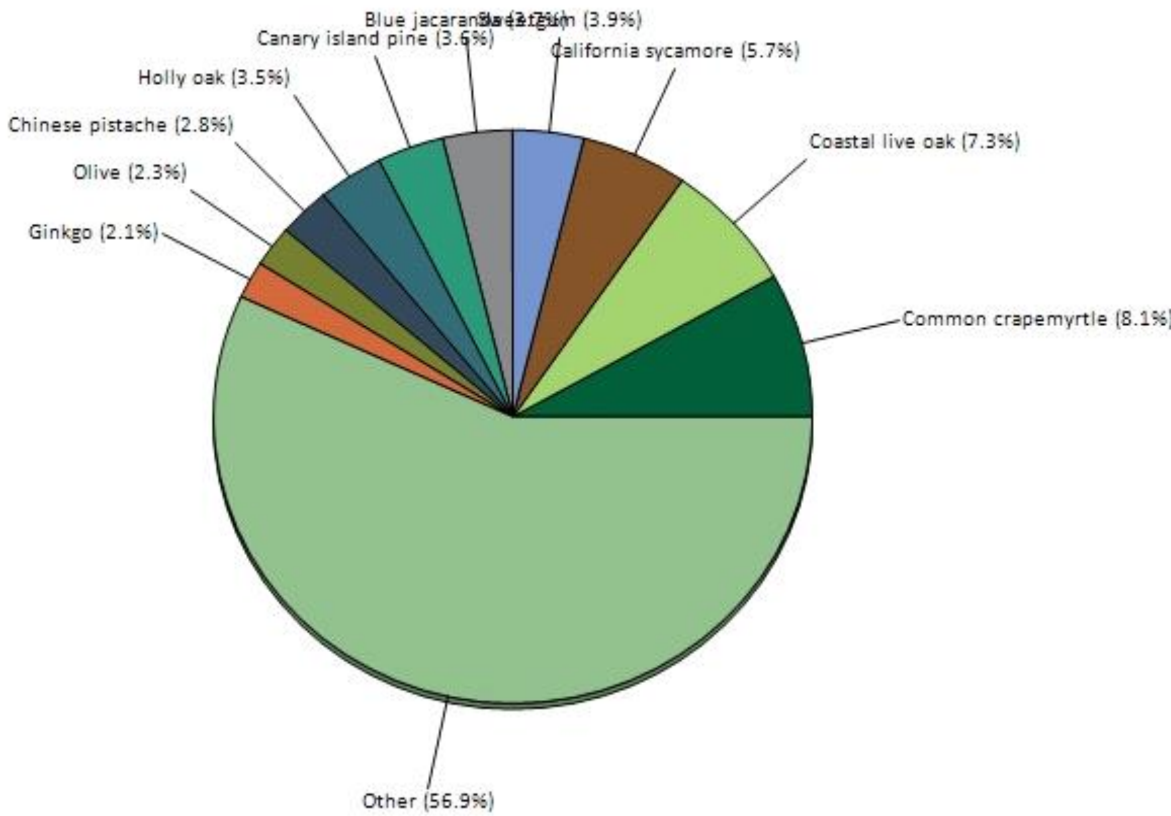


Figure 1. Tree species composition in City of Claremont

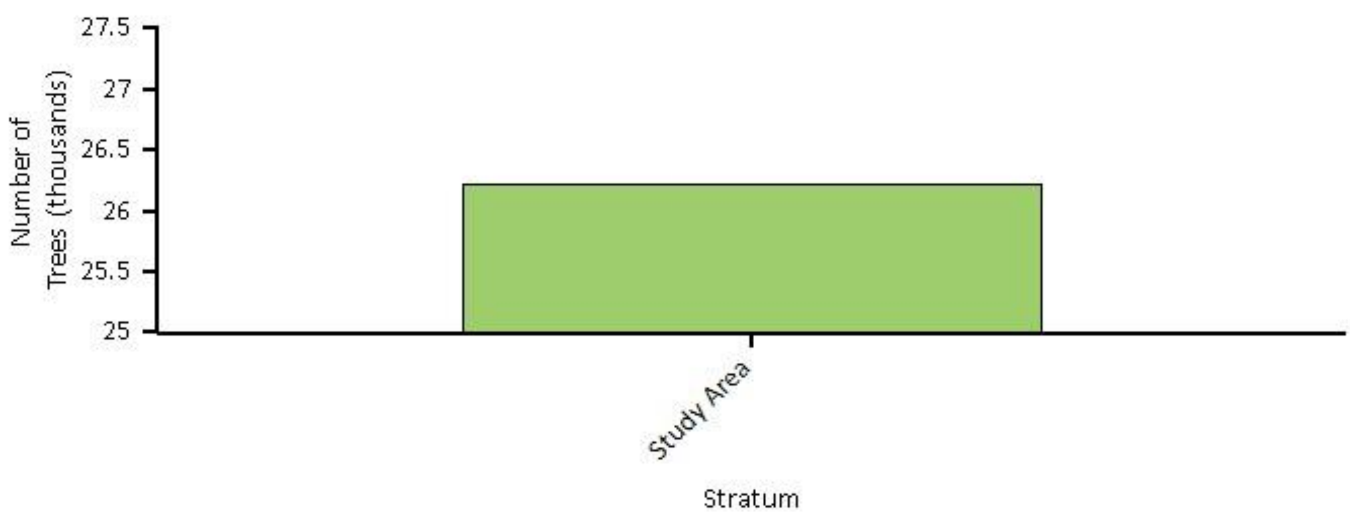


Figure 2. Number of trees in City of Claremont by stratum

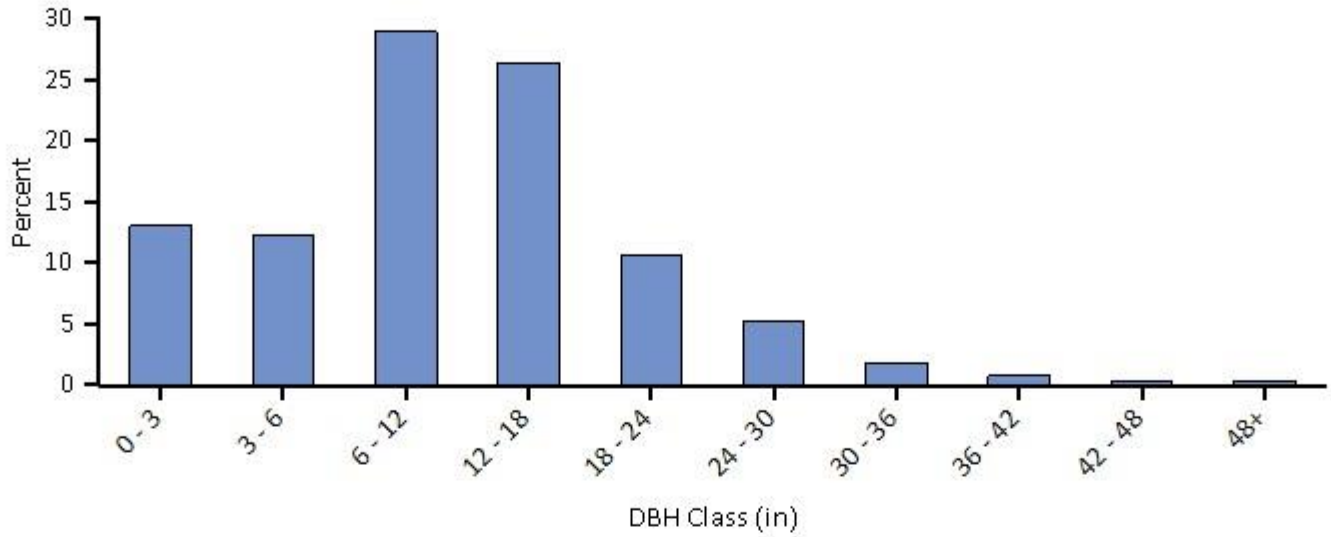


Figure 3. Percent of tree population by diameter class (DBH - stem diameter at 4.5 feet)

Urban forests are composed of a mix of native and exotic tree species. Thus, urban forests often have a tree diversity that is higher than surrounding native landscapes. Increased tree diversity can minimize the overall impact or destruction by a species-specific insect or disease, but it can also pose a risk to native plants if some of the exotic species are invasive plants that can potentially out-compete and displace native species. In City of Claremont, about 33 percent of the trees are species native to North America, while 18 percent are native to California. Species exotic to North America make up 67 percent of the population. Most exotic tree species have an origin from Asia (26 percent of the species).

