City of Los Angeles

URBAN FOREST MANUAL

2024 UPDATE

Department of Recreation & Parks

Lost

Stand still. The trees ahead and bushes beside you

Are not lost. Wherever you are is called Here,

And you must treat it as a powerful stranger,

Must ask permission to know it and be known.

The forest breathes. Listen. It answers,

I have made this place around you.

If you leave it, you may come back again, saying Here.

No two trees are the same to Raven.

No two branches are the same to Wren.

If what a tree or a bush does is lost on you,

You are surely lost. Stand still. The forest knows

Where you are. You must let it find you.

—DAVID WAGONER (1999)

City of Los Angeles

Land Acknowledgement Statement

A Land Acknowledgment Statement is currently under development.

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Department of Recreation & Parks

URBAN FOREST MANUAL

Introduction

The City of Los Angeles, Department of Recreation and Parks (RAP) has developed the Urban Forest Manual to raise the level of understanding of our natural ecosystems within the Los Angeles Basin and to elevate regard and appreciation for our urban forest. This guidebook has been designed for all City staff members—the gardener, the planner, the administrator, the construction staff, the activity programmer, and the facility director—it is available for everyone, in hopes that they may better understand our most precious natural resource: urban trees. The included Tree Care Manual (see Chapter 3) provides useful information regarding the daily supervision, care, and protection of this valuable link to our ecosystem and is a guide for the custodianship of our ecological community.

Children at play at Shane's Inspiration, Griffith Park.

Sharing the environment with all living things . . .

An ecosystem is a specific biological community interacting with its physical environment. A biological community consists of all the populations of living things in a given area, including people. The physical environment includes climate, temperature, soil, and light. Both the biological community and the physical environment are continually interacting.

The physical environment significantly influence the biological community, and in turn, the biological community uses and modifies the environment. To assist our efforts in developing successful landscapes, it is necessary to develop an understanding of the many relationships existing between all living things and their significance to the Los Angeles Basin ecosystem.

The Department of Recreation and Parks Forestry Division is charged with the responsibility to care for and oversee this sizable portion of our public urban forest. The City of Los Angeles Department of Recreation and Parks owns and operates 538 parks and associated facilities that span over 16,000 acres throughout Los Angeles and operates according to their mission:

Our mission is to enrich the lives of the residents of Los Angeles by providing safe, welcoming parks and recreation facilities and affordable, diverse recreation and human services activities for people of all ages to play, learn, contemplate, build community, and be good stewards of our environment.

The Forestry Division cannot sustain an urban forest alone. The future of the Los Angeles urban forest requires the involvement of us all. The Urban Forest Manual has been developed as a guide to promote healthy trees through our daily behavior, planning, and decision-making, and to guarantee the sustainability of our urban forest ultimately.

Purpose

The purpose of the Urban Forest Manual is to develop a single resource that will provide direction to the Department of Recreation and Parks (RAP) staff and promote the sustainability of a healthy urban forest. Since the Los Angeles ecosystem has been changed dramatically to accommodate the needs of a growing population, the natural cycles that govern a healthy ecosystem have been disturbed and in some locations completely broken. In order to survive within these altered conditions, trees in City parks must rely on human intervention. The Urban Forest Manual represents established procedures and standards that encourage tree preservation and enhance an urban ecosystem that is vulnerable to destruction. The procedures and standards include criteria for the removal, maintenance, and planting of diverse tree species.

The Urban Forest Manual addresses the three following subjects:

CITYWIDE TREE MANAGEMENT

- Recreation and Parks Forestry Division oversees tree operations within the City of Los Angeles parkland. Tree maintenance is performed in two ways: by Department staff supervised by International Society of Arboriculture Certified Arborists and/or by a contracted tree company administered and overseen by the Department's Certified Arborists. The Forestry Division also oversees proper species selection.
- Bureau of Street Services, Urban Forestry Division manages parkway trees along City parks and streets.
- Los Angeles Department of Water and Power manages pruning near electric utilities.
- Arborists within the Forestry Division work with Planning, Construction, and Maintenance Division landscape architects on species selection and the protection of trees during construction projects.

URBAN FOREST SUSTAINABILITY AND TREE PLANTING PROGRAMS

- RAP Forestry Division implements pruning techniques that prolong tree health and longevity. Special care is given to applying pruning techniques that improve structure, mitigate risk, provide clearance, maintain health, manage wildlife habitat, and achieve other key objectives. Crown cleaning, crown thinning, and crown raising are the most common pruning methods used on medium to mature trees in city parks (Gilman et al. 2012). If a crown reduction is necessary, reduction cuts are used. In reduction cuts, the longest portion of a branch is cut back to an existing lateral branch that is at least one-third the diameter of the retained lateral branch. Utilizing reduction cuts along the periphery of a tree crown temporarily results in a smaller crown. Topping, or indiscriminate heading cuts on large-diameter branches, is a destructive pruning technique that is not practiced, nor accepted, in Los Angeles City Parks (rare exceptions include retrenchment and preservation pruning).
- RAP Forestry Division Program oversees proper tree selection as part of its ongoing parks reforestation. Partners such as City Plants help RAP grow tree species that are not widely available in the Griffith Park Commonwealth Nursery using locally sourced seed whenever possible. The Division also coordinates tree-planting efforts with nonprofit organizations, seeks funds within existing resources and programs and identifies new funds through grant writing.

TREE PRESERVATION AND MANAGEMENT REGULATIONS

RAP adheres to the Tree Preservation Policy— under enforcement by Forestry Division and Planning and Construction Division.
The policy and best management practices are regulatory tools that provide for the orderly protection of specified trees in city parks. The manual provides information regarding existing codes, technical regulations, standards, and specifications necessary to implement the above policies and contains guidelines for the required and recommended care, removal, and replacement of regulated trees.

The RAP Forestry crew member works at Camp High Sierra, removing dead fir trees infested with bark beetles.

Intent and Purpose

City parks are enriched with a large population of trees, including magnificent individual trees, groupings of trees, Heritage trees, Special Habitat Value trees, and other ornamental trees from climates around the world. These trees, representing nearly 500 different species, provide large cooling islands for the City and offer an escape to a natural environment from the manmade cityscape. Trees are a key component in the ecosystem and are aesthetically pleasing to neighborhood landscapes. Trees provide economic benefits to the community and contribute to a high quality of life.

Sustaining trees in developed environments presents a challenge that requires careful planning and attentive maintenance. The remnants of the original native plant life of the Los Angeles Basin are increasingly vulnerable after more than a century of development and a changing climate. In order to meet these challenges, the Urban Forest Manual has been developed and approved as a policy of the Department of Recreation and Parks.

Heritage tree—tipu tree, (*Tipuana tipu*)—one of the largest specimens in the Los Angeles area grows in the Chavez Ravine Arboretum at Elysian Park among many more species of rare and unique trees.

The Recreation and Parks Tree Preservation Policy is the primary regulatory tool that gives direction for the orderly protection of specified trees. The policy maintains the value of trees and avoids significant negative effects on the ecosystem. By assuring preservation and protection through regulation and standards of care, these resources will remain significant contributions to the environment and landscape and will continue to add to the unique character of Los Angeles City Parks.

Heritage tree in Green Meadows Park—fruits and flowers of an odd-looking African sausage tree, (*Kigelia africana*), rare and unique in Los Angeles landscaping.

Heritage tree—unusual *Eucalyptus conferruminata* in Pacific Palisades Park.

The Tree Care Manual is included as chapter 3 in this manual and issued by the general manager through the Divisions of Forestry and Planning, Maintenance and Construction. This document establishes specific technical regulations, standards and specifications necessary to implement the RAP Tree Preservation Policy (Appendix A) and defines the city's tree preservation goals. These goals are intended to provide consistent care and to serve as indicators of achievement. Their purpose is to:

- Ensure and promote the preservation of the existing tree canopy cover within Los Angeles City parks.
- Provide standards of preservation required for protected trees.
- Increase the survivability of trees during and after construction by providing protection standards and best management practices.
- Provide standards for the replacement of trees and the planting of trees.
- Define criteria for tree risk assessment and economic evaluations.
- Establish safety standards for tree care operations.
- Provide safety criteria for employees and the public.

"Without trees, a city is just a scab on the earth."

—CHUCK GILSTRAP

top: Roger Jessup Park.
bottom: Blue mahoe (*Taliparitiatum elatum*) flower.

Queensland kauri (*Agathis robusta*)—another exceptional tree in Los Angeles City Parks.

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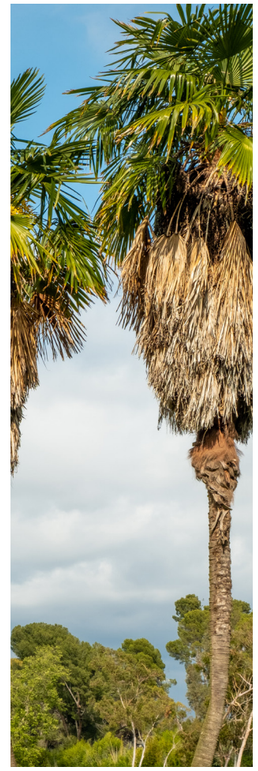




1.0 INTRODUCTION TO SECTION ITEMS

In order to provide the required and recommended care for removal and replacement of regulated trees, the Tree Care Manual (see Chapter 3) provides information regarding existing codes, technical regulations, standards, and guides and specifications necessary to implement the best management practices for trees regulated by Ordinances, Policies, and Procedures.

RAP recognizes and implements regulatory procedures for trees specified in the Tree Preservation Policy under four categories: (1) Trees Protected by Ordinance, (2) Heritage Trees, (3) Special Habitat Value Trees, and (4) all other Common Park Trees. For a detailed reference of protected trees, please see the RAP Tree Preservation Policy (Appendix A).

2.0 Definitions

A list of the arboricultural and construction-related terms and their definitions are presented here. They are defined as they are used in the Manual. They serve to outline uniform concepts and provide an understanding of events as discussed in the document.

3.0 Tree Maintenance Guidelines

The best management practices for tree care operations that cause minimal harm to trees and the associated wildlife are contained here. This section provides information based on tree biology and arboricultural research over the last decade, and introduces models that project the effects climate change may have on the urban forest. It discusses techniques vital to maintaining good tree structure. It also outlines specifications for maintaining trees growing in turf. This section describes practices to avoid and recommends maintenance applications that promote tree health.

4.0 Protection of Trees During Construction

Information necessary to preserve trees during all stages of construction is presented here. This section discusses tree growth characteristics as they pertain to construction and provides alternative solutions to mitigate or eliminate damage to trees. It explains the tree preservation process from evaluating the resource through planning, design, impact evaluation, construction, and post-construction management.

5.0 Tree Removal, Replacement, and Planting

Procedures for tree removal and replacement are reviewed here. This section specifies step-by-step actions that are taken when a tree or group of trees require removal. It covers the latest specifications for tree selection and planting, as well as an introduction to climate-ready trees. It includes the Tree Planting and Selection Guidelines established for RAP. It explains the recycling process for green waste generated from pruning and removals and how mulch and organic matter are incorporated back into the park system.

6.0 Tree Evaluation for Hazard and Economical Value

All trees have the potential to fail, but only a relative few actually do. In establishing criteria to evaluate trees for hazards, the focus is given to trees in urban areas, recognizing the unique combinations of species and site characteristics found in cities. An understanding of hazard evaluation, risk management, and liability are critical for Department managers and arborists.

The general public often does not understand the criteria for tree removal, and RAP's position regarding the removal of hazardous trees is clarified in this chapter. When trees must be appraised, a method is provided that is most useful in city park settings. This section also explains the brush-clearing process and other fire mitigation and rehabilitation measures used by the Department.

7.0 Safety Standards

The latest editions of the American National Standards Institute (ANSI) safety standards for tree care operations are contained here, including safety criteria for employees and the public. The RAP Code of Safe Practices, established exclusively for the Department's Forestry Operation is also presented.

8.0 Appendices

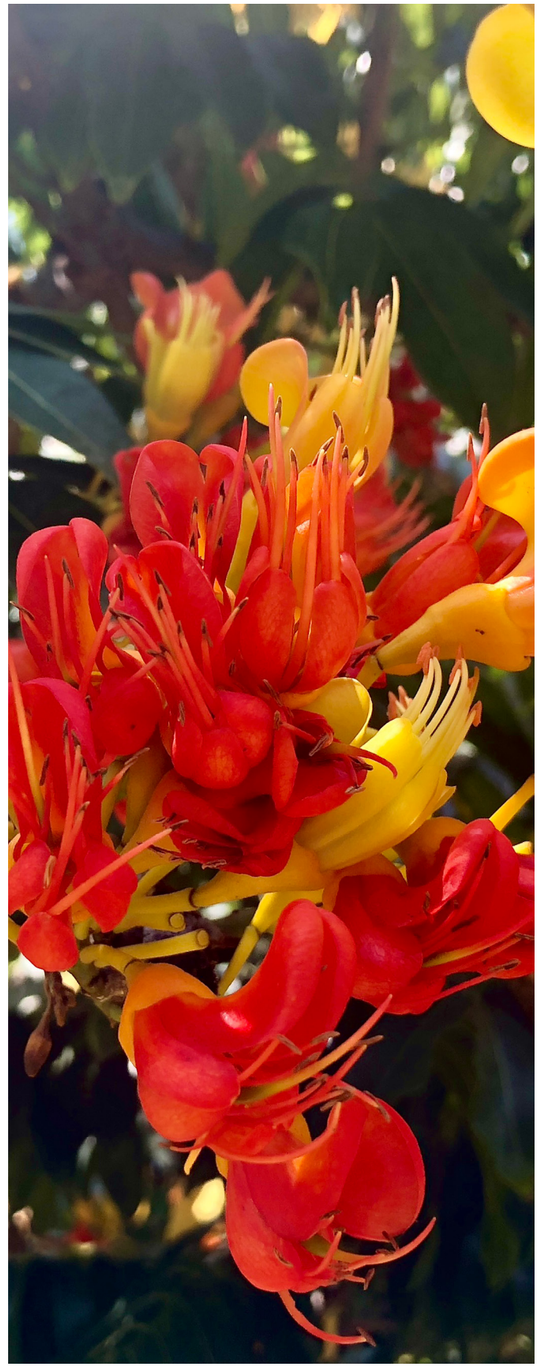
Sources are provided for technical information and supplemental material referenced within the Manual. These are highly recommended for any Department staff interacting with trees or making decisions affecting trees. The source material is given for the preservation of trees and the sustainability of the urban forest.

9.0 Assumptions

RAP assumes no responsibility for matters legal in character that is contained in this manual. The manual was created to conform to current standards of care, best management practices, established technical specifications, evaluation and appraisal procedures, and sound arboricultural practices as recommended by the sources listed in the References section.

10.0 References

Various reference resources were used to compile the manual. All of the resources are listed. It is recommended that these materials be obtained and kept as desk references.



Moreton Bay chestnut (*Castanospermum australe*) provide spectacular flower shows each year.

2.0 DEFINITIONS

The Definitions section is a list of the arboricultural and construction-related terms and their definitions as used in the Manual. They serve to outline uniform concepts and provide an understanding of events as discussed in the document.

Aeration. In soil, the process by which air from the atmosphere is brought into the soil. Usually to reverse loss of macropores resulting from compaction.

Adventitious Buds and Suckers. Lateral buds whose growth was previously suppressed by an auxin (growth hormone) produced by the dominant leader or side branch. As the suppressing chemicals become weaker, adventitious buds produce a large number of new sprouts or sucker growth near the point of the pruning cut or wound break.

Aging. Orderly changes of an organism over time, or its parts as it is genetically designed. In trees, the ratio between the volume of wood with living cells being walled off to the volume of wood with living cells being generated.

Allelopathy. Chemical inhibition of growth and development of one plant by another.

Amendment (Soil). Any substance other than fertilizers, such as lime or sulfur. For example, gypsum and sawdust are used to alter the chemical or physical properties of soil, generally to make it more productive.

ANSI A300. American National Standards Institute—reference source for standards for pruning trees and shrubs.

ANSI Z133.1. American National Standards Institute—reference source for standards for arboricultural operations.

Apical Dominance. Upright/vertical growth supersedes lateral growth. It is one of the ways a tree attempts to regain its natural form when limbs or branches are removed through pruning, disease, or accident.

Arboriculture. The science and art of caring for trees, shrubs, and other woody plants in a landscape setting.

Best Management Practices (BMPs). International Society of Arboriculture's continually updated guidelines for tree care industry professionals with useful information on tree care standards and practice.

Branch. A secondary shoot or stem arising from the main stem or trunk.

Branch Collar. Trunk tissue (usually marked by a swelling or collar) that forms around the base of a branch between the main stem and the branch or a branch and a lateral. As a branch decreases in vigor or begins to die, the collar usually becomes more pronounced and more completely encircles the branch.

Branch Bark Ridge. A ridge of bark in a branch crotch that marks where branch and trunk tissues meet and often extends down the trunk.

Caliper. Synonym for trunk diameter used to measure the size of nursery stock.

Callus. Undifferentiated tissue is initially formed by the cambium around and over a wound.

Cambium. The tree cell generator. A layer of cells between the inner bark and wood. By the cell division a cork cambium forms the outer tissue of the tree's bark; on the inside a vascular cambium divides in an outward direction producing phloem and on the inner side xylem.

Canopy. The part of the tree composed of leaves and small twigs.

Certified Arborist. An individual who obtained arborist certification from the International Society of Arboriculture based on knowledge and competence, and who receives on a regular basis continuing education administered by the International Society of Arboriculture (ISA).

City Arborist. Recreation and Parks employee who possesses current certification from the International Society of Arboriculture.

Circling Roots. Roots that grow around the trunk in a circular manner, rather than laterally away from it.

Climate Ready Trees. Tree species that exhibit promising qualities in their ability to withstand the changes in the climate.

Codominant. Two or more vigorous and upright branches of relatively equal size that originate from a common point, usually where the leader has been lost or removed.

Compaction. Breaking down soil particles by mechanical means, resulting in loss of soil macropores and leading to lack of oxygen and water in soils. A major cause of death of tree roots. See also Soil Compaction.

Compartmentalization. Physiological process that creates the chemical and physical boundaries that act to limit the spread of disease and decay organisms.

Compost. Organic residues or mixture of organic residues and soil, that have been piled, moistened, and allowed to undergo biological decomposition.

Conifer. Plant that bears seeds in a cone.

Crotch. The angle formed at the attachment between a branch and another branch, leader or trunk of a woody plant.

Crown. The above ground parts of the tree, including the trunk.

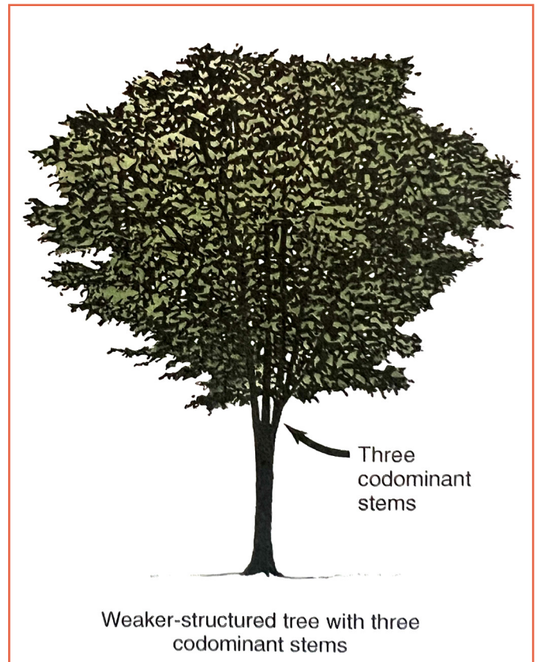
Crown Cleaning. The removal of dead, dying, diseased, crowded, weakly attached, and/or low-vigor branches from a tree crown.

Cultivar. A named plant selection from which identical or nearly identical plants can be produced, usually by vegetative propagation or cloning.

Decay. Process of degradation of woody tissues by fungi and bacteria through the decomposition of cellulose and lignin.

Deciduous. A perennial plant that loses all its leaves at one time during the year.

Decurrent. Round-headed or spreading plant with no main leader to the top of the plant (e.g., coast live oak).



Decurrent growth habitat.

Disturbance. Various activities from construction or development that may damage trees.

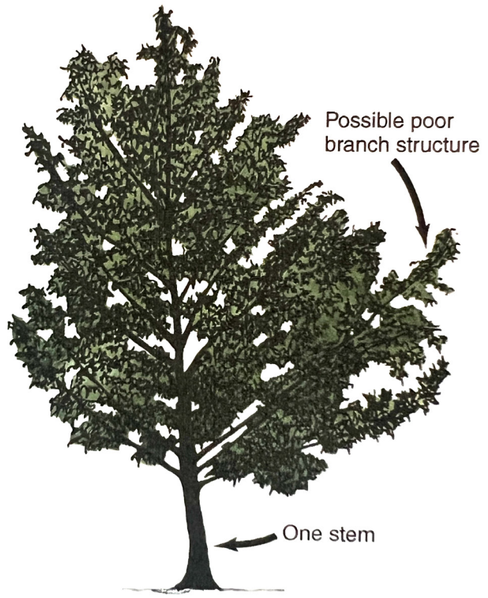
Dripline. The width of the crown, measured by the lateral extent of the foliage.

Drop-Crotch. Reduction cut, which reduces the length of a branch or stem back to a live lateral branch large enough to assume apical dominance—this is typically at least one-third the diameter of the cut stem. Branches are selectively pruned or removed at varying distances resulting in a thinning out of the tree canopy.

Epicormic Shoot. Shoots growing from mature branches or near large pruning wounds. Most of these shoots arise from latent buds and are seldom firmly attached to the stem from which they arise.

Evergreen. Plant that retains its leaves for more than one growing season.

Excurrent. Tree with cone-shaped crown with a central leader that outgrows and subdues lateral branches (e.g., *Liquidambar* sp.).



Strong-structured tree with one dominant stem

Excurrent growth habitat.

Field Capacity. The soil water content after gravitational pull has pulled away excess water.

Final Cut. The last cut made on a limb. It could be the only cut, or the last cut in a series. Final cuts should be made at a minimal distance from the parent stem just outside of the branch collar.

Flush Cut. Pruning technique in which both branch and stem tissue are removed; generally considered poor practice.

Grading. Altering existing terrain and elevation of land, usually performed by the use of large equipment.

Green Waste. Organic materials originating from tree trimmings and tree removals such as leaves and limbs/branches.

Growth Ring (Annual Ring). Width of secondary xylem (wood) produced by the stem in 1 year.

Hazard Tree (Hazardous Tree). Any tree or tree part that poses a high risk of failure or fracture that causes damage to property or injury to people.

Heading. Cutting a currently growing or 1-year-old shoot back to a bud, or cutting an older branch to a stub or a tiny twig not sufficiently large enough to assume the terminal role. This technique is rarely appropriate on established trees and should not be used to reduce the height or size of trees.

Heartwood. Nonliving xylem in the center of a trunk or branch; wood is darker in color and can be a site for storage; provides structural strength to a tree.

Included Bark. Bark that occurs in a crotch between branch and trunk or between codominant stems. Included bark usually:

- Prevents the trunk from growing around a branch.
- Occurs on defective V-shaped crotches in which the bark grows inward and on itself, causing a physical weakness where the co-dominant leaders meet.

Indigenous Plants. Plants occurring or living naturally in an area; not introduced; native.

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

International Society of Arboriculture (ISA). ISA is a nonprofit organization that promotes the professional practice of arboriculture and recognizes qualified, competent, and safe tree care professionals.

Kinked Root. A primary root(s), which is sharply bent and causes a restriction to water, nutrient, and photosynthate movement. Kinked roots may compromise the structural stability of the root system.

Lateral. A branch or twig growing from a parent branch or stem.

Leader. A dominant upright stem, usually the main trunk. There can be several leaders in one tree.

Limb. Same as branch, but usually larger and more prominent.

Lions Tailing. Removing interior lateral branches resulting in concentrated growth at branch ends.

Mature Trees. Trees that have reached at least 75 percent of their typical final height and spread.

Mulching. Any material such as sawdust, woodchips, leaves, plastic film, gravel, and loose soil that is spread on a surface to protect the soil and roots from the effects of raindrops, soil crusting, freezing, and evaporation. May aid in reducing soil compaction.

Mycorrhizae Treatment. Soil treatment with mycorrhizae spores to increase symbiotic relationship of tree roots and beneficial fungi.

Parent Branch or Stem. The tree trunk; or, the larger limb from which lateral branches grow.

Permanent Branches (Permanent Limbs). Branches that will remain on a tree for many years, perhaps until maturity.

Phloem. The food-conducting tissue of trees formed by the division of the outside layer of the vascular cambium. New phloem is produced yearly; older cells are crushed and compacted.

Photosynthate. Pertains to sugar and other carbohydrates that are produced by the foliage during photosynthesis, an energy-trapping process.

Plant Health Care. A management practice that includes regular monitoring for pest and disease, nutrition, and cultural methods to promote plant health.

Protected Trees. Trees protected by the RAP Tree Preservation Policy.

Pruning. Systematic removal of branches of a plant, usually a woody perennial.

Root Buffer. A temporary layer of material to protect the soil texture and roots.

Root Collar. The junction between the root of a plant and its stem, often indicated by the trunk flare.

Sapwood. Functional, conductive and youngest layer of secondary xylem positioned next to the bark tissues; transports and stores water, mineral elements, and carbohydrates.

Scaffold Branches. Large, main branches that form the main structure of the crown. In decurrent trees a large limb that is or will be part of the permanent branch structure of a tree.

Shall. Used to denote a practice that is mandatory.

Should. Used to denote a practice that is highly recommended.

Slipping. When cut, the bark easily lifts or peels in one uniform layer from the underlying wood without tearing.

Soil Compaction. Compression of soil particles that may result from the movement of heavy machinery and trucks, storage of construction materials, structures, paving, etc. within the tree dripline.

Species (Tree Species). Group of plants that resemble each other closely and that interbreed freely.

Sucker. Vigorous upright epicormic shoot that arises from latent buds below soil level or the graft union.

Sustainability. Maintenance of ecological, social, and economic functions and benefits over time.

Taper. The thickening of a stem (trunk) or branch toward its base.

Target. People or property potentially affected by tree failure.

Temporary branch. A small branch that is retained temporarily along the lower trunk of a young tree; not a permanent limb. Temporary branches are often left on young trees to encourage taper and sturdy trunk development and to prevent sunscald. Temporary branches provide photosynthate to increase trunk caliper and taper and to provide protection from mechanical injury. Such branches should be kept small and gradually removed as the trunk develops.

Thinning. Pruning technique in which branches are removed at their point of origin.

Topping. Pruning technique to reduce height by heading of large branches. Generally considered poor practice. See also heading.

Tree Protection Zone. Area identified by City arborist in which no soil disturbance is permitted and activities are restricted. Usually the area of a temporary fenced tree enclosure.

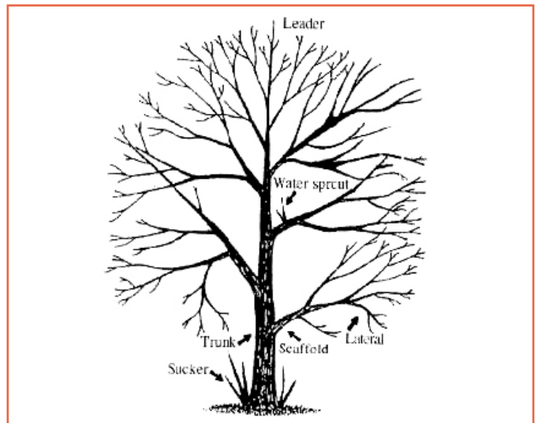
[1] Virginia State University, 2002. A Guide to Successful Pruning.

Trenching. Any excavation to provide irrigation, install foundation, utility lines, services, pipes, drainage or other property improvements below ground.

Trunk. The main stem or axis of a tree that is supported and nourished by the roots and to which branches are attached.

Undercut. Cutting partway through the underside of a limb to prevent the bark from tearing. Failure to make an undercut can cause the bark of a tree to tear down.

Watersprout. Vigorous, upright, epicormic shoots that grow from latent buds in older wood. Reciprocal are suckers that arise above the soil level or graft union. Seldom firmly attached to the stem from which they arise.



Typical Tree Framework.[1]

Wildland Urban Interface (WUI). Areas where the built environment meets the natural environment and where there is infrastructure adjacent to or within natural areas that exhibit conditions favorable to wildfire.

Wound. An opening that is created when the tree's protective bark covering is penetrated, cut, or removed, injuring or destroying living tissue. Pruning a live branch creates a wound, even when the cut is properly made.

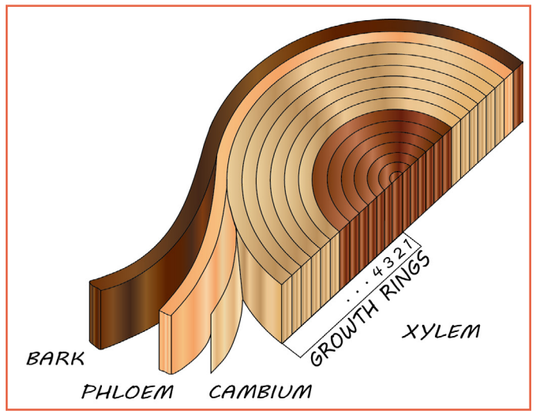
Wound Closure. The closing of a wound, necessary for the continued health of the tree. Wounds do not heal (return to restore to original condition or integrity) because wounding breaks or destroys the cambium; they close.

Woundwood. Differentiated woody tissue that forms after an initial callus has formed around the margins of a wound. Wounds are closed primarily by woundwood.

Vertical Mulching. Technique designed to increase aeration of compacted soils. Holes are drilled into the ground and coarse textured or organic materials are added to replace the removed soil.

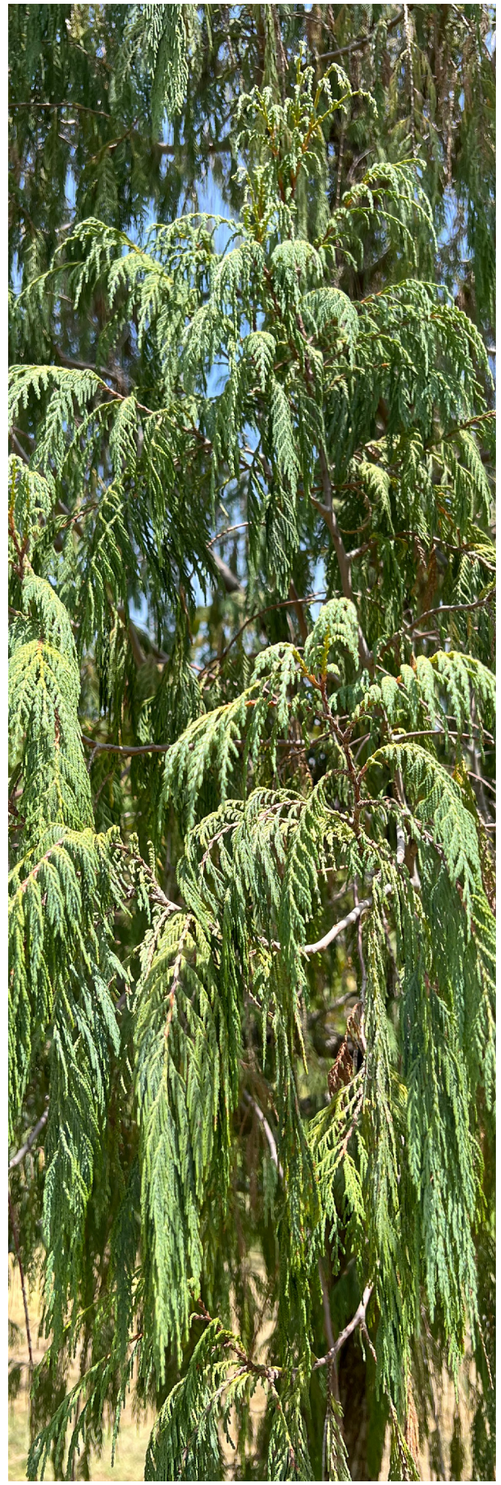
Xeriscape. Style of landscape design, construction, and maintenance focused on minimizing the need for supplemental irrigation.

Xylem. Cells formed by the division of the vascular cambium. Xylem cells function to transport and store water and mineral elements as well as provide mechanical support.



Relative locations of the phloem, cambium, and xylem.[2]

[2] ISA, 1998. Tree Climber's Guide.



3.0 TREE MAINTENANCE GUIDELINES

Introduction

Trees are a major element of city parks, and Department staff should continue to learn more about tree care in order to prolong the health of all trees. All RAP Divisions should perceive the cost of tree maintenance as an investment in its capital assets. It is the intention of the following sections to provide guidelines to maintenance practices that result in the best environment for park trees.

3.1 Care of Trees Listed in the RAP Tree Preservation Policy

Pruning performed on park trees adheres to the latest standards and recommendations made available by industry professionals and the International Society of Arboriculture (ISA). In the following sections, plant health care policies (e.g., watering, fertilizing, and general maintenance practices) will be discussed. Work performed on trees protected by the LA City Protected Trees Ordinance, as well as Heritage Trees and Special Habitat Value Trees, must always adhere to these recommendations.

Trees recognized as RAP Heritage Trees and Special Habitat Value Trees can be pruned with the approval of the RAP Forestry staff. Pruning shall be done in accordance with industry standards. Any work within the tree protection zone (TPZ) also requires approval from RAP Forestry staff.

Park trees recognized as Common Park Trees are to be protected by applying the most current ANSI (American National Standards Institute) and ISA recommendations for tree pruning as well as maintenance practices as described in the following sections.

3.2 Request for Tree Work Guidelines

To date, the Department has not established a pruning cycle, and tree care performed by the Forestry Division is by demand only. Currently, RAP pruning occurs by request and as needed, but the Department does not have adequate staffing or funding levels to follow this industry standard and best management practices for pruning. A regular pruning cycle would ultimately promote tree health while simultaneously enhancing public safety/decreasing liability and exposure.

Field staff shall call the Forestry Division at 213.485.4826 or email forestry.joborder@lacity.org any time tree pruning or inspection is required. Trees by nature shed bark and drop leaves, fruits, seeds, and small branches. In many instances, the Forestry crew will not be able to solve tree litter problems by pruning. It is important for field staff to evaluate tree pruning needs before calling in the work order. Misleading information and calling regular tree pruning needs as emergency requests results in inefficient use of the Forestry crews. On the following page is a guideline of regular job order requests and emergency requests for tree work.

3.2.1 REGULAR WORK ORDER REQUESTS

Regular work order requests are for all tree maintenance that does not fall under the "Tree Emergencies" category. These types of requests include pruning of trees not posing an immediate hazard to human life or property or for large-scale projects (e.g., trees blocking light fixtures, signs, or impeding walkway/road clearance) and require a work order submitted to the Forestry Division. The lead Senior Gardener, Park Maintenance Supervisor, or Senior Park Maintenance Supervisor must call in all work order requests. Work orders will be reviewed and prioritized by Forestry Division supervisorial staff.

3.2.2 TREE EMERGENCIES

The following is a list of possible tree emergencies in priority order:

High Priority

- Trees or limbs that have fallen and caused accidents or personal injury.
- Trees or limbs that have fallen and caused damage to vehicles or structures.
- Trees or limbs which are in immediate danger of falling or breaking.
- Broken hanging limbs adjacent to structures, roads, or in picnic or play areas.
- Trees or limbs blocking streets or roads.

Lesser Priority

- Trees or limbs that have fallen and are not an immediate hazard.
- Trees or limbs that have fallen and are not blocking roads or streets.
- Hanging tree limbs that may not be in immediate danger of falling.
- Dead or severely declining trees without a target present.

3.3 RAP Pruning Objectives

Pruning means the selective removal of plant parts to achieve the following:

- Manage risk.
- Manage health.
- Develop structure.
- Provide clearance.
- Manage size or shape.
- Improve aesthetics.
- Manage production of fruit, flowers, or other products.
- Manage wildlife habitat.

Trees and other woody plants respond biologically to pruning (wounding) in specific and predictable ways. Careful study of these responses has led to pruning practices that can best develop, preserve, and enhance the structural integrity, beauty, and functional value of trees.

Climbing spurs shall not be used to climb park trees or palms for the purpose of pruning. Climbing spurs may be used to rescue an injured worker or remove dead, dying, or hazardous trees.

3.3.1 INDUSTRY STANDARDS

The ANSI A300, Part 1—Pruning Standard Practices (2017) presents consensus performance standards for the professional management of trees, shrubs, and other woody plants. The A300 Standards are research-based guidelines useful in writing work specifications for the care and management tasks of woody plants and palms. The A300 Standards are subdivided into ten parts: Pruning, Soil Management, Supplemental Support Systems, Lighting Protection Systems, Management, Planting and Transplanting, Integrated Vegetation Management, Root Management Standard, Tree Risk Assessment, and Integrated Pest Management (IPM).

Best Management Practices—Pruning, 3rd Edition (2019) is the companion publication to the ANSI A300 (Part 1).

3.3.2 STRUCTURAL PRUNING SPECIFICATIONS

RAP is actively working towards implementing a proactive maintenance program. Though, based on current resource limitations, many routine reactive management tasks include:

- Clearing branches for public safety lighting.
- Raising the canopy above roads/sidewalks.
- Removing failed branches or entire trees.

Proactive maintenance will allow RAP to plan ahead to achieve future necessary clearance while also preventing dangerous structural defects from forming or from becoming worse. Structural pruning is core to this strategy. Structural pruning requires observation, imagination, foresight, and practice. It has many benefits, but there are also consequences when it is not applied to a tree.

Benefits of Structural Pruning

Structural pruning can prevent premature failure by addressing clearance, weakness, structure, and risk to create sustainable, long-lived, and beneficial trees for the community. Common contributors to failure include codominant stems, weak branch unions, low aggressive branches, and decay.

Pruning early and often, especially while the tree is young, minimizes the cut size, capitalizes on a young tree's vigor and capacity for wound closure, and achieves a rapid change in tree architecture. As branches and trunks grow in length and girth over time, issues become progressively more difficult or improbable to correct.

If defects are allowed to remain, the costs and risks compound over time. Some consequences include:

- Greater need for technical, specialized pruning.
- Premature removal.
- Larger volumes of biomass that require handling, processing, and disposal.
- Increased potential for decay and tree failure.
- More severe consequences from failures due to larger trees with heavier limbs that can have larger target areas.

Examples of tree defects. Low, aggressive branches (left). Same tree 14 years later requires a nine-inch pruning cut (right).[1]

Why Practice Structural Development Pruning?

The fundamentals of structural pruning are rooted in replicating observations of trees in forest conditions. In tropical and temperate forests, large-maturing trees typically grow one large dominant trunk with few and comparatively small branches. Hormones drive this growth habit in response to environmental factors and resource competition (Murray, 2010).

