Planning for the Future of Rocklin's Urban Forest

Prepared for
City of Rocklin
Community Development Department
Prepared by
Phytosphere Research

September 2006

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Acknowledgements

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Executive Summary

This document provides an overall framework for managing Rocklin's urban and natural forest resources. It is based on the condition of the forest in 2003 and an analysis of trends that have shaped Rocklin's urban forest to date and will continue to influence it in the future. The major portions of this document are described below.

1. Management plan for Rocklin's urban forest. This section discusses issues and trends that are likely to impact Rocklin's tree resources over at least the next 25 to 50 years. These include:

- Tree canopy cover increased from 11% in 1952 to 18% in 2003 (a 63% increase), due to protection of existing oaks and growth of both new and existing trees. Current and future issues related to overall tree canopy include low canopy cover in commercial parking lots and along most residential streets and long-term sustainability of native oak woodlands.
- Most of the current urban forest canopy is relatively young and in good health. However, the overuse of some species and the relatively uniform age distribution over much of the City could lead to problems in the future that would affect a large portion of the urban forest.
- The cost of maintaining both public and private trees will increase as these trees age

The management plan also presents community-based goals for managing and protecting Rocklin's tree resources. Objectives and guidelines for managing and protecting Rocklin's urban and natural tree forest are provided for each goal. Major goals of the plan include:

- Establishing and maintaining target levels of tree canopy throughout the City.
- Promoting conservation of existing tree resources.
- Developing an urban forest canopy that is stable over the long term
- Promoting efficient and cost-effective management of publicly-owned urban and natural forest resources.
- Fostering community support for the local urban forestry program and encouraging good tree management on privately-owned properties.

2. The current state of Rocklin's urban forest and tree management practices. This section presents the results of surveys and other evaluations of Rocklin's urban forest. The information is organized into six subject areas.

- **Overall tree canopy changes from 1952 to 2002** - The increase in canopy cover over this time is largely due to growth of conserved oaks and new tree plantings, primarily in residential developments.
- **Oak woodland open space lands** - The City-owned oak woodlands include both riparian and upland stands, which differ with respect to management issues. Current tree condition is generally good, but regeneration is an issue in upland stands while invasive species are a bigger concern in riparian areas.
- **Trees in parks** - Most planted park trees are in good condition, but conserved oaks in some older parks are declining. Pruning to improve tree structure and safety is the most common maintenance need.
- **City-maintained parkway trees** - In 2004, the City maintained an estimated 10,000 trees along about 28 miles of streets. Most of these trees were in good condition but

were generally young. Maintenance needs and costs will rise as the tree population ages.

- **Private trees along residential streets** – Private trees constitute the overwhelming majority of trees along Rocklin streets, although most are planted too far from the street to shade pavement. Most of the private tree population is relatively young and healthy, but many conserved oaks are in decline.
- **Trees in commercial parking lots** - Levels of tree shade in most parking lots is low, with very few spaces being even half shaded. Although trees were young in many lots, older lots did not necessarily have higher levels of shading due to the loss of planted trees over time.

3. Involving residents in the care of Rocklin's urban forest. City residents play a major role in the planting and maintaining the majority of Rocklin's urban forest. Through public education and outreach programs, the City can help improve the selection and care of trees on residential properties and can increase the involvement of community volunteers in the restoration of native oak woodlands on City lands. The appendix includes a public information package on basic tree selection, planting, and care.

4. Funding sources for urban forestry. This section lists a number of external funding sources available to the City and to citizen groups to help fund urban forestry projects, including tree planting, environmental restoration, and community outreach and education. These sources of funding can help augment, but will not replace, the City's need to provide funding from internal sources, including assessment districts, the Oak Tree Preservation Fund, and the General Fund.

5. Technical guides for urban forest management. Section 6 of this document and several of the appendices are technical guides that describe the management actions needed to maintain Rocklin's urban forest in a manner consistent with the goals that have been identified. Major elements include a list of recommended tree species and associated planting, placement, and maintenance guidelines.

1. Introduction

Trees provide a variety of benefits, particularly in the urban environment. Trees in cities are widely appreciated for their aesthetic qualities. Trees play a large role in the identity of many cities. For example, a search of the internet shows that many cities throughout the world embrace the term "City of Trees" as part of their community identity.

Trees make cities more livable in a variety of ways. Some of these are difficult to quantify in economic terms. For example, trees and shrubs can help muffle urban noise, and trees provide important foraging and nesting opportunities for birds and other wildlife. However, it is possible to assign a dollar value to some of the benefits that trees provide, which emphasizes the importance of the urban forest as a key element of urban infrastructure. Researchers at various institutions have been working to quantify some of the benefits provided by the urban forest. In particular, scientists at the Center for Urban Forest Research (http://cufr.ucdavis.edu/) at the University of California, Davis, have been studying the economic benefits of trees in California communities since 1992. Their results are available online as both technical reports and short summary handouts.

Trees help save energy

In hot climates, one of the principal economic benefits provided by trees is due to shade.

- Trees in residential yards that shade western and eastern facing windows, roofs, and walls can reduce energy needed for cooling by as much as 34% (Simpson and McPherson 1996).
- On hot summer days, temperatures within urbanized areas can be up to 10°F hotter than the surrounding countryside, a phenomenon known as the urban heat island effect (http://www.epa.gov/heatisland/). Buildings and pavement made of dark materials absorb the sun's rays, leading to an increase in the temperature of the surfaces and the air around them. Trees and other vegetation reduce summer temperatures through direct shading of surfaces and through the process of evapotranspiration. Evapotranspiration refers to the way that water is evaporated from within plant leaves, exiting through tiny pores in the leaf. As the water evaporates, it cools the leaf and the air around it in much the same way that swamp coolers function. By combating the urban heat island effect, trees reduce the overall summer temperature within urban areas, helping to reduce energy use.
- Trees serve as windbreaks, which helps save energy by reducing the amount of outside air that infiltrates into heated or cooled building interiors (Heisler 1986).

Trees improve air quality

- Trees improve ambient air quality by removing gaseous air pollutants and particulates from the air (Scott et al, 1998).
- Although the majority of human-caused smog precursors come from moving vehicles, parked cars also emit volatile hydrocarbons and nitrogen oxides into the atmosphere that react to form smog. Cars parked in shade are much cooler and release fewer volatile hydrocarbons and nitrogen oxides into the atmosphere (Scott et al, 1999).
- As trees reduce the urban heat island effect, they also reduce the formation of photochemical smog because the chemical reactions that form smog are favored by higher temperatures (http://eetd.lbl.gov/HeatIsland/AirQuality/).

Trees provide other important urban services

- Tree canopies intercept rainfall, moderating stormwater runoff and reducing the amount of pollutants that wash off buildings and paved surfaces into creeks and storm drains (Xiao et al, 1998, Xiao and McPherson 2003, Geiger 2003).
- Tree shade over pavement slows down pavement deterioration (McPherson et al 1999).
- Trees planted along roadways can have a "traffic calming" effect which reduces driving speeds by visually narrowing the road (Otak, Inc. 2002)
- Tree roots help to hold soil in place, and tree canopies shield soil from the impact of rain drops, resulting in decreased soil erosion during storms, which improves stream water quality and reduces silt deposits in reservoirs and flood control basins.

Trees provide direct economic benefits

- A variety of studies show that trees increase residential property values. People pay more for homes with attractive trees, that are in neighborhoods with attractive trees, or that are near open space areas with trees. (Anderson and Cordell 1988, Wolf 1998b).
- A study by researchers in the State of Washington found that consumers perceive business districts with trees to be higher quality than those without trees. Consumers were willing to pay up to 10% more for goods bought in tree-lined business districts (Wolf 2003a,b).

Social benefits related to trees

A growing body of research has shown that the presence of trees in neighborhoods and views of trees and nature contribute to both physical and mental health of urban residents.

- Trees are associated with lower crime rates, and improved mental health, stronger ties between neighbors, and greater feelings of safety and well-being of City residents (Kuo 2003).
- Researchers have shown that office workers who can see nature from their desks have 23% less time off sick and report greater job satisfaction than those who can not see any nature (Wolf 1998).
- Hospital patients with views of trees have been shown to recover significantly faster than those who can not see any natural features (Ulrich 1985).

Benefits vs. Costs

Urban trees clearly provide a wide variety of benefits, although it is only possible to calculate an economic value for some of these. There are also obvious costs associated with planting, maintaining, and removing trees in cities. In addition, indirect costs associated with trees include the costs of clearing away fallen leaves, repairing damage to nearby structures that may be damaged by tree roots in certain planting situations (e.g., large trees planted too close to curbs and sidewalks), and the administrative costs associated with maintaining a community urban forest program. Do the economic benefits of urban trees exceed their cost?

The answer, provided by a number of studies of communities in California and elsewhere, is a definite "yes". Studies by Dr. Greg McPherson and colleagues at the Center for Urban Forest Research have consistently shown that the economically quantifiable benefits of urban trees are several times greater than their associated costs. Furthermore, their studies show that the benefit-to-cost ratio is higher for large trees than small trees (McPherson 2003). An urban forest composed primarily of trees that are small-statured at maturity provides a much lower total

economic benefit to the community and has a lower benefit-to-cost ratio than an urban forest with a preponderance of large-canopied trees (Geiger et al 2004).

Securing tree-related benefits

Many different City planning and management actions, especially those that occur during development, have a large impact on the character and condition of the urban forest. Rocklin has expanded rapidly over the past decade and is scheduled to complete its ultimate residential buildout by about 2015. Urban forest planning and management actions taken over the past decade, as well as those made in the next decade, will shape the future of Rocklin's urban forest for the next half century or more. To ensure the development of a thriving urban forest that will benefit the community, the City needs to develop a long term plan that accounts for the needs of trees in the urban environment. Both tree growth and tree decline are typically slow processes, so management actions related to these processes need to be initiated far in advance of the desired outcomes. This urban forest plan provides an overall strategy that will help the City maximize the benefits the urban forest will provide in the years to come.

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Xiao, Q.; McPherson; E.G. 2003. Rainfall interception by Santa Monica's municipal urban forest. Urban Ecosystems 6:291-302.

General sources of information on tree-related benefits

Center for Urban Forest Research, Pacific Southwest Research Station, USDA Forest Service website - http://wcufre.ucdavis.edu/default.asp

Center for Urban Horticulture, College of Forest Resources, University of Washington website - http://www.cfr.washington.edu/research.envmind/

Human-Environment Research Laboratory; University of Illinois at Urbana Champaign website - http://www.herl.uiuc.edu/

2. Recommendations for the management of Rocklin's urban and natural tree forest

This section summarizes some of the important issues and trends that are likely to affect Rocklin's urban and natural tree forest over the next 25 to 50 years and beyond. Based on these issues, local concerns and priorities, and general urban forest management principles, Phytosphere developed a list of goals that could be used to help guide the overall management of Rocklin's urban and natural tree forest. The objectives associated with these goals and recommendations for attaining these objectives constitute an overall framework for the sustainable management of Rocklin's tree resources.

These issues and related goals have been organized into three general topic areas. **Tree canopy cover** includes issues that are related to the overall amount of tree canopy in Rocklin and its distribution within the City. **Tree and forest health** addresses the long-term health and sustainability of both individual trees and the forest as a whole. **Management of the urban forest** addresses issues that are specific to the care and maintenance of the urban forest by both the public and private sectors. These main topic areas, as well as the goals and objectives listed under them are highly interrelated. Hence, objectives listed under one goal may in fact support several other goals as well.

This section includes cross references to supporting data and discussions found in other portions of this document.

2.1. Tree canopy cover

Issues and trends

- Mean summer temperatures will tend to rise due to the urban heat island effect (localized heating of urban areas associated with pavement and other heat absorbing surfaces) and overall global warming trends. Increased tree canopy cover can help moderate these impacts.
- Regional air quality will continue to be an issue of concern. The Sacramento air basin in the vicinity of Sacramento has frequently exceeded national ambient air quality standards for ozone and, to a lesser degree, airborne particulates matter. Tree canopy intercepts and reduces both ozone and particulate pollutants.
- Tree canopy cover in Rocklin has increased by 63% over the past 50 years, from about 11% in 1952 to 18% in 2003, as a result of both new tree planting and growth of existing native trees over the past 50 years (Section 3.1).
- The Sacramento Regional Urban Forest Compact (also known as the GreenPrint) establishes a goal of doubling the region's tree canopy coverage to 35% over the next 40 years.
- Many of Rocklin's existing trees are young, and with proper care will continue to grow in size, increasing overall canopy cover (Sections 3.3, 3.4, 3.5, 3.6).
- Most commercial parking lots never obtain even moderate levels of tree shading. Most parking lots achieve only low levels of tree shade within about 10 years and then begin to lose canopy as the result of both poor growth and trees loss (Section 3.6).

- Due to tree placement and species selection, most existing residential tree plantings in front yards on private property are unlikely to provide significant shading of streets when trees mature (section 3.5).
- Native oak woodlands on Rocklin public lands are generally in fair to good condition, but low levels of natural regeneration in some areas may affect long-term sustainability of some stands (Section 3.1).
- Conserved oaks provide significant amount of tree canopy in various developed areas. However, many of these trees have sustained high levels of root damage due to both construction-related activities and subsequent alteration of the root zone and are likely to decline and be removed over the next few decades (Sections 3.1, 3.5, 3.6).

Goal 1. Establish and maintain target levels of tree canopy throughout the City.

Objective 1.1. Establish target levels of tree canopy cover citywide and for specific land use categories.

Actions

Adopt an appropriate goal and timetable for increasing overall canopy cover within the City of Rocklin.

Establish canopy cover goals for open space lands, residential areas, commercial parking lots, public facilities (including parks and schools), city-maintained parkways, and other major land use categories that will contribute to attainment of the overall canopy cover goal.

Objective 1.2. Maximize levels of successful tree establishment in new construction areas.

Actions

Continue and expand policies and programs that require or encourage tree planting in new developments.

Update existing planting standards to improve tree establishment and performance. Revisions should address improving planting site preparation (including modification of the planting hole standard), staking, tree species selection, and nursery stock quality.

Increase levels of parking lot shading by adopting and implementing standards that improve design, site preparation, and short-and long-term maintenance practices.

Objective 1.3. Maintain or increase tree canopy cover levels in existing developed areas.

Actions

Continue efforts to replant trees in publicly-maintained streetscapes and developed parks as needed to maintain appropriate levels of tree canopy.

Promote appropriate tree planting on privately-owned properties by Rocklin businesses and residents.

Objective 1.4. Increase native tree cover in City-owned natural woodlands.

Actions

Promote natural regeneration in heavily-used City-owned oak woodlands by maintaining adequate levels of organic matter on the soil surface beneath oak canopy.

Promote natural regeneration in City-owned oak woodlands by selectively protecting existing native seedlings and saplings in appropriate locations from mowing, herbicide application, or other potentially damaging maintenance practices.

Increase tree cover in historically-forested open space lands by planting with locally native tree species where appropriate. Continue and expand recent efforts by Public Works and the Parks Division to propagate and plant locally native trees in open space areas in collaboration with community volunteers.

Continue to monitor establishment, survival, and growth of restoration plantings to help refine and optimize planting methods and identify potentially limiting factors.

Goal 2. Promote conservation of existing tree resources.

Objective 2.1. Increase the level of protection provided to oaks before and during construction.

Actions

Continue enforcement of Rocklin's Oak Tree Ordinance.

Continue City policies that attempt to maximize conservation of tree cover when developing in areas that contain existing tree resources. Use site planning to protect groups of trees and minimize the amount of disturbance to the roots of existing trees by expanding the protected area for root growth.

Continue to implement tree protection measures and monitoring of trees designated to remain during development activities.

Review and update Rocklin's oak tree protection guidelines as needed to reduce tree damage during development and improve long term survival of retained trees.

Objective 2.2. Improve the management of retained oaks.

Actions

Promote good tree care practices by private tree owners by continuing to provide recommendations on oak tree care to interested citizens.

Continue and expand tree care training / education opportunities for City staff involved in oak tree maintenance and landscape planning.

Goal 3. Choose and locate new trees to maximize tree-related benefits

Objective 3.1. Match species to sites to the greatest degree possible.

Actions

Provide guidelines on tree selection and placement to residents to promote planting the right tree in the right place and avoid tree/site combinations that will result in shortened tree life or excessive maintenance costs (e.g., redwoods on thin soils, big trees planted in small places, tall trees under electric distribution lines, etc.)

Continue to select suitable species and place trees appropriately to minimize conflicts with infrastructure along streets (e.g., signs, traffic signals, streetlights).

Objective 3.2. Increase the use of large-canopy trees where practical to maximize tree benefits relative to costs.

Actions

Include large-statured trees in planting plans for parks, streets, and other public lands where practical.

Objective 3.3. Locate new tree plantings in areas that will maximize energy conservation in buildings and shading of pavement.

Actions

Provide homeowners with information on how to place trees to maximize energy conservation.

Use the planning and design review processes to encourage the use of parking lot and streetscape designs that provide greater amounts of pavement shading.

2.2. Tree and forest health

Issues and trends

- Greater genetic diversity within the urban forest reduces the risk of serious pest and disease epidemics. Genetic diversity can be increased by using multiple tree species and by using trees that are of seedling origin. Trees grown from seed are more genetically diverse than trees that are propagated clonally (grafted or grown from cuttings) and are consequently genetically identical. Most named tree varieties are genetically identical clones.
- A few tree species and varieties, such as flowering pear varieties, constitute a higher-than-optimal percentage of all publicly-managed trees (Sections 3.3, 3.4), but efforts are now being made to increase genetic diversity in both new and replacement public right-of-way streetscape plantings.
- Because much of Rocklin has been developed recently over a fairly short time period, even-aged stands of trees make up large portions of Rocklin's urban forest. Within these stands, trees with similar life spans will reach the end of their useful life as a group.
- Water conservation will continue to be a regional issue, especially during periods of drought. Currently, about a third of City-maintained trees along parkways are drought-tolerant.
- Soil conditions in many parts of Rocklin pose moderate to severe limitations on tree growth and survival (Section 6.4). Trees planted in difficult sites and trees that are poorly adapted to Rocklin's soil and climate conditions will tend to be short-lived and/or may develop pest and disease problems.
- Some publicly-owned woodlands along creeks have been invaded to varying degrees by aggressive non-native species that may displace native riparian vegetation (Section 3.2).
- Native oak woodland stands are subject to "genetic pollution" from non-local oaks planted nearby. This may reduce the fitness of seedlings in the native stands and interfere with natural regeneration (Section 3.5).

Goal 4. Maintain trees in a healthy and safe condition.

Objective 4.1. Institute a program for identifying and correcting tree-related hazards on public properties.

Actions

Develop a program for locating and evaluating potentially hazardous trees on public lands and public rights-of-way.

Objective 4.2. Follow best management practices for tree planting and care for trees on public land.

Actions

Monitor tree health on public lands (parks, streets, open space areas, and public buildings) to identify developing pest and disease problems.

As needed, update the list of tree species potentially suitable for landscape uses in Rocklin to reflect new pest problems that may render a tree unsuitable for continued planting.

Plant good-quality, preferably locally-grown, disease-free nursery stock to increase long-term survival. Implement the use of updated tree nursery stock standards to ensure the use of good quality stock. Continue existing pre-and post-planting inspections conducted by City staff, and implement new inspections where necessary for trees planted on public lands.

Continue use of current ANSI or other nationally-recognized pruning standards for pruning conducted by City staff and tree care contractors.

Develop and implement standards for assessing and improving (if necessary) soil conditions prior to planting to improve long term tree health and survival.

Assess and remediate site conditions prior to replanting trees which have died. Do not replant sites that are determined to be unsuitable for tree planting.

Objective 4.3. Encourage the use of best management practices (BMP) for tree planting and maintenance for trees planted on private lands.

Actions

Continue existing pre-and post-planting inspections conducted by City staff, and implement new inspections where necessary for trees planted on private lands as a condition of project approval.

Continue current City practice of accepting calls from private property owners about unusual tree pest or disease problems and, if warranted, inspecting affected trees as a way to identify new problems.

Make BMP guidelines for tree planting and maintenance available to permit applicants and the general public to encourage better tree selection, planting and care.

Goal 5. Develop an urban forest canopy that is stable over the long term.

Objective 5.1. Avoid excessive use of individual tree species or varieties within large plantings and within the urban forest as a whole.

Actions

Establish upper limits for the percentage of the tree population that a single variety or species should comprise within planning areas or citywide. This will minimize the exposure of

the urban forest to damage by new diseases, pests, or problems that affect only a single species or variety. Use these percentages to aid in species selection for new and replacement tree plantings.

Where possible, substitute trees of different species or varieties for overused species/varieties when planting new or replacement trees.

Objective 5.2. Maximize the effective age diversity of plantings to avoid even-aged stand problems.

Actions

In new plantings where even age plantings cannot be avoided, use a mix of species with different useful life spans. For example, oaks may live for well over 100-150 years whereas flowering pears may have a maximum useful life closer to 30-50 years.

When planting replacement trees, avoid using trees that will reach the end of their useful life at the same time as existing trees in the planting.

Objective 5.3. Increase the percentage of drought-tolerant trees in Rocklin's urban forest.

Actions

Increase compliance with existing policies that emphasize the use of drought tolerant trees in new plantings.

Increase the use of locally-native oaks, especially blue oak, in new landscape plantings.

Reduce or eliminate the use of trees with high water use requirements in harsh sites such as street tree plantings and parking lots.

Increase the overall percentage of drought tolerant trees in City street tree plantings and in parks and private development by using more drought tolerant species in new and replacement plantings when feasible.

Objective 5.4. Protect the long-term viability of conserved native oak woodlands in Rocklin.

Actions

Use only trees of local genetic stock in and near native oak stands to conserve the genetic integrity of local oak populations.

Reduce cover of invasive exotic plant species in riparian woodlands.

Avoid using invasive exotic plant species in landscape situations to prevent escape of these plants into natural areas. Maintain a "do not plant" list for landscape plan review purposes.

2.3. Management of the urban forest

- Most publicly-managed trees in Rocklin are young and in relatively good condition. Tree care costs are likely to rise somewhat as trees become larger. Both the Department of Public Works and the Parks Division of the Department of Community Services and Facilities maintain City-owned trees (Sections 3.3, 3.4).
- Rocklin will reach residential buildout around 2015. Once residential development is complete, there will be fewer payments into the Oak Tree Preservation Fund.

- The majority of the trees in Rocklin's urban forest are on privately-owned lands. Most property owners want to protect their trees, but many lack knowledge of currently-accepted tree care practices.
- Currently, City goals for tree planting and oak tree conservation are addressed primarily through the actions of the Planning Department. Through the City's development review process, the Planning Department implements Rocklin's Oak Tree Preservation Ordinance and General Plan Goals and Policies that affect the urban forest.
- Once development is completed, responsibility for care and maintenance of planted trees and conserved oak woodlands shifts to other departments (Public Works and the Parks Division of the Community Services and Facilities Department), or to private individuals. Maintenance of additional public trees will require additional maintenance staff (Public Works and Parks Division) and/or more contracted tree care services.

Goal 6. Promote efficient and cost-effective management of publicly-owned urban and natural forest resources.

Objective 6.1. Develop a systematic approach to inspect and prune City-maintained trees in an efficient manner.

Actions

Develop appropriate criteria for inspecting and pruning trees of various species and size classes present in City-maintained landscapes.

Inspect and, as needed, prune young trees that will become medium to large-statured as needed (generally no more frequently than every 2 to 3 years) to establish good structure and avoid later remedial pruning.

Inspect and, as needed, prune mature trees on an appropriate schedule to maximize cost-efficiency (generally no more frequently than every 5 to 7 years).

When financially feasible, develop a tree inventory system to track tree care.

Objective 6.2. Increase coordination and communication between City departments/divisions whose activities affect the urban forest.

Actions

Foster communication and feedback between Planning, Public Works, and Parks and Facilities staff who deal with tree-related planning and maintenance issues.

Formally review the City tree list at least every two years and update as necessary.

Review the management plan, tree planting and maintenance guidelines, and public information brochure portions of this document every five years and update as necessary.

Develop management plans for maintaining specific sectors of the City's urban forest (e.g., parks, street segments, riparian corridors, open space areas). Formally review these management plans every 5 years and update as needed.

Continue and expand tree care training / education opportunities for City staff involved in tree maintenance and landscape planning.

Objective 6.3. Develop basic budget information on costs associated with maintaining and caring for the community forest.

Actions

Track costs associated with maintaining parkway and park trees to ensure assessment districts will provide adequate funding as trees mature.

As part of the City's annual budget process, prioritize necessary maintenance and preservation activities to be funded through sources other than the Oak Tree Fund. Where possible, apply for external grants to leverage City funding.

Periodically compare relative cost-efficiency of in-house versus contracted tree care for planting, young tree care, and mature tree care. Use these data to ensure that tree care tasks are allocated to contractors or City staff in a cost-efficient manner.

Goal 7. Foster community support for the local urban forestry program and encourage good tree management on privately-owned properties.

Objective 7.1. Institute an ongoing program to educate the public about tree selection, placement and care.

Actions

Provide locally-appropriate technical tree care information to residents through a variety of media to emphasize good tree selection and placement, optimal planting techniques, proper pruning of young and mature trees, and care of conserved native oaks.

Disseminate information about appropriate management of the residential/open space interface to landowners that are adjacent to public open space lands.

Encourage participation of local groups in public tree planting and tree care projects.

If local support exists, assist in the development of a tree-related non-profit / volunteer organization that can obtain grant funding for tree planting, tree care, and public education.

Provide funding, as feasible, for additional City staff time needed to carry out this objective. Alternatively, contract with a local tree non-profit to provide public outreach and volunteer coordination services.

3. Current state of Rocklin's urban and natural tree forest

3.1. Changes in overall canopy levels within the City from 1952 to 2003

Introduction

Most of the major benefits that trees provide to urban areas are directly related to the amount of tree canopy cover present. These benefits include energy conservation associated with shading, evaporative cooling, and reduction of the urban heat island effect; improving air quality by intercepting particulate and gaseous air pollutants; reducing flooding and erosion and improving water quality by moderating stormwater runoff; and providing habitat for birds and other wildlife species (see also Section 1).

Tree canopy cover levels can increase over time through the growth of existing trees and the addition of new trees. Canopy cover can also decrease as the result of tree death or removal. Although tree canopy can be reduced quickly, increasing canopy cover is typically a slow process that can take many years. Hence, long-term planning is needed if tree canopy cover is to be maintained or increased over time.

Overview

Findings

- Canopy cover in the currently-developed portion of Rocklin has increased from an average of 11.3% in 1952 to 18.5% in 2003.
- Gains in canopy cover over the past 50 years are due to both canopy growth of conserved native oaks and planting of trees in new developments.
- Conserved oak canopy accounts for a high percentage of the total tree cover in many parts of Rocklin.
- Tree canopy cover in residential areas is typically much greater than canopy cover in other types of developments.
- The overall distribution of oak woodlands within Rocklin's current boundaries has not changed substantially since at least the 1930's.

Management issues and recommendations

- Existing policies to conserve native trees in new developments should be continued.
- Existing policies to encourage or require tree planting in new developments should continue.
- Ways to increase tree cover in commercial/industrial sites should be explored.

Current status

Regulations related to canopy development and retention

The City of Rocklin has a number of ordinances and regulations that pertain to tree planting or tree care within the City, including the following:

- Street Tree Ordinance, originally adopted in 1979, and modified slightly in 1993

- Oak Tree Ordinance and Guidelines, updated in 1997
- Design Review Objective and Criteria adopted in 2000
- The current City of Rocklin General Plan, primarily the Circulation and Open Space, Conservation and Recreation Elements
- Southeast Rocklin Circulation Element, which applies to the portion of the City located southeast of I-80.
- Northwest Rocklin General Development Plan and Northwest Rocklin Design Guidelines, adopted in 2002, which apply to Northwest Rocklin.

The last two documents listed, which cover specific portions of the city, are typical of recent general development plans and design guidelines adopted for other areas of the City. These two documents are currently proposed to be incorporated into the City General Plan scheduled to be adopted in 2006. Many of the regulatory instruments listed above contain language that promotes retention or development of tree canopy in developed areas.

Tree planting requirements

The Street Tree Ordinance calls for a program to plant and maintain trees on publicly owned property in the City of Rocklin. Circulation Policy 7 of the Rocklin General Plan requires landscaping and a tree planting along major new streets and highways, and along existing streets as appropriate. In addition, general development plans and design guidelines adopted for specific areas of the City also call for planting along arterial roads. The Northwest Rocklin Design Guidelines require landscape medians in major arterial streets and address the planting of trees in landscape corridors along streets.

The Northwest Rocklin General Development Plan indicates that at least one shade tree should be planted per single family lot in new developments. (Exhibit B. Section D, Air quality, item 3). This same plan also makes reference to tree planting in new parks, emphasizing the use of native species. The General Plan Land Use Element (Land Use Policies 22 and 31) specifies the use of appropriate buffers, which may include trees in landscaping, greenbelts, or open space areas, between commercial and industrial land uses and incompatible adjacent land uses.

Requirements for planting in parking lots appear in several regulatory documents. The Design Review Resolution (section 6) sets several requirements for landscaping in parking lots. The Northwest Rocklin General Development Plan and Northwest Rocklin Design Guidelines include several standards related to the use of trees and other landscaping in parking lots (Northwest Rocklin GDP, Section N Landscaping, item 1, Northwest Rocklin Design Guidelines, Section 6 Landscaping, Item G).

Protection of existing trees

The City of Rocklin's Oak Tree Ordinance is designed to conserve existing stands of native oaks and natural topographic features during new residential development. When new residential development will result in the loss of native oaks, the ordinance requires that tree loss be mitigated. On-site planting of nursery stock of native oak species is the preferred mitigation alternative. Mitigation requirements can also be met through off-site planting and, in some situations, dedication of land for an oak tree preserve. A monetary payment into the Oak Tree Preservation Fund is also a mitigation option.

Although new business or commercial developments are not required to mitigate for removing oak trees, the ordinance encourages staff to work with developers to minimize

impacts to existing trees. Incentives (delays in fee payments) are provided if new commercial developments can be designed to conserve native oaks. The Design Review Resolution (section 6) also requires that existing trees be incorporated into parking lot design where possible.

The Oak Tree Ordinance includes provisions to help protect oaks conserved during the development process after construction is completed. The ordinance forbids removal of a healthy oak from a commercial development when the oak tree was protected during development. However, homeowners may remove protected healthy oaks that were conserved during development. Homeowners are required to mitigate for these tree removals either with new tree planting or a payment into the Oak Tree Preservation Fund.

The Open Space, Conservation and Recreation Element of the Rocklin General Plan contains several policies that encourage the protection of existing oak woodlands and other native trees. The General Plan specifies that conservation easements, buffers, setbacks, or other measures are to be used to protect natural resource areas, scenic areas, hilltops, open space areas and parks from encroachment or destruction by incompatible development. Buffers (50 feet minimum from top of bank) required around both perennial and intermittent streams provide protection for existing riparian woodland habitat along these watercourses. Adequate setbacks are also required from other open space and natural resource areas to provide protection for existing trees and woodland habitat. This element (Policy 4) also encourages the protection of native oaks and other significant vegetation.

The Southeast Rocklin Circulation Element also contains policies that provide for the protection of oaks and riparian trees along roadways in southeast Rocklin. These include aligning and designing roads to minimize impacts to oaks and riparian habitat and measures to protect retained trees in road construction areas. Oak trees with a diameter of six inches or more that are removed as a result of road construction are also replaced in kind at a ratio 2:1 (replaced:removed) or greater. Replacement plantings are conducted in areas adjacent to the roadway.

Assessment of canopy cover

General methods

Current and historical aerial photography of Rocklin was used to track changes in tree canopy cover that have occurred over the past 51 years. Phytosphere Research measured canopy cover on 23 matched sample plots on recent (2003) and historical (1952) aerial photographs. Samples were located in areas that were mostly or entirely developed by 1998 and for which 1952 aerial photo coverage was also available (Figure 3.1-1). The total sample area was 5.26 square miles. This represents about 40% of the developed area of the City and about 27% of the total City area. Further details of the survey methods used are presented in the Appendix (Section 7.1.1).

To look at canopy cover changes prior to 1952, Phytosphere examined some older aerial photographs (1938), as well as historical photos taken in the Rocklin area in the late 1800's from the Online Archive of California (http://findaid.oac.cdlib.org).

Native tree cover in the Rocklin area

In Rocklin, as in much of California, the state of the native vegetation that existed prior to settlement is clouded by the lack of records from early explorers and settlers. However,

based on our knowledge of oak woodland ecology, existing vegetation, historical information, and some early photographs of the area, it is possible to draw some conclusions about past conditions and possible future potential of Rocklin's native oak woodlands.

Photographs of the Rocklin area from the late 1800's show oak woodlands and blue oak-foothill pine woodlands that were already being extensively cut and cleared for both fuel and agriculture (Figures 3.1-1 to 3.1-3). In response to a poll conducted by the California State Board of Forestry in 1886, the respondent from Placer County indicated that half to two-thirds of the foothill woodlands had been cut, with some oak and "nut pine" (foothill pine, *Pinus sabiniana*) left standing (e.g., Figure 3.1-1 background).

After clearing, some native oak stands regenerated, primarily from pre-existing understory seedlings and sprouts from cut stumps (Swiecki and Bernhardt 1998). This regrowth and residual trees that were left after clearing gave rise to the native woodlands that exist in Rocklin today. In other areas, regeneration was either actively or unintentionally inhibited. As a result, some areas that originally supported oak woodland or savanna were left devoid of trees, or with only a few outlying stragglers. It is likely that most if not all of the land within the current City limits once supported native oak stands. More open savanna-like stands dominated by blue oak and foothill pine would likely have been present on the poorer soils, especially on the west side of the City, while denser woodlands including interior live oak, valley oak, and other species would have occurred along the creeks and drainages.

The earliest aerial photos of the area, taken in 1937 and 1938, show a distribution of oak woodland cover in the western part of the City that is virtually identical to that seen in 1952 aerial photos. Only the areas in the southwestern part of the City, which were more actively farmed in that time period, show some changes in tree cover associated with agricultural clearing between 1937 and 1952.

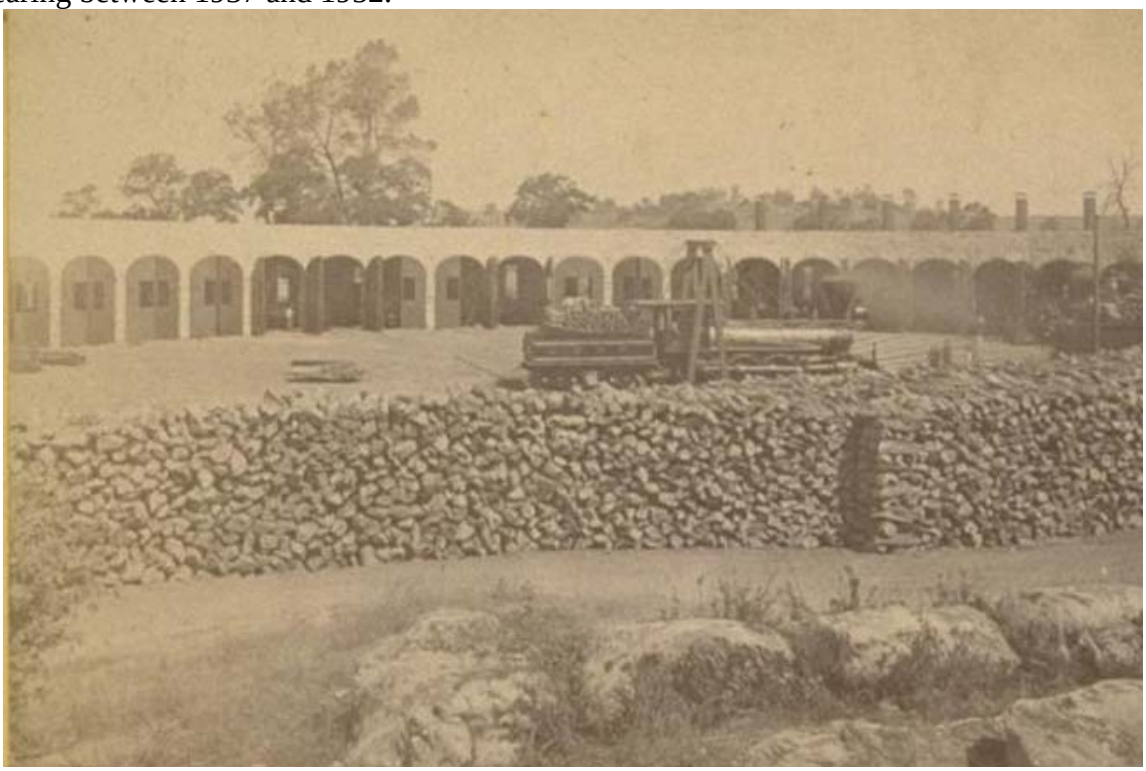

Figure 3.1-1. This photo of the engine house in Rocklin, taken in the late 1860's, shows foothill pine and oaks in the background and a large stack of oak cordwood used to fuel

locomotives. Oaks, especially blue oaks, were the most common source of fuel in the area throughout the 19th century. (Photo credit: "Engine House and Turntable. Rocklin, 22 miles from Sacramento." Photographer's number: 241, Central Pacific Railroad, California. Scenes in the Valley of the Sacramento. Alfred A. Hart Stereograph Collection Relating to the Central Pacific Railroad, ca. 1866-1869, The Bancroft Library. University of California, Berkeley., accessed from the Online Archive of California, http://ark.cdlib.org/ark:/13030/tf4v19p0zf/)

Figure 3.1-2. Views of J.P. Whitney's Ranch in what is now north Rocklin show evidence of past clearing for agriculture (top) and other purposes. Young trees that regenerated after clearing are visible in both photos. (Photo credits: top – "Spring Valley Ranch.