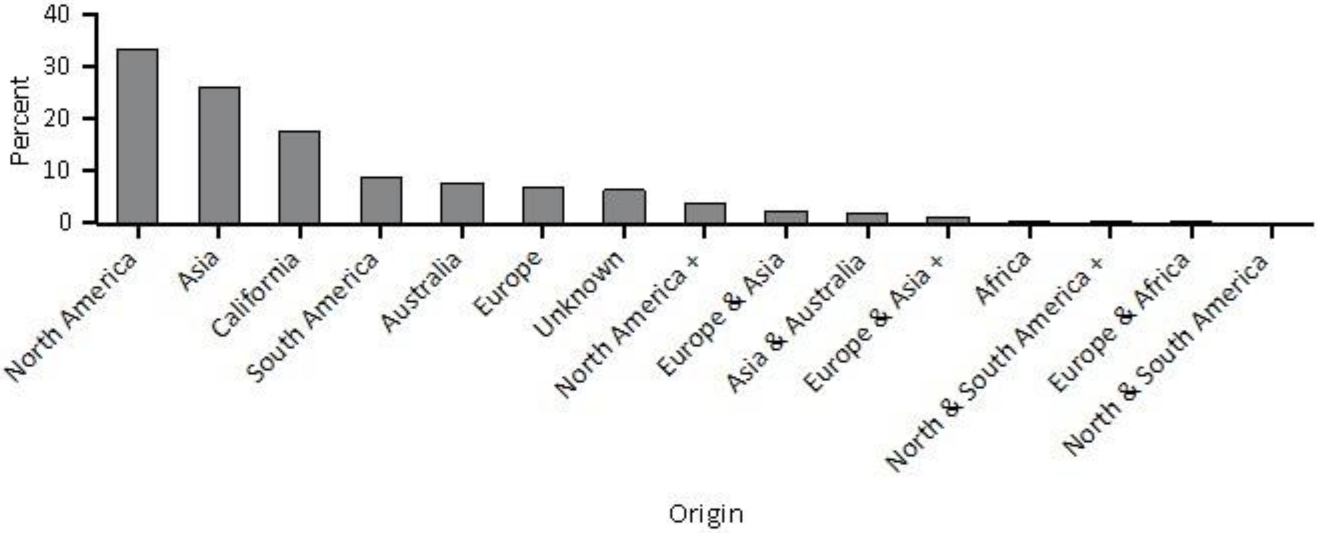


Figure 4. Percent of live tree population by area of native origin, City of Claremont

The plus sign (+) indicates the tree species is native to another continent other than the ones listed in the grouping.

Invasive plant species are often characterized by their vigor, ability to adapt, reproductive capacity, and general lack of natural enemies. These abilities enable them to displace native plants and make them a threat to natural areas. Five of the 283 tree species in City of Claremont are identified as invasive on the state invasive species list (California Invasive Species Advisory Committee 2010). These invasive species comprise 2.9 percent of the tree population though they may only cause a minimal level of impact. The three most common invasive species are California peppertree (1.2 percent of population), Brazilian peppertree (0.9 percent), and Chinese tallow tree (0.7 percent) (see Appendix V for a complete list of invasive species).

II. Urban Forest Cover and Leaf Area

Many tree benefits equate directly to the amount of healthy leaf surface area of the plant. Trees cover about 274.2 acres of City of Claremont and provide 1,174 acres of leaf area.

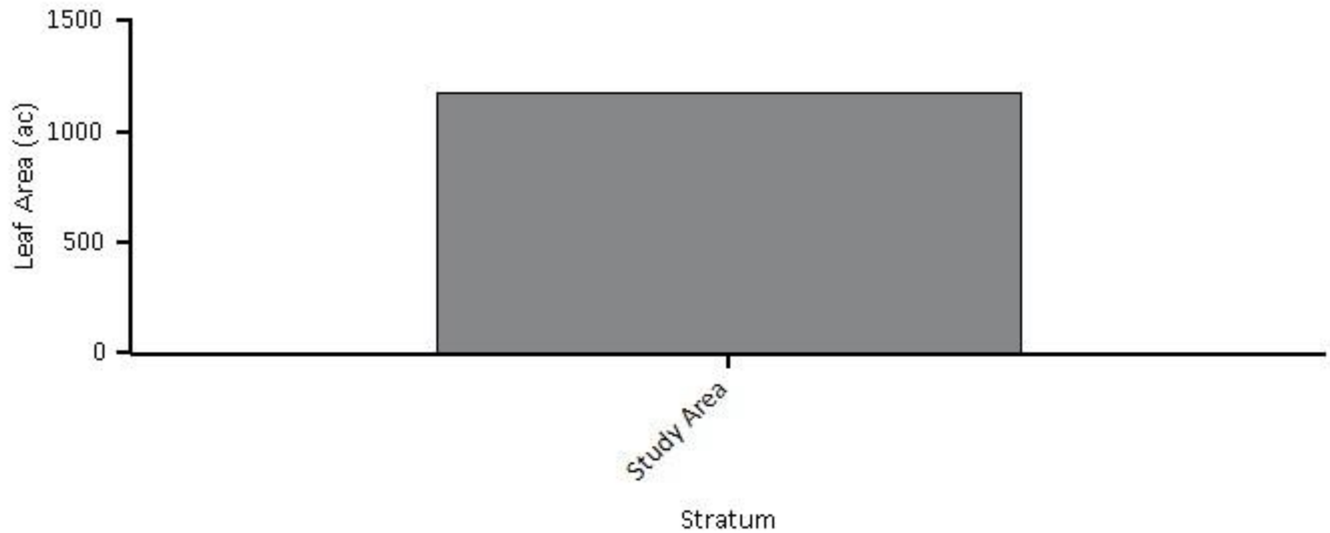


Figure 5. Leaf area by stratum, City of Claremont

In City of Claremont, the most dominant species in terms of leaf area are California sycamore, Coastal live oak, and Canary island pine. The 10 species with the greatest importance values are listed in Table 1. Importance values (IV) are calculated as the sum of percent population and percent leaf area. High importance values do not mean that these trees should necessarily be encouraged in the future; rather these species currently dominate the urban forest structure.

Table 1. Most important species in City of Claremont

Species Name	*Percent Population*	*Percent Leaf Area*	*IV*
California sycamore	5.7	15.1	20.8
Coastal live oak	7.3	7.7	15.0
Common crape myrtle	8.1	2.1	10.2
Sweetgum	3.9	5.0	8.9
Canary island pine	3.6	5.2	8.8
Blue jacaranda	3.7	4.2	8.0
Holly oak	3.5	4.1	7.6
Mugga ironbark	1.8	4.1	5.9
Olive	2.3	2.7	5.0
Shamel ash	1.6	2.4	4.0

III. AIR POLLUTION REMOVAL BY URBAN TREES

Poor air quality is a common problem in many urban areas. It can lead to decreased human health, damage to landscape materials and ecosystem processes, and reduced visibility. The urban forest can help improve air quality by reducing air temperature, directly removing pollutants from the air, and reducing energy consumption in buildings, which consequently reduces air pollutant emissions from the power sources. Trees also emit volatile organic compounds that can contribute to ozone formation. However, integrative studies have revealed that an increase in tree cover leads to reduced ozone formation (Nowak and Dwyer 2000).

Pollution removal[1] by trees in City of Claremont was estimated using field data and recent available pollution and weather data available. Pollution removal was greatest for ozone (Figure 7). It is estimated that trees remove 9.308 tons of air pollution (ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), particulate matter less than 2.5 microns (PM2.5)[2], and sulfur dioxide (SO2)) per year with an associated value of $25.7 thousand (see Appendix I for more details).