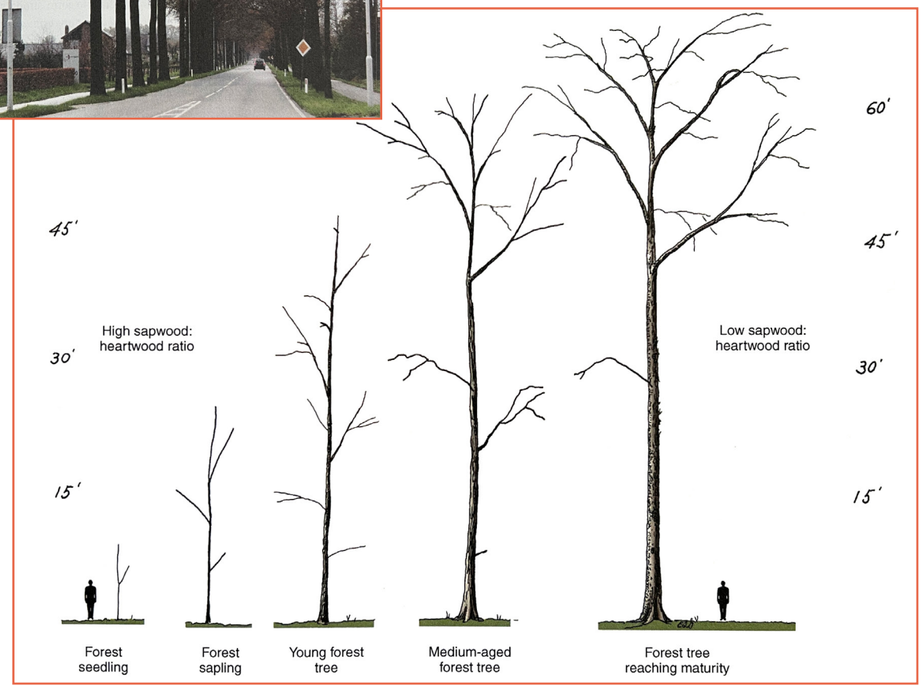
The result is a structurally stable tree that is resilient to pressures of wind, precipitation, and the weight of its expanding canopy. This natural condition is shown to be ideal for the urban environment as well.

[1] Gilman, E.F. 2012, *An Illustrated Guide to Pruning*. © Cengage Learning, 2012.

In Los Angeles, public trees under the care of RAP are diverse. Many large-maturing shade trees found in the city are native to distant tropical and temperate forests. Based on the tree inventory, common public trees include eucalyptus (*Eucalyptus* spp.), California pepper (*Schinus molle*), London planetree (*Platanus × hispanica*), crape myrtle (*Lagerstroemia* sp.), and lacebark elm (*Ulmus parvifolia*).

Training the architecture of these trees to resemble their forest-grown counterparts is a sound management practice. Most large-maturing trees will benefit from structural pruning, particularly when planted along streets and in other RAP-managed sites. In natural areas and undeveloped sites, such as portions of Ernest E. Debs Regional, Griffith, Elysian, and O'Melveny Parks with little or no public access, trees are allowed to grow naturally and, as a result, provide beneficial wildlife habitat.

Well-pruned trees with a dominant central leader are visually appealing and are efficient to manage.[1]



This figure shows the same forest-grown tree at five different life stages from seedling to maturity. The trunk grows upright toward the sunlight because the crown is shaded from the sides by surrounding trees (not shown). Most branches are in the top half of the tree. This dominant trunk form is considered a strong structure. Not all trees get this tall, but most grow with this type of habit in the forest. Forest trees are usually taller than they are wide.[1]

[1] Gilman, E.F. 2012, *An Illustrated Guide to Pruning*.

Park Trees with Decurrent Growth Habits

Trees on open sites, such as city streets, parks, and landscapes, receive abundant sunlight and experience limited competition. Hormones interact to produce lateral, instead of mostly vertical, growth. An example of this growth habit can be found in the native coast live oak (*Quercus agrifolia*). While this broad, spreading crown without a central leader is natural, such a form is best suited to large sites where clearance or risk mitigation is not a requirement. Based on contributions to the University of California Western Tree Failure Database, the coast live oak is among the most failure-prone species present in California (University of California Agriculture and Natural Resources, 2014).

A dormant oak tree, trained for the past ten years using the structural pruning principles, is demonstrating the benefits of structural pruning techniques.

Making a Plan

Before making any cuts, several considerations should be made, including tree health, species characteristics, size and type of cut, and regional climate.

Maximum Critical Diameter

The largest size pruning wound the tree can tolerate before health is compromised is called the maximum critical diameter. Some species are known to be genetically weak or strong compartmentalizers (Gilman, 2002). However, a visual assessment can provide clues to the arborist on whether or not a large pruning wound is advisable. Are old wounds actively closing? Do existing large wounds have visible decayed wood or cavities?

Ultimate Clearance Requirement

Determine the lowest branch of the permanent canopy. On young trees, it may be assumed that every branch below a certain height—20 feet, for example—is temporary and will eventually require removal for clearance. If temporary branches are kept short and small, when their eventual removal is required for clearance, the wound at the trunk is also relatively small (between one and three inches in diameter is preferred).

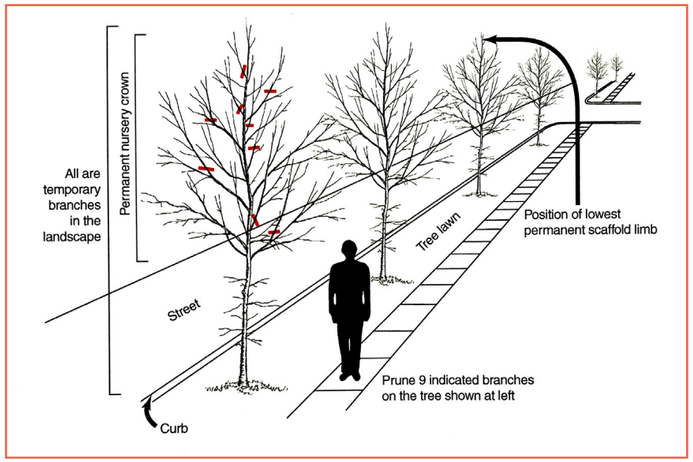
Choice of Cuts

Reduction cuts are core to structural pruning practices, as are skillful reduction and appropriate heading cuts. A reduction cut effectively removes growth from the ends of branches, encouraging other parts of the tree to grow larger (specifically the trunk and central leader). Reduction cuts are useful for subordinating aggressive branches, maintaining short temporary branches, or slowing the growth of scaffold branches. Detailed descriptions of each can be found in the ANSI A300 (Part 1)—2017 Pruning Standard Practices.

Structural and Wood Strength Characteristics

RAP Arborists pay attention to the structural and wood strength characteristics of commonly planted park species. These characteristics are used by staff to determine pruning needs and even help predict and prevent tree failure. Poorly structured species and soft wooded species commonly experience limb failure whereas well structured species and hard wooded species commonly do not. See below for examples in each category:

Poor Structure	Good Structure	Soft Wooded	Hard Wooded
Carob (*Ceratonia siliqua*)	Chinese pistache (*Pistacia chinensis*)	Alder (*Alnus rhombifolia*)	Most oaks (*Quercus* spp.)
Brazilian pepper (*Schinus terebinthifolia*)	Tulip tree (*Liriodendron tulipifera*)	Cottonwood (*Populus fremontii*)	London plane (*Platanus x acerifolia*)
Ornamental pear (*Pyrus calleryana*)			Chinese elm (*Ulmus parvifolia*)
Silk oak (*Grevillea robusta*)			Eucalyptus (*Eucalyptus* spp.)
Tipu (*Tipuana tipu*)			



Many recently planted trees along streets and in other locations have no permanent branches on the tree at planting. All branches are temporary in the sense that they will be or should be removed as the tree grows taller. On all but the most narrow, upright tree types, do not allow existing branches to grow upright because they are too low on the trunk to become a permanent part of the crown. Prune so branches grow horizontally by using reduction cuts. That way, they are sure to be removed as they grow (see nine pruning cuts on the left tree).[1]

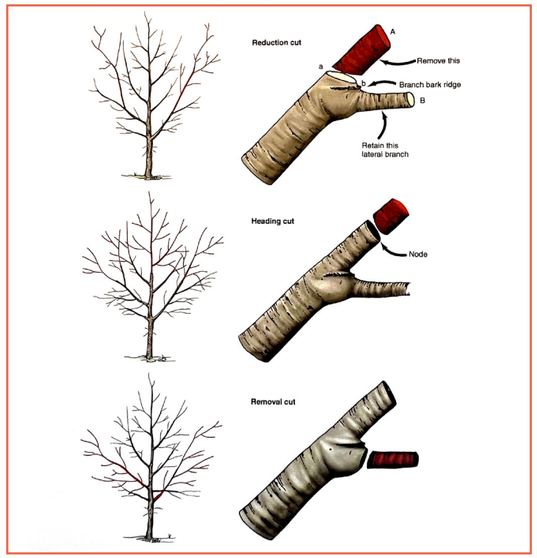
[1] Gilman, E.F. 2002. *An Illustrated Guide to Pruning*

Branch Aspect Ratio

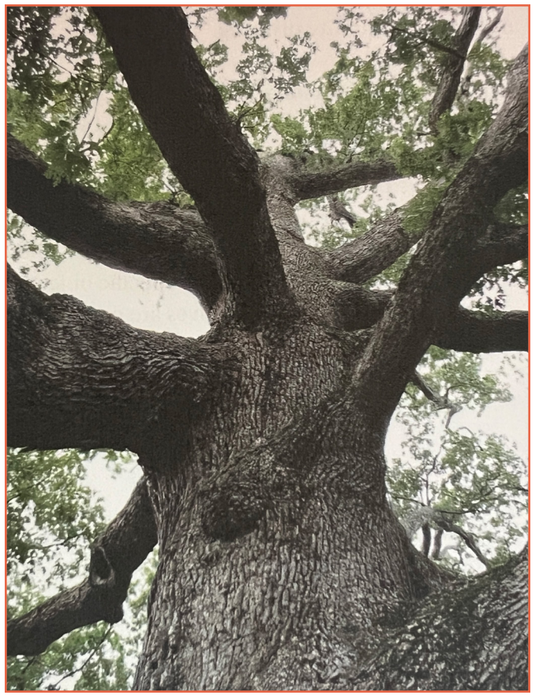
Branch aspect ratio is the ratio of a branch (A) relative to the size of its parent branch (B) measured just beyond the branch union (i.e., A:B) (Lilly et al. 2019). For example, a branch measuring 3 inches in diameter that is attached to a parent branch measuring 6 inches in diameter has an aspect ratio of 1:2 or 50% (3 ÷ 6 = 0.5). In contrast, a branch measuring 5 inches in diameter that is attached to a parent branch measuring 6 inches in diameter has an aspect ratio of 5:6 or 83% (5 ÷ 6 = 0.83). Branch aspect ratio is a better indicator of the strength of a branch attachment than the branch angle. Generally, branches and parent branches with smaller branch aspect ratios have more branch wood overlap (i.e., branch collar) and are more strongly attached. A branch collar helps prevent breaks at the branch union by distributing that stress to weaker parts of the branch (away from the branch union or trunk). Additionally, branch protection zones, chemically rich tissues that prevent the spread of decay into the parent branch or trunk when the branch dies or is removed, form more readily in branches with smaller aspect ratios.

Working the Plan

The fundamental purpose of structural pruning is to select and develop a single dominant leader with branches that are smaller in diameter than the trunk. The central leader does not have to be perfectly straight but simply larger in diameter than primary branches, ideally two-to-one or greater.



A reduction cut (top) is made back to a branch (B) no smaller than about one-third (minimum) to one-half (preferred) the diameter of the cut stem (A). Making the cut from "a" to "b" rather than cutting from "b" to "a" reduces the likelihood of the union splitting. A heading cut is made back to a node or bud (center). A removal cut is made back to the collar (bottom).[1]



A white oak (*Quercus alba*) with a dominant leader and branches that are smaller than the trunk. [1]

[1] Gilman, E.F. 2002. *An Illustrated Guide to Pruning*

In order to select a dominant leader, especially in younger trees, removal, reduction, and/or heading cuts will be necessary to subordinate or remove competing stems. Retain branches that are spaced well apart, are spaced radially around the trunk, and are less than half the diameter of the trunk.

Arborists remove branches that are damaged, diseased, or have formed included bark (Downer, 2004). Knowing the ultimate clearance requirement for the site will dictate if a branch should be allowed to grow naturally or if it should be considered temporary and be shortened/subordinated. Retaining low yet short branches is important to evenly distribute wind and maintain vital leaf area available for photosynthesis. To achieve sustainable structure, removing or subordinating other stems/branches that will contribute to weakness or are prone to failure, such as vertically oriented stems, branches with narrow unions, and overextended branches, will likely be necessary.

Before Pruning

After Pruning

Spatial benefits of structural pruning, before and after. [1]

[1] Gilman, E.F. 2002. *An Illustrated Guide to Pruning*

Achievements of Structural Development Pruning

Development of good structure may take decades, but there are clear benefits, including:

- **Resilience and risk reduction—**Trees pruned with defect removal and weakness mitigation in mind are better equipped to withstand storms, strong winds, and increased loads of a growing canopy.
- **Lower maintenance costs—**When small cuts are made, smaller tools and equipment can be used to remove, handle, and process biomass.
- **Minimal injury to the tree—**Small cuts close faster and may resist decay-causing organisms.
- **Maximize benefits—**The City's investment in site preparation, species selection, tree installation, irrigation, and maintenance can be returned to the community when trees are well positioned to live to their full potential lifespan.
- **Aesthetics—**When clearance pruning becomes necessary, disfiguration of the canopy is avoided by early training. Temporary limbs remain small and growth of the crown is trained away from above-ground conflicts.

Structural development may be the most important technique to ensure a tree's long-term viability. This methodology is proven to be effective at achieving a structurally sound tree, especially when applied to large-maturing trees. Structural pruning encourages vertical growth, which anticipates and allows for the need for eventual necessary clearance while minimizing weakness and defects.

Structural pruning is not a one-time effort. As trees continue to grow, structural pruning should be the primary objective each time a tree is pruned, with other objectives being secondary. RAP is committed to maximizing trees' lifespan, investment, and environmental benefits by utilizing structural pruning principles.

3.3.3 TYPES OF PRUNING

The RAP Forestry staff evaluate trees from the ground before determining the type of pruning that is required to meet the desired objective.

Considerations are based on tree species and can include the following:

- Species growth characteristics.
- Time of year.
- Tree form (e.g., excurrent or decurrent).
- Tree condition (health).
- Tree structure (presence of weaknesses or defects).

Staff determines from the ground what limbs need to be removed to achieve or enhance a tree's structural integrity, appearance, or desired size.

Types of pruning include[1]:

- Structure.
- Crown cleaning.
- Thinning.
- Raising.
- Reducing.
- Restorative.
- Palm and conifer.

[1] The most current version of *Best Management Practice—Pruning* does not reference the different types of pruning.

Pruning for Structure

Structural pruning is the removal of live branches and stems to influence structural integrity. It usually follows three procedures:

1. Development or re-establishment of a dominant leader.
2. Establishment of the lowest permanent scaffold limb.
3. Establishment of structurally sound scaffold limbs by removing competing stems or branches and leaving branches with a diameter less than 1/2 (ideally 1/3 or less) of the trunk (or parent branch).

Pruning to Clean

Cleaning is the selective removal of dead, diseased, detached, rubbing, and broken branches. This type of pruning is done to reduce the risk of branch failure and the transmission of decay, insects, and diseases.

Pruning to Reduce Density

Reducing crown density requires strategic removal and reduction of the largest branches within a tree's outer crown. This is often prescribed to temporarily increase air and light penetration. However, if improving structure is considered first, a secondary result is often a reduction in crown density. Reducing or removing the central leader is not typically appropriate. Excessive removal of live interior and lower secondary branches results in the concentration of growth at branch ends is known as "lion-tailing" and is not acceptable.

Pruning to Raise

Raising is the selective removal of branches to provide vertical clearance. Caution must be taken to not remove too many lower branches. This can lead to slow development of trunk taper, cause cracks or decay in the trunk, or transfer too much weight to the top of the tree.

Pruning to Reduce

Reduction is the selective removal of branches and stems to decrease the height and/or spread of a tree. This type of pruning is done to minimize the risk of failure, to reduce height or spread, for utility clearance, to clear vegetation from buildings or other structures, or to improve tree appearance. Crown reduction shall be accomplished with reduction cuts rather than heading cuts.

Pruning to Restore

Restoration is the selective removal of branches, sprouts, and stubs from trees that have been topped, severely headed, vandalized, lion-tailed, broken during a storm, or otherwise damaged. Full restoration usually requires several pruning events over a number of years.

Pruning Palms

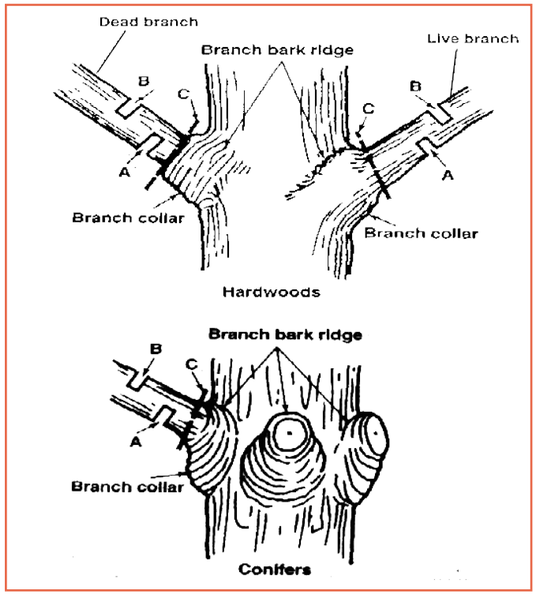
Palm pruning primarily removes dead and chlorotic fronds. Green fronds growing at an angle of more than 45 degrees from horizontal shall be retained. RAP Forestry staff minimizes the risk of disease transmission by pruning green fronds of *Washingtonia* and *Phoenix* species with handsaws disinfected in one-percent bleach solution after each tree is pruned.

Pruning Conifers

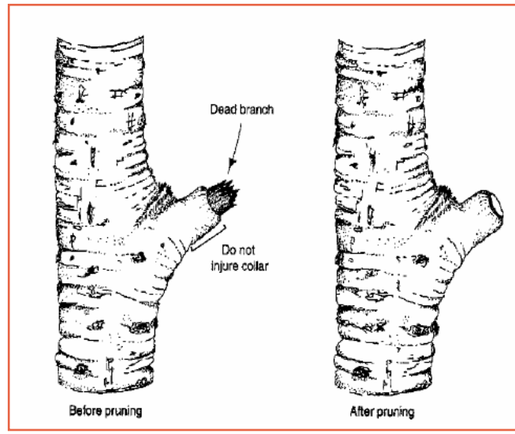
Conifers are primarily pruned to control the density of branching, the shape of young trees, and the size of older ones. They are intolerant of topping or heading. Conifers typically have an excurrent growth habit, which is usually maintained throughout the lifespan of the tree. RAP strives to prune conifers outside of hot summer months when the infestation of the bark beetles is more likely to occur. Thinning, by the selective removal of small branches, is the most appropriate method when pruning conifers.

3.3.4 PRUNING CUTS

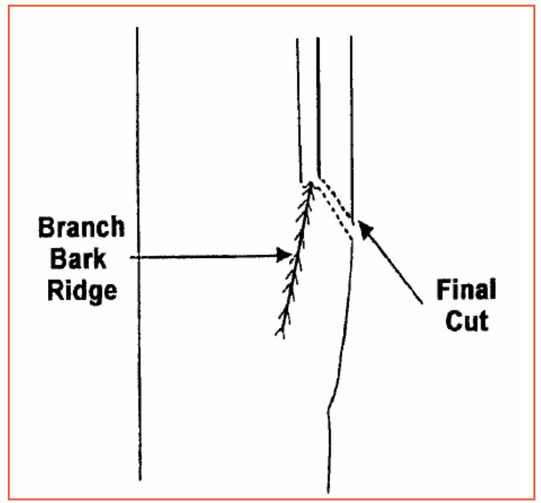
A proper pruning cut causes very little injury to the adjoining stem. When the pruning cut is properly made, a ring of woundwood forms above and below the wound during the first growing season after the cut. Pruning cuts are not covered with wound dressings or sealants. RAP typically uses two types of cuts: "Branch removal cuts" and "reduction cuts." "Flush cuts," those made *flush* with the parent stem, removes chemical barriers that counter decay and is not an accepted practice.



The first cut (A) undercuts the limb. The second cut (B) removes the limb. The final cut (C) should be just outside the branch collar to remove the resulting stub. A pruning cut that removes a branch at its point of origin shall be made close to the trunk or parent limb, without cutting into the branch bark ridge or collar, or leaving a stub. Branches too large to support with one hand shall be precut to avoid splitting of the wood or tearing of the bark.[1]



When removing a dead branch, do not cut into the swollen collar growing around the dead branch, even if it is large. Removing the collar from around the dead branch will injure the trunk since this is composed of trunk wood.[2]



A final cut that removes a branch with a narrow angle of attachment should be made from the outside of the branch to prevent damage to the parent limb.[3]

[1] Gilman, E.F. 2002. An Illustrated Guide to Pruning

[2] ANSI A300

[3] University of Illinois at Urbana-Champaign, Plant Health Care for Woody Ornamentals

3.3.5 TIMING OF PRUNING

Developing sustainable branching architecture is a key objective and is best applied early and often (see section 3.3.3). Proper structural pruning effectively "trains" growth to avoid inevitable clearance conflicts in the future and encourages desirable growth. By addressing any developing structural weakness early, the pruning cuts remain small, and the tree is best positioned to achieve good structure. Approaching pruning with these objectives leads to a long-lived, healthy, and beneficial tree.

Defects and growth habits that contribute to weakness should be addressed when they are discovered. Trees of any species with defects that pose a risk to public safety may be pruned any time of the year. Removal of dying, diseased, broken, rubbing, or dead limbs can also be accomplished at any time with little negative effect on the tree. Light pruning (removing less than ten percent of the foliage) can be performed safely on most species at any time, providing the trees are in good health.

Plant development can be slowed and plant size maintained if pruning takes place soon after the initial growth flush for the season (Lilly et al. 2019). Such pruning should not be so severe or so early as to encourage new shoot growth. If maximum dwarfing is desired, most plants should be pruned in the period from early to midsummer. This will reduce leaf area for the longest period.

Most deciduous plants can be pruned during the dormant period between leaf fall and the end of winter with similar growth results. Evergreens will be least compromised if they are pruned in the late winter. This also minimizes bark beetle attack on conifers.

Pruning when trees are dormant can minimize the risk of pest problems associated with wounding (attracting insects to fresh wounds) and can allow trees to take advantage of the full growing season to close and compartmentalize wounds. Avoid pruning trees, especially stressed trees, during or soon after the initial growth flush in spring. This is when the cambium is active and bark is particularly vulnerable to being torn loose.

Defining objectives for pruning may be easier during the growing season. Branches that hang too low from the weight of leaves or fruit and dead and weak limbs can be more easily spotted for reduction or removal.

It is a recommended practice to evaluate each tree before pruning. If necessary, alternate the schedule according to condition. For example, if oak tree dieback (caused by *Diplodia quercina*) is found, pruning should be performed between November and January. If oak twig blight (caused by *Cryptocline cinerescens* or *Discula quercina*) is identified, reschedule pruning during dry weather in the summer or fall. To prevent trees from the attack of boring insects, pruning should be performed during the least favorable time for these insects to relocate, commonly in cooler winter months.

During bird nesting season, RAP Forestry staff does not schedule large pruning projects for park trees. Forestry staff also take special precautions to watch for signs of bird activity on the ground and scout trees for occupied nests before beginning pruning projects. On occasions when the birds are present and the tree does not appear to be at risk, the pruning project is delayed for a few months.

Further reading on tree care operations and birds can be found in section 3.4.1 Tree Care for Birds and Wildlife.

3.3.6 PRUNING STRESSED TREES

Pruning is cutting into a tree's live tissue. Therefore, it is important to apply pruning practices that do not compound stress. This is especially true if pruning is performed on trees that are already stressed from various other factors. When a tree is stressed, its defense system is weakened. When defense systems are weakened and a pathogen is present, infection usually takes place and may result in tree decline.

- If the tree has been recently damaged by injury or disturbance, evaluate damage to the crown, trunk, and root system, the potential for failure and proximity to targets. Extensive cracks and damage may require complete tree removal. If removal is not necessary, prune to redevelop or improve structure, form, and appearance. Reduction and removal cuts should be used to prune broken branches back to intact living branches of suitable diameter. In storm damaged mature trees, heading cuts may be appropriate when a removal cut would, for example, result in large diameter wounds near the trunk. Decay in main stem heartwood increases the potential for whole tree failure. Retain sprouts that emerge following disturbance, as they are vital to the tree's recovery process. Over time, sprouts can be reduced or removed following structural pruning principles (Gillman, 2022).
- If the tree is stressed from receiving inadequate care, prune moderately (one third or less canopy removed) to achieve the specified objectives.
- Periods of drought are characteristic of Southern California's climate. Native trees in favorable sites are adapted to these conditions and can typically withstand gaps in precipitation. However, native and non-native trees alike face uniquely harsh conditions in the urban environment. These conditions are increasingly exacerbated by extreme weather events as a result of climate change (National Integrated Drought Information System, n.d.). Pruning removes stored energy, reduces photosynthetic area, and may increase stress and water requirements. Increased stress limits a tree's capacity to defend against insect and pathogen pressure. Therefore, during times of drought, unnecessary pruning should be avoided. If specifications and resources allow, non-critical pruning may be dispersed over a two- to three-year period. Removing dead, broken, or infested branches during drought is acceptable.
- Care must be taken to prune stressed trees during the best time of the season for the species and when common pests are not present.

3.3.7 PRUNING YOUNG TREES

The average life expectancy for trees growing in harsh urban conditions is less than 20 years. Pruning trees early can improve tree vitality and preserve structural integrity. They may be pruned at planting time to remove branches damaged during handling and transplanting and to establish the tree's permanent framework. Lower branches are typically retained as "temporary branches"—they serve to strengthen and protect the trunk. The following should be pruned:

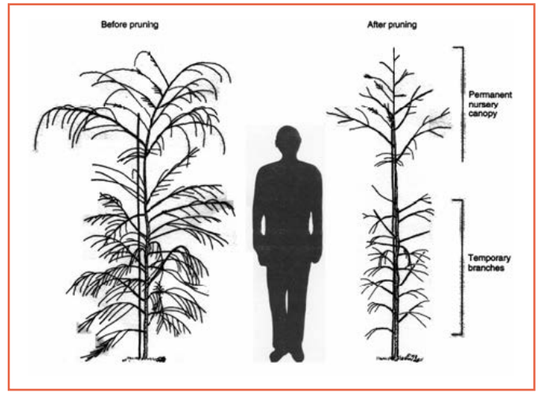
- Broken, dead, and diseased branches.
- Sucker growth arising from the base or watersprouts growing vertically from a branch.
- Crossing and rubbing branches.

Staking may be necessary to temporarily support, anchor, or protect young trees.

Subtle pruning cuts have a dramatic effect on the future structure of a tree. The goal is to develop trees with one dominant leader, strong and balanced scaffold branches, and good trunk taper and to correct weaknesses, such as included bark or codominant stems.

It is important for the field maintenance staff to:

- Monitor and adjust rubbing tree stakes and ties that are too tight. In a park setting, most properly developing trees should have stakes removed after one to three years.
- A temporary branch is considered to be any branch originating below the lowest chosen scaffold branch. Maintain temporary branches for the first three to five years after the tree has been planted. To allow mowing and prevent breaking, shorten temporary branches to 12 to 18 inches as shown below. For young trees with main stems less than one inch in caliper, retain temporary branches three-eighths of an inch or less in diameter.



Temporary branches on the lower part of the trunk are to remain for three to five years after planting. These branches will nourish the trunk, build caliper, and prevent over extension of the leader. Be sure to shorten any temporary branches growing into the permanent canopy.[1]

Temporary branches are crucial in the development of young trees. They allow for flow of photosynthates, nutrients, and water between the trunk and temporary branches and leaves. Temporary branches aid in the development of a robust tapered trunk and can result in a tree that withstands greater stress from wind, stands erect, and is better equipped to support a crown mass at maturity. These branches should be shortened to about 12 to 18 inches and remain for at least three to five years after planting. When they are permanently removed, they should be pruned according to established guidelines. Do not "flush cut" or leave stubs, which are invitations to disease.

Only RAP Forestry arborists shall prune young trees. RAP staff not authorized who prune young trees may face disciplinary action.

[1] Gilman, E.F. 2002. An Illustrated Guide to Pruning

Tree Pruning - Do

Hire a professional arborist
Hiring an ISA Certified Arborist is a good way to ensure trees are pruned properly and safely.

Inspect each tree
If the observed condition is beyond the original scope of work contact the manager and/or client immediately.

Establish pruning objectives
Different trees and tree species have unique growth habits and maintenance requirements. Address the specific needs for each tree. Consider the growth cycle and structure of individual species, site characteristics, and the type of pruning to be performed.

Promote good structure
Selective pruning promotes strong structure. Structural pruning should address issues with codominant branches and poor branch attachments, as well as establish the lowest permanent branches. Proper pruning results in cuts at the branch union where natural pathways promote compartmentalization and wound closure.

Prune trees to reduce risk
Pruning trees can mitigate safety hazards including providing clearance for pedestrians and vehicles, addressing structural defects, and removing dead or weak branches that have potential for failure.

Make the smallest diameter cut possible
Larger pruning cuts take longer to compartmentalize. Pruning cuts can serve as entry points for pests or decay pathogens.

Avoid excessive removal of live foliage
Pruning too much leaf surface area can cause unnecessary stress for trees. In general, healthy trees can sustain up to 25% loss of live foliage. This percentage should be reduced for older, mature trees.

Maintain pruning tools and equipment
Keep pruning tools sharp and disinfected to promote proper cuts and reduce the liklihood of spreading pathogens from one tree to another.

Establish a pruning routine
Regular pruning is essential for maintaining the health and structure of urban trees. Routine pruning removes dead or diseased branches, promotes proper growth, and enhances the overall appearance of trees.

Follow ANSI standards and ISA Best Management Practices (BMPs)
Pruning trees in accordance with ANSI standards and ISA BMPs ensures that trees are maintained safely and that pruning is less likely to cause long-term negative health outcomes for the tree.

Hire a Utility Specialist to maintain trees near overhead wires
Pruning trees near utility lines is extremely dangerous. All overhead wires should be considered energized. Trees that are within 10 feet of primary power lines may only be pruned by a certified line clearance worker.

Tree Pruning - Don't

Remove more than necessary
Avoid excessive pruning and over thinning. Loss of foliage impacts photosynthesis and other biological functions. Prune selectively and conservatively, focusing on maintaining a tree's natural shape and structure.

Prune in the wrong season
Pruning in the wrong season or during drought can harm trees. It is important to understand the optimal timing for each species.

Use improper pruning techniques
Avoid damaging the branch bark ridge or collar, or leaving a stub. Improper pruning techniques cause damage and create entry points for pests and decay pathogens.

Top trees
Topping results in stub cuts and adventitious growth. This improper pruning practice leads to weak, structurally unsound regrowth and makes the tree more susceptible to diseases and storm damage.

Thin or lace trees
As trees grow, branches develop in response to the environment. Pruning can disrupt this natural balancing act. Over thinning or "lacing" trees exposes remaining limbs to more direct impacts from wind and sunlight, making trees more susceptible to sun damage and structural failure.

Lion tail
Lion tailing is a harmful pruning practice where interior and lower lateral branches are removed. This concentrates foliage and weight at the ends of branches and results in a structure that resembles a lion's tail. Lion tailing removes a valuable food source (leaves) and increases the likelihood of limb failure.

Topping.

Lion tailing.

3.4 Biodiversity and the Urban Forest

Los Angeles is bordered by Santa Monica, Santa Susana, and Verdugo mountains as well as the Pacific Ocean. These diverse landscapes make LA a "Global Biodiversity Hotspot" for wildlife and plantlife. Within the city, there are a number of microclimates, each supporting a unique biodiversity. Despite being densely populated and fragmented by a vast freeway system, LA is home to more than 1,200 native species (2018 and 2022 Biodiversity Reports[A]). While it is important to emphasize native flora and fauna, it is equally important to recognize the valuable ecosystem services that non-native species provide in urban environments. RAP-managed parks and natural areas are home to a significant portion of urban wildlife and plantlife, including a diverse public tree resource, comprising nearly 500 different woody species. When looking at California cities that have public tree inventories, LA is one of the most species-rich (Love et al. 2022[B]). There are relatively few native tree species to the area and many are not adapted to the cityscape.

Species diversity and abundance in a given area can be measured using a diversity index. In 2018, LA created a baseline report based on the "Singapore Index of Cities' Biodiversity" (2018 Biodiversity Report[A]). Then, as outlined in LA's 2020 Biodiversity Report[A], the City developed a set of customized indicators called the "LA City Biodiversity Index," which is tailored to LA and is used to measure biodiversity and track changes over time. The evaluation helps to guide the City in protecting, enhancing, and mitigating impacts to biodiversity toward the no-net-loss target. The report acknowledges that "biodiversity stewardship is central to cities' ability to provide urban forest cooling benefits" and both public and private property are central to increasing greenspace and habitat. One of the indicators in the LA Biodiversity Index "Neighborhood Landscape/Tree Canopy Footprint" is focused on urban greening throughout LA. Scores are given based on the change (increase or decrease) in landscape/tree canopy over time.

The 2018 Biodiversity Report[A] outlined recommendations relating to the urban forest, including:

- Plant trees in locations that maximize the benefits received (e.g., increased shade, walkability, traffic calming).
- Estimate carbon storage and sequestration (RAP uses i-Tree tools[C]).
- Plant long-lived and/or low-maintenance trees for better carbon sequestration.
- Plant fast-growing species where immediate shading is desired.
- Explore additional tree species that are suitable for current and future climates.
- Plant native species where appropriate.
- Plant species that attract birds.

RAP takes the management implications and recommendations associated with this indicator into consideration during regular work planning and visioning.

3.4.1 TREE CARE FOR BIRDS AND WILDLIFE

Wildlife provides many services such as seed dispersal, pollination, and carbon and nutrient cycling and creates a sense of place and belonging. When managing trees, RAP takes measures to reduce the impact on birds and other wildlife to help keep urban forest managers and wildlife safe. Since 1918, the Migratory Bird Treaty Act has been in place to support the conservation of bird species and outline unlawful activities to promote their success. The Western Chapter ISA has compiled research-based best management practices to lessen the impacts on wildlife and promote wildlife habitat during tree care operations (Bassett et al. 2021).

In addition to understanding the Act and participating in training on best management practices, RAP modifies their pruning schedule to accommodate bird nesting and has gained some knowledge about the potential bird and wildlife species that may be encountered, as well as their nesting and feeding activities. RAP modified pruning practices, when possible, to leave downed trees and snags because they create bird and wildlife habitat. However, public safety and fire mitigation take priority.

The following actions are best management practices that field maintenance staff should consider in order to avoid wildlife conflicts and minimize disturbances (Bassett et al. 2021):

- Be aware of wildlife in the area.
- Assess habitat quality and determine the breeding season of local wildlife (e.g., bird nesting is typically February through August in Southern California).
- Conduct pre-work inspections to identify any wildlife or active nests present at the work site.
- Leave nests, eggs, or young in trees.
- Minimize disturbances by taking nest status, distance from nest, temperature, duration of project, and proper tool selection (e.g., hand tools) into consideration.
- Create no mow zones under tree driplines to create pollinator habitat and nesting sites.
- Schedule inspections in rare situations where permission is needed to remove a tree with an active nest.
- Be trained and prepared for encountering wildlife encounters.
- Consult or provide wildlife-trained arborist or a wildlife biologist when encounters are likely or with questions on how to best work in the case of encountering wildlife.
- If injured wildlife is found, call the numbers listed on this card or another wildlife rehabilitation service.

If work has to be performed on trees during the nesting season, trees are evaluated by a wildlife expert and an appropriate buffer zone is established (Appendix M).

An added benefit of promoting wildlife is the natural biological controls of what are commonly considered pest species for urban trees. For example, raptors provide control for rodents that commonly gnaw at the base of trees—sometimes girdling them—or that initiate tunneling damage in and around the root system. Birds and bats feed on insects, many of which can cause feeding damage to trees.

HAWK/OWL/FALCON: Call Ojai Raptor Center ORC
(805) 649-6884. Nighttime/after-hours emergency call/text (805) 798-3600

WATER BIRDS LIKE PELICANS OR GULLS:
International Bird Rescue at (310) 514-2573

OTHER WILDLIFE: CA WILDLIFE CENTER (CWC)
(818) 222-2658. Text photos to CWC at (818) 415-7269

HELP WITH CAPTURE OR COORDINATING TRANSPORT: Courtney McCammon
(949) 285-7096 (RAP Urban Ecologist) OR Park Ranger (323) 644-6661

UNABLE TO REACH WILDLIFE REHAB OR TRANSPORT VOLUNTEER:
Call LA Animal Services at (888) 452-7381. They can capture and coordinate with rehab.

INJURED WILDLIFE??

PARK PROUD LA

A — Biodiversity Reports

B — "Diversity and structure in California's urban forest"

C — iTree Tools

Building Bird, Bat, and Bee Houses

While it is most important to provide habitat, including food and nesting resources for birds, bats, and insects, supplemental structures can be incorporated into the landscape. Some information is available on the optimal placement for nesting/roosting boxes that can be used by birds, bats, bees, and wasps. RAP has been partnering with community members and organizations such as the Western Los Angeles County Council Scouts Program to build and incorporate raptor nesting boxes.

RAP encourages and supports opportunities to collaborate with groups and organizations to help build and incorporate nesting/roosting boxes, and/or aid in landscape restoration, including:

- **Western Los Angeles County Council Scouts Program.**
- **Los Angeles Unified School District (schools that have Agriculture and/or woodworking programs or classes).**
- **University of California Agriculture and Natural Resources Cooperative Extension.**
- **Natural History Museum of LA County.**
- **Los Angeles Zoo.**
- **Internal City Departments focused on biodiversity (e.g., LA Sanitation & Environment).**

3.4.2 USING THE URBAN FOREST TO FOSTER SUITABLE HABITAT FOR WILDLIFE

Plant management techniques can be used to increase habitat quality for wildlife, including:

- Follow best management practices for tree establishment, care, and removal.
- Maintain mature trees.
- Trim mature trees to reduce risk, but maintain material when possible to provide habitat.
- When public safety allows, leave some dead, dying, or declining trees.
- Increase species, age, and spatial diversity within the urban forest.
- Use trees to create stepping stones, corridors, or other connections to strategically foster wildlife movement and increase habitat connectivity.
- Promote healthy soils by incorporating compost, biochar, mulch, and leaving organic matter (e.g., grass clippings and leaf litter).
- Use pest control tactics that minimize the risk to non-target organisms (i.e., avoid the use of pesticides as they can harm biodiversity and be detrimental to the environment and human health).
- Reduce the amount of invasive plant species and areas of turf.
- Integrate shrubs and groundcovers.
- Plant native species of trees, shrubs, groundcovers, and bunchgrasses, especially species that support pollinators and other insects.
- Leave some areas of bare ground and tall grasses for the various species of ground nesting bees.
- Ensure there are flowering plants available for pollinators throughout the growing season (Xerces Society, n.d.).
- Rather than removing all material, incorporate dead wood and decaying tree parts into landscapes as potential habitat.
- Promote ongoing biodiversity projects in the LA area on both public and private land (e.g., wildlife connectivity) and support the City's 2017 Biodiversity Motion.
  - » Los Angeles Sanitation
  - » Los Angeles Sustainable Development Goals
  - » Los Angeles-proposed Ridgeline Protection Ordinance

3.4.3 URBAN FOREST DIVERSITY IN A CHANGING CLIMATE

Research on climate change in complex urban ecosystems is challenging and still evolving. In LA, regional climate projections estimate that the urban forest could face significant damage due to excessive heat and flooding. Under a high emissions scenario, average annual daily temperatures are predicted to rise by approximately 4.8 °F to 7.9 °F, and precipitation patterns may vary up to ten percent from current levels by the end of the century (Cal-Adapt, 2022). Although there is no clear consensus on the future outcomes, it is thought that extraordinary weather events are likely to increase in years to come. As temperatures rise and precipitation patterns fluctuate from historical norms, existing tree species must adapt or succumb to the changes in climate. Impacts on Los Angeles' urban forest and RAP's program may include:

- Health and structural impacts on tree species that are not adaptive to new and changing conditions.
- Increased incidence in pests and disease as well as susceptibility as a result of changes in temperature, precipitation, and tree stress.
- Additional costs for mitigation and tree removal for marginal species and individual trees.
- Canopy loss, especially where key species (e.g., predominant species) become marginalized.