Vineyard and Buildings." Unit ID: 9; bottom – "Spring Valley Ranch. Park in Clover Valley." Unit ID: 13. From: Spring Valley Ranch of J.P. Whitney by Runnels & Stateler, San Francisco, The Bancroft Library. University of California, Berkeley., accessed from the Online Archive of California, http://findaid.oac.cdlib.org/images/ark:/13030/tf4489p11c)

Figure 3.1-3. Upper photo taken in 1889 with J. P. Whitney's mansion "The Oaks" at center shows evidence of extensive woodland clearing and some regeneration (e.g., young trees on slope to right of house). Similar view photographed in February 2004 shows similar canopy cover on the outlying hills, including some of the trees visible in 1889. Park Drive is the street across the lower portion of the photo. (Top photo credit. "The Oaks. Residence of J. Parker Whitney, Rocklin, Placer Co., Cal." Unit ID: 1; Spring Valley Ranch of J.P. Whitney by Runnels & Stateler, San Francisco, The Bancroft Library. University of California, Berkeley., accessed from the Online Archive of California, http://findaid.oac.cdlib.org/images/ark:/13030/tf4489p11c)

Canopy cover change 1952-2003

Figure 3.1-4 shows the distribution of plots sampled for assessment of canopy cover in 1952 and 2003 aerial photos. The samples are distributed throughout the developed portion of the City. Sample plots include areas that have been developed for many years, as well as some areas that have been built within the past 5 years. A few parcels with ongoing construction and some as-yet undeveloped parcels were also present within the sampled area.

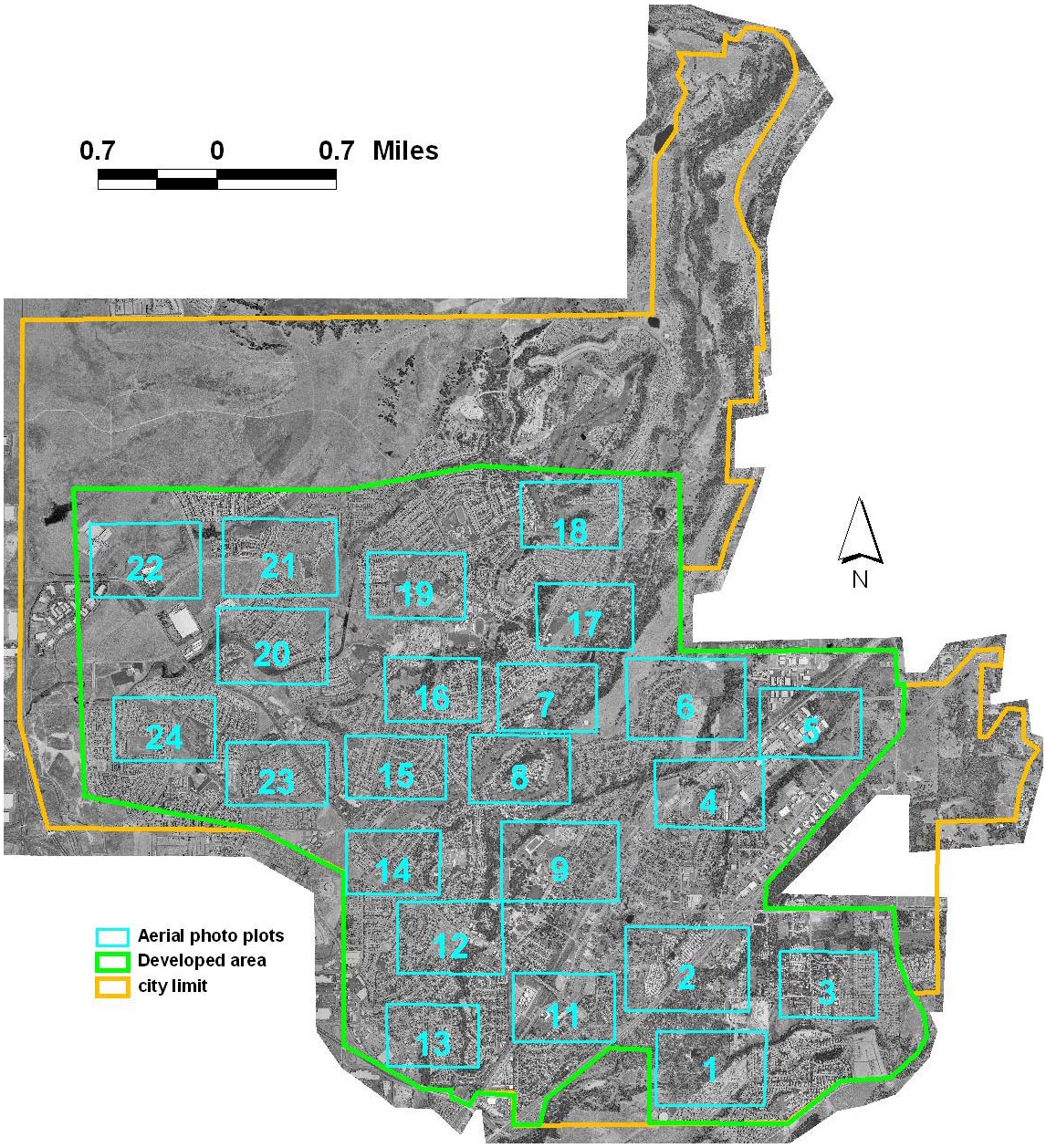

Figure 3.1-4. Locations and numbers of plots (numbered boxes) sampled in the survey of canopy cover. Samples were limited to the developed portion of the City shown by the green line. Plot size and shape varies because areas were matched to 1952 aerial photos that were not ortho-corrected. Plot number 10 (not shown) was not used because it overlapped with adjoining plots. Date of photograph: August 2003.

Figure 3.1-5 shows the percent of each sample plot that was developed in 1952 and in 2003. Sixteen of the 23 plots were rated as undeveloped in 1952, indicating that they lacked structures or evidence of intensive agriculture. Other than some residential and commercial/industrial development near the core area of Rocklin, the major developed land uses in 1952 were agricultural. Both orchards and field crops were present, mainly in areas

east of current I-80 (Figure 3.1-11). Overall, only 12% of the sample area showed any sort of development in 1952.

In contrast, most of the sample plots were nearly or completely developed in 2003. About 77% of the total sample area was developed in 2003. Residential land uses predominate in most of the plots. Exceptions include plots 8 and 9, which are dominated by park land and a golf course, and plots 4, 5, and 22, which are dominated by commercial/ industrial uses. In 2003, the total sample plot area was 52% residential housing (single and multifamily), 9% commercial / industrial, and 16% other developed uses (including parks, schools, golf courses, but not undeveloped open space).

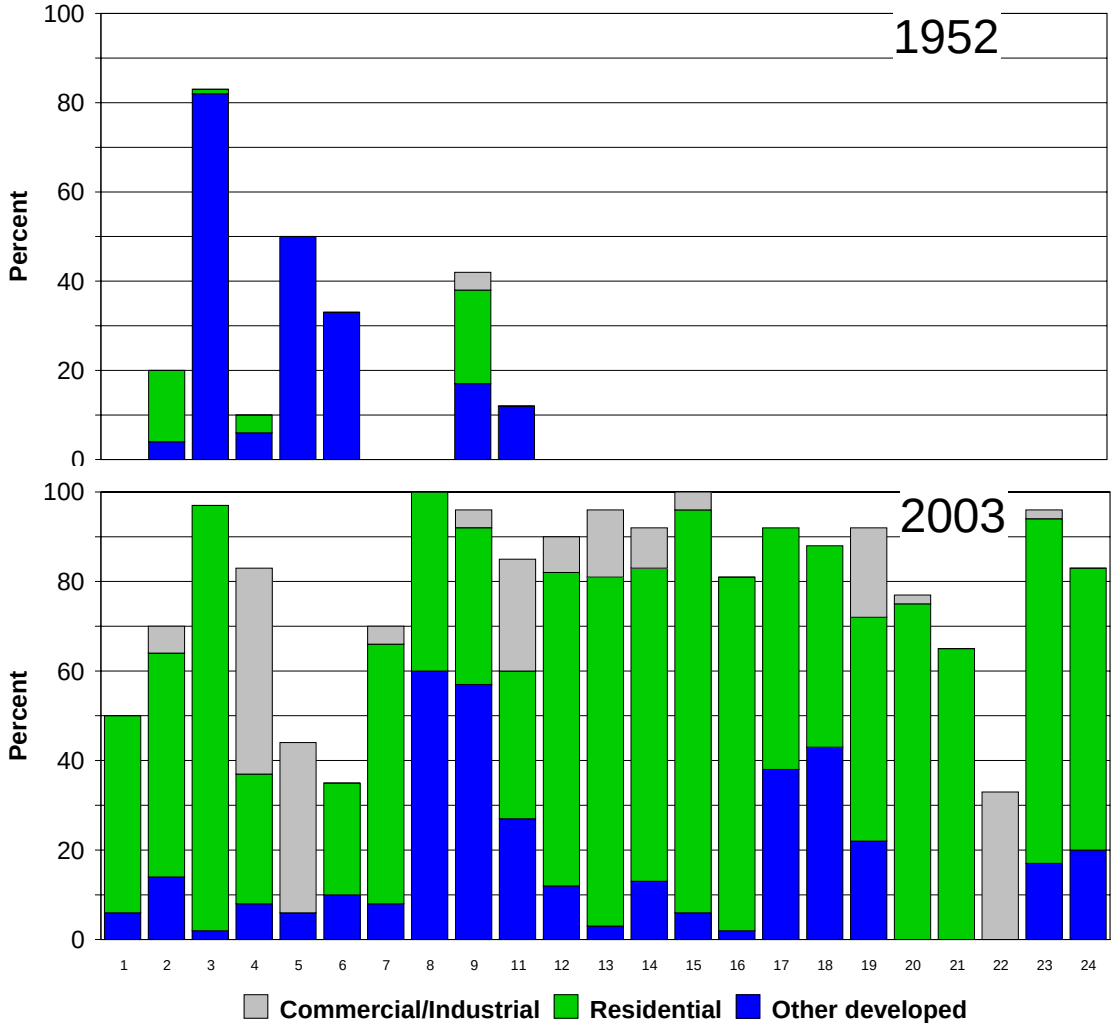

Figure 3.1-5. Developed land uses of sample plots in 1952 and 2003. Other developed land uses include orchards and agricultural fields (mainly 1952), parks, golf courses, school sites, and highways and railroads and their associated rights-of-way.

Overall tree canopy cover in the surveyed plots is shown in Figures 3.1-6 and 3.1-7. Canopy cover was greater overall in 2003 (18.5%) than in 1952 (11.3%). Furthermore, 19 of 23 plots showed increases in canopy cover over the 51 year interval, and four plots showed slight decreases in canopy cover over this period (Figures 3.1-6 and 3.1-7). Canopy cover

increases were due to both increased numbers of trees and increased canopy spread of existing trees, mainly native oaks. Canopy cover levels in 2003 ranged from about 1% to 35% within the 24 sampled plots.

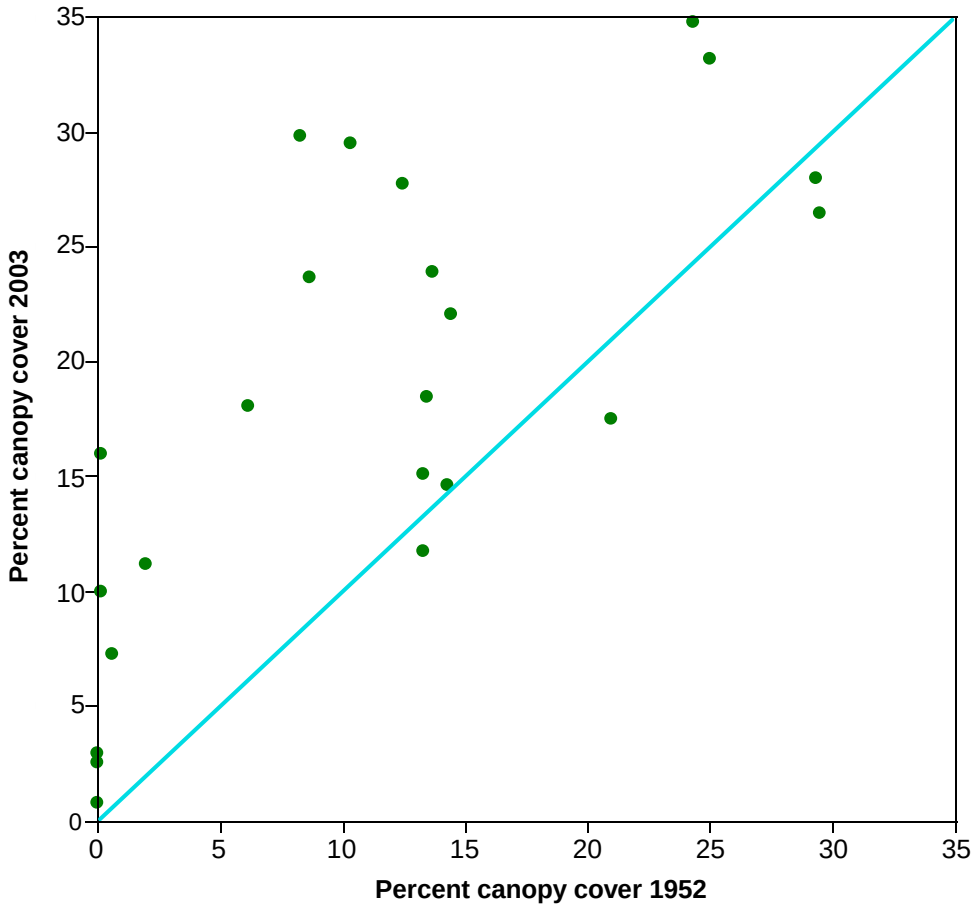

Figure 3.1-6. Percent tree canopy cover for the 23 sample plots in 1952 and 2003, as determined from aerial photographs. Tree canopy cover levels in the two years are correlated; about 53% of the variation in 2003 canopy cover is related to canopy cover in 1952. The diagonal line represents equal levels of canopy in 1952 and 2003. Points above the line represent plots in which canopy cover increased over the time interval. Points below the line are plots that lost canopy over the interval.

Trees in conserved oak and riparian woodlands contribute substantially to the overall levels of canopy cover in Rocklin (e.g., Figures 3.1-8, 3.1-9). Plots that had high levels of tree canopy cover in 1952, mainly due to the presence of oak woodlands, also had high levels in 2003 (Figures 3.1-6, 3.1-7). For example, the five plots with more than 15% canopy cover in 1952 (average canopy cover 26%) had an average canopy cover of 28% in 2003. This is well above the overall average canopy cover (18.5%) for all plots. In comparison, the seven plots that had 2% or less canopy cover in 1952 averaged only 7% canopy cover in 2003.

In general, areas with high levels of tree canopy in1952 experienced some tree loss during subsequent development. It can take a number of years before trees planted after development grow large enough to offset such canopy loss (e.g., Figure 3.1-11). Therefore, most of these areas showed only modest gains or slight losses in canopy cover between 1952 and 2003. In contrast, plots with lower levels of canopy cover in 1952 (less than 15% cover) showed the largest relative gains in canopy cover over the past 50 years. Many of these plots are in parts of the City that have been built out for a longer period of time, so canopy from planted trees has had more time to develop (e.g., Figure 3.1-10).

Among the various land uses within the surveyed plots, park and open space areas with conserved native woodlands and other undeveloped wooded parcels generally had the highest levels of canopy cover in the 2003 sample. Developed areas normally support lower levels of tree cover because pavement and structures occupy a relatively high percentage of the total land area. Within developed areas, older residential neighborhoods generally had the highest levels of canopy cover. Canopy cover was minimal in newly-constructed residential areas that had no pre-existing tree cover, such as those in the northwestern portion of the surveyed areas. Canopy cover was also generally low in industrial and commercial areas, including older commercial centers. Most commercial parking lots (e.g., Figure 3.1-8) have only minimal levels of canopy cover due to sparse plantings and slow tree growth (see also Section 3.6).

McPherson and Simpson (2003) have reported on tree canopy cover levels for 21 California cities. However, it is difficult to make meaningful comparisons between cities with respect to total canopy cover. Most of the observed differences in canopy cover within and between cities can be attributed to factors such as land use, development density, native woodland/forest cover, and the number of years elapsed since development. These factors should be taken into account when comparing canopy in different cities. Furthermore, the data of McPherson and Simpson (2003) are based on surveys that extended to the City limits and therefore included extensive tracts of undeveloped land for some cities. Phytosphere's analysis was restricted to the area bounded by the green line in Figure 3.1-4, which excludes extensive tracts of undeveloped land. Although these canopy cover data are not directly comparable to those reported by McPherson and Simpson (2003), it appears that Rocklin's overall canopy cover is near the middle of the range seen in comparable California cities.

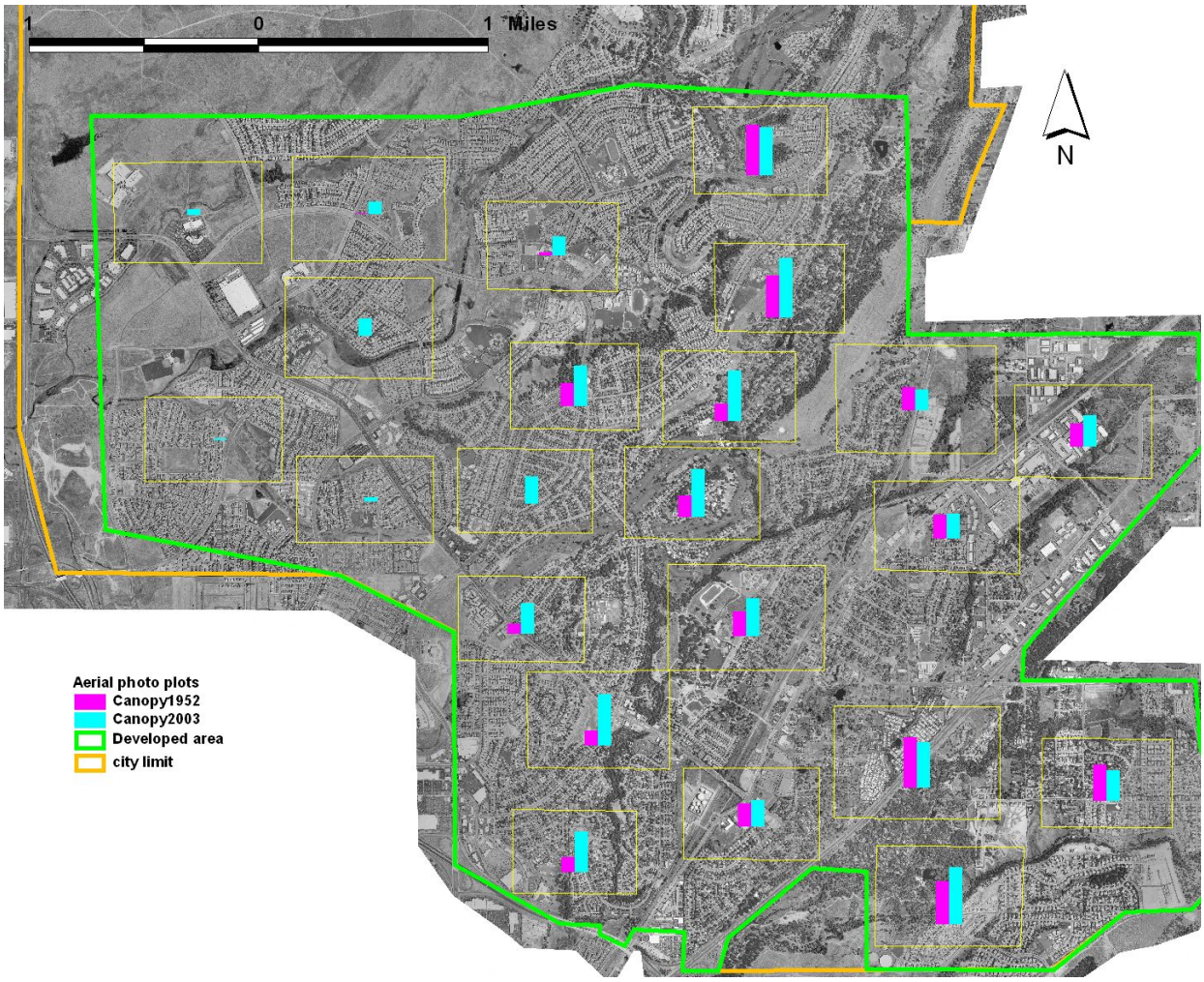

Figure 3.1-7. Relative levels of canopy cover in 1952 and 2003 within surveyed sample plots. The tallest bar shown (blue bar in plot 17, see figure 3.1-4 for plot numbers) represents 35% canopy cover.

Figure 3.1-8. Plot 11 area in 1952 (top) and 2003 (bottom). Overall canopy cover increased slightly from 1952 to 2003. Recent (2003) photo shows low canopy cover in industrial (upper left corner) and commercial (upper middle) areas. Residential neighborhoods (lower right) with conserved oaks have higher levels of canopy cover.

Figure 3.1-9. Plot 16 area in 1952 (top) and 2003 (bottom). Overall canopy cover increased from 1952 to 2003. Most oaks present in 1952 were conserved in open space areas and additional canopy cover has developed in residential neighborhoods.

Figure 3.1-10. Plot 15 area in 1952 (top) and 2003 (bottom). Overall canopy cover increased from 1952 to 2003. The few oaks in the upper left corner are shown for reference, but are beyond the actual sampled plot, so canopy cover in 1952 was zero. Tree canopy present in the plot in 2003 was due to growth of new trees planted in the developed area. (Lines and numbers on the 1952 image are markings on the original photo).

Figure 3.1-11. Plot 3 area in 1952 (top) and 2003 (bottom). Tree cover in relatively recent housing developments has not yet compensated for removal of oak woodland and orchard trees. Hence, overall canopy cover declined from 1952 to 2003.

Management issues and recommendations

The Sacramento Regional Urban Forest Framework (GreenPrint), an initiative of the Sacramento Tree Foundation and the Sacramento Area Council of Governments (SACOG), establishes a goal of approximately doubling regional tree canopy cover over the next 40 years to 35% canopy cover. As shown in Figure 3.1-6, one of the sampled areas (plot 17) currently has 35% tree canopy cover, and several other plots had canopy cover near or above 30%. Given that these areas could support even greater canopy cover and that canopy cover in most other areas is likely to increase substantially if most existing trees survive to maturity, a goal of 35% overall canopy cover in 40 years is an attainable goal for Rocklin. However, planning and conscious efforts by the City will be needed in order to achieve this overall goal. Required actions will include the following:

- establish canopy cover goals for major land use categories and develop specific strategies to help attain these goals;
- maximize the success of tree establishment in newly constructed areas;
- increase levels of shading in parking lots;
- encourage residential tree planting;
- promote proper care of mature trees on public and private lands;
- increase tree canopy cover on city open space lands by promoting natural regeneration of oaks and planting native trees where natural regeneration is insufficient.

Current canopy cover in Rocklin is a result of both historical clearing, most of which dates to the late 1800's, and the City's recent policies and ordinances related to tree conservation and planting. Without the efforts that the City has made to protect existing trees, tree canopy cover would undoubtedly be much lower than it is. Phytosphere recommends that the City continue its efforts to conserve as much tree canopy as possible and provide adequate buffering from woodlands when developing in areas that contain existing tree resources. Because existing native tree cover is such a major contributor to total canopy cover in the City, protection and proper management of these trees is important for achieving the City's overall tree canopy cover goals.

In general, long-term protection of oak woodland resources is best achieved with conserved woodlands on open space lands that are adequately buffered from adjacent land uses. In addition, the City's existing policies encouraging protection of these areas needs to be coupled with monitoring and appropriate management of these woodlands. In open space lands, persistence of existing trees and natural or assisted regeneration are needed to maintain canopy cover. Tree survival and regeneration can be affected by management, and periodic monitoring is needed to assess the influence of management practices. The current status of oak woodlands on City-owned open space is addressed in detail in Section 3.2 of this report.

Many conserved trees within built areas have shortened potential life spans due to construction-related damage and suboptimal management of trees after construction. Improving the protection and subsequent management of conserved oaks within developed areas will help extend the useful life of these important tree resources. However, as these trees eventually decline and are removed, replacement planting of the same or similarly large species will be needed to avoid likely future losses in canopy cover.

In addition, efforts to encourage tree planting in new developments, especially in areas lacking native tree cover should be continued and bolstered. Commercial developments in particular tended to have very low tree cover, so additional strategies to allow for tree planting

in these areas could be considered. This situation is not unique to Rocklin. McPherson and Simpson (2003) found that only 6% of the trees in 21 California cities were found on commercial/industrial land uses. In contrast, 77% of the trees in these cities occurred in residential land uses. Furthermore, average tree cover in commercial/industrial areas averaged 7% compared with 24% tree cover in residential areas among cities in previously forested areas (Western Center for Urban Forest Research and Education 1997). Although the percentage of land area covered by pavement and structures in commercial sites tends to be high, increased use of trees with moderate to wide canopy spread (a minimum of 30 to 35 feet) could increase the canopy cover in such locations.

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Swiecki, T. J; Bernhardt, E. A. 1998. Understanding blue oak regeneration. Fremontia 26:19-26.

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3.2. City-owned oak woodlands

Introduction

The City of Rocklin owns lands with substantial stands of native woodlands in at least 11 locations throughout the City. Many of these woodland areas are adjacent to traditional multi-use City parks and are used recreationally to varying degrees. These woodland areas provide City residents a nearby connection to the natural environment and Rocklin's natural history. In addition, these areas provide wildlife habitat, protect slopes and watercourses from erosion, moderate stormwater runoff, provide shade and evaporative cooling, and contribute to Rocklin's aesthetics and community identity. The woodlands are also important as a source of locally-adapted native tree genetic stock.

Overview

Findings

- Oak woodlands in Rocklin include both riparian oak woodlands along streams and upland woodlands.
- Most oak woodland open space areas are in fair to good condition.
- Threats to long-term survival of riparian oak woodlands include invasion by non-native species.
- Threats to long-term survival of upland woodlands include lack of regeneration.
- Non-local oaks have been used in horticultural plantings adjacent to native oak woodlands, and have the potential to adversely impact locally native oak populations.

Management issues and recommendations

- To encourage natural regeneration and promote root health, adequate levels of organic matter should be maintained on the soil surface beneath oak canopy, especially in more heavily-used areas such as Johnson-Springview Park.
- In some sites, oak regeneration can also be favored by protecting existing native seedlings and saplings from mowing, herbicide application, or other potentially damaging maintenance practices.
- To minimize future impacts and costs of managing invasive species, small localized infestations of invasive species should be eliminated before they spread further.
- To protect the genetic integrity of local oak populations, only locally-collected native oak species should be used in landscape plantings that adjoin native stands.
- Woodland areas should be monitored at least every 3-5 years to assess status and identify management needs.
- Landowners adjacent to City-owned oak woodlands need to be informed about appropriate management of urban/woodland interface areas.
- Urban/woodland interface areas should be monitored and, if necessary, inappropriate encroachment by adjacent landowners should be abated.

Current status

Existing Regulations and Plans

The City of Rocklin currently has some City regulations and plans that specifically address management of oak woodlands on publicly-owned parcels. In addition to oak woodlands, the City has non-forested open space areas that have been designated as wetland preserves and/or protected vernal pools by the US Army Corps of Engineers.

The City of Rocklin has developed plans for fighting fires on open space lands, which include access points and fire access roads. City guidelines on fire protection in and around open space lands specify that 4 to 6 inches of vegetative cover be maintained on slopes and hillsides to minimize fire hazards while providing some erosion protection during the wet season. The City also recommends that residents adjacent to open space maintain their properties in a way that minimizes the possibility that a wildland fire would affect their homes. Recommended fire safety practices include using fire-resistant plants in landscaping, maintaining adequate clearances between structures and open space areas, trimming low or overhanging tree branches that might serve as fuel ladders, and maintaining yards free of debris or materials that would be easily ignited.

Current management practices

Most City-owned open space areas are managed by Public Works. These areas are not actively managed at present, but Public Works responds to any problems that arise. Dead or failed trees are removed as needed to maintain safety.

Open space areas that are adjacent to City parks and used as extensions of the parks are managed by the Parks Division of the Department of Community Services and Facilities. Some of these areas are mowed at certain times of the year. Oak woodlands adjacent to developed parks may also receive summer irrigation runoff.

The Parks Division and Public Works have cooperated on coordinating oak restoration projects with citizen volunteers. As part of the City's volunteer program, approximately 100 native trees have been planted and maintained in an area set aside for that purpose in one of the parks. This program has been very successful, and plans are underway to add another park to this program. Additional native oak and riparian tree plantings using locally-propagated stock were completed in fall of 2004 by Public Works. Public Works has also initiated an "Oak Tree Propagation Project" by collecting acorns from local native oaks, and planting the acorns in tall (TP-4) seedling containers to produce oak seedlings for outplanting in projects involving community voluneteers. Planning is also underway to develop and implement an oak tree restoration program to revitalize the oak trees at Johnson-Springview Community Park.

City-owned oak woodlands in Rocklin receive varying amounts of recreational use, depending on their accessibility and proximity to developed parks and housing. Johnson-Springview Park probably has the most heavily-used woodlands. Within this park, most of the upland blue oak woodland receives regular use by a wide variety of users. Portions of the riparian woodlands are also used heavily. However, the presence of dense understory vegetation, which often includes Himalayan blackberry and poison oak, tends to restrict recreational use of many riparian woodlands to trails and clearings.

In some areas, homeowners whose parcels abut City lands have undertaken management activities on City lands. For example, Phytosphere observed plantings of non-native, landscaping plants installed and maintained by adjacent landowners in some City-owned areas.

Adjacent property owners have also cleared fuel breaks on some City-owned areas by mowing and raking organic debris off the soil surface. Although management of fuel and vegetation in these wildland-urban interface areas may be needed, uncoordinated and sometimes inappropriate management activities by private homeowners have the potential to increase soil erosion and adversely impact public oak woodland resources.

Field assessment of oak woodlands

Based on discussions with City staff, Phytosphere identified 11 areas with natural oak woodlands for sampling. All selected areas were either owned by the City of Rocklin, or in the case of the Greenbrae Road site, were to be transferred to the City as a condition of project approval (Table 3.2-1, Figure 3.2-1). The sites included both open space areas with upland woodlands and creekside corridors with riparian woodlands. At the China Garden Rd. site, Phytosphere surveyed only the south portion of the parcel, beyond the area being considered for development.

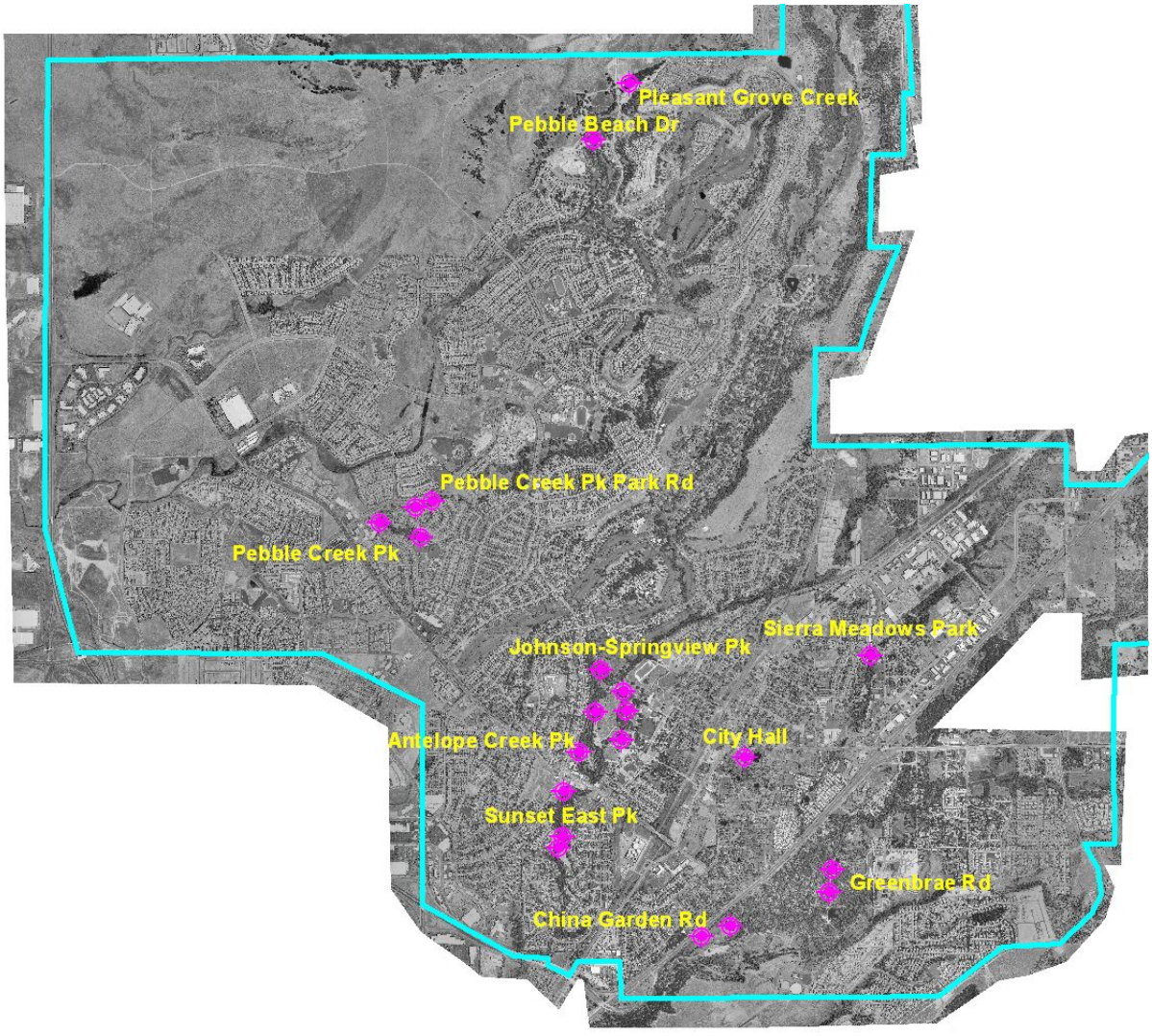

Figure 3.2-1. Locations of oak woodland survey plots (markers) and location names. Date of photograph: August 2003.

To describe current conditions in these stands, Phytosphere established permanent survey plots at each site and collected baseline data on the trees in the plots, including species present, tree size class, and tree condition. Phytosphere also assessed the status of oak regeneration. Methods used are described in detail in Section 7.1.2. The permanent survey plots can be reassessed in the future to determine how these stands are changing over time in response to management actions.

Woodland characteristics

Woodlands in Rocklin can be placed in two broad categories. Riparian woodlands (Figure 3.2-2) are found along perennial and some seasonal creeks. Upland woodlands (Figures 3.2-3, 3.2-4) are found both on slopes and on relatively level areas away from creeks. Within each category, several different woodland types or associations (e.g., blue oak woodland) can be identified based on the most dominant tree species present. Although the species present in riparian and upland woodlands overlap (Table 3.2-1), these woodlands differ in several ways and are considered separately in this report. Most smaller City-owned parcels include only one woodland type, but some of the larger parcels include two or more woodland types. To be effective, management objectives and methods need to be geared toward the type of woodland and the species present.

Species composition of riparian areas vs. upland woodlands

Riparian woodlands are characterized by the presence of species that are adapted to relatively high levels of soil moisture and periodic flooding. Willows, cottonwood, alder, Oregon ash, and buttonbush are normally very closely associated with creeks or ponds. Due to their relative lack of drought tolerance, these species do not typically extend into the drier uplands. Valley oak, interior live oak, California buckeye, and elderberry are also commonly found along riparian areas but also occur in some uplands (Table 3.2-1).

Valley oak is the most common oak and often the dominant tree in Rocklin's riparian woodlands. Valley oak is found away from creeks only if its roots can tap into shallow water tables or deep soils that store high amounts of water. Interior live oak is more drought tolerant than valley oak, and is common in both riparian and upland woodlands. It occurred in all survey locations (Table 3.2-1). Blue oak is only occasionally found close to riparian areas, partly because it is intolerant of wet soils and partly because it is quickly overtopped and shaded out by faster-growing riparian species in moist sites.

Figure 3.2-2. Riparian valley oak woodland in Sierra Meadows Park.