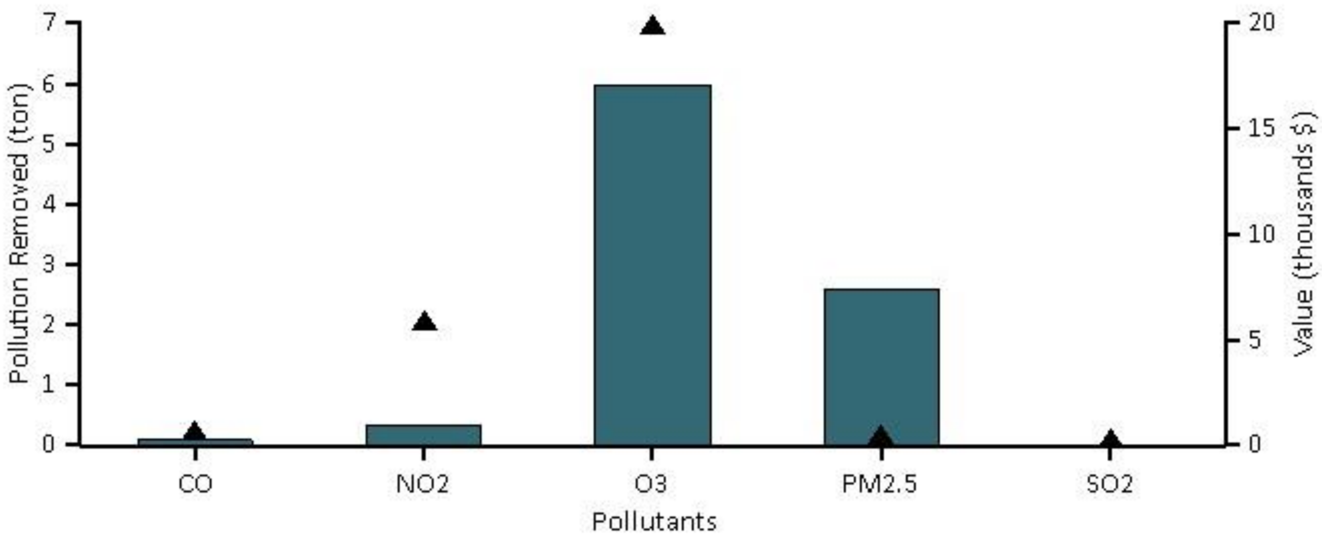


Figure 7. Annual pollution removal (points) and value (bars) by urban trees, City of Claremont

General recommendations for improving air quality with trees are given in Appendix VIII.

[1] Particulate matter less than 10 microns is a significant air pollutant. Given that i-Tree Eco analyzes particulate matter less than 2.5 microns (PM2.5) which is a subset of PM10, PM10 has not been included in this analysis. PM2.5 is generally more relevant in discussions concerning air pollution effects on human health.

[2] Trees remove PM2.5 when particulate matter is deposited on leaf surfaces. This deposited PM2.5 can be resuspended to the atmosphere or removed during rain events and dissolved or transferred to the soil. This combination of events can lead to positive or negative pollution removal and value depending on various atmospheric factors (see Appendix I for more details).

IV. CARBON STORAGE AND SEQUESTRATION

Climate change is an issue of global concern. Urban trees can help mitigate climate change by sequestering atmospheric carbon (from carbon dioxide) in tissue and by altering energy use in buildings, and consequently altering carbon dioxide emissions from fossil-fuel based power sources (Abdollahi et al 2000).

Trees reduce the amount of carbon in the atmosphere by sequestering carbon in new growth every year. The amount of carbon annually sequestered is increased with the size and health of the trees. The gross sequestration of City of Claremont trees is about 423.3 tons of carbon per year with an associated value of $72.2 thousand. See Appendix I for more details on methods.

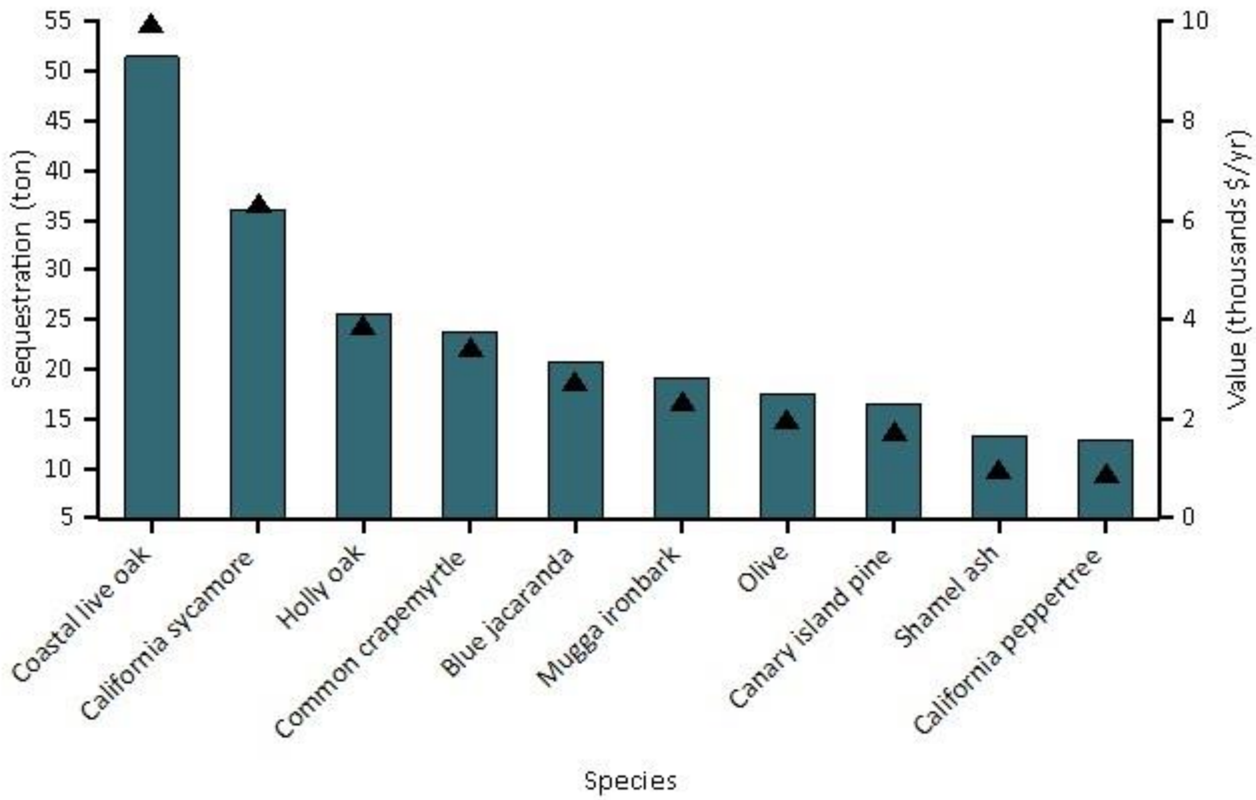


Figure 8. Estimated annual gross carbon sequestration (points) and value (bars) for urban tree species with the greatest sequestration, City of Claremont

Carbon storage is another way trees can influence global climate change. As a tree grows, it stores more carbon by holding it in its accumulated tissue. As a tree dies and decays, it releases much of the stored carbon back into the atmosphere. Thus, carbon storage is an indication of the amount of carbon that can be released if trees are allowed to die and decompose. Maintaining healthy trees will keep the carbon stored in trees, but tree maintenance can contribute to carbon emissions (Nowak et al 2002c). When a tree dies, using the wood in long-term wood products, to heat buildings, or to produce energy will help reduce carbon emissions from wood decomposition or from fossil fuel or wood-based power plants.

Trees in City of Claremont are estimated to store 12,000 tons of carbon ($2.05 million). Of the species sampled, Coastal live oak stores and sequesters the most carbon (approximately 15.5% of the total carbon stored and 12.9% of all sequestered carbon.)