Tree species can adapt to climate change by contracting or changing their range (e.g., expanding northward or to a higher elevation). In a study of North American tree species, more than half were contracting their ranges in response to climate change (Zhu et al., 2012). While native tree species are important components of the urban forest, non-native landscape species should also be considered for their ability to withstand harsh urban environments.

The impacts of climate change will also differ depending on the region. In LA, there are several microclimates, each can support some unique tree species. The different microclimates in LA are coastal and inland. Therefore, RAP manages parks within each microclimate differently, especially for tree species selection and irrigation.

Increasing species diversity and tracking species performance can help managers determine suitable species and lessen the detrimental consequences in the event that one or more species are more susceptible to changes in climate and urbanization. Staff are following the results of UC Davis' Climate Ready Trees program to incorporate species that have been identified as suitable candidates for future predicted climate conditions. These species are identified in the climate ready tree list (Appendix J).

3.5 Prohibited Acts

Any damaging acts or excessive alterations to protected trees are prohibited. We discuss a few of the most common harmful practices below.

3.5.1 EXCESSIVE PRUNING

The most common offense in urban areas is excessive pruning. People often see different tree pruning styles and assume that these practices are good for trees.

Forestry staff are cautious to trim only as much as necessary to achieve these results: a healthy and beautiful tree, increased public awareness, and the greatest ecological benefit.

3.5.2 TOPPING AND HEADING

Topping is the indiscriminate cutting back of tree branches to stubs or to lateral branches that are not large enough to assume the terminal role. Topping disregards the plant's long-term health and structural integrity.

Other names for topping include "heading," "tipping," "hat-racking," and "rounding over." A common misconception is that a tall tree poses a hazard, and its height should be reduced to make it safer. Topping may reduce the hazard in the short term, but is not a viable method for height reduction.

"Topping is perhaps the most harmful tree pruning practice known. Yet despite more than 25 years of literature and seminars explaining its harmful effects, topping remains a common practice."

ISA, WHY TOPPING HURTS TREES

Topping Stresses Trees

Topping often removes 50 to 100 percent of the leaf-bearing crown of a tree. Since the leaves are the "food factories" of a tree, topping can temporarily "starve" a tree. The severity of the pruning triggers a kind of survival mechanism. The tree activates latent buds, forcing rapid growth of multiple shoots below each cut. The tree needs to form a new crop of leaves as soon as possible, and if it doesn't have the stored energy to do this, it is seriously weakened and may die.

A stressed tree is more vulnerable to insect and disease infestations. Large, open pruning wounds expose the sapwood and heartwood to attack. The tree may lack sufficient energy to chemically "defend" the wounds against invasion. Some insects are actually attracted by chemical signals to stressed trees.

Topping Causes Decay

Cuts made along a limb between lateral branches create stubs. The tree may not be able to close these wounds and the exposed tissues are subject to decay. Normally a tree will compartmentalize these decaying tissues, but few trees can defend against multiple, severe wounds caused by topping.

Topping Can Lead to Sunburn

When leaves are removed, the remaining branches and trunk are suddenly exposed to high levels of light and heat. The result may be sunburn of the tissues beneath the bark. This can lead to cankers, wood decay, bark splitting, and death of some branches.

Topping Makes Trees Ugly

The natural branching structure of a tree is a biological wonder. Topping removes the ends of the branches, often leaving ugly stubs. Topping destroys the natural form of a tree.

Topping May Create Hazards

Stubs left from topping usually decay. Shoots that are produced below the cut are often weakly attached and may be at risk of failure. Unlike typical branches that develop normally, only the outermost tissue layer of the parent branches is connected to these new shoots. The new shoots grow quickly and may become heavy and prone to breakage.

3.5.3 OTHER PROHIBITED ACTIONS

- "Lions tailing." This practice removes all or most secondary and tertiary branches from the interior portion of the crown, leaving most live foliage at the perimeter of the canopy.
- Excessive root pruning that damages more than 25 percent of the root zone. Limiting root pruning operations to a distance at least 6x DSH away from the trunk will minimize consequences to both tree health and stability (see sections 4.2.5 and 4.2.6).
- Excessive tree raising.
- Compacting soil within the dripline because of unnecessary driving or parking.
- Recreation activities that will damage trees.
- Excessive pruning to accommodate solar panels[1] or property views.

[1] The City does not have a policy to address solar and tree conflicts; RAP follows state law. RAP recognizes the importance of both solar infrastructure and the urban forest.

California's Solar Shade Control Act requires specific and limited controls on trees and shrubs. It restricts the placement of trees or shrubs that cast a shadow greater than ten percent of an adjacent existing solar collector's absorption area upon the solar collector surface between the hours of 10 a.m. and 2 p.m. The Act exempts trees or shrubs that were: (1) Planted prior to the installation of a solar collector, (2) On land dedicated to commercial agricultural crops, (3)Replacement trees or shrubs that were planted prior to the installation, and/or (4) Subject to city and county ordinance.

RAP Standards for Clearance Pruning

RAP uses minimum standards for pruning in order to keep the parks safe. Clearance pruning applies to the following:

- **At least nine feet over sidewalks.**
- **At least 14 to 20 feet over roads.**
- **At least six feet clearance over buildings.**
- **Security cameras and lights (illuminating walkways, buildings, ball diamonds, and parking lots) are adequately cleared on a regular basis.**

3.6 Maintaining Tree and Turf Association

Trees and turf are mutually exclusive in nature. It is rare to see many trees growing in grasslands and, conversely, grass is not common on the forest floor. Each plant group has its own demands and strategies to inhibit the growth of the other, leading to competition for water, nutrients, sunlight, and rooting space. Turf requires morning sunlight for optimum growth, health, and stand density.

3.6.1 MULCHING AS TURF ALTERNATIVE

Golf course design considers tree location and species selection with respect to placement of turf areas. RAP uses many design alternatives at their golf courses—for example, aligning maintenance requirements by using indigenous plants or using mulch to minimize compaction and enhance tree health. RAP also uses designs that reduce the amount of turf in parks to decrease their water use. More information is provided in Appendix L, Training Topic 3—Trees and Turf Associations.

3.6.2 MOWING AND OTHER EQUIPMENT

Mowing equipment, spray rigs, aeration equipment, and skip loaders can all cause irreversible mechanical injury to trees. Severe damage can occur and tree trunks can eventually become girdled and die when trees are hit repeatedly with equipment such as string trimmers. Sometimes referred to as "mower blight," trunk wounds also serve as entry points for diseases, borers, or other insects.

RAP commonly uses mulch around trees as a deterrent against this kind of damage. Tree guards are also used to protect the trunks of young trees. Tree guards should be routinely examined and either readjusted or removed as trees mature.

Crew working in trees.

3.7 Plant Health Care

Plant Health Care is a plant management program that consists of routinely monitoring landscape plant health and individualized plant management recommendations in order to maintain or improve the vitality, appearance, and safety of trees and other plants. Plant Health Care approaches take preventative measures and eco-smart products into consideration.

3.7.1 WATERING PRACTICES

Water needs of trees vary by species, tree age, soil type, microclimate, and environmental conditions. The relationship between soils, plants, and water is a complex subject and is only briefly discussed in this section.

Supplemental irrigation for mature trees should be deep and infrequent. Deep watering can increase drought tolerance and encourage deep roots less likely to damage hardscape. Excess irrigation can promote root-rotting fungi and lead to tree decline, whereas frequent shallow watering encourages surface roots that provide poor anchorage.

Watering frequency depends on temperature, humidity, wind, soil type, irrigation system, and drainage. RAP uses a soil probe to determine soil moisture and establishes its irrigation schedules accordingly. Smart controllers are available but not currently set up to run off of weather stations. The current irrigation practices do not take the kind of sprinkler head into consideration. RAP endeavors to water in the early morning when rates of evaporation are lower, irrigation is less likely to interfere with park activities, and foliage is allowed to dry during the day—an important consideration for trees that are susceptible to fungal-related foliar diseases.

Water-holding capacity is the amount of water versus air filling the soil pores or spaces. When all of the soil pores are filled with water, the soil is considered saturated. When a portion of the water has drained out of the soil pores from gravity, the soil is at field capacity. Different landscape settings and soil types have varying field capacities. Soil texture and structure (i.e., the sand, silt, and clay content and their aggregation) changes how quickly water moves through the soil (Fields-Johnson and Abbott, 2020). An optimal watering schedule regularly brings the soil back to field capacity.

The two microclimates in LA have unique rainfall patterns and soil types. Despite this, irrigation is the same across microclimates with varying needs. RAP is interested in better understanding the soil type and its water-holding capacity in the parks to match the amount of irrigation to the setting and irrigation emitters present at the site. This will allow RAP to determine the amount of water needed to irrigate more accurately based on the water demand of the site. To help determine the amount of water, the UCANR Landscape Water Requirement Calculators, built upon the ANSI/ASABE S623 Standard, "Determining Landscape Plant Water Demands," can be used.

Proper irrigation is key to the survival of newly planted trees. If rainfall is not sufficient for tree establishment, supplemental water is necessary. The best indicator is to probe the root zone, adjacent to the root ball to determine the moisture content of the root ball.

RAP largely uses overhead irrigation but tries to avoid irrigation that wets tree canopies and/or tree bases, especially of those trees that are susceptible to foliar diseases or diseases caused by crown- or root-rotting fungi.

Native trees adapt to environmental conditions of the region and after establishment rarely require supplemental irrigation. Planting native and drought-tolerant trees in turf-dominated city parks requires careful irrigation management.

More information on watering practices can be found in Appendix L, Topic 4—"Watering Practices" and Topic 7—"Maintaining Young Trees."

3.7.2 WATERING DURING DROUGHT

During periods of drought, trees need supplemental water to prevent stress and areas of dieback. Trees are a long-term investment, and drought can cause lasting stress, resulting in costly damage. Typically, the impacts of drought take several years before trees die, but there are some early signs, such as premature fall color and leaf drop and greater susceptibility to insects and disease.

Typically, irrigated parks are watered three times per week in a way that does not produce runoff. Supplemental water is necessary to maintain greenspaces and the many benefits they provide in urban areas like LA, especially during times of drought. In California, nine percent of the total statewide water use goes toward irrigating both public and private landscapes. Of this, two percent of the water is used to irrigate large parks/gardens (Hodel and Pittenger 2015). Adequately irrigating park lands will not significantly contribute to overall water use but ensures the benefits provided to residents, including wildlife, are sustained for the future.

Drought impacts LA municipal parks differently. Parks with open spaces and natural areas that are not irrigated can have trees that incur severe impacts on survival as a result of drought. Even

parks that receive regular irrigation can be impacted by drought when they do not receive their typical water regime. Inadequate water during times of drought could be a result of water restrictions, turf reduction, or other instances where the trees were accustomed to receiving a greater amount of water. Drought commonly predisposes trees to additional stressors. For example, Botryosphaeria canker diseases appear on multiple kinds of park trees following drought stress (e.g., ficus, olive, and sweetgum).

Watering restrictions are enacted for irrigated park lands during droughts. Watering restrictions do not take the location and associated microclimate of the park, soil type, irrigation infrastructure (e.g., emitter type, sprinkler type), or the needs of the tree resource into consideration. While exemptions are permitted, they are difficult to obtain and it is common for parks to be so large that an irrigation cycle cannot occur in the time period given. As a result, park trees are suffering. For example, the 2015 drought was thought to have caused four percent of park trees to die (approximately 14,000 trees). Ensuring that LA parks are watered adequately during drought will require reasonable exemptions from water restrictions.

To promote the conservation and efficient use of water, a Model Water Efficient Landscape Ordinance (MWELO) was adopted by the state of California in 2009 and later revised in 2015. The Ordinance requires increases in water efficiency standards for new and retrofitted landscapes through the use of more efficient irrigation systems, greywater usage, and onsite stormwater capture. It also limits the portion of landscapes that can be covered in turf.

RAP has taken additional measures to help reduce evaporation and adapt to drought and heat impacts on the park tree canopy, including:

- Using mulch around trees.
- Reducing the amount of turf by transitioning from turf to mulched and landscaped areas.
- Planting new trees between October and April.
- Installing irrigation bubblers at the tree's dripline to provide deep watering during improvement projects.
- Using reclaimed water when possible.
- Identifying priority areas where park trees should be prioritized for watering during times of drought.

Climate change poses uncertainty to whether typical rainfall patterns will occur or not. LA has been getting hotter and drier, droughts are increasingly common and a reality RAP is preparing for. As droughts and water restrictions become more normal, RAP will need to find creative ways to water.

Irrigating with Reclaimed Water

A number of LA municipal parks are irrigated using reclaimed water. To do so, wastewater is recycled through a process that converts it into a form of reusable water. As of 2022, eight golf courses, nine entire parks, and sections of Woodley Park and Griffith Park are watered using reclaimed water. This practice is beneficial because reusing wastewater provides a constant and ample water supply that is not impacted by droughts, allowing parks that use reclaimed water to be irrigated more regularly. Retrofitting the irrigation systems in established parks to allow for the use of reclaimed water is a very expensive endeavor (approximately $1 million/mile). Therefore, it is more common for parks to be set up with irrigation that uses reclaimed water during new construction and capital improvement projects.

Golf Courses

Hansen Dam
Woodley Lakes
Encino
Balboa
Wilson
Harding
Roosevelt
Los Feliz

Parks by Region

Valley	Metro	Griffith Park Sections
Balboa Park	Albion Riverside/ Downey Recreation Center	Bond Area
Barry Sanders All Access Sports Field	Rio De Los Angeles	Bette Davis/Pump 7
Delano Park		CETA Forest/Old Maintenance
Lake Balboa/Anthony Beilenson Park		Crystal Springs
Sepulveda Sports Complex		Merry-Go-Round/Dry Wash
Woodley Apollo Flight Field		Mineral Wells
Woodley Cricket Field		Old Zoo
Woodley Sections 1,2,3,4		Pecan Grove
		Pote Field
		Roadside Picnic
		Shane's Inspiration Playground
		Chevy Chase Recreation Center

3.7.3 MULCHING

Mulching the root areas of trees is perhaps the simplest but most beneficial practice we can perform to enhance tree health and minimize competition with turf. The application of mulch can:

- Aid in soil moisture retention.
- Moderate soil temperature.
- Eliminate weed and turf competition and reduce allelopathic interference.
- Condition the soil and improve microbial activity.
- Reduce irrigation requirements.
- Prevent or alleviate soil compaction.
- Prevent soil erosion and surface crusting.
- Increase root and plant vigor.

By design, mulch keeps mowing equipment from damaging tree trunks and eliminates the need for herbicide applications. It is also aesthetically pleasing.

Mulch should be applied between four and six inches deep and kept a minimum of six inches away from tree trunks. Mulching a large area will visually and physically tie groupings of trees together.

3.7.4 SOIL CONDITION

Soil compaction is the largest single factor responsible for the decline of mature trees. Ninety percent of the damage to the upper 18 inches of soil occurs during the first pass by heavy equipment and cannot be reversed. RAP staff makes every effort to avoid soil compaction by not parking or driving within the dripline of trees.

The following aeration methods and drainage systems are recommended to improve soil porosity in compacted soils:

Drainage

Adequate drainage must be provided before planting new trees. If trees are planted in compacted soil with low water infiltration rates (less than two inches per hour), RAP may employ one of the following drainage systems:

- Redirect surface water using shallow ditches, culverts, berms, swales, and/or mounds.
- French drains at a minimum depth of three feet.
- Drain tiles or lines installed beneath trees.
- Drain holes augered at the bottom of the planting pit at a specified diameter and depth, and filled with medium-size sand or fine gravel.

Soil Management

Aeration of soil-supporting turfgrass should be avoided within the tree's dripline. Hollow-tine aeration can lead to the elimination of tree roots in the upper few inches of soil and usually results in improved turf root growth. Soil that is disturbed or compacted within the dripline can be loosened or aerated to protect roots, promote root growth, and/or enhance tree vitality. Though they each have upsides and downsides, one of the following aeration methods may be specified to correct compacted soil conditions:

- **Air/Pneumatic Tillage and Excavation—** Using highly compressed air, soil is cultivated, broken up, removed, and/or amended with organic matter without damaging medium and large roots.
- **Vertical mulching—**Auger holes two to four inches diameter, six inches to two feet deep, and six inches to three feet apart. Backfilling the holes with porous material (perlite, vermiculite, volcanic rock, peat moss, etc.), compost, for amended soil can improve water infiltration rates.
- **Radial trenching—**Using an air excavator, excavate a soil trench four to 18 inches wide and 12 to 18 inches deep from approximately three feet from the trunk radiating out to the edge of the dripline. The trenches shall radiate out from one foot at the closest point. Fill the trenches with high-quality replacement soil or organic matter.
- **Soil fracturing—**Using a pneumatic soil probe to deliver a sudden burst of air that cracks, loosens, or expands the soil profile. The newly expanded horizontal soil profile can be injected with amendments or fertilizers and may improve drainage.

Fertilizing Standards and Mycorrhizae Treatments

Trees require certain essential elements to function and grow, though they typically do not require supplemental fertilizer for optimum growth. With the exception of nitrogen, most soils supply adequate amounts of nutrients. Excess and unnecessary fertilizer applications can predispose trees to disease and insect infestation, pollute groundwater, and create salt buildup in the soil. If a tree appears to have a nutrient deficiency, a laboratory soil and foliar analysis should be performed before fertilizer is applied. Current funding levels do not allow RAP to fertilize trees on an individual level. If fertilization were to occur, the following is specified: subsurface injections under moderate hydraulic pressure, using a three-foot probe and applied on three-foot centers within the dripline.

Mycorrhizae are root structures that are created when young lateral roots are invaded by specific fungi that form symbiotic associations to the advantage of each. Plants benefit from mycorrhizae by enhanced nutrient uptake and may improve water absorption and drought resistance.

Analysis of tree roots for the presence of native mycorrhizal fungi should be performed, and a better understanding of the species-specific mycorrhizae is warranted before the application of inoculants.

Organic matter used in city parks includes biosolids and compost (see section 5.20 Recycling and Green Waste). RAP has had success applying organic matter adjacent to trees growing in infertile urban soils.

Biochar is created through the combustion of organic material in an environment with limited to no oxygen. Biochar has a highly porous structure and a charged surface that allows it to retain nutrients. When used as an amendment, biochar can enhance soil structure, texture, and suitability for associated microorganisms. Certain soil types, such as clay- or sand-based soils where it can increase in water-holding capacity, drainage, and structural integrity, and respond well to the addition of biochar. Biochar is stable for many years; therefore, it can also be used to meet carbon sequestration goals (Fields-Johnson and Abbott 2020). The addition of biochar can help prime plant defenses to increase resistance to pests and pathogens (Poveda et al. 2021).

3.7.5 INTEGRATED PEST MANAGEMENT

Appropriate species selection and providing for a tree's basic growth requirements are critical components of pest management. Proper planting techniques, irrigation, pruning, and aftercare all contribute to a plant's tolerance of and defense against pests. Many factors contribute to plant stress and pest susceptibility. Drought conditions and smog, for example, are stressors. Stressors, such as severe storms, floods, droughts, and heat waves, are expected to increase as a result of climate change (see section 3.4.3 Urban Forest Diversity in a Changing Climate). All of these stressors can predispose trees to pests and pathogens.

In the 1980s, thousands of blue gum eucalyptus trees died when drought increased their susceptibility to longhorn borers. In the early 2000s, years of repeated defoliation events caused by the redgum lerp psyllid has resulted in the death of thousands of eucalyptus trees and the removal of 5,000 specimens from city parks. Over the past several decades, olive trees (*Olea europaea*) in city parks have incurred significant dieback or have died as a result of infection with a complex of pathogenic fungi (formerly thought to be caused by the bacterium *Xylella fastidiosa*) (Hodel, 2020). A total of 28 park olive trees have been removed since 2014. A recently emerged pest-disease complex, Fusarium dieback/invasive shot hole borer, can impact a wide range of tree species (Eskalen et al. 2013), including California sycamore (*Platanus racemosa*), which is an important native species in many city parks. Since 2010, 731 California sycamore have been removed as a result of Fusarium dieback/invasive shot hole borer.

A vigorous plant is best equipped to stave off pest infestation.

Following Integrated Pest Management (IPM) protocol and best management practices when preparing for and addressing pests and diseases can help to minimize their economic, health, and environmental consequences (Wiseman and Raupp, 2016). Some management practices include:

- Obtain current information on emergent pests and pathogens.
- Increase understanding of the biology of the pest and pathogen as well as symptoms that indicate infestation/ infection.
- Identify procedures and protocols that will be followed in the case of an introduced pest or pathogen.
- Complete training and licensing in the case of pesticide or fungicide use.
- Plant tree species that are resistant or tolerant to identified pest and pathogen threats.
- Choose healthy, vigorous nursery stock.
- Diversify plantings at the genus level, as many pests threaten several species within a genus.
- Prevent the long distance movement of felled tree materials that may be harboring pests or pathogens, such as untreated logs, firewood, and woodchips.

RAP implements IPM, a strategy that is designed to prevent and suppress pest problems with minimum adverse effects on human health, the environment, and non-target organisms. The Vegetation Management Unit of the Forestry Division is responsible for pest identification and actions taken or recommended to control and, if needed, eradicate pests before damage to a tree is irreversible. RAP staff notify the Forestry Division at 213.485.4826 with observations and/or concerns. Accurate timing is critical for success.

3.8 Training Materials

RAP believes that providing training and sufficient information to enhance the knowledge of those involved in maintenance, construction, or recreation activities around trees is the best solution to unintentional tree damage. Training also provides additional information that helps field staff make their own decisions.

Training materials are available in various formats:

- Topics that may be distributed during tailgate meetings.
- Informational brochures.
- PowerPoint training presentation (available in outline form).

The information included in the training material focuses on the most common situations and problems occurring in our parks and explains how trees respond to these situations (Appendix L).

The material offers recommendations, alternatives, and practices to avoid or apply when working around trees. Appendix L includes the following:

- Understanding the Protected Tree Wounds.
- Tree and Turf Associations.
- Watering Practices.
- Mulch and Its Benefits.
- Tree Staking.
- Maintaining Young Trees.

Extensive damage to a tree trunk.

3.9 Tree Inventory

The successful management of any resource begins with an inventory of the resource, and the urban forest is no exception. Inventories are essential for planning, scheduling, monitoring maintenance tasks, and assisting in management decisions, particularly when developing a monetary budget.

Global positioning systems (GPS) and geographic information systems (GIS) are best for collecting and representing tree inventory data. GPS employs a handheld unit that locates a point (e.g., a tree) on the ground via a satellite system. This information can then be readily transferred to GIS. These systems of collecting data provide "layers" of information that are important to other park functions and can reduce field data collection time by 30 percent.

A tree inventory provides data specifications on tree location, species, size, condition, and management needs. The information can be used to:

- Locate planting sites.
- Identify management needs.
- Locate hazardous trees in need of pruning or removal.
- A tool in public relations as a news release that describes public tree resources, both in terms of the number and value of trees.
- Enhance the ecological value of park trees and provide direction regarding the planting of trees that are attractive and beneficial to wildlife and the connection of wildlife corridors.
- Track species performance and determine climate suitability.
- Visualize the flow of benefits and costs over time.
- Track the impact of climatic events (e.g., storms, drought, wildfire), disease or pest outbreaks, land use changes, and other stressors that can severely affect the urban forest.
- Track the benefits provided by park trees to communicate their importance.

The inventory information is used to develop IPM strategies to transition RAP's park tree management from a reactive to a proactive approach, including:

- Identify species to avoid due to pest vulnerabilities.
- Explore planting species with known pest resistance.
- Develop treatment plans.
- Locate areas with pest infestations of trouble spots.
- Monitor for emerging pests and pathogens.

In an effort to meet the ambitious goals set by the Green New Deal, the City of Los Angeles has, as of 2022, planted 65,000 trees and nearly completed the citywide tree inventory. A comprehensive inventory of all trees in parks, golf courses, and at park facilities was recently completed. Where access was limited by terrain and steep slopes, a drone was used to collect aerial imagery to assess trees and other existing vegetation on a broader scale. As of 2022, the Los Angeles municipal park tree inventory includes 138,445 trees and 13,294 available planting sites. The inventory is maintained by RAP using a software management system that allows managers to maintain current inventory specifics with regard to tree characteristics, health, history, and maintenance needs.

The inventory is updated on a continuous basis by inputting data into the software management system using handheld devices and by collecting data regarding newly planted trees.

Work history and work orders are managed in conjunction with the tree inventory. This includes assigned work, scheduled work, and completed work. For example, a work order is created when a tree needs to be removed. The inventory system is used to schedule the work, and after the removal is completed, it is updated to indicate a stump is now present. When the stump is ground, the inventory is updated to indicate the site is vacant. Moving forward, RAP intends to continue advancing the program using the tools within the inventory.

Some examples include:

- Maintaining the inventory database to track tree growth, history, and any changes in condition.
- Identifying additional planting sites for trees.
- Increasing genus and species diversity in new and replacement tree plantings to reduce reliance on over-represented groups.
- Reviewing age distribution of key species and considering ongoing planting to maintain benefits and importance value.
- Incorporating trees that promote the character of the specific park and consider the historical importance of certain tree species.
- Continuing to promote wildlife habitat by protecting standing dead trees in areas where they do not pose a hazard to the public.

There is potential to continue adding inventory attributes within the software management system, such as to track tree failure. Tree failure data should then be submitted to the University of California Western Tree Failure Database to aid the industry by providing region-specific information. The species composition in parks could also be compared against the database to help identify species that have high failure rates.

For example, RAP may want to pay particular attention to coast live oak (*Quercus agrifolia*) when monitoring trees because of not only its abundance in the inventory, but also the risk of tree failure and the threat of several pests and diseases.

In summary, the tree inventory for park trees carried out on a continuous basis will establish a baseline of where the tree population has been, where it is now, and where it is going in the future.

4.0 PROTECTION OF TREES DURING CONSTRUCTION

Introduction

The objective of this section is to reduce the negative impacts of construction on trees to achieve preservation goals. Land development is a complex process and is even more challenging when trees are involved. Construction damage can negatively influence tree health and result in tree decline and death.

Tree protection begins before construction begins. Adequate tree protection requires careful planning. Without pre-construction planning, preservation measures are not likely to be considered, delayed, or ignored until construction begins. If protective measures are not implemented early, trees are likely destined to fail. While planning can help mitigate the impacts of construction on trees, in most cases construction impacts on trees cannot be completely eliminated. The goal for our park planners and designers during the planning process and during construction is to keep injury to trees at a minimum and allow building projects to proceed and meet the desired use of the land.

All trees cannot and should not be preserved. Trees that are structurally unstable, in poor health, or unable to survive the effects of construction become a liability to the project and should be removed. A realistic tree preservation program acknowledges that conflicts between trees and development may sometimes result in the removal of some trees and recognizes the detrimental effect on the project and community when trees die after construction is completed.

Successful tree preservation occurs when designers, construction personnel, and project managers are committed to tree preservation. In many instances a monitoring arborist trained in protecting trees in a construction zone may be hired to act as a consulting expert. All members of the project team must be familiar with the rudimentary aspects of tree biology and construction practices in order to implement an effective tree protection plan and preservation strategy.

It is commonly thought that the above-ground parts of a tree are a "mirror" of what lies below. In actuality, most roots are within the top 12 inches of soil and spread five or more times the tree height and/or canopy spread away from the tree's trunk. The spread and depth of tree roots vary depending on species, soils, and the level of oxygen in the soil. These factors make it difficult to estimate the actual depth and spread of a tree's root system. Making assumptions about the root system may unnecessarily damage trees that are to be protected in place.

The roots that extend out from the trunk branch out readily and taper rapidly in diameter and make up the root plate. The root plate is roughly three to six times the trunk diameter. The radius of the root plate is the primary support in winds up to 40 miles per hour. Disturbance of the roots that extend out from the trunk, including digging and other construction activities, can result in the tree tipping over and failing at the edge of the root plate.

Beyond the root plate, roots grow horizontally through the soil. These roots are primarily responsible for water and mineral transport. The depth of the roots is dependent on the oxygen levels in the soil. In areas where the soil has less oxygen or is more compacted, the roots will come to the surface. In non-compacted soils, "sinker" roots will follow natural openings into deeper soil, which are important for drought resistance. Roots do not grow uniformly around the tree and some areas may be void of roots, whereas other areas will be heavily concentrated. A common myth is that trees have tap roots, which originate from the seed radical and is the primary root to emerge from a germinating seed. However, most trees do not have a tap root beyond the seedling stage. In fact, nurseries will remove the tap root to promote branching in the root system.

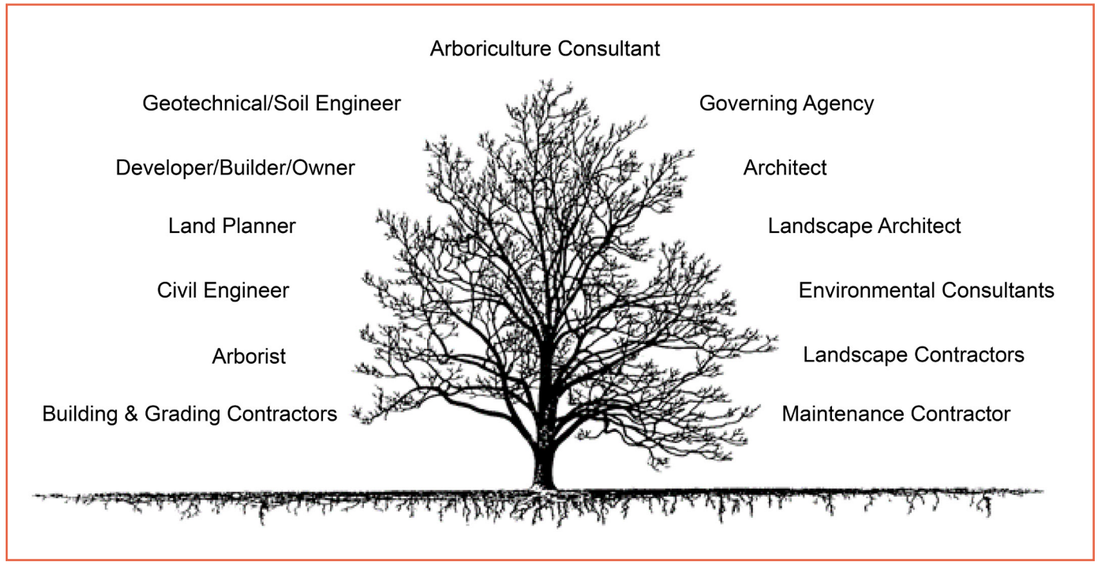
Smaller roots absorb and uptake water and nutrients from the soil. There can be hundreds of roots in a cubic inch of soil; thus, any removal of soil or root severance forces a tree to compromise its physiological processes to sustain the loss.

Not all tree roots are essential to tree health. However, successful tree preservation occurs when damage (or impact) to the rooting area is minimized or avoided altogether before, during, and after construction. The challenge is to determine when impacts will be too severe for the tree to survive, not only in the short term, but also in the long term.

While there are no quantitative methods to calculate this critical level, determining the optimum tree protection zone provides a guideline for protective measures.

The following are the three guiding principles for making trees part of the plan, which will improve the success rate for tree preservation efforts:

- Acknowledge that not all trees are in excellent health or have good structural stability.
- Tree preservation is everyone's responsibility, and each person involved in the development project must understand that their activities and decisions influence the success of tree preservation efforts.
- Preventing damage is key as there are few remedies for construction damage.



Tree Preservation during development requires the commitment of everyone involved in the project's planning, design, construction, and management.[1]

[1] Adapted from Matheny, N.P. and Clark, J.R. 1998. Trees and Development

Tree Preservation Lessons

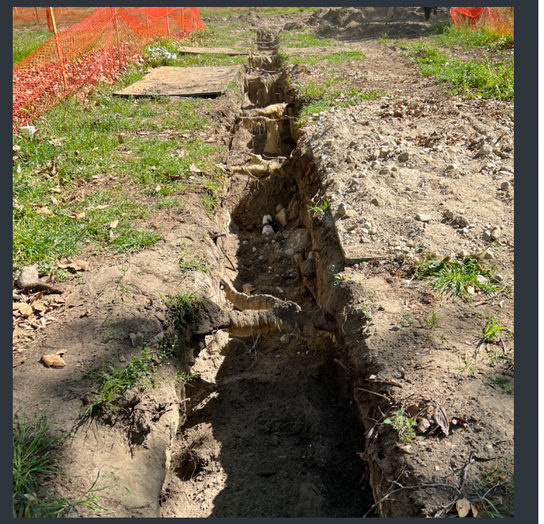
In 2021, Arroyo Seco's Tiny Home Village, a housing project for unhoused people, was opened. The project was developed in a parking lot at Avenue 60 Pocket Park. The Recreation and Parks Department emphasizes the need to be involved in the initial planning phase for projects. They should also be brought in duirng project implementation to ensure tree protection policies are being followed.

Lesson 1: Trees should always be considered at the start of construction projects. The site is part of a historic alluvial fan with a riparian ecosystem. At the project site, the soil is sandy and there are a number of large sycamore trees. RAP arrived on the site to check if:

- Tree protective fencing was installed properly.
- Vehicles and other materials were not being stored next to the trunk of trees.
- Excavation occurred outside of the tree protection zones.

Lesson 2: Mitigation plantings do not provide the same amount of benefits as existing mature trees. Tree damages sustained in construction projects can result in the removal of a number of trees. In this instance, two mature California sycamores were removed. To help mitigate the loss of benefits from the mature trees that were removed, new trees were planted, and the irrigation system was updated. However, it takes decades for mitigation plantings to mature and return to the level of benefits that were provided by the mature sycamore trees.

Lesson 3: Tree preservation practices help to protect and retain existing trees during construction. A common method used to install irrigation is to trench directly through an area to run piping between emitters. Without proper consideration of existing trees, trenching often results in severed roots and significant damage to trees. To help avoid further damage to existing trees near the Tiny Home Village, trenching practices were modified to ensure that large roots were preserved. When roots were detected during trenching, work was stopped and the contractor used hand tools to finish trenching underneath the roots. Once exposed, the roots were wrapped in burlap, which was periodically wet with water to keep the roots moist. These methods successfully avoided additional root damage.



Tunneling under California sycamore roots at Arroyo Seco Ave 60 Park.

4.1 Planning for All Projects

No matter the size of a project, whether a project is a capital improvement project, an in-house construction project, a sport field renovation, or even the addition of a few sprinkler lines, all have the potential to affect trees. RAP considers trees as important assets and requires plotting tree locations on every section of the plans for *all* projects.

4.1.1 PLANNING AND DESIGNING FOR IN-HOUSE AND CAPITAL IMPROVEMENT PROJECTS

Projects may be designed by in-house design staff and/or by outside design firms. Regardless, all design teams should follow the requirements defined by RAP's Tree Preservation Policy (Appendix A) and Tree Protection Guidelines (Appendix B, C, and D) to assure that trees are accounted for from project initiation through final inspection.

Survey Before Planning

The site survey must accurately plot all trunk locations within the project site. The survey shall include construction staging areas and delivery routes. For all in-house projects, contact the Forestry Division for an accurate survey of trees on the job site.

Evaluation of Tree Health and Structure

An ISA Certified Arborist or anther qualified professional with experience in construction zones must evaluate the health and structure of the trees indicated on the site plan. The evaluation shall describe:

- Location.
- Planter space.
- Species.
- Diameter.
- Vigor and condition.
- Presence of pests and/or disease.
- Method of irrigation (if applicable).
- Suitability for preservation.

For in-house projects, the Forestry Division will make available the results of tree evaluations. Understanding the health and structure of existing trees will help planners to anticipate the tolerance of the affected trees to construction activities.

Plan with a Vision

Conduct all projects with tree preservation in mind. Structural damage to a tree or its root system resulting from construction activities may disrupt and negatively affect physiological processes and cause depletion of energy reserves. Significant disruption will result in a decline in vigor and/or tree death, which typically does not manifest until many years after the disruption occurs. Preservation of mature trees during construction has limitless benefits to the success of a project.

When new trees are planted, consideration should be given to increasing species diversity and appropriateness of the location. To prevent destructive clearance pruning in future years, mature canopy height and root spread should be considered.

Plan for All Aspects and Entire Duration of Project

Construction projects are multi-faceted and often require the participation of various construction trades and subcontractors. It is important to plan for tree protection with an understanding of construction dynamics. Trees must be protected in the staging area, during demolition and grading, in construction employee parking areas, on adjacent properties, and within the actual construction site.

Arrangements must be made to ensure that trees on construction sites receive adequate irrigation, particularly when existing irrigation lines are severed or shut off. It is also critical to protect soils and minimize compaction near existing trees. For in-house projects, it is necessary to coordinate with the Principal Ground Maintenance Supervisor II. Tree protection measures shall remain in place until all construction activities have been completed.

4.2 Pre-Construction Requirements—Tree Protection and Preservation Plan

Prior to the commencement of a development project, the RAP forestry arborist must be assured that, if any activity of the project is within the tree protection zone (TPZ) of trees to be protected in place, a site-specific tree protection plan is prepared. The following seven steps shall be incorporated as part of the Tree Protection and Preservation Plan.

4.2.1 SITE PLAN

For all projects, site plans must indicate accurately plotted trunk locations and the TPZ of all trees or groups of trees to be preserved within the development area and any trees to be protected in place that are on adjacent properties. Additionally, site plans shall accurately show the trunk diameter, dripline, and clearly identified tree protection zones for each protected tree. The tree protection zone to be enclosed with tree fencing shall be specified and indicated with a bold dashed line.

4.2.2 PROTECTIVE TREE FENCING FOR ALL CATEGORIES OF PROTECTED TREES

Fenced enclosures shall be erected around trees to be protected. This will achieve four primary goals: (1) to keep crowns and branching structure clear from contact by equipment, materials, and activities; (2) to preserve roots and soil condition in an intact and non-compacted state; (3) to identify the structural rooting area in which no disturbance shall occur; and (4) to identify the TPZ in which no soil disturbance is permitted and activities are restricted unless otherwise approved by the RAP arborist.

All trees to be preserved shall be protected with five-foot-high chain link fences. Fences are to be mounted on two-inch galvanized iron posts, driven into the ground to a depth of at least two feet and at no more than ten-foot centers. A two-foot wide access gate shall be installed to allow access for tree maintenance.

Tree fences shall be erected before demolition, grading, or construction begins and remain until final inspection of the project. No storage of material, topsoil, vehicles, or equipment shall be permitted within the fenced area throughout the entire duration of the construction project. All work within the protective fencing requires prior approval from the RAP arborist. Fence configurations are dependent on the site and are described as follows:

- Type I tree protection fence shall enclose the entire area of theTPZ. If fencing must be located on paving or concrete that will not be demolished, an appropriate grade-level concrete base may support the posts.