Figure 3.2-3. Upland blue oak woodland along Pebble Creek Drive. Buttonbush (light green plants) growing along a creek are visible in the lower center of the photo.

Table 3.2-1. Tree species present in surveyed locations.

		Native species									Non-native species				
Location	Woodland type	Blue oak *Quercus douglasii*	Valley oak *Q. lobata*	Interior live oak *Q. wislizeni*	Calif. Buckeye *Aesculus californicus*	Foothill pine *Pinus sabiniana*	Willows *Salix* spp.	Cotton-wood *Populus fremontii*	White alder *Alnus rhombifolia*	Elder-berry *Sambucus mexicana*	Other species	Fig *Ficus carica*	Chinese tallow *Sapium sebiferum*	Privet *Ligustrum* sp.	Other species
Antelope Creek Pk	Riparian		✓	✓			✓	✓						✓	
China Garden Rd (south end)	Upland	✓	✓	✓			✓								
	Riparian		✓	✓			✓	✓	✓	✓		✓			Silk tree- *Albizzia julibrissen*
City Hall	Upland	✓	✓	✓		✓	✓	✓							
Greenbrae Rd*	Upland	✓		✓	✓	✓									
	Riparian		✓	✓	✓		✓	✓	✓						
Pebble Beach Dr (near creek and detention basin)	Upland	✓	✓	✓											
	Riparian		✓	✓			✓								
Pebble Creek Pk	Riparian		✓	✓	✓		✓	✓		✓	Oracle oak- *Q.× morehus*	✓	✓	✓	mulberry- *Morus alba*, sweetgum- *Liquidambar styraciflua*
Park Dr. near Pebble Creek Pk	Upland	✓	✓	✓						✓					
Pleasant Grove Creek	Riparian	✓	✓	✓						✓					
Sierra Meadows Park	Riparian		✓	✓			✓	✓							Plum cherry - *Prunus cerasifera*
Johnson-Springview Park	Riparian	✓	✓	✓			✓	✓				✓			
	Upland	✓		✓											
Sunset East	Upland	✓	✓	✓											
	Riparian		✓	✓			✓	✓			Oregon ash- *Fraxinus latifolia*		✓		Silk tree

* future park site not City-owned at the time of survey.

Various non-native tree species, including fig, mulberry, silk tree, privet, Chinese tallow tree, and plum cherry are found in some of the riparian woodlands (Table 3.2-1). The California Invasive Plant Council (Cal-IPC, http://www.cal-ipc.org/) maintains an inventory of exotic plants that are invasive in natural areas. Appendix 7.6 at the end of this report contains a list of trees from the inventory that may be invasive in the Rocklin area. Invasive plant species, such as Chinese tallow tree and fig can proliferate in riparian areas, displacing native vegetation and disrupting native ecosystems. Although only 3% of the trees in the riparian woodland survey plots were non-natives, exotic species such as these have the potential to spread in riparian zones and may displace more desirable native species over time.

Non-native vegetation dominates the understory in many of Rocklin's riparian woodlands. One of the most common understory plants is Himalayan blackberry (*Rubus discolor=R. armeniacus*), a thorny bramble that produces edible blackberries. This is a highly invasive exotic that displaces native understory species and may interfere with regeneration of native tree species.

Rocklin's upland woodlands are dominated by oaks, most commonly blue oak. Blue oak is Rocklin's most drought-tolerant native oak and occurs in nearly pure stands in the driest sites. Mixtures of blue oak, interior live oak, and valley oak are found in most other upland woodlands (Table 3.2-1, Figure 3.2-4). Foothill pine and California buckeye were present in only a few of the upland woodlands included in the survey. Even willows are sometimes found in upland woodlands if relatively shallow groundwater is present. Upland woodlands are not commonly invaded by non-native trees, mainly because few exotic trees can withstand the levels of drought stress present in these areas. However, non-native annual plant species, including yellow star thistle and a variety of exotic grasses, are common in the understory of upland woodlands. This dense annual vegetation can interfere with oak regeneration by competing with oak seedlings for scarce soil water and by favoring high populations of rodents such as voles, which damage or kill oak seedlings.

Density and canopy cover

Tree density (trees per acre) and canopy cover (the percent of the land area covered by tree canopy) are important descriptors of woodlands that help describe both condition and changes in the woodland that occur over time. Habitat values and various benefits provided by woodlands generally increase with increasing canopy cover. Tree canopy cover also tends to increase with increasing tree density up to a point. However, complete canopy cover can be attained with varying levels of tree density. Overly high tree densities, typically the result of past management actions, may lead to excessive levels of competition between trees and can adversely affect tree health.

Rocklin's riparian woodlands are generally much denser than its upland woodlands, a pattern that is typical throughout most of the Sierra Nevada foothills. Survey plots in riparian woodlands had an average density of 171 native trees per acre, including all trees at least 4 inches in diameter. In comparison, survey plots in upland woodlands averaged 34 native trees at least 4 inches in diameter per acre. Higher tree densities can typically be sustained in riparian areas because more water is available for tree growth in these areas. However, some of the densest riparian stands may be subject to natural thinning because of excessive tree density.

Figure 3.2-4. Mixed oak woodland dominated by interior live oak at Greenbrae Rd. The California buckeye at center bottom is undergoing normal summer drought-induced leaf drying. Tall dying tree at left and dead tree at right are foothill pines.

The high tree density in riparian plots is due to the presence of numerous small-diameter trees. As shown in Figure 3.2-5, riparian plots had very high densities of trees between 4 and 12 inches in diameter, and even higher densities of saplings/young trees in the 1 to 4 inch diameter size class. This high density of small diameter trees is generally the result of abundant seedling and sapling growth following earlier episodes of clearing in these areas. The growth of many of these trees has subsequently been slowed by competition due to overcrowding. In the densest stands, a high proportion of the smaller trees in the understory are in decline due to excessive competition and can be expected to die out over time.

Tree densities in most upland woodlands were generally close to sustainable levels with a few exceptions. Several plots at the Greenbrae Road site had high densities of interior live oak, and as discussed below, these high tree densities may contribute to the poor condition of many of the interior live oaks at this site.

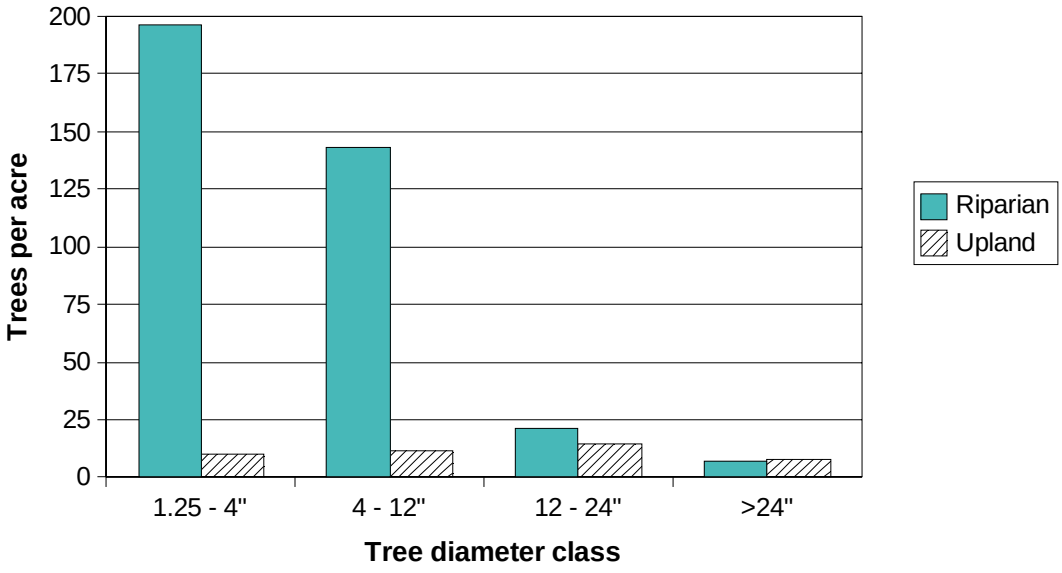

Figure 3.2-5. Average tree density in riparian and upland woodland survey plots by diameter class.

Most of the riparian woodlands consist of relatively narrow bands of trees along creeks, mostly about 110 to 160 feet wide. The riparian woodlands along Antelope Creek in Johnson-Springview Park are the broadest, ranging from about 200 to 300 feet wide. Between 80 and 100% of the land area within these riparian corridors is covered by tree canopy. The main exception to this pattern is the north end of Sunset East Park, southwest of Sunset Boulevard. Due to previous clearing, much of this section has less than 50% tree canopy cover, well below its potential. Most riparian woodlands in Rocklin would be expected to have complete (100%) or nearly complete canopy cover at maturity.

Upland woodlands in the surveyed areas are more variable and patchy than the riparian woodlands. They include patches with complete or nearly complete canopy cover and clearings of varying size with no tree cover. For the surveyed sites, tree canopy cover ranges from about 25% (China Garden Road site) to 70% (blue oak woodland portion of Johnson-Springview Park). Most of the surveyed upland woodland areas are probably capable of supporting 70% to 90% native tree canopy cover.

Tree condition

The health and condition of trees within stands are important indicators of the health and sustainability of the stand as a whole. Many of Rocklin's native trees are long-lived species that tend to decline slowly in response to stressful conditions and diseases. Evaluating tree condition provides clues to unfavorable stand conditions, such as competition due to overcrowding, as noted above. Tree condition ratings can also help identify trends that will change the stand in the future. For example, if older canopy trees are in decline, tree death and canopy cover loss are likely over the short term, increasing the importance of natural regeneration to refill gaps created in the canopy.

As discussed in section 3.1, Rocklin's current oak woodlands have been greatly altered by past human activities. Virtually all of these oak woodlands were at least partially logged at various times over the past 150 years. Most of the existing trees in these stands are

second- or third-growth trees, that is, trees that arose after the first or second round of tree cutting, respectively.

Because the locally native oak species all have potential lifespans in excess of 300 years, most of the second and third-growth oaks in these areas are still in their prime. This accounts for the generally good condition of most mature trees in relatively undisturbed stands: 87% of the native riparian trees and 90% of the native upland trees in the survey plots were in at least fair condition.

Despite the generally good condition of most woodland trees, tree health problems were evident in several situations. Small-diameter trees in the understory of dense valley oak riparian woodlands often showed high amounts of canopy dieback (dead twigs and branches). Overall, about 10% of the valley oaks in riparian woodland survey plots were in decline and 3.5% were dead. All of these declining and dead valley oaks had stems less than 12 inches in diameter and most were in the understory. This tree decline and death represents natural thinning of an excessively dense stand, and therefore does not imply that regeneration is needed to replace the lost trees.

Declining or dead interior live oaks were present at most of the upland survey locations. Overall, 4% of the interior live oaks were dead and 7% were in decline. This level of interior live oak death and decline is largely related to the historical development of these stands. In some sites, many of the interior live oaks present have developed from stump sprouts and have high levels of wood decay and are structurally weak due to the presence of multiple trunks. As decay becomes more advanced, large limbs and trunks fail (i.e., break), leading to tree decline and death. In other areas, for example, portions of the Greenbrae Road site (Figure 3.2-4), competition for limited soil moisture may be contributing to the early decline of interior live oaks. Excess competition can develop when the current density of interior live oaks is artificially elevated over historical natural levels due to past clearing practices. Interior live oak readily produces vigorous sprouts from stumps. Live oak is also both faster growing and more resistant to browsing by animals than blue oak. Consequently, some sites that were originally dominated by the more drought-tolerant blue oak now have excessively dense stands of interior live oak, leading to elevated levels of drought stress in these stands.

Despite the fact that blue oak woodland was probably the dominant forest type over most of the Rocklin area prior to settlement, the amount of relatively undisturbed blue oak woodland on City of Rocklin park lands is very limited. Most of the blue oaks in the surveyed areas were still in at least fair condition. Seven percent of the blue oaks in survey plots were rated as in decline, but none were dead.

At Johnson-Springview Park, many of the upland blue oaks show early signs of stress associated with adverse impacts to their roots. Much of the understory in this area has been reduced to bare soil due to close mowing and heavy pedestrian use. Because most tree roots are relatively shallow, compaction of the soil surface can directly damage or kill fine roots. Soil compaction also reduces water infiltration and diffusion of oxygen into the soil. These changes also negatively affect root growth and health. Because the soil in this area lacks an organic mulch layer, tree roots are also subjected to greater extremes of soil temperature and moisture stress. Natural oak woodlands typically have a well-developed mulch layer that not only moderates soil conditions but provides a source of nutrients needed for roots and their associated soil microorganisms and provides a favorable seedbed for oak seedling establishment.

Regeneration

Regeneration refers to the process by which new trees are established in forests and woodlands to maintain the stand as existing trees die or are removed. Seedlings and saplings in the understory are also commonly referred to collectively as regeneration. Regeneration patterns vary between species. In addition, a given species may exhibit different regeneration patterns on different sites. For example, regeneration may be much more widespread in moist sites compared to dry sites.

In species such as willows and cottonwoods, seedlings establish best on bare mineral soil in open sites after some sort of disturbance, such as a flood. In contrast, in locally native oak species, seedlings typically become established in the natural mulch layer beneath existing tree canopy.

Although the shaded environment under the tree canopy helps oak seedlings establish, the seedlings are subsequently suppressed by the overhead trees. Consequently, understory oak seedlings persist in reserve for many years and normally do not grow into trees until a canopy opening develops through the death of an overstory tree. At that point, the established seedlings grow rapidly to fill the gap. Many of the existing second- and third-growth stands that developed after cutting followed this pattern of regeneration.

Oaks can also become established from seed in pre-existing openings in favorable sites that have adequate amounts of mulch cover and soil moisture. This is why oak seedlings often become established in openings close to existing oak canopy and in irrigated landscape beds.

To maintain a woodland over the long term, regeneration is needed to replace mature oaks that decline and die. Only a relatively small percentage of the seedlings present in the understory will survive to become trees when a gap in the canopy is created by tree death. Hence, low numbers of seedlings (less than about 10-15 healthy seedlings and saplings per overstory tree) may indicate that regeneration is inadequate to maintain the stand if mature trees die.

To assess the regeneration potential of the surveyed oak woodland sites in Rocklin, Phytosphere counted seedlings and saplings within survey plots. Oak seedlings were present in every surveyed plot. Interior live oak and valley oak seedlings and saplings were the most common and abundant overall (Figure 3.2-6). Blue oak seedling and sapling counts were especially low (Figure 3.2-6) and generally inadequate to ensure that existing canopy trees could be replaced. Only one of eight plots had as many as 10 blue oak seedlings per overstory tree. In heavily used sites such as the blue oak woodland area of Johnson-Springview Park, seedling survival is reduced due to impacts from mowing and pedestrians. High populations of ground squirrels in parts of this park may also have negative effects on seedling survival.

Seedling and sapling densities were generally more favorable for natural regeneration in riparian than in upland woodlands. However, even within riparian woodlands, seedling densities vary from spot to spot. Drier sites along seasonal creeks, sites with very heavy Himalayan blackberry cover, and highly trampled areas tend to have few oak seedlings.

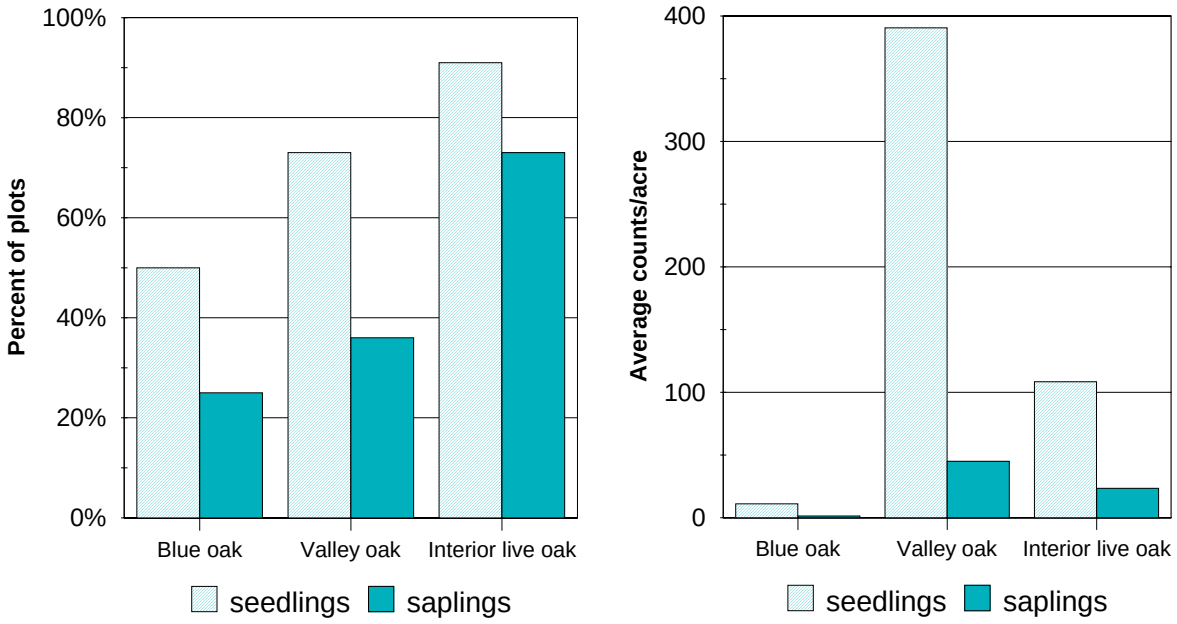

Figure 3.2-6. Regeneration within survey plots. LEFT: Percent of plots with seedlings or saplings present under tree canopy of the same species. RIGHT: Average counts of seedlings and saplings per acre in plots with tree canopy of the same species.

Management issues and recommendations

Change, either for better or worse, typically occurs slowly in oak woodlands. Although the condition of most of the surveyed oak woodland areas is still acceptable, Phytosphere identified several issues that could degrade the condition of these resources over time. Even if corrective actions are undertaken immediately, it may require many years before the impacts of these activities are obvious. Both tree growth and tree decline can proceed slowly, especially for blue oak.

Appropriate management activities vary by site and the type of woodlands present, although some recommendations apply to most locations. Most recommended changes to management will need to be ongoing in order to achieve their desired effect. Recommendations for maintaining oak woodland are summarized in Table 3.2-2 below. The list of locations for each recommendation is based on our field observations at 11 locations and so is not necessarily complete for all woodlands owned by the City. The list also includes parks Phytosphere visited for the park assessments (section 3.3) that have small areas of relatively undeveloped woodlands.

Some of the recommended practices can be implemented with little or no additional cost to the City. For instance, changing mowing height and the timing of mowing to help conserve seedlings does not increase the cost of mowing operations. Similarly, where well-placed natural oak seedlings exist, the only cost associated with tree establishment may be placing a stake next to the seedling to mark its position and prevent its destruction. Locally native oaks can be restored in many areas by directly outplanting locally-collected acorns in the fall. Community volunteers organized by staff from Public Works and the Parks Division have already accomplished projects of this type in some areas and could be involved in efforts to locate and mark existing natural seedlings as well.

Planting projects are especially important in old clearings that contain no or very few trees. Because natural oak seedlings establish most readily under or near existing oak canopy, natural recolonization of large openings by oaks may take centuries if it occurs at all. Direct planting into large openings is often the only practical way to ensure that oak woodlands become reestablished in these areas.

Native oaks directly seeded as acorns can often be established without irrigation and with little or no maintenance. Methods for direct planting of oaks are available online at http://phytosphere.com/oakplanting/oakplanting.htm and are also discussed in detail in UC ANR Publication 21601 (McCreary 2001). The City has begun an "Oak Tree Propagation Project" by collecting acorns from local native oaks and planting the acorns in tall (TP-4) seedling containers. These seedlings are used for plantings on City lands. Various local native plant nurseries can also propagate container stock of locally-collected oaks or other native plants for situations where such stock might be needed. The California Native Plant Society's website includes a listing of nurseries that can grow native materials on a contract basis (http://www.cnps.org/links/native_plant_nurseries.htm).

The success of an individual planting project depends on a number of factors that interact over time. Information on past planting projects can serve as the basis for refining and optimizing restoration techniques for local conditions. Useful information includes records on the methods and materials used in planting projects, including follow-up maintenance; seedling survival and growth over time; and factors that have damaged or killed seedlings. Records should be sufficient to determine what has worked, what hasn't, and why. Volunteers could be used to help collect data. City staff would be responsible for periodically compiling and analyzing the data.

Where efforts are being made to protect and enhance woodlands, interpretive signage that explains the project goals may be useful for educating the public and gaining public support for the project. By involving the public in various restoration activities, the City can help reduce overall costs of management activities. Projects involving monitoring, invasive plant removal, tree planting, tree protection, and other activities can be conducted by trained and supervised community volunteers to keep program costs low. These volunteer activities also help to educate the community about the importance of managing public woodlands and provide a greater sense of community ownership and pride in these natural areas.

References

McCreary, D. D. 2001. Regenerating rangeland oaks in California. University of California Agriculture and Natural Resources Publication 21601.

Table 3.2-2. Proposed management objectives and corresponding activities to enhance City-owned oak woodlands.

Objectives	Priority	Management activities	Woodland types	Locations
Maintain layer of organic mulch on soil surface to encourage oak seedling establishment and promote root health of existing trees	High	- Change mowing practices (mower height, timing) to conserve organic matter on soil surface (e.g., leave at least 4-6 inches of residue where possible, especially within and near tree driplines; attempt to time final mowing before annual plants are completely dry to avoid excessive loss of residue) - In critical areas (e.g., heavily used sites, rootzones of trees showing evidence of decline) apply 3-4 inches of clean wood chips as mulch within rootzone.	Upland (primarily)	Johnson-Springview Monument Park Woodside Park
Promote natural regeneration and restocking of native tree cover, especially in low-canopy areas and areas where existing trees are in decline.	High	- Selectively protect appropriately located existing native seedlings / saplings from destruction caused by mowing, herbicide application, etc.	Riparian Upland	All
Reduce cover of non-native species to promote health and regeneration of native trees and shrubs.	High	- Eliminate small localized infestations (a few individuals to about 0.25-0.5 acre) of invasive species before they spread further. - Minimize the amount of disturbance during eradication efforts.	Riparian Upland	All
	Medium	- Suppress and/or remove large infestations (0.5 acre or more) of invasive exotic trees (e.g., privet) and shrubs (e.g., Himalayan blackberry).	Riparian (primarily)	Johnson-Springview Antelope Creek Park China Garden Road Greenbrae Road Pebble Creek Park Sierra Meadows Park Sunset East
Avoid contamination and possible degradation of local tree gene pools.	High	Use only locally-collected native oak species in restoration/planting projects and in park landscape plantings that adjoin native stands.	Riparian Upland	All
Reduce chance of injury or property damage from tree failures.	High	Identify trees with high hazard potential and mitigate by minimizing target exposure (e.g., by closing off likely failure zone) or failure potential (e.g., corrective pruning, tree removal)	Upland (primarily)	Johnson-Springview Park Woodside Park
Assess woodland resources to allow for adaptive management.	Medium	Monitor woodland areas at least every 3-5 years to assess status and identify management needs.	Riparian Upland	All
Restore native tree canopy cover in previously cleared areas and areas previously occupied by exotics.	Medium	Plant native oaks and other native trees and understory species using locally-collected seed or cuttings.	Riparian Upland	China Garden Rd Sunset East (north end)

Table 3.2-2. continued

Objectives	Priority	Management activities	Woodland types	Locations
Prevent conflicts and negative impacts on woodland resources at the interface between residential and open space areas	Medium	- Educate adjacent landowners about appropriate management of interface areas. - Monitor interface areas and enforce abatement of inappropriate encroachment.	Upland (primarily)	Park Dr.

3.3. Trees in parks

Introduction

The City of Rocklin maintains 24 improved parks with 148 acres of developed parkland (as of September 2003) that includes both planted trees and conserved native trees. Developed areas of parks are cared for by the Parks Division of the Community Services and Facilities Department. These parks are a key contributor to the quality of life in Rocklin. The trees in these parks increase the desirability and usability of the parks by providing critical shading and visual interest. They also provide habitat for wildlife species and enhance opportunities for wildlife viewing within the City. Trees in parks also provide a variety of other benefits, such as controlling soil erosion, intercepting particulate and gaseous air pollution, and reducing urban noise, which are noted in Section 1. Trees are a long-term asset of City parks that need to be managed in a way that maintains their utility and safety for as long as possible. Heavy human use of park lands and maintenance of turf and other park assets can also impact tree health.

Overview

Findings

- Tree density in most parks ranged from about 15 to 30 trees per acre.
- The majority of the park trees were in the intermediate age class, although some individual parks had a preponderance of trees in the youngest or oldest age classes.
- Although the selection of tree species in the parks was moderately diverse, flowering pear varieties were planted more commonly than is considered optimal for a given species.
- Almost all parks had some declining trees, but 91% of all surveyed trees were in fair to good condition.
- Many mature oaks that were retained in developed park areas are in decline due to altered conditions (due to grading, soil compaction, and irrigation) in the trees' rootzones, which have adversely impacted root health.
- Pruning to improve tree structure and safety is the most common maintenance need identified in park trees.
- Personnel from the Parks Division of the Department of Community Services and Facilities have the ability to prune trees from the ground, whereas other tree care work requires the use of private contractors who have specialized equipment for tree removal, high tree work, and pest control.
- The City has very few regulations or guidelines that are related to tree planting in parks.

Management issues and recommendations

- Rocklin parks contain many young trees which need to be inspected and pruned to develop good structure. Timely pruning of young trees reduces later maintenance needs.

- Many older trees are developing problems associated with poor structure or decline that will require more expensive pruning of large branches to mitigate hazardous conditions.
- Most of the problems seen in park trees are related to the design and execution of the landscape installation at the time the park was constructed.
- To guide tree selection, placement, and soil preparation as replacement plantings become necessary, long-term management plans should be developed for each park.
- Site assessments should be conducted before replanting empty planting spaces so that corrective actions can be taken if necessary to improve the planting site and/or species selection.
- Species composition of new plantings should be reviewed to ensure that common species are not overused to the exclusion of other suitable species.
- If native oaks are planted in parks adjacent to natural oak stands, seed sources of planted material should be from the Rocklin area.

Current status

Existing Regulations and Plans

The City of Rocklin has few City regulations or guidelines related to tree planting in public parks. Like many other cities, Rocklin City Code includes sections dealing specifically with City street trees, but does not include regulations unique to City park trees.

The General Plan states that the City will continue its long term revitalization program to beautify and upgrade all City parks (policy # 12), but trees are not specifically mentioned in this planning document.

The Northwest Rocklin General Development Plan does include a specific mention of park landscaping. Section G.8 of this plan states that "plant materials used within the parks adjacent to open space shall be carefully chosen to make the parks appear as extensions of the native corridor. Designs shall be by a licensed landscape architect and approved by the City. Native trees, shrubs and groundcover materials shall be emphasized."

Current management practices

Trees in developed portions of Rocklin parks are maintained by the City of Rocklin Parks Division of the Community Services and Facilities Department. Trees in open space parcels are the responsibility of the Rocklin Public Works Department, except that natural areas within developed parks are maintained by the Parks Division.

City of Rocklin Parks Division staff provided information about their park tree maintenance practices in the spring of 2004. This information on current management practices is summarized below. A chronological description of past and current tree care practices prepared by City of Rocklin Parks Division staff is included in Appendix 7.2.

The current status of park tree resources largely reflects past construction and maintenance practices, dating back 10 to 20 or more years. Especially for large mature trees such as conserved oaks, impacts of these practices will influence tree management options for the remaining life of the trees. Current management and maintenance practices will similarly affect the future status of park trees by influencing tree growth and health.

City of Rocklin Parks Division staff conducts most of the tree care in City parks as part its regular parks maintenance program. Parks Division staff estimated that they prune 500 to

600 trees per year. The lower limbs of all City park trees are inspected and pruned once a year and on an as needed basis during the year. Work on large park trees, mostly native oaks, is done on an as-needed basis by contractors. Last year, 11 park trees were removed. The number of removals varies from year to year, depending on weather, disease, vandalism, and other factors.

About 90% of the tree work in parks is done as part of the regular inspection cycle. Parks Division staff conduct tree care activities in City parks on an as needed basis as time permits as part of the daily workload. At every visit, Parks Division staff visually inspect parks for items in need of repair and safety-related issues. All parks are visited at least once a week and a thorough inspection of each park is conducted once a month. The monthly inspection includes an in-depth inspection of all areas of the park and documentation of the results. Parks Division staff also inspects all parks following major storms.

About 10% of the park tree maintenance is done in response to complaints and problems that fall outside of the regular inspection cycle. Residents occasionally call the City to report problems with City park trees. Parks Division staff follow up on such calls by inspecting the tree(s) in question and taking the appropriate action. Most of these calls relate to tree damage caused by vandalism.

Due to the way that tree care is scheduled in parks, total tree care expenditures and staff time are not broken out of the parks budget as a separate budget item. However, contracted tree care costs can be tracked separately. In the last budget year, approximately $2,000 was spent on tree removal by private contractors. As more park trees grow beyond the size that can be maintained from the ground, contracted expenditures are likely to increase. The entire budget for parks has increased over the past 5 years, primarily because the number of parks has increased.

As of mid-2004, the Parks Division had one International Society of Arboriculture (ISA) Certified Arborist on staff. Other Parks Division staff have attended professional tree care training classes. Parks Division staff are expected to prune in accordance with the ISA / ANSI pruning standards, which are the current industry standard for tree care professionals.

The Parks Division has used private contractors for various purposes, including pruning of large trees, tree removals, emergency work, pest control, and the use of specialized equipment. Overall, Parks Division staff report that they have been satisfied with the work performed by contractors. Although contractors are not explicity given pruning standards to follow, contractors employed by the City have ISA Certified Arborists on staff and are expected to follow ISA / ANSI standards when pruning trees.

Parks Division staff monitor parks for trees that die or otherwise may need to be replaced on an ongoing basis. A list of trees needing to be replaced is compiled throughout the year and replacement tree plantings are done in the fall, which is the optimum time to plant new trees in the Rocklin area. Trees are replaced in the original locations unless the tree was in an undesirable or poor location, such as areas with poor drainage. In such cases, new trees are relocated to a more favorable planting location.

Damage to hardscape or turf due to tree roots has occasionally been observed at various parks. When this situation arises, the area is inspected for safety issues and various corrective alternatives are considered. This can include rerouting the path, mulching or adding wood chips around the tree, and relocating or removing the tree. In addition, many of the mature oaks at Johnson-Springview Park are experiencing root problems that will adversely affect the health and longevity of these trees. A restoration committee is working to address and correct

these issues. Plans have been made to apply mulch beneath the trees to improve root health. Costs for these efforts will come out of the Parks Division budget.

Field assessment of park trees

Phytosphere conducted a sample survey of Rocklin City parks in September 2003 to investigate the status of trees in these representative parks. Eight City parks were selected for the survey (Table 3.3-1, Figures 3.3-1 to 3.3-6). The parks included in the survey were distributed geographically throughout the City and ranged in age from about 15 years old to just more than a year old at the time of the survey.

Phytosphere consulted with Don Jorgenson and Shawn Darling of the Parks Division of the Department of Community Services and Facilities before undertaking the survey to find out what information would be useful to Parks Division staff. Parks Division staff were particularly interested in tree condition ratings that could be used to help forecast future management needs for park trees. Details of the survey methods are presented in Section 7.1.3.

Characteristics of surveyed areas

All of the surveyed park areas support a variety of recreational uses and include general use turf areas, playground areas, picnic tables, and various other structures. Twin Oaks Park is a large community park, whereas the remaining sites are smaller neighborhood parks.

Five of the surveyed eight parks include areas with conserved native oak trees. These oaks were included in the survey if they were incorporated into the developed portions of the park, such as at Woodside Park. Oaks in woodlands along creeks (e.g., Clover Valley, Sierra Meadows) or in undeveloped portions of the parks (e.g., Monument, Pebble Creek) were not included in these surveys, but are addressed in the section on City-owned native woodlands (Section 3.2.)

Table 3.3-1. Parks included in the survey.

Park	Approximate construction date	Area surveyed (acres)	Total trees surveyed[a]	Number of species	Park includes native oak woodland
Clover Valley Park	1987	3.42	54	12	yes
Monument Park	2001	1.536	36	5	yes
Pebble Creek Park	1987	4.385	67	10	yes
Sasaki Park	2001	1.548	78	5	no
Sierra Meadows Park	1987	3.335	49	10	yes
Twin Oaks Park	1993	4.784	87	10	no
Vista Grande Park	1996	3.945	114	10	no
Woodside Park	1987	3.391	116	7	yes

[a] Excludes native trees in riparian areas and undeveloped woodland areas.

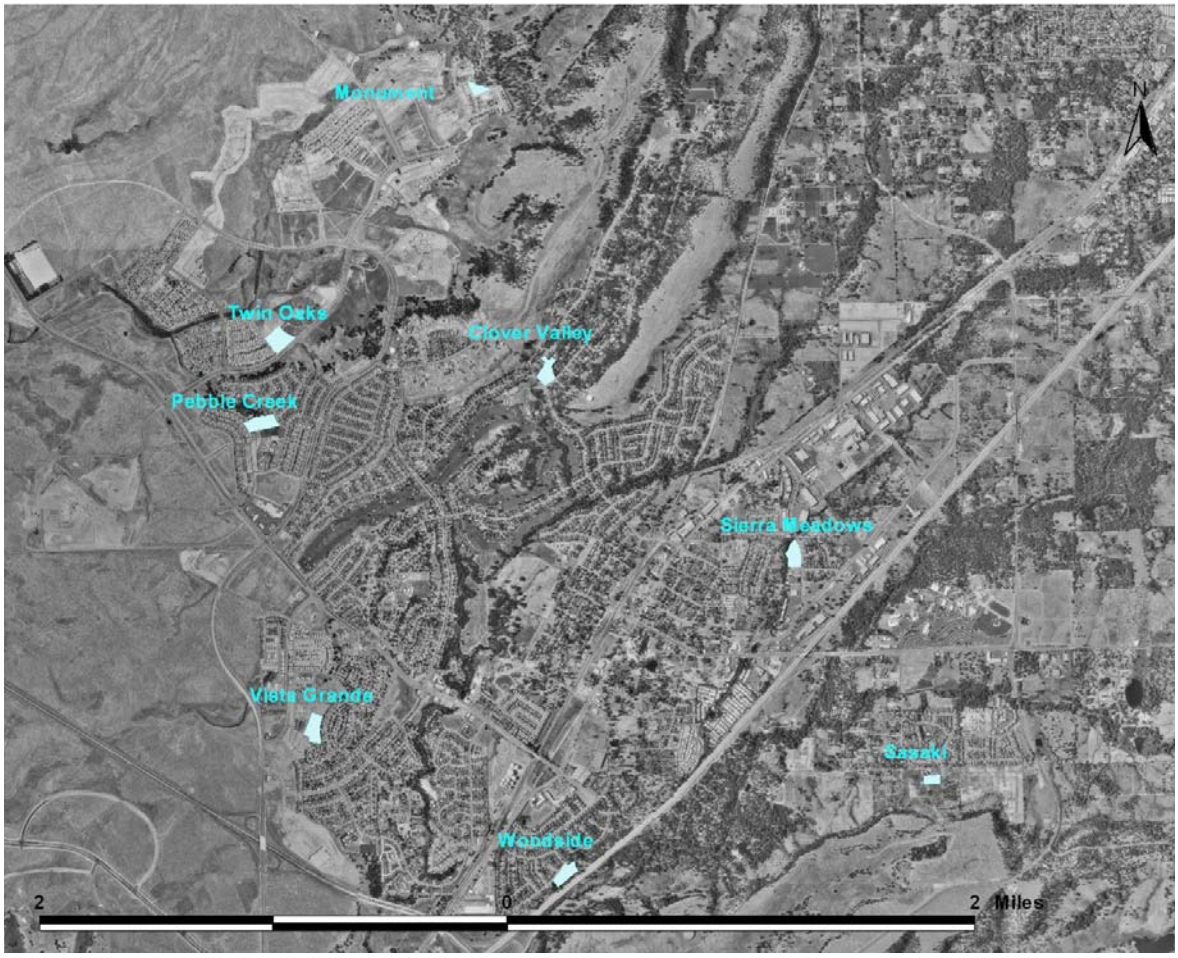

Figure 3.3-1. Locations of parks (light blue shading) included in the survey.

Figure 3.3-2. Planted trees at Monument Park, constructed in 2001, were all in the youngest age class. The woodland with mature oaks in background was not included in the survey.

Figure 3.3-3. Trees at Woodside Park, built in 1987, included many conserved mature oaks and a smaller number of planted non-native species.

Figure 3.3-4. Vista Grande Park, built in 1996, had a high density of trees in the area near the playground (top), but planting beds near the large turf area had vacant planting spaces (bottom).

Figure 3.3-5. Trees in this portion of Twin Oaks Park (built in 1993) were planted around the edges of a large turf area.

Figure 3.3-6. The developed portion of Sierra Meadows Park, built in 1987, had a few conserved oaks, including the two in this turf area, and a number of other planted trees seen in the background. The original design of this park includes irrigation and turf within the drip line of the conserved oaks, which can lead to root rot and premature death. Current design practices would exclude turf and irrigation from inside the drip line of conserved oaks.