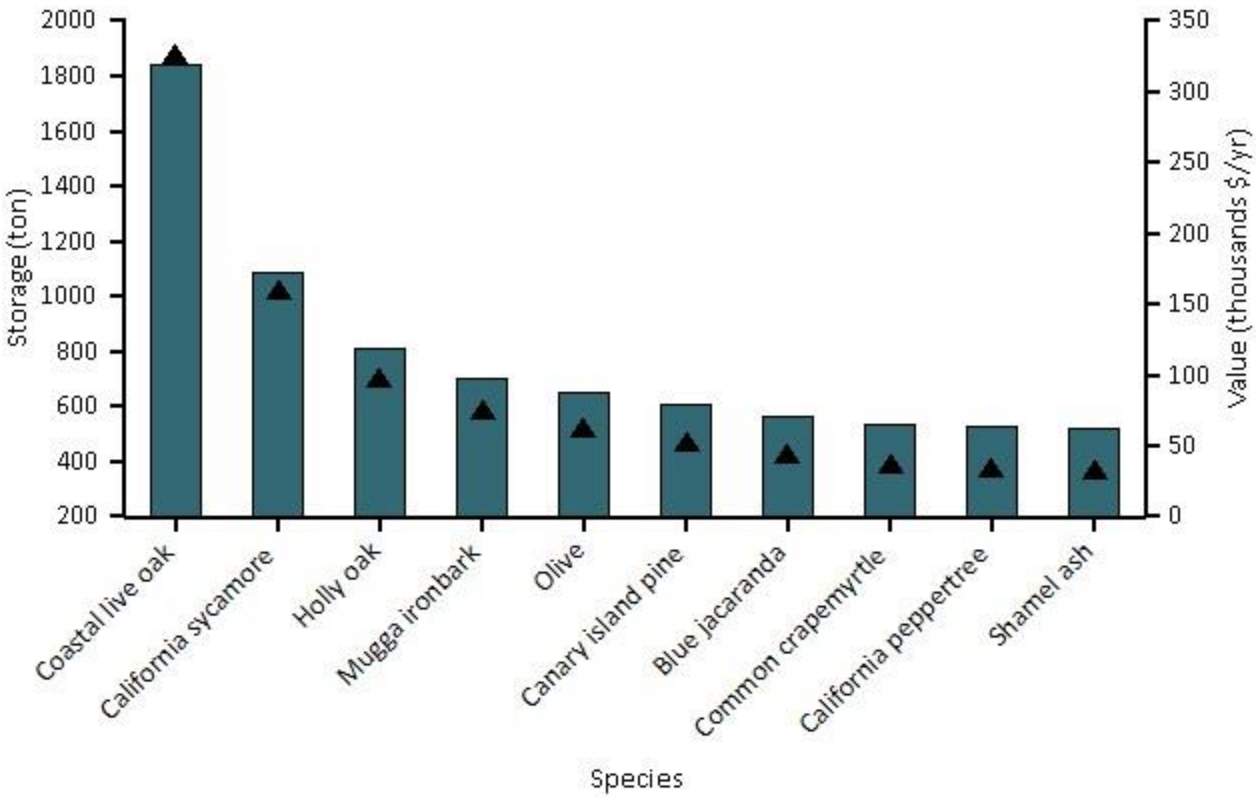


Figure 9. Estimated carbon storage (points) and values (bars) for urban tree species with the greatest storage, City of Claremont

V. OXYGEN PRODUCTION

Oxygen production is one of the most commonly cited benefits of urban trees. The annual oxygen production of a tree is directly related to the amount of carbon sequestered by the tree, which is tied to the accumulation of tree biomass.

Trees in City of Claremont are estimated to produce 1.129 thousand tons of oxygen per year.[4]

Table 2. The top 20 oxygen production species.

Species	*Oxygen (ton)*	*Gross Carbon Sequestration (ton/yr)*	*Number of Trees*	*Leaf Area (acre)*
Coastal live oak	145.35	54.51	1,914	89.85
California sycamore	97.39	36.52	1,505	177.15

Holly oak	64.60	24.23	929	47.88
Common crape myrtle	58.56	21.96	2,135	24.39
Blue jacaranda	49.44	18.54	983	49.36
Mugga ironbark	44.16	16.56	469	47.99
Olive	39.28	14.73	605	31.86
Canary island pine	35.94	13.48	946	61.40
Shamel ash	25.76	9.66	420	27.62
California peppertree	24.80	9.30	316	2.11
Sweetgum	23.15	8.68	1,010	59.00
Camphor tree	20.63	7.74	380	16.59
Chinese pistache	19.88	7.46	731	4.38
Sugargum	17.38	6.52	153	25.92
Southern magnolia	16.90	6.34	395	14.95
Lemonscented gum	16.57	6.22	183	17.21
London plane	16.18	6.07	417	25.59
Callery pear	16.04	6.02	441	11.58
Velvet ash	15.77	5.91	370	20.36
Brazilian peppertree	14.57	5.46	226	1.54

VI. Avoided Runoff

Surface runoff can be a cause for concern in many urban areas as it can contribute pollution to streams, wetlands, rivers, lakes, and oceans. During precipitation events, some portion of the precipitation is intercepted by vegetation (trees and shrubs) while the other portion reaches the ground. The portion of the precipitation that reaches the ground and does not infiltrate into the soil becomes surface runoff (Hirabayashi 2012). In urban areas, the large extent of impervious surfaces increases the amount of surface runoff.

Urban trees and shrubs, however, are beneficial in reducing surface runoff. Trees and shrubs intercept precipitation, while their root systems promote infiltration and storage in the soil. The trees and shrubs of City of Claremont help to reduce runoff by an estimated 231 thousand cubic feet a year with an associated value of $15 thousand (see Appendix I for more details). Avoided runoff is estimated based on local weather from the user-designated weather station. In City of Claremont, the total annual precipitation in 2015 was 9.0 inches.

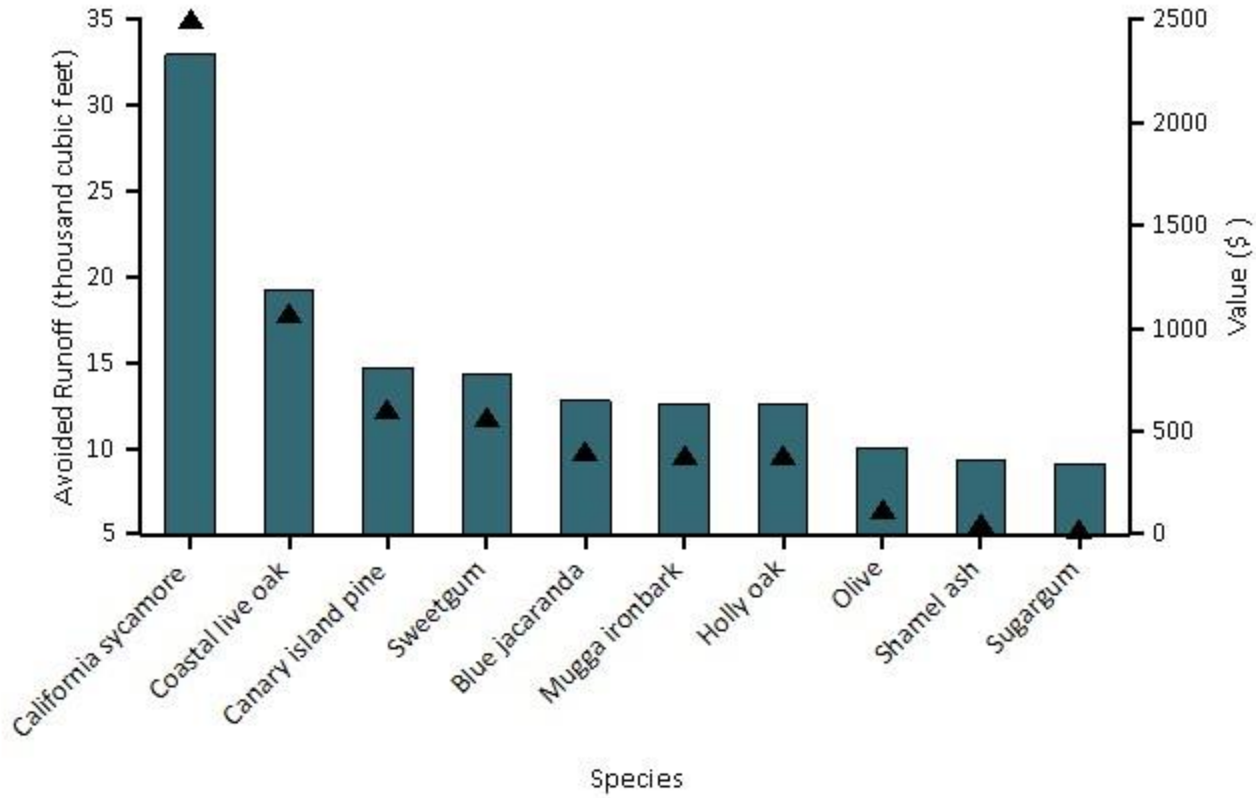


Figure 10. Avoided runoff (points) and value (bars) for species with greatest overall impact on runoff, City of Claremont

VII. TREES AND BUILDING ENERGY USE

Trees affect energy consumption by shading buildings, providing evaporative cooling, and blocking winter winds. Trees tend to reduce building energy consumption in the summer months and can either increase or decrease building energy use in the winter months, depending on the location of trees around the building

VIII. Structural and Functional Values

Urban forests have a structural value based on the trees themselves (e.g., the cost of having to replace a tree with a similar tree); they also have functional values (either positive or negative) based on the functions the trees perform.