- Type II tree protection fence is for trees situated in narrow planting areas, where only the planting area is enclosed with the required chain link protective fencing. The walkways and traffic areas are left open to vehicular and pedestrian use.

- Type III tree protection fence is for trees in small tree wells, building site planters or sidewalk planters. Trees shall be wrapped with two inches of orange plastic fencing from the ground to the first branch and overlaid with two-inch thick wooden slats that are bound securely (slats shall not be allowed to dig into the bark). During installation of the plastic fencing, caution shall be used to avoid damaging branches. Major scaffold limbs may also require plastic fencing as directed by the RAP arborist.

A "Warning" sign shall be prominently displayed every 20 linear feet of protective fence.

The sign shall be a minimum of 24 inches by 18 inches and clearly state the following:

> **TREE PROTECTION ZONE**
>
> This fence shall not be removed AND is subject to penalty according to the Recreation and Parks Board of Commissioners and adopted as City policy.

4.2.3 VERIFICATION OF TREE PROTECTION

The project manager shall verify in writing that all preconstruction tree preservation conditions have been met as follows:

- Tree fencing installed.
- Erosion control secured.
- Tree pruning completed.
- Soil compaction preventive measures installed.
- Tree maintenance schedule established.

The Forestry Division must be engaged throughout the process and sign this verification. The contractor must verify in writing that they understand RAP's tree protection specifications and the consequences for violating them.

4.2.4 PRE-CONSTRUCTION MEETING

The RAP arborist shall attend all pre-construction meetings to assure that everyone fully understands previously reviewed procedures and tree protective measures concerning the project site, staging areas, hauling routes, watering, contacts, etc.

4.2.5 STRUCTURAL ROOTING AREA

The structural rooting area encompasses the root plate, which includes roots that are critical for holding the tree erect under compression. The structural root plate shall be protected from all disruption. If roots in the structural rooting area are destroyed or severely damaged, there is a significant risk of catastrophic tree failure. The structural rooting area distance from any tree shall be calculated by multiplying the trunk diameter in inches measured at four and a half feet above grade by 0.9. The resulting value is the diameter of the structural rooting area.

4.2.6 TREE PROTECTION ZONE (TPZ)

Each tree to be retained shall have a designated TPZ, which shall be determined by calculating the radius (not the diameter) according to the following:

- **Single trunk trees–**Multiplying the trunk diameter in inches measured at four and a half feet above grade by one and a half feet.
- **Multi trunk trees–**There are different methods for multi trunk trees. For larger stature trees RAP will use the sum total. For smaller stature trees RAP will determine an appropriate method to calculate the TPZ.
- **Palm trees–**Five feet from the base of the trunk.

Calculating the area of the TPZ by squaring the radius and multiplying by pi (3.14). **The RAP arborist retains the discretion to extend or modify the TPZ at any time. For areas with groups or groupings of trees where the TPZ's overlap, the TPZ's may be combined and treated as one contiguous TPZ to create a more clearly defined and manageable TPZ.**

The TPZ shall be shown on ***all*** site plans, including: demolition, grading, building, utilities, irrigation, and landscaping. Improvements or activities such as paving, utility, and irrigation trenching, including other ancillary activities, shall occur *outside* the TPZ unless otherwise approved by the RAP arborist. The protection fence shall serve as the TPZ.

- Activities prohibited within the TPZ include:
  - » Parking vehicles or equipment.
  - » Storage of building materials, erosion and sediment controls, refuse, dumpsters, chemical toilets, or excavated soils.
  - » Dumping poisonous material on or around trees and roots, including, but not limited to, paint, petroleum products, concrete or stucco mix, concrete washout, dirty water, or any material that may be harmful to tree health.
  - » The use of tree trunks as a backstop, winch support, anchorage, as a temporary power pole, signpost, or other similar function.
  - » Cutting of tree roots by utility trenching, foundation digging, placement of curbs and trenches, or other miscellaneous excavations without prior approval of the RAP arborist.
  - » Soil disturbance or grade change.
  - » Drainage changes.
- Activities permitted or required within the TPZ include:
  - » Mulch—During construction, wood chips may be spread within the TPZ to a four- to six-inch depth, leaving the trunk clear of mulch. This will aid in inadvertent soil compaction and moisture loss. Mulch shall be two-inch unpainted, untreated, shredded wood or approved material.
  - » Root Buffer—When areas under the tree canopy cannot be fenced, a temporary buffer is required and shall cover the root zone and remain in place at the specified thickness until the final grading stage. During the installation of constructed buffers, the wheels of the equipment shall remain on the existing pavement or on the buffer itself. The protective buffer shall consist of shredded wood chips spread over the roots at a minimum of six inches in depth (keeping the trunk clear of chips) and layered by three-quarter-inch quarry gravel to stabilize the three-quarter-inch plywood sheets laid on top. Steel plates can also be used with heavier equipment. Wherever possible, existing pavement should remain or be retained as long as possible to serve as a buffer.
  - » Irrigation, aeration, fertilization, mycorrhizae treatments, biochar, or other beneficial practices that have been specifically approved for use within the TPZ.
- **Erosion Control:** If a tree is adjacent to or in the immediate proximity of a grade slope of eight percent (23 degrees) or more, approved erosion control or silt barriers shall be installed outside the TPZ to prevent siltation and/or erosion within the zone, including, but not limited to:
  - » Silt fence.
  - » Triangular sediment filter dike.
  - » Mulch socks.

If trees within the TPZ are damaged, RAP can make final determinations on replacement fees (i.e., for larger stature multi-trunk trees, the sum will be used but for smaller stature multi trunk trees the cumulative methods may be reassessed) (Appendix I).

4.2.7 TREE PRUNING, PLANT HEALTH CARE AND REMOVAL

Prior to construction, various trees may require branches to be pruned away from structures, proposed construction activity, or buildings. Branches may even require cabling or bracing to provide mechanical support. Construction or contractor personnel shall not attempt pruning. Only personnel approved by the RAP arborist can perform pruning operations.

If the RAP arborist recommends that trees be pruned, trees shall be pruned in accordance with the most current edition of ANSI A300 Part 1: "Tree, Shrub, and Other Woody Plant Management—Standard Practices (Pruning)." Trees shall be pruned to reduce risk and promote good structure. The least amount or percentage of foliage or crown will be removed to meet objectives.

If the RAP arborist finds that branches are defective or weakly or poorly attached and cannot be feasibly removed, cabling and bracing shall be installed in accordance with the most current edition of ANSI A300 Part 3: "Tree, Shrub, and Other Woody Plant Management–Standard Practices (Supplemental Support Systems)." The cabling system chosen shall be approved by a RAP arborist. Cables shall be taut and allow for limbs to move. Rigid braces shall be used in conjunction with cables.

If the RAP arborist determines that plant health care is necessary to promote health and prolong the life or structure of a tree, the tree shall be provided with appropriate treatments.

Removal of trees that extend into the branches and roots of trees that are to remain shall only be completed by personnel approved by the RAP arborist. The demolition or construction crew shall not damage any above- or below-ground structures for trees that will remain.

If stumps are to be removed, the developer shall first consider whether or not the roots are entangled with the roots of trees that are to remain and engage a RAP arborist for guidance. If so, these stumps shall have their roots severed before extracting the stump. Stumps shall be removed by grinding to a minimum depth of 24 inches but expose soil beneath the stump to provide drainage. If a tree is going to be replanted in the site, the entire stump shall be removed and large surface roots shall be removed within three feet of the stump.

4.3 Activities During Construction and Demolition Near Trees

Soil disturbance or other damaging activities within the TPZ are prohibited unless approved by the RAP arborist. If a tree that is to remain is damaged or if soil is disturbed, the following mitigation is required.

4.3.1 SOIL COMPACTION

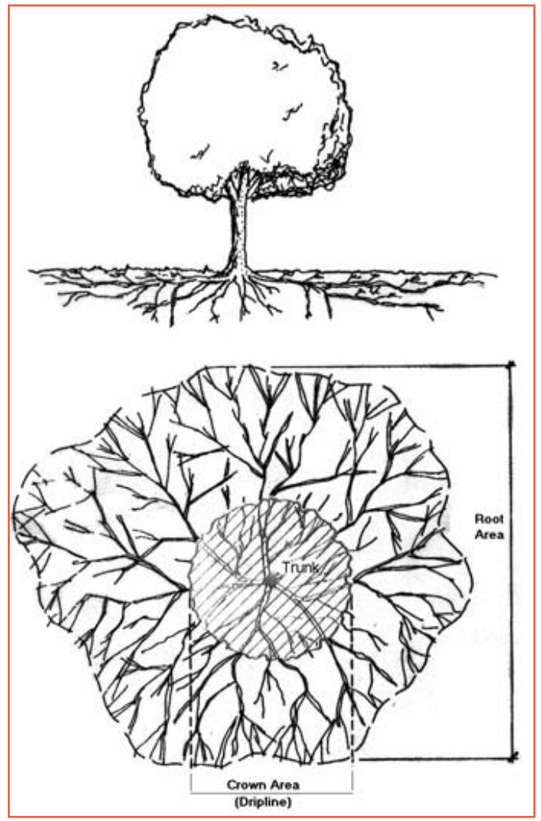
Soil compaction is the single biggest factor responsible for the decline of trees on construction sites. Every effort should be made to avoid compaction of the soil within the TPZ **at all times**. Protective measures to avoid applying pressure and increasing soil density must be made before a project begins and equipment arrives on site. The following techniques can lessen compaction: vertical mulching, soil fracturing, core venting, and radial trenching. Do not compact soil to higher density than needed: to 95 percent proctor density (moisture–density) in improved areas for asphalt or concrete pavements and not to exceed 85 percent in unimproved open landscape areas that use water jet compaction.

4.3.2 GRADING LIMITATIONS WITHIN THE TREE PROTECTION ZONE

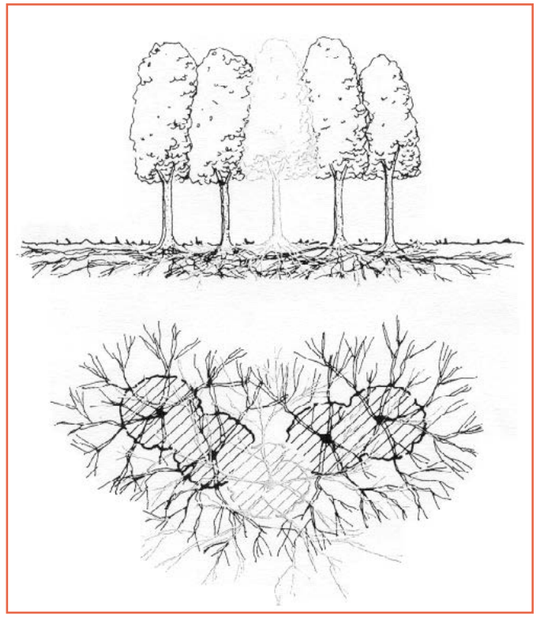
Any changes in grade around trees can have an immediate and long-term effect on trees. During construction projects, the following regulations apply:

- Grade changes within the TPZ are not permitted.
- Grade changes outside the TPZ shall not significantly alter drainage patterns.
- Grade changes under specifically approved circumstances shall not allow more than six inches of fill soil or allow more than four inches of existing soil to be removed from natural grade unless mitigated.
- Grade fills over six inches of impervious overlay shall incorporate an approved permanent aeration system, permeable material, or other approved mitigation.
- Grade cuts exceeding four inches shall incorporate retaining walls or an appropriate transition equivalent.

The following pictures illustrate the pattern of tree root development and areas where encroachments may have an adverse effect on tree health. See Training Topics (Appendix L) for a list of information offered by the Forestry Division.



Tree root system can be described as shallow and widespread, extending far beyond the edge of the canopy.[1]



In many parks, where trees grow closely together, root systems of individual trees overlap and intertwine, forming a dense mat of roots. [1]

4.3.3 TRENCHING, EXCAVATION, AND EQUIPMENT USE

Wherever possible, trenching, excavation, or boring shall occur outside of the Tree Protection Zone. If no alternatives for such activities are feasible and with the approval of the RAP arborist, the following measures shall be followed:

Notification

The developer (or project manager) shall notify the RAP arborist a minimum of 24 hours in advance of performing any activity in the Tree Protection Zone. All pruning must be approved by a RAP arborist. In addition, all approved work inside the TPZ shall be overseen by a RAP Forestry approved monitoring arborist at the expense of the contractor.

Retaining Root Moisture

Avoid exposing roots during hot, dry weather. Trenches shall be backfilled as soon as possible with soil and soaked with water the same day. If the trench must be left open, all roots must be wrapped with peat moss and burlap, and a tarpaulin to keep them from drying out. Small roots can die in ten to 15 minutes, and large roots may not survive an hour of exposure.

Equipment

Excavation and construction equipment shall be positioned and operated to avoid damage to tree roots, branches, and trunks. If clearance is inadequate, branches should be guyed upward or pruned to raise the crown prior to work.

Trenching

If trenching is unavoidable, the following restrictions apply:

When trenching, a minimum distance from the face of the tree in any direction shall be maintained depending on the diameter of the tree:

TRUNK DIAMETER INCHES	DISTANCE FROM FACE OF THE TREE FEET
Less than 9	9
10–14	10–14
15–19	15–19
More than 20	20+

Root Severance

No roots greater than two inches in diameter shall be cut without approval of the RAP arborist. Tunneling under roots is the approved alternative. Prior to excavation for foundation/footing/walls—or grading or trenching within the TPZ—roots shall be severed cleanly one foot outside the TPZ to the depth of the planned excavation. When roots must be cut, they shall be cut cleanly with a sharp saw to sound wood and flush with the trench site. Ripping or tearing roots is prohibited. If structural footings are required, discontinuous-type footings, piers, and structural-grade beams shall be used to minimize root pruning.

[1] Matheny, N.P. and Clark, J.R. 1998. Trees and Development

Excavation

Any approved excavation, demolition, or extraction of material shall be performed with equipment that is placed outside the Tree Protection Zone. Hand digging, hydraulic, or pneumatic excavation are permitted methods for excavation within the Tree Protection Zone.

Vehicles

Vehicles within the Tree Protection Zone are prohibited unless approved by the RAP arborist. If allowed, an approved protective root buffer is required.

4.3.4 TUNNELING AND DIRECTIONAL DRILLING

Approved trenching or pipe installation within the Tree Protection Zone shall be either cut by hand, air spade or by mechanically boring a tunnel under the roots with a horizontal directional drill using hydraulic or pneumatic air excavation technology. In all cases, install the utility pipe immediately, backfill with soil, and soak with water within the same day. Tunneling under the root system can greatly reduce both damage to the tree and the cost to repair landscape and other features destroyed in the trenching process.

There are times, such as when working in rocky soils and slopes, when tunneling is not a reasonable alternative.

The following recommendations for tunneling depths should be observed:

TRUNK DIAMETER INCHES	DISTANCE FROM FACE OF THE TREE FEET
Less than 9	8
10–14	8–12
15–19	13–16
More than 20	16+

When boring, a minimum distance from the face of the tree in any direction shall be maintained depending on the diameter of the tree:
When boring, a minimum depth shall be maintained based on the diameter of the tree:

TRUNK DIAMETER INCHES	MINIMUM TUNNEL DEPTH FEET
Less than 9	2.5
10–14	3
15–19	3.5
More than 20	4

4.3.5 ALTERNATIVE METHODS FOR HARDSCAPE TO PREVENT ROOT CUTTING

The following remedies should be considered as an alternative to severing tree roots:

- Grinding a raised walkway or concrete pad.
- Ramping the walkway surface over the roots or lifting the slab with pliable paving.
- Routing the walkway around tree roots.
- Installing flexible and/or permeable paving materials (e.g., decomposed granite), interlocking pavers, or flagstone walkways on sand foundations.

4.3.6 USING ALTERNATIVE BASE COURSE MATERIALS

The use of an engineered structural soil mix is an alternative material for hardscape areas near trees that may be used if approved by the RAP arborist. More information can be found at www.amereq.com.

4.4 Tree Maintenance During Construction

Providing adequate maintenance can mitigate stressful changes that occur to a tree's environment during construction. To remain vigorous, the tree needs to maintain stored carbohydrates and preserve the effectiveness of its growth regulators. It is recommended that large projects provide:

4.4.1 IRRIGATION

Providing supplemental irrigation for trees under water stress may be the single most important treatment. Irrigation should be designed to achieve field capacity in the TPZ and be replaced when 50% of the water has left or the top 2" of has dried out. Sub-surface irrigation may be applied at regular specified intervals by injection on approximate three-foot centers, ten gallons of water per inch trunk diameter within the Tree Protection Zone. The irrigation program shall remain in place through the duration of the project to reach field capacity unless specified otherwise by the RAP arborist

4.4.2 SOIL COMPACTION MITIGATION

To prevent negligent encroachment into the Tree Protection Zone, trees to be preserved during construction must have the specified type of protection fences in place at all times. Removal of fences, even temporarily, to allow deliveries or equipment access is **not allowed** unless approved by the RAP arborist and a root buffer is installed.

The root buffer components, mulch, gravel, and metal, plywood or material approved by RAP must be maintained continually to assure their effectiveness against soil compaction.

4.4.2 DUST CONTROL

Accumulation of dust on trees needs to be avoided. Periods of extended drought, wind, or grading may allow dust to settle on trunks, limbs and foliage. If dust starts to accumulate, it needs to be washed off with water.

4.5 Damage to Trees

4.5.1 REPORTING DAMAGE OR INJURY TO TREES

Any mechanical or chemical damage or injury to trees shall be reported as soon as possible to the RAP arborist to implement mitigation measures.

4.5.2 MITIGATION AND DAMAGE CONTROL

Root Injury

When trenching, tree roots must be cleanly cut back to sound wood. All exposed root areas within the Tree Protection Zone shall be backfilled or covered within one hour. Exposed roots may be kept from drying out by temporarily covering the roots and draping layered burlap over the upper three feet of trench walls. The materials must be kept wet until backfilled to reduce evaporation from the trench walls.

Bark or Trunk Injury

Bark tracing or other plant health care treatment methods consistent with current standards shall be performed by a qualified tree care specialist within 48 hours of the injury.

Branch or Leaf Injury

Remove broken or torn branches back to an appropriate branch capable of resuming terminal growth within five days. The RAP arborist must be contacted within six hours if leaves are scorched from equipment exhaust pipes.

4.5.3 CONTRACTOR SUBJECT TO PENALTIES

If a tree designated to remain is removed or irreparably damaged by the contractor as determined by the RAP arborist, the contractor shall be liable for all damages to RAP, which may include without limitation the value of the damaged tree. The contractor shall be required to install a replacement tree matching in size, quality, and variety, using a contractor designated by the RAP arborist. If an acceptable replacement tree is not available, the contractor shall be required to pay damages to RAP Forestry for the value of the damaged tree. The value, assessed by a qualified tree and plant appraiser, is determined using the guidelines set forth in the most current edition of the "Council of Tree & Landscape Appraisers Guide for Plant Appraisal", the trunk formula technique, or other industry-approved methods. The trunk formula is based on the species, diameter, height, condition, and location value of the tree for mitigation purposes.

4.5.4 EMPLOYEES SUBJECT TO DISCIPLINE

In the event of damage to above- or below-ground parts of park trees, the construction supervisor or RAP supervisor shall conduct an investigation to determine the cause of the damage. If it is found that damage was caused due to the error, negligence, or willfulness of an RAP employee, then that employee may be subject to appropriate disciplinary action.

4.6 Monthly Tree Activity Report

The project arborist retained by the developer shall submit a monthly tree activity report of the construction sites containing trees to be preserved and protected. The project arborist shall inspect tree protection and/or plantings with the standards outlined within this manual and provide a written summary of the condition of trees, changing conditions at the site, and actions that have been taken to ensure tree protection. Monthly tree activity reports shall be emailed to the RAP arborist (see Appendix E).

4.7 Documents to Be Included in All Projects

4.7.1 MODEL TREE PROTECTION SPECIFICATIONS FOR DESIGNERS AND PROJECT MANAGERS

This document should be distributed to the planning and construction designers, project managers, city inspectors, bidding contractors, and contracted design firms (see Appendix D).

4.7.2 TREE PROTECTION SUMMARY AND INSTRUCTIONS ON HOW TO PREVENT DAMAGE TO TREES DURING CONSTRUCTION

Information should be distributed to the construction and maintenance staff for implementation during all in-house projects (see Appendix A, D, and F).

4.8 Right of Entry Permits and Documents to Be Included with Every Permit

Carnivals and festivals that are celebrated in our parks provide exceptional and enriching opportunities that bring our communities together. These activities can potentially affect the park environment. Filming crews, food concessions, permitted vendors, and special events activities affect the physical properties of our parks and trees.

In order to sustain a healthy urban forest, it is imperative that all RAP staff understand the need to protect park trees. Every individual, organization, or agency given a right of entry permit or agreement to enter RAP property should be in compliance with RAP policies protecting park trees and be given documentation that will help to ensure tree protection during the permitted activity. The document titled "Instructions on How to Prevent Damage to Trees During Construction" shall be distributed to every permittee, and the permittee shall comply with these instructions.

Strawberry tree (*Arbutus undedo*) flowers.

5.0 TREE REMOVAL, REPLACEMENT, & PLANTING

Introduction

Trees in city parks are components of an ecosystem undergoing dynamic physiological processes. These trees like any others grow, develop, may become diseased and decayed, and die. To manage a sustainable urban forest, a methodology must be in place to direct us when trees need to be removed, when it is necessary to replace them, and how to prolong the longevity of an urban forest as a whole through reforesting with young, diverse, and appropriately located tree species.

5.1 Tree Removal

A tree in a City park may be removed based on the criteria provided in Appendix F. A tree in a city park may be removed for the following reasons: (1) if it is dead or dying, (2) if it has a pest or pathogen that cannot be feasibly treated, (3) if it is irreparably damaged or injured to the extent that is likely to die or become diseased, or (4) it is determined to pose an unacceptable risk to public safety. Furthermore, its removal should enhance the health of remaining trees within the immediate vicinity and be consistent with good forestry practices.

Nuisance trees are also removed when any part of the tree causes or is about to cause impairment of City operations (including recreation) or damage to buildings, hardscape, or permanent infrastructure lines that cannot be relocated and, in the opinion of the RAP arborist, pruning will too severely compromise the tree's structure.

Proposed capital improvement projects that recommend tree removal must have consensus of the community. Participants must agree to the removal of all trees specified in a project before the project proceeds to the next phase.

Crews work to clear a downed tree blocking a road.

5.1.1 RAP TREE REMOVAL PROCEDURE

The procedures outlined in the Tree Removal Procedure (Appendix F) must be followed when trees are removed.

Disciplinary action may apply to RAP staff if these procedures are not precisely followed.

5.1.2 NOTIFICATION PROTOCOL FOR LARGE-SCALE TREE REMOVAL PROJECTS

When a large number of trees have been approved for removal, the notification protocol must be followed before the project begins (Appendix G). The protocol assures that information is communicated to the public, City council offices, the Park Advisory Board, and to the Department divisions affected by the removal project. This protocol provides an opportunity for the public to become involved with forestry issues and supports Department coordination.

5.1.3 TREE REMOVAL—FOUR CATEGORIES OF RAP PROTECTED TREES

Trees Protected by Ordinance

Trees Protected by Ordinance (Appendix A) must always have a permit and approval from the RAP Board of Commissioners before any live, healthy, and moderate- to low-risk trees are removed. The only exception is if the tree poses an immediate threat to life or public safety. The RAP forestry staff has the discretion to conduct emergency tree removal. Documentation (including digital photos) shall follow after the hazard has been mitigated. The request for the removal of a tree in this category must begin with the RAP Forestry Division.

Heritage Trees

Heritage Trees must follow the RAP tree removal procedure before any alteration to the trees is made. Furthermore, the general manager of RAP or their designee must approve the removal recommendation before any action is taken. The only exception is if the tree poses an immediate threat to life or public safety. The forestry staff has the discretion to conduct emergency tree removal. Documentation (including digital photos) shall follow after the hazard has been mitigated. A record of the event will be entered to the designated Heritage Trees list.

Special Habitat Value Trees

RAP engages the Environmental Division before altering Special Habitat Value Trees. Special Habitat Value Trees must follow the RAP tree removal procedure before any alteration is made to them. Additionally, the general manager of RAP or their designee must approve the removal before any action is taken. The only exception is if the tree poses an immediate threat to life or public safety. The forestry staff has the discretion to conduct emergency tree removal. Documentation (including digital photos) shall follow after the hazard has been mitigated. A record of removed trees will be entered to the Forestry Work Order System.

Common Park Trees

The removal of any park tree is not permitted without approval. If the tree is not a tree protected by the LA Ordinance or RAP Tree Preservation Policy (Appendix A) as a Heritage Tree or Special Habitat Value Tree, the RAP tree removal procedure takes precedence.

5.2 Recycling and Green Waste

The greatest value from urban trees comes from the benefits they provide when they are alive. When trees need to be pruned or removed, the woody and leafy materials can continue to provide value. RAP strives to divert all green waste produced from in-house pruning and removals from the landfill. RAP recycles green waste materials to produce mulch and compost that are incorporated back into the parks. RAP is committed to recycling as much material as possible and is playing an important role in LA's Green New Deal Plan, which aims to divert 100 percent of waste from landfills by 2050.

During in-house tree trimming and removals, RAP hauls the resulting material to the RAP green waste facility located in Griffith Park. Material that needs to be chipped is taken to the yard at Griffith Park, where staff use a horizontal grinder. Large-diameter trunks and stumps that are too large for RAP's horizontal grinder are sent to the Public Works green waste and composting facility to be processed in a larger grinder. Pruning and removal contracts require the vendor to dispose of green waste.

Recycling green waste also includes processing felled trees into lumber to create wood products, such as building materials and furniture. RAP recognizes the importance of these kinds of projects but does not currently participate in this kind of wood use for several reasons, such as:

- RAP has limited staffing to coordinate with woodworkers for pick-up and transport.
- Woodworkers need the felled material to meet certain requirements on length, diameter, and quality.
- RAP does not have a wood yard that can store the material.
- The City does not have the insurance for this kind of liability and risk/exposure.

RAP is pursuing ways these challenges can be addressed and overcome so that this level of wood utilization can be incorporated into the program in the future.

5.2.1 MULCH

The majority of green waste produced from RAP's and Public Works Urban Forest Division's tree trimming and removals are transported to either RAP's or Public Works Urban Forestry Division's green waste facility and turned into mulch. Palm, yucca, and bamboo materials are transported to the landfill to preserve equipment and avoid phytotoxicity to plants where the mulch is applied.

Free Public Mulch Pick Up

The public can pick up mulch and composted biosolids at the green waste facility at Griffith Park seven days a week during park hours (6am–10pm). The Sanitation Department has additional locations throughout the city. More information on sanitation can be found using the following website: www.lacitysan.org.

Mulch is incorporated around new tree plantings and to create compost called "zoo doo." Mulch and compost products are available to other LA City departments (e.g., Public Works and Water and Power) and free to the public. Internal and nonprofit partners can request mulch for tree-planting events and routine tree care. RAP supports five major LA City nonprofit organizations (planting partners) as well as volunteer events and other nonprofits. Mulch is delivered to the work sites, and this service requires several weeks to coordinate.

Mulch being spread around a new tree planting in Elysian Park during a MLK Jr. Day of Service and Tu BiShvat or the "New Year of Trees."

5.2.2 BIOSOLIDS AND COMMUNITY COMPOSTING

RAP has a memorandum, dating back to the mid-1990s, with LA Sanitation & Environment and the Los Angeles Zoo to create a composted product called "zoo doo." To make zoo doo, approximately 200 yards of mulch gets mixed with animal waste from the zoo and biosolids from the Terminal Island Water Reclamation Plant each week. The mixture is composted at the Griffith Park Composting Facility for approximately 46 days before it is ready for use. RAP uses the compost during various maintenance projects. For example, it is used as a top dressing for re-seeding ball fields, incorporated into flower beds (e.g., the rose garden at LA Expo), applied at golf courses during aerification of greens and fairways, and mixed into mulch. There is an opportunity to expand the use of compost and mulch at parks throughout LA. The "zoo doo" compost is also free to the public for pick up.

RAP works with the local nonprofit LA Compost to provide residents with opportunities to access local composting infrastructure at Griffith Park and is considering incorporating compost sites at additional parks. Currently, this is small-scale production. The Forest Division anticipates adding carbon or mulch to the mixture for a high-quality compost.

5.3 Tree Replacement

Tree replacement is guided by the objectives and functions as defined by the Recreation & Parks Department and follows the planting specifications (Appendix K).

RAP trees are planted according to the reforestation practices. Sometimes when crowding or other physical constraints make it impossible to plant the same tree in the same place where it was removed, an alternate location is found. Undesirable tree species are not replaced.

5.4 Tree Planting

The role of the urban forest is to improve environmental quality and increase the economic, physical, and social health of communities. As communities continue to grow urban forests will become even more important to the quality of life.

"A Society grows great when old men plant trees whose shade they know they shall never sit in"

—GREEK PROVERB

Part of sound urban forest management is to plant desirable, sustainable trees in the urban environment. The ideal park tree is a shade tree with minimum susceptibility to wind damage and branch drop, does not require frequent pruning, produces slight litter, is deep-rooted, has few serious pest and disease problems, and tolerates a wide range of soil conditions, irrigation regimes, and air pollutants. Since relatively few trees have all these traits, it is important to match the tree species to the planting site by determining what issues are most important on a case-by-case basis.

With a potential for an increased incidence of maladapted species in the tree population due to climate change and for urban areas to exacerbate these stresses, it is important to incorporate new species in ongoing planting and tree replacement and then proactively monitor and select high-performing species for new plantings. Climate ready trees are trees that are likely better suited to the new climate trends in a particular region with traits that allow them to be drought tolerant, resist pests and disease, and withstand other stressors associated with climate change, such as increased salt and wind.

Government agencies, researchers, nonprofits, nursery growers, and nursery brokers are leading the way in the climate ready trees initiative to experimentally plant trees that are best suited to the new challenges brought up by climate change. Candidate tree species are being monitored and, when possible, being promoted/incorporated in Los Angeles parks if they seem likely to succeed in future conditions.

5.4.1 RAP REFORESTATION PRACTICES

In new tree plantings, RAP does a general evaluation of tree canopy in each of the city parks and/or the specific location with respect to age class; tree size; and a variety of evergreen, deciduous, and coniferous trees. RAP calls for the gradual planting of trees at each park facility in the coming decade.

On average, approximately 500 trees are planted in LA parks each year. The majority of trees planted are through grant funding and partnerships with nonprofit partners that receive the grants, such as the current collaboration with the City Plants program. City Plants coordinates with nonprofit partners and multiple LA City Departments to promote and organize tree planting and young tree care throughout the city. Additional tree planting occurs during capital improvement projects as replacement plantings and through grants or the tribute program.

Kids gather around a newly planted tree.

5.4.2 PLANTING GUIDELINES FOR PARK TREES

Recreation and Parks Tree Planting and Selection Guidelines (Appendix J) are guidelines to assist staff in making the best possible match of tree species to a specific location. They provide a starting point for species selection and are not intended to be limiting.

Department guidelines include priorities for native habitat restoration or enhancement, prevention from large canopy losses caused by pest epidemics, climate change, and geographic consideration for species selection.

5.4.3 NURSERY SPECIFICATION FOR PARK TREES

It is often said that arboriculture begins in the nursery. Specifications for the purchase of trees by RAP call for high-quality, healthy plant stock. Healthy and vigorous park trees begin with plants that meet the specifications outlined in Appendix K. RAP staff may refuse plants that do not meet the specification with any cost for replacement.

5.4.4 SOURCING PARK TREES

Currently, RAP has a commodity contract through the General Service Department to obtain planting material from a single source. While their source stocks an assortment of species, the current process poses limitations. For example, species availability is dependent upon the nursery stock available at the time and some desirable species are not carried. Species that are difficult to source are therefore not widely planted. Working with several sources (e.g., through a prequalified list of nurseries) and working with contract growers to obtain hard-to-find species would allow the contract to better fit the Department's needs.

To promote locally adapted nursery stock, RAP and partnering organizations identify and select individual trees that show desirable traits for propagation. Parent trees have been located by RAP in Los Angeles parks, the Huntington Botanical Gardens, and through regional collaborators. Propagation occurs through cloning and/or seed collection. RAP has a partnership with City Plants at Commonwealth Nursery in Griffith Park where they grow locally sourced seeds at the nursery. The resulting materials will help ensure that seedlings are well-adapted to local conditions.

5.4.5 REPLACEMENT OF REMOVED TREES OR SHRUBS PROTECTED BY LA CITY PROTECTED TREES ORDINANCE

Replacement of removed protected trees or shrubs will occur with trees or shrubs of a protected variety. To the extent possible, as determined by RAP, (1) a protected tree shall only be replaced by other protected tree varieties and shall not be replaced by shrubs, (2) a protected shrub shall only be replaced by other protected shrub varieties and shall not be replaced by trees, and (3) protected trees and shrubs shall be replaced within the same property boundaries.

Protected trees and shrubs always need to be replaced with at least a 4- 24-inch box tree of one of the protected tree/shrub species.

If the diameter of the tree to be replaced is ten inches or greater, Department of Recreation and Parks' inch-per-inch replacement policy will be used to determine the replacement requirements beyond the 4- 24-inch box protected species.

Replacement species beyond the 4- 24-inch box protected species will be determined by Planning and Forestry.

6.0 TREE EVALUATION FOR HAZARD & ECONOMICAL VALUE

Introduction

Evaluation of trees for possible hazards and removal is critical if we are to provide a safe environment in our city parks. A Certified Arborist with TRAQ qualification in the RAP Forestry Division performs the evaluation and must consider risk thresholds and liability. Unlike in the natural forest where a tree manager might permit a tree with a history of branch failure to continue to be retained, in a public area, the manager must evaluate risk and mitigate the potential for failure. If a tree is determined to have moderate to high risk, RAP is responsible if the tree falls and causes damage or injury to persons or property.

Because of the value of trees to neighborhoods, if a tree is to be removed, the reason for removal is made public. Trees beautify neighborhoods, provide energy savings, offer a pleasant park setting for recreational activities, and add value to the property.

6.1 Hazardous Trees

All trees have the potential to fail, but relatively few actually do so. In establishing criteria to evaluate trees for risk, a focus is given to trees in urban areas, recognizing the unique combinations of species and site characteristics found in cities.

Documentation of tree risk assessment is kept in the Forestry Work Order System. The ISA Basic Tree Risk Assessment Form (Appendix H) is completed for all trees undergoing a risk assessment.

6.1.1 EMERGENCY REMOVAL OF TREES

If in the judgment of the arborist of the Forestry Division a tree poses an imminent likelihood of failure with high likelihood of impacting a target and causing significant or severe damage, it will be removed. If the tree is a protected tree, documentation (including digital photos) will follow after the hazard has been mitigated.

RAP crew working to clear a downed tree off a parked car.

It is also highly recommended that all tree removals are properly documented before the removal.

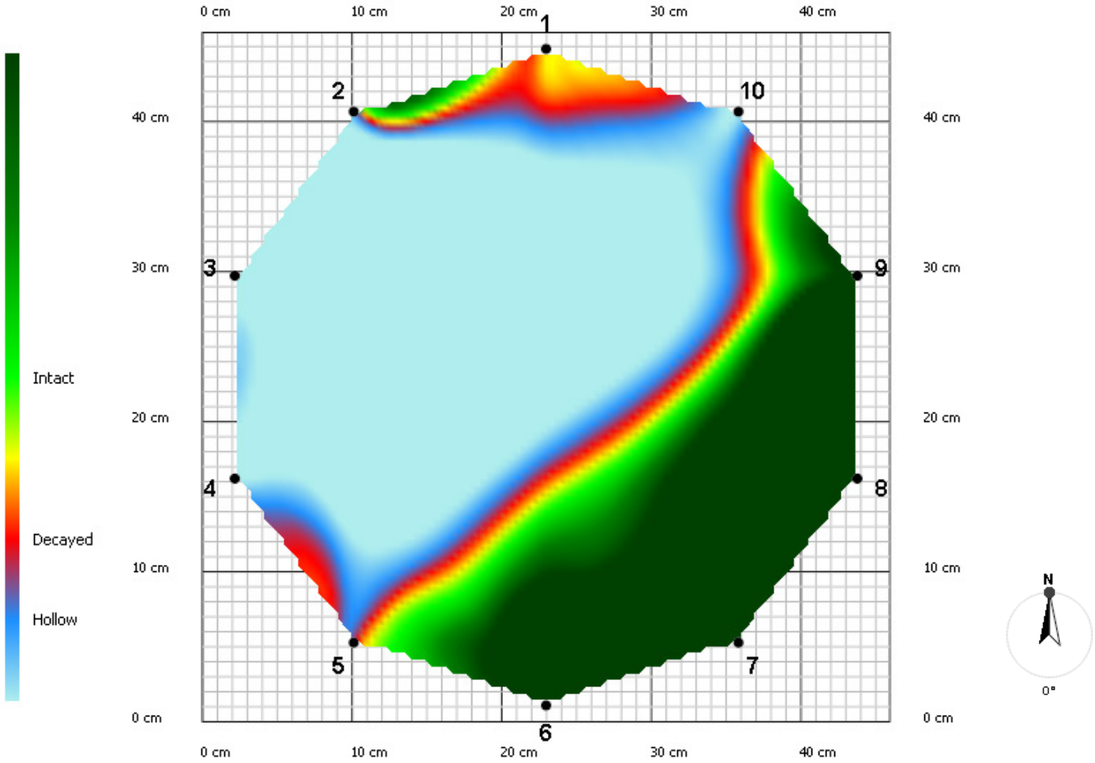
6.1.2 CRITERIA DETERMINING HAZARDOUS TREES

The risk level of a tree is based on the likelihood of failure, likelihood of impact, and consequence of failure.

RAP employee stands next to a large oak tree with a hollow base.

Methods of diagnosing internal defects in trees can be broadly classified into two classes: (1) destructive methods, such as using increment borers or resistance micro-drilling, and (2) nondestructive methods, such as using acoustic waves or electromagnetic waves. For mature and well-established park trees, especially those designated as heritage, historical, or protected trees, nondestructive diagnostic methods should be used to minimize physical damage to the trees. Sonic tomography can detect and measure patterns of internal decay of living trees without damaging the trees. Sensors are placed around the trunk to measure the speed of sound traveling through healthy versus decayed wood. Data is captured and then displayed in an image that depicts sound wood and the extent of decayed wood or illustrates the presence of cavities.

RAP occasionally uses sonic tomography to determine the extent of decay in high-value trees to determine if they are hazards and if removal is necessary. Moving forward, RAP would like to use sonic tomography more regularly.



Internal tree health can be visualized in standing trees using sonic tomography.

6.1.3 PUBLIC NOTIFICATION

Removal of any trees other than emergency removals within the limits of RAP Department must follow the Tree Removal Procedure (Appendix F). The Notification Protocol must precede removal of a large number of trees for Large-Scale Tree Removal Projects (Appendix G). The document contained in this appendix informs respective council districts and the public by the posting of notification signs on trees two weeks prior to their removal.

LA Parks Facilities and Disaster Recovery

Forestry employees are a dynamic resource for the City. RAP-specialized staff can be recalled to provide emergency tree work and clear roadways. RAP recreation facilities become shelters during any disaster. There are several recent examples of park facilities being used due to wildfire, including shelters during the Saddleridge Fire and the LaTuna Fire. They also open shelters for those affected by apartment fires or other emergencies that affect small, densely populated areas. These include the 27th Street explosion where 61 people were displaced and RAP opened Trinity Recreation Center to aid those affected. RAP staff support the Red Cross in running the shelters, but some shelters have been completely staffed by RAP.