Tree age class

Phytosphere compared current tree size to the typical size of a given tree species at maturity to estimate age classes of trees in the surveyed parks (Figure 3.3-7). About half of the trees were in the intermediate age class (25-75% of mature size), with the remainder almost evenly split between the most mature and youngest age classes. However, within most individual parks, the age distribution is much more skewed. For example, all surveyed trees in the two most recently constructed parks (Sasaki, Monument [Figure 3.3-2]) were in the youngest age class (<25% of mature size). At the opposite extreme, Woodside Park (Figure 3.3-3) had no trees in the youngest age class, and the majority of the trees, primarily conserved oaks, were in the oldest age class.

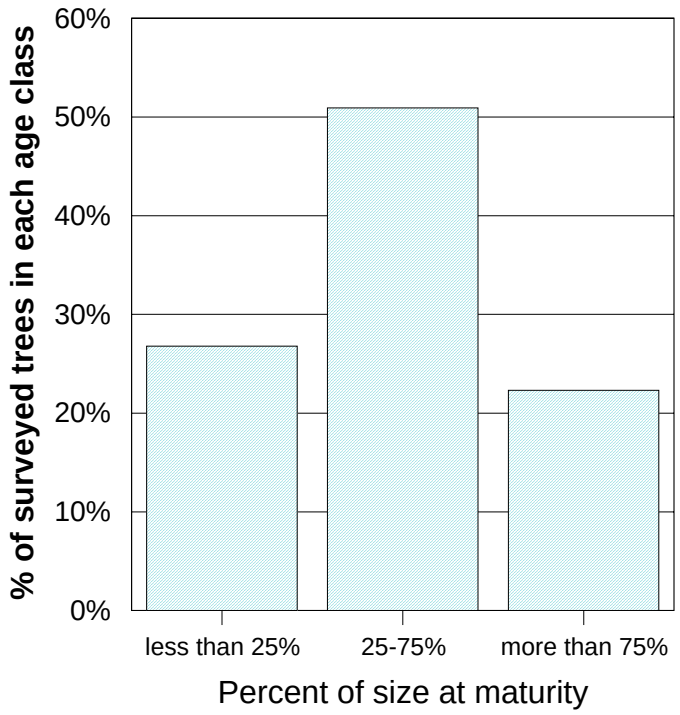

Figure 3.3-7. About half of the surveyed trees in the City parks sample were in the intermediate age class (25% to 75% of mature size).

Tree density

The overall density of trees in the sampled parks ranged from about 15 to 50 trees per acre (Figure 3.3-8). These densities do not include trees along riparian areas present in Clover Valley and Sierra Meadows Parks. The highest tree density overall was in Sasaki Park, a relatively small, recently constructed park. High density plantings in portions of this park (Figure 3.3-9) and the relatively small extent of the turf area help contribute to the atypically high tree density in this park. The tree density in most other parks was less than 30 trees per acre. In the absence of a complete tree survey, tree density can be used to provide an estimate of the total park tree population. If the overall average tree density in the sample (25 trees/acre) is representative of the density in the City's 148 acres of developed parkland, the citywide park tree population should be on the order of 3,700 trees.

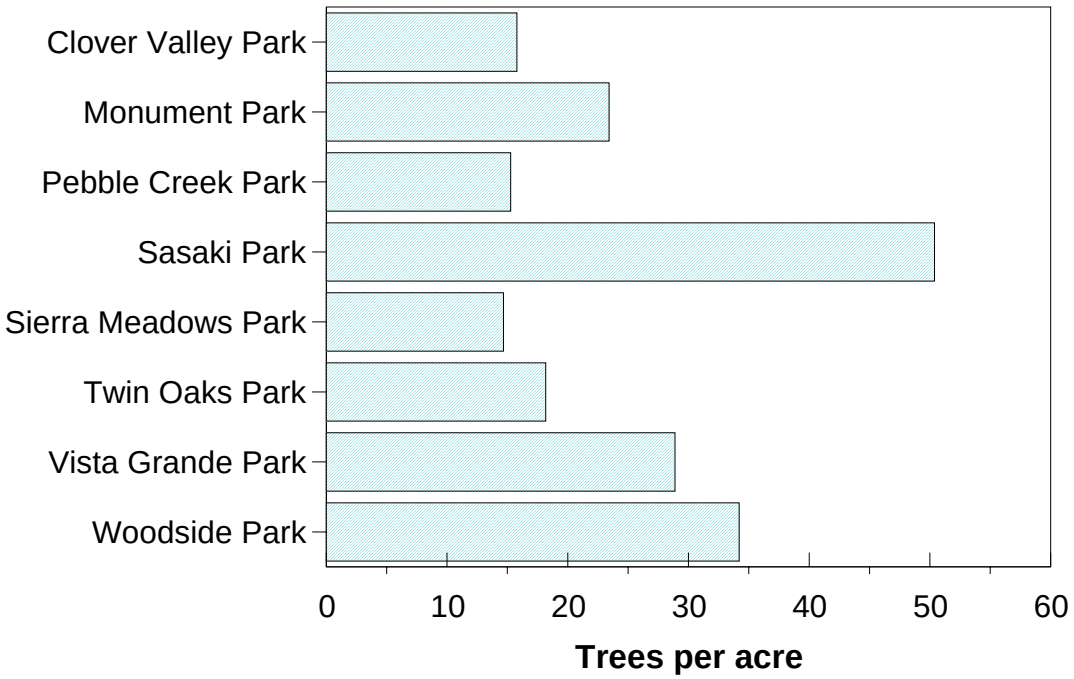

Figure 3.3-8. Tree densities (trees per acre) within the surveyed areas of the parks. Densities do not include native oaks along riparian areas.

Figure 3.3-9. The high density of trees at Sasaki Park is due to the dense planting of flowering pears and other trees to shade the playground area and the relatively small turf area of this small neighborhood park.

Species composition

The number of species present in surveyed parks ranged from five (in Sasaki and Monument Parks) to 12 in Clover Valley Park (Table 3.3-1). Overall, at least 32 species of trees were growing in the sampled parks. Most of these species are used only sparingly in the surveyed parks. Ten of the species were represented by five or fewer individuals, and 14 species were present in only one of the eight parks.

The most common species present in the surveyed parks are shown in Figure 3.3-10. Flowering pear was the most common tree in the surveyed parks, constituting almost one in every five trees. A commonly-used guideline for urban tree species diversity is that no single cultivated species should make up more than about 10% of the tree population. Hence, flowering pears represented a higher percentage of all park trees than is considered optimal, especially given that various maintenance issues are associated with this species (see "Tree condition and management concerns" below). Some of the common species on the list (e.g., Lombardy poplar) are no longer planted, but were still common at one or two parks.

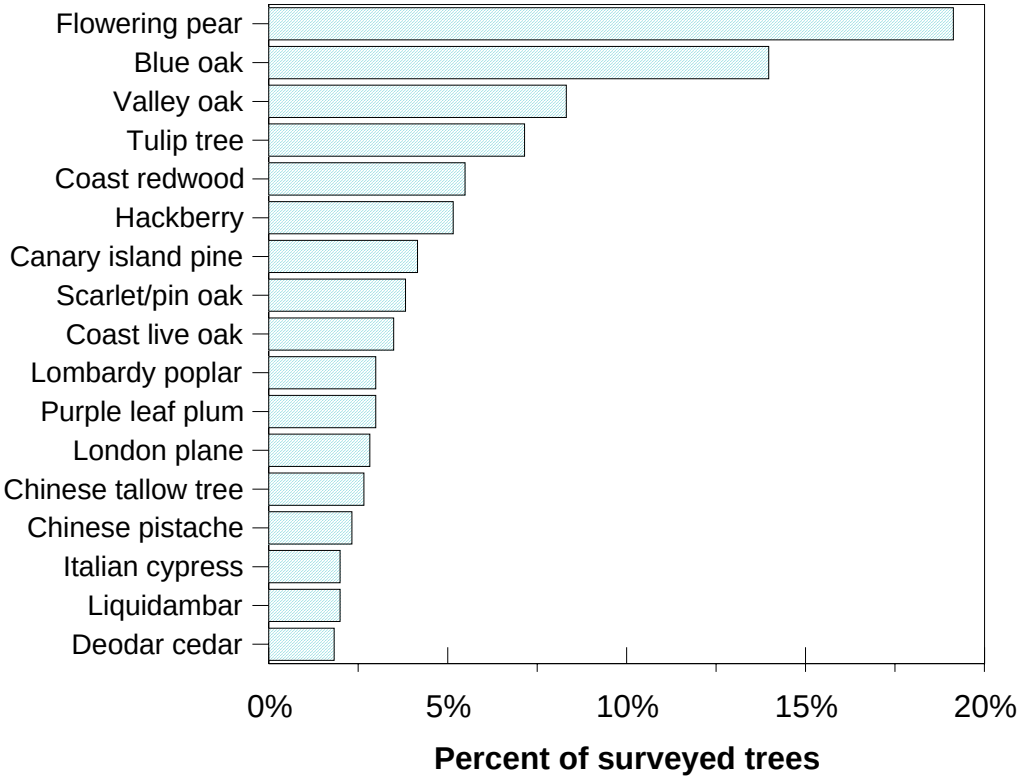

Figure 3.3-10. Most common tree species in surveyed parks. List includes all species represented by more than 10 individuals.

Two of the locally native oaks, blue oak and valley oak, were the second and third most common species, and together made up more than 20% of the trees in the sample. Most of the blue oaks in the survey (88%) were conserved mature trees in Woodside Park. For several reasons (i.e., most oaks were existing trees, native species have greater genetic diversity compared to cultivated species, and native species are well-adapted to local conditions) the

relatively high percentage of blue oaks in the overall tree species mix is not considered to be a problem.

Overall, most oaks in the surveyed parks were either mature oaks that were conserved when the parks were developed (Figures 3.3-2, 3.3-6) or small volunteer seedlings and saplings that have become established in planting beds. A few parks, including Monument Park (Figure 3.3-2) and Sasaki Park, also contain oaks that have been planted as nursery stock. Some of the nursery stock used in Monument Park was evidently of poor quality, leading to early decline and death of some of the trees. In some other parks, transplanted oaks have good form (Figure 3.3-11).

Figure 3.3-11. This native oak in Clarke Dominguez Neighborhood Park shows a favorable form for a young tree. Small branches are growing along the entire trunk. Such branches are directly responsible for providing nutrients to the trunk and increase the rate at which the trunk diameter expands. Young trees with branches along the trunk grow faster overall than trees in which the branches have been pruned off. However, as the tree grows, these temporary low branches are eventually removed. This may need to be done earlier in some situations if low branches are subject to breakage. Unfortunately, most nurseries remove lower branches along the trunk long before trees are sold.

Parks typically represent sites with sufficient space to grow trees that have large canopies at maturity. Researchers at the Forest Service Center for Urban Forest Research at UC Davis have shown that a mature large-statured tree provides an annual net benefit two to six times that of a mature small-statured tree (http://cufr.ucdavis.edu/products/cufr_419.pdf). A number of large-statured trees, including the various oak species, are common in Rocklin parks. However, the most common park tree, flowering pear, is only a medium-statured tree, and several other medium to small trees are among the most common trees listed in Figure 3.3-10.

Tree condition and management concerns

Most surveyed park trees (91%) were rated as being in fair to good condition. However, all surveyed parks except Clover Valley had some declining trees. Only four of the surveyed parks had empty planting spaces, i.e., spaces where trees had died and no apparent replacements had been planted. Overall, the number of empty planting spaces was low. Only 11 empty planting spaces (1.8% of the total tree count) were observed in the surveyed parks. Because replacement tree plantings are normally done in the fall, at least some of these sites could have been scheduled to be replanted.

The percentage of declining trees varied widely by species (Figure 3.3-12). Almost 90% of the surveyed Lombardy poplar trees were in decline. All of the Lombardy poplars were mature trees growing at Pebble Creek Park (Figure 3.3-13). The trees were declining as a result of Cytospora canker, a disease that commonly kills mature Lombardy poplars, especially those that become water-stressed. Because of their short useful life and other problems, the City no longer plants Lombardy poplars in Rocklin parks.

Although most native oaks were in fair to good condition, some conserved mature blue oaks were in decline. This was typically related to direct and indirect root damage that was inflicted at the time that the parks were constructed and subsequent irrigation within the rootzone (e.g., Figure 3.3-6). Several other species had some individuals showing decline symptoms that were associated with a variety of causes, including poor condition of young nursery stock planted in Monument and Sasaki Parks.

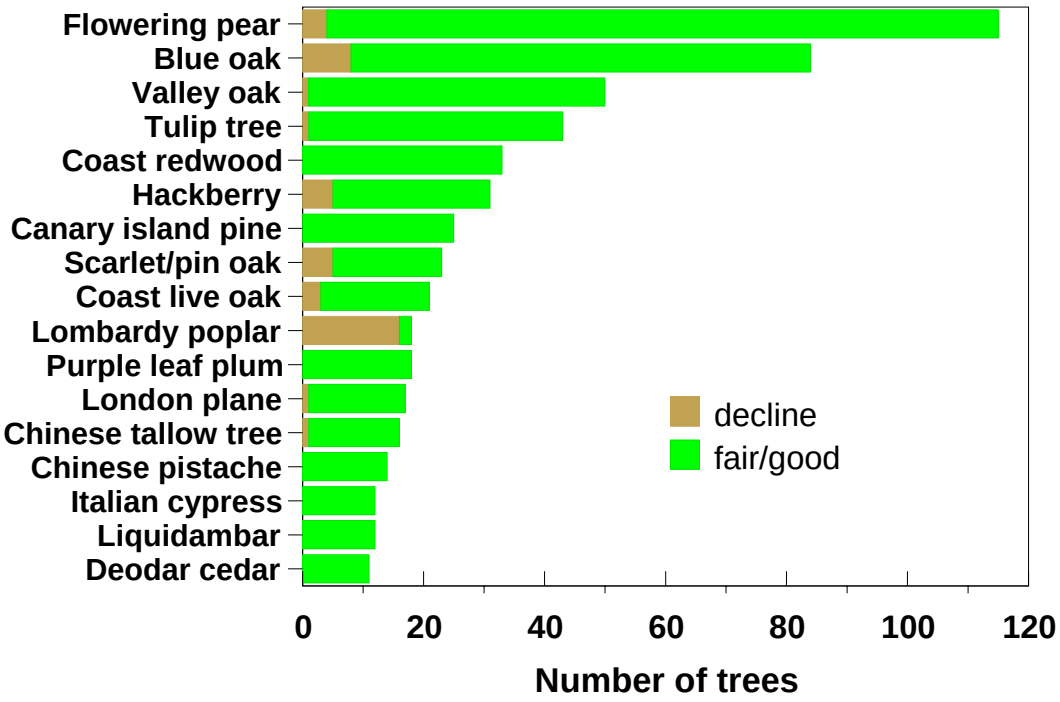

Figure 3.3-12. Condition ratings of the most common tree species present in surveyed parks. List includes all species represented by more than 10 individuals.

Figure 3.3-13. Dying Lombardy poplars at Pebble Creek Park. Although Lombardy poplars are fast growing and introduce a vertical design element into a landscape, they are no longer accepted in new landscaping in City of Rocklin parks due to their tendency to develop Cytospora canker disease and die at a relatively young age.

The management concerns identified in the field survey are described in Table 3.3-2 below. Pruning needs and related tree structural problems were the most commonly identified management concerns and occurred in a wide variety of tree species (Table 3.3-2) and parks (Figure 3.3-14). For conserved mature oak trees, such as those at Woodside Park, removal of dead wood was the most common pruning need. The need for corrective pruning was especially common in flowering pears, 71% of which had structural problems that may require some corrective pruning (Figure 3.3-15). These structural problems are almost exclusively due to the structure of the original nursery stock that was planted in the parks.

Table 3.3-2. Descriptions of management concerns identified in surveyed park trees and number of affected species.

Management concern	Description	Number of species affected
Structure / Pruning / Clearance	Tree structure is poor and/or pruning is needed to improve structure, remove dead wood, or provide adequate clearance.	16
Hazard	Tree or tree part has an elevated likelihood of failing in the future and failure could damage property or cause injury.	3
Tree placement / excessive density	Poor tree placement (e.g., under existing mature canopy) or excessive tree density	11
Diseases / pests	Typically canker rot and other decay fungi in oaks, other problems including sunburn and borer invasion in other species	6
Rootzone problems (conserved trees primarily)	Past or current fill, grading, compaction, paving, and/or irrigation of an existing tree's rootzone that has adversely affected tree health and survival	3
Excessive surface roots	Surface roots are commonly damaged by mowers and may be more subject to decay	16
Mechanical damage	Most commonly damage to lower trunk from mowers	7

Although tree structure and pruning concerns were common in parks of all construction vintages, several concerns were primarily found in the oldest surveyed parks and were associated with mature trees (Figure 3.3-14). Older parks generally have older trees, which are prone to certain problems not seen in young trees, such as the potential tree hazard issues noted in mature oaks at Sierra Meadows and Woodside Parks. In addition, some older parks have problems associated with certain design elements (e.g., inadequate rootzone protection and irrigation near conserved oaks) and plant materials that are no longer used (e.g., Lombardy poplar).

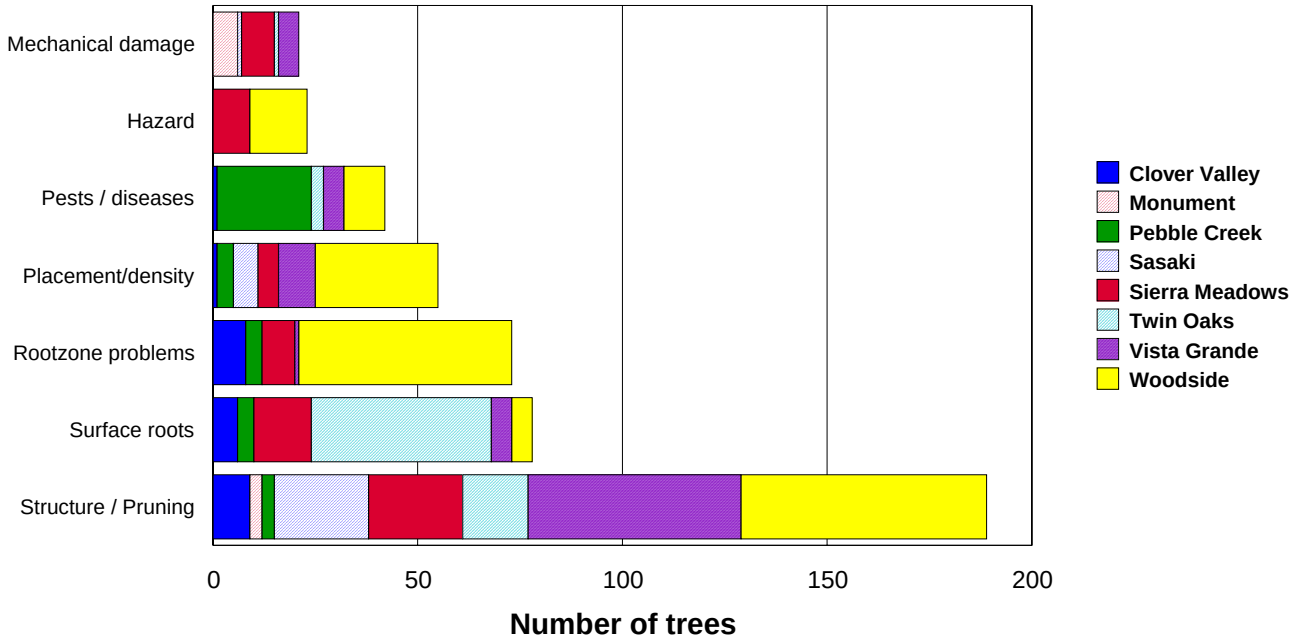

Figure 3.3-14. Frequencies of management concerns among trees at surveyed parks. In this graph, the oldest parks are shown with solid fill colors; the most recently-constructed parks are shown with the lightest striped fill.

Figure 3.3-15. Many older flowering pears (e.g., tree at Sierra Meadows Park, above) have excessive numbers of branches arising from a single point. As the tree continues to grow, these crowded branches are prone to splitting out. The problem, which is typically found in the original planted nursery stock, can best be corrected by pruning when trees are still small. The young flowering pear tree at right, (Clarke Dominguez Neighborhood Park) has a much better branch structure.

Some concerns that are more prominent at certain parks are related to local soil conditions. For instance, trees in some parks show excessive surface rooting, i.e., high numbers of shallow roots that project above the soil surface (Figure 3.3-16). Surface roots can interfere with mowing and may become tripping hazards in some situations. Roots are also subject to wounding and exposure to herbicides applied around trees, both of which can adversely affect the health of the tree. Surface roots were most common at Twin Oaks and Sierra Meadows Parks although they occurred in several other locations. Highly compacted and shallow soils contribute to excessive surface rooting.

Figure 3.3-16. Excessive surface roots on a hackberry at Sierra Meadows Park. The roots have been damaged by repeated injuries from lawn mowers. Excessive development of surface roots at certain locations may be due to excessive soil compaction at the time that the landscaping was originally installed. The tree at right, located in Vista Grande Park, has almost no surface roots.

Management issues and recommendations

Although this survey was limited to eight parks, the management issues apparent in these locations are representative of those in most Rocklin City parks. The maintenance needs of trees in the surveyed parks vary widely, in large part associated with their ages. In recently-constructed parks with uniformly young trees, the major tree maintenance issue is early structural pruning to develop good permanent branch structure. Other issues include avoiding wounding trees and replacing young trees that have died. Older parks are more likely to have trees of mature size, including both fast-growing non-native species and conserved oaks. These older and larger trees tend to have more problems related to pests and diseases and potential hazards related to poor structure and dead or declining branches.

Two distinct types of pruning are needed in various parks in Rocklin. In more recently-developed parks, many young trees need to be inspected, and pruned as needed to develop good branch structure that will reduce later maintenance needs. Such inspections typically need to occur on a two to three year cycle, and would involve about 25 to 30% of all park trees, based on our sample. Much of this pruning, especially in relatively new parks, can be done from the ground and will involve relatively small cuts. The Parks Division of the Department of Community Services and Facilities's current practice of inspecting and pruning trees on a regular basis should be sufficient to accommodate these pruning needs.

The second type of pruning involves trees in the larger size classes. In these trees, pruning is more commonly needed to reduce the potential for branch failures associated with dead or dying branches or structurally weak branches. In many cases, this type of pruning involves the removal of larger branches at greater heights in the trees. Climbing and/or aerial lift equipment may be needed in many of these cases.

Most trees in Rocklin's Parks have not yet attained their potential mature size. As the tree population ages in these parks, pruning needs will tend to shift from the first type to the second type. This second type of pruning is currently contracted out because Parks Division lacks the specialized crews and equipment needed for large tree work. The increasing need for more specialized equipment and more highly trained tree workers may be addressed either by greater use of arboricultural contractors or by the acquisition of personnel and equipment resources to perform the work in-house.

In order to anticipate maintenance costs, the City should consider developing a program to inspect and inventory park trees for maintenance needs. Such an inventory system would be one part of the Parks Division's stated long term goal of instituting a tree management program. Software for inventorying trees and scheduling maintenance is available from a variety of sources. For example, the Mobile Community Tree Inventory (MCTI) and Street Tree Electronic Management System (STEMS) systems are free software developed by the USDA Forest Service (see http://www.umass.edu/urbantree/mcti/index.htm).

Some management issues identified in the surveyed parks result from the planning and construction methods followed in the development of the parks. Although many, if not all, of these practices have been changed in recent years, Parks Division staff still must deal with the consequences of past practices in many parks for the foreseeable future. Some of the issues identified in one or more of the surveyed parks are listed below.

- Trees are planted too densely in certain areas, in some cases near or under existing conserved trees. This can lead to excessive competition between trees and reduced tree vigor.
- Excessive encroachment (grading, soil compaction, and irrigation) within the rootzones of native oaks being retained within parks has led to reduced vigor and tree decline in some parks.
- Excessive rootzone compaction has resulted in heavy surface rooting and/or water stress associated with restricted root development in some parks. This situation can be minimized by more intensive efforts to create favorable soil conditions around tree planting sites at the time of construction;
- Some species, notably flowering pear cultivars, are planted too commonly than is desirable.
- A few species present in parks, most notably Lombardy poplar, are short-lived or likely to develop water stress and/or pest/disease problems as they mature.
- Low-quality nursery stock used in some parks has performed poorly or requires substantial reshaping of the canopy through corrective pruning.

Weaknesses in the original design and installation of park landscaping can become costly to correct, especially if the removal of mature trees becomes necessary. Designs and specifications related to the tree issues noted above should be carefully reviewed during the park design and construction process to minimize future maintenance issues. Greater input from Parks Division maintenance staff in the review of park design and construction specifications may help identify design issues that have developed into maintenance problems. Even with good designs and specifications, plant materials and installation procedures need to be adequately inspected for compliance. Enforcement procedures need to be used as necessary to ensure that specifications are followed.

Proper maintenance in the establishment period is also critical for ensuring that good tree structure is established and trees are not damaged by mowing equipment. Wounding of tree trunks with mowers and/or trimmers was seen in several parks (Figure 3.3-14) but is entirely avoidable.

Although the number of dead trees and empty planting sites is currently low, loss of additional trees from disease can be anticipated at several parks, most notably Pebble Creek and Woodside Parks. Before these sites are replanted, site analyses should be conducted to investigate factors that caused the tree to die, including soil conditions, irrigation systems, tree species, condition of original planting stock, and disease or insect pest problems. Based on

these findings and a functional evaluation of the site, a determination can be made as to whether the site should be replanted, whether remedial site preparation is needed, and what species would be most beneficial for the site.

This process of determining whether to plant replacements, where to plant them, what species to use, and how to prepare the soil, can be facilitated by developing long-term management plans for individual parks that account for problems that have developed over time. Individual tree replacements should contribute toward attaining the management objectives for each park.

Current park plantings are moderately diverse, although flowering pears make up a large percentage of the park tree population. Most flowering pears in use represent only a few clonally propagated varieties, meaning that all individuals of a given variety are genetically identical. This increases the risk that most of these trees could be adversely affected by a pest or disease problem. Populations of native oaks present at various parks are derived from seed and have higher amounts of genetic diversity within a given species. Both species diversity and genetic diversity within species should be considered in developing targets for the composition of plantings in parks.

As noted elsewhere, coast live oak has been used in some parks, with mixed levels of success. Although this species is native to California, it is not native to the Rocklin area, and may generally be less tolerant of the hotter, drier interior climate of the area than is the locally native interior live oak. Interior live oak and coast live oak are related closely enough that hybrids may develop through cross pollination. Because these hybrids may be less well adapted to the local climate than the native oak populations that have developed over time in the area, they may reduce the potential for successful oak regeneration. This is an issue in parks that are close to native oak stands, as are five of the eight sampled parks. Hence, Phytosphere recommends that coast live oak not be used in park plantings, especially where it will be adjacent to native oak stands.

For the same reason, Phytosphere recommends that nursery-grown oaks of the locally-native species valley, blue, and interior live oak that are planted in parks be derived from local seed sources. For example, the range of valley oak extends to the coast and down to southern California. Local valley oaks are more likely to tolerate conditions that are found in the Rocklin area than are trees that are derived from distant populations in cooler or wetter areas. Native oaks can be established directly from locally-collected seed either by directly planting acorns or by contracting with local native plant nurseries to produce nursery stock from local seed. Public Works has begun to purchase native oaks from a supplier that produces oak container stock from locally-collected acorns. Public Works is also producing native oak container stock in-house using locally collected acorns; this material has been used for plantings completed by community volunteers on City open space lands.

3.4. City-maintained trees along streets and parkways

Introduction

The City of Rocklin Public Works Department maintains trees along arterial streets and parkways throughout the City. These include plantings in street medians and along street shoulders. Well-designed and properly maintained street tree plantings not only enhance the aesthetics of City streets and the community as a whole, but can provide a variety of other benefits. Shading and evaporative cooling provided by trees are obvious benefits, but street trees can also help intercept particulate and gaseous air pollutants; moderate stormwater runoff; increase traffic safety through "traffic calming" effects that tend to reduce vehicle speed; extend the life of asphalt paving through shading; and have positive economic impacts on businesses located along streets (see Section 1 for a more detailed discussion of tree-related benefits).

Overview

Findings

- In 2004, the City maintained an estimated 10,000 trees along approximately 28 miles of streets.
- The majority of surveyed City-maintained street trees were young trees that are in relatively good condition.
- About 7% of the tree planting spaces were empty, mostly due to the death of young trees.
- Street tree plantings included a moderately diverse assemblage of species. Diverse plantings may be less susceptible to severe pest or disease problems than plantings that rely heavily on only a few species. Existing City regulations emphasize uniformity for aesthetic reasons.
- Current City design guidelines require or strongly recommend the use of drought tolerant species. About one third of the surveyed street trees can be classified as drought tolerant. Some of the most common tree species in street plantings have relatively high water requirements and may not have good long-term prospects in street plantings.
- At least 15% of the City street trees were species that are small at maturity. Although these trees provide visual accents, they provide only low levels of shade and other benefits related to tree canopy.

Management issues and recommendations

- To optimally maintain the population of young and mature City street trees present in 2004, City crews would need to inspect and, as needed, prune about 2,700 street trees per year. Most (about 2,000) of these are young trees that need early training to minimize future maintenance expenses.
- Irrigation is critical for maintaining the condition of most of Rocklin’s street trees. Increased use of more drought-tolerant species would reduce street tree maintenance costs.

- Phased replanting of empty sites could be used to increase the percentage of drought tolerant species among City street trees and increase age diversity within the plantings.
- Soil problems have been a common cause of poor tree performance in street tree plantings. When dead trees are removed, the planting site should be assessed to determine whether adverse soil conditions need to be corrected before the site is replanted.
- Because soil conditions and planter arrangements can vary widely between different roadway segments, long-term management plans should be developed for specific street segments to guide tree replacement.
- By monitoring species composition of new plantings, the City can avoid overuse of the most common tree species.
- City regulations emphasizing uniformity in tree plantings should be amended to recognize the benefits associated with species and age diversity in plantings.
- If street shading and other benefits of tree canopy are a goal of street tree plantings, greater use of large-statured trees will be needed in future plantings.

Current status

Existing Regulations and Plans

Various City regulation and planning documents encourage tree planting along City streets. These include the Street Tree Ordinance (Rocklin Municipal Code chapter 12.08), the General Plan, development plans, and design guidelines.

The Street Tree Ordinance, first adopted in 1979 and revised slightly in 1993, calls for a program to plant and maintain trees on publicly owned property in the City of Rocklin. The ordinance states that the purpose of the tree program is to beautify the City, purify its air, and provide shade for its inhabitants. The ordinance stresses beautification as a primary goal in tree selection (Sections 12.08.010.A, 12.08.040.B.2) although shade is also noted in the latter section. The ordinance also has provisions related to City tree maintenance and protection of City trees from damage or unauthorized maintenance.

The City Manager is responsible for enforcing and implementing the street tree program, and has designated the Public Works Director to administer the requirements of the ordinance, as allowed for in the ordinance. The main instrument of the tree program specified in the ordinance is the official tree planting list. The ordinance specifies that only species on the list are to be used for all new and replacement tree plantings on City streets. The list is supposed to be updated on an ongoing basis. However, the most current version of the approved tree list that Phytosphere reviewed, which appears in the Department of Public Works Improvement Standards (section 4-26), was somewhat out of date and didn't completely reflect species currently in use.

The Improvement Standards also includes standards related to tree planting (section 12-8) which apply to City-maintained street trees. They encourage the use of drought tolerant species, provide standards related to the size of tree planting stock, specify minimum setbacks, and require tree plantings to conform with City-approved street tree master plans where applicable.

Various planning documents also specify policies and standards related to City street trees. General Plan Circulation Policy 7 requires landscaping and tree planting along major

new streets and highways, and along existing streets as appropriate. The Northwest Rocklin General Development Plan and the Northwest Rocklin Design Guidelines are typical planning documents for new development within the City. The Design Guidelines state that landscape corridors along all arterials should be designed to create a sense of unity along the streets and within the community. They require that landscaped medians be provided in major arterial streets. They also specify that a dominant species of tree is to be designated for each major roadway to "provide visual continuity and harmony". Similar language related to uniformity in tree plantings is found in the tree ordinance. The guidelines require that maintenance in the public right-of-way be funded by a local assessment district or other acceptable funding mechanism.

The Landscaping section of the Northwest Rocklin Design Guidelines also encourages the use of plants with low water requirements. It states that drought tolerant plant materials and the use of efficient irrigation systems are strongly recommended and may be required. The design guidelines also call for the use of various landscaping techniques to improve growing conditions in areas affected by soils with low soil water holding capacity and/or limited rooting depth.

The Northwest Rocklin General Development Plan also requires that developers use drought-resistant plant species in landscaping where appropriate. It requires all street landscaping, whether publicly or privately owned, to be irrigated by a permanent drip system or low water consumption system acceptable to the City. Responsibility for street landscape maintenance is either (a) assigned to adjacent commercial, business/ professional, or industrial users or a Homeowner's Association, or (b) funded by placing the landscape areas into the City Landscape and Lighting District, a Community Facilities District, or similar financing district.

The Southeast Rocklin Circulation Element, which pertains to the portion of the City southeast of I-80, is intended to minimize the impact of road construction on existing riparian corridors and oak woodlands. Policies in this element seek to minimize impacts to trees by avoiding impacts in the design phase and mitigating for necessary impacts through tree protection, replanting, and habitat restoration. Policy 37 requires that oak trees (6 inches or more in diameter) removed as a result of road construction be replaced in kind at a 2:1 (replaced:removed) ratio or greater in areas adjacent to the roadway.

Current management practices

City of Rocklin Public Works staff provided information about their street tree program in the spring of 2004. This information on existing management practices is summarized below. A brief account of past and current tree maintenance practices prepared by Public Works Staff is also included in Appendix 7.2. To a large degree, the current status of street tree resources largely reflects past maintenance practices, dating back 10 or more years. Likewise, the impact of current management practices will be evident in the future, as tree growth and health are shaped by current maintenance practices.

The City of Rocklin Public Works Department currently (2004) maintains trees along about 28 miles of arterial streets and parkways throughout the City. These include plantings in street medians and along street shoulders. Currently Public Works prunes about 300 trees a year, and removes about 12 trees. About 70% of this tree care work follows an inspection pruning cycle. The remaining 30% is performed in response to problems and complaints.

Funds to pay for street tree work are derived from assessment districts that pay for overall upkeep of landscaped areas along streets, the general fund, and gas tax revenues. Public Works does not have a separate budget category for tree work along streets. In the past fiscal year, expenditures for street tree replacement were about $25,000. About 10% of Public Works' tree care dollars are spent on work done by contractors. Public Works staff indicated that the current budget for tree planting and maintenance was not adequate to meet current needs. In general, funding for street tree work has increased in newly built areas and decreased in older parts of town. This situation does not necessarily reflect maintenance needs, since older plantings commonly require more expensive tree care work than young plantings.

Current street tree care requires about one full-time equivalent (FTE) of staff time per year. Despite the increasing number of trees managed by Public Works in recent years, staffing for the tree program has not increased over the past five years. As of March 2004, Public Works did not have any staff with International Society of Arboriculture (ISA) arborist or tree worker certification. However, the department has been upgrading staff training and working to develop a trained Urban Forest Tree Crew unit.

Public Works follows ISA / ANSI pruning standards in its tree work. However, the need to obtain adequate street clearances (14 feet) sometimes requires levels of pruning that may exceed ISA standards. Public Works also requires contractors that perform tree care for the City to follow ISA pruning standards. Private contractors have been used for tree planting, pruning small and large trees, emergency work, large tree removal, pest control, and for providing specialized equipment. Public Works reported that both arborist services and tree maintenance provided by contractors have increased over the previous five years. Public Works staff reports that they have been generally satisfied with the work performed by most private contractors.

Prior to 1994, street trees that died were not replaced. Between 1995 and 1998, some efforts were initiated to replace dead street trees, but starting in 1999 a tree replacement program was instituted for City trees in street plantings. Through this program, trees are replaced as a result of automobile accidents, and storm or wind damage. Trees lost prior to the start of the program are now being replaced. A list of needed replacement trees is compiled over the year and trees are planted in the fall, which is the optimal time for tree planting in the Rocklin area. Trees damaged in automobile accidents represent an exception to this procedure. These trees are replaced within days of their loss and replanting is done by contractors. The cost of replacing trees damaged or destroyed by auto accidents is recovered by insurance payments from the responsible parties.

Public Works has made efforts to improve tree performance in street tree plantings. These include replacement of turf with other materials to reduce damage from mowing equipment and competition between trees and turf, and changes in tree species selection to improve diversity and tree-site compatibility. Some problems associated with soil conditions are an ongoing source of problems. Tree roots cause damage to sidewalks and median curbs throughout the City. Public Works typically responds by removing the offending root and installing root barriers. Poor soil conditions and high water tables in some areas also cause waterlogging of planting sites in some areas, causing trees to decline or perform poorly. Shallow soils in some areas can also make trees prone to drought stress, especially through the summer months.