The structural value of an urban forest tends to increase with a rise in the number and size of healthy trees (Nowak et al 2002a). Annual functional values also tend to increase with increased number and size of healthy trees. Through proper management, urban forest values can be increased; however, the values and benefits also can decrease as the amount of healthy tree cover declines.

Urban trees in City of Claremont have the following structural values:

- Structural value: $123 million
- Carbon storage: $2.05 million

Urban trees in City of Claremont have the following annual functional values:

- Carbon sequestration: $72.2 thousand
- Avoided runoff: $15.5 thousand
- Pollution removal: $25.7 thousand

(Note: negative value indicates increased energy cost and carbon emission value)

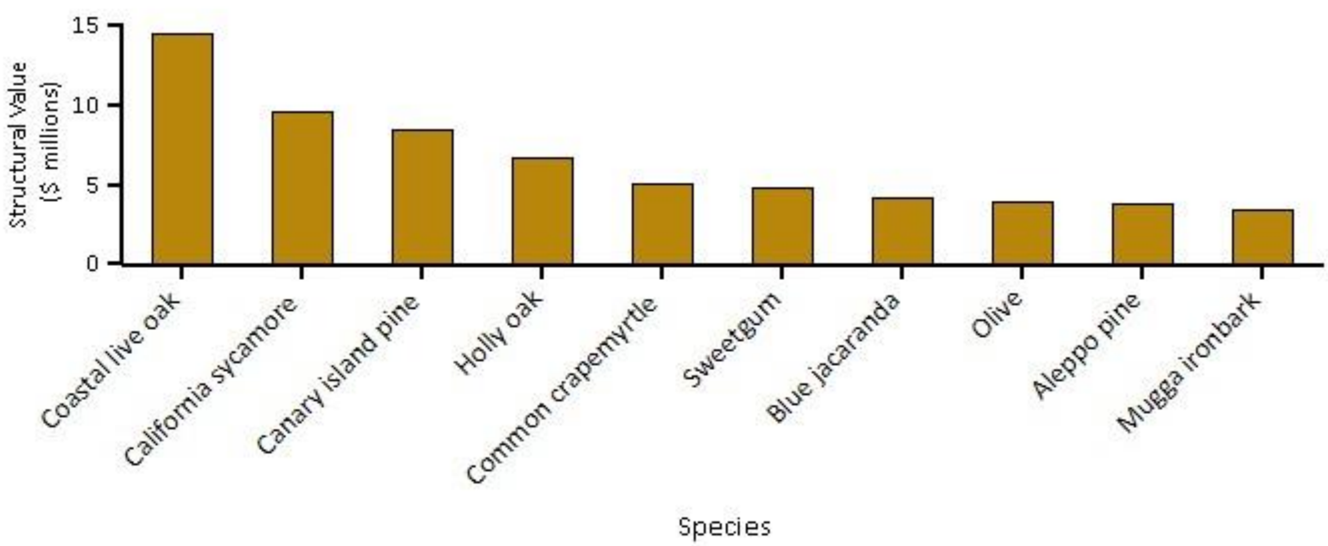


Figure 11. Tree species with the greatest structural value, City of Claremont

IX. Potential Pest Impacts

Various insects and diseases can infest urban forests, potentially killing trees and reducing the health, structural value and sustainability of the urban forest. As pests tend to have differing tree hosts, the potential damage or risk of each pest will differ among cities. Thirty-six pests were analyzed for their potential impact and compared with pest range maps (Forest Health Technology Enterprise Team 2014) for the conterminous United States to determine their proximity to Los Angeles County. Two of the thirty-six pests analyzed are located within the county. For a complete analysis of all pests, see Appendix VII.

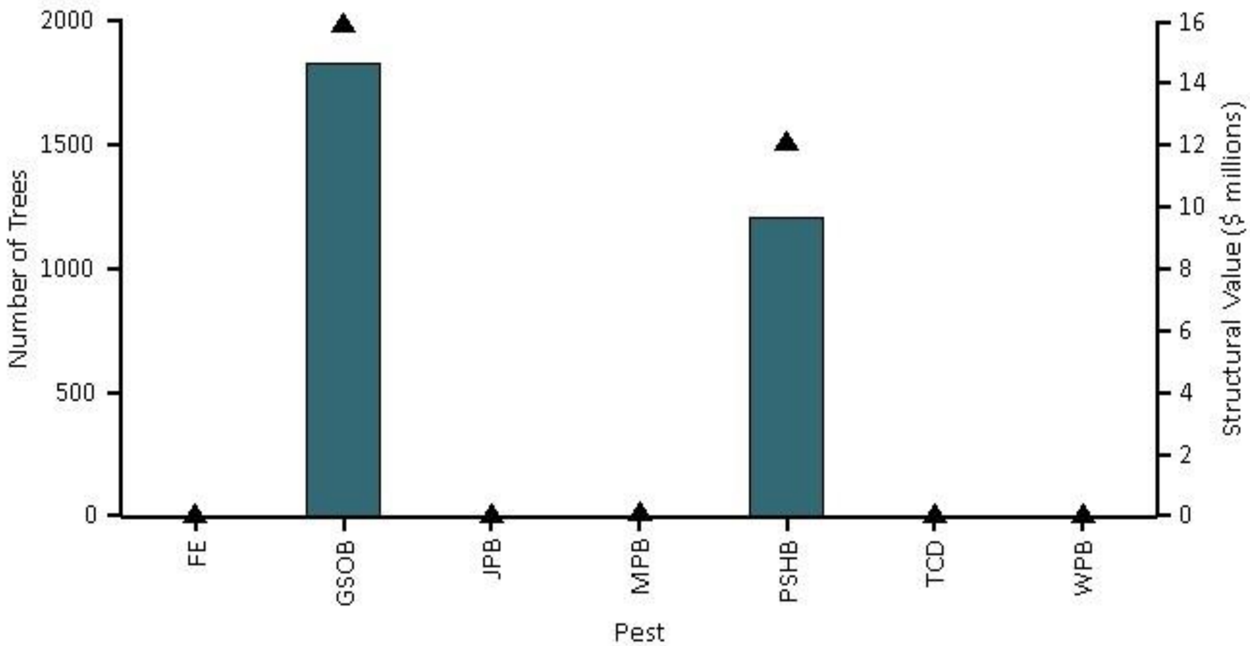


Figure 12. Number of trees at risk (points) and associated compensatory value (bars) for most threatening pests located in the county, City of Claremont

Infestations of the goldspotted oak borer (GSOB) (Society of American Foresters 2011) have been a growing problem in southern California. Potential loss of trees from GSOB is 7.6 percent ($14.7 million in structural value).

Polyphagous shot hole borer (PSHB) (University of California 2014) is a boring beetle that was first detected in California. City of Claremont could possibly lose 5.8 percent of its trees to this pest ($9.65 million in structural value).

Appendix I. i-Tree Eco Model and Field Measurements

i-Tree Eco is designed to use standardized field data and local hourly air pollution and meteorological data to quantify urban forest structure and its numerous effects (Nowak and Crane 2000), including:

- Urban forest structure (e.g., species composition, tree health, leaf area, etc.).
- Amount of pollution removed hourly by the urban forest, and its associated percent air quality improvement throughout a year.
- Total carbon stored and net carbon annually sequestered by the urban forest.
- Effects of trees on building energy use and consequent effects on carbon dioxide emissions from power sources.
- Structural value of the forest, as well as the value for air pollution removal and carbon storage and sequestration.

Typically, all field data are collected during the leaf-on season to properly assess tree canopies. Typical data collection (actual data collection may vary depending upon the user) includes land use, ground and tree cover, individual tree attributes of species, stem diameter, height, crown width, crown canopy missing and dieback, and distance and direction to residential buildings (Nowak et al 2005; Nowak et al 2008).