In 2019, RAP sheltered 643 people, which was the largest yearly response on record. The Saddleridge Fire was the largest single emergency response, where they sheltered 325 people. On average, RAP responds to emergencies like these three to four times a year. In addition to shelters, sometimes helicopter response uses the park to stage during water dumping.

RAP Responding to an Emergency.

6.2 Tree Appraisal

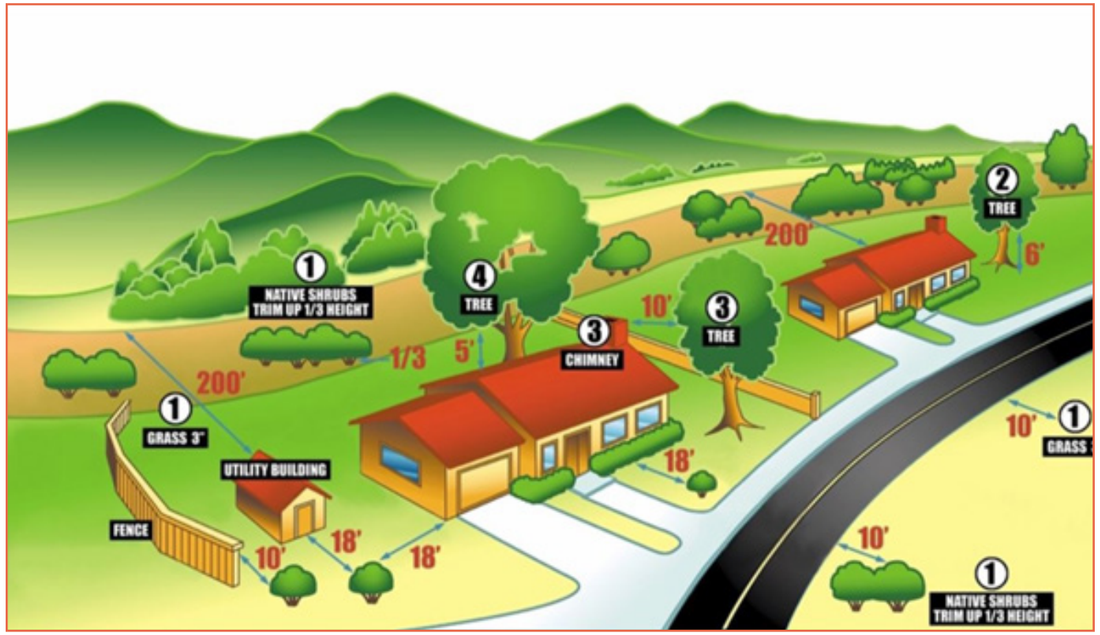
Values of trees are subjective—it is difficult to appraise the true worth of a tree. RAP applies the following three methods of tree appraisal:

- **Repair Cost.** This method is used when there is damage to the tree. The goal is to correct the damage or mitigate further losses. The repair cost is an estimate of providing these necessary treatments.
- **Reproduction Cost.** This method is used when a tree has been significantly and/or irreparably damaged or removed. The goal is to estimate the cost to replicate or duplicate the original tree with a tree of a similar species, size, shape, and condition that provides most or all of the same benefits.
- **Functional Replacement Cost.** This method is used in similar situations as the reproduction cost method, but the functional replacement cost evaluates the cost of restoring benefits rather than duplicating the original tree.

6.3 Wildland Urban Interface (WUI)

The wildland urban interface (WUI) is defined as areas where the built environment meets the natural environment. Commonly, this area is characterized by infrastructure adjacent to or within natural areas that exhibit conditions favorable to wildfire. All park lands are classified as WUI, and RAP manages several naturalized areas within parks that contain flammable fuels that could facilitate the rapid spread of small and large fires (e.g., large amounts of litter, ladder fuels, peeling bark, and plant oils/resins). The hazards in the WUI have been intensified by years of fire exclusion throughout the country. As fires become more common, it is important for RAP to develop a wildfire plan that considers the park location, type of park, type of fire, and the implications fires have for the park system.

RAP follows the fire department's policies and procedures to prevent and respond to wildfire (Appendix N). RAP dispatches a park ranger and fire equipment to all reports of fires on park land. When a fire is confirmed, the Los Angeles Fire Department (LAFD) is requested. Griffith Park has a fire response team, which may be first on site to put out fires in certain circumstances.



6.3.1 PREVENTATIVE MEASURES AND BEST MANAGEMENT PRACTICES

All staff are trained on preventing wildfire, and designated staff are trained in responding to wildfire (e.g., Griffith Park Fire Response Team). While policies, procedures, and best management practices are followed during wildfire prevention and safety, many of the recent fires have burned hot, and high winds have played a role in their rapid spread. Defensible space becomes less meaningful in these types of fires, and they are expected to increase as a result of climate change.

Brush Clearance

The primary preventative wildfire measure in parks is brush clearance (for more information see Ordinance No. 185789). Brush clearance occurs yearly in all parks, May through August, and the ordinance outlines acceptable equipment and conditions for it to occur. RAP Maintenance Supervisors in each district assess the need for brush clearance to stay in compliance with LAFD policies on wildfire safety. RAP solicits vendors to complete the necessary work, including tree removal and brush clearance. After a vendor is chosen, RAP ensures the work has been done to their specifications. Each year, the LA Fire Department ensures the parks are in compliance.

During the brush clearance process, RAP balances addressing public safety with preserving wildlife habitat. Bird surveys are done in some parks, especially those with sensitive habitats. This ensures that work crews follow best management practices and allow for a buffer to avoid disturbing wildlife.

Fire Bans

The Park Ranger Division employs peace officer park rangers who enforce park ordinances and fire ordinances as they pertain to very high fire hazard severity zones. Grilling is restricted in the very high fire hazard severity zones and can be closed off in other parks during the high fire danger months. This includes caution taping of grills and interactions with park users, such as the issuance of citations or arrest for persons smoking, kindling fires, or creating a fire hazard on department property.

Other preventative measures and best management practices include (Southern California Guidebook Sustainable and Fire-Safe Landscapes In The Wildland Urban Interface and National Park Service Wildland Urban Interface):

- Identify locations with significant dead or dying vegetation and/or invasive species.
  - » Address fuel loading, fuels management, and public safety related to wildfire risk and damage.
  - » Prioritize tree management activities, including removals, structural pruning, irrigation adjustments, pest control, or other alterations in maintenance.
- Implement landscape design features, fuel breaks, tree management practices, and plant selection to help prevent the spread of fire into built areas.
- Focus on converting areas dense in highly flammable invasive plant species into more fire-resistant vegetation (characteristics include storing water in leaves or stems, deep root systems, slow growth, relatively low concentrations of volatile compounds, open branching structures with minimal dead material).
- Create defensible space by pruning up low limbs (help prevent crown fires) and continue emphasizing brush clearance in routine park maintenance.
- Be aware of red flag days and modify behaviors (e.g., heightened awareness, avoid using certain equipment/vehicles).
- Understand escape routes and emergency contact information in the case of fire.
- Regularly turn mulch piles to avoid spontaneous combustion and monitor them to catch any signs of fire early and apply water to the piles to reduce the fire hazard.
- Communicate with neighboring land managers for congruent fire mitigation across property borders.
- Balance public safety with habitat maintenance.
  - » Prescribed burning where safe to promote native species, wildlife habitat, and reduce the severity and intensity should a fire start.
  - Implement and retrofit structures to be "firewise" as park improvement projects occur.

Aerial Imagery

RAP uses aerial imagery to understand the health and density of trees and shrubs in inaccessible park land. This additional data allows managers to better understand fuel loads and density to inform wildfire prevention and planning.

6.3.2 POST-FIRE ACTION

It is equally important to take steps to rehabilitate parks after a fire. This entails both immediate stabilization and long-term restoration. Once it is safe to enter a burned area, RAP assesses trees and generates a plan for blocking off areas of parks and the removal of trees that impact public safety. RAP monitors burnt areas. Snags are left when possible, to promote wildlife habitat, and RAP staff continue to monitor these areas to determine if there is a chance of tree failure months to years after the fire. RAP allows for standing dead trees to stay up when they do not cause concerns for public safety.

Some additional practices RAP considers include (Forest Service):

- Stabilize burned areas with debris traps, mulch, straw, or other materials to help prevent erosion, flooding, and sediments in the water supply.
  - » Focus on areas with steep slopes and/or fragile habitats.
- Use fencing and signage to protect both the park land and visitors from risks associated with the wildfire.
- Re-establish vegetation, including reseeding and planting trees.
- Repair damaged facilities.
- Monitor restoration treatments.

6.3.3 WILDFIRE AND PRIVATE PROPERTY

Article 7 of LA's Fire Protection and Prevention Code requires property owners to engage in fire safety activities relating to vegetation that could fuel a wildfire. Further, the brush clearance requirements specify that property owners in very high fire hazard severity zones also engage in safety measures. Requirements include acceptable equipment and conditions for brush clearance to occur. It also specifies the areas that need to be cleared, acceptable height of brush, and trimming/spacing for shrubs and trees (Appendix N).

7.0 Safety Standards

Introduction

Safe tree maintenance is the most important objective for the supervisory staff of the RAP Forestry Division. Employees are continuously trained on safe tree-care operations to avoid injury, loss of time, loss of equipment, damage to property, and to protect public safety. RAP recognizes safety standards, which are represented in the following two documents:

7.1 ANSI Z133.1 Safety Standards for the Tree Care Industry

The publication (Appendix B) establishes safety standards for tree-care operations in the United States and provides safety criteria for workers and the public.

The following are topics covered in the publication:

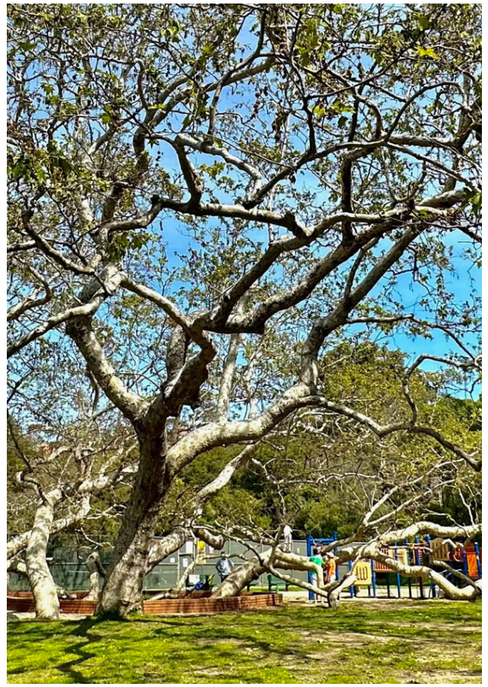
- General safety requirements.
- Electrical hazards.
- Safe use of vehicles, mobile, and towed equipment.
- Portable power hand tools.
- Hand tools and ladders.
- Tree climbing

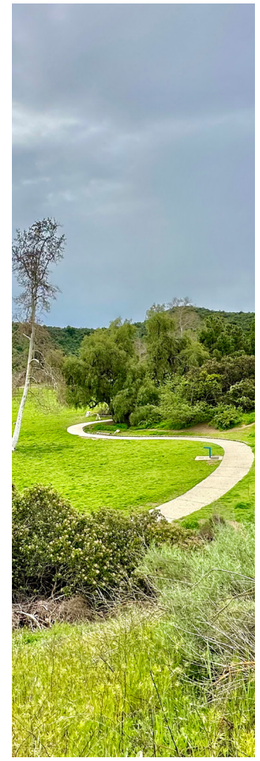
The booklet also provides:

- Glossary of terms used in the tree industry.
- Recommended guidelines for standard performance and safety training.
- General safety procedures that apply to all tree work.
- Available resources.
- Weight of green logs.
- Aerial rescue flowchart.
- Hand signals for crane operations.
- Electrical hazard abatement.
- Fall-protection systems.
- Live line tools.

7.2 RAP Code of Safe Practices for Forestry Operations

The RAP safety officer established this code to be recognized by all employees working in tree operations (Appendix C). The safety practices also apply to any contractors performing work for RAP.





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Appendix A. RAP Tree Preservation Policy

PURPOSE

The purpose of the Tree Preservation Policy is to establish a regulatory tool to provide orderly protection of specified trees, protect their value, and avoid significant negative impacts to the ecosystem. The policy regulates protection of trees in four categories: (1) Trees Protected by Ordinance, (2) Heritage Trees, (3) Special Habitat Value Trees, and (4) all other Common Park Trees.

TREES PROTECTED BY ORDINANCE

The current City of Los Angeles ordinance protects the coast live oak (*Quercus agrifolia*), Valley Oak (*Quercus lobata*), laurel bay tree (*Umbellularia californica*), western sycamore (*Platanus racemosa*), Mexican elderberry (*Sambucus mexicana*), Southern California black walnut (*Juglans californica*), toyon (*Heteromeles arbutifolia*), or any other tree of the oak genus indigenous to California but excluding the scrub oak (*Quercus berberidifolia*) measuring four inches or more in diameter, four and a half feet above the ground level at the base of the tree. This definition shall not include any tree or shrub grown or held for sale by a licensed nursery or trees or shrubs planted or grown as a part of a planting program. The RAP Board of Commissioners must grant permission before any alterations to protected trees are made that could cause them to be damaged, relocated, or removed. If the tree poses an immediate threat to life or public safety, the RAP arborist has the discretion to modify this process, maintaining proper documentation, including digital photographs. Protected trees and shrubs identified as dead trees by the RAP arborist can be removed without a permit.

HERITAGE TREES

Heritage Trees are individual trees of any size or species that are specifically designated as heritage for their historical, commemorative, or horticultural significance. The list of designated Heritage Trees remains open for new designations and provides useful information to RAP staff regarding the importance of their actions while planning activities near Heritage Trees. Since Heritage Trees are protected trees, recommendations from the RAP arborists must be obtained before any alterations to the protected trees are made that may cause the tree to become damaged, relocated, or removed. The General Manager of RAP or their designee must approve the recommendation before any action proceeds. Pruning also can cause irreversible damage to the tree and must be in compliance with the ISA Tree Pruning Guidelines. Pruning must be performed under supervision of ISA Certified staff only. If the tree poses an immediate threat to life or public safety, the Forestry Division arborist may compromise the process as long as proper documentation, including digital photographs, is kept. Heritage Trees identified as dead by the RAP arborist will be removed and recorded into the designated Heritage Trees list. The Heritage Trees list can be obtained from the Regional Headquarters Office and the Forestry Division.

SPECIAL HABITAT VALUE TREES

After more than a century of development, the native and indigenous landscape throughout the city has changed significantly. Special Habitat Value Trees, because of decreasing numbers and their fragility in an urban setting, are particularly noteworthy because of the following:

- California native trees provide habitat for state or federally protected animal species.

- California native trees that are located in the Pacific Flyway are important to thousands of migratory birds each spring and fall during migration season.
- California native trees provide a foundation for biodiversity and a healthy ecosystem.

The following California native trees are protected in this group: California sycamore (*Platanus racemosa*), California bay (*Umbellularia californica*), boxelder (*Acer negundo* 'Californica'), big leaf maple (*Acer macrophyllum*), California walnuts (*Juglans californica* and *J. hindsii*), toyon (*Heteromeles arbutifolia*), native cherry trees (*Prunus ilicifolia*, *Prunus lyonii*), cottonwood (*Populus fremontii*, *P. trichocarpa*), and native willow trees (*Salix hindsiana*, *S. laevigata*, *S. lasiandra*, *S. lasiolepis*). Additional species may be included in this group with respect to their species habitat value.

Special Habitat Value Trees are protected trees. Before any alterations to protected trees are made that may cause them to be damaged, relocated, or removed, a recommendation for action must be obtained from the RAP arborists. If the area is riparian or other protected sensitive habitat, RAP's Environmental Division should be contacted.

The recommendation, which outlines measures to protect and preserve—and in some circumstances remove—must be approved by the general manager of RAP or their designee before any action proceeds. Some forms of pruning also can cause irreversible damage to trees and must be in compliance with the ISA Tree Pruning Guidelines. Pruning must be performed under supervision of ISA Certified staff only. If the tree poses an immediate threat to life or public safety, the RAP arborist may intervene, maintaining documentation and digital photos.

Special Habitat Value Trees identified as dead by the forestry arborist will be assessed. Trees may be reduced and kept as snags if they do not threaten targets or be removed and recorded into the Forestry Work Order System.

COMMON PARK TREES

Most city parks contain mature exotic trees that have great value beyond the shade they provide to park users. They are a scenic resource to surrounding neighborhoods, and their removal or disfigurement by extreme pruning for construction, clearance, or other reasons diminishes the value of the urban forest and often provokes public protest. Some trees have not been designated under a protected group of trees but still provide aesthetic, sentimental, economical, and environmental value.

The large number of trees in our parks has a significant cooling effect on the urban environment in Los Angeles, where tree canopy represents only 22 percent of the land. Every tree in our city parks is recognized as a valuable asset and must be protected. The Tree Care Manual (see chapters 3 and 4) provides guidelines for protecting trees during construction and offers suggestions and alternative technical solutions to avoid damages to trees. The Department's Assistant General Managers are responsible for seeing that the planning, maintenance, construction and recreation staff follow and implement tree preservation and protection practices outlined in the Tree Care Manual.

Appendix B. ANSI Standards and Best Management Practices

ANSI STANDARDS

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

- ANSI A300 Pruning Standard—Part 1, 2017.
- ANSI A300 Soil Management—Part 2, 2011.
- ANSI A300 Support Systems Standard—Part 3, 2013.
- ANSI A300 Lightening Protection Systems Standard—Part 4, 2008.
- ANSI A300 Construction Management Standard—Part 5, 2012.
- ANSI A300 Transplanting Standard—Part 6, 2012.
- ANSI A300 Integrated Vegetation Management Standard—Part 7, 2012.
- ANSI A300 Root Management Standard—Part 8, 2013.
- ANSI A300 Tree Risk Assessment Standard a Tree Failure—Part 9, 2017.
- ANSI A300 Integrated Pest Management—Part 10, 2016.

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

- ANSI Z133 Safety Standard, 2017.

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

The ANSI publications can be obtained from:

- International Society of Arboriculture (ISA), www.isa-arbor.com.
- American National Standard Institute Standard for Tree Care Operations—Tree, Shrub, and Other Woody Plant Maintenance—Standard Practices.

BEST MANAGEMENT PRACTICES (BMPS)

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

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

- Action Thresholds.
- Monitoring Tools and Techniques.
- Preventive Tactics.
- Control Tactics.
- Documentation and Record keeping.

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

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

Lightning Protection Systems, Third Edition, E. Thomas Smiley, A. William Graham, Jr, and Scott Cullen, 2015

Describes proper installation and maintenance of lightning protection systems that can effectively prevent serious lightning damage to trees. It also serves as a companion publication for American National Standard for Tree Care Operations—Tree, Shrub and Other Woody Plant Management—Standard Practices (Lighting Protection Systems).

Managing Trees During Construction, Third Edition, Nelda Matheny, Dr. E. Thomas Smiley, Ryan Gilpin, and Dr. Richard Hauer, 2023

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

Reducing Infrastructure Damage by Tree Roots, Larry Costello and Katherine S. Jones, 2003

Provides a comprehensive reference on tree and infrastructure conflicts, containing up-to-date descriptions and assessments of methods used to reduce damage. The information guides tree managers, planners, and engineers to create effective management plans.

Root Management, Laurence R. Costello, Gary Watson, E. Thomas Smiley, and Richard Hauer, Second Edition, 2023

Recommended practices for inspecting, pruning, and directing the roots of trees in urban environments to promote their longevity while minimizing infrastructure conflicts. Special companion publication to the ANSI A300 Part 8: "Tree, Shrub, and Other Woody Plant Management–Standard Practices" (Root Management).

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

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

Tree Injection, Shawn Bernick, and E. Thomas Smiley Second Edition, 2022

Provides guidance for arborists who use tree injection to systemically treat trees for pest problems, nutrient deficiencies, or growth regulation. Topics include:

- Why Use Tree Injection?
- Types of Tree Injection
- Potential Damage from Tree Injection
- Application Considerations
- Administering Injections
- Record Keeping and Legal Considerations
- Tree Ring Porosity of Hardwood Tree Genera
- Sample Bid Specifications and Tree Injection Contract Language

Tree Inventories, Second Edition, Jerry Bond, 2013

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

Tree Planting, Second Edition, Gary Watson, 2014

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

Tree Pruning, Third Edition, Sharon J. Lilly, Edward F. Gilman, and E. Thomas Smiley, 2019

Provides an interpretation of the ANSI 300 Pruning standards that is useful in the specification and practical application of pruning. Includes descriptions and background information on pruning systems, pruning objectives, a tree's response to pruning, types of cuts, work practices, and others.

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

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

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

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

Tree Support Systems, Third Edition, E. Thomas Smiley and Sharon Lilly, 2014

Presents proper installation and maintenance for cabling and bracing branches, guying established trees, and guying and propping newly planted trees. Covers installation and tools needed for methods on both established and newly planted trees.

Utility Pruning of Trees, Geoffrey P. Kempter, 2004

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

Utility Tree Risk Assessment, John W. Goodfellow, 2020

Guides utility personnel, utility vegetation managers, utility tree risk assessors, and line clearance contractors in assessing tree-related risk to overhead electric utility infrastructure by tree failure as accurately and consistently as possible, and to support decisions related to risk mitigation practices that achieve utility objectives. It also serves as a companion publication to the ANSI A300 Part 9: Tree, Shrub, and Other Woody Plant Management—Standard Practices (Tree Risk Assessment a. Tree Failure).

Appendix C. Code of Safe Practices

CITY OF LOS ANGELES DEPARTMENT OF RECREATION AND PARKS CODE OF SAFE PRACTICE FORESTRY DIVISION

1. Employees and contractors shall follow all safety rules and regulations established by the federal, state, and local government. Employees shall report any unsafe condition or practice immediately to their supervisor.
2. All employees shall participate in a safety tailgate at least every ten working days.
3. Any employee known to be under the influence of drugs or alcohol shall be removed from the job site and reported immediately to supervision.
4. Horseplay, scuffling, or other acts which can have an adverse effect on employee health and safety shall be prohibited.
5. Supervisors shall ensure that employees engaged in tree work are provided safe operating rules. Employees shall be trained and instructed in the hazards involved in their job assignments, including proper use of equipment.
6. All tree surgeon supervisors shall be certified arborists or obtain certification by the end of their probationary period. Each work location where tree care operations are to be done shall be under the direction of a qualified arborist.
7. Employees shall be instructed to ensure that all safeguards and controls are in place.
8. When removing a tree, the work area shall be clear to prevent injury and provide escape.
9. No employee shall knowingly be permitted to work if that employee's ability is impaired by fatigue or illness and might unnecessarily cause injury to other employees.
10. No employee shall operate power equipment that requires specific training and certification unless they have been trained and possess the current certification for that equipment.
11. No employee shall operate a motor vehicle without a current California driver's license for the class of vehicle assigned. All accidents involving City vehicles shall be reported immediately to supervision and the police department.
12. All on-the-job injuries shall be reported immediately to supervision no matter how slight. Employees shall be trained in the identification of poisonous plants and harmful animals.
13. Employees are responsible for inspecting all hand and power tools before the start of each shift. Any damaged or defective hand or power tools shall be removed from the job immediately and tagged out of service.
14. Power saw engines shall be shut off or have the chain brake engaged whenever the saw is carried for a distance greater than 50 feet or across hazardous terrain.
15. Saw engines shall be shut off for all maintenance, refueling, and adjustments.
16. All personal protective equipment, such as head, hand, face, eye, hearing, respiratory, and cut resistant leg protections, shall be worn at all times when required.
17. All tree workers' saddles and ropes shall be inspected daily.
18. Employees engaged in tree maintenance or removal in proximity to electrical conductors and other energized equipment shall be trained to recognize and be qualified to work within electrical hazards.
19. If employees cannot maintain a minimum distance from energized conductors, employees shall report the concern to the supervisor. The work will then be contracted out to be completed by a qualified line-clearance arborist.
20. Tree workers shall never carry tools while climbing.
21. Supervisors shall establish rescue procedures and provide training in first-aid, cardiopulmonary resuscitation (CPR), and aerial rescue.

Appendix D. RAP Tree Preservation Specifications

1.01 TREE PROTECTION

The requirements listed below shall be included in all Construction Document sets. Once determined, the TPZ shall be clearly shown on all plans submitted to the Department of Recreation and Parks for project review and approval purposes, and on all applicable Construction plan sheets.

Determining the Tree Protection Zone (TPZ):

All trees (including the dripline) that occur within the project area of work as shown on the plans (and any associated project laydown, storage, and parking areas), and not specifically approved for removal, shall be protected with a designated TPZ, determined by the following means:

- The TPZ for each tree shall be the area inside a radius (*not the diameter) measured from the outside of the tree trunk, and shall be calculated according to the following formulas:
  - » Single trunk trees - multiply the trunk diameter in inches, measured 4.5' above grade, by 1.5 feet.
  - » Multi-trunk trees - multiply the sum of the diameters of all trunks in inches, measured 4.5' above grade, by 1.5 feet.
  - » Palm trees - 5' from the base of the trunk.
  - » Example: 10" of measured trunk diameter would require 15' of TPZ radius.

Tree Protection Fencing:

- The Contractor shall install a continuous 5' high temporary chain link fence with one pedestrian access gate along the boundary of the TPZ. See TREE PROTECTION FENCE detail. If the approved plans show a differing TPZ fencing layout, those plans will supersede.
- The contractor shall provide one sign per every 20 lineal ft. of fence bordering the TPZ indicating that fencing shall not be removed. See the sign detail that is included as part of the TREE PROTECTION FENCE detail.
- In cases of approved construction activity shown within a TPZ area, the location of the Tree Protection Fencing may be altered at the Contractor's request (permanently or temporarily) to minimize conflicts with construction activity if approved in advance by RAP Forestry (and may include additional mitigation requirements). Note that TPZ requirements still apply within the entire TPZ area, even if it is outside the TPZ fencing.
- All required TPZ fencing shall be installed and approved by RAP Forestry prior to beginning any demolition or construction activities.

Within the TPZ, the Contractor shall adhere to the following general requirements, including but not limited to:

- No stockpiling or storage of any material, debris, or soil.
- No storage of any construction equipment.
- No vehicular access routes or parking.
- No cutting of roots 2" diameter or larger.
- No disturbance of soil or grade changes. (See Planting Specifications for soil preparation methods inside TPZ areas).
- No objects of any kind are to be attached to tree trunks.

Approved Work inside TPZ areas:

No work is permitted within the TPZ without the prior approval of each of the following: (1) the project Landscape Architect, (2) the Project Manager, and (3) RAP Forestry staff. Any work shown or described on approved bid set plans shall be presumed to be authorized.

Any work authorized within the TPZ must be done under the supervision of a Monitoring Arborist, who shall be provided and paid by the Contractor. The Monitoring Arborist must be an ISA Certified Arborist or a Registered Consulting Arborist, with verifiable experience in the protection of trees during construction. Prior to the start of any demolition or other construction work, the Contractor shall submit the proposed Monitoring Arborist to RAP Forestry for approval. No work inside TPZ areas shall commence before the Monitoring Arborist is approved and available.

The role of the Monitoring Arborist shall be:

- To generally monitor the enforcement of the Tree Protection Specifications listed herein. Any violations of the Tree Protection Specifications observed shall be promptly reported to the Construction Manager and BCA Inspector.
- To Provide close observation and monitoring of any construction activity requiring excavation inside the TPZ area to assure adherence to the Tree Protection Specifications and prevent damage to tree roots.
- If determined by the Monitoring Arborist and/or RAP Forestry that excavation or trenching inside the TPZ using conventional methods & equipment cannot proceed without prohibited damage to tree roots, special methods and equipment may be required. This may include air spades, hand excavation, or other methods approved by RAP Forestry.
- If any roots over 2" diameter are damaged during construction, the Monitoring Arborist shall prescribe and supervise any remedial care required, or the safe cutting and removal of damaged roots per ISA standards.
- Report to RAP Forestry and the Construction Manager promptly if any unforeseen conditions or other issues arise during construction that may impact the protection of existing trees.

Additional Requirements outside of TPZ areas:

Beyond the TPZ, the Contractor shall also be responsible for protecting all trees within the boundaries of the construction zone, including vehicular access areas leading to the construction zone, lay-down areas, and any other areas impacted by construction activities.

Within the boundaries of the construction zone (including the TPZ), the Contractor shall be responsible for mitigating construction-related dust accumulation on all trees by spraying the trunks, limbs, and foliage with water to a maximum height of 30 feet during April through November, at monthly intervals.

The Contractor shall be responsible for irrigating all existing trees within the work area. If the existing irrigation systems are functional, the Contractor may choose to use them. If not, or if the irrigation system is temporarily shut down or being replaced, the Contractor must hand water the trees as needed. Trees should be watered deeply and less frequently, based on weather conditions, ensuring soil moisture reaches at least 18 inches deep, as measured with a soil probe.

Any trees damaged in these areas shall also be subject to the same mitigation requirements (as determined by RAP Forestry), monetary or replacement, specified in Section 1.02 below. Any necessary root cutting in this area must be confirmed in advance by RAP Forestry and under the supervision of the Monitoring Arborist.

See also the General Conditions for any damage done by the Contractor to landscaping or other park amenities that fall outside the boundaries of the construction zone.

Upon completion of work and approval of the Project Manager, the Contractor shall promptly remove all items installed to protect trees during the construction process.

Any of the following Southern California native tree and shrub species shall be protected under RAP's Protected Tree Policy:

Protected Trees:

- Oak tree, including valley oak (*Quercus lobata*) and California live oak (*Quercus agrifolia*), or any other tree of the oak genus indigenous to Southern California but excluding the scrub oak (*Quercus berberidifolia*).
- Southern California black walnut (*Juglans californica*).
- Western sycamore (*Platanus racemosa*).
- California bay (*Umbellularia californica*).

Protected Shrubs:

- Mexican elderberry (*Sambucus mexicana*).
- Toyon (*Heteromeles arbutifolia*).

The Contractor shall comply with the requirements of the ordinance.

1.02 CONSEQUENCES OF VIOLATING THE TREE PROTECTION SPECIFICATIONS

ANY FAILURE BY THE CONTRACTOR TO ADHERE TO THE REQUIREMENTS DETAILED WITHIN THESE SPECIFICATIONS WILL RESULT IN THE SUSPENSION OF ALL CONSTRUCTION ACTIVITIES, TO BE DONE AT THE CONTRACTOR'S EXPENSE. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MITIGATION OF, PAYMENT FOR OR REPLACEMENT OF ANY TREES DAMAGED THROUGH NON-COMPLIANCE WITH THESE SPECIFICATIONS.

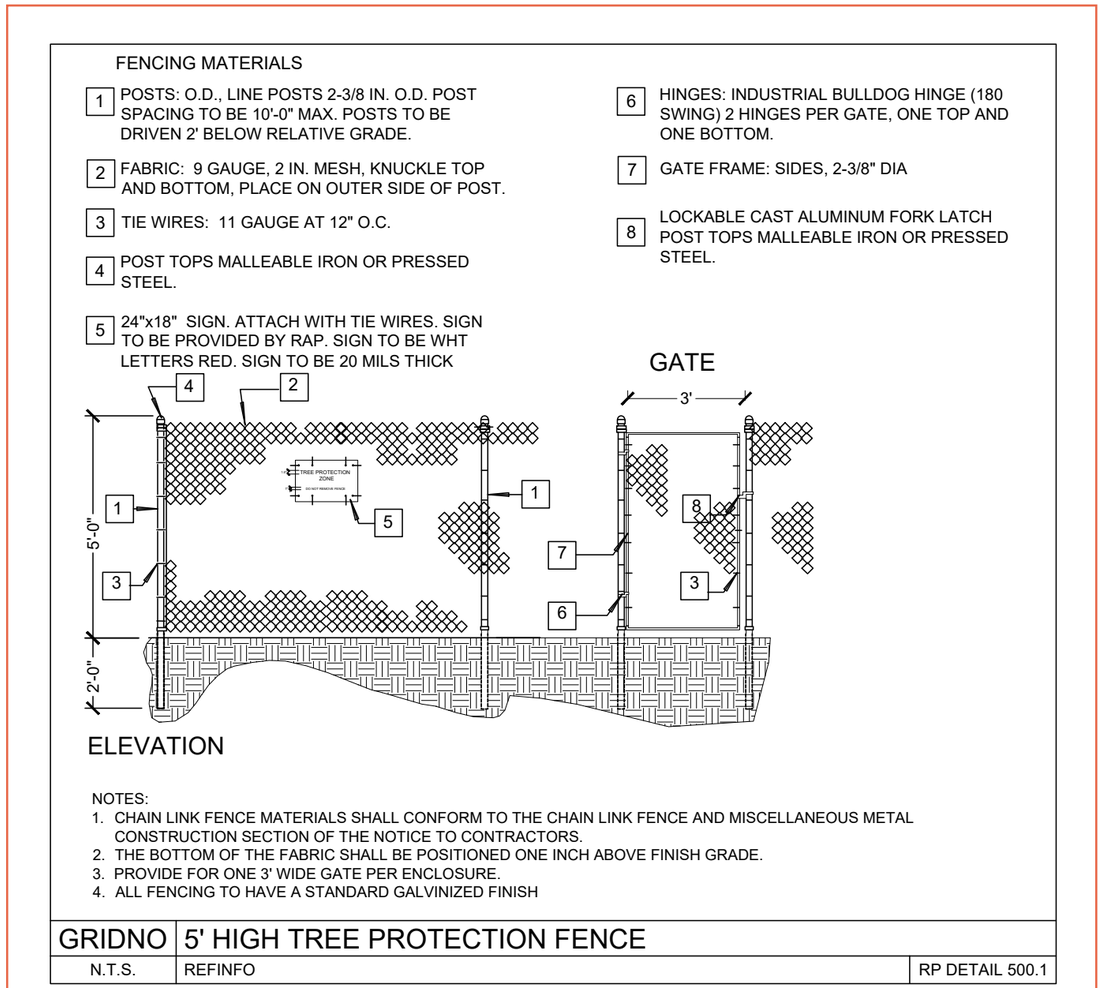
The choice of whether the damaged trees are mitigated with new trees or compensated financially will be determined by RAP Forestry.

- Monetary valuations for damaged trees will be determined by RAP Forestry.
- For mitigation with new trees, RAP determines the quantity of replacement trees by measuring the diameter (DSH) of the tree(s) being mitigated:
  - » For single trunk trees, the diameter (DSH) is measured 4.5' above the ground in inches.
  - » For multi-trunk trees, the DSH of each of the multiple trunks is measured 4.5' above the ground, then all are summed to arrive at a single diameter value in inches.
  - » The total inches of caliper (as defined by RAP Nursery Specifications) of new trees planted must equal or exceed the sum of the DSH inches of trees damaged or removed. The specific number of replacement trees will be determined by RAP Forestry staff and the project Landscape Architect. Replacement trees are typically from 24" box to 48" box in size but can vary with RAP approval.

For on-site tree replacement, RAP Forestry staff and the project Landscape Architect shall determine the replacement tree species and planting locations. The project Landscape Architect shall also provide nursery inspection & selection of the trees consistent with the Planting Specifications. Mitigation trees shall be planted per the same planting detail as other project trees.

If the replacement ratio cannot be achieved by planting within the project boundary, then one of the following shall apply:

- Contractor shall deliver the trees to RAP Forestry.
- Contractor shall deliver the trees to the nearest RAP service yard.
- Contractor shall plant the trees outside the project limits in other RAP facilities as determined by RAP Forestry on an approved, area-wide basis.
- Tree species will be determined by RAP Forestry.



TREE PROTECTION FENCE Detail.

Appendix E. Monthly Tree Activity Report

Monthly Tree Activity Report

City of Los Angeles Department of Recreation and Parks

This report is due every month and must be emailed to the RAP Arborist.

Tree Inspection Information

Inspection Date:
Inspector Name:
Site Address:

Project Contact Information

Project Manager
Company Name:
Contact Phone & Email:

Project Arborist

Arborist Name:
Company Name:
Contact Phone & Email:

Include the following information on each tree activity report:

1. Assignment Activity (Demolition/grading/trenching/excavation/tunneling/directional drilling/equipment use)
   - ☐ Inspect to verify that tree protection measures are in place
   - ☐ Determine if field adjustments or plan revisions may be needed

2. Field Observations (general site-wide and list by individual tree)
   - ☐ Tree Protection Zones (note any changes/shifts in fence placement, storage of materials, debris, etc.)
   - ☐ Tree health and condition (note changes in leaf color, defoliation, presence of dead or dying limbs, etc.)

3. Action Items and Due Date (list site-wide and list by individual tree)
   - ☐ Tree Protection Zone
   - ☐ Root zone buffer material

4. Recommendations, notes, or monitor items for project/staff/schedule

5. Past visits (must carry-over items satisfied/still outstanding)

6. Photographs (please attach to email)

7. Tree Location Map (please attach to email)

Appendix F. Tree Removal Procedure

All park trees are valuable assets of the Department of Recreation and Parks (RAP). The steps listed below have been developed to have the least effect on park property when it is necessary to remove a tree. These steps must be adhered to at all times:

Step One. Submit a Tree Removal Request to Forestry Division When:

- A tree is confirmed to be dead by the RAP arborist.
- A tree is diseased or damaged and cannot be reasonably treated, and the RAP arborist determines that it poses an unreasonable risk to public safety.
- A tree presents obstacles to other infrastructure repairs or causes impairment to a park function, which cannot be reasonably mitigated through means other than removal.
- Other reasons as determined by the RAP forestry arborist such as public safety, site suitability, and invasive species.

Step Two. Provide Detailed Information

- Contact the Forestry Division at 213.485.4826.
- Indicate what "protection category" the tree is in: Tree Protected by Ordinance, Heritage Tree, Special Habitat Value Tree, or Common Park Trees.
- Provide a project outline that includes a timeline.

Step Three. Forestry Division Actions

- Evaluation of the tree removal request.
- Confirmation of the tree's protection category.
- Inspection and evaluation of the tree with appropriate staff.
- Discussion of alternatives and recommendations.
- All information is entered into the Forestry Work Order System.

Step Four. Obtain Final Approval for Removal of Tree

- For trees that are protected by LA City ordinance, Forestry Division personnel will contact the RAP Board of Commissioners and initiate the process necessary to obtain a tree removal permit.
- For Heritage or Special Habitat Value Trees, the RAP arborist makes a recommendation to the general manager for removal. The general manager or designee must make the final approval before the tree can be removed.
- For a Common Park Tree, the RAP arborist may recommend removal.