Problems such as excessive surface rooting and poor drainage are often associated with excessive soil compaction developed at the time of construction. Although it may be possible to at least partially correct various adverse soil conditions during the original construction of streets (e.g., by decompacting planting beds through tillage), options are much more limited in established beds due to the presence of existing vegetation, irrigation pipes, wiring, and other infrastructure.

Field assessment of City-maintained street trees

In order to manage City-maintained street trees effectively, the City needs information on the number and kinds of trees present. Due to a lack of inventory or sample survey data, this critical information on City-maintained street trees was lacking. In October 2003, Phytosphere surveyed a random sample of street segments with City-maintained trees and collected data on tree density (trees per street mile). This tree density data was used to estimate the total number of trees in City-maintained street plantings. Phytosphere also assessed tree age class, condition, and species, and noted empty planting spaces. Details of the survey methods used are presented in Section 7.1.4.

Characteristics of surveyed areas

The street segments included in our survey of Rocklin's City-maintained street landscaping are listed in Table 3.4-1 and illustrated in Figure 3.4-1.

Table 3.4-1. Street segments included in the survey of City-maintained street trees. Also listed are the locations of tree plantings within the segments (medians and/or shoulders), and the number of empty planting spaces observed in each segment. Counts of empty spaces do not include dead trees that were still standing in place.

Street	Segment number	Nearby cross streets	Median	Shoulders	Empty spaces
Blue Oaks Blvd.	15	Taft Dr./Sonora Pass Way/Tanager Way	yes	one side	2
Crest Dr.	3	Tahoe Vista Dr./Newland Heights Dr.	no	both	2
Pacific Ave.	7	Oak St./E. Midas Ave.	yes	both	2
Park Dr.	4	Coldwater Pl./Lake Tahoe Ct.	no	both	4
Park Dr.	11	Farrier Rd./Twin Oaks Park	yes	both	*
Rocklin Rd.	8	El Don Dr./Havenhurst Cir.	yes	no	0
S .Whitney Blvd.	13	Lincoln Way/Springview Dr.	yes	no	**
Scarborough Way	9	Helmsdale Way/Camborne Way	yes	both	7
Stanford Ranch Rd.	1	Stoney Rd./Cobblestone Dr.	yes	both	1
Sunset Blvd.	5	Atherton Rd/SR65	yes	both (extra wide)	0
Sunset Blvd.	10	S. Whitney Blvd./Springview Dr./3rd St	yes	no	1
W. Stanford Ranch Rd.	6	Sunset Blvd./Sioux St.	yes	no	2
West Oaks Blvd	2	Wendall Ct./Talon Dr.	yes	both	6
Whitney Blvd.	12	Midas Ave/Argonaut Ave./Topaz Ave.	yes	no	4
Wyckford Blvd.	14	Park Dr./Concord Rd./ Steward St.	yes	both	3

* Although 10 empty planting spaces were noted as missing in the survey, some of the empty planting spaces in this segment were from trees that were removed to improve lines of sight along the roadway, so the actual number of empty spaces is unknown. ** All but one of the trees along this section are volunteers growing among the planted oleander hedge, so the empty tree space criterion used does not apply. The section has the potential to support trees planted at a standard density for most of its length (e.g., about 20 more trees at a spacing of 30 feet).

Figure 3.4-1. Locations of street segments (white lines) included in the survey of City-maintained street trees (background: 2003 aerial photo).

Only two of the surveyed segments did not include planting beds in the medians (Figure 3.4-2). Five did not include shoulder plantings either because the areas were undeveloped (e.g., W. Stanford Ranch Rd.) or because the street shoulders were lined by residential front yards (e.g., Whitney Blvd., Figure 3.4-3) or commercial properties (e.g., Sunset near 3rd, Figure 3.4-4).

Figure 3.4-2. Narrow City-maintained shoulder plantings along Park Drive near Lake Tahoe Ct. No center median plantings are present in this area.

Figure 3.4-3. City-maintained center median planting along Whitney Blvd. Shoulder areas are not City-maintained and include residential front yards and plantings along the golf course.

Figure 3.4-4. Trees in center median on Sunset Blvd. near 3rd Street include a double row of purple leaf plums. Trees are situated to accommodate future widening of the street which will remove part of the median. Shoulders have no City-maintained trees.

Figure 3.4-5. Wide planting beds on both shoulders and a center median bed (which is not continuous over the entire surveyed section) on Sunset Blvd. near Atherton. The extra wide shoulder areas are designed to accommodate future lane expansion. Coast redwoods on the left are on private property just beyond the City-maintained shoulder plantings. Most trees in this area are London plane and coast redwoods.

Tree age class

Phytosphere compared current tree size to the typical size of a given tree species at maturity to categorize trees into functional age classes. Most of the surveyed street sections had relatively young tree plantings. Trees had just been installed on the Rocklin Road segment, and many other areas included recently developed or recently renovated planting beds. Consequently, the majority of all trees were rated in the youngest age class, less than 25% of mature size (Figure 3.4-6).

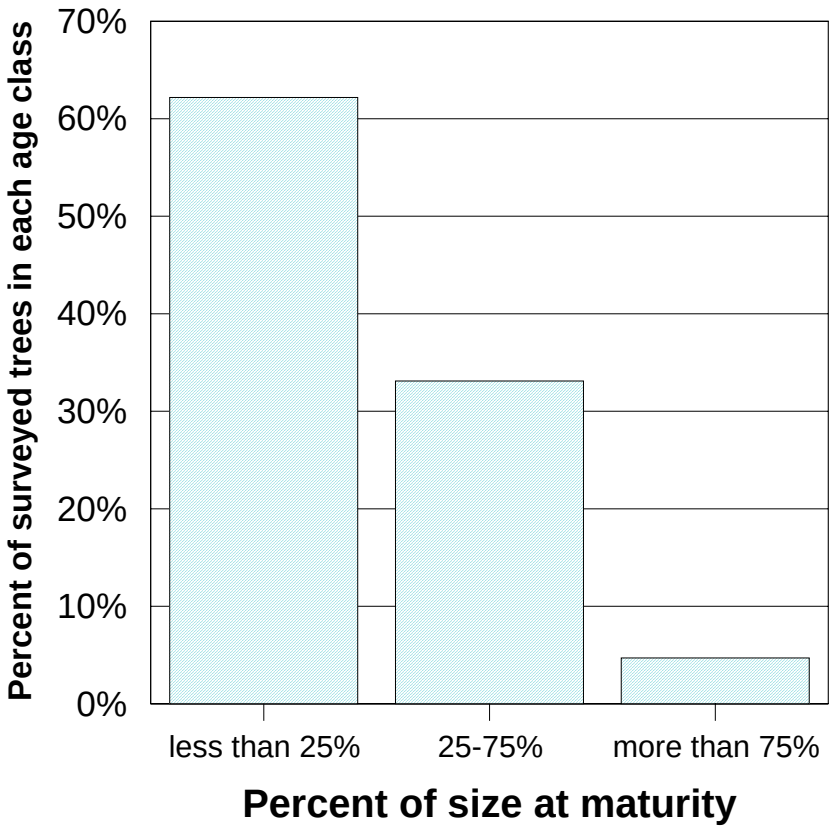

Figure 3.4-6. Most of the surveyed City-maintained street trees are in the smallest and youngest age class, less than 25% of their mature size.

Tree density

For the 15 surveyed segments , the overall density of trees per street mile was 353. The density per street mile ranged from 58 (W. Stanford Ranch Rd.) to 792 (Sunset at Atherton), but the density for most segments was between about 160 and 450 trees per street mile. By way of comparison, among over 200 California cities that provided street tree data in the 1992 California Urban Forest Survey (Bernhardt and Swiecki 1993), the average street tree density was 103.5 trees per street mile.

Much of the variation in the number of trees per street mile is associated with the number of landscaped beds per street segment, which ranges from one (e.g., center median only) to three (median plus both shoulders) (Figure 3.4-7). If the number of planting beds is taken into account, the average number of trees per street mile per planting bed is 160, with a

range of 58 to 264 (Figure 3.4-7). This corresponds to an average of one tree for every 40 feet of roadway per landscaped bed.

Many of the species in these City-maintained street tree plantings (see below) do not have a very wide canopy spread at maturity. Assuming an overall average canopy spread of 25 to 30 feet at maturity for each tree, an average of one tree per 40 feet of roadway will generally not provide a continuous tree canopy if all trees reach mature size.

Actual planting density within beds is typically somewhat higher than one tree per 40 feet because many beds are interrupted by areas such as intersections that do not contain trees. The numbers presented above are based on the total length of each sampled street segment, including intersections and other interruptions in the planting beds. Hence, trees are planted densely enough within many street landscaping beds to provide continuous tree canopy within at least portions of the bed, even though the street as a whole will not have a continuous tree canopy.

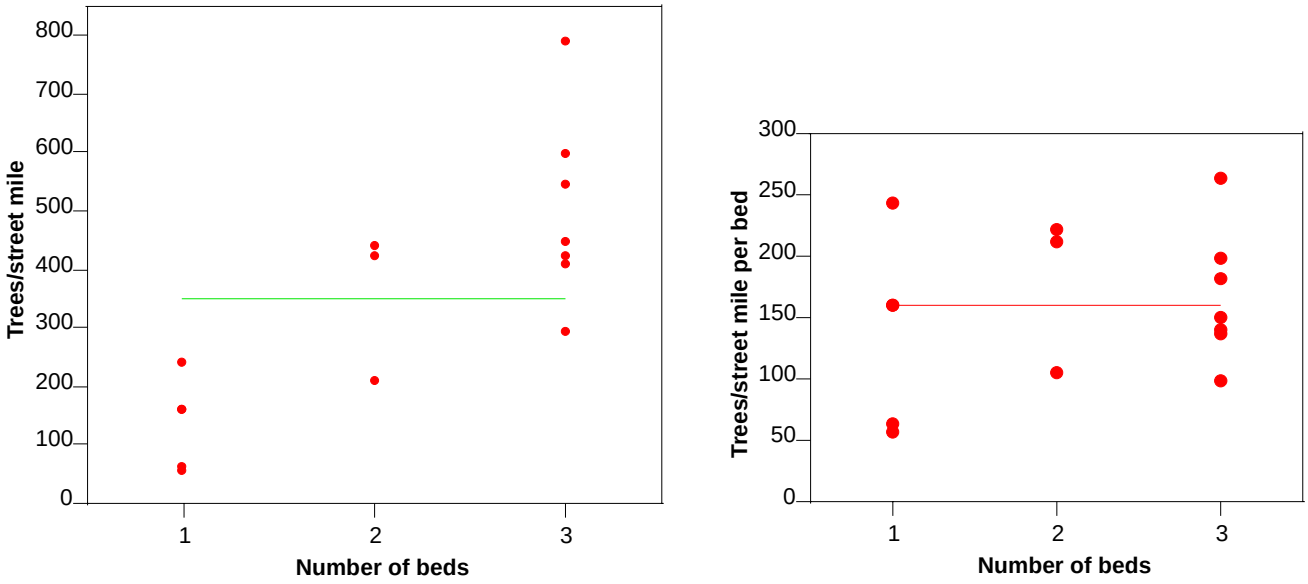

Figure 3.4-7. The relationship between tree density and the number of planting beds is illustrated in these graphs. The left graph shows that the number of trees per mile of street increases with the number of planting beds along the street (i.e., center median and/or one or both shoulders). In the graph at right, the tree density of the surveyed street segments have been put on an equivalent basis by dividing by the number of planting beds present. Horizontal lines represent the overall average for all sampled streets in each graph. Variation in tree density between different beds is due to differing planting designs, mature tree size, and site conditions.

From the overall density of trees per street mile (353) in sampled streets and the number of miles of streets with City-maintained trees (approximately 27.7 miles in 2004), Phytosphere estimated that the overall number of City-maintained street trees is approximately 9,800. There is a fair amount of uncertainty in this estimate. Statistically, there is a 95% chance that the actual number of City-maintained street trees is between 6,600 and 12,960. A more precise estimate could be obtained by sampling more street segments and/or by using the per planting bed estimate in conjunction with the total length of City-maintained planting beds along streets. The estimate does not include approximately 1.8 miles of street landscaping (on Pacific St., Sunset Blvd., and Granite Drive) which were not

yet under City maintenance at the time of our survey. If tree densities in these areas are similar to the average of sampled areas, these areas may include approximately 640 additional trees.

Most of the surveyed street segments (12 of 15) had at least one empty tree planting space (Table 3.4-1). Overall, 5% of the planting spaces in the surveyed street segments were empty in October 2003. City-wide, this would represent about 820 trees, based on our estimate of the City street tree population. Most of the empty planting sites were places where trees had died during the establishment period and had not been replaced. Larger trees were removed in only a few of the sites. A few of the empty sites are spots where trees have been intentionally removed to improve lines of site (some of the trees in segment 11). As noted earlier, Public Works initiated a formal program to replace missing street trees in 1999.

In addition to street trees, City crews also maintain vegetation that includes trees at the Rocklin Museum Parking Lot, Fire Station # 2, and the Stanford Ranch Road Park and Ride lot. Trees in these areas are not included in our overall tree count estimates, but contribute to Public Work's overall tree care work load.

Species composition

At least 26 species of trees were present within the sampled street segments. However, many of the observed species were represented by only a few individuals. The 12 least common species made up only 8.5% of all surveyed street trees. By comparison, the 5 most common species make up more than 50% of the sample in the survey. This is not surprising given the emphasis on aesthetics and planting uniformity called for in the Street Tree Ordinance and City planning documents. Figure 3.4-8 shows all species that made up at least 5% of the sample.

In general, a high level of diversity is desirable to reduce the chance that a major problem that develops in one species will impact a high percentage of the total tree population. A commonly-used guideline is that a single cultivated species should not make up more than 10% of the urban street tree population. The four most common street tree species in the survey each constitute about 10% of the total street tree population, which is consistent with the above guideline.

About one third of the trees in the sample (32%) could be classified as being drought tolerant, i.e., able to perform reasonably well with low or very low levels of irrigation. However, about 20% of the trees in the sample were coast redwoods and magnolia, both of which have relatively high water requirements. In hot, dry inland areas, trees with high water requirements typically develop drought stress when planted in harsh sites. Street tree planting beds are typically harsh environments for tree growth due to both restricted rooting area and additional summer heat radiated from pavement. Although trees such as coast redwood may perform well over the short term along streets, older coast redwood plantings in other inland sites in northern California have not fared well, eventually developing significant top dieback. The long-term prospects for coast redwood in Rocklin street plantings are doubtful, particularly if drought conditions were to occur that would require reduced irrigation.

About 21% of the trees in the sample (including crape myrtle, purple leaf plum, and crabapple) are small-statured trees. These trees provide aesthetic benefits and are relatively inexpensive to maintain, but they are too small to provide significant shading, and provide only minimal benefits in categories such as air quality improvement and stormwater retention.

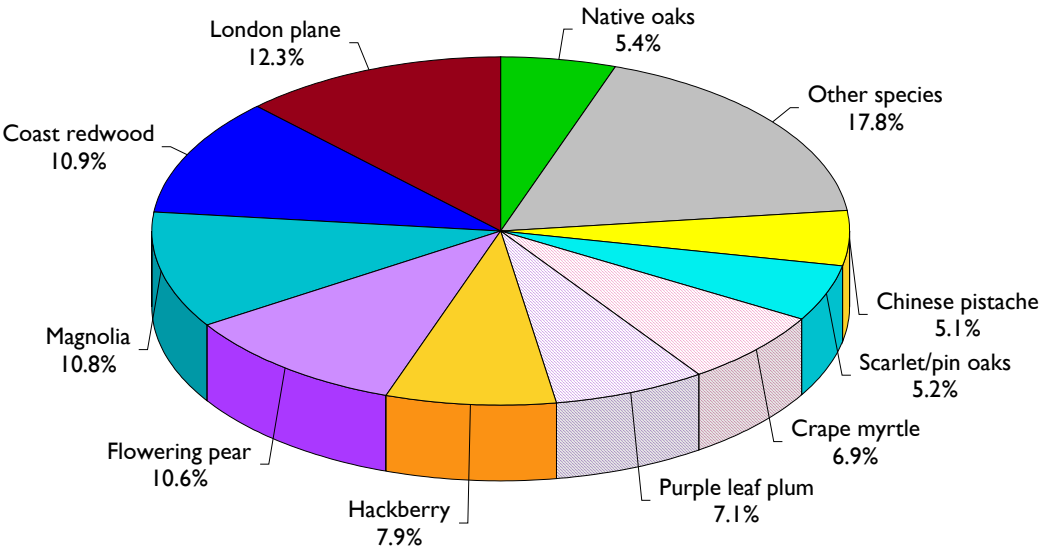

Figure 3.4-8. The most common tree species in sampled City-maintained street tree plantings. All species comprising at least 5% of the sample are shown. Three locally native oak species in the sample (blue, interior live, and valley oak) are grouped. Small-statured trees are indicated by stripes; solid colors represent medium to large-statured trees. The 'Other species' group includes small to large-statured trees.

Tree condition

Dead and declining trees were found in 7 of the 15 surveyed street sections, but were quite uncommon overall. Only 1.7% of the trees in the sample were in decline and 0.24% were dead. Combined with empty planting spaces as noted above, about 7% of the street tree population is either in decline or has died since installation and not been replaced. Poor condition of the original nursery stock, poor soil conditions at the site, and/or inadequate irrigation appeared to be the most common causes for the decline and death of street trees. In cases where poor soil conditions are the main underlying cause of tree death (such as on shallow granitic or "lava cap" soils), replanting of the site may not be warranted unless a major renovation of the planting bed is undertaken to change soil conditions.

Declining trees were present at nearly the same frequency among all three tree age classes. Among the most common species, shown in Figure 3.4-8, declining or dead trees were found among magnolia, flowering pear, scarlet/pin oak, purple leaf plum, and Chinese pistache.

Management issues and recommendations

The sample street tree survey provides an estimate of the overall number of trees that are maintained along streets by Rocklin Public Works. In turn, this can be used to estimate the amount of time required to inspect and prune trees.

In order to develop good branch structure that will reduce later maintenance needs, most young trees should be inspected, and pruned as needed, on a two to three year cycle until the

permanent branch structure is developed. This is most important for hardwood trees (i.e., trees other than conifers) that will be medium to large-statured at maturity. Early training of conifers that have a typical excurrent growth pattern (like a Christmas tree) is much less critical and mainly consists of eventually removing low branches to develop clearance. About 62% of the sample, or an estimated 6,000 trees City-wide, fall in the youngest age class (<25% of mature size). If conifers and small-statured trees (e.g., crape myrtles) are deducted from this group, an estimated 4,600 young street trees are likely to need inspection and pruning to establish good tree form. To maintain these trees using a three year cycle, about 1,500 trees per year would need to be inspected and pruned as needed. For the remaining 5,400 street trees, a longer inspection/pruning cycle, on the order of 5 to 7 years, may be appropriate. A mean interval of six years would require that an additional 900 trees per year be inspected and pruned as needed.

With a more extensive sample survey or a complete tree inventory, the maintenance needs for City street trees could be estimated and scheduled more precisely. The number of City-maintained trees is expected to increase as the City assumes responsibility for new sections of street landscaping. Also, as young trees begin to mature, they can be inspected and pruned less frequently. Hence, the number of trees to be inspected and pruned per year, and the type of pruning needed (young vs. mature tree) will continue to change over time for some years to come. A city street tree inventory, even a partial one based on sample data, would help the City track and forecast its street tree maintenance over time. As noted in Section 3.3, software for tree inventory and tree work scheduling is available from various sources.

Irrigation is also a critical maintenance issue. Many of the most common street tree species, comprising over half of the trees in the sample (Figure 3.4-8), have at least moderate irrigation requirements. Coast redwoods, which make up more than 10% of the sample, have a high irrigation requirement. As noted above, street tree plantings tend to be especially stressful because soil conditions are typically poor (high compaction, restricted soil volume) and summer water demand is high due to heat radiated off paved surfaces. In these sites, trees with moderate to high moisture requirements can easily become critically stressed if irrigation is inadequate. Improperly adjusted timers or malfunctioning equipment can result in water deficits that can severely damage established trees and can kill young trees.

Maintenance needs in street tree plantings could be reduced by phasing out high water-use species in favor more drought tolerant species. In many sites, drought tolerant tree species, including locally native oaks, may be able to grow with little or no irrigation. For example, in relatively wide beds that have adequate amounts of soil that is suitable for root growth, species such as blue oak should be capable of surviving without irrigation once established. Because blue oak would grow relatively slowly in these sites, its pruning requirements would also be low. In many sites, it may be possible to establish locally native oaks from seed among existing plantings. Eventually, such oaks could replace shorter-lived, higher maintenance species that were originally present in the plantings. This process has already started naturally in some planting beds, such as the median on South Whitney Blvd., where native oaks have become established from acorns planted by scrub jays.

As noted above, about 7% of the available planting spaces in the beds were unoccupied or contained dead or declining trees. Before a missing site is scheduled for replanting with the same species that had died, Phytosphere recommends that an assessment be made to determine the likely cause(s) of tree death or decline. Potential causes of tree death may

include adverse soil conditions (e.g., compaction, shallow soil depth), irrigation system problems, poor match between species and site conditions, poor condition of the original planting stock (e.g., circling roots), and disease or insect pest problems. This assessment should be made at the time a dead or declining tree is removed, when many of these problems can be readily observed. Based on these findings and a functional evaluation of the site, a determination can then be made as to:

- whether the site should be replanted at all;
- whether remedial site preparation is needed before replanting; and
- which species would be most likely to perform well at the site.

This type of replacement strategy will help the City optimize its use of scarce tree planting funds. However, to be effective, long-term management plans need to be developed for individual street segments so that individual tree replacements will contribute toward attaining the plan's objectives.

Although the current plantings are moderately diverse, relatively few species still make up a large percentage of the street tree population. Many of the most common species in use are clonally propagated varietal selections. All individuals of a horticultural variety (e.g., Capital flowering pear, *Pyrus calleryana* var. 'Capital') are genetically identical. In contrast, a population of trees of a given species raised from seed can have high amounts of genetic diversity. Such diversity is important in reducing the impact of pest or disease epidemics. In both new tree plantings and replanting of existing landscape beds, it will be important to avoid the overuse of already common tree species, especially clonal varieties. In addition to maintaining genetic diversity in street tree plantings citywide, it is also important to consider the level of diversity as part of the street segment management plan. Genetic diversity can be increased not only by using a wider mix of species, but by using species propagated from seed (e.g., local native oak species) or using multiple clonal varieties rather than a single variety.

Age diversity within plantings is also an important factor that affects the long-term sustainability of the street tree population (Maco and McPherson 2003). Especially when genetically uniform clonal varieties are used, trees of a given species planted at a site at one time will also tend to reach the end of their useful life at the same time. In plantings that have a diversity of species and tree ages represented, only a small percentage of the trees will need to be replaced in any given year. Currently, Rocklin's street tree plantings have low levels of age diversity, i.e., most street trees citywide fall in a relatively narrow age range. Phased replacement of dead trees in the existing plantings following the replacement protocol outlined above will help produce a more stable mix of species and tree ages. This will also allow the City to gradually replace short lived species used in the original plantings with longer-lived, better adapted species.

A moderate percentage of the tree species in the current plantings will be small-statured at maturity. Small tree size is necessary and desirable in tight planting situations, including plantings under utility lines. However, a number of relatively large beds with dense plantings of small- statured trees such as purple leaf plum could alternatively accommodate a smaller number of large-statured trees. One consequence of the current planting pattern is that little or no tree canopy is actually directly over pavement, so street surfaces will not receive substantial amounts of shade during the hottest periods. Many of the benefits that street trees provide are directly related to canopy size, and researchers have shown that the benefit-to-cost ratio generally increases with tree size (McPherson 2003). Overuse of small-statured trees greatly reduces many of the benefits that are associated with street tree plantings.

In setting goals for the urban forest, City policymakers may want to consider increasing the level of canopy cover over street pavement. For example, the Street Tree Policies for the City of Los Angeles include the following objective:

> "Achieve an optimum degree of canopy cover in order to shade City streets and thereby help mitigate the urban heat island effect, and maximize the benefits from the urban forest ecosystem." (http://www.cityofla.org/BOSS/streettree/StreetTreePolicies.htm)

Various other cities have similar street tree policies. Such a policy would represent a shift from current policy, which emphasizes the use of street trees for aesthetic benefits rather than as providers of diverse benefits related to canopy cover.

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3.5. Privately-maintained trees along residential streets

Introduction

The City of Rocklin currently has about 161 miles of public streets. As noted in section 3.4, the Rocklin Public Works Department currently maintains about 9,800 trees along about 28 miles of arterial streets and parkways throughout the City. However, the overwhelming majority of Rocklin's streets run through residential neighborhoods in which the only street trees are those that grow in residential front yards. These and most of the other trees in Rocklin's urban forest are owned and maintained by Rocklin residents. Hence, it is important to consider the status of this resource, which provides a wide variety of benefits to the City as a whole (see Section 1 for a discussion of tree-related benefits). In particular, the "traffic calming" effect produced by having rows of trees along roads can reduce vehicle speeds and make residential neighborhoods safer. Studies also show that trees in neighborhoods are associated with stronger ties between neighbors and lower crime rates (Kuo 2003).

Overview

Findings

- Most Rocklin neighborhoods had at least a moderate numbers of trees in front yards.
- Most residential front yard trees were relatively young and well below mature size.
- Although several commonly planted species exhibit health problems, most trees planted in front yards were in good condition.
- In contrast, nearly half of the native oaks retained in residential front yards were in decline as a result of construction-related impacts and incompatible landscaping practices.
- Slightly more than half of the surveyed street segments had some front yards with no trees. In general, treeless yards were more common in older neighborhoods than in newly-constructed neighborhoods.
- The diversity of tree species used within surveyed streets was relatively high, with older neighborhoods tending to have greater levels of tree species diversity.
- Some of the most commonly used tree species may not have good long-term prospects due to either high water requirements or likely problems with surface roots.
- All surveyed neighborhoods currently have very little or no tree canopy over the street. Due to both tree size and placement, very little canopy will be present over streets even when existing trees reach mature size.

Management issues and recommendations

- A few commonly used tree species may not be sustainable over the long term. Providing more information on tree species to tree planters (both homeowners and developers who plant trees in new residential developments) may help them make better species selections.
- Increased use of drought-tolerant tree species, including locally native oak species, should be encouraged where appropriate.

- Rocklin's oak tree protection guidelines need to be enforced more rigorously to improve the long-term health of retained native oaks. A few portions of the guidelines should be updated.
- Residents with conserved native oaks may need more guidance on how to effectively maintain these trees in residential landscapes.
- Canopy cover over residential streets is likely to remain quite low unless efforts are made to plant larger-statured trees and place them closer to the street.
- Educational efforts should be undertaken to ensure that residents are aware of proper tree pruning practices to keep topping and other destructive practices from gaining a foothold in Rocklin.

Current status

Existing Regulations and Plans

City of Rocklin has several types of regulations and plans that relate to private front yard trees. Minimum setbacks for tree planting near streets are found in the City of Rocklin Improvement Standards (Section 12-8.F) and are discussed in section 7.1.1. These include setbacks of 6 feet from the back of sidewalks, 10 feet from driveways and fire hydrants, and 4 feet from buried utility lines. In addition, tree planting is prohibited in control areas around intersections to provide unobstructed lines of sight. The Improvement Standards also specify minimum clearances for tree limbs (14.5 feet over streets, 8 feet over bike paths and 7 feet over pedestrian rights-of-way).

The Oak Tree Ordinance and Oak Tree Preservation Guidelines encourage the retention of existing native oaks in new residential developments and helps protect conserved oaks in already-developed parcels. Homeowners may remove protected healthy oaks that were conserved during development, but new tree planting or a payment into the Oak Tree Preservation Fund is required as mitigation.

The Northwest Rocklin General Development Plan indicates that at least one shade tree should be planted per single family lot in new developments. (Exhibit B. Section D, Air quality, item 3). However, homeowners have no specific requirements to retain trees planted by developers in residential lots.

Field assessment of residential front yard trees

To assess the status of privately-owned trees in residential areas Phytosphere surveyed 20 randomly-selected street segments in residential neighborhoods in August 2003. The street segments included in the survey are shown in Figure 3.5-1 and listed in Table 3.5-1. The survey was limited to trees in front yards or side yards adjacent to streets, i.e., private trees that may also function as street trees. Data on tree density (trees per street mile) was used to estimate the total number of trees along streets in residential areas. Phytosphere also assessed tree age class, condition, and species composition. This information is important for predicting the maintenance needs of the trees and the longevity of the plantings. Phytosphere also assessed whether trees were capable of providing canopy cover over the street. Details of the survey methods used are presented in Appendix 7.1.5.

Figure 3.5-1. Locations of street segments (light lines) included in the survey of privately owned front-yard trees in residential areas. Surveyed sections were approximately 0.1 mile long (background: 2003 aerial photo).

Table 3.5-1. Street segments included in the survey of privately owned front yard trees in residential areas. Also shown is the number of empty planting spaces observed in each segment, based on a minimum of one tree per lot. Counts of empty spaces do not include dead trees that were still standing in place. The last column notes whether houses on the street were constructed within the past 10 years, based on analysis of aerial photographs dated 22 May 1993.

Street	Nearby cross streets	Empty planting spaces	Constructed after May 1993
Argonaut Ave	Roble Way / La Paloma Ct	3	no
Blackstone Ct	Balfour Ct./ Blackstone Dr	0	no
Bluffs Dr	Sand St./ Cobblestone Dr.	2	no
Bradford Dr	Wyckford Bl / Windham Wy	1	yes
Clubhouse Dr	Maryella Dr	0	yes
Dry Gulch Ct	Rawhide Rd	0	no
Hannah Way	Arnold Dr / Surfbird	1	yes
Jersey Dr	Harvest Rd /West Oaks	0	yes
Lodestar St	Topaz Ave/ Paragon St	1	no
Longview Dr	Mira Vista Dr / Floridale Ct	0	yes
Outlook Dr	Adobe Rd	1	no
Parkview Ln	5th St./ Willowglen Wy	6	no
Poppy Dr	Sage Dr	0	yes
Puffin Ct / Swan Ct	Albatross Wy	0	yes
Racetrack Circle	Gate Wy / Racetrack Rd	0	no
Scenic Dr	Bristol Ct / Scenic Ct	0	yes
Southside Ranch Rd	Thoroughbred Ct / Rodeo Pl	4	yes
Turquoise Dr	Marley Wy / Sapphire Dr	1	no
Twincreeks Ln	Meadowdale Dr / Springview Meadows Dr	2	no
Westwood Dr.	Delwood Ct /Edgewood Wy	3	no

Characteristics of surveyed areas

Eighteen of the 20 surveyed street segments were in conventional residential subdivisions (Figures 3.5-2 to 3.5-6) that had lot sizes typical of most Rocklin neighborhoods, generally between about 6,000 and 10,000 square feet. Most had standard street widths (about 50 feet), but wider and narrower streets were represented in the sample. With only a few exceptions, almost all of the trees in these front yards have been planted, either by the original subdivision developer or by homeowners. A few conserved native oaks are present in some of these areas.

Two of the surveyed street segments differed substantially from the others and are more typical of custom and semi-custom developments found in some areas of Rocklin. Both of these locations (Clubhouse Dr. [Figure 3.5-7] and Dry Gulch Ct.) had both larger lot sizes and greater numbers of conserved native oaks. Because these two segments differ from the others in several significant ways, they are considered separately in some of the analyses discussed below.

Figure 3.5-2. Older subdivision with a wide street along Argonaut Avenue. Current street canopy cover was rated at less than 1%.

Figure 3.5-3. Older subdivision with a standard street width along Racetrack Circle. Street canopy cover was 0% within the surveyed segment.

Figure 3.5-4. Older subdivision along Outlook Drive. Current street canopy cover was rated at less than 1%.

Figure 3.5-5. Recent subdivision along Jersey Drive. Current street canopy cover was rated at less than 1%. London plane trees are planted relatively close to the street. If these trees are allowed to reach mature size, street tree canopy cover should increase substantially.

Figure 3.5-6. Recent subdivision along Puffin Court and Swan Court. Current street canopy cover was 0%.

Figure 3.5-7. Recent subdivision along Clubhouse Drive with narrow streets and numerous conserved oak trees. Current street canopy cover was rated at between 1% and 5%.

Tree age class

Phytosphere compared current tree size to the typical size of a given tree species at maturity to assign trees to age classes. Most trees in the surveyed street sections were still relatively young and well below their mature size (Figure 3.5-8). Trees that were rated as being more than 75% of mature size were typically found in older developments, and included some species that are small-statured at maturity (e.g., crape myrtle, purple leaf plum) or are relatively fast-growing (e.g., birch). In both older and fairly recent developments, native oak trees that had been retained during development were also rated in the two older age classes.

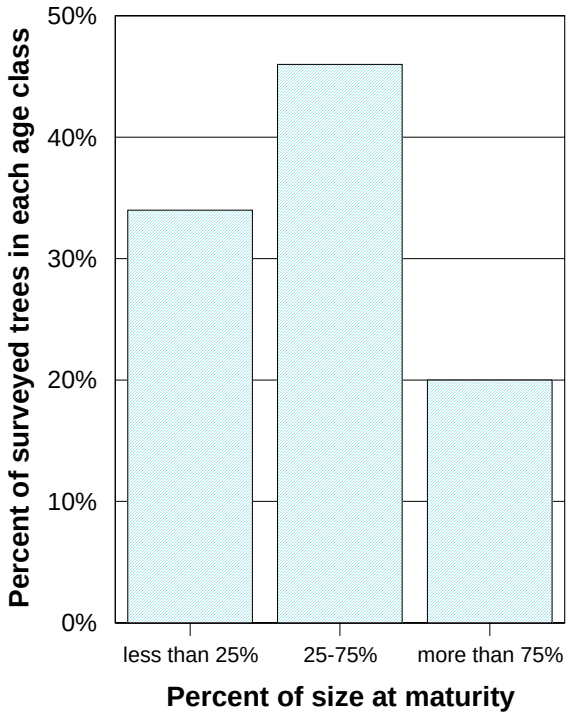


Figure 3.5-8. Most of the surveyed trees in residential front yards were not yet of mature size, and about a third of these trees were in the youngest age class, less than 25% of their mature size.

Tree density

For the 18 typical street segments in the survey, the density of front-yard trees ranged between 235 and 598 trees per street mile, counting trees on both sides of the street. The overall average was 348 trees per street mile. Assuming an average street frontage of 70 feet per lot, there are about 150 residential lots per street mile, including both sides of the street. Therefore, surveyed streets averaged slightly more than 2 front-yard trees per lot, which is a reasonable number of trees overall given the relatively small size of most front yards.

The two streets with large lots (Clubhouse Dr. and Dry Gulch Ct.) had much higher tree densities of 746 and 890 trees per street mile. These high counts were associated with lower housing densities, high numbers of conserved native trees, and especially deep front yards (Figure 3.5-7). Because of these differences, direct comparisons between these numbers and those in more typical subdivisions are not meaningful.

Eleven of the 20 surveyed street segments had at least one empty planting site, i.e., a front yard (or in some cases a side yard adjacent to the street) that did not have a tree (Table 3.5-1). At one location, about a third of the front yards did not have a tree. In other locations, the percentage of front yards without trees ranged from about 5% to 25%.

Front yards lacking trees were more common on street segments in developments more than 10 years old (treeless yards in 8 of 11 surveyed segments) than in more recent developments (treeless yards in 3 of 9 segments). This probably reflects the loss of trees that were installed by the developer that have not been replaced and/or subdivisions that did not include developer-planted front yard trees. However, because many homeowners eventually plant multiple trees in their yards, the lack of trees in some yards is offset to some degree by numerous trees in other yards. As a result, the average number of trees per street mile does not differ between neighborhoods constructed before or after May 1993. Nonetheless, streets with a high percentage of treeless front yards have a different overall look and often lower levels of canopy cover than comparably-aged streets that have trees in almost all front yards.

The City of Rocklin currently has about 161 street miles of public streets. The majority of these street miles occur in residential neighborhoods. If about half of the public street miles occurred in neighborhoods with the same average number of front yard trees seen in the sample, Phytosphere estimates that about 28,000 privately-maintained trees were present along Rocklin's residential streets in 2003. This conservative estimate of privately-maintained street tree is nearly three times the estimated number of City-maintained street trees, even though the average density of trees per street mile is the same for both groups.

Tree canopy cover over streets

The shading of paved surfaces by trees provides several important benefits (see Section 1). The amount of shading over streets can be quantified by evaluating canopy cover at the edge of pavement (CCEP). CCEP is reported as the percentage of pavement edge (the line defined by the junction of the street and curb) that has tree canopy directly over it (see http://www.isa-arbor.com/publications/tree-ord/ccep.aspx). Trees that provide any substantial shading at the pavement edge typically extend over the street as well. During the survey, Phytosphere counted the number of trees in each surveyed segment that currently had canopy over the pavement edge and the number of trees whose canopies would be expected to extend over the edge of pavement once they reach mature size. The current percent CCEP over the surveyed section was also estimated.