During data collection, trees are identified to the most specific taxonomic classification possible. Trees that are not classified to the species level may be classified by genus (e.g., ash) or species groups (e.g., hardwood). In this report, tree species, genera, or species groups are collectively referred to as tree species.

<u>Tree Characteristics:</u>

Leaf area of trees was assessed using measurements of crown dimensions and percentage of crown canopy missing. In the event that these data variables were not collected, they are estimated by the model.

An analysis of invasive species is not available for studies outside of the United States. For the U.S., invasive species are identified using an invasive species list (California Invasive Species Advisory Committee 2010)for the state in which the urban forest is located. These lists are not exhaustive and they cover invasive species of varying degrees of invasiveness and distribution. In instances where a state did not have an invasive species list, a list was created based on the lists of the adjacent states. Tree species that are identified as invasive by the state invasive species list are cross-referenced with native range data. This helps eliminate species that are on the state invasive species list, but are native to the study area.

<u>Air Pollution Removal:</u>

Pollution removal is calculated for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide and particulate matter less than 2.5 microns. Particulate matter less than 10 microns (PM10) is another significant air pollutant. Given that iTree Eco analyzes particulate matter less than 2.5 microns (PM2.5) which is a subset of PM10, PM10 has not been included in this analysis. PM2.5 is generally more relevant in discussions concerning air pollution effects on human health.

Air pollution removal estimates are derived from calculated hourly tree-canopy resistances for ozone, and sulfur and nitrogen dioxides based on a hybrid of big-leaf and multi-layer canopy deposition models (Baldocchi 1988; Baldocchi et al 1987). As the removal of carbon monoxide and particulate matter by vegetation is not directly related to transpiration, removal rates (deposition velocities) for these pollutants were based on average measured values from the literature (Bidwell and Fraser 1972; Lovett 1994) that were adjusted depending on leaf phenology and leaf area.

Particulate removal incorporated a 50 percent re-suspension rate of particles back to the atmosphere (Zinke 1967). Recent updates (2011) to air quality modeling are based on improved leaf area index simulations, weather and pollution processing and interpolation, and updated pollutant monetary values (Hirabayashi et al 2011; Hirabayashi et al 2012; Hirabayashi 2011).

Trees remove PM2.5 when particulate matter is deposited on leaf surfaces (Nowak et al 2013). This deposited PM2.5 can be re-suspended to the atmosphere or removed during rain events and dissolved or transferred to the soil. This combination of events can lead to positive or negative pollution removal and value depending on various atmospheric factors. Generally, PM2.5 removal is positive with positive benefits. However, there are some cases when net removal is negative or re-suspended particles lead to increased pollution concentrations and negative values. During some months (e.g., with no rain), trees re-suspend more particles than they remove. Re-suspension can also lead to increased overall PM2.5 concentrations if the boundary layer conditions are lower during net re-suspension periods than during net removal periods. Since the pollution removal value is based on the change in pollution concentration, it is possible to have situations when trees remove PM2.5 but increase concentrations and thus have negative values during periods of positive overall removal. These events are not common, but can happen.

For reports in the United States, default air pollution removal value is calculated based on local incidence of adverse health effects and national median externality costs. The number of adverse health effects and associated economic value is calculated for ozone, sulfur dioxide, nitrogen dioxide, and particulate matter less than 2.5 microns using data from the U.S. Environmental Protection Agency's Environmental Benefits Mapping and Analysis Program (BenMAP) (Nowak et al 2014). The model uses a damage-function approach that is based on the local change in pollution concentration and population. National median externality costs were used to calculate the value of carbon monoxide removal (Murray et al 1994).

For international reports, user-defined local pollution values are used. For international reports that do not have local values, estimates are based on either European median externality values (van Essen et al 2011) or BenMAP regression equations (Nowak et al 2014) that incorporate user-defined population estimates. Values are then converted to local currency with user-defined exchange rates.

For this analysis, pollution removal value is calculated based on the prices of $1,380 per ton (carbon monoxide), $2,465 per ton (ozone), $453 per ton (nitrogen dioxide), $167 per ton (sulfur dioxide), $61,925 per ton (particulate matter less than 2.5 microns).

Carbon Storage and Sequestration:

Carbon storage is the amount of carbon bound up in the above-ground and below-ground parts of woody vegetation. To calculate current carbon storage, biomass for each tree was calculated using equations from the literature and measured tree data. Open-grown, maintained trees tend to have less biomass than predicted by forest-derived biomass equations (Nowak 1994). To adjust for this difference, biomass results for open-grown urban trees were multiplied by 0.8. No adjustment was made for trees found in natural stand conditions. Tree dry-weight biomass was converted to stored carbon by multiplying by 0.5.

Carbon sequestration is the removal of carbon dioxide from the air by plants. To estimate the gross amount of carbon sequestered annually, average diameter growth from the appropriate genera and diameter class and tree condition was added to the existing tree diameter (year x) to estimate tree diameter and carbon storage in year x+1.

Carbon storage and carbon sequestration values are based on estimated or customized local carbon values. For international reports that do not have local values, estimates are based on the carbon value for the United States (U.S. Environmental Protection Agency 2015, Interagency Working Group on Social Cost of Carbon 2015) and converted to local currency with user-defined exchange rates.

For this analysis, carbon storage and carbon sequestration values are calculated based on $171 per ton.

Oxygen Production:

The amount of oxygen produced is estimated from carbon sequestration based on atomic weights: net O2 release (kg/yr) = net C sequestration (kg/yr) × 32/12. To estimate the net carbon sequestration rate, the amount of carbon sequestered as a result of tree growth is reduced by the amount lost resulting from tree mortality. Thus, net carbon sequestration and net annual oxygen production of the urban forest account for decomposition (Nowak et al 2007). For complete inventory projects, oxygen production is estimated from gross carbon sequestration and does not account for decomposition.

Avoided Runoff:

Annual avoided surface runoff is calculated based on rainfall interception by vegetation, specifically the difference between annual runoff with and without vegetation. Although tree leaves, branches, and bark may intercept precipitation and thus mitigate surface runoff, only the precipitation intercepted by leaves is accounted for in this analysis.

The value of avoided runoff is based on estimated or user-defined local values. For international reports that do not have local values, the national average value for the United States is utilized and converted to local currency with user-defined exchange rates. The U.S. value of avoided runoff is based on the U.S. Forest Service's Community Tree Guide Series (McPherson et al 1999; 2000; 2001; 2002; 2003; 2004; 2006a; 2006b; 2006c; 2007; 2010; Peper et al 2009; 2010; Vargas et al 2007a; 2007b; 2008).

For this analysis, avoided runoff value is calculated based on the price of $0.07 per ft³.

Building Energy Use:

If appropriate field data were collected, seasonal effects of trees on residential building energy use were calculated based on procedures described in the literature (McPherson and Simpson 1999) using distance and direction of trees from residential structures, tree height and tree condition data. To calculate the monetary value of energy savings, local or custom prices per MWH or MBTU are utilized.

For this analysis, energy saving value is calculated based on the prices of $154.53 per MWH and $11.38 per MBTU.

Structural Values:

Structural value is the value of a tree based on the physical resource itself (e.g., the cost of having to replace a tree with a similar tree). Structural values were based on valuation procedures of the Council of Tree and Landscape Appraisers, which uses tree species, diameter, condition, and location information (Nowak et al 2002a; 2002b). Structural value may not be included for international projects if there is insufficient local data to complete the valuation procedures.

Potential Pest Impacts:

The complete potential pest risk analysis is not available for studies outside of the United States. The number of trees at risk to the pests analyzed is reported, though the list of pests is based on known insects and disease in the United States.

For the U.S., potential pest risk is based on pest range maps and the known pest host species that are likely to experience mortality. Pest range maps for 2012 from the Forest Health Technology Enterprise Team (FHTET) (Forest Health Technology Enterprise Team 2014) were used to determine the proximity of each pest to the county in which the urban forest is located. For the county, it was established whether the insect/disease occurs within the county, is within 250 miles of the county edge, is between 250 and 750 miles away, or is greater than 750 miles away. FHTET did not have pest range maps for Dutch elm disease and chestnut blight. The range of these pests was based on known occurrence and the host range, respectively (Eastern Forest Environmental Threat Assessment Center; Worrall 2007).