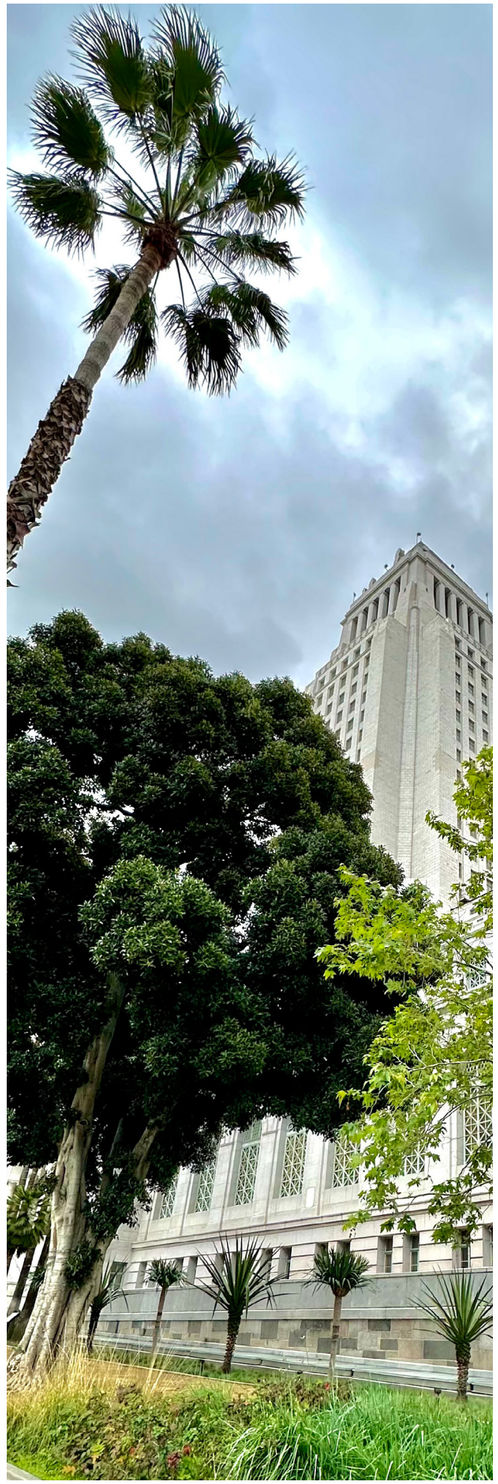
Step Five. Tree Removal Procedures to Mitigate Risk

During routine tree removal operations, forestry staff may determine that a tree must be removed for safety or other reasons. Staff members should:

- Contact the Principal Forester or Tree Surgeon Supervisor II and explain the situation.
- The Principal Forester or Tree Surgeon Supervisor II will contact all appropriate RAP staff to obtain further instructions and final approval before authorizing the tree to be removed.
- **Exception to the Rule:** If any park tree poses an immediate life-threatening emergency or safety hazard, the RAP arborist may bypass the regular procedure and authorize removal of the tree. Detailed documentation will be required, including digital photos of the tree before and after the hazard has been mitigated.

Step Six. Notification Protocol for Large-Scale Tree Removal

Forestry Division and region personnel must follow established notification protocol when informing the public, local government officials, organizations, and department representatives about large-scale tree removal projects.



Appendix G. Notification Protocol for Large-Scale Tree Removal Projects at Los Angeles City Parks

Large-scale removals should be avoided at all costs. However, there are many stressors that can cause many trees in a park or in the city to die off, such as invasive pests, diseases, and drought. Examples of this are the lerp psyllid that hit certain species of eucalyptus and the invasive shot hole borer (ISHB). In such cases, the following protocols will be followed.

1. Forestry Division will notify the Principal Ground Maintenance Supervisor II and the Recreation Superintendent of the respective region as well as the Director of Public Relations as soon as the project is identified but no later than three weeks prior to commencement of the tree removals.
2. The Regions will inform the appropriate Council office and Park Advisory Board (PAB) immediately upon notification from the Forestry Division.
3. Forestry staff will post a notice of "intent to remove trees" in the respective park. Notification will include: sections of the park will be closed, the dates for the project, and contact information for the Forestry Division. Other information may be included as well.

Appendix H. Basic Tree Risk Assessment Form

Basic Tree Risk Assessment Form

Client _____ Date _____ Time _____
Address / Tree location _____ Tree no. _____ Sheet _____ of _____
Tree species _____ dbh _____ Height _____ Crown spread dia. _____
Assessor(s) _____ Time frame _____ Tools used _____

Target Assessment

Target number	Target description	Target zone: Target within drip line	Target zone: Target within 1 x Ht.	Target zone: Target within 1.5 x Ht.	Occupancy rate (1 – rare, 2 – occasional, 3 – frequent, 4 – constant)	Practical to move target?	Restriction practical?
1							
2							
3							
4							

Site Factors

History of failures _____ **Topography** Flat ☐ Slope ☐ _____% **Aspect** _____
Site changes None ☐ Grade change ☐ Site clearing ☐ Changed soil hydrology ☐ Root cuts ☐ Describe _____
Soil conditions Limited volume ☐ Saturated ☐ Shallow ☐ Compacted ☐ Pavement over roots ☐ _____% Describe _____
Prevailing wind direction _____ **Common weather** Strong winds ☐ Ice ☐ Snow ☐ Heavy rain ☐ Describe _____

Tree Health and Species Profile

Vigor Low ☐ Normal ☐ High ☐ **Foliage** None (seasonal) ☐ None (dead) ☐ Normal _____% Chlorotic _____% Necrotic _____%
Pests _____ **Abiotic** _____
Species failure profile Branches ☐ Trunk ☐ Roots ☐ Describe _____

Load Factors

Wind exposure Protected ☐ Partial ☐ Full ☐ Wind funneling ☐ _____ **Relative crown size** Small ☐ Medium ☐ Large ☐
Crown density Sparse ☐ Normal ☐ Dense ☐ **Interior branches** Few ☐ Normal ☐ Dense ☐ **Vines/Mistletoe/Moss** ☐ _____
Recent or planned change in load factors _____

Tree Defects and Conditions Affecting the Likelihood of Failure

— Crown and Branches —

Unbalanced crown ☐ LCR _____%
Dead twigs/branches ☐ ____% overall Max. dia. _____
Broken/Hangers Number _____ Max. dia. _____
Over-extended branches ☐
Pruning history
Crown cleaned ☐ Thinned ☐ Raised ☐
Reduced ☐ Topped ☐ Lion-tailed ☐
Flush cuts ☐ Other _____

Cracks ☐ _____ Lightning damage ☐
Codominant ☐ _____ Included bark ☐
Weak attachments ☐ _____ Cavity/Nest hole ____% circ.
Previous branch failures ☐ _____ Similar branches present ☐
Dead/Missing bark ☐ Cankers/Galls/Burls ☐ Sapwood damage/decay ☐
Conks ☐ Heartwood decay ☐ _____
Response growth _____

Main concern(s) _____

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐ _____
Likelihood of failure Improbable ☐ Possible ☐ Probable ☐ Imminent ☐ _____

— Trunk —

Dead/Missing bark ☐ Abnormal bark texture/color ☐
Codominant stems ☐ Included bark ☐ Cracks ☐
Sapwood damage/decay ☐ Cankers/Galls/Burls ☐ Sap ooze ☐
Lightning damage ☐ Heartwood decay ☐ Conks/Mushrooms ☐
Cavity/Nest hole _____ % circ. Depth _____ Poor taper ☐
Lean _____° Corrected? _____
Response growth _____
Main concern(s) _____

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure
Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

— Roots and Root Collar —

Collar buried/Not visible ☐ Depth _____ Stem girdling ☐
Dead ☐ Decay ☐ Conks/Mushrooms ☐
Ooze ☐ Cavity ☐ _____% circ.
Cracks ☐ Cut/Damaged roots ☐ Distance from trunk _____
Root plate lifting ☐ Soil weakness ☐

Response growth _____
Main concern(s) _____

Load on defect N/A ☐ Minor ☐ Moderate ☐ Significant ☐
Likelihood of failure
Improbable ☐ Possible ☐ Probable ☐ Imminent ☐

Page 1 of 2

Risk Categorization

Condition number	Tree part	Conditions of concern	Part size	Fall distance	Target number	Target protection	Likelihood: Failure: Improbable	Failure: Possible	Failure: Probable	Failure: Imminent	Impact: Very low	Impact: Low	Impact: Medium	Impact: High	Failure & Impact (from Matrix 1): Unlikely	Failure & Impact: Somewhat	Failure & Impact: Likely	Failure & Impact: Very likely	Consequences: Negligible	Consequences: Minor	Consequences: Significant	Consequences: Severe	Risk rating of part (from Matrix 2)
1							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
2							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
3							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
4							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	
							○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	

Matrix 1. Likelihood matrix.

Likelihood of Failure	Likelihood of Impacting Target: Very low	Low	Medium	High
Imminent	Unlikely	Somewhat likely	Likely	Very likely
Probable	Unlikely	Unlikely	Somewhat likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Matrix 2. Risk rating matrix.

Likelihood of Failure & Impact	Consequences of Failure: Negligible	Minor	Significant	Severe
Very likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Notes, explanations, descriptions _____

North

Mitigation options _____ **Residual risk** _____
Residual risk _____
Residual risk _____
Residual risk _____

Overall tree risk rating Low ☐ Moderate ☐ High ☐ Extreme ☐ **Work priority** 1 ☐ 2 ☐ 3 ☐ 4 ☐
Overall residual risk Low ☐ Moderate ☐ High ☐ Extreme ☐ **Recommended inspection interval** _____
Data ☐ Final ☐ Preliminary **Advanced assessment needed** ☐ No ☐ Yes-Type/Reason _____
Inspection limitations ☐ None ☐ Visibility ☐ Access ☐ Vines ☐ Root collar buried Describe _____

Page 2 of 2

Appendix I. Policies for the Installation and Preservation of Landscaping and Trees on Public Property

OF RECREATION AND PARKS DEPARTMENT

Official City of Los Angeles Charter June 8, 1999.

General Objectives

The urban forest is recognized as a vital infrastructure system essential to the quality of life in the City of Los Angeles. Tree canopy and landscaping are important factors in every neighborhood, enhancing aesthetics, mitigating the heat island effect, improving air quality, reducing stormwater runoff, providing economic, psychological and sociological benefits to all inhabitants. Therefore, planting new trees, which will develop broad canopies, as well as the preservation of mature tree canopy and landscaping shall be considered to be a priority on all park lands.

Proposed Improvement Projects

While planting new trees and preserving existing mature trees is a priority on RAP property, not all areas within recreational spaces are suitable for trees and landscaping. Improvement projects may provide opportunities to plant additional trees and optimize tree cover and landscaping; however, trees will only be planted in suitable locations and when resources allow.

Trees and landscaping may be planted in areas adjacent to parkways, on slopes, adjacent to streets, in isolated land remnants, in or adjacent to street frontages abutting public buildings or structures, in median and traffic islands, and on the grounds of public buildings provided that a tree is the right species in the right place and planted for the right reasons.

Parking lots, roofs, plazas and other impervious surfaces are known to contribute to urban heat islands. Narrow planting spaces with limited soil volumes, compaction from pedestrian traffic, damage from vehicles or vandalism are some examples of the hurdles for trees growing in urban areas. Therefore, planting trees in LA requires thoughtful design and careful selection of tree species.

During construction, if any portion of construction or its staging areas affects existing landscaping, detailed guidelines for tree preservation and protection during construction shall be implemented (see Chapter 4).

Authority And Responsibility

Within the Recreation and Parks Land

RAP is responsible for the design, construction, and operations of all Recreation and Parks properties, including tree and site selection.

Adjacent Public Buildings and within Their Grounds, Including Parking Lots

RAP has contracts in any given fiscal year with the Fire Department, the Department of General Services, and the Police Department to maintain the landscapes at specific sites. Some landscape services are performed by RAP staff.

Removal

Before removal of existing trees is approved, a detailed investigation of all possible alternatives to prevent removal of the trees shall be made. Trees may be permitted for a removal if a tree is:

1. Dead or dying
2. Infested with a pest or pathogen that cannot be feasibly treated
3. Irreparably damaged and/or injured to the extent that it is likely to die
4. Determined to pose an unreasonable risk to public safety

Replacement of Trees

When healthy, sound trees are removed or damaged (e.g., capital improvement projects), the existing trees' aggregate diameter, measured at standard height (DSH, or 4.5-feet above the ground; multi-trunk trees are to be measured immediately below the lowest trunk) shall be replaced at an equal or greater rate of caliper of new trees. Each one-inch DSH of the existing tree shall be replaced with a minimum one-inch caliper new tree. Replacement trees shall have a minimum caliper of ¼-inch. For example, a single-trunk tree with a DSH of 9 inches may be replaced with 36 trees of ¼-inch caliper, or with 3 trees of 3-inch caliper. This replacement ratio should represent a minimum. All replacement trees shall be healthy and free of kinked, overgrown, or otherwise defective roots.

It is not always feasible to plant replacement trees in the park where the trees were removed nor in surrounding parks. If the project cannot meet RAP tree replacement requirements, it may be modified to preserve trees or returned to the planning and design phase to find an alternative that allows for tree preservation.

Tree Selection

Tree species selected for a particular area shall conform to the Recreation and Parks Department Tree Planting, Selection, and Maintenance Guidelines (Appendix J). Deviations in species selection shall be made with the approval of the Recreation and Parks Principal Forester.

Tree species and site selection should balance maximizing environmental benefits and aesthetics with appropriate maintenance levels. Tree species that will eventually provide a wide canopy and significant shade are preferred in spaces that can support them (i.e., adequate soil volume, no overhead utilities, etc.). Palm species provide fewer environmental benefits and require more frequent maintenance than trees and therefore will only be approved in specific circumstances.

Biodiversity

There are no native tree species to the urban environment. The use of a combination of both native and non-native species allows for greater opportunity to provide ecosystem services, urban forest cooling, greenspace, and habitat. To enhance biodiversity, trees will be planted in locations that maximize the benefits received. Long-lived and/or low-maintenance trees will be preferred to encourage long-term carbon storage and sequestration. Native species will be planted where appropriate and tree species that are suitable for current and future climates will continue to be explored.

Removal of Invasive Species and Habitat Restoration

Invasive species can have significant impacts on native ecosystems or plants. Controlling invasive species is important for habitat restoration. Tree species that are considered invasive by the California Invasive Plant Council or determined by RAP arborists may be removed without a permit.

Maintenance of Trees

Maintenance of landscaping based on the best available arboricultural practices and urban forestry practices using state-of-the-art professional standards for planting, pruning, and general maintenance, including but not limited by use of the most recent management tools shall be the responsibility of the Recreation and Parks Department. Agencies shall develop a maintenance schedule for trees located on lands under their control.

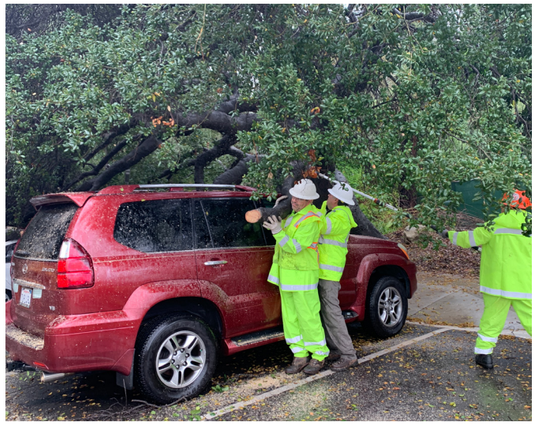
TREE PALETTE FOR PARKS

Inland Community areas compared to coastal regions have hotter summers and higher levels of air pollution. This region's climate is still mild enough to grow a diverse mix of trees. The ocean influences the Inland Community climate less than 15 percent of the time. The community's boundaries correspond with Sunset Western Garden Book's climate zones 18, 19, 20, and 21.

Appendix J. Recreation and Parks Department Tree Planting, Selection, and Maintenance Guidelines

The urban forest, which includes trees in our parks, improves environmental quality and increases the economic, physical, and social health of communities. Urban forests will be important to the quality of life as communities continue to grow in the next decade. Urban forests provide energy benefits, improve air and water quality, and have social benefits such as noise abatement, creation of wildlife habitat, reduction of exposure to ultraviolet light, provision of pleasure, improvement of individual health, provision of jobs and educational opportunities, and increased land value.

The ideal park tree is a shade tree with minimum susceptibility to wind damage and branch drop; does not require frequent pruning; produces slight litter; is deep-rooted; has few serious pest and disease problems; and tolerates a wide range of soil conditions, irrigation regimes, and air pollutants. Few trees have all these traits, it is important to match the tree species to the planting site by determining what issues are most important on a case-by-case basis. A tree list is provided to establish a uniform guiding principle, but is not meant to limit tree selection if another tree is a better choice for the planting site.



Crew working to trim a tree that has fallen on a car after a storm.

Our department recognizes a number of factors that should be considered when selecting park trees.

Below is a list of guidelines and recommendations that RAP recognizes as important when selecting and planting park trees:

- The use of California native tree species and trees that are indigenous to the area that have proven to adapt well.
- Trees that conserve water and energy.
- To avoid a monoculture, non-native trees from a diverse species list that represent a minimum ratio of no more than 20 percent of one genera, ten percent of one species, and five percent of one cultivar.
- Trees must be compatible with the climate zone recommended by the current edition of the Sunset Western Garden Book.
- Trees are selected to provide shade. Large trees should be used only when space permits proper branch and root development.
- Trees are selected to provide aesthetics with respect to color, shape, and texture.
- Dense evergreen trees are recommended where windbreaks are desired.
- Tree species that drop fruit or seed pods should not be planted near paved areas used by pedestrians.
- Trees (in their maturity) that will conflict with overhead power lines, lights, underground main water or sewer lines, signs, and buildings shall not be planted.
- Newly planted trees are selected to match water requirements with those of surrounding plants.
- Trees will only be planted in locations where adequate aftercare can be provided.
- Nurseries that provide trees with their natural form intact will be used as suppliers (e.g., those that do not prune remove lower branches).
- Minimum 15-gallon-sized trees are recommended for planting in our parks. Smaller-sized specimens may be considered on slopes.
- A minimum of 30 feet between newly planted trees is required. Denser spacing may be considered for palms or if the density does not interfere with the use of the park or hinder proper tree development and where denser spacing does not affect park programming and will enhance the natural feel of the park (e.g., trees that grow in groves).
- Trees are required to be properly staked with three wooden stakes and cinch ties.
- The possibility of vandalism needs to be considered when planning, planting, and establishing replacement agreements or policies.
- For every hazard tree removed, the replacement ratio is minimum two to one.
- A six-foot diameter tree basin shall be established around all newly planted trees.
- It is recommended trees have root protection barriers installed when rodents are present. Root barriers are always installed according to the manufacturer's specifications.

To establish a compatible climate zone and properly match the palette of tree species for each zone, the locations of city parks are divided into two communities:

Inland Plant Community and Coastal Plant Community

The Department's arborists, horticulturists, landscaping, and maintenance staff have selected the tree species listed below to be the primary tree palette. Trees on this list have proven to work well in California's temperate climate, require moderate pruning, and are considered to be pest and disease resistant. Other tree species will be considered on an individual basis.

Climate Change and Species Selection

As a result of climate change, much of California is increasingly vulnerable to longer and more frequent periods of drought. Additionally, the number of days with extreme heat is on the rise. These changes are already having negative effects on tree species that were once successful. These shifts have prompted various research projects to identify how climate change will affect environmental conditions and how tree species may respond to future climatic conditions. Groups like the USDA Forest Service, UC Davis, and local wholesale nursery, Devil Mountain Nursery, are conducting experiments to identify which tree species are "climate ready".

Federal and State Information for the Region:

- California's Fourth Climate Change Assessment
- LA County Extreme Heat and Climate Change

TREE PALETTE FOR PARKS

Inland Community areas compared to coastal regions have hotter summers and higher levels of air pollution. This region's climate is still mild enough to grow a diverse mix of trees. The ocean influences the Inland Community climate less than 15 percent of the time. The community's boundaries correspond with Sunset Western Garden Book's climate zones 18, 19, 20, and 21.

Scientific Name	**Common Name**	**Tree Type***	**Utility Friendly** (yes, no)	**Hardscape Damage Potential** (information unavailable, low, moderate, high)	**Edible Fruit** (yes)	**Wildlife Value** (e.g., edible fruit, nectar, pollen, habitat, etc.)	**Water Use** (very low, low, moderate, high)	**Minimum Grow Space** (feet)	**Max Height**	**Canopy Width**	**Pests, Diseases** (resistant, susceptible)	**Other Considerations** (e.g., allergen potential, moderate/high BVOC emissions, etc.)
Acacia stenophylla	shoestring acacia	BES	N	L			VL	5	30	20	S:Null R:Deer	Allergen potential Moderate BVOC emissions, fast growing and roots may sprout
Acer paxii	evergreen maple	BES	N	L			M	5	35	15–20	S: Armillaria, Root Rot, Verticillium, Invasive Shot Hole Borer, Aphids. R: Deer	Allergen potential
Acrocarpus fraxinifolius	pink cedar	BDL	N	M			M	>10	70	15–30	S:Null R:Deer	Fast growing, weak branch strength
Aesculus californica	California buckeye	BDS	Y	L			L	5	25	20–30	S:Armillaria, Phytophthora ramorum/Sudden Oak Death, Invasive Shot Hole Borer, Thrips	Allergen potential, Poisonous
Aesculus x carnea	red horse chestnut	BDM	N	L			M	>10	50	30–50	S:Chlorosis, Powdery Mildew, Rust, Beetle Borers R:Deer	Allergen potential, Poisonous, weak branch strength
Afrocarpus falcatus	African fern pine	CEM	Y	L	Y		M	>10	65	25–35	S:Null R:Deer	Fruit is resinous
Agathis robusta	Queensland kauri	BEL	N	H			M	>10	150	60–75	S:Null R:Deer	
Agonis flexuosa	peppermint tree	BES	N	M			L	5	35	15–30	S:Phytophthora, Root Rot R:Deer	High BVOC Emitter
Albizia julibrissin	mimosa; silk tree	BDS	N	M	Y	Nectar, Pollen	M	5	35	20	S:Armillaria, Fusarium, Root Rot, Invasive Shot Hole Borer, Caterpillars R:Deer	Allergen potential
Allocasuarina verticillata	coast beefwood; mountain she-oak	CES	N	M			M	5	35	20–35	S:Armillaria, Phytophthora, Root Rot R:Deer	
Angophora costata	gum myrtle	BEL	N	M		Pollen	L	>10	65	30–50	S:Armillaria R:Deer	
Araucaria araucana	monkey puzzle tree	CEL	N	M			M	>10	90	25–35	S:Phytophthora, Root Rot, Sooty Mold, Leaf Spots, Scales R:Deer	

Tree Type: BDS: Broadleaf Deciduous Small, BDM: Broadleaf Deciduous Medium, BDL: Broadleaf Deciduous Large, BES: Broadleaf Evergreen Small, BEM: Broadleaf Evergreen Medium, BEL: Broadleaf Evergreen Large, CES: Coniferous Evergreen Small, CEM: Coniferous Evergreen Medium, CEL: Coniferous Evergreen Large

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Araucaria bidwillii	bunya-bunya	CEL	N	M	Y	Fruit	M	>10	100	20–30	S:Null R:Deer	
Araucaria columnaris	Cook pine	CEL	N		Y	Fruit	M	>10	160	20	S:Mealybugs R:Deer	
Araucaria cunninghamii	hoop pine	CEL	N	M	Y	Fruit	M	>10	160	20	S:Phytophthora, Root Rot R:Deer	
Araucaria heterophylla	Norfolk Island pine	CEL	N	M	Y	Fruit	M	>10	100	60	S:Null R:Deer	
Arbutus 'Marina'	Marina strawberry tree	BEM	N	L	Y	Fruit, Nectar, Pollen	L-Moist	2	40	30	S:Anthracnose, Phytophthora, Root Rot, Rust, Scales, Thrips R: Armillaria, Deer	
Arbutus unedo	strawberry tree	BES	N	L	Y	Fruit, Nectar, Pollen	M	5	35	20–35	S:Phytophthora, Root Rot, Rust, Scales, Thrips R:Armillaria	Allergen potential
Banksia integrifolia	coast banksia	CEM	N		Y	Nectar, Pollen	VL	>10	60	15–30	S:Null R:Deer	
Brachychiton acerifolius	flame bottle tree	BDM	N	M		Pollen	M	>10	60	30–40	S:Null R:Deer	Seeds are edible if cooked, hairs are removed
Brachychiton bidwillii	little kurrajong	BDS	Information unavailable	Information unavailable		Pollen, Nectar	L, Drought tolerant	Information unavailable	12–15	12		
Brachychiton discolor	Queensland lacebark; hat tree	BDM	N	M	Y	Fruit	M	>10	65	30	S:Root Rot R:Deer	Allergen potential
Brachychiton rupestris	narrowleaf bottle tree; Queensland bottle tree	BDM	N	M	Y	Fruit	M	>10	40	20–30	S:Root Rot R:Deer	Irritant Seeds can be eaten raw, young stems edible
Caesalpinia (Paubrasilia) echinata	Brazilwood	BES	Information unavailable	Information unavailable		Pollen	M, Drought tolerant	Information unavailable	40	40		Thorns, Endangered species
Callistemon citrinus	lemon bottlebrush	BES	Y	L		Nectar	L	5	25	25	S:Chlorosis R:Deer	High BVOC Emitter, Allergen potential, leaves can be used in tea
Callistemon rigidus	stiff bottlebrush	BES	Y	L		Nectar	L	2	20	10	S:Null R:Deer	
Callistemon viminalis	weeping bottlebrush	BES	Y	L		Nectar	L	2	20	15–20	S:Armillaria, Root Rot R:Deer	High BVOC Emitter, Allergen potential
Calodendrum capense	Cape chestnut	BDM	N	L		Nectar	M	5	40	25–40	S:Null R:Deer	

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Carya illinoinensis	pecan	BDL	N	M	Y	Fruit, Pollen	M	>10	100	70	S:Chlorosis, Mistletoe, Phytophthora, Root Rot, Aphids, Beetle Borers, Beetle Grubs, Caterpillars R:Armillaria, Deer	
Casimiroa edulis	white sapote	BDM	N	H	Y	Fruit, Pollen	M	>10	50	25–30	S:Null R:Deer	Wet fruit
Cassia fistula	golden shower tree; crown of gold tree	BDS	N	L	Y	Pollen	M	5	35	40–75	S:Root Rot, Leaf Spot, Caterpillars R:Deer	Weak branch strength
Castanea sativa	Spanish chestnut	BDL	N	L	Y	Fruit, Pollen	M	>10	100	50	S:Armillaria, Chlorosis, Phytophthora, Root Rot R:Deer	Allergen potential
Castanospermum australe	Morton Bay chestnut	BEL	N	M	Y	Fruit, Pollen	M	>10	100	15–40	S:Null R:Deer	Poisonous
Casuarina cunninghamiana	river she-oak	BEL	N	L		Habitat	L	>10	70	30	S:Phytophthora, Root Rot R:Deer	Allergen potential
Casuarina equisetifolia	horsetail tree; ironwood	BEL	N	L		Habitat	L	>10	65	20	S:Armillaria, Phytophthora, Root Rot R:Deer	Allergen potential
Cedrus atlantica	Atlas cedar	CEM	N	M		Habitat	M	>10	65	35–50	S:Phytophthora, Root Rot, Sooty Mold R:Deer	
Cedrus atlantica 'Glauca'	blue Atlas cedar	CEM	N	M		Habitat	M	>10	60	25–40	S:Phytophthora, Root Rot, Sooty Mold R:Deer	
Cedrus deodara	deodar cedar	CEM	N	M		Habitat	M	>10	60	20–30	S:Armillaria, Phytophthora, Root Rot, Sooty Mold, Beetle Borers R:Verticillium, Deer	Allergen potential
Cedrus libani	cedar of Lebanon	CEL	N	L		Habitat	M	>10	100	80–100	S:Null R:Verticillium, Deer	Allergen potential
Ceiba speciosa	floss silk tree; kapok	BDM	N	M			L	>10	60	40–50	S:Null R:Deer	Thorns
Celtis australis	European hackberry	BDL	N	M	Y	Fruit	M	>10	70	40–50	S:Null R:Armillaria, Deer	Allergen potential
Cercis canadensis	eastern redbud	BDS	N	L		Fruit	M	5	35	25–35	S:Anthracnose, Crown Rot, Armillaria, Phytophthora, Caterpillars, Scales R:Deer	Allergen potential
Cercis canadensis 'Forest Pansy'	Forest Pansy redbud	BDS	N	L		Fruit	M	5	30	20–25	S:Anthracnose, Crown Rot, Armillaria, Phytophthora, Caterpillars, Scales R:Deer	Allergen potential

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Cercis canadensis var. texensis 'Oklahoma'	Oklahoma redbud	BDS	Y	L		Fruit	M	2	15	15	S:Canker, Leaf Spot, Verticillium, Scales R:Deer	
Cercis occidentalis	western redbud	BDS	Y	L		Fruit	M	2	20	20	S:Crown Rot, Phytophthora, Root Rot, Caterpillars, Scales R:Armillaria, Deer	
Cercocarpus betuloides	mountain mahogany	BES	Y	L		Pollen, Habitat	VL	2	20	20	S:Null R:Null	Allergen potential
Chilopsis linearis	desert willow	BDS	N	L		Pollen, Habitat	VL	2	30	20	S:Root Rot R:Texas Root Rot, Deer	Allergen potential
Chionanthus retusus	Chinese fringe tree	BDS	Y	L		Pollen	M	2	20	12	S:Null R:Deer	Allergen potential, wet fruit
Chiranthodendron pentadactylon	Mexican hand tree	BEM	N	H		Pollen, Habitat	L	>10	60	20–30	S:Null R:Deer	
Cinnamomum camphora	camphor tree	BEM	N	H		Edible Fruit	M	>10	65	50–60	S:Anthracnose, Armillaria, Phytophthora, Root Rot R:Deer	Allergen potential
Corymbia aparreninja	ghost gum	BEM	N	M			VL	5	50	20-35	S: Armillaria, Root Rot and Beetle Borers R: Deer, Texas Root Rot, Verticillium	
Corymbia calophylla	redgum; beautiful leaf eucalyptus	BEL	N	M		Edible Fruit, Pollen	L	>10	130	50–100	S:Armillaria, Root Rot, Beetle Borers R: Deer, Texas Root Rot, Verticillium	
Corymbia ficifolia	red flowering gum	BEM	N	M		Edible Fruit, Pollen	L	5	45	15–60	S:Armillaria, Phytophthora, Root Rot, Invasive Shot Hole Borer, Beetle Borers, Thrips R:Texas Root Rot, Verticillium, Deer	
Corymbia maculata	spotted gum	BEL	N	M		Pollen	L	>10	100	30–40	S:Armillaria, Phytophthora, Root Rot, Beetle Borers, Psyllid R: Texas Root Rot, Verticillium, Deer	High BVOC Emitter
Corymbia torelliana	cadaga	BEL	N	M		Pollen	L	>10	90	15–40	S:Armillaria, Phytophthora, Root Rot, Beetle Borers, Thrips, Sooty Mold R: Texas Root Rot, Verticillium, Deer	High BVOC Emitter
Cotinus coggygria	smoke tree	BDS	Y	L		Pollen, Edible Fruit	L	2	15	18	S:Root Rot, Verticillium R:Armillaria, Deer	Allergen potential
Cryptocarya rubra (alba)	cryptocarya	BES	N	M	Y	Edible Fruit	M	5	30	20–30	S:Null R:Deer	

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Cupressus cashmeriana	Kashmir cypress	CEM	N	L			M	>10	60	15–20		
Dais cotinifolia	pompon tree	BDS	Y	M		Pollen	L-M, Drought tolerant	2	18	15	S: Pink disease	
Dombeya cacuminum	strawberry snowball tree	BEM	N				L-M, Drought tolerant	5	50	15–25		
Dombeya rotundifolia	South African wild pear	BDS	Y	L	Y	Edible Fruit, Pollen	M	5	25	15–20		
Dombeya wallichii	pink ball tree	BES	N	M		Nectar	H	5	30	20	S:Null R:Deer	
Dracaena draco	dragon tree	BES	Y	L	Y	Edible Fruit	L	2	20	15	S:Null R:Texas Root Rot, Deer	Wet fruit
Dracaena spp.	dracaena species											
Ehretia anacua	anacua	BDM	N	Information unavailable	Y	Edible Fruit, Nectar	L	Information unavailable	50	20–50		Wet fruit
Ehretia tinifolia	bastard cherry	BES	Information unavailable	Information unavailable	Y	Edible Fruit, Pollen, Nectar	M	5	10	10		Wet fruit
Eriobotrya deflexa	bronze loquat	BES	Y	L			M	5	25	15–25	S:Fire Blight R: Deer	
Eriobotrya japonica	edible loquat	BES	N	L	Y	Edible Fruit, Pollen	M	5	30	15–30	S: Fire Blight, Armillaria, Root Rot	
Erythrina caffra	kaffirboom coral tree	BDM	N	M			M	5	40	40–60		Allergen potential
Erythrina coralloides	naked coral tree	BDS	N	L			M	5	30	30	S: Sooty Mold, Invasive Shot Hole Borer, Aphids	Allergen potential
Erythrina crista-galli	cockspur coral tree	BDS	Y	L			M	2	20	15–20	S: Armillaria, Root Rot, Sooty Mold, Aphids, Erythrina Gall Wasp	Allergen potential
Erythrina falcata	Brazilian coral tree	BDM	N	L			L	5	40	20–40		Allergen potential
Erythrina humeana	natal coral tree	BDS	N	L			M	5	30	15–20		Allergen potential
Erythrina x sykesii	Australian coral tree	BES	N	L			M	5	30	15–20		Allergen potential
Eucalyptus camaldulensis	red gum; river red gum	BEL	N	M			L	>10	150	45–105	S: Armillaria, Root Rot, Beetle Borers, Psyllid	High BVOC Emitter, Allergen potential

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Eucalyptus cinearea	silver dollar tree	BEM	N	Information unavailable			M	5	40–50	20–50		Fast growing
Eucalyptus cladocalyx	sugar gum	BEL	N	M			L	>10	90	45–75	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	
Eucalyptus conferruminata	bushy yate; spider gum	BES	Y	L			L	5	25	15–30	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	
Eucalyptus cornuta	yate	BEM	N	M			L	>10	65	25–40	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	
Eucalyptus deglupta	rainbow eucalyptus	BEL	N	M			H	>10	125	60–80	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	
Eucalyptus erythrocorys	red-cap gum	BES	N	L			L	5	30	25	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	High BVOC Emitter
Eucalyptus grandis	flooded gum; rose gum	BEL	N	M			M	>10	250	60–75	S: Armillaria	
Eucalyptus leucoxylon	white ironbark	BEL	N	M			L	>10	90	18–60	S: Armillaria, Root Rot, Beetle Borers	
Eucalyptus leucoxylon 'Rosea'	pink flowering gum; pink flowering yellow gum	BEL	N	H			L	5	90	30–60	S: Chlorosis, Armillaria, Phytophthora, Root Rot, Beetle Borers, Thrips	High BVOC Emitter
Eucalyptus macrocarpa 'Rosea'	large-fruit red flowering gum	BES	Y	L			VL	2	20	20	S: Root Rot, Branch Blight, Aphids, Scale insects	
Eucalyptus megacornuta	warty yate	BES	N	M			L	5	30	15	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	
Eucalyptus nicholii	Nichol's willow-leaved peppermint	BEM	N	M			M	>10	50	15–40	S: Armillaria, Root Rot, Beetle Borers	
Eucalyptus parvifolia	small-leaved gum	BEM	N				L, Drought tolerant	5	30–50	30–50		
Eucalyptus polyanthemos	silver dollar gum	BEL	N	M			L	>10	75	15–45	S: Armillaria, Root Rot, Beetle Borers	High BVOC Emitter
Eucalyptus pulverulenta	silver mountain gum; mealy-white gum	BEM	N				L	5	35	15	S: Armillaria, Psyllid	
Eucalyptus punctata	gray gum	BEL	N						100			
Eucalyptus resinifera	red mahogany	BEL	N						150	50		

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Eucalyptus robusta	swamp mahogany	BEL	N	M			L	>10	75	30–75	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	
Eucalyptus rudis	desert gum; flooded gum	BEM	N	M			L	>10	60	25–40	S: Armillaria, Phytophthora, Root Rot, Beetle Borers, Psyllid, Thrips	High BVOC Emitter, Allergen potential
Eucalyptus saligna	Sydney blue gum	BEL	N	M			M	>10	150	85	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	
Eucalyptus sideroxylon	red ironbark	BEL	N	H			L	>10	90	30–60	S: Chlorosis, Armillaria, Phytophthora, Root Rot, Beetle Borers, Thrips	High BVOC Emitter
Eucalyptus spathulata	swamp mallee	BEM	N	L			L	5	40	20	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	
Eucalyptus torquata	coral gum	BES	N	L		Fruit	VL	5	35	15–30	S: Armillaria, Phytophthora, Root Rot, Beetle borers R: Deer	Allergen potential
Eucalyptus viminalis	manna gum; ribbon gum	BEL	N	M			M	>10	150	25–50	S: Chlorosis, Armillaria, Phytophthora, Root Rot, Beetle Borers	Moderate BVOC Emitter
Euphorbia tirucalli	pencil tree	BES	Y	L			VL	2	20	6		Allergen potential
Ficus auriculata	Roxburgh fig	BDS	Y	L			M	5	25	15–25		
Ficus benghalensis	banyan fig	BEL	N	M			H	>10	100	120	S: Sooty Mold, Scales	High BVOC Emitter
Ficus benjamina	weeping fig; Benjamin fig	BEL	N	M			M	>10	100	50–60	S:: Root Rot, Sooty Mold, Verticillium, Mealy Bugs, Scales, Spider Mites	High BVOC Emitter
Ficus carica	edible fig	BDS	N	L	Y		M	5	30	20	S: Canker, Fusarium, Armillaria, Root Rot, Invasive Shot Hole Borer	High BVOC Emitter, Allergen potential
Ficus drupacea	banyan fig; Mysore fig	BEL	N				M	>10	110	40		
Ficus elastica	rubber tree	BEM	N	H			H	5	45	25–30		
Ficus maclellandii	Long leaf fig	BES	Information unavailable	Information unavailable			M	5	6–12	4–6	S: Mealy bugs, Scales, Root rot	
Ficus macrophylla	Moreton Bay fig	BEL	N	H	Y		M	>10	180	70–130		High BVOC Emitter, Allergen potential
Ficus microcarpa	Indian laurel fig	BEM	N	M			M	>10	35	35–40		High BVOC Emitter, Allergen potential

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Ficus pertusa	Sonoran strangler fig; camichin	BEM	N	H			M	>10	60	50–70		
Ficus rubiginosa	rustyleaf fig	BEM	N	H			M	>10	50	35–60		High BVOC Emitter
Ficus sur	Cape fig	BDL	N	H	Y		M	>10	100	30–60		
Ficus sycomorus	sycamore fig	BEM	N	H	Y	Fruit, Pollen	M	Information unavailable	70–115	30–40	S: Powdery mildew, Root rot, Aphids, Whiteflies	
Fraxinus angustifolia 'Raywood'	Raywood ash	BDM	N	M			M	>10	50	20–30	S: Root Rot, Sooty Mold, Verticillium, Beetle Borers, Scales, White Fly	Allergen potential
Fraxinus velutina	velvet ash; Arizona ash	BEM	N	H			M	>10	50	30–40	S: Mistletoe, Root Rot, Rust, Beetle Borers, Spider Mites, White Fly	Allergen potential
Fraxinus velutina 'Modesto'	Modesto ash	BDM	N	H			M	>10	30	30–40	S: Mistletoe, Root Rot, Rust, Beetle Borers, Psyllid, Spider Mites, White Fly	Allergen potential
Geijera parviflora	Australian willow	BEM	N	L			M	5	35	20		Moderate BVOC Emitter
Ginkgo biloba	ginkgo	BDM	N	M			M	>10	65	25	S: Anthracnose	Moderate BVOC Emitter, Allergen potential
Handroanthus chrysotrichus	golden trumpet tree	BDS	N	M			M	2	30	25–30		Moderate BVOC Emitter
Handroanthus heptaphyllus	pink trumpet tree	BDS	N	L			M	5	30	15–25		
Harpullia arborea	tulipwood	BEL	N				M	Information unavailable	110	40		
Harpullia pendula	Australian tulipwood	BEM	N	L			M	5	40	15–25		
Hesperocyparis arizonica	Arizona cypress	CEM	N	L			L	5	40	20	S: Leaf Blight	
Hesperocyparis arizonica var. glabra	smooth Arizona cypress	CEM	N	M			L	>10	50	20	S: Branch Blight, Juniper Blight, Caterpillars, Spider Mites	Allergen potential
Hesperocyparis macrocarpa	Monterey cypress	CEM	N	M			L	>10	65	15–20	S: Armillaria, Phytophthora, Root Rot, Beetle Borers	
Hesperocyparis macrocarpa 'Lemon Yellow'	Lemon Yellow Monterey cypress	CEL	N	H		Nectar	L	>10	65	20	S: Canker	