Current street tree canopy was low in all sampled streets. The estimated overall CCEP for all surveyed streets was less than 1% at the time of the survey. Eight of the 20 sampled street segments had no CCEP, and only three had CCEP levels as high as 1-5%. Only 5% of the front yard trees tallied provided canopy over the street.

The low level of CCEP was due to three factors:

- relatively few large-canopied trees are planted in residential front yards;
- trees are commonly placed well back from the sidewalk, and commonly well beyond the public utility easement along the street;
- most trees are still far below their mature canopy spread.

To account for the effect of the third factor (tree maturity), Phytosphere estimated whether existing trees could provide CCEP once they reached their mature size. Based on these data, the number of trees with CCEP could triple to about 16% if all trees currently present attain their typical mature spread. When expressed on the basis of trees per street mile

(counting both sides of the street), the number of trees providing CCEP is expected to increase from 19 trees/street mile to 62 trees/street mile as the current tree population grows to mature size. Based on Phytosphere's field observations, most of the trees whose canopies will reach the edge of pavement at maturity will only barely extend to that point. Most of these trees will only provide a few feet of CCEP at maturity. Assuming an optimistic average 8 feet of CCEP per tree on average, the 62 trees per mile will provide about 500 feet of CCEP, or about 5% CCEP on each side of the street. By comparison, a well-canopied street would typically have at least 50% CCEP.

From the foregoing analysis, it appears that even when existing trees reach mature canopy spread, their placement away from streets and relatively small canopy spread will limit future levels of tree canopy cover on Rocklin streets. High levels of CCEP can develop only in areas where trees with wide canopies are situated relatively close to the street and allowed to grow to mature size. Only a few of the surveyed streets had plantings of this nature. On the surveyed sections of Jersey Dr. and Scenic Dr., large-growing London plane trees have been planted close to the street. If most of these trees survive and are properly maintained, high levels of CCEP can be anticipated. In contrast, in many other neighborhoods where small to medium-sized trees are planted close to the houses and away from the street, no increase in CCEP is likely to occur with the current plantings. Nonetheless, even in these situations, well-located front-yard trees could still provide important shade benefits by shading driveways or windows.

Species composition

At least 58 species of trees were present among the 833 front yard trees included in the sample. More than half of these species (38) occurred at frequencies of less than 1% of the trees in the sample. Eighteen species were represented by only one or two individuals.

Conserved native oaks, mostly blue oak and interior live oak, make up 11% of the sample, but most of these native trees are found on one atypical street segment (Clubhouse Drive). If the conserved native oaks from this location are omitted, native oaks drop to less than 3% of all trees in the sample. This lower percentage of native oaks is more representative of the level found in most of Rocklin. Conserved native oaks are a dominant component of residential street landscapes in some Rocklin neighborhoods, but native oaks are not present in most residential street landscapes in Rocklin. Phytosphere's surveyors saw a few sites where homeowners had encouraged volunteer oak seedlings, but locally native oaks were not planted in any of the surveyed street sections.

If the native oaks from Clubhouse Drive are excluded from the sample, seven tree species were present at frequencies of more than 5%. These seven species (Figure 3.5-9) comprise about half of the 759 trees in these plantings. The most common yard tree, sweetgum or liquidambar, is known for its propensity to produce shallow, intrusive roots that can cause problems with sidewalks and associated hardscape. This tree is not the best tree choice for many sites, and as a result, this species is commonly removed by homeowners as it begins to approach mature size. In addition, two of the seven most common species, coast redwood and birch, are species that require high amounts of water to remain healthy in Rocklin's hot, dry climate. Although these species are popular because of their rapid growth and attractive appearance, they may not have good long-term prospects in many sites, especially in smaller yards.

Two of the most commonly planted trees (crape myrtle and purple leaf plum) are small-statured at maturity and provide fairly minimal amounts of canopy. Overall, about a quarter of the trees in the planted tree sample (n=759) were trees that will have small canopies at maturity, and about half will have moderate canopy spread at maturity. As noted above, this preponderance of small- to medium-canopied trees combined with the tendency to plant far beyond the public utility easement along streets eliminates the prospect of developing significant amounts of street shading in most neighborhoods. Furthermore, unless they are planted very close to houses, small trees may not provide significant energy conservation benefits.

The number of tree species present within a given street segment tends to increase as the age of the development increases. Some of the most recently-constructed neighborhoods had as few as six front-yard species, whereas older neighborhoods typically had 15 or more species. The increased diversity is the result of both tree replacement and additional plantings by homeowners. High species diversity is generally desirable for reducing risks associated with pests and diseases.

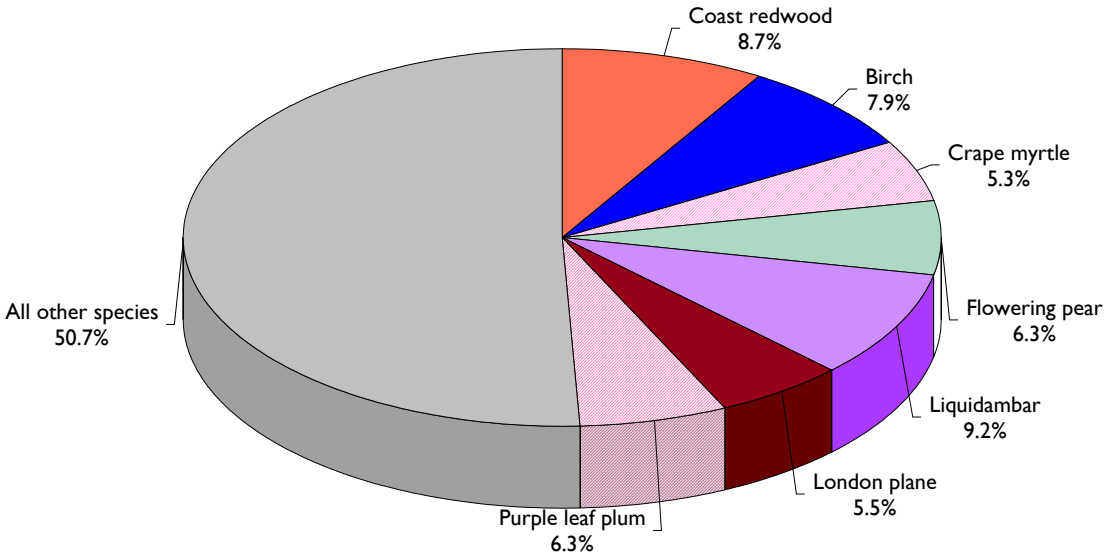


Figure 3.5-9. The most common tree species along residential streets. Conserved native oaks present in one surveyed segment (Clubhouse Dr.) are omitted from the totals. Species comprising at least 5% of the sample are shown. Small-statured trees are indicated by stripes; solid colors represent medium to large-statured trees. The 'all other species' group includes at least 51 other species of small- to large-statured trees.

Tree condition

The overwhelming majority (91%) of the front-yard trees in the surveyed areas were in at least fair condition. Only 4 dead trees were observed. This constitutes less than 0.5% of the sample. However, 8.4% of the trees in the sample were in poor condition and were rated as being in decline. Most of these were conserved native oaks that were in decline as a result of construction-related damage. Almost half (45%) of the three locally native oak species represented in the sample (blue oak, interior live oak, valley oak) were rated as being in

decline. Figure 3.5-10 shows typical situations in which declining trees are found. Most of these trees were severely damaged during the time that the homes were built because their roots were inadequately protected from damage associated with grading and other construction activities. In many cases, improper irrigation practices following construction have further accelerated tree decline.

About 4% of the trees other than conserved native oaks were in decline. These were primarily younger trees. Only two of the 31 declining or dead non-native trees were mature or nearly mature trees. Three of the seven most common tree species (Figure 3.5-9) had relatively high rates of decline. Dead or declining trees made up 17% of the birch, 8% of the flowering pear, and 3% of the coast redwood in the sample. Other common species that had relatively high levels of decline were Chinese tallow tree and maples.

Figure 3.5-10. Nearly half of the native oaks that have been retained during development are in decline due to adverse impacts to their root systems. At left, one of the two blue oaks retained in this recently-built subdivision shows early evidence of canopy thinning due to root damage. Irrigation runoff from turf is likely to speed decline. At right, retained valley oak in older subdivision shows extensive canopy thinning and is in severe decline.

In many California cities, established trees are often subjected to poor pruning practices, particularly topping (cutting back large limbs to stubs). Topping can destroy tree structure and make trees more hazardous. Fortunately, at least in the surveyed areas, topping is currently very uncommon in Rocklin. Most of Rocklin's trees are still relatively young, so many have not been pruned to any great degree to date. However, in areas of Rocklin that have overhead utility lines along streets, some trees have been topped to maintain utility line clearance. Although PG&E and other utilities are changing from topping to directional pruning (also known as “V” trimming) to maintain clearance, the best solution for planting under utility lines is to use species that will not grow tall enough to require clearance pruning.

Management issues and recommendations

Most of Rocklin's residential streets, including all of those included in the survey, have negligible amounts of canopy over the street. Furthermore, very little additional street canopy cover is likely to develop over time due to tree species selection and placement. If achieving

higher levels of street tree canopy is identified as an objective for Rocklin's urban forest, specific efforts would be needed to encourage the use of large-statured trees placed just beyond the City's public utility easement.

Fairly good levels of tree species diversity were present within sampled streets and across the entire sample. However, some of the species in wide use may not be especially good selections for long-term performance. Because most front yards in the surveyed areas contain at least some irrigated turf, the wide use of trees that tolerate lawn irrigation schedules, such as coast redwood and birch, is understandable. However, these and other high water use species tend to fare badly during drought periods, especially when they become large. Condition data indicate that these species may already be developing problems in some areas. Given Rocklin's soil and climate, and the increasingly tight water supplies in the state, greater use of drought tolerant species should be encouraged.

Many conserved oaks have not fared well in residential front yards. Trees in these areas are typically subject to high amounts of root disturbance associated with grading and compaction for house pads, driveways, streets, and trenching for underground utility lines. In some situations, the City's current guidelines related to oak tree protection have clearly not been followed. Even if followed precisely, the City's current guidelines may not be sufficient to protect enough of the rootzone to maintain tree health. For example, the oak ordinance requires actions to protect roots only under the tree's dripline. Because roots of mature oaks typically extend out twice to three times the diameter of the canopy, the area under the dripline may include as little as one quarter to one third of the tree's roots. Destruction of close to half of a mature oak's roots can greatly stress the tree and may cause it to decline. The City may want to consider revising the guidelines to encourage greater levels of rootzone protection where it is feasible.

In addition, landscape design and maintenance practices instituted after construction is complete often do not conform to the City's guidelines or current best management practices. Further efforts may be needed to enforce compliance with oak protection measures during development, and encourage better stewardship of retained oaks by homeowners. Efforts to increase the planting of locally native oaks where appropriate could also be used to help maintain native oaks as an element of Rocklin neighborhoods.

Most of Rocklin's front yard trees have not yet been impacted by poor pruning practices, such as topping. This may be due primarily to the fact that most trees in these areas have not grown very large. Unfortunately, topping and other poor practices tend to spread locally once they start to appear because some homeowners will erroneously assume that their trees must "need" to be pruned in the same way. Proactive educational efforts should be undertaken to ensure that Rocklin's trees don't become victims of topping and other adverse practices just when they are beginning to provide their greatest benefits.

References

Kuo, F. E. 2003. The role of arboriculture in a healthy social ecology. Journal of Arboriculture 29:148–155.

3.6. Trees in commercial parking lots

Introduction

Parking lots can occupy a substantial amount of a City's land area. In Sacramento for instance, 5.6% of the land area is occupied by parking lots (McPherson 2001). Trees in parking lots help mitigate some of the negative environmental impacts of parking lots while improving their appearance. Adequate numbers of appropriately placed trees can mitigate stormwater runoff and reduce the temperatures of both pavement and vehicles, thereby improving both water quality and air quality. However, parking lots can be harsh sites for tree growth, so good site design and proper tree maintenance are needed to achieve the benefits that parking lot trees can provide.

Overview

Findings

- The City of Rocklin has several regulations designed to increase tree canopy in parking lots.
- Surveyed parking lots had low levels of shading provided by trees. Less than 3% of surveyed parking spaces were at least 50% shaded.
- Less than half of the surveyed parking lot trees actually provided canopy cover over parking spaces.
- Ratios of parking spaces per tree were variable, ranging from 2.25 to almost 8 parking spaces per tree.
- Small parking lots generally had higher levels of shading and fewer parking spaces per tree than larger lots.
- Most parking lot trees were well below mature size.
- Levels of parking lot shade were not correlated with parking lot age.
- Empty tree planting sites were common, averaging 9% of all planting sites overall. The number of empty sites increased with increasing parking lot age.
- About 7% of existing parking lot trees were in poor condition.
- Most parking lot trees are of only moderate size at maturity, and 18% are small-statured trees that will not provide substantial shade at maturity.
- Most native oaks retained in parking lots were in poor condition, although some have survived for over 20 years since construction.

Management issues and recommendations

- Changes in parking lot planning and tree maintenance practices will be needed to increase levels of parking lot shading in Rocklin.
- Lower ratios of parking spaces per tree can help increase shading, but only if coupled with proper tree placement and tree size.
- Soil conditions need to be improved in parking lot tree planting sites to improve tree growth, condition, and survival. Soil problems should be avoided or corrected before the original planting and corrected as needed before replanting empty sites.

- Tree species used in parking lots should only include those that are adapted to the relatively harsh site conditions.
- Native oaks retained in parking lots can sometimes provide many years of substantial canopy cover even if the rootzone has been excessively encroached upon by construction activity. Greater levels of rootzone protection would improve the long-term health and survival prospects of most retained trees.
- Follow-up monitoring of parking lots is needed to ensure that trees are properly maintained and replacements are planted as needed.

Current status

Existing Regulations and Plans

The City of Rocklin has enacted regulations designed to enhance tree planting and shading in parking lots. Section 6 of the Design Review Resolution adopted in 2000 has requirements for landscaping in parking lots. It specifies a ratio of 5 parking spaces per tree, calls for trees to be distributed throughout the parking lot, and mandates the use of drought resistant species and that the overall landscaping plan conforms to the State Water Conservation in Landscaping Act (AB325). In addition it requires existing trees be incorporated into the parking lot design where possible.

Phytosphere also reviewed the Northwest Rocklin General Development Plan and the Northwest Rocklin Design Guidelines. These plans are typical of those used in new developments within the City. The General Development Plan requires that parking lot landscaping be designed to filter light and daytime glare from distant views through the use of dense canopy shade trees, earth berms, and continuous perimeter landscape plants. Parking lots must also include a minimum 15-foot wide perimeter landscaping area and/or earth berm along adjacent streets to assist in screening the views of parked cars (Northwest Rocklin GDP, Section N Landscaping, item 1).

The design guidelines require that one tree be provided for every five parking spaces within non-residential parking lots (Northwest Rocklin Design Guidelines, Section 6 Landscaping, Item G). Landscaping materials are to be selected with consideration for water requirements over the lifetime of the plants. The use of materials with low water requirements, particularly plants that are considered drought tolerant, and the use of efficient irrigation systems are strongly recommended and may be required (Northwest Rocklin Design Guidelines, Section 6 Landscaping, Item I).

Field assessment of parking lot trees

Phytosphere surveyed portions of ten parking lots on commercial properties in Rocklin in late August and early September 2003. Within the sampled portion of each lot, Phytosphere collected data on the number of trees, empty planting spaces, and parking spaces. In all, 867 parking spaces were surveyed. Phytosphere directly assessed the number of trees that were currently shading parking spaces, the number of spaces being shaded, and the degree to which parking spaces were shaded. Phytosphere also collected data on tree age class, condition, and species. Details of the survey methods used are presented in Appendix 7.1.6.

Characteristics of surveyed areas

The randomly-selected parking lots in the survey included large retail centers (Figures 3.6-1, 3.6-2), business professional complexes (Figure 3.6-3), a single small commercial building (Figure 3.6-4), and a hotel/restaurant site. The locations and characteristics of the parking lots are listed in Table 3.6-1. Four of the parking lots (1, 8, 9, and 10) were constructed within the previous 10 years. All other lots were constructed prior to May 1993.

Table 3.6-1. Locations and characteristics of commercial parking lots included in the survey. For all lots other than number 2, only a portion of the lot was sampled. Parking lots that include retained native oaks are noted.

Lot	Type of business	Location	Number of parking spaces surveyed	Includes retained oaks	Approximate year landscape installed
1	Retail center	Pacific St. / Sunset Bl. SE (Dollar Tree)	89	no	1995
2	Bank branch	Whitney Bl. / Sunset Bl.	23	no	1975
3	Professional offices	4200-4240 Rocklin Rd.	97	yes	1986
4	Retail center	Stanford Ranch Rd. / Sunset Bl.	86	no	1991
5	Retail center	Granite Dr./Sierra Meadows Dr. S (Safeway/Longs)	91	yes	1982
6	Retail center	Pacific St. / Sunset Bl. NE (K Mart)	118	no	1989
7	Professional offices	Fairway Dr. / Sunset Bl.	81	no	1992
8	Retail center	Stanford Ranch Rd. / Park Dr.	100	no	2002
9	Retail center	Five Star Bl. / South Whitney Bl.	81	no	1998
10	Hotel / restaurant	China Garden Rd.	101	yes	1997

Almost all of the parking lots had some trees in planting beds located along the adjacent streets or along buildings. Most larger lots also had trees in planters of various sizes and configurations that were located within the lot. Three parking lots (Table 3.6-1) included one or more native oaks that were retained on site during development (Figure 3.6-2).

The bank parking lot (number 2, Figure 3.6-4) was the smallest lot surveyed, and all of its spaces were included in the survey. All of the non-covered spaces at lot 7 were also included in the survey. For the remaining lots, two or more aisles of parking spaces were selected at random for the survey.

Figure 3.6-1. Parking lot 6 has relatively large planters, but trees are widely spaced with only one tree per nearly 8 parking spaces. About 12% of the surveyed parking spaces were at least 25% shaded.

Figure 3.6-2. Large eucalyptus trees at lot 5 were being removed at the time of the survey, reducing tree canopy. This lot included several conserved oaks, including the one in the background to the right.

Figure 3.6-3. This professional office development (lot 7) had the highest percentage of shaded parking spaces and the lowest ratio of parking spaces to trees (2.25) of the surveyed lots.

Figure 3.6-4. In lot 2, the smallest and oldest lot surveyed, few trees were planted in areas where they could shade parking spaces.

Tree age class

Phytosphere compared current tree size to the typical size of a given tree species at maturity to estimate age classes of trees in the surveyed parking lots. Only about 12% of the trees in the surveyed lots were more than 75% of mature size (Figure 3.6-5). Most of the trees that were at or near their mature size were trees that develop small to medium canopy size at

maturity. Several mature oaks that had been retained in or near parking lots during development are also included in the most mature age class. Some coast redwoods were also rated as being at more than 75% of mature size because they were not likely to show much more growth given the limitations of the sites in which they were planted.

Parking lot trees were mostly in the younger/smaller age classes for several reasons. A number of the parking lots were not very old (Table 3.6-1), so trees were still young. However, many older lots still had trees that were well below mature size. This was generally due either to slow growth associated with poor site conditions, e.g., small planters in the middle of pavement or the fact that trees had died or were otherwise removed and replaced with trees that were much younger than the parking lot's age.

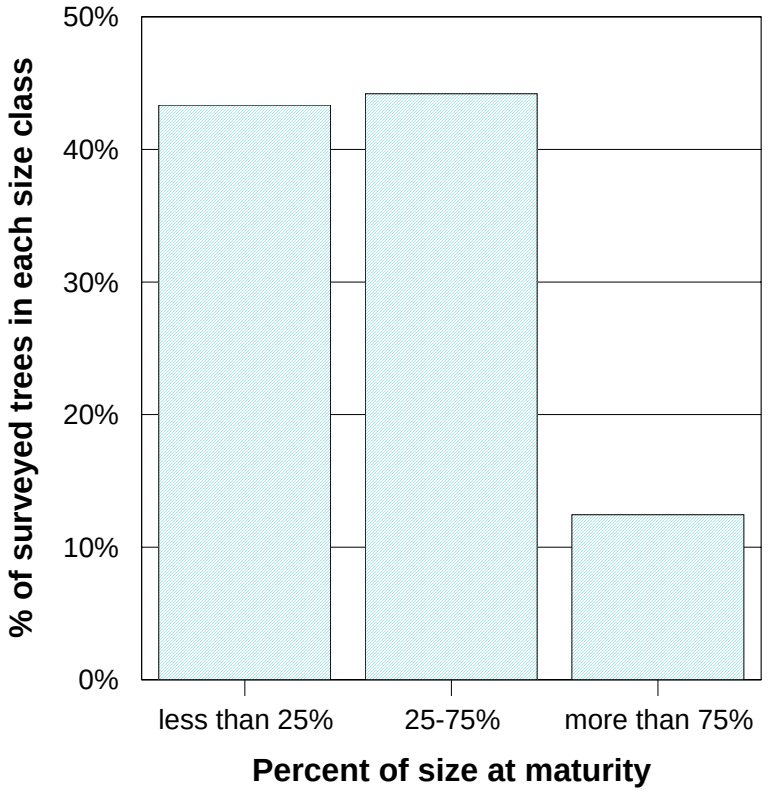


Figure 3.6-5. Age classes of surveyed parking lot trees. Most of the surveyed trees in parking lots were not yet of mature size.

Parking space to tree ratios

The ratios of parking spaces to trees for the ten surveyed lots are shown in Figure 3.6-6. The ratio ranged from one tree for every 2.25 spaces for a professional office complex to one tree for every 7.9 spaces in a large retail shopping center. These ratios exclude trees that were too far from parking spaces to provide overhead shade at maturity. If tree sizes are equal, lower parking space to tree ratios are likely to shade larger portions of the parking area. Greater levels of planting near buildings and/or along streets contributed to the lower space/tree ratios seen in narrow parking lots situated around buildings (Figure 3.6-3) compared with large parking lots (Figures 3.6-1, 3.6-2).

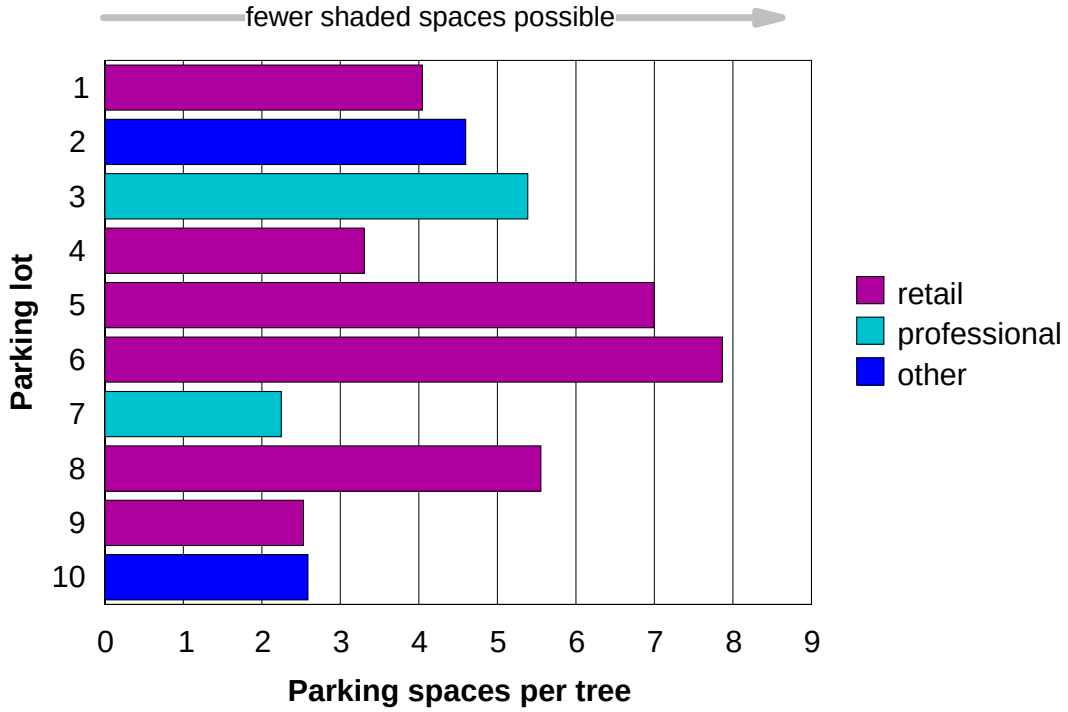


Figure 3.6-6. The number of parking spaces per tree varied by more than a factor of three between the surveyed parking lots. Even similar types of commercial developments showed a wide range in the number of spaces for each tree. Parking lot numbers are as in Table 3.6-1.

Shading of parking spaces

The survey evaluation directly addressed whether tree canopy extended over parking spaces, providing overhead shade in midsummer. In general, a parking space needs to be at least 25% shaded (green portions of bars in Figure 3.6-7) before it can provide any substantial midday shading of a car's passenger compartment. As shown in Figure 3.6-7, the proportion of spaces receiving even partial shade was low for most surveyed lots. Overall, only 2.7% of all surveyed spaces were more than 50% shaded. An additional 5.3% of the surveyed spaces were 25% to 50% shaded.

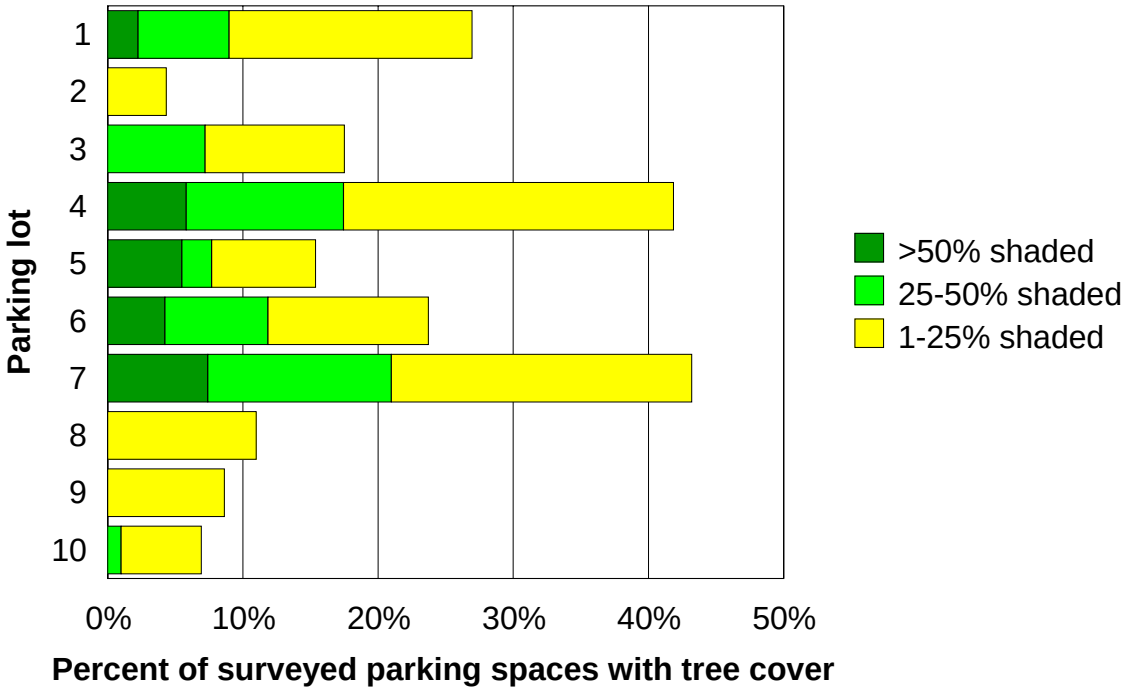


Figure 3.6-7. The percentage of parking spaces with overhead tree canopy in the ten surveyed parking lots. Spaces with more than 25% shading (green) would generally have enough canopy to at least partially shade vehicle windows. Parking lot numbers are as in Table 3.6-1.

Tree size, planter size, and the placement of trees in planters all influence whether trees actually shade parking spaces. Small-statured and young trees are less likely to extend over parking spaces, especially if they are in large planters, such as those that border parking lots. Overall, the percentage of trees in the lots that actually provided shade to parking spaces was quite variable, and ranged from 20% to 87%. On average, only 46% of the surveyed parking lot trees were actually providing canopy over parking spaces.

The highest levels of shading were seen in parking lots 4 and 7, which had 2 to 3 parking spaces per tree (Figure 3.6-6). However, because some parking lots contain trees that are too small to provide much shade at maturity, the number of parking spaces per tree doesn't necessarily predict shading levels. Parking lot 6, with about 8 parking spaces per tree, had a higher percentage of at least partially shaded spaces than most other lots because many of the trees present were relatively large London plane trees. Lots 8, 9, and 10, all had similarly low shading levels (Figure 3.6-6) even though lots 9 and 10 had much lower space to tree ratios than lot 8 (Figure 3.6-5). In all three of these lots, trees were relatively young and well below their

potential size, although at location 9, poor maintenance and site conditions may also be stunting tree growth. The low level of shading in lot 2 was due to the fact that most trees were in the planter between the street and lot, and few trees were properly positioned within the lot to shade parking spaces.

Influence of parking lot age

Over time, a tree's canopy normally increases in size until it reaches the maximum size it can attain. This maximum size is determined by both the genetics of the tree and the constraints of the site in which it is growing. Pruning can also artificially limit the maximum size a tree will attain.

In general, shading levels in parking lots are assumed to increase over time as trees grow older and larger. However, for the 10 surveyed parking lots, this did not happen. Older parking lots did not have the most shade (Figure 3.6-8, top). In part, this was because they typically had the most empty planting spaces (Figure 3.6-8, bottom). These data suggest that instead of becoming progressively shadier over time, parking lots shade levels tend to level off within a decade or so, and may actually decline thereafter due to the loss of trees.

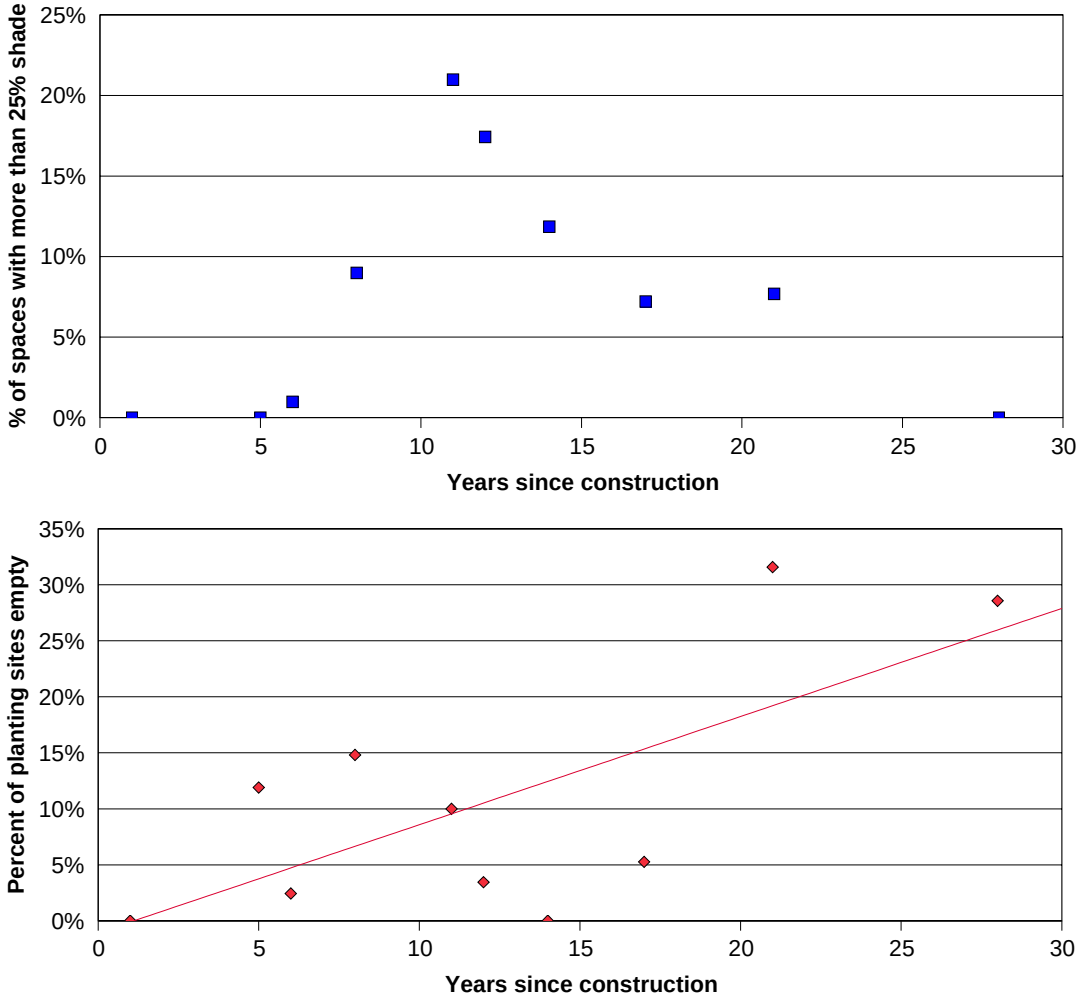


Figure 3.6-8. The percentage of parking spaces with at least moderate amounts of shade (more than 25% shaded) was not correlated with the age of surveyed parking lots (top).

However, the percentage of unoccupied planting sites did tend to increase significantly with the age of the parking lot (bottom).

Species composition

Twenty-five tree species were present in the surveyed parking lots. The number of species per lot ranged from 3 to 8, but plantings were usually dominated by a single species. For example, in lot 4, hackberry trees constituted over 70% of the surveyed trees. In most lots, at least one third of the trees were of a single species, but the most common species generally differed from lot to lot.

Overall, 32% of the surveyed trees were species that have large canopy spread at maturity. About 18% were small-canopied species, including crape myrtle and purple leaf plum. These small trees can extend over parking spaces in some situations but seldom provide significant shading in parking lots. Most of the trees in the surveyed parking lots were species that have moderate canopy spread at maturity, and therefore have a limited ability to shade parking spaces.

Conserved native blue oaks and interior live oaks were present in three lots (Table 3.6-1) and native oak species were planted in two other lots. Retained oaks made up the majority of all large-statured trees that were in the oldest age class (>75% of mature size). Other large-statured species included London plane (11% of surveyed trees), pin and/or scarlet oak (4.7%) and valley oak (12%). Valley oak was planted extensively in lot 10 only.

Although the majority of species present in parking lots were species that have the potential to survive in these relatively harsh sites, some species appear to have poor prospects of long-term survival. Trees that have high water demands, including birch, coast redwood, and Lombardy poplar, were present in several lots. These species were generally planted in linear beds that provide more rooting volume than cutouts surrounded by pavement. However, even in such sites the long-term prospects for these species are not good. As these trees reach the maximum size that the available rooting volume and applied irrigation can support, they will tend to become water-stressed during the late summer. When stressed, these species become susceptible to canker diseases and/or wood-boring insects that can cause the trees to decline.

Tree condition

About 93% of the surveyed trees in the 10 parking lots were in fair to good condition. However, this figure doesn't tell the entire story with respect to tree health in these lots because severely declining and dead trees are likely to be removed rather than left in place. Overall, 9% of all planting spaces were empty, and the percentage of empty sites was as high as 32% in one lot (Figure 3.6-9). When empty planting spaces and declining trees are considered together (Figure 3.6-9), impacts of poor tree health on parking lot tree populations are more obvious. In the case of parking lot 5, the high percentage of missing trees was due to the removal of large eucalyptus trees, which was ongoing at the time of the survey (Figure 3.6-2). It was not clear why these trees were being removed, but factors other than tree health may have been involved.

Poor tree condition was not limited to the oldest parking lots. Lot 9, which was about 5 years old at the time of the survey, had a high combined percentage of missing and declining trees (Figure 3.6-9).

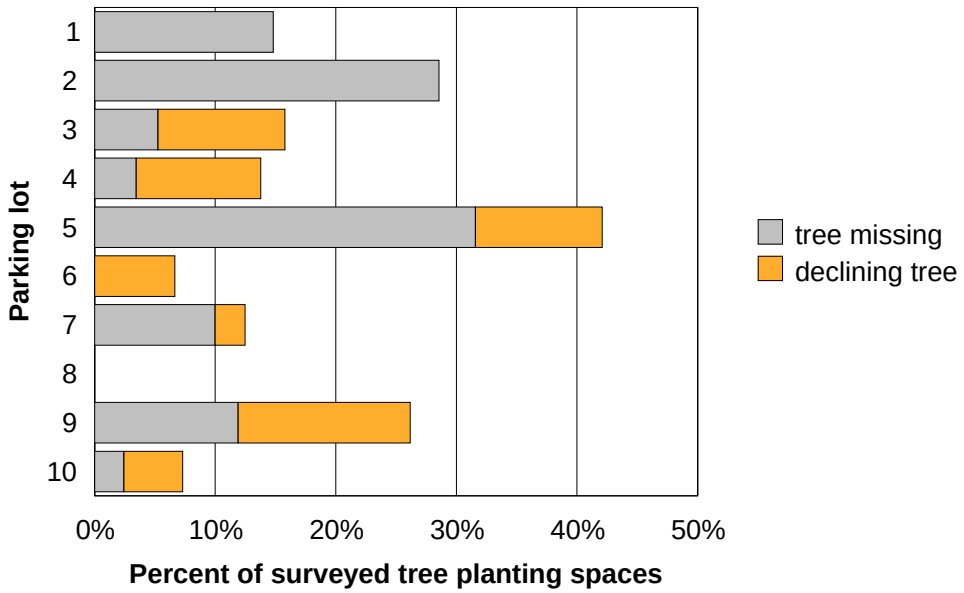


Figure 3.6-9. Combined impacts of missing trees and tree decline on tree populations in the sampled parking lots. Empty planting spaces result from tree removal due to a variety of reasons, although tree decline and death is a common cause of removal.