Relative Tree Effects:

The relative value of tree benefits reported in Appendix II is calculated to show what carbon storage and sequestration, and air pollutant removal equate to in amounts of municipal carbon emissions, passenger automobile emissions, and house emissions.

Municipal carbon emissions are based on 2010 U.S. per capita carbon emissions (Carbon Dioxide Information Analysis Center 2010). Per capita emissions were multiplied by city population to estimate total city carbon emissions.

Light duty vehicle emission rates (g/mi) for CO, NOx, VOCs, PM10, SO2 for 2010 (Bureau of Transportation Statistics 2010; Heirigs et al 2004), PM2.5 for 2011-2015 (California Air Resources Board 2013), and CO2 for 2011 (U.S. Environmental Protection Agency 2010) were multiplied by average miles driven per vehicle in 2011 (Federal Highway Administration 2013) to determine average emissions per vehicle.

Household emissions are based on average electricity kWh usage, natural gas Btu usage, fuel oil Btu usage, kerosene Btu usage, LPG Btu usage, and wood Btu usage per household in 2009 (Energy Information Administration 2013; Energy Information Administration 2014)

- CO2, SO2, and NOx power plant emission per KWh are from Leonardo Academy 2011. CO emission per kWh assumes 1/3 of one percent of C emissions is CO based on Energy Information Administration 1994. PM10 emission per kWh from Layton 2004.
- CO2, NOx, SO2, and CO emission per Btu for natural gas, propane and butane (average used to represent LPG), Fuel #4 and #6 (average used to represent fuel oil and kerosene) from Leonardo Academy 2011.
- CO2 emissions per Btu of wood from Energy Information Administration 2014.
- CO, NOx and SOx emission per Btu based on total emissions and wood burning (tons) from (British Columbia Ministry 2005; Georgia Forestry Commission 2009).

Appendix II. Relative Tree Effects

The urban forest in City of Claremont provides benefits that include carbon storage and sequestration, and air pollutant removal. To estimate the relative value of these benefits, tree benefits were compared to estimates of average municipal carbon emissions, average passenger automobile emissions, and average household emissions. See Appendix I for methodology.

Carbon storage is equivalent to:
- Amount of carbon emitted in City of Claremont in 24 days
- Annual carbon emissions from 8,500 automobiles
- Annual carbon emissions from 3,480 single-family houses

Carbon monoxide removal is equivalent to:
- Annual carbon monoxide emissions from 2 automobiles
- Annual carbon monoxide emissions from 5 single-family houses

Nitrogen dioxide removal is equivalent to:
- Annual nitrogen dioxide emissions from 289 automobiles
- Annual nitrogen dioxide emissions from 130 single-family houses

Sulfur dioxide removal is equivalent to:

- Annual sulfur dioxide emissions from 709 automobiles
- Annual sulfur dioxide emissions from 2 single-family houses

Annual carbon sequestration is equivalent to:

- Amount of carbon emitted in City of Claremont in 0.8 days
- Annual carbon emissions from 300 automobiles
- Annual carbon emissions from 100 single-family houses

Appendix IV. General Recommendations for Air Quality Improvement

Urban vegetation can directly and indirectly affect local and regional air quality by altering the urban atmosphere environment. Four main ways that urban trees affect air quality are (Nowak 1995):

- Temperature reduction and other microclimate effects
- Removal of air pollutants
- Emission of volatile organic compounds (VOC) and tree maintenance emissions
- Energy effects on buildings

The cumulative and interactive effects of trees on climate, pollution removal, and VOC and power plant emissions determine the impact of trees on air pollution. Cumulative studies involving urban tree impacts on ozone have revealed that increased urban canopy cover, particularly with low VOC emitting species, leads to reduced ozone concentrations in cities (Nowak 2000). Local urban management decisions also can help improve air quality.

Urban forest management strategies to help improve air quality include (Nowak 2000):

Strategy	*Result*
Increase the number of healthy trees	Increase pollution removal
Sustain existing tree cover	Maintain pollution removal levels
Maximize use of low VOC-emitting trees	Reduces ozone and carbon monoxide formation
Sustain large, healthy trees	Large trees have greatest per-tree effects
Use long-lived trees	Reduce long-term pollutant emissions from planting and removal
Use low maintenance trees	Reduce pollutants emissions from maintenance activities
Reduce fossil fuel use in maintaining vegetation	Reduce pollutant emissions
Plant trees in energy conserving locations	Reduce pollutant emissions from power plants
Plant trees to shade parked cars	Reduce vehicular VOC emissions
Supply ample water to vegetation	Enhance pollution removal and temperature reduction
Plant trees in polluted or heavily populated areas	Maximizes tree air quality benefits
Avoid pollutant-sensitive species	Improve tree health
Utilize evergreen trees for particulate matter	Year-round removal of particles

Appendix V. Invasive Species of the Urban Forest

The following inventoried tree species were listed as invasive on the California invasive species list (California Invasive Species Advisory Committee 2010):

Species Name[a]	*Number of Trees*	*% of Trees*	*Leaf Area (ac)*	*Percent Leaf Area*
California pepper tree	316	1.2	2.1	0.2
Brazilian pepper tree	226	0.9	1.5	0.1
Chinese tallow tree	184	0.7	4.8	0.4
Blue gum eucalyptus	37	0.1	8.0	0.7
Tree of heaven	10	0.0	0.2	0.0
Total	**773**	**2.95**	**16.68**	**1.42**

[a] Species are determined to be invasive if they are listed on the state's invasive species list