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Heteromeles arbutifolia	toyon	BES	Y	L			L	5	25	15	S: Sudden Oak Death, Armillaria, Root Rot, Scales, Thrips	
Hibiscus elatus	Cuban bast; blue mahoe	BEL	N		N			>10	80	60–80		
Hymenosporum flavum	sweetshade	BEM	N	L			M	5	35	15–20		
Inga feuillei	ice cream bean tree; pacay	BEM	N		Y		M	5	60	30–60		
Jacaranda mimosifolia	jacaranda	BDM	N	L			M	5	50	15–30	S: Phytophthora, Root Rot, Invasive Shot Hole Borer, Aphids	
Juglans californica	southern California black walnut	BDS	N	M	Y		M	5	30	15–30	S: Mistletoe, Phytophthora, Root Rot, Sooty Mold, Aphids, Caterpillars	Moderate BVOC Emitter, Allergen potential
Juglans hindsii	northern California black walnut	BDM	N	M	Y		M	>10	60	30–60	S: Mistletoe, Phytophthora, Root Rot, Sooty Mold, Aphids, Caterpillars	Moderate BVOC Emitter, Allergen potential
Juglans nigra	black walnut	BDL	N	H	Y		M	>10	100	70	S:: Armillaria, Anthracnose, Phytophthora, Root Rot, Beetle Borers, Caterpillars	Moderate BVOC Emitter, Allergen potential
Juglans regia	English walnut	BDL	N	M	Y		M	>10	100	50–60	S: Bacterial Blight, Canker, Chlorosis, Aphids, Husk Fly, Scales, Spider Mites, Anthracnose	Allergen potential
Juniperus chinensis 'Torulosa'	Hollywood juniper	CES	Y	L			M	2	15	10	S: Armillaria, Root Rot, Rust, Beetle Borers, Spider Mites	
Juniperus deppeana	alligator juniper	CEL	N	L			M	>10	70	20–25	S: Armillaria, Root Rot, Rust, Aphids, Beetle Borers, Spider Mites	Allergen potential
Juniperus scopulorum	Rocky Mountain juniper	CES	Y	L		Fruit	M	5	20	10	S: Texas root rot	
Kigelia africana	African sausage tree	BEM	N				M	>10	50	15–20		Allergen potential
Koelreuteria bipinnata	Chinese flame tree	BDM	N	L			M	5	40	15–30		High BVOC Emitter
Koelreuteria elegans	flamegold	BDM	N	L			M	>10	50	35–50	S: Verticillium, Scales, Root Rot, Canker	

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Koelreuteria paniculata	goldenrain tree	BDM	N	L			M	5	35	25–40	S: Root Rot, Verticillium, Beetle Borers, Plant Bug, Scales	High BVOC Emitter, Allergen potential
Lagerstroemia indica	crape myrtle	BDS	Y	L			L	2	25	25	S: Leaf Blight, Sooty Mold, Powdery mildew, Aphids	
Lagunaria patersonii	primrose tree	BEM	N	L			M	5	50	20	S: Sudden Oak Death, Armillaria, Root Rot, Scales, Thrips, Phytophthora	Allergen potential
Laurus nobilis	Sweet bay	BEM	N	M			M	5	40	15–30	S: Leaf Blight, Phytophthora, Root Rot, Psyllid, Scales	
Leptospermum laevigatum	Australian tea tree	BEM	N	L			L	5	30	15–30	S: Chlorosis, Armillaria, Root Rot	
Liriodendron tulipifera	tulip tree	BDL	N				M	>10	90	30–50		
Lophostemon confertus	Brisbane box	BEM	N	M			M	5	50	15–25	S: Phytophthora, Root Rot, Scales	High BVOC Emitter
Lyonothamnus floribundus ssp. aspleniifolius	fernleaf Catalina ironwood; Santa Cruz ironwood	BEM	N	M			L	5	40	15–20	S: Leaf Blight, Phytophthora	
Malosma laurina	laurel sumac	BES	Information unavailable	Information unavailable		Pollen, Nectar, Fruit	VL	5	20	20		
Melaleuca armillaris	drooping melaleuca	CES	N	L			M	5	30	15–30	S: Phytophthora, Root Rot	
Melaleuca linariifolia	flax-leaf paperbark	BES	N	L			L	5	30	20–25	S: Chlorosis, Phytophthora, Root Rot	High BVOC Emitter
Melaleuca nesophila	pink melaleuca	BEM	N	L			L	5	30	15–30	S: Sudden Oak Death, Armillaria, Root Rot, Scales, Thrips, Phytophthora	
Melaleuca quinquenervia	cajeput tree	BEM	N	L			L	5	40	15–25	S: Phytophthora, Root Rot	High BVOC Emitter, Allergen potential
Melaleuca styphelioides	prickly melaleuca	BEM	N	L			M	5	40	15–20	S: Sudden Oak Death, Armillaria, Root Rot, Scales, Thrips, Phytophthora	
Metasequoia glyptostroboides	dawn redwood	CDL	N	M			H	>10	90	15–20		
Metrosideros excelsa	New Zealand Christmas tree	CEM	N	M			L	5	35	30–35		High BVOC Emitter

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Michelia champaca	champaca	BES	Y	L			M	5	25	15–25	S: Armillaria	
Nyssa sylvatica	sour gum; black tupelo	BDM	N	L			H	>10	50	20–30	S: Fusarium, Phytophthora, Root Rot, Rust	Allergen potential
Olea europaea	olive	BES	N	M	Y		L	5	30	25–30	S: Armillaria, Phytophthora, Root Rot, Scales, Psyllid, Anthracnose	Allergen potential
Peltophorum africanum	African wattle; weeping wattle; yellow poinciana	BDM	N	Information unavailable		Pollen	M		45	15–20		Poisonous
Peltophorum pterocarpum	yellow poinciana; yellow flame tree	BEM	N	L			M	>10	50	30–40		
Phytolacca dioica	pokeberry	BEM	N	H			M	>10	60	40–50		Allergen potential
Pinus canariensis	Canary Island pine	CEL	N	M			M	10	80	20–35	S: Armillaria, Phytophthora, Root Rot, Sooty Mold, Aphids, Beetle Borers, Spider Mites	Moderate BVOC Emitter, Allergen potential
Pinus coulteri	Coulter pine	CEL	N	M			M	>10	80	30–40	S: Armillaria, Pitch Canker, Aphids, Beetle Borers	Moderate BVOC Emitter, Allergen potential
Pinus edulis	pinyon pine	CEM	N	L	Y		L	5	35	20–25	S: Armillaria, Root Rot, Aphids, Scales	Moderate BVOC Emitter, Allergen potential
Pinus eldarica	Afghan pine	CEL	N	M			L	>10	80	15–25	S: Armillaria, Aphids	
Pinus halepensis	Aleppo pine	CEM	N	M			M	>10	60	20–40	S: Armillaria, Phytophthora, Root Rot, Pitch Canker, Aphids, Spider Mites	Allergen potential
Pinus patula	Jelecote pine	CEL	N	M			M	>10	70	20–30	S: Armillaria, Chlorosis, Aphids	Allergen potential
Pinus pinea	Italian stone pine	CEL	N	M			M	10	80	20–40		Allergen potential
Pinus ponderosa	ponderosa pine	CEL	N	M			L	>10	100	25–30	S: Leaf Blight, Pitch Canker, Red Ring Rot, Pitted Sap Rot, Armillaria, Aphids, California Five Spined Engraver Beetle, IPS, Red Turpentine Beetle	Moderate BVOC Emitter, Allergen potential

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Pinus monophylla	singleleaf pinyon pine	CES	N	L	Y	Fruit	L	5	30	20	S: Verticillium	
Pinus radiata	Monterey pine	CEL	N	M			M	>10	100	25–35	S: Armillaria, Leaf Blight, Phytophthora, Root Rot, Aphids, Beetle Borers, California Five Spined Engraver Beetle, IPS	Allergen potential
Pinus roxburghii	chir pine	CEL	N	M			M	>10	80	30–40	S: Armillaria, Aphids	Allergen potential
Pinus sabiniana	gray pine	CEL	N	M	Y		L	>10	70	15–20	S: Sudden Oak Death, Root Rot, Scames, Thrips, Pitch Canker, Mistletoe, Western Gall Rust, Armillaria, Aphids, California Five Spined Engraver Beetle, IPS	Allergen potential
Pinus thunbergii	Japanese black pine	CES	N	M			M	5	30	20–35	S: Armillaria, Aphids	Moderate BVOC Emitter, allergen potential
Pinus torreyana	Torrey pine	CEM	N	M			M	>10	50	20–25	S: Armillaria, Pitch Canker, Aphids, Beetle Borers, Spider Mites	Moderate BVOC Emitter, Allergen potential
Pistacia chinensis	Chinese pistache	BDM	N	L			L	5	35	25–35	S: Verticillium, Root Rot	Moderate BVOC Emitter, Allergen potential
Pistacia x 'Red Push'	Red Push pistache	BDM	N	L			M	5	40	20–40		
Pittosporum phillyraeoides	willow pittosporum	BES	Y	L			M	5	25	15	S: Leaf Blight, Sooty Mold, Aphids, Scales	Allergen potential
Pittosporum tenuifolium	tawhiwhi tree; tarata pittosporum	BES	N	L			M	5	30	15	S: Leaf Blight, Sooty Mold, Aphids, Scales, Anthracnose	
Pittosporum tobira	Japanese pittosporum; Japanese cheesewood	BES	Y	L			M	5	25	15	S: Leaf Blight, Phytophthora, Root Rot, Sooty Mold, Aphids, Scales	Allergen potential
Pittosporum undulatum	Victorian box	BEM	N	L			M	5	40	30–40	S: Leaf Blight, Sooty Mold, Aphids, Scales	Allergen potential
Pittosporum viridiflorum	Cape pittosporum; Cape cheesewood	BES	Y	L			L	2	20	10	S: Leaf Blight, Sooty Mold, Aphids, Scales	Allergen potential

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Platanus mexicana	Mexican sycamore	BDM	N	M			M	>10	50	30	S: Leaf Blight, Invasive Shot Hole Borer, Beetle Borers, Scales, Spider Mites, , Anthracnose, Powdery mildew	High BVOC Emitter, Allergen potential
Platanus occidentalis	American sycamore	BDL	N	M			M	>10	90	50–70	S: Sooty Mold, Mites, Scales	High BVOC Emitter, Allergen potential
Platanus racemosa	California sycamore	BDL	N	M			H	10	80	20–50	S: Anthracnose, Armillaria, Phytophthora, Mistletoe, Invasive Shot Hole Borer, Leaf Miner, Scales, Spider Mites	High BVOC Emitter, Allergen potential
Platanus x hispanica	London plane tree	BDL	N	H			M	>10	85	50–70	S: Anthracnose, Powdery Mildew, Invasive Shot Hole Borer, Scales, Spider Mites, Powdery mildew	Allergen potential
Podocarpus elongatus	Breede River yellowwood; Cape yellowwood	BEL	N		Y		M	Information unavailable	90	30–40		
Podocarpus henkelii	long-leafed yellowwood	BEM	N	L			H	5	35	60–75		
Podocarpus latifolius	real yellowwood	BEM	N	L			M	>10	50	40–45		
Podocarpus macrophyllus	yew podocarpus; yew pine	BES	N	L			M	2	30	20	S: Sooty Mold, Mites, Scales	
Podocarpus totara	totara	CES	N	L			M	5	30	18–25		
Populus fremontii	Fremont cottonwood	BDL	N	H			H	>10	80	30–50	S: Canker, Anthracnos, Crown Rot, Mistletoe, Aphids, Beetle Borers, Beetle Leaves, Caterpillars	High BVOC Emitter, Allergen potential
Populus nigra	black poplar	BDL	N	H			H	>10	100	15–30	S: Leaf Blight, Stem Canker, Crown Rot, Mistletoe, Invasive Shot Hole Borer, Beetle Borers, Scales, Thrips, Anthracnose	Allergen potential
Prunus caroliniana	Carolina cherry laurel	BES	N	L		Fruit	M	5	15–40	30	S: Armillaria, Fire Blight, Root Rot, Rust, Scales R: Deer	Wet fruit
Prunus ilicifolia ssp. Lyonii	Catalina cherry	BES	N	L			L		35	20–30	S: Root Rot, Rust, Verticillium, Virus	Wet fruit

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Prunus campanulata	Taiwan cherry	BES	Y	L		Fruit, Pollen	M	5	25	25	S: Armillaria, Phytophthora, Root Rot, Rust, Caterpillars R: Deer	
Prunus ilicifolia	hollyleaf cherry	BDS	N	L			L	5	30	15–20	S: Armillaria, Root Rot, Rust, Sooty Mold, White Flies, Aphids, Caterpillars	Allergen potential
Prunus virginiana	Chokecherry	BDS	N	L		Fruit, Pollen	M	5	30	25	S: Armillaria, Phytophthora, Root Rot, Rust, Caterpillars R: Deer	Allergen, Poisonous
Pseudotsuga macrocarpa	big-cone Douglas fir	CEM	N	L			M	>10	65	20–40	S: Armillaria	Moderate BVOC Emitter
Pterocarya fraxinifolia	Caucasian wingnut	BDL	N	H			M	>10	80	50–65		
Pterocarya stenoptera	Chinese wingnut	BDL	N	H			M	>10	80	30–50	S: Leaf Blight, Phytophthora, Root Rot, Invasive Shot Hole Borer	Allergen potential
Quercus agrifolia	coast live oak	BEL	N	L			L-Moist	35	70	20–70	S: Sudden oak Death, Crown Rot, Mistletoe, Armillaria, Carpenterworm, Invasive Shot Hole Borer, Goldspotted oak Borer, Aphids	High BVOC Emitter
Quercus alba	white oak	BDL	N	L	Y		M	>10	100	60–100	S: Armillaria, Canker, Leaf Spot, Leaf Miner, Caterpillars, Borer, Aphids, Anthracnose	
Quercus arizonica	Arizona white oak	BDL	N	Information unavailable		Fruit	L	>10	60	30	R: Deer	
Quercus x acutidens	Torrey's oak	BES	Information unavailable	Information unavailable			M	5	20	20	S: Aphids, Powdery mildew	
Quercus berberidifolia	scrub oak	BES	Y	L			VL	2	12	8	S: Armillaria, Root Rot, Coddling Moths	High BVOC Emitter, allergen potential
Quercus bicolor	swamp white oak	BEL	N	M		Fruit	M	>10	70	50	S: Armillaria, Anthracnose, Phytophthora, Root Rot R: Verticillium, Deer	
Quercus buckleyi	Texas red oak	BDM	N	L			M	>10	50	30–50	S: Armillaria, Canker, Leaf Spot, Caterpillars, Borer, Aphids, Scales, Anthracnose	
Quercus cerris	Turkey oak	BDM	N	L			M	>10	50	30–50	S: Armillaria	

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Quercus chrysolepis	canyon live oak; maul oak; golden cup oak	BEL	N	M			L	>10	70	30	S: Leaf Blight, Sudden Oak Death, Crown Rot, Mistletoe, Armillaria, Invasive Shot Hole Borer, Goldspotted Oak Borer, Aphids, Caterpillars	High BVOC Emitter, Allergen potential
Quercus coccinea	scarlet oak	BDL	N	M			M	>10	70	50	S: Armillaria, Caterpillars, Scales	High BVOC Emitter, Allergen potential
Quercus laurifolia	laurel oak	BDL	N	M			M	>10	70	35–45	S: Armillaria, Root Rot, Canker, Leaf Spot, Leaf Miner, Borer, Aphids, Caterpillars	
Quercus lobata	valley oak	BDL	N	M			M	>10	70	50	S: Armillaria, Crown Rot, Mistletoe, Root Rot, Invasive Shot Hole Borer, Beetle Borers, Caterpillars, Insect Galls	Moderate BVOC Emitter, Allergen potential
Quercus macrocarpa	burr oak	BDL	N	M			M	10	80	30	S: Armillaria, Aphids, Spider Mites	Allergen potential
Quercus oblongifolia	Mexican blue oak	BEL	N	M		Fruit	M	>10	70		S: Armillaria, Root Rot, Invasive Shot Hole Borer, Coddling Moths, Mistletoe, Spittlebugs R: Powdery Mildew, Sooty Mold, Sudden Oak Death, Verticillium, Aphids	Allergen potential, Poisonous
Quercus palustris	pin oak	BEL	N	L		Fruit	M	>10	70	30–40	S: Armillaria, Scales R: Verticillium	
Quercus pagoda	cherry bark oak	BDL	Information unavailable				M	>10	100	50	S: Oak wilt, Chestnut blight, Shoestring root rot, Anthracnose,Oak leaf blister, Cankers, Leaf spots, Powdery mildew, Scale, oak skeletonizer, leaf miner, galls, oak lace bugs, borers, caterpillars, nut weevils	
Quercus polymorpha	Mexican white oak	BDL	N	M		Fruit	M	>10	60	30–40	S: Oak wilt R: Powdery Mildew, Sooty Mold, Sudden Oak Death, Verticillium, Aphids	Allergen potential, poisonous
Quercus rubra	northern red oak	BDL	N	M			M	>10	80	50–70	S: Armillaria, Phytophthora, Root Rot, Aphids, Caterpillars, Insect Galls, Anthracnose	High BVOC Emitter, allergen potential

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Quercus rugosa	netleaf oak	BEM	N	L		Fruit	M	>10	60	20–40	S: Root Rot, Scales, Spider Mites, Spittlebugs R: Powdery Mildew, Sooty Mold, Sudden Oak Death, Verticillium, Aphids, Mistletoe	
Quercus shumardii	Shumard oak	BDL	N	M			M	>10	70	40	S: Armillaria, Beetle Borers, Beetle Leaves, Caterpillars, Insect Galls	Allergen potential
Quercus suber	cork oak	BEL	N	M			L	10	70	70	S: Armillaria, Phytophthora, Root Rot, Invasive Shot Hole Borer	High BVOC Emitter, allergen potential
Quercus virginiana	southern live oak	BEM	N	M			M	10	80	60–100	S: Armillaria, Phytophthora, Root Rot, Insect Galls	High BVOC Emitter, allergen potential
Quercus wislizeni	interior live oak	BEL	N	M			M	>10	70	40–80	S: Armillaria, Crown Rot, Mistletoe, Caterpillars, Coddling Moths, Insect Galls, White Fly, Powdery mildew	High BVOC Emitter, Allergen potential
Quillaja saponaria	soapbark tree; quillay	BEM	N	L			L	10	45	15–25		
Rhodosphaera rhodanthema	yellow wood	BDM	N				M	Information unavailable	60	20–35		
Robinia 'Purple Robe'	Purple Robe locust	BDM	N	H			L	5	40	20–30	S: Fusarium, Armillaria, Root Rot, Canker, Aphids, Borer, Leaf Miner	
Robinsonella cordata	heartleaf robinsonella	BES	N	L			M	2	30	15		
Salix alba	white willow	BDL	N	H			H	>10	80	40–70	S: Willow Blight, Armillaria, Phytophthora, Aphids, Beetle Borers, Caterpillars, Spider Mites, Anthracnose	Allergen potential
Salix gooddingii	Goodding's willow	BDS	Y	M			H	5	25	15–25	S: Willow Blight, Armillaria, Phytophthora, Invasive Shot Hole Borer, Aphids, Beetle Borers, Caterpillars, Anthracnose	Allergen potential
Salix laevigata	polished willow; red willow	BDM	N	H			H	>10	50	15–35	S: Willow Blight, Armillaria, Phytophthora, Invasive Shot Hole Borer, Aphids, Beetle Borers, Caterpillars, Anthracnose	High BVOC Emitter, Allergen potential

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Salix lasiolepis	arroyo willow	BDM	N	H			H	5	35	15–25	S: Willow Blight, Armillaria, Phytophthora, Invasive Shot Hole Borer, Aphids, Beetle Borers, Caterpillars, Anthracnose	Allergen potential
Sambucus nigra ssp. Cerulea	Mexican elderberry	BDS	Y	L	Y		M	2	20	20	S: Root Rot, Verticillium, Beetle Borers	Allergen potential
Schinus molle	California pepper tree; Peruvian pepper tree	BEM	N	H			L	>10	50	25–40	S: Armillaria, Phytophthora, Root Rot, Sooty Mold, Aphids, Psyllid, Scales, Thrips	Moderate BVOC Emitter, Allergen potential
Spathodea campanulata	African tulip tree	BDL	N	M			M	>10	80	30–60		
Spathodea campanulata 'Lutea'	yellow African tulip tree	BDL	N	Information unavailable			M	Information unavailable	25–40	15–20		
Stenocarpus sinuatus	firewheel tree	BES	N	L			M	5	30	15		
Taxodium distichum	bald cypress	CDL	N	M			M	>10	80	25–35	S: Leaf Blight, Phytophthora, Root Rot, Beetle Borers, Beetle Leaves	Allergen potential
Taxodium mucronatum	Montezuma cypress	CEL	N	M			M	>10	80	20–40		
Tecoma stans	yellow bells	BES	Y	L			M	5	25	15–20		
Thuja occidentalis	American arborvitae	CEM	N	M			M	>10	60	15	S: Armillaria, Phytophthora, Root Rot, Leaf Miner, Spider Mites	Allergen potential
Thuja plicata	western red cedar	CEL	N	M			M	>10	70	15–25	S: Armillaria, Root Rot, Beetle Borers, Leaf Miner, Spider Mites	
Tilia americana	American linden	BDM	N	M			M	>10	65	20–25	S: Leaf Blight, Root Rot, Sooty Mold, Verticillium, Aphids, Spider Mites, Scales	Allergen potential
Tilia american var. heterophylla	American linden	BDM	N	M			M	>10	120	30–60		
Tilia cordata	little leaf linden	BDM	N	M		Fruit, Pollen	M	>10	50	15–30	S: Root Rot, Sooty Mold, Verticillium, Aphids	Allergen potential
Tipuana tipu	tipu	BDM	N	M			M	>10	50	25–50		Moderate BVOC Emitter

TREE PALETTE FOR PARKS (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests, Disease	Other Considerations
Toona ciliata	Australian red cedar	BDL	N				M-H	Information unavailable	65-100	65–100		
Triadica sebifera	Chinese tallow tree	BDM	N	M			M	5	40	25–30		allergen potential
Tristaniopsis laurina	water gum	BEM	N	L			M	10	35	15–30		
Ulmus 'Frontier'	Frontier elm	BDM	N	H			M	5	25	30		
Ulmus parvifolia	Chinese elm	BDM	N	M			M	>10	60	50–70	S: Dutch Elm Disease, Armillaria, Phytophthora, Root Rot, Aphids, Beetle Borers, Beetle Leaves, Caterpillars	Allergen potential
Umbellularia californica	bay laurel	BEL	N	M			M	>10	75	60–75	S: Armillaria, Sudden Oak Death, White Mottled Rot, Beetle Borers, Leaf Miner, Cottony Cushion Scale, Beetle Leaves, Anthracnose	Moderate BVOC Emitter, Allergen potential
Vitex lucens	New Zealand chaste tree; puriri	BEM	N	M			M	>10	50	30–50		
Wollemia nobilis	Wollemi pine	CEL	N	L			H	>10	130	12	S: Leaf Blight, Phytopthora cinnamomi	
Zelkova serrata	sawleaf zelkova	BDM	N	M			M	>10	65	50–65	S: Dutch Elm Disease, Beetle Leaves, Spider Mites	

TREE LIST OF CLIMATE READY SPECIES

The climate ready tree list was generated using resources from Devil Mountain Wholesale Nursery and University of California Davis (UC Davis, 2023, Devil Mountain Nursery 2022).

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests and Pathogens	Other Considerations
Acacia aneura	mulga	BES	Y	L			VL	2	20	15–20	S: Root Rot and Invasive Shot Hole Borer R: Armillaria, Deer	Allergen potential
Acacia cognata	river wattle	BES	Y	L			M	5	25	15–25	R: Deer	Allergen potential
Angophora costata	rusty gum	BEM	N	M			L	>10	65	30–50	R: Armillaria, Deer	
Brachychiton discolor	Queensland lacebark	BDL	N	M			M	>10	65	30	S: Root Rot R: Deer	Allergen potential
Casuarina glauca	swamp sheoak	CEM	N	Information unavailable		Fruit	L	>10	60			Allergen potential
Cedrela fissilis	Brazilian cedar wood	BDM	N	M			M	>10	65	25–30	R: Deer	
Celtis reticulata	Netleaf Hackberry	BDM	N	L		Fruit	M	5	50		S: Nipple gall R: Deer	
Chilopsis linearis 'Bubba'	Bubba desert willow	BDS	Y	L		Fruit	L	2	20	15	S: Root Rot R: Texas Root Rot, Deer	Moderate BVOC emitter, Allergen potential
Corymbia aparrerinja	ghost gum	BEM	N	M			VL	5	50	20–35	S: Armillaria, Root Rot, Beetle Borers R: Texas Root Rot, Verticillium, Deer	
Corymbia citriodora	lemon scented gum	BEL	N	M			L	>10	160	50–100	S: Armillaria, Phytophthora, Root Rot, Beetle Borers, Psyllid, Thrips R: Texas Root Rot, Verticillium, Deer	High BVOC emitter
Dalbergia sissoo	Indian rosewood	BDL	N	M			VL	>10	60	30–40	R: Deer	
Eucalyptus cinerea	silver dollar tree; argyle apple	BEM	N	M			M	>10	50	20–40	S: Armillaria, Root Rot and Beetle Borers R: Deer	
Eucalyptus erythrocorys	red-cap gum	BES	N	L		Fruit	L	5	30	15–25	S: Armillaria, Phytophthora, Root Rot, Beetle Borers R: Texas Root Rot, Verticillium, Deer	High BVOC emitter
Eucalyptus neglecta	omeo gum	BEM	N	M			M	>10	60	40–60	S: Armillaria, Gray Mold, Collar Rot, Crown Gall, Stem Galls, While Aphids, Scale Insects, Powdery Mildew R: Deer	

TREE LIST OF CLIMATE READY SPECIES (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests and Pathogens	Other Considerations
Eucalyptus platypus	platypus gum	BEM	N	L			VL	5	35	15–35	S: Armillaria, Phytophthora, Root Rot, Beetle Borers R: Texas Root Rot, Verticillium, Deer	
Eucalyptus polyanthemos	silver dollar gum	BEL	N	M			L	>10	75	15–45	S: Armillaria, Root Rot,Beetle Borers R: Texas Root Rot, Verticillium, Deer	High BVOC emitter
Eucalyptus prava	orange gum	BEL	N	Information unavailable			L, M	Information unavailable	25-75	25–35		
Eucalyptus sideroxylon 'Rosea'	pink ironbark	BEL	N	H		Fruit	L	5	90	30–60	S: Chlorosis, Armillaria, Phytophthora, Root Rot, Beetle Borers, Thrips R: Texas Root Rot, Verticillium, Deer	High BVOC emitter
Eucalyptus spathulata	swamp mallee	BEM	N	L			L	5	40	20	S: Armillaria, Phytophthora, Root Rot, Beetle Borers R: Texas Root Rot, Verticillium, Deer	
Eucalyptus torquata	coral gum	BEM	N	L		Fruit	VL	5	35	15–30	S: Armillaria, Phytophthora, Root Rot, Beetle Borers R: Texas Root Rot, Verticillium, Deer	Allergen potential
Ficus religiosa	bo tree, bodhi tree	BEL	N	M			M	>10	100	60–100	R: Deer	Allergen potential
Hakea drupacea	sweet hakea	BES	Y	L			VL	2	20	15–20	S: Phytophthora, Root Rot R: Deer	
Harpephyllum caffrum	African wild plum	BEM	N	H	Y	Fruit	M	5	50	40–50	R: Deer	Moderate BVOC emitter
Hesperocyparis forbesii	Tecate cypress	CES	Y	M		Fruit	VL	5	25	20	R: Deer	Moderate BVOC emitter
Lyonothamnus asplenifolius	Catalina Ironwood	BEM	N	M		Fruit	L	5	50	25		
Mariosousa willardiana	palo blanco	BDS	Y	L			VL, drought tolerant	2	20	15	R: Deer	Allergen potential
Olea europaea 'Swan Hill'	swan hill olive	BES	N	M			L	5	30	25–30	S: Armillaria, Phytophthora, Root Rot and Scales, Psyllid, Anthracnose R: Texas Root Rot, Deer	
Parkinsonia x 'Desert Museum'	Desert Museum palo verde	BDS	Y	L			VL	2	20	20–25	R: Texas Root Rot, Deer	Moderate BVOC emitter

TREE LIST OF CLIMATE READY SPECIES (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests and Pathogens	Other Considerations
Pistacia chinensis 'Red Push'	red push pistache	BDM	N	L			M	5	40	20–40	R: Verticillium, Deer	
Platanus racemosa 'Roberts'	California sycamore 'Roberts'	BDM	N	M		Fruit	M	>10	50	35–40		Allergen potential
Prosopis glandulosa 'Maverick'	Maverick mesquite	BDM	N	L	Y	Fruit	L	5	35	25–35	R: Deer	
Prunus lyonii	Catalina cherry	BDM	N	L			L	10	35	20–30	S: Root Rot, Rust, Verticillium, Virus	
Quercus canbyi	Canby's oak	BDM	N	L			L	>10	50	30–50	S: Armillaria, Root Rot, Scales, Spider Mites, Anthracnose R: Verticillium, Deer	High BVOC emitter
Quercus castaneifolia	Persian oak	BDL	N	L		Fruit	M	>10	90	30–90	S: Charcoal disease R: Verticillium	
Quercus engelmannii	Engelmann oak; mesa oak	BDL	N	M		Fruit	VL	10	65	80–120	S: Armillaria, Crown Rot, Mistletoe, Root Rot, Invasive Shot Hole Borer, Coddling Moths, Insect Galls, Scales	High BVOC emitter
Quercus fusiformis	escarpment live oak	BEM	N	M			M	10	50	20-40	S: Armillaria, Phytophthora, Live oak Wilt, Root Rot and Insect Galls	High BVOC emitter, Allergen potential
Quercus gambelii	Gambel oak	BDM	N	M		Fruit	L	5	35	20–30	S: Armillaria, Crown Rot, Mistletoe, Root Rot, Beetle Borers, Caterpillars, Insect Galls, Scales R: Verticillium, Deer	Moderate BVOC emitter, Allergen potential
Quercus gravesii	Graves oak	BDM	N	L			M	>10	60	35	S: Oak Wilt, Insect Galls	Allergen potential
Quercus hypoleucoides	silverleaf oak	BEL	N	M			L	>10	80	20–30	S: Armillaria, Drippy Oak, Root Rot, Scales, Spider Mites, Spittlebugs R: Sooty Mold, Verticillium, Aphids, Mistletoe, Powdery Mildew	Allergen potential
Quercus ithaburensis	Mount Tabor oak	BDL	N	M			L	>10	60	20–30	S: Root Rot, Mistletoe, Scales, Spider Mites R: Sooty Mold, Sudden Oak Death, Verticillium, Aphids, Powdery Mildew	

TREE LIST OF CLIMATE READY SPECIES (CONTINUED)

Scientific Name	Common Name	Tree Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests and Pathogens	Other Considerations
Quercus laceyi	lacey Oak	BDM	N	Information unavailable		Fruit, Habitat	L	Information unavailable	30	30	R: Oak Wilt	
Quercus oblongifolia	Mexican blue oak	BEL	N	M			M	10	60	20–40	S: Armillaria, Root Rot, Invasive Shot Hole Borer, Coddling Moths, Mistletoe, Spittlebugs R: Sooty Mold, Sudden Oak Death, Verticillium, Aphids, Powdery Mildew	Allergen potential
Quercus rugosa	Mexican netleaf oak; netleaf oak	BEL	N	M			L	10	60	20–40	R: Powdery Mildew	Allergen potential
Quillaja saponaria	soapbark tree	BEM	Information unavailable	Information unavailable			L, drought tolerant		25–40	10–15		Poisonous
Quercus tomentella	island live oak	BEM	N	M			L	10	50	25–40	S: Armillaria R: Verticillium, Deer	
Quercus virginiana 'Skyclimber'	sky climber live oak	BDL	N	M			M	>10	80	60–100	S: Armillaria, Phytophthora, Root Rot, Insect Galls R: Verticillium	High BVOC emitter, Allergen potential
Quercus x comptoniae	Compton oak	BDM	N	L		Fruit	M	5	60	20–40	S: Armillaria R: Verticillium, Deer	
x Gordlinia grandiflora	sweet tea	BES	Information unavailable	Information unavailable		Nectar	M	Information unavailable	30	15	S: Wilt, Root rot	

LIST OF PALMS

Scientific Name	Common Name	Palm Type*	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests and Pathogens	Other Considerations
Archontophoenix cunninghamiana	king palm	PEL	N	M			M	5	40–60	8–12	S: Phytophthora, Root Rot, Invasive Shot Hole Borer	
Brahea aculeata	hesper palm	PEM	Information unavailable	Information unavailable			L	Information unavailable	30	15		
Brahea armata	Mexican blue palm	PEM	N	L	Y		L	5	50	15–25	S: Crown Rot R: Texas Root Rot, Deer	
Brahea brandegeei	San Jose hesper palm	PEM	N	M			L	>10	50	15–25	R: Texas Root Rot, Deer	
Brahea edulis	Guadalupe palm	PES	Y	L	Y	Fruit	L	5	25	15	R: Texas Root Rot, Deer	
Butia capitata	jelly palm	PES	Y	L	Y	Fruit	L	5	25	12	S: Root Rot, Scales R: Deer	
Butia odorata	pindo palm	PES	Y	L	Y	Fruit	L	5	25	15	S: Root Rot, Scales	
Caryota maxima	fishtail palm; mountain fishtail palm	PEM	N	L			H	5	35	16	R: Texas Root Rot, Deer	
Caryota urens	fishtail wine palm	PEM	N	L			H	5	35	16	R: Texas Root Rot, Deer	
Chamaerops humilis	Mediterranean fan palm	PES	Y	L			L	2	15	15	R: Texas Root Rot, Deer	
Dioon spinulosum	giant dioon	PES	Information unavailable	Information unavailable			M, drought tolerant once established	Information unavailable	7–12	5–7		
Dypsis decaryi	triangle palm	PES	Y	L			M	5	20	15	R: Deer	
Jubaea chilensis	Chilean wine palm; syrup palm	PEL	N	M			L	>10	80	25	R: Texas Root Rot, Deer	
Livistona australis	Australian fan palm	PEM	N	M			L	>10	50	15	R: Texas Root Rot, Deer	
Livistona chinensis	Chinese fountain palm	PEM	N	Information unavailable			M	5	40	15	R: Texas Root Rot, Deer	
Livistona decipiens	ribbon fan palm; weeping cabbage palm	PEM	N	Information unavailable			L		40	20–25		
Phoenix canariensis	Canary Island date palm	PEM	N	M			L	5	60	40	S: Fusarium, Root Rot R: Texas Root Rot, Deer	High BVOC Emmitter, Allergen potential

Palm Type: PES - Palm Evergreen Small, PEM - Palm Evergreen Medium, PEL - Palm Evergreen Large

PALMS (CONTINUED)

Scientific Name	Common Name	Palm Type	Utility Friendly	Hardscape Damage Potential	Edible Fruit	Wildlife Value	Water Use	Minimum Grow Space	Max Height	Canopy Width	Pests and Pathogens	Other Considerations
Phoenix dactylifera	date palm	PEL	N	M	Y	Fruit	L	>10	100	20–40	R: Texas Root Rot, Deer	High BVOC Emmitter, Allergen potential
Phoenix paludosa	Bengal palm	PES	Information unavailable	M	Y		M-H	Information unavailable	16			
Phoenix reclinata	Senegal date palm	PEM	N	L			M	5	35	15–20	S: Leaf Spot, Scales R: Deer	
Phoenix roebelenii	pygmy date palm	PES	Y	L			M	2	15	7	S: Leaf Spot, Scales	
Phoenix roebelenii x rupicola	hybrid date palm	PES	Information unavailable	Information unavailable			H	Information unavailable	13–20	13–28	R: Deer	
Phoenix rupicola	cliff date palm	PEM	Y	L			M	5	25	15–20		
Rhapidophyllum hystrix	needle palm	PEs	Information unavailable	Information unavailable			M	Information unavailable	3–6	3–8		Very hardy
Rhopalostylis baueri	Norfolk Island palm	PEM	N	M			H	>10	50	20	R: Texas Root Rot, Deer	
Roystonea regia	Cuban royal palm	PEL	N	M			H	>10	80	15	S: Phytophthora, Root Rot R: Texas Root Rot, Deer	
Sabal causiarum	Puerto Rican hat palm; Puerto Rico palmetto	PEM	N	Information unavailable			M	Information unavailable	50	16	S: Leafhoppers, Ganoderma fungus	
Sabal minor	dwarf palmetto	PES	Y	Information unavailable	Y	Fruit	M	5	7	10	R: Deer	
Trachycarpus fortunei	windmill palm	PES	N	L			L	2	30	10		Allergen potential
Howea forsteriana	Forster sentry palm	PES	Y	L		Fruit	M	5	25	10	R: Texas Root Rot, Deer	

MAINTENANCE FOR NEWLY PLANTED TREES

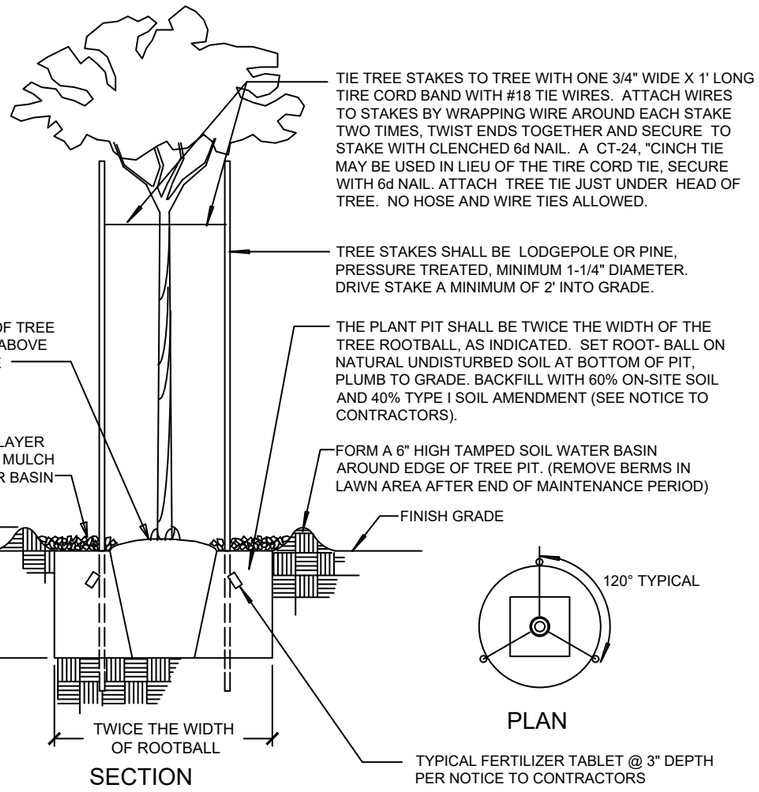
Tree care will include providing trees planted in irrigated areas supplemental deep watering twice a month for the whole three- to five-year period of establishment. The only exception is when we have received normal to high rain for the season. After the season ends, the supplemental watering will resume.