Because most species in the sample were present in small numbers, few conclusions can be drawn about health trends by species. One clear trend is that many of the conserved native oaks in parking lots were declining In general, mature oaks do not readily tolerate the high amounts of root loss and rootzone alteration that typically occur during parking lot construction. On the other hand, although many are beginning to decline, most of these retained oaks have already outlived some of the trees that were planted when the parking lots were developed. For example, in lot 5, the retained native oaks have already survived over 20 years since the lot was developed, while the planted eucalyptus were removed this past summer. If reasonable efforts are made to protect mature oaks during parking lot development, these trees can provide a substantial amount of canopy for many years, even if their potential lifespan is reduced.

Other species showing relatively high levels of decline in parking lots include Chinese tallow, hackberry, magnolia, and coast redwood. The two latter species generally do not perform well under the especially hot, dry conditions found in parking lots.

Management issues and recommendations

Overall, current levels of shade in Rocklin parking lots are relatively low. Aside from the nuisance factor associated with hot vehicles, lack of shade in parking lots creates a local heat island which increases cooling costs for buildings. Rates of fuel evaporation are also higher from hot vehicles, and the increased volatile organic compound (VOC) emissions lead to higher air pollution levels. In one study, researchers found that parking lot trees in Davis, CA, reduced the surface temperatures of asphalt by as much as 36°F, cabin temperatures of vehicles by over 47°F, and fuel-tank temperatures by nearly 7°F (Scott and others 1999).

Several factors contribute to low levels of shade in Rocklin parking lots. Many of the surveyed lots simply had too few trees in positions to do the job. Ratios of parking spaces to trees only partially explain the situation. Parking lots can have low numbers of well-shaded spaces for several other reasons:

- if many of the trees are planted around edges of the lot, little of the canopy may extend over parking spaces;

- trees with small canopies will provide little shading even at relatively high planting densities. Canopy size may be small because trees are young, have been stunted by poor site conditions or improper maintenance, or are simply small-statured at maturity;

- if trees are planted densely (mainly in linear planters near buildings or the edges of the lot), canopies can overlap and provide less shade than more widely spaced trees would.

Furthermore, parking spaces typically occupy only a portion of the total paved area of a parking lot. In the best-shaded lot (lot 7, Figures 3.6-3, 3.6-7), about 7% of the spaces were more than half shaded. When driveways and aisles between parking spaces are taken in to account, it is clear that the absolute level of canopy cover over the paved portion of this lot is less than 5%. To increase levels of parking lot shade beyond that seen in the surveyed lots, additional tree planting and design changes are needed to maximize the amount of effective pavement shading provided by trees.

Tree health and maintenance are other factors that influence levels of shade that develop in parking lots. If growing conditions are poor, both new and older trees will remain stunted and will not attain the size anticipated in the approved landscape plan. Tree canopy size can also be restricted by improper pruning practices, such as topping. An evaluation of Sacramento's parking lot ordinance, which requires 50% shade after 15 years, found that many trees in parking lots did not attain the canopy spreads shown in plan diagrams (McPherson 2001). Average shading in Sacramento parking lots at least 15 years old was about 8%.

Parking lot canopy cover is also adversely affected by premature tree decline and death. Tree death and removal causes an immediate loss of tree canopy. If trees are not replaced, the ratio of parking spaces per tree is increased over the long term. Even if trees are replaced, the new trees are small and typically do not provide significant shade for a number of years. Any program to develop better-shaded parking lots has to include provisions to replace lost trees and monitor the health and maintenance of existing trees.

As currently constructed, parking lots are typically not good sites for tree growth. This is a recognized problem throughout the United States and ameliorating these harsh growing conditions is the focus of much urban forest research. Soils under pavement are normally compacted to levels that inhibit root growth. Compacted soils may also drain poorly, leading to long periods of soil flooding in the winter or after irrigation. Impervious pavement reduces the amount of water and oxygen in the soil, further restricting root growth. Unshaded pavement absorbs and re-radiates heat, making summer growing conditions especially hot. Due to all of these factors, small cutouts in paved areas are very difficult environments for tree growth. Berms, mounds, and slopes, which are common in planters around the edges of parking lots, can be excessively dry sites because much of the applied irrigation runs off from the sloped areas.

These negative features can be mitigated to some degree through design and construction techniques. Increasing planter size and using linear planters can provide greater amounts of rootable soil, but only if the soil is deeply tilled to reduce soil compaction and improve drainage. Irrigation systems must be designed and operated to ensure that applied water does not simply run off. Some areas of impervious pavement can be replaced by pavers or other pervious materials within the rootzone. Structural soil mixes, which provide adequate levels of aeration and pore space when compacted to engineering specifications, can be also be used to increase the rootable area beneath pavement. Tree species that are more tolerant of heat and drought can be used in preference to species that do not perform well under such conditions. Some of these

these improvements, such as decompacting planting beds and making use of permeable paving materials may require some additional costs at the construction phase, but these modest investments will pay off in terms of reduced maintenance, superior tree performance, and more shade-related benefits over the long term. In older lots, efforts to ensure that missing trees are replaced will be more successful if they include soil modifications to improve growing conditions.

Constructing parking lots usually involves grading, compacting soil to engineering requirements, and building trenches for underground utilities. All of these activities commonly occur in the rootzone of native oaks that are incorporated into parking lots. Such activities destroy sizeable portions of the root systems of these trees, which has negative impacts on tree health, particularly for older trees and those on harsher sites. Given these impacts, it is not surprising that most of the native oaks retained around parking lots were in decline.

At least some of these retained native oaks are trees that have been counted as removed trees (i.e., mitigation fees have been paid as if the trees had been removed) but efforts are nonetheless made to retain the tree, with the knowledge that its lifespan will be significantly shortened. As noted in the discussion of tree canopy cover (Section 3.1), conserved oaks contribute significantly to Rocklin's overall canopy cover, so the retention of trees even on a temporary basis does provide significant benefits. However, whenever existing oaks can be sufficiently protected to allow for long term survival, benefits provided by these mature trees will extend for a longer period, and costs associated with tree removal will be deferred.

Protecting roots only within the dripline is usually insufficient to allow a retained tree to attain a normal lifespan. Revising standards to set a target for protecting at least half of the rootzone and a specific zone around the trunk could improve the long-term survival prospects for retained oaks (see Appendix 7.4). Incorporating oaks as a groups into parking lots can also provide for more root zone protection (Figure 3.6-10). In addition, it is necessary to closely monitor compliance with oak protection measures during development and encourage better stewardship of retained oaks. Because mature trees have such a major effect on shading, local microclimate, and aesthetics, efforts to ensure better protection of retained oaks will provide immediate benefits.

Figure 3.6-10. Conserved mature blue oaks incorporated as a group into a new parking lot, in keeping with the Design Review Resolution adopted in 2000.

Poor pruning practices, such as topping, were not observed in the surveyed lots. Excessive pruning of parking lot trees tends to occur when trees start to grow large enough to obscure signage or when property ownership changes. Given the difficulty associated with developing adequate parking lot shade, practices that could unnecessarily destroy mature canopy need to be prevented before they become a problem. Parking lot owners should be made aware of the need and advantages of developing tree canopy in their lots so that they will take the steps necessary to protect their trees.

References

McPherson, E.G. 2001. Sacramento's parking lot shading ordinance: environmental and economic costs of compliance. Landscape and Urban Planning. 57: 105-123.

Scott, K. I.; Simpson, J. R.; McPherson, E. G. 1999. Effects of Tree Cover on Parking Lot Microclimate and Vehicle Emissions. Journal of Arboriculture 25(3): 129-142.

4. Involving residents in the care of Rocklin's urban forest

People play a major role in urban forest ecology

In Rocklin, as in most urban areas, people are essential to the functioning of the urban forest. Urban environments can severely limit the ability of trees to become established and grow. Soil compaction, paved surfaces, buildings, and utilities can limit both below-ground rooting space and above-ground space for canopy spread. If people did not make space available, plant trees, and maintain them, trees would simply not exist in many urban areas.

Planting, maintenance, and removal

Tree seedlings can sometimes establish in urban areas naturally from seeds dropped from existing trees or buried by animals in favorable sites such as landscape beds. However, generally trees must be planted if they are going to become established in sites where they can grow to maturity. To obtain a healthy, long-lived tree, people need to select the appropriate species for the site, adequately prepare the planting site, and select good quality planting material. Most trees in urban areas need some irrigation, at least during the establishment phase, applied in the right place, at the right times, in the right amounts. Inadequate and excessive irrigation are two common causes of tree death in urban areas, especially in new plantings.

As trees become established, pruning is typically needed to ensure that trees develop a strong structure that will minimize later problems. Large, established trees need to be inspected and pruned as needed to ensure that dead or structurally weak branches do not pose a hazard to people or property within the tree's target zone. In a natural forest, trees eventually die, fail, and decay, recycling their nutrients into the soil. These processes generally aren't allowed to proceed in the urban forest for obvious reasons. Large trees that are declining and hazardous trees typically need to be removed before they can fall, and the resulting waste typically must be disposed of actively, rather than passively decaying on the landscape.

Providers of tree care

A variety of people are necessarily involved in managing the various phases of trees' life cycles in the urban forest. Informed and trained residents can manage many of the basic aspects of tree care on their own, including planting, irrigation, and basic pruning of young trees. Even if these tasks are delegated to landscape maintenance contractors, property owners need to have enough basic knowledge about tree care to ensure the quality of tree care they are purchasing.

Because of the specialized skills and knowledge needed, trained tree care professionals are needed for most work on large mature trees. Again, property owners need to know enough to ensure that they hire a qualified professional that will protect their investment in their trees.

City staff and their contractors manage the urban forest on City owned lands. In addition, City staff and their consultants can provide expertise needed to help manage the urban forest as a cohesive unit. The City can play a leadership role by looking at processes that extend beyond individual properties and providing strategies and technical information that will help further the community's urban forest goals. By providing locally appropriate

information on tree planting and care, the City can help residents make good decisions on tree selection, planting, and care.

Partnerships between the community residents and the City

The majority of Rocklin's urban forest is and will continue to be managed by individual landowners. If the City has an overall goal of maintaining and improving its urban forest, it needs to play a role in helping residents understand the importance of the urban forest and how to successfully manage trees on their properties.

City-sponsored efforts

Many cities, especially larger ones, have a position of City Arborist or Urban Forester. This is a staff member that not only coordinates and oversees tree care on City lands, but also interacts with the community. The City Arborist/Urban Forester provides information on City policies and regulations and tree care, and may even conduct inspections of privately-owned trees to investigate health problems or safety issues. By providing this outreach, the City helps improve the quality of tree care on private lands, helps to secure compliance with local regulations, and gains insight into tree problems that may impact City lands and the community as a whole. The City can provide this type of outreach without a dedicated City Arborist/Urban Forester position. However, it is preferable to have the primary responsibility with a single staff position to maintain consistency and to provide a single point of contact for residents. Support for eventually developing a City Arborist position for Rocklin was expressed at the July 2004 Urban Forest Community Meeting (Appendix 7.3).

As part of this document, Phytosphere has developed educational handouts on tree planting and placement, irrigation, and pruning, which are included in Appendix 7.7. These information sheets can be distributed by making them available at public buildings (City Hall, community centers, library) and posting them on the City web site. With some additional effort, it may be possible to make these sheets available at local nurseries, garden centers, home improvement centers, and equipment rental outlets where residents buy trees and rent or buy tools used for tree pruning. The tree lists in section 7.1.2 (Tables 7-1, 7-2) should also be made available on the City website and in printed form to help residents select appropriate tree species.

City newsletters (such as the Recreation Guide) and utility bill inserts can also be used in the outreach effort. These avenues can be used to disseminate information directly (e.g., the handouts or excerpts from them, City tree regulations and guidelines, tree pest updates, etc.) or can be used to point residents to where the information can be accessed. Workshops on tree selection, planting, and care could be offered by the City through the Community Services and Facilities Department recreation class offerings or as special events (e.g., in association with Arbor Day, Make-A-Difference Day, etc.).

Some cities leverage their buying power to provide financial support to residents that might not otherwise be able to afford high quality tree care. A program being implemented in Visalia allows residents to have trees pruned by the city's oak tree pruning contractor at the city's reduced programmatic (i.e., "bulk") rate. In this program, the city, rather than the contractor, bills the residents that make use of the service. The pruning contractor is able to bid a lower overall per-tree cost due to efficiencies of size and the certainty of a long term contract. The city benefits by ensuring that landmark oaks on private lands are pruned

according to the city's standards. This model could also be used by homeowner associations to provide better quality tree care at a reduced price to association members.

On a smaller scale, tool loan programs can be used to help residents perform proper pruning on young or small trees. By providing City-approved pruning guidelines with tools that are loaned either free or with a minimal charge, the City could provide a benefit to residents at the same time that it provides information that will promote good tree care practices.

Community tree groups and volunteer projects

Even in communities that have a City arborist, non-profit community tree groups often work in partnership with the City to provide community outreach and education and to help coordinate tree planting and tree care activities by community volunteers. Currently, there are at least 75 established community tree groups that are members of California ReLeaf, an umbrella organization that provides networking and support for these organizations. Because community tree groups make use of volunteers, they are able to leverage small amounts of funding to provide greater levels of service. Many community groups are also very successful at raising funds from the business community as well as the community at large to help support their efforts. In recognition of the important role that community groups play in urban forestry, a number of grant programs are available only to such groups or to cities that partner with such groups on a project.

A significant amount of effort is needed to establish and run a community tree group either on a fully volunteer basis or as a registered nonprofit organization. At least one highly motivated leader/organizer is needed as well as a contingent of active volunteers. Such groups also benefit from in-house expertise, such as from local tree professionals. Although the City can promote and facilitate the establishment of a community tree group, the availability and interest of community members is ultimately needed to develop a successful group.

In the absence of a dedicated community tree group, the City can continue to partner with existing community organizations to coordinate tree planting and care projects by community volunteers. As noted in Section 3.2, the City of Rocklin has involved community volunteers in native oak restoration on City parkland, and is continuing to expand these successful efforts. In the fall of 2004, Public Works coordinated plantings of native trees by community volunteers on public open space lands. One of the plantings included plant materials propagated in conjunction with the Rocklin High School Environmental Club. In addition to local schools, including Sierra College, local members of the UC Master Gardeners Program, the local California Native Plant Society chapter, and similar groups could be approached to help in projects that may involve longer-term involvement than the typical one-day planting event.

Careful planning and concerted efforts are necessary to coordinate successful community volunteer projects. Projects need to be well-organized so that participants can feel like their time is being put to good use. Planting projects need to be followed up by necessary tree care, either by the City or by additional volunteer work, so that volunteers can see that their efforts are valued and result in a lasting legacy. Despite the effort required, successful volunteer projects provide a wide variety of long-lasting benefits. Besides the trees that are planted and cared for, community volunteer tree projects provide opportunities for residents to

come together, work together, and form bonds with each other, the community, and their local environment.

5. Funding sources

Internal funding sources

Currently, funding for the planting and care of trees on City of Rocklin lands comes from several sources. Developers are required to plant landscaping, including trees, in new City parks and public parkways constructed as part of a development plan. Subsequent maintenance of trees in these new public landscaping areas is funded through local assessment districts. In older areas that do not have assessment districts, the ongoing maintenance and eventual replacement of public trees along streets and in parks is derived from the City's General Fund, as part of the overall budget for the Public Works Department and the Parks Division of the Community Services and Facilities Department.

Under the City of Rocklin's Oak Tree Ordinance, the City also collects fees into the Oak Tree Preservation Fund, which may be applied to the protection and restoration of the City's oak woodlands. However, as the City approaches full buildout, payments into the Oak Tree Preservation Fund are likely to diminish. Hence, it may be prudent to set aside at least a portion of the Fund to establish an endowment that can be used to fund maintenance and restoration efforts on an ongoing basis. Assuming a 5% annual return on the invested endowment, each $100,000 of the endowment would generate $5,000 per year, excluding costs associated with the administration of the endowment fund. These costs can range up to about 1% of the investment per year, but actual costs will depend on the trustee chosen to administer the endowment.

External funding sources

Grants provided by other agencies and organizations can serve to augment the City's existing sources of funding. However, many grant programs require that some matching funding be provided by the applicant.

Various grant programs administered by state and federal agencies or private foundations and organizations provide funding for a variety of projects related to urban forestry. Some grants are available directly to local governments, whereas others are only available to other entities, such as schools or non-profit community tree groups (Table 5-1). By partnering with other groups, the City can expand its options for obtaining urban forestry grant funding.

External funding programs may change over time. Some state programs are funded by specific ballot propositions and have a limited lifespan. New programs also become available over time. The listing below includes grant programs that were in existence as of Fall 2004. Individual granting agencies and organizations should be checked for the current availability, guidelines, and deadlines for the grants listed. In addition, the website http://www.grants.gov/ provides information on competitive grant opportunities from all Federal grant-making agencies and should be monitored for new federal grant programs. The Foundation Center website (http://www.fdncenter.org/) provides a variety of information related to grants provided by private foundations.

Table 5-1. Summary of various grant programs available for providing funds for urban forestry projects and organizations.

Grant provider	Grant program	Local governments	Schools / teachers	Non-profit organizations
U.S. Environmental Protection Agency	Environmental Education Grants		yes	yes
State of California, Resources Agency	Environmental Enhancement and Mitigation Program	yes		yes
State of California, Dept. of Forestry and Fire Protection	Proposition 12 Tree Planting Grants	yes		yes
State of California, Dept. of Forestry and Fire Protection	Leaf-It-To-Us Grants		yes	
California ReLeaf / California Dept. of Forestry and Fire Protection	California ReLeaf Urban Forestry Grant Program			yes
State of California, Wildlife Conservation Board	Oak Woodlands Conservation Program	yes		yes
State of California, Wildlife Conservation Board	California Riparian Habitat Conservation Program	yes		yes
State of California, Dept. of Water Resources	Urban Streams Restoration Program	yes		yes
American Forests	American Forests/Global ReLeaf Forest Cost-Share Grants	yes	yes	yes
National Fish and Wildlife Foundation	various	yes	yes	yes
California Architectural Foundation	William Turnbull Jr. Environmental Education Grant		yes	yes
The Home Depot Foundation	Home Depot Grants for the Environment		yes	yes
The Conservation Fund	Kodak American Greenways Awards Program	yes		yes (receive preference)
Great Valley Center	LEGACI Grant Program			yes
National Tree Trust	Roots and Seeds Programs			yes
WalMart / Sam's Club	Community Matching Grant Program	yes	yes	yes
ESRI	various			yes

State and federally-funded grants

California ReLeaf Urban Forestry Grant Program

http://www.californiareleaf.org/grants.html

With the goal of enhancing and preserving trees in urban communities, Congress passed the Urban and Community Forestry Assistance Act of 1990, authorizing funding for urban forestry education and technical assistance. Funds are made available through the USDA Forest Service to each state for community-based urban forestry projects. California's portion of this funding is administered by the California Department of Forestry and Fire Protection (CDF). CDF has contracted with California ReLeaf (formerly affiliated with the National Tree Trust and the Trust for Public Lands) to implement and administer this grant program.

The intent of the program is to assist new and emerging grassroots groups with tree-related projects, and to provide more extensive capacity-building support for established community-based organizations with a proven track record in urban forestry. Groups with limited experience in urban forestry are encouraged to keep their proposals modest and/or work with an established tree group. Incorporated nonprofit organizations, unincorporated

citizen groups (e.g., neighborhood associations), and City-affiliated volunteer entities (e.g., tree advisory boards, beautification commissions) are eligible to apply. These funds are not available to individuals or public entities, such as cities, counties, and school districts. In the 2004 grant program year, the minimum grant request was $1,000; the maximum was $7,500.

California Riparian Habitat Conservation Program

http://www.wcb.ca.gov/Pages/california_riparian_habitat_conservation_program.htm

The program has a basic mission to develop coordinated conservation efforts aimed at protecting and restoring the state's riparian ecosystems. Grants are for riparian conservation purposes, including land acquisition and environmental restoration. Examples of appropriate projects include removal of nonnative invasive plant species and restoration (active or passive) of native riparian vegetation and bank stabilization and revegetation to control excessive erosion and establish a functional riparian corridor.

Environmental Protection Agency Environmental Education Grants

http://www.epa.gov/enviroed/grants.html

The Grant Program sponsored by EPA's Office of Environmental Education supports environmental education projects that enhance the public's awareness, knowledge, and skills to help people make informed decisions that affect environmental quality. EPA awards grants each year based on funding appropriated by Congress. Annual funding for the program ranges between $2 and $3 million. More than 75 percent of the grants awarded by this program are for less than $15,000.

Environmental Enhancement and Mitigation Program

http://resources.ca.gov/eem/

The Environmental Enhancement and Mitigation Program (EEMP) was established by the Legislature in 1989. It offers a total of $10 million each year for grants to local, state, and federal governmental agencies and to nonprofit organizations for projects to mitigate the environmental impacts caused by new or modified state transportation facilities. State gasoline tax monies fund the EEMP. Grants are awarded in three categories:

Highway Landscape and Urban Forestry-- Projects designed to improve air quality through the planting of trees and other suitable plants.

Resource Lands -- Projects for the acquisition, restoration, or enhancement of watersheds, wildlife habitat, wetlands, forests, or other natural areas.

Roadside Recreational -- Projects for the acquisition and/or development of roadside recreational opportunities.

Leaf-It-To-Us Grants

http://www.ufei.org/files/grantinfo/LITUGrants.html

The purpose of these grants is to (1) foster an appreciation and increased interest among school students on the role trees play in our urban environments, and (2) promote increased awareness in the proper planting and care needed to foster healthy community forests while incorporating community involvement, participation, education, and stewardship. Assistance is limited to the purchase of trees and supplies necessary to improve the learning environment of school student campuses throughout California's school environments. Eligible projects

include planting trees to shade concrete/asphalt, walkways, parking lots, school buildings, and playground areas.

Oak Woodlands Conservation Program

http://www.wcb.ca.gov/Pages/oak_woodlands_program.htm

The Oak Woodlands Program is designed to accept applications from private landowners, local governmental entities, park and recreation districts, special districts, local resource conservation districts, nonprofit organizations and state departments. This grant program provides funds for the purchase of oak woodland easements, restoration or enhancement projects, long-term leases, and cost-sharing incentive payments. At least 80% of the program funds shall be expended for the purchase of conservation easements, grants for land improvements or cost-sharing incentive payments. Up to 20% of the program funds may be used for public education and outreach, assistance to develop and implement oak conservation elements in local general plans or technical assistance designed to preserve oak woodlands. Overall, $10 million has been provided to fund this program.

To be eligible for funding, the City would need to have a prepared an Oak Woodlands Management Plan that meets specific guidelines, most of which are met by the information in Sections 3.1 and 3.2 of this document. All projects must be certified by the City as being consistent with the locally approved Oak Woodlands Management Plan. To qualify for funding consideration for restoration, enhancement, purchase of an oak conservation easement or long-term agreement, projects must meet one or more of the specified guidelines and selection criteria and the oak stand must have greater than 10 percent canopy. To qualify for funding consideration for a public education, outreach or technical assistance project, the project must meet specified guidelines.

Green Trees for the Golden State

http://www.ufei.org/grantinfo.lasso

These grants provide funds to help cities, counties, districts and non-profit 501c(3) organizations plant trees in public urban settings and provide three years of care for those trees. The goals of the grant program are to improve urban environments and to promote increased awareness in the proper planting and care needed to foster healthy community forests while incorporating community involvement, participation, education and stewardship. The original grant funding was provided by Proposition 12 in the year 2000.

Urban Streams Restoration Program

http://www.watershedrestoration.water.ca.gov/urbanstreams/

USRP provides grants for local projects that reduce flooding and erosion of urban streams, improve environmental values and promote community stewardship. Past grants have funded a variety of activities: creek cleanups; eradication of exotic or invasive plants; revegetation and bioengineering bank stabilization projects; channel reconfiguration to improve stream geomorphology and aquatic habitat functions; and acquisition of property critical for flood management.

A project may be eligible for a USRP grant if most of the questions below can be answered with "yes":

1. Does the proposed project address a stream-related problem?
2. Is flooding and/or erosion from the stream affecting an urban area?
3. Will the project utilize cost-effective, low-maintenance, and environmentally-sensitive stream management techniques to decrease flooding or erosion?
4. Will the project help restore the natural environmental values of the creek (e.g. restore hydrology and biology closer to conditions found on a naturally-functioning creek system)?
5. Are there two sponsors for the project: a local (not state or federal) government sponsor, and a citizen's group?
6. Are the citizens of the affected area directly involved to plan, carry out, and maintain the project?
7. Will the project better inform the public about stream and watershed management and the impacts of development on flooding and erosion?

The California Department of Water Resources (DWR), Urban Streams Restoration Program (USRP) had $4.6 million in Proposition 40 funding for the 2005 grant year. Grant awards are limited to $1 million per project and have averaged approximately $350,000.

Non-governmental grants

American Forests/Global ReLeaf Forest Cost-Share Grants

http://www.americanforests.org/global_releaf/grants/

American Forests is looking for quality tree-planting projects to be funded by their ReLeaf Forests ecosystem restoration program. They are particularly interested in partnering with private and public sector organizations and agencies to plant trees and improve the environment in projects that would otherwise not be feasible. They support projects that plant the right trees in the right places for the right reasons.

ESRI-Sponsored Grants

http://www.esri.com/grants/esri/conservation.html

ESRI, a leading geographic information systems (GIS) software developer, continues to seek relationships with organizations by partnering in common task initiatives. ESRI has found the best way to forge relationships is through education and grant programs. Free software, hardware, and training bundles are available under several ESRI-sponsored grant programs.

Great Valley Center LEGACI Grant Program

http://www.greatvalley.org/legaci/index.aspx

The Great Valley Center serves the Central Valley's 19 counties by supporting innovative proposals for nonprofit work in the areas of Land Use, Economic Development, Growth, Agriculture, and Community Investment. During the past six years, grant sizes have ranged from $500 to more than $20,000, the average being $10,000. To date, about one in three applicants have received awards

The Conservation Fund/Kodak American Greenways Awards Program

http://www.conservationfund.org/?article=2106

Kodak, The Conservation Fund, and the National Geographic Society, provide small grants to stimulate the planning and design of greenways in communities throughout America. The annual grants program was instituted in response to the President's Commission on Americans Outdoors recommendation to establish a national network of greenways. Made possible by a generous grant from Eastman Kodak, the program also honors groups and individuals whose ingenuity and creativity foster the creation of greenways. Awards will primarily go to local, regional, or statewide nonprofit organizations. Although public agencies may also apply, community organizations receive preference.

National Fish and Wildlife Foundation

http://www.nfwf.org/programs.cfm

The National Fish and Wildlife Foundation funds projects to conserve and restore fish, wildlife, and native plants through matching grant programs. Local governments, educational institutions, and nonprofit organizations are welcome to apply for a general matching grant throughout the year. In addition to the general matching grant and small grant programs, the Foundation administers a number of special grant programs with specific guidelines and time-lines.

National Tree Trust Roots and Seeds Programs

http://www.nationaltreetrust.org

The National Tree Trust believes strong organizations are key to healthy urban and community forests. Through the Seeds Program grant, established urban and community forestry organizations use funding for organizational needs, which include rent, staff salary and purchase of upgraded technology.

The Roots Program grant funding is targeted at projects designed to engage the community and improve the health of their urban and community forest. These projects include reaching out to underserved youth to plant and maintain trees, educating the public about the needs and values of the urban and community forest, and building community partnerships to care for the trees in the community.

The Home Depot Grants for the Environment

http://www.homedepotfoundation.org

The Home Depot Foundation considers requests for grants to: 1) conserve forestlands and/or promote responsible forestry management, 2) encourage green building and sustainable design in affordable housing, 3) identify and help alleviate the causes of lead poisoning in children in at-risk communities, and 4) promote community recycling and clean-up.

William Turnbull Jr. Environmental Education Grant

http://www.aiacc.org

The California Architectural Foundation is a non-profit organization dedicated to the advancement of architecture and the science and art of environmental design, preservation and construction. The Foundation promotes these elements by enhancing the standards of architectural education, training and practice through education and research and soliciting contributions for these purposes.

In 1998, the Foundation initiated a new grant program, the "William Turnbull Jr., FAIA, Environmental Education Grant," with the purpose of fostering public education and public awareness programs related to the built and natural environment. The Board of Regents administers the grant program in accordance with the Foundation's goals and community needs. Grant amounts vary between $500 and $2,000.

WalMart/Sam's Club Community Matching Grant Program

http://www.walmartfoundation.org/

The Community Matching Grant Program is the largest program funded by Wal-Mart and Sam's Club. The Matching Grant program allows local nonprofit organizations to hold fundraisers at their local Wal-Mart or Sam's Club. Wal-Mart and Sam's can elect to match a portion of the funds raised up to $1,000. Events held off the premises of a Wal-Mart store or Sam's Club are also eligible for funding when a Wal-Mart or Sam's Club associate is actively involved in the event. Additionally, once the Wal-Mart or Sam's Club has met certain criteria in the Matching Grant Program each year, a second source of funding is awarded to the store / club to use in the community. These funds do not require a fundraiser to be held, instead the funds can be awarded directly to a deserving organization.

7. Appendices

Appendix 7.1. Methods used for assessments

7.1.1. Assessing changes in overall canopy levels within the City from 1952 to 2003.

Phytosphere used 1998 aerial photographs supplied by the City of Rocklin to delimit the approximate boundaries of the developed portions of the City. These boundaries were digitized in a geographic information system (GIS) covering Rocklin. The delimited area covered about 13 square miles, or approximately two-thirds of the current City area. Phytosphere also contacted the County of Placer to find historical aerial photo coverage of the Rocklin area. Information provided by George Nunes of the Placer County Public Works Department and an image of the index sheet located in the U.C. Davis Library were used to add the approximate boundaries of the available historical aerial images to the GIS. Stratified random sampling was used to identify sample points that were within the delimited developed area and for which historical aerial coverage was available.

Sample points were located on prints of the historical (1952) aerial photographs at the Placer County offices in January 2004 by Phytosphere. The area around each sample point was photographed at a fixed magnification using a 4 megapixel digital camera. Digital images of these sample areas were subsequently matched to the degree possible with the most recent (August 2003) aerial images provided by the City of Rocklin. Once both digital images were aligned and adjusted to the same magnification, a grid was superimposed over both images that served as the actual sample plot. If necessary, the grid was shifted to ensure than adjacent sample areas did not overlap. Because the 1952 aerial photos were not orthocorrected (i.e., they were not corrected to show a direct overhead perspective), the sample plots (Figure 3.1-4) vary slightly in area and shape.

Phytosphere assessed whether canopy cover was present or absent at each of a minimum of 575 dots randomly superimposed over the sample area on the image. Land uses (% developed, % residential, % commercial/industrial) within each sample area were visually estimated with the aid of a superimposed grid. Canopy measurements were made on 23 sample plots. The size of the sample plots averaged 159 acres (about 0.25 square mile). A total of 3,364 acres (5.26 square miles) were sampled for both photo dates, using a minimum of 13,800 individual dots for each year counted.

7.1.2. Oak woodland evaluation methods

In consultation with City staff, Phytosphere identified 11 locations with oak woodlands to be included in the evaluation. All areas were either currently owned by the City of Rocklin, or in the case of the Greenbrae Road site, was to be transferred to the City as a condition of project approval (Table 3.2-1, Figure 3.2-1). At the China Garden Rd. site, only the south portion of the parcel was surveyed; this is beyond the area being considered for development.

Stratified random sampling was used to establish the position of permanent survey plots in these woodlands. Using May 1993 aerial imagery, wooded areas within the designated City-owned parcels were located. Wooded areas were subdivided into subunits no larger than about 6 acres. Random coordinates from within each subunit were generated and uploaded to

a GPS receiver that was used to locate the coordinates in the field. The coordinates were used to establish the center of each survey plot. Survey plots were 52.5 feet (16 m) radius circular plots (0.2 acres) for most open woodlands, but in dense riparian woodlands, the plot radius was reduced to 26.25 feet (8 m) (area=0.05 acres). Data in survey plots was collected in August 2003, using the attached datasheet. Plot coordinates are given in Table 7-1 below.

Two to three trees closest to the plot center were tagged with 1 inch diameter round aluminum tree tags secured with aluminum nails. Tags face the plot center and are placed at a height of about 6 to 8 feet to reduce vandalism. Phytosphere's tag numbers range from 784 to 842. In many of the locations other types of aluminum tags are present on some trees due to previous tree surveys.

Data were collected on both tagged trees and non-tagged trees within the plots. Data on other plot characteristics were also recorded, as shown in the attached datasheet. In addition to data collected within plots, additional observations were made on the overall composition and condition of the woodlands within each surveyed location.

Table 7.1-1. Coordinates of oak survey plots.

Plot	Latitude	Longitude	Location
1	38.78930167	-121.24708833	Johnson-Springview Pk
2	38.79136071	-121.24660707	Johnson-Springview Pk
3	38.79280860	-121.24680472	Johnson-Springview Pk
4	38.79442940	-121.24895727	Johnson-Springview Pk
5	38.79130019	-121.24945734	Johnson-Springview Pk
6	38.78792538	-121.23558621	City Hall area
7	38.79528210	-121.22383830	Sierra Meadows Park
8	38.78225662	-121.25259569	Sunset East Pk
9	38.78553500	-121.25251500	Sunset East Pk
10	38.78142379	-121.25303951	Sunset East Pk
11	38.78844221	-121.25101226	Antelope Creek Pk
12	38.77968295	-121.22753288	Greenbrae Rd
13	38.77806818	-121.22781375	Greenbrae Rd
14	38.77562251	-121.23709780	China Garden Rd
15	38.77489538	-121.23972310	China Garden Rd
16	38.80418024	-121.26555797	Pebble Creek Pk
17	38.80526167	-121.26940073	Pebble Creek Pk Park Rd
18	38.80635199	-121.26604496	Pebble Creek Pk Park Rd
19	38.80676170	-121.26455340	Pebble Creek Pk Park Rd
20	38.83304165	-121.24919968	Pebble Beach Dr
21	38.83714677	-121.24574566	Pleasant Grove Creek

Oak woodland datasheets, definitions, and protocols

The following three pages show copies of the datasheets and the data definitions and protocols used in the oak woodlands evaluations.

Oak Woodland Datasheet: Date: Location:

Plot number	UTM X	UTM Y	waypt
To / From		dist m	azm °
Plot slope %	plot aspect °	stumps	
Plot canopy cover 0-6:	Shrub cover 0-6:	herb cover 0-6:	Bare 0-6:
10 yr gap - yes no	in stand / stand edge	road/ trail / fence /	in plot /within m
disturbance/mgmt			

TAGGED TREES

Tag number:			
species	Qd Qw QL Ac Ps	Qd Qw QL Ac Ps	Qd Qw QL Ac Ps
Origin / Number of stems	seed / sprout	seed / sprout	seed / sprout
Distance to plot center	m	m	m
Azimuth tree to plot center	□ from center °	□ from center °	□ from center °
DBH stems>3cm			
Decline	yes no	yes no	yes no
sky exposed canopy %: 0-6			
thinning: 0-2			
epicormics 0-2			
canopy dieback: 0-6			
decay impact: 0-3			
canker rot (CR) / fungi			

☐☞**Circle sp. name if in overstory** PLOT TREES OTHER THAN TAGGED TREES

Coding: count/ status/m if mult stems(if >1)/ u if understory: decline 3 stem = Cm; live 1 stem understory = Lu

Live deCline - Xdead	3-10 cm	10-30 cm	30-60 cm	>60 cm	adv reg1 s0	regen s1&2	sapl regen s3
Q douglasii							
Q lobata							
Q wislizeni							
P sabiniana							
Buckeye							

UNDERSTORY SPP

Poison oak	Honeysuckle	Toyon	Coffeeberry	Wild rose
Rhamnus ilicifolia	Ceanothus cuneatus	Manzanita		Rubus
Yellow Starthistle				
Nassella				

browse impact 0-3	Inonotus / Phellinus / Ganoderma / Laetiporus / canker rot / root disease/ rodents /deer /cattle
photos	

0-6 SCALE
0: not seen
1:< 2.5%
2: 2.5 <20%
3: 20 < 50%
4: 50 < 80%
5: 80 < 97.5%
6: > 97.5%

0-2 SCALE
0 - trace or not seen
1 - slight / few
2 - definite / many

0-3 Decay Impact Scale
0- no impact
1-low impact
2- moderate impact
3 high impact

Understory = sky exp ≤ 2
regen count to 10, then to nearest 10
s0: <1 cm basal
s1-2: >1 cm basal, up to 1 cm dbh
s3: 1-3 cm dbh

Oak Woodland Datasheet (page 2 of 2)
Plot number Date: Woodland type_____

Other species in vicinity

Dominant	Common	Uncommon

Human use: low moderate heavy
access -
use types/impacts:

Management issues:
exotics

human use

regeneration

other

Oak Woodland Datasheet definitions and protocols

DBH – diameter at 4.5 feet (137 cm) above grade, measured at center ground elevation for trees on slopes

Oak regeneration size classes:
S0 – less than 1 cm basal diameter
S1-2 – at least 1 cm basal diameter, less than 1 cm DBH
S3 – 1 to 3 cm DBH
Saplings with at least 1 stem 3 cm DBH or larger are counted in tree size classes

Multistem: 2 or more stems originate at or within 30 cm of soil surface; two stems may be appressed to a height greater than 30 cm, but if origin is clearly below this level, they are scored as multiple stems

Multistem non-tally trees - count multistemmed tree as one tree; overstory if any stem in overstory. Count stems separated by 1 m or more as separate trees even if they have originated from the same ancestral stump.

Decline: Trees in severe decline, i.e., overall tree condition is poor enough that tree death within 10 years is likely.

Dead: Dead trees are scored only if they appear to have died within the past 10 years. Trees with entirely dead top but with live basal sprouts are rated as dead.

Sky exposed canopy: percent of tree canopy projection that is exposed to overhead light, i.e., percent that would be visible in an overhead aerial photo.

Overstory/understory designation: Overstory- trees with intermediate to dominant canopy position (overhead sun) = sky exposed canopy of 2 - 6; understory if overtopped = sky exposed canopy of 0 or 1 (<2.5%)

Shrub species are classified under shrubs even if greater than 3 cm in DBH

7.1.3. Methods for assessing City park trees

Based on discussions with Parks Division of the Department of Community Services and Facilities staff (Don Jorgenson, Shawn Darling), Phytosphere included details that focused on long- and short-term management issues associated with tree care in the City park tree survey. Because surveying was more intensive and time consuming than the other urban tree assessments conducted in this project, the number of parks sampled was limited.

Stratified random sampling was used to select eight parks for the survey that were distributed throughout the City and represented a range of ages since construction. Phytosphere surveyed the developed portions of the selected parks, not including adjoining oak woodland areas or oaks in riparian corridors. A GPS receiver was used to delineate the surveyed portions of each park. Only the southwestern portion of Twin Oaks Park was included in the survey for that location. The surveyed area of Twin Oaks Park included an open turf area and a playground.

Data collected on trees in the sampled areas included:

Species or species group Tree species was noted for the most common and conspicuous species. Less common species were identified only to genus (e.g., pines, maples) or in general groups (e.g., miscellaneous hardwoods).

Condition class: Trees were placed into one of three condition classes.

Healthy - Trees in fair or better condition

Decline - Trees in poor condition; generally such trees are not likely to show significant growth or survive more than 10 years

Dead - Dead trees.

Age class: Age class was rated as the percent of the final canopy size that the tree is likely to achieve at maturity at the site, which may be less than the reported maximum size. For example, though coast redwood can grow to great size in its native range, the maximum size that these trees typically reach in the Sacramento Valley is much more modest. This provides an estimate of how much additional canopy cover the trees are likely to provide as they mature. The age classes used were:

(1) Less than 25% of size at maturity

(2) 25 to less than 75% of size at maturity

(3) 75% or more of size at maturity

Empty planting spaces. Stumps of removed trees or obvious blank areas in planting beds were counted as empty planting spaces. Surveyors did not attempt to estimate how many additional trees could be added to the sites.

Management concerns: The most obvious short and long-term tree management concerns that applied to the rated trees were noted as shown in Table 7.1-2. These ratings are based on only a quick evaluation, and may not include all maintenance and management items. The concerns were coded by species. For analysis, categories A and C were combined.

Table 7.1-2. Management concern categories rated for trees in the assessment of City park trees.

Category	Type	Notes
A	Structure / Pruning	Tree structure is poor and/or pruning is needed to improve structure or remove dead wood.
B	Current or potential hazard (with target)	Tree or part likely to fail in the future due to current or projected conditions and could damage property or cause injury.
C	Clearance	Trees needing pruning for clearance
D	Tree placement / excessive density	Poor tree placement (e.g., under existing mature canopy) and/or excessive tree density
E	Diseases / pests	Includes canker rot and other decay fungi in oaks, other problems including sunburn and borer invasion in other species
F	Rootzone problems (conserved trees primarily)	Past or current fill, grading, compaction, paving, and/or irrigation of an existing tree's rootzone having an adverse effect on tree health and survival
G	Excessive surface roots	Surface roots are were numerous enough and large enough to be damaged by mowers or otherwise subject to injury and/or constitute a tripping hazard
H	Mechanical damage	Most commonly damage to lower trunk from mowers

7.1.4. Methods for assessing City-maintained trees along streets and parkways

Stratified random sampling was used to establish the location of survey plots along streets for which the City currently maintains shoulder and/or median tree plantings. Ron Patten of Public Works provided Phytosphere with a map showing street segments that included City-maintained trees. Sampling points within the City were selected by first superimposing random geographic coordinates on the map and then finding the intersection of City-maintained streets that was closest to each random point. These intersections were used as the starting points of survey plots. Each plot proceeded along the selected street in a randomly-selected direction from the starting point for a distance of about 0.15 mile (250 m). GPS readings were taken at both endpoints of the street segment to estimate the total distance of each surveyed street section.

Only City-maintained trees along the street segment were included in this survey. These included both median and shoulder plantings where applicable.

Data collected on trees in the sampled areas included:

Species or species group: Tree species was noted for the most common and conspicuous species. Less common species were identified only to genus (e.g., pines, maples) or in general groups (e.g., miscellaneous hardwoods).

Condition class: Trees were placed into one of three condition classes.

Healthy - Trees in fair or better condition

Decline - Trees in poor condition; generally such trees are not likely to show significant growth or survive more than 10 years

Dead - Dead trees.

Age class: Age class was rated as the percent of the final canopy size that the tree is likely to achieve at maturity at the site, which may be less than the reported maximum size. For example, though coast redwood can grow to great size in its native range, the maximum

size that these trees typically reach in the Sacramento Valley is much more modest. This provides an estimate of how much additional canopy cover the trees are likely to provide as they mature. The age classes used were

(1) Less than 25% of size at maturity

(2) 25 to less than 75% of size at maturity

(3) 75% or more of size at maturity

Empty planting spaces: The count of empty planting spaces was based on gaps in the regular planting patterns and the presence of stumps from removed trees.

7.1.5. Methods for assessing privately maintained trees along residential streets

Phytosphere used stratified random sampling to establish the location of survey plots in single-family residential neighborhoods throughout the City. First, random geographic coordinates were generated for locations within the City. If these coordinates fell within residential neighborhoods, a 0.1 mile long sample plot was established along the street section. At the site, one end of the sample area was identified from a map showing the starting coordinates and a car odometer was used to establish the other end about 0.1 mile away. GPS readings were taken at both endpoints of the street segment to provide an estimate the total distance of each surveyed street segment.

Data were collected from both sides of the sampled street segments by an evaluator walking along the segment. Data were recorded for all trees in front yards in the segment. In areas where the side of the lot was along the street, back or side yard trees were included in the survey if they were within the average front yard setback distance.

Data collected on trees in the sampled areas included:

Species or species group: Tree species was noted for the most common and conspicuous species. Less common species were identified only to genus (e.g., pines, maples) or in general groups (e.g., miscellaneous hardwoods).

Condition class: Trees were placed into one of three condition classes.

Healthy - Trees in fair or better condition

Decline - Trees in poor condition; generally such trees are not likely to show significant growth or survive more than 10 years

Dead - Dead trees.

Age class: Age class was rated as the percent of the final canopy size that the tree is likely to achieve at maturity at the site, which may be less than the reported maximum size. For example, though coast redwood can grow to great size in its native range, the maximum size that these trees typically reach in the Sacramento Valley is much more modest. This provides an estimate of how much additional canopy cover the trees are likely to provide as they mature. The age classes used were:

(1) Less than 25% of size at maturity

(2) 25 to less than 75% of size at maturity

(3) 75% or more of size at maturity

Canopy at edge of pavement: Midday shading of streets requires that tree canopies extend over the pavement. Evaluators noted, by species, the number of trees whose canopies (1) currently extended past the edge of pavement (beyond the street edge of the curb) or (2)

could extend beyond the edge of pavement at maturity. Evaluators also estimated the overall level (percent) of canopy cover at the edge of pavement for the entire surveyed street section.

Empty planting spaces: For residential lots, empty planting spaces were designated by conservatively estimating that each front yard (or equivalent length of street frontage for other yards along streets) would support one tree. In actuality, many sites not rated as empty could support additional tree plantings.

7.1.6. Methods for assessing trees in commercial parking lots

Simple random sampling was used to select parking lots to be surveyed. Sampled parking lots were those in the commercially zoned parcel closest to each of 10 random geographic coordinates within the City. The sample included large parking lots associated with large retail centers, business professional complexes, a small stand-alone lot for a bank, and a hotel/restaurant site. Portions of 10 commercial parking lots were included in the sample.

Within parking lots, a random number table was used to select rows of parking spaces for sampling. For double rows of parking spaces, both sides of the row were surveyed. The line of each selected row was projected to the end of the parking lot (street or buildings) so that parking spaces in rows oriented at right angles to the main rows would be represented in the sample. Hence, trees included in the survey included those located in parking lot islands as well as those in beds on the edges of the lot along streets or near buildings.

A minimum of three rows or 80 parking spaces was surveyed in each selected parking lot. For the one small lot included in the sample (lot 2), the entire parking lot was surveyed. GPS readings were taken at the endpoints of surveyed rows.

Data collected on trees in the sampled areas included:

Species or species group: Tree species was noted for the most common and conspicuous species. Less common species were identified only to genus (e.g., pines, maples) or in general groups (e.g., miscellaneous hardwoods).

Condition class: Trees were placed into one of three condition classes.

Healthy - Trees in fair or better condition

Decline - Trees in poor condition; generally such trees are not likely to show significant growth or survive more than 10 years

Dead - Dead trees.

Age class: Age class was rated as the percent of the final canopy size that the tree is likely to achieve at maturity at the site, which may be less than the reported maximum size. For example, though coast redwood can grow to great size in its native range, the maximum size that these trees typically reach in the Sacramento Valley is much more modest. This provides an estimate of how much additional canopy cover the trees are likely to provide as they mature. The age classes used were:

(1) Less than 25% of size at maturity

(2) 25 to less than 75% of size at maturity

(3) 75% or more of size at maturity

Pavement shading: By species, evaluators counted the number of trees that were currently providing some direct overhead (midday) shading of pavement, i.e., the canopy extended beyond the planter bed over pavement. Evaluators also noted whether tree canopy would extend over parking lot pavement when the tree reached mature size.

Empty planting spaces: Treeless planters were considered to have an empty planting space if they were large enough to hold a tree that could shade pavement. Generally these were sites that clearly contained trees in the past, but in some cases, the original design might have only included shrubs or other landscaping.

Parking spaces with shade. Within the sampled portion of each parking lot, evaluators counted the number of parking spaces and placed them into categories based on the amount of direct overhead tree canopy cover. The categories used were:

(1) 1 to 25% shade canopy cover

(2) 25 to less than 50% shade canopy cover

(3) 50% or more shade canopy cover

In general, a parking space with at least 50% canopy cover would be considered reasonably well shaded. Spaces with 25 to 50% shade would be considered marginally shaded, and lower levels of shading would generally be inadequate.

Although the shade evaluations provided a rapid means for assessing relative shading, they do not account for shade provided by trees when the sun is at lower angles, such as in the late afternoon. This effect is most pronounced for tall trees.

Appendix 7.2. Past and current maintenance practices for City of Rocklin public trees

City of Rocklin Public Works and Parks Division of the Department of Community Services and Facilities staff provided the following summaries of historical and current maintenance practices for public trees along streets and parkways and in developed parks.

Streetscape Tree Maintenance Practices

Prepared by Michael Rock, Public Works Operations Manager and Ron Patten, Public Works Landscape Maintenance Supervisor. Dated June 24, 2004.

Following is a brief chronological narrative of the past and present maintenance practices for the City of Rocklin's streetscape trees. The information was obtained from employees who have worked for the Public Works Landscape Maintenance Division from 1991 to 2004.

Soil Conditions

Soils within the Rocklin area are generally of poor quality; no areas have been identified as having prime soils.

- Prominent soil conditions
    1. Granite
    2. Decomposed granite
    3. Lava cap
    4. Lava cap mixed with cobble
    5. Hardpan/Clay

Tree Care Practices: Past

1991-1994: During this period the City was developing its maintenance standards and had just begun some basic training for staff on tree maintenance.

- Tree Replacement: None
    1. Filled tree well with soil
- Pruning: Respond to complaints only
    1. No pruning standards were in place at this time
    2. Trimmed over sidewalks
    3. Removed downed branches
- Equipment:
    1. Manual pruning pole saws
    2. Lopping shears
    3. 1 small 12" chain saw
    4. Any available truck
- Fertilizer: None
- Insecticide: None
- Irrigation: Overhead spray

1995-1998: During this period the City began specialized training for staff in tree care and irrigation maintenance.

- Tree Replacement: Occasional/sporadic
    1. Replaced a few dead trees with 5 gallon size trees
    2. Transplanted volunteer trees from Stanford Ranch area to the redevelopment area
    3. Staked downed trees back in place
- Pruning:
    1. Pruning standards were starting to be used, in house training only
    2. Responded to complaints
    3. Trimmed over sidewalks
    4. Removed downed branches
    5. Removed dangerous limbs
    6. Started a Fall/Winter "Pruning Program"
- Equipment:
    1. Manual pruning pole saws
    2. Lopping shears
    3. Chain saws
    4. Any available truck
- Fertilize:
    1. Fertilizer tablets were dug into the soil at the base of some trees.
- Insecticide:
    1. Merit (liquid pesticide) was injected into the soil at the base of Crape Myrtle trees to control aphids.
- Irrigation: Over head spray

Tree Care Practices: Present

1999-2004: During this period the City continues to refine its training for staff and has sent some staff to specialized training in irrigation technology and practical pruning for arborists.

- A Tree Replacement Program is now in place:
    1. Trees are replaced as a result of automobile accidents, and storm/wind damage.
    2. Replacement costs, due to auto accidents, are recovered by insurance.
    3. Accident related replacement of trees is contracted out.
    4. Accident related trees are replaced with large 24" box trees.
    5. Trees lost in previous years are being routinely replaced.
    6. A list of replacement trees is kept for the year; trees are then replaced in the fall.
- Pruning:
    1. Regular fall/winter, and early spring pruning is done by the City of Rocklin Landscape Maintenance Staff, and by landscape maintenance contractors under contract with the City of Rocklin.
    2. Landscape Maintenance Staff are trained to prune to the International Society of Arboriculture pruning standards. Training is received at the University of California Davis. Contractors are required to meet this same standard.
    3. Respond to resident complaints
    4. Trim over sidewalks to 8 feet
    5. Trim over streets to 14 feet

6. Remove downed branches
7. Remove dangerous limbs
8. Remove public and private tree limb's that obscure traffic signals
9. Remove problem or undesirable trees

- Equipment:
  1. Pneumatic pruning shears
  2. Extended power pole chain saws
  3. A variety of chain saw size selections 12" to 24"
  4. Chipper
  5. Urban Forest truck for chipped material. Vehicle is outfitted with a hydraulic system for pneumatic pruning tools.
- Fertilizer:
  1. Fertilizer is generally a 15-15-15 slow release product
  2. Groups of trees are chosen each season, on a rotating base, to be fertilized in the fall when the rain starts, and again in the spring before the rain stops.
- Insecticide:
  1. Imicide (liquid pesticide is injected into targeted trees). There are immediate results controlling scale, aphids, and white flies.
  2. The injections are done on an as needed basis, and on every second tree, so as not to kill off desirable insects.
- Irrigation:
  1. Existing irrigation is being changed from overhead spray to a Netafim drip line grid at the base of each tree.
  2. New irrigation installed by developers is required to be Netafim subterranean drip for shrubs and groundcover, and bubbler heads at trees.

Many of the "Urban Forest" problems that the City of Rocklin is experiencing today are the result of past practices that are no longer part of the City's maintenance program. Trees that are planted within the City's right-of-way by developers, contractors, and the City are now inspected for problems that started in the nursery. The trees are either accepted, or rejected due to obvious defects. The trees are now properly pruned to International Society of Arboriculture pruning standards, fertilized, and irrigated. These current practices will show the rewards in the long term, with a more vigorous and healthier "Urban Forest".

Parks Tree Maintenance Practices

Prepared by Shawn Darling, Parks Maintenance Supervisor. Dated October 25, 2004.

Following is a brief chronological narrative of the past and present maintenance practices for the City of Rocklin's park trees. The information was obtained from employees who have worked for the Parks Division of the Department of Community Services and Facilities from 1989 to 2004.

Soil Conditions

Soils within the Rocklin area are generally of poor quality; no areas have been identified as having prime soils.

- Prominent soil conditions

1. Granite
2. Decomposed granite
3. Lava cap
4. Lava cap mixed with cobble
5. Hardpan/Clay

Tree Care Practices: Past

1989-1994: During this period the Park Division was developing its maintenance standards and had just begun some basic training for staff on tree maintenance.

- Tree Replacement: Dead trees were replaced unless location was poor or the tree was undesirable.
- Pruning: Basic tree pruning practices varied based on skills of staff.
    1. Trimmed for safety
    2. Trimmed over sidewalks
    3. Removed downed branches
    4. Trimmed to allow for mowing equipment to pass under trees.
- Equipment:
    1. Manual pruning pole saws
    2. Lopping shears
    3. 1 small 12" chain saw
    4. Any available truck
- Fertilizer: Trees in turf area received fertilization only.
- Insecticide: None
- Irrigation: Overhead spray

1995-1998: During this period the Park Division began specialized training for staff in tree care and irrigation maintenance.

- Tree Replacement: Continual
    1. Replaced dead trees unless the location was in a poor drainage area or the tree was undesirable.
    2. Staked trees to maintain upright position.
- Pruning:
    1. Pruning standards were starting to be used, in house training only
    2. Responded to complaints
    3. Trimmed over sidewalks
    4. Removed downed branches
    5. Removed dangerous limbs
    6. Started a Fall/Winter "Pruning Program"
- Equipment:
    1. Manual pruning pole saws
    2. Lopping shears
    3. Chain saws
    4. Any available truck
- Fertilize:

1. Fertilizer tablets were installed to some existing trees that appeared to be lacking in nutrition. All newly planted trees received fertilizer tabs.

- Insecticide: None
- Irrigation: Over head spray

Tree Care Practices: Present

1999-2004: During this period the City continues to refine its training for staff and has sent some staff to specialized training in irrigation technology and practical pruning for arborists.

- Tree Replacement: Continual
  1. Replaced dead trees unless the location was in a poor drainage area or the tree was undesirable.
  2. Trees in bad locations were replaced and moved to a desirable planting location.
  3. A list of replacement trees is kept for the year; trees are then replaced in the fall.

- Tree Planting Projects: In-house and volunteer.
  1. Oak restoration projects were completed in Breen Park and Ruhkala Park.
  2. Wesley Park received 40 additional trees in the undeveloped area above the original park landscape.
- Pruning:
  1. Regular fall/winter, and early spring pruning is done by the City of Rocklin Parks Maintenance Staff.
  2. Parks Maintenance Staff are trained to prune to the International Society of Arboriculture pruning standards. Training is received at the University of California Davis. Contractors are required to meet this same standard.
  3. Respond to resident complaints
  4. Trim over sidewalks to 8 feet
  5. Remove downed branches
  6. Remove dangerous limbs
  7. Remove problem or undesirable trees
- Equipment:
  1. Pneumatic pruning shears
  2. Extended power pole chain saws
  3. A variety of chain saw size selections 12” to 24”
  4. Chipper
  5. Urban Forest truck for chipped material. Vehicle is outfitted with a hydraulic system for pneumatic pruning tools.
- Fertilizer:
  1. Fertilizer tablets were installed to some existing trees that appeared to be lacking in nutrition. All newly planted trees received fertilizer tabs.
- Insecticide:
  1. Imicide (liquid pesticide is injected into targeted trees). There are immediate results controlling scale, aphids, and white flies.
  2. The injections are done on an as needed basis, and on every second tree, so as not to kill off desirable insects.
- Irrigation: Overhead spray

Many of the “Urban Forest” problems that the City of Rocklin is experiencing today are the result of improper installation, poor tree selection and maintenance practices that are no longer part of the City’s pruning program. Since quality tree selection is the beginning of the process, we are continuing to be proactive in the inspection of trees once they have arrived from the nursery. The trees are now properly pruned to International Society of Arboriculture pruning standards, fertilized, and irrigated. These current practices will show the rewards in the long term, with a more vigorous and healthier “Urban Forest”.

Appendix 7.3 Notes from the Rocklin Urban Forest Community Meeting, July 15, 2004

On July 15, 2004, an open community meeting was held in the Rocklin City Council Chambers at City Hall to discuss the draft urban forest plan. The meeting was attended by about 15 Rocklin residents and a number of City staff members. Introductory remarks were made by City Council Member Ken Yorde and Senior Planner David Mohlenbrok. Consultant Ted Swiecki of Phytosphere Research presented overviews of urban forest benefits and the urban forest planning process and then discussed the results of the assessments of Rocklin's urban forest. Covered topics included the evaluations of tree canopy cover change (Section 3.1), native oak woodlands on City-owned lands (Section 3.2), park trees (Section 3.3), City-maintained trees along streets (Section 3.4, residential front yard trees (Section 3.5), and trees in commercial parking lots (Section 3.6).

Following the formal presentation, an extended question-answer and public comment session was held to obtain input from City residents. The comments and questions from the meeting are summarized below. Summarized responses by the consultant or City staff are shown in italics.

- Lack of planting strip between street and sidewalk in the City of Rocklin contributes to the lack of a street canopy.
- Smaller lots are resulting in the need to have to plant smaller trees and why many trees don't grow to their full size.
- Newly developing areas are prone to inferior planting practices by developers (on private property) which results in the need to replace trees in the short term. Particularly, planting holes that are dug for new trees not large enough to prepare sufficient soil for future tree growth. Possible solutions to address this situation would be to make sure that the planting standards are enforceable and measurable, and to have increased inspection requirements.
- Will the consultant be making specific recommendations to the City? For example, has the consultant identified areas in the City that need new plantings? *The urban forest plan contains a variety of recommendations, but specific planting plans by area are not included.*
- Invasive species – will the consultant be recommending the removal of invasive species? Cottonwoods that are regenerating are of particular concern for some because of their "messiness". *A possible solution would be to develop creek management plans for various creek sections. These plans would set objectives for managing vegetation within the riparian zone in a fashion that is compatible with adjacent land uses, flood and erosion control needs, habitat values, etc. The plan would provide guidance on vegetation composition and management and other creek bed maintenance issues. Plans may be subject to review by state and/or federal agencies. .*
- Tree density – is there a priority for oaks specifically, and can the oak tree mitigation fund monies be used to help regenerate oaks, acquire new oak woodland areas, and/or help maintain existing oaks? Recognize that public safety is a priority where oaks are near publicly accessible areas and require limb removal/trimming.

- Noticed many public areas are planted with non-oak trees such as flowering pear trees. Would rather see oaks planted instead of non-oaks in public areas.
- Is the disc golf course a problem to existing oaks? *This activity was not addressed in consultant's analysis.*
- Is the ground squirrel population a problem? *Too many squirrels usually indicate some type of ecological imbalance in the landscape. High ground squirrel populations can result in the loss of seeds (acorns) and young oak seedlings.*
- Some jurisdictions have programs where incentives are given to encourage the growing and/or planting of trees – does Rocklin have a similar program? Aren't there other tree planting programs sponsored by national groups or entities such as PG&E? *The Plan will include a listing of outside sources of funds for tree planting / tree care projects.*
- Comment that at least one local school had been growing local oaks in containers that could be made available for planting by others.
- Observation was made that it's expensive for landowners to remove and replace trees when they die, so financial assistance of some sort would be welcome.
- The City needs to get other agencies (PG&E, SPMUD, etc) to get involved in (oak) tree programs. There needs to be assistance given to Homeowner Associations (HOAs) on planting and maintenance.
- How limiting are the soils in Rocklin with regard to certain species of trees? *Plan will include discussion of soil factors that limit tree growth in Rocklin.*
- Near the Stanford Ranch Road/Park Drive area, there is a large wildlife/wetlands area that has lots of water but very little vegetation – can trees, especially oaks, be planted there?
- It is a great idea to be thinking ahead about the City's trees because money can be saved in the long run, which is ideal. The urban forest plan will help with recommendations and guidelines, but it needs to be made easy and understandable for the public. As an example, the City of Sacramento has a pamphlet of trees that discusses different species, where to plant, where to see mature examples, etc. It would be nice to have something like that here in Rocklin.
- The gap between the City and the general public needs to be bridged. Suggested methods for "getting the word out" were pamphlets, website, and eventually having a City tree department and City arborist.
- Many plants sold at local nurseries aren't adapted to the area or were grown in nurseries outside of the Sacramento region and therefore have a difficult time acclimating to the area.
- Nurseries need to be educated and they need to provide education to their customers about the trees that they are buying. Big box stores (e.g., Home Depot, Lowe's) should provide education/information like they do for other products they sell (how-to classes), or the City should see about having some educational literature available locally to give guidance.
- Kudos to the City on the planting at Taylor /Pacific Street and Sunset.
- The recreation guide (as an ad or class), billing inserts, and other publications are other opportunities to help "get the word out". The City could partner with nurseries where a discount could be offered by the City for planting the "right tree in the right place".

- Suggestion made that fruit trees do well in Rocklin and can provide shade as well as produce. *However, due to fruit drop and other issues, large fruit trees are not good options for many urban planting situations. Another option is to consider community orchards, similar to community gardens that exist, to provide options for residents to grow/harvest tree fruit that might not be possible in yard situations.*

Post meeting communications with City of Rocklin Planning Department:

- Would like to see Front Street tree-lined or enhanced with trees and plants, from Rocklin Road to Farron Street. It may be that railroad ownership of that property would present some complications, but it would certainly beautify that part of the City. Another location would be the screening of the tank farm at the corner of Sunset and Pacific. Some nice conifers or pines around the site might make it look less ghastly.
- I attended the Rocklin tree planning meeting Thursday evening. I'm glad to see the City of Rocklin is taking a proactive approach with this subject. I am a resident in the City and an I.S.A. certified Arborist with a few years of experience in the field. If I can be of any help, I would be happy to do some volunteer work.

Appendix 7.4. Recommended changes to Oak Tree Preservation Guidelines

Based on our review of Rocklin's current Oak Tree Preservation Guidelines (dated January 1997) Phytosphere suggests the following revisions to address technical issues.

General comment – the term oak is used thoughout to refer to oaks native to Rocklin, but this is not explicitly stated. Because non-native oaks are widely planted in Rocklin, it would avoid confusion to note that oak refers only to oaks native to Rocklin unless otherwise noted.

Section II.D.1 – Consider allowing direct seeding of local acorns and protection/recruitment of existing natural oak seedlings or saplings as an alternative to planting.

Section III.B.1. – Because the condition and size of trees can change over time, language should be inserted to indicate how recent the arborist's survey and report should be. Reports greater than two years old should at least be updated to note any changes from the original survey.

Section III.B.1.a, last paragraph – When a sampling method is used to assess impacts, it should be coupled with an analysis of aerial imagery to evaluate the potential amount of total canopy cover loss associated with the project.

Section III.C.2, first and fourth bullets – Because roots can extend out 2 to 3 time the canopy spread (dripline distance), protection to the vicinity of the dripline is often inadequate for long-term tree health. The "dripline + 1 foot" standards should not be viewed as an ideal standard. A more flexible and superior alternative would be this "2-2/3 standard": require protection of a continuous zone including at least 2/3 of the area equal to twice the diameter of the canopy spread, while not allowing any encroachment any closer than 2/3 of the distance between the trunk and dripline. This has the potential to protect a greater fraction of the rootzone while still providing flexibility for site design purposes. In situations where root distribution is likely to be non-uniform, an arborist should provide direction as to the likely location of the bulk of the root system.

Section III.D.1, last paragraph – Add caveat that mitigation would be required if the death of tree or its dying/diseased status was the result of intentional actions by the owner. In other words, it should be clear that intentionally killing trees in advance of development to avoid mitigation is not an option.

Section III.D.3. – Presumably, this formula provides an incentive to avoid removing more than 20% of the oaks on a property, but it is not immediately clear from the text itself. In particular, because the term "discount diameter" is used in connection with removal in excess of 20%, it almost seems like it is better (i.e., you get a discount) to remove more than 20% of the trees. Changes in the text would clarify the intent of this section for those who encounter it for the first time. It might also help to note the minimum replacement ratio of 2:1 and a reference to the Appendix C in this section as well as in section 4.

Appendix A. – Remove *Quercus agrifolia* (Coast live oak) from the list of native oaks. It is not native to the Rocklin area. The *Q. agrifolia* hybrids can also be removed from the list as such hybrids are not likely to occur naturally in the Rocklin area.

Appendix D.1. – The diagram is a bit more geared toward trees in areas with summer rainfall. In dry areas like Rocklin, root density in the upper 6-8 inches of the soil profile is typically low. Also, the rule of thumb that root spread is typically 2 to 3 times the dripline

diameter is probably more applicable than the height-based estimate. Also, it is not clear why the diagram shows few roots to the left side of the tree. This would not be typical for any tree.

Appendix D.2. Root zone – For most trees, the number of roots beyond the dripline is much greater that that within the dripline. For Rocklin's oaks, the root spread is likely to be in the 2-3+ times dripline range (for 2X, only 25% of the rootzone is within the dripline). The source of the 1.67 times dripline figure is not stated, but it is more likely to be typical of trees growing in wetter regions than Rocklin.

Appendix D.3.B.1. – A better standard for protection around the trunk would be to have no excavation within 1/2 to 2/3 of the distance from the trunk to the dripline. This standard would also apply to Section 3.B.3.a

Appendix D.3.B.3. – The dry well diagram shown is not an acceptable method for protecting oak trees and should be deleted. Fill of up to a foot depth should be considered the same as rootzone destruction and should be subject to the limits discussed earlier.

Appendix D.3.D.4. – The concept of "balancing" root removal with corresponding top removal is not supported by research and may be more detrimental than beneficial. The pruning recommendation should be removed from this section.

Appendix D.3.E.1. – Change fence placement to the designated protected root zone area + 3 feet rather than dripline +3 feet.

Appendix D.5.A.2.a.iii. – Delete sentence about spraying. Most of these insects produce only 1 generation per year and by the time damage is obvious, spraying is usually too late to provide any benefit.

Appendix D.5.A.2.c. – Mushrooms are infrequently seen in trees with *Armillaria.* Damage to the roots, especially fill, coupled with summer irrigation are main factors that allow *Armillaria* to decay the roots and root crowns of oaks.

Appendix D.5.A.2.d. – Replace with following:

Canker rot and other decay fungi. A number of wood decay fungi attack living oaks, most commonly infecting through wounds. They can result in branch dieback and the slow decline of affected oaks. Extensive wood decay may also cause branches or the entire trunk to break. An arborist should be consulted to evaluate whether levels of decay are cause for concern and whether pruning can be used to reduce potential hazards.

Appendix D.5.A.2.f. – Spanish moss poses no threat to oaks.

Appendix D.5.B.2. – Change references to more current guidelines noted in this document.

Appendix D.5.B.3. – Delete this recommendation.

Appendix D.5.B.4,5. – Large branch removals should preferentially be done in the summer for all oaks as noted in this report. Also, oaks should never be "heavily" pruned.

Appendix D.5.C.3. – In general, oaks do not benefit from fertilization and excess fertilization can be associated with various problems. Phytosphere recommends deleting this section, other than adding the foregoing sentence.

Appendix D.6. – This section includes several questionable recommendations. Phytosphere recommends that the section be replaced with information they have developed based on various studies and practical experience. See http://phytosphere.com/oakplanting/oakplanting.htm

Appendix 7.4. Recommended changes to Oak Tree Preservation Guidelines

Appendix D. Exhibit 1. – There are more recent and extensive lists available. (e.g., Bruce W. Hagen, Barrie D. Coate, Keith Oldham, 1991. **Compatible Plants Under and Around Oaks.** California Oak Foundation)

Appendix 7.5. Regional survey on the performance of common tree species in urban settings

Methods

Phytosphere surveyed both the Sacramento Valley Regional Urban Forest Council (SVUFC) members and City of Rocklin Public Works and Parks staff by email in November 2003. The objective of the survey was to get opinions on trees that perform especially well or especially poorly in an urban setting in the lower Sierra foothills area. Respondents were asked to note species that perform either especially well or poorly in typical **street tree** settings (median and shoulder planting beds, parking lots) and **yard/park** settings (in or around turf, large landscaping beds typical of developed parks or residential yards). The survey instrument was designed to help identify trees that, based on local experience, are especially good or bad trees in these situations.

A list of the most common tree species found in Rocklin's parks, front yards, parking lots, and street plantings was provided as a species list in the survey. Though limited, this list contained many of the most common trees found in the area. Respondents were asked to place an x in the appropriate column for species they felt were especially good or bad trees for yard/park or street settings. Columns were left blank if the respondent had no strong opinions one way or the other about a given tree, so the number of responses per tree varied.

Respondents were also asked to add species to the list that were likely to be especially good for use in the area. For these additional species, respondents were asked to indicate whether their opinion was based on long term observations of local trees or other information. Phytosphere received and tabulated results from 8 SVUFC member surveys. Phytosphere also received a compiled response from City of Rocklin staff that included data from at least 6 respondents.

The ratings were tabulated by concatenating the responses directly from the surveys. Some respondents used both capital and lower case x's, which are reproduced in the results table. Presumably the capital X's are used for emphasis (very good or bad). Additional notes provided by some respondents are also reproduced in the table. Different responses are separated by semicolons. Responses from City of Rocklin staff are shown in separate columns from those of the SVUFC members.

Results

A review of the Table 7.5-1 shows that some trees were universally panned and others were universally liked. However, many of the trees had both proponents and detractors for various uses. Presumably, at least some of this variation reflects differences in tree performance in different areas and situations. In general, species with mixed reviews should probably get special scrutiny during the process of matching a tree to a site.

One comment is in order for coast live oak, which generally got good reviews. Although this species may have horticultural uses in inland areas, there are good ecological reasons not to use this species in areas where it is close to native interior live oak. These two species can hybridize, and introducing coast live oak genes into native populations of interior live oak is potentially deleterious to the population genetics of the latter species. For the protection of native oak forest genetic resources, Phytosphere strongly recommends that coast

live oak not be used within about 2 miles of native stands of interior live oak or riparian corridors and generally advises against its use in Rocklin altogether.

Tables 7.5-2 and 7.5-3 include species that are not on the main list but that respondents felt were especially good for use in the area. Table 7.5-2 includes species for which respondents had good long term observations, i.e., tree are performing well after being in place at least 30 years or so. Table 7.5-3 includes species deemed likely to perform well that had not been observed over a long enough time period yet. Some species are listed in both tables, presumably reflecting different periods that species have been used in different areas.

Table 7.5-1. Compiled tree survey responses from Sacramento Valley Regional Urban Forest Council members (SVUFC) and City of Rocklin Public Works and Parks staff (Rocklin).

Common name (Scientific name)	Good yard/ park (SVUFC)	Bad yard/ park (SVUFC)	Good street (SVUFC)	Good street (Rocklin)	Bad street (SVUFC)	Bad street (Rocklin)	Comments
alder, Italian (*Alnus cordata*)	xX	xxx	x	xx	xxX	xxx	Short lived, codominant trunks;
alder, white (*Alnus rhombifolia*	x	xxxxx		xx	xXxxX	xxx	Short lived (15-20 years), invasive roots; Short lived, borers; Alder borer;
ash, modesto (*Fraxinus velutina* 'Modesto')		xxxxxx		x	xxXxxX	xxxx	Pests and disease ; Dangerous structure,; Do not use; Mistletoe, anthracnose, poor structure; Structural problems, anthracnose, mistletoe;
ash, raywood (*Fraxinus oxycarpa* 'Raywood')	x	xxxx	x	xxxx	Xxxx	xx	Weak crotches, ash lilac borer, but seems to do pretty well in Roseville; Do not use; Borers, poor structure; Structural problems, serious canker disease;
birch (*Betula* spp.)	?xxxx	x		xxxx	XxxX	x	White struggles with borers , try B. nigra for more heat tolerance; Ok in cooler neighborhoods; Water demanding, borers; Bore disease in direct sun;
catalpa (*Catalpa* spp.)	xXx	xx	x	x	xxX	xxxxx	Struggles in hot weather; Litter, poor