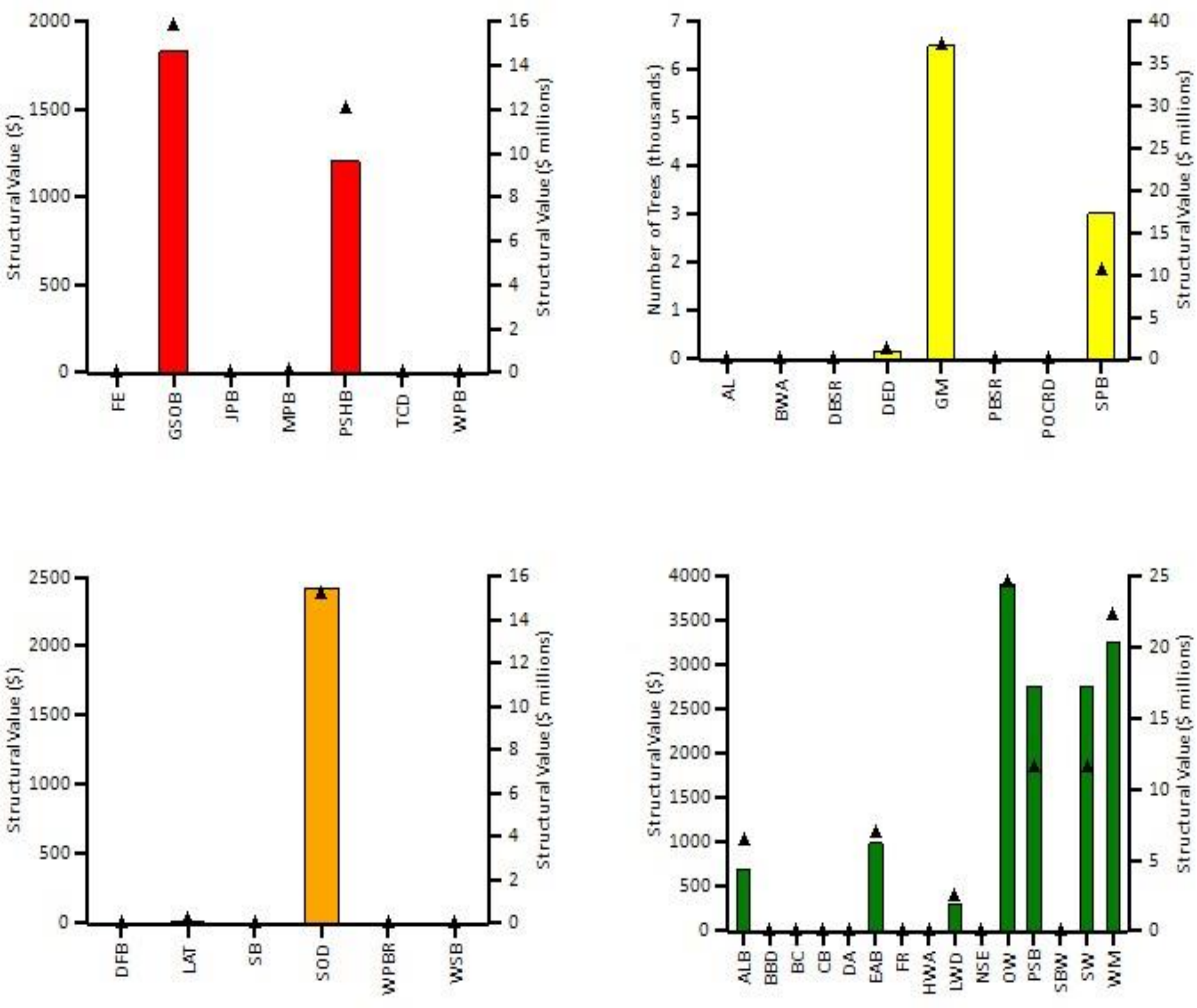
Appendix VI. Potential Risk of Pests

Thirty-six insects and diseases were analyzed to quantify their potential impact on the urban forest. As each insect/ disease is likely to attack different host tree species, the implications for {0} will vary. The number of trees at risk reflects only the known host species that are likely to experience mortality.

Code	Scientific Name	Common Name	# of Trees at Risk	Value ($ millions)
AL	Phyllocnistis populiella	Aspen Leafminer	2	0.00
ALB	Anoplophora glabripennis	Asian Longhorned Beetle	1,024	4.38
BBD	Neonectria faginata	Beech Bark Disease	0	0.00
BC	Sirococcus clavigignenti juglandacearum	Butternut Canker	0	0.00
BWA	Adelges piceae	Balsam Woolly Adelgid	0	0.00
CB	Cryphonectria parasitica	Chestnut Blight	0	0.00
DA	Discula destructiva	Dogwood Anthracnose	0	0.00
DBSR	Leptographium wageneri var. pseudotsugae	Douglas-fir Black Stain Root Disease	0	0.00
DED	Ophiostoma novo-ulmi	Dutch Elm Disease	202	0.83
DFB	Dendroctonus pseudotsugae	Douglas-Fir Beetle	0	0.00
EAB	Agrilus planipennis	Emerald Ash Borer	1,111	6.20
FE	Scolytus ventralis	Fir Engraver	0	0.00
FR	Cronartium quercuum f. sp. Fusiforme	Fusiform Rust	0	0.00
GM	Lymantria dispar	Gypsy Moth	6,533	37.16
GSOB	Agrilus auroguttatus	Goldspotted Oak Borer	1,982	14.66
HWA	Adelges tsugae	Hemlock Woolly Adelgid	0	0.00
JPB	Dendroctonus jeffreyi	Jeffrey Pine Beetle	0	0.00
LAT	Choristoneura conflictana	Large Aspen Tortrix	21	0.06
LWD	Raffaelea lauricola	Laurel Wilt	391	1.95
MPB	Dendroctonus ponderosae	Mountain Pine Beetle	6	0.03
NSE	Ips perturbatus	Northern Spruce Engraver	0	0.00
OW	Ceratocystis fagacearum	Oak Wilt	3,942	24.50
PBSR	Leptographium wageneri var. ponderosum	Pine Black Stain Root Disease	0	0.00
POCRD	Phytophthora lateralis	Port-Orford-Cedar Root Disease	0	0.00
PSB	Tomicus piniperda	Pine Shoot Beetle	1,853	17.28
PSHB	Euwallacea nov. sp.	Polyphagous Shot Hole Borer	1,508	9.65
SB	Dendroctonus rufipennis	Spruce Beetle	1	0.00
SBW	Choristoneura fumiferana	Spruce Budworm	0	0.00
SOD	Phytophthora ramorum	Sudden Oak Death	2,374	15.49
SPB	Dendroctonus frontalis	Southern Pine Beetle	1,853	17.28
SW	Sirex noctilio	Sirex Wood Wasp	1,852	17.28
TCD	Geosmithia morbida	Thousand Canker Disease	4	0.01
WM	Operophtera brumata	Winter Moth	3,574	20.42
WPB	Dendroctonus brevicomis	Western Pine Beetle	4	0.03
WPBR	Cronartium ribicola	White Pine Blister Rust	0	0.00

WSB	Choristoneura occidentalis	Western Spruce Budworm	1	0.00

In the following graph, the pests are color coded according to the county's proximity to the pest occurrence in the United States. Red indicates that the pest is within the county; orange indicates that the pest is within 250 miles of the county; yellow indicates that the pest is within 750 miles of the county; and green indicates that the pest is outside of these ranges.



Note: points - Number of trees, bars - Structural value

Based on the host tree species for each pest and the current range of the pest (Forest Health Technology Enterprise Team 2014), it is possible to determine what the risk is that each tree species in the urban forest could be attacked by an insect or disease.

Spp. Risk	Risk Weight	Species Name	AL	ALB	BBD	BC	BWA	CB	DA	DBSR	DED	DFB	EAB	FE	FR	GM	GSOB	HWA	JPB	LAT	LWD	MPB	NSE	OW	PBSR	POCRD	PSB	PSHB	SB	SBW	SOD	SPB	SW	TCD	WM	WPB	WPBR	WSB
	13	Norway spruce																																				
	12	Coulter pine																																				
	11	Coastal live oak																																				
	11	California black oak																																				
	11	Canyon live oak																																				
	8	Arroyo willow																																				
	8	Pinyon pine																																				
	7	Northern red oak																																				
	7	Pin oak																																				
	7	White alder																																				
	6	European white birch																																				
	4	California sycamore																																				
	4	Canary island pine																																				
	4	Aleppo pine																																				
	4	California white oak																																				
	4	Afghan pine																																				
	4	American elm																																				
	4	Engelmann oak																																				
	4	Italian stone pine																																				
	4	Live oak																																				
	4	Japanese pine																																				
	4	Scarlet oak																																				
	4	Torrey pine																																				
	4	Siberian elm																																				
	4	Turkish pine																																				
	4	Blue oak																																				
	4	Southern California walnut																																				
	4	Monterey pine																																				
	4	Bur oak																																				
	3	Holly oak																																				
	3	Camphor tree																																				
	3	Chinese elm																																				
	3	Cork oak																																				

3	Texas red oak
3	Columnar english oak
3	Island live oak
3	elm spp
2	Sweetgum
2	Callery pear
2	Velvet ash
2	California peppertree
2	Evergreen pear
2	Silver maple
2	Japanese flower crabapple
2	'Aristocrat' callery pear
2	Apricot
2	Littleleaf linden
2	European crabapple
2	White ash
2	Sugar maple
2	Smoke tree
2	'Redspire' callery pear
2	Silver dollar eucalyptus
2	Red maple
2	Texas ash
1	Shamel ash
1	London plane
1	Narrow-leafed ash
1	Modesto ash
1	Persian silk tree
1	Peach
1	Avocado
1	Japanese maple
1	Trident maple
1	Common plum
1	Horse chestnut
1	Autumn purple ash
1	California buckeye
1	Fremont cottonwood
1	Freeman maple

	1	Red Horse chestnut																																				

<u>Note:</u>
Species that are not listed in the matrix are not known to be hosts to any of the pests analyzed.

<u>Species Risk:</u>
- Red indicates that tree species is at risk to at least one pest within county
- Orange indicates that tree species has no risk to pests in county, but has a risk to at least one pest within 250 miles from the county
- Yellow indicates that tree species has no risk to pests within 250 miles of county, but has a risk to at least one pest that is 250 and 750 miles from the county
- Green indicates that tree species has no risk to pests within 750 miles of county, but has a risk to at least one pest that is greater than 750 miles from the county

<u>Risk Weight:</u>
Numerical scoring system based on sum of points assigned to pest risks for species. Each pest that could attack tree species is scored as 4 points if red, 3 points if orange, 2 points if yellow and 1 point if green.

<u>Pest Color Codes:</u>
- Red indicates pest is within Los Angeles county
- Red indicates pest is within 250 miles county
- Yellow indicates pest is within 750 miles of Los Angeles county
- Green indicates pest is outside of these ranges

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