Tree care will also require maintenance of the tree stakes by either adjusting or replacing tree ties, re-staking or removing stakes (because the tree is set) during the tree's establishment period of three years.

Tree care will also include maintaining the mulch and weeds within the tree basin. The mulch shall be maintained at four to six inches of depth over the planted root ball and not mounded against the trunk. Weeds shall be hand pulled and line trimmers shall not be used. Tree guards will be installed at the time of planting to protect the trunk of the young trees and maintained during the establishment period.

Pruning shall only be done by an International Society of Arboriculture Certified Arborist trained in young tree structural pruning standards.

Tree Planting Specifications



GRIDNO	TREE PLANTING AND 3X STAKING	
N.T.S.	REFINFO	RP DETAIL ---

Appendix K. Nursery Specification for Park Trees for Five-Gallon, 15-Gallon, and 24-Inch Box Container-Grown Trees

PROPER IDENTIFICATION

All trees shall be true to name as ordered or shown on the planting plans and shall be labeled individually by genus and species and, where appropriate, the cultivar.

COMPLIANCE

All trees shall comply with federal and state laws and regulations requiring inspection for plant disease, pests, and weeds. Inspection certificates required by law shall accompany each shipment of plants. Clearance from the county agricultural commissioner, if required, shall be obtained before planting trees originating outside the county in which they are to be planted. Even though trees may conform to county, state, and federal laws, the buyer may impose additional requirements.

TREE CHARACTERISTICS AT THE TIME OF SALE OR DELIVERY

Tree Health

As is typical for the species/cultivar, trees shall be healthy and vigorous, as indicated by an inspection for the following:

- Foliar crown density
- Length of shoot growth (throughout crown)
- Size, color, and appearance of leaves
- Uniform distribution of roots in the container media
- Appearance of roots
- Absence of twig and/or branch dieback
- Relative freedom from insects and diseases

Note: some of these characteristics cannot be used to determine the health of deciduous trees during the dormant season.

RAP employee showing a young tree to volunteers.

Crown

Form: Trees shall have a symmetrical form as is typical for the species/cultivar and growth form.

- **Central Leader:** Trees shall have a single, relatively straight central leader and a tapered trunk, free of codominant stems and vigorous, upright branches that compete with the central leader. Ordinarily, the central leader should not have been headed. However, in cases where the original leader has been headed, an upright branch at least half the diameter of the original leader just below the pruning point shall be present.

Note: This section applies to single trunk trees, as typically used for street or landscape planting. These specifications do not apply to plants that have been specifically trained in the nursery (e.g., topiary, espalier, multi-stem, clump, etc. or unique selections, such as contorted varieties).

- **Main Branches (Scaffolds):** Branches should be distributed radially around and vertically along the trunk, forming a generally symmetrical crown typical for the species. Minimum vertical spacing may be specified.
  - » Main branches, for the most part, shall be well-spaced.
  - » Branch diameter shall be no larger than half the diameter of the trunk, measured one inch above the branch.
  - » The attachment of scaffold branches shall be free of included bark.
- **Temporary Branches:** Unless otherwise specified, small "temporary" branches shall be present along the lower trunk below the lowest main (scaffold) branch, particularly for trees less than one and a half inches in trunk diameter. Temporary branches should be distributed radially around and vertically along the lower trunk. They should be no greater than three eighths of an inch in diameter and no greater than half the diameter of the trunk at the point of attachment. Heading of temporary branches is usually necessary to limit their growth.

Trunk

Trunk diameter and taper shall be sufficient so that the tree will remain vertical without the support of a nursery stake.

The trunk shall be free of wounds (except properly made pruning cuts), sunburned areas, conks or other fungal fruiting-bodies, wood cracks, bleeding areas, signs of boring insects, galls, cankers, and/or lesions.

Trunk diameter at six inches above the soil surface shall be within the diameter range shown for each container size below:

CONTAINER	TRUNK DIAMETER INCHES	SOIL LEVEL FROM TOP OF CONTAINER INCHES
5 gallon	0.25–0.75	1.25–2
15 gallon	0.75–1.5	1.75–2.75
24-inch box	1.5–2.5	2.25–3

All palm trees shall have a minimum six-foot brown trunk.

Roots

Long-term root health begins at the nursery. The types of containers that trees are grown in at the nursery can cause circling roots, which can later result in girdling roots and other root issues. Nursery practices such as air pruning can help encourage the branching of roots. In containers such as pioneer pots, roots grow through vertical ribs in the side of the container and are air pruned due to the reduction in humidity outside of the container. Such containerized nursery stock are preferred because research suggests these containers promote greater lateral root growth and result in fewer circling roots (Gilman et al. 2010).

The trunk, root collar (root crown), and large roots shall be free of circling and/or kinked roots. Soil removal near the root collar may be necessary to inspect for circling and/or kinked roots.

The tree shall be well-rooted in the soil mix. When the trunk is carefully lifted, both the trunk and root system shall move as one.

The upper-most roots, or root collar, shall be within one inch above or below the soil surface. The soil level within the container below the rim should be within the distance ranges shown in the table above. When the container is removed, the root ball shall remain intact.

The root ball periphery should be free of large circling and bottom-matted roots. The acceptable diameter of circling peripheral roots depends on species and size of root ball. The maximum acceptable size should be indicated for the species (if necessary).

Moisture Status

At time of inspection and delivery, the root ball shall be moist throughout, and the tree crown shall show no signs of moisture stress, as indicated by wilt, shriveled or dead leaves, or branch dieback. Roots shall show no signs of being subjected to excess soil moisture conditions, as indicated by root discoloration, distortion, death, or foul odor.

INSPECTION

The City reserves the right to reject trees that do not meet specifications as set forth in these guidelines or as adopted by the buyer. If a particular defect or sub-standard element or characteristic can be easily corrected, appropriate remedies shall be required. If destructive inspection of root balls cannot be avoided, the buyer and seller should have a prior agreement as to the time and place of inspection, including the minimum number of trees to be inspected (or the percentage of a species or cultivar) and financial responsibility for the inspected trees.

Guarantee

The successful bidder shall guarantee that the trees meet all of the specifications included in this contract. If a particular defect or sub-standard element or characteristic can be easily corrected, appropriate remedies shall be required. If destructive inspection of root balls is to be done, the City and seller should have a prior agreement as to the time and place of inspection, including the minimum number of trees to be inspected (or the percentage of a species or cultivar) and financially responsibility for the inspected trees.

Rejection

The City reserves the right to reject trees that do not meet specifications as set forth in this contract or as adopted by the buyer at the time of delivery. The successful vendor shall be responsible for picking up the rejected trees at no cost to the City.

Appendix L. Training Topics

Topic 1. "Understanding Protected Trees & Shrubs"

Topic 2. "Tree Wounds"

Topic 3. "Tree and Turf Association"

Topic 4. "Watering Practices"

Topic 5. "Mulch and It's Benefits"

Topic 6. "Tree Staking"

Topic 7. "Maintaining Young Trees"

UNDERSTANDING PROTECTED TREE & SHRUBS

What does RAP's Tree Preservation Policy Do?

RAP's Tree Preservation Policy states that trees or shrubs protected by Ordinance and on RAP property may not be relocated or removed without permission from the RAP Board of Commissioners. The term "removal" shall include any act that will cause a protected tree or shrub to die, including, but not limited to, acts that inflict damage upon the root system or other part of the tree or shrub by fire, application of toxic substances, operation of equipment or machinery, or by changing the natural grade of land by excavation or filling the dripline area around the trunk.

Defining Protected Trees

A protected tree or shrub is any of the following Southern California indigenous tree species, that measures four inches or more in cumulative diameter, four and a half feet above the ground level at the base of the tree, or any of the following Southern California indigenous shrub species that measures four inches or more in cumulative diameter, four and a half feet above the ground level at the base of the shrub.

Protected Trees:

- Oak tree including valley oak (*Quercus lobata*) and California live oak (*Quercus agrifolia*), or any other tree of the oak genus indigenous to Southern California but excluding the scrub oak (*Quercus berberidifolia*).
- Southern California black walnut (*Juglans californica*)
- Western sycamore (*Platanus racemosa*)
- California Bay (*Umellularia californica*)

Protected shrubs:

- Mexican Elderberry (*Sambucus mexicana*)
- Toyon (*Heteromeles arbutifolia*)

The definition shall not include any tree or shrub grown or held for sale by a licensed nursery or trees planted or grown as part of a tree planting program.

Large oak tree with a hollow base.

TREE WOUNDS

What Is a Tree Wound?

A wound is a cut or breach in living tissue due to external intrusion. Wounds destroy the cambium layer, which is responsible for tree growth. Cambium, by division, forms new cells on both sides. These new cells are the duct system of trees. Xylem, the inside cells, conduct water and nutrients from the soil up the stems, and phloem, the outside cells near the bark, conduct organic substances responsible for physiological processes of trees from regions of higher to lower concentration in the tree. Wounds often close but do not heal. When wounds close and do not heal, the wood inside the tree will decay in what appears on the outside a sound tree trunk. Decayed wood loses conductive and storage capabilities.

Why Do Trees Die from Starvation and Not a Wound?

Trees, like other living things, starve when water, nutrients, and organic substances (food) become limited. Trees also starve when space for storing energy reserves begins to decrease. Decayed wood means no storage.

How Many Times Can You Wound a Tree Before It Dies?

Trees have a defense system that is called CODIT (Compartmentalization of Decay in Trees). This system develops "internal barriers" that limit the spread of pathogens in trees vertically and horizontally. Trees do not heal, they compartmentalize. Any treatment that breaks the internal boundaries will destroy the tree's defense system, and the pathogens will spread rapidly. Trees survive as long as they can form new parts in new positions faster than old parts are breaking down. Many wounds create many entries for pathogens; additional strains mean less vigor in developing the defense system. Trees will die if the CODIT does not develop in only one wound thus multiple wounds dramatically increase the potential of trees to die.

What Are the Pathogens?

Pathogens are microorganisms that cause diseases. Fungi, bacteria, viruses and nematodes are the most common pathogens.

What Causes Stress and Strain?

Injuries, cuts, burn, soil compaction around roots, over-watering, under-watering, or insect damage are factors that cause stress. Stress is a reversible process. Stress is a condition resulting from disruption, breakage, drain, or shunt of energy. When stress is chronic, the tissues become strained. Strain is an irreversible condition resulting from excessive stress.

How Do Wounds Occur?

Wounds may occur naturally through self-pruning or can be made inadvertently in the course of normal tree care. The bark of the trunk is the tissue of trees most often subject to mechanical damage, especially in spring and early summer when the cambium is active and the bark is "slipping." Mowers, string trimmers, rubbing tree stakes and ties, aerating and other equipment bumping into trees, and intentional knife carving debarks trees at any season. Hot coals, chains, and even ropes left tied on tree trunks over time will injure trees.

How to Prevent Wounds?

The best way to prevent injuries is to place mulch around tree basins to provide distance between operating machinery and tree trunks. Stakes and ties need to be removed before they rub against the bark and girdle the tree. For surfacing roots, place soil over exposed areas.

TREE AND TURF ASSOCIATIONS

The common association of trees and turf in landscaped areas is a complex competition for resources, such as water, nutrients, and sunlight. Trees and turf grass are commonly grown together in human-made landscapes because of the desire to have both lush, green lawns and the shelter of large shade trees. Grassy lawns with trees are an unnatural ecosystem.

Tree habitat: Trees are native to forests, wooded savannas, and riparian areas. Forests provide dense shade that prevents grasses and under-story plants from becoming established and competing for available nutrients. Undisturbed topsoils are moist and fertile from the constant decomposition of leaf litter and other organic matter. The soil is porous and loose; conditions are highly favorable for tree root growth. Water and nutrient-absorbing roots occupy the top 12 to 18 inches of topsoil.

Turf habitat: Grasses are native to dry and arid prairie settings. They adapt to low water availability by developing dense, aggressive root systems and have the ability to go dormant in periods of drought. The absence of an over-story allows grasses to capture plenty of light to fuel their aggressive growth. Healthy turf requires morning sunlight to optimize growth, health, and stand density. Roots occupy the top 12 inches of topsoil.

Competition Problems and Maintenance Conflicts

Trees block sun exposure from turf. Therefore, in areas where trees are already well established, grass is often sparse and unhealthy due to lack of sunlight. Some shade-tolerant types are able to get by with less light than others; however, all perform poorly in the heavy shade of a densely canopied tree. Heavy shade conditions can also create temperature and moist conditions that are favorable to turf disease organisms. Some grasses have the ability to produce chemicals that can retard the growth of tree roots, stunting the growth and development of young trees.

Trees that have grass growing up to their trunks will invariably have wounds at the base of the trunk caused by lawnmowers and string-line trimmers. Exposed tree roots that run along the surface of the ground also fall victim to scalping by these machines. Mechanical wounds make a tree more susceptible to decay and insects, which can eventually compromise its health and structural integrity. Wounds to the trunk remove not only the bark but also tissue just inside of the bark, which is responsible for diameter growth and food transport. When wounds destroy enough of the trunk, the tree is girdled—cut off from its food supply and the tree dies.

Frequent irrigation required to maintain turf in the hot summer months is detrimental to some trees. Water that strikes the tree trunk and collects at the base can cause root and stem rot. High-pressure sprinklers set too close to the trunk will peel off the bark and create wounds that never close.

Finding Solutions

Instead of struggling to keep your competing trees and turfgrass healthy with heavy inputs of water and fertilizer, the best approach is to eliminate or reduce the competition and conflicts by mimicking the conditions under which these plants grow best in nature. The result will be fewer insect and disease problems, less time and expense in maintenance, and a more attractive, longer-lasting landscape. Here are a few of the ways to accomplish these objectives:

- Designate turf-free areas under the canopies of trees. Turf outside of the tree's canopy area will have ample sunlight, and competition for rooting space within a major portion of the tree's root zone will be eliminated. Remember to establish boundaries according to the ultimate size of the tree, or plan to enlarge the turf-free zone, as the young tree gets larger.
- Mulch with wood chips, bark, or pine straw within the turf-free zone surrounding the trees. The larger the mulched area, the better for the tree. Apply mulch up to six inches deep but avoid piling it directly against tree trunk, which can create moist conditions that can lead to rot or insect invasion of the tree trunk.
- Before mulching, use herbicides cautiously around trees to kill any dense patches of grass. If grass growth is already suppressed by shade conditions, then mulching alone will most likely eliminate it, much like a tree would in its native environment. Many herbicides used to control weeds in turf are absorbed by tree roots and can severely injure or kill trees.
- Plant shade-tolerant shrubs and ground covers in mulched areas if more "green" is desired under tree canopies. Although these plants also compete with the tree, their root systems are much less aggressive than that of turfgrass. They also are better adapted to living within the shade of trees. Ideally, these plantings should be done while a tree is young. However, if you must plant around mature trees, be careful not to cut large roots or disturb any of the finer feeder roots in the top four to six inches of the soil. Tilling the planting area is not recommended, as it will sever a large portion of those finer roots. Instead, dig individual planting holes using hand tools.
- Supplement water and nutrients to reduce the effects of competition in areas where trees and turfgrass must grow together. You may irrigate turf with sprinklers during dry periods, but avoid wetting the base of tree trunks. Young trees will respond better to occasional deep soakings rather than to the more frequent light watering for turf.

WATERING PRACTICES

Poor water management is probably the biggest problem suffered by landscape trees. Each species has a different range of maximum and minimum water necessary for survival. An optimal watering should simulate natural climatic patterns of the tree's origin and should follow seasonal changes. Unfortunately, the park trees grow in conflicting environments. Trees and turf are mutually exclusive in nature.

It is rare to see trees growing in grasslands, and grass is not common on the forest floor. Grassy lawns with trees are an unnatural ecosystem as they compete for water and nutrients. They also compete for sunlight and root space underground. However, watering brings the biggest challenge in maintaining a healthy environment for both. This topic will provide tree facts and watering do's and don'ts, which should help to apply attractive and accommodating alternatives in our parks.

Keeping Roots Healthy

Healthy roots are vital to a tree's survival. Trees absorb water, nutrients, and oxygen through root tips (also called fine roots), of which 85 percent are in the top 18 inches of soil surrounding trees. Roots typically extend beyond the tree canopy dripline, and the majority of trees have a root system extending twice the tree height. Roots eliminate waste carbon dioxide, store food, reduce erosion, produce compounds essential to the plant, and support the above-ground structure.

Damage appearing on the above-ground structure often occurs because roots have been improperly cared for. Roots are often neglected because they grow underground and are not seen. Most healthy trees have beneficial fungi (mycorrhizae or mycorrhizal root tips) growing in or on their roots. Trees need more water in the growing season and warm/hot months when evapotranspiration is increased. Trees "transpire" water through stomates—small openings mostly occurring in leaves. One isolated tree with a canopy spread of 36 feet may transpire 525 gallons of water per summer day.

Water stress symptoms exhibited by broadleaf trees include wilting of leaves and normally shiny green foliage that becomes faded, dull, or grayish. Growing tips may wilt in the afternoon and recover as evening approaches. Stress is a reversible condition; the sooner the condition is eliminated the better chance for total recovery. Native and drought-tolerant trees benefit from deep, supplemental water at one- or two-month intervals during summer.

Tree Watering Do's

Water trees around and beyond the dripline, not near the trunk. Water infrequently and deep to encourage a deep root system. Examine trees regularly for symptoms of water stress. For young trees and mature trees showing drought stress, form a basin by creating a berm of soil several inches high that encompasses the dripline of the tree and fill basin with water. Probe the soil to a depth of three feet to monitor soil moisture within the dripline—daily and weekly for young trees and monthly to bimonthly for mature trees. Irrigate trees early morning or just before dawn. Install sprinklers outside the dripline and direct sprinklers away from trunks and canopy.

Tree Watering Don'ts

Do not underwater, which leads to drought stress. Do not overwater, which is a more common problem in our parks due to trees growing in turf. Excess water excludes oxygen from soil, a vital factor for healthy roots. Excessive water increases probability of soil compaction by closing soil pores essential for root survival. Excessive water in the root zone, especially near the root collar, is a primary cause of root and crown diseases, such as Armillaria, Phytophthora, and Rosellinia. These fungi-causing diseases are present in many soils but activate damaging effects in moist and/or warm conditions. Do not install sprinklers within the dripline. Avoid sprinklers wetting tree trunks and canopies, especially trees susceptible to fungal diseases.

Finding an Attractive and Accommodating Alternative

Plant shrubs near trees that have the same water requirements. Mulch trees in groups and individually as far from tree trunks as possible.

Mulch within the tree's dripline is perhaps the most important maintenance recommendation. It will minimize competition with turf, improve moisture content in the soil, and enhance tree health. Learn how to properly apply mulch in the next training topic "Mulch and Its Benefits."

MULCH AND ITS BENEFITS

Mulching enriches and protects soil, helping to provide a better growing environment for trees. Mulch is simply a protective layer of material that is spread on top of the soil. Mulches can either be organic, such as grass clippings, straw, shredded wood, bark chips, and similar materials or inorganic, such as stones, brick chips, gravel, and plastic. Properly applied mulches, both organic and inorganic, have numerous benefits, including:

- Protecting the soil from erosion.
- Reducing compaction from the impact of heavy rains.
- Conserving moisture, reducing the need for frequent watering.
- Maintaining a more even soil temperature.
- Preventing weed growth.
- Providing a protection zone for trees against accidental equipment damage.

Organic mulches also improve the condition of the soil. As these mulches slowly decompose, they provide organic matter, which helps keep the soil loose. This improves root growth, increases the infiltration of water and also improves the water-holding capacity of the soil. Organic matter is a source of plant nutrients and provides an ideal environment for earthworms and other beneficial soil organisms. In poor soils, organic mulch may cause a nitrogen deficiency caused by wood-decomposing bacteria. In that case, apply nitrogen fertilizer at the minimized rate.

Inorganic mulches have their place in certain landscapes; however, they lack the soil-improving properties of organic mulches. Inorganic mulches, because of their permanence, may be difficult to remove if you decide to change your garden plans at a later date.

When to Apply Mulch?

Mulch may be applied at any time in our Southern California climate. Mulches moderate the soil temperature by providing an insulating barrier between the soil and the air. This means that a mulched soil in the summer will be cooler than the adjacent unmulched soil while in the winter, the mulched soil may not cool off as deeply. Since mulches slowly decompose, they need to be replenished every two to three years to maintain an effective layer.

How Much Mulch to Apply?

Mulch groups of trees, trees in planters, individual trees, and all young trees for at least three to five years after planting. Mulch is measured in cubic feet. As an example, if you have an area ten feet by ten feet and you wish to apply six inches of mulch, you would need 50 cubic feet.

How to Apply Mulch?

Do not apply mulch directly in contact with plants and especially tree trunks. Leave an inch or so of space next to plants and six inches away from tree trunks to help prevent diseases from flourishing from excessive humidity. Remove weeds before spreading mulch. Spread mulch evenly at a thickness of six inches.

Griffith Park's Green Waste Facility produces shredded tree trimming mulch continually, which is always available for distribution throughout city parks. Call 213.485.4826 to request a mulch delivery to your park.

TREE STAKING

Newly planted trees may need artificial support to prevent excessive swaying in the wind, to promote upright growth, or to guard against mechanical damage.

Why to Stake Park Trees?

Staking is not always necessary for many trees and can have negative effects on the young trees being planted. Research has shown that staked trees develop smaller root systems and decreased trunk taper. The young trees are often injured by leaving the tree ties on too long or by using metal wire and other unsuitable material for securing the tree to the stake. The decision to stake or not should be determined by the strength of the trunk of the tree being planted, wind conditions, traffic patterns, and maintenance requirements. The proper use of stakes on young trees can lessen or prevent problems that may occur as the tree matures.

Trees with strong trunks may need stakes only to prevent mechanical damage, such as weed eater line girdling, being run into by lawnmowers, and park patron vandalism. The stakes are there to provide stability for the young tree until its roots can expand and grow into the surrounding soil, anchoring it securely.

How to Stake Park Trees?

The Forestry Division recommends that at least three stakes be used when staking a tree. Stakes should be at least nine to 12 inches from the trunk of the tree. Stake ties should be loose enough to allow the tree to sway with the wind to help develop trunk strength. If the ties are too tight, they will cause weak spots in the trunk that will eventually lead to trunk failure.

The materials used during staking can be either metal or wood. RAP recommends wooden peeler poles that are biodegradable and easily removed when needed. The material used for tying the trees to the stakes should never be metal or wire.

There are many new products on the market that do not damage the tree's bark and can expand with the developing trunk structure. The ties should make a "figure eight" pattern around the trunk and back to the stake, and then nailed to the stake. The ties should be spaced along the trunk of the tree at different heights, not all at one height at the same place on the trunk of the tree.

How Long to Keep Tree Stakes?

Trees should be staked no longer than two to three years. If the tree is unable to support itself after that time, it should be evaluated for removal and replacement. Tree stakes are for protection—not for support of the tree.

MAINTAINING YOUNG TREES

Mulching, pruning, watering, staking, and fertilizing affect the growth and development of young trees.

Park tree casting shade over an empty chair.

Why is Mulching Important?

Mulching is the most important post-planting practice that you can do to improve the health and vitality of your landscape plant. Research has shown that wood chip mulch can nearly double plant growth in the first few years after planting. Mulching conserves moisture and insulates roots from heat and cold extremes. Proper mulching provides a well-groomed appearance, eliminates grass or weed competition, and prevents mechanical damage from mowers and weed trimmers. Mechanical damage is one of the leading causes of injury and death to landscape plants.

Mulch groups of trees, trees in planters, young trees for at least three to five years after planting. Mulch is measured in cubic feet. As an example, if you have an area ten feet by ten feet and you wish to apply six inches of mulch, you would need 50 cubic feet. Do not apply mulch directly in contact with plants and especially tree trunks. Leave six inches away from tree trunks to help prevent diseases flourishing from excessive humidity. Remove weeds before spreading mulch. Spread mulch evenly at a thickness of six inches.

Caution must be used when applying mulch since heavy mulching can also be a problem in poorly drained or wet sites where moisture can remain at high levels for extended periods and cause root dieback. In addition, heavy mulch layers encourage tree roots to grow up into the mulch material, which may dry out during long dry periods and cause these roots to die.

How Much to Prune?

Trees and shrubs should be pruned at planting time to remove branches damaged during handling and transplanting. The main leader on a single-stemmed tree should not be pruned unless it has been damaged. Lower branches should not be removed because they manufacture critically needed food and help to develop a strong trunk caliper. All planted and transplanted trees should be inspected during the first fall and winter after planting and pruned to remove any dead or crossing branches or to improve structure. This pruning period is also an excellent time to inspect the trees for other problems.

How to Water Young Trees?

Water is critical to the success of any tree or shrub planting. Tree roots, especially the small, water-absorbing roots, are easily damaged during original planting and transplanting. For sufficient water uptake to occur, the root ball of a newly planted tree must be kept moist, but not saturated. Monitor the moisture in the root ball daily, and water as needed so that the root ball does not dry out. The area outside of the root ball also should be watered to encourage root growth into the surrounding soil. Avoid over-watering, which is a major cause of tree failure. Heavy clay soils that have been compacted during construction activities severely restrict the movement of water and commonly lead to saturated conditions.

In areas with fine textured soils, such as those containing high levels of clay or silt, newly planted trees should receive no more than an inch of surface water per week during the growing season. Supplemental watering may not be necessary during periods of adequate rainfall. Water no more than two or three times per week for a total of one inch. Operating automatic lawn irrigation systems for 20 to 30 minutes per day often results in a continuously saturated soil condition, which, in turn, causes severe root damage and tree death.

In sandy soils, water drains more easily, and up to two inches of water per week may be necessary to keep the soil moist. Carefully monitor the moisture level in the root ball of container trees planted in sandy soils. Water does not drain easily from the fine textured soil of the root ball into the surrounding sandy soil, and saturated conditions in the root ball may develop. Use a typical two-foot soil probe to monitor soil moisture in no more than seven-day intervals.

How to Stake, Tie, and Why to Install Tree Guards?

The purpose of most staking and tying is to prevent the newly planted tree from tipping over in the wind. If at all possible, staking and guying systems should not be used. In windy, exposed areas, this practice is sometimes appropriate. Excessive movement will dislodge the small, fibrous roots from their new footing in the soil before they are firmly established. However, many trees are girdled and killed because guying materials are not removed or are improperly installed.

Staking and guying materials should be strong enough to provide support but flexible enough to allow some movement. Ties should have a broad surface to prevent damage from rubbing. Do not use a wire in a hose. All guying materials should be loosened or removed at the end of the first growing season to prevent trunk girdling. Trees with strong trunks need stakes only to prevent mechanical damage such as weed eater line girdling, being run into by lawnmowers, and park patron vandalism.

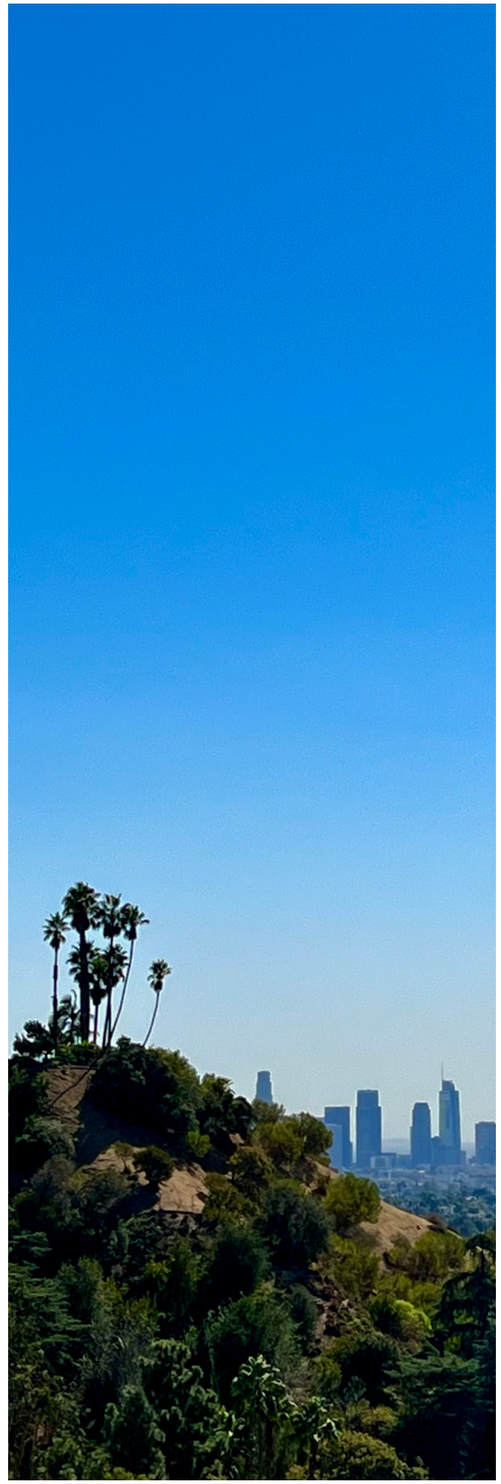
The Forestry Division recommends that at least three stakes be used when staking a tree. They should be at least nine to 12 inches from the trunk of the tree. Stakes should be removed after two to three years. If the tree is unable to support itself after that time, it should be evaluated for removal and replacement. Plastic tree guards can prevent trunk damage from rodents, mowers and weed trimmers. They should be monitored regularly and removed before rubbing or girdling problems occur.

Should the Young Trees Be Fertilized?

Fertilizers are generally not recommended at planting time since most soils contain sufficient levels of available nutrients to supply the requirements of newly planted landscape trees. Nitrogen fertilizers, in particular, should be avoided because the nitrogen promotes shoot growth over root growth, and re-establishment of the root system is required before a newly planted tree can adequately support new top growth.

Sites with very poor soil, or where construction activities have altered the soil composition, may be deficient in certain nutrients and especially mycorrhizae, which are fungal organisms that have beneficial association with tree roots. They are present in all native soils. Although they do not directly provide nutrients, they greatly increase effective surface area for root absorption of nutrients and water from the soil.

If a tree grows in poor urban soil, shows stress symptoms, and all other tree's requirements are met, most likely this is an indicator of a fungi-sterile soil. Analysis of existing tree roots for the presence of native mycorrhizae fungi may be advisable prior to deciding about the application of mycorrhizal fungal inoculants. If fertilizing applications are needed, fertilizing formula should be slow release. Complete fertilizing with chelate trace of elements and mix at label rates not to exceed four pounds of nitrogen per 100 gallons of water.



Appendix M. Supplemental Tree Care and Biodiversity

Depending on the sensitivity of the habitat, it may need to be evaluated by a wildlife expert. This will allow RAP to establish an appropriate buffer zone based on the species of wildlife and location. RAP uses discretion when determining the buffer zone. For example, a bird species nesting in a riparian area that is difficult to access would require a larger distance than one adjacent to a path. A "Notice of Exemption" is used when RAP does work around trees during the nesting season.

LA BUREAU OF ENGINEERING SPECIFICATIONS

In compliance with the Migratory Bird Treaty Act and California Fish and Game Code Sections 3503 and 3503.5, tree removal activities would take place outside of the nesting bird season (February 1 to September 1) to the extent feasible. In accordance with these regulatory requirements, efforts would be made to schedule removal of mature trees between September 2 and January 31 to avoid the nesting bird season. If activities were to occur during the nesting bird season, all suitable habitats would be thoroughly surveyed for the presence of nesting birds by a qualified biologist (or a qualified arborist) within three days prior to any tree removal. If any active nests are detected, the area will be flagged, and a minimum 250 foot (500 foot for raptors) non-disturbance buffer would be established (a modification of this buffer would be determined by the monitoring biologist and in consultation with US Fish and Wildlife Service and California Department of Fish and Wildlife) and would be avoided until the nesting cycle has been completed and the monitoring biologist determines that the nest has fledged.

TRAINING MATERIALS

"Why hire a wildlife-trained arborist?"

1

TREE CARE FOR BIRDS AND OTHER WILDLIFE

Why hire a wildlife-trained arborist?

- Wildlife-trained arborists are familiar with Federal, State and local laws that protect birds, nests, and other wildlife. They are trained to honor these regulations while caring for your trees, and to spare you negative public relations problems.
- Wildlife-trained arborists recognize that wildlife provide vital ecological services to the planet. Their tree care practices and landscape guidance can protect and may even enhance habitat on your property.
- By making your property more beneficial to wildlife, you enrich your city's overall urban forest, and add enjoyment to your life.
- Practices used by wildlife-trained arborists are often better both for the health of your trees as well as your own. Trees on your property, if properly located and managed, by a trained arborist, provide many unseen services. They not only have a lower risk of failure, but save you energy costs, make the air you breath healthier, and contribute to ground water reserves.
- Managing trees for wildlife may save costs.

DID YOU KNOW

BIRDS NEST IN ALL THESE LOCATIONS?

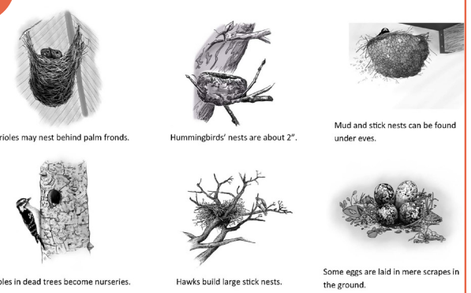
YOU CAN HELP WILDLIFE

- Be especially watchful for nests between February and August, and keep a safe distance from them.
- Use climate-appropriate and wildlife friendly trees and plants.
- Remember that some leaf litter and dead wood is wildlife friendly.
- Keep trees watered during drought.
- Avoid chemicals that reduce helpful insects and other prey, and may harm wildlife.
- Keep cats indoors.

TreeCareForBirds.com

2

Not all nests are the same



To learn about laws protecting birds and nests:
www.fws.gov/cno/conservation/MigratoryBirds/BirdNests-final.pdf
How to find a license arborist in your region:
www.isa-arbor.com/findanarborist/findanarborist.aspx
Where to learn about climate-suitable plants:
www.nps.org
What to do when you find a baby bird or injured animal:
www.songbirdcareandeducation.org/foundababybird.html
Wildlife Protection:
www.tws-west.org

"Preventing Harm to Wildlife During Tree Care"

1

TREE CARE FOR BIRDS AND OTHER WILDLIFE

Preventing Harm To Wildlife During Tree Care

Almost all bird nests are protected by law. The tree care worker can reduce harm to wildlife, comply with bird regulations, and know how to protect wildlife habitat. Become familiar with the Best Management Practices and other materials at:
www.treecareforbirds.com.

Job Steps Affected by this Topic
- Working during the nesting season vs the non-nesting season.
- Preparation before work begins.
- Actions when safety concerns conflict with wildlife regulations.
- Action when wildlife are accidentally impacted.

Potential Risks
- Harming wildlife unnecessarily.
- Violation of bird regulations and possible fines.
- Negative public relations.

Why are Wildlife Important?

Wildlife contribute to the environment. They also rely on trees for their food and homes.

Many laws and regulations exist to protect wildlife. The Federal Migratory Bird Treaty Act of 1918 states that it is against the law to kill or injure native birds, fledglings, eggs or active nests. This includes putting them at risk by scaring parents away from eggs or young.


Immature songbird by Four Oaks

WILDLIFE EMERGENCIES

If you find injured wildlife or an immature bird out of its nest, call a Wildlife Rehabilitation Center before intervening. Parents are highly likely to continue caring for immature birds when they have fallen out of the nest. It is against the law to take a wild bird home as a pet.


Immature Red-tailed Hawk by David Watkins

Tree Care For Birds and Other Wildlife - treecareforbirds.com
Thank you to the primary project funders: The Britton Fund and CAL FIRE Urban and Community Forestry

2

Project preparation

Be prepared with contact information for a Wildlife Trained Arborist, Wildlife Biologist (with training and experience in ornithology), and a Wildlife Rehabilitation Center.

- Know if work is to be done during the nesting season (Feb.-Aug.) when most birds nest, or outside the nesting season (Sep. - Jan.)
- Consider the quality of the habitat in which work is to occur. High habitat value areas and riparian areas are more likely to have wildlife present. (Figure 1-3)


Figure 1 High habitat value
Riparian areas with or without water all year.


Egrets commonly nest in riparian areas.
Photo by Tom Grey

Figure 2 High habitat value
Large areas with mature trees, some dead trees, and understory vegetation.


Owls are found in high quality habitats where there is good canopy cover.
Photo by Peggy Honda

Figure 3 Low Habitat Value
Areas with large hard surfaces.

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3

KNOW WHAT TO LOOK FOR AND WHERE TO LOOK


Figure 5


Figure 6

Fieldwork

Conduct a pre-work inspection prior to starting work or in the days before the work is scheduled but not more than a week before the work is planned to begin. Look for signs of wildlife and nesting birds in likely locations. (Figure 5 and 6).

If a nest is found, determine whether it has eggs or immature birds (active nest), is an old, abandoned nest, or if it is a large, stick nest which may have special protection law all year.

If an active nest is present, it is best to delay work until the immature wildlife have left the nest. (Wildlife continue to rely on parents in the first few weeks after they have left the nest.) If it is not possible to delay work, consult a Wildlife Trained Arborist or Wildlife Biologist for instructions.

If a nest/wildlife is accidentally injured, contact a Wildlife Rehabilitation Center or Wildlife Biologist. Keep the bird in view, but keep away from it. Avoid handling or relocating it unless directed to do so. It is against the law to take a bird home.

It is illegal for anyone to keep a nest, or any part of a native bird (including feathers) without a permit from the U.S. Fish and Wildlife Service.

For further information about bird nests and permits, contact: U.S. Fish and Wildlife Service Pacific Southwest Region Division of Migratory Birds and Habitat by emailing: permitsr8mb@fws.gov

Tree Care For Birds and Other Wildlife - treecareforbirds.com
Thank you to the primary project funders: The Britton Fund and CAL FIRE Urban and Community Forestry

4

Look closely for these three hard-to-spot nests


Under palm fronds


Hummingbird nest about 2" in diameter


Holes in dead trunks and limbs

Most nests are protected. Degree of protection depends on the species and location.

To learn more:
https://www.fws.gov/endangered


Small, old/abandoned nests can often be removed but should be left in place if possible.


Large stick nests usually have special protection even if abandoned or unoccupied.

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Appendix N. Brush Clearance Requirements

Ordinance No. 185789 is followed by RAP and guides maintenance operations in the WUI to prevent fires in sensitive areas. The ordinance prohibits the use of certain metal-cutting blades for brush clearance to prevent sparks and sets penalties for violations with a multi-strike system.

Use the following link to access the ordinance: Ordinance No. 185789

9.0 Assumptions

The City of Los Angeles Recreation and Parks Department assumes no responsibility for matters legal in character regarding the Tree Care Manual (see chapter 3). The manual was created to conform to current standards of care, best management practices, established technical specifications, evaluation and appraisal procedures, and sound arboricultural practices as recommended by the sources listed in the “References” section.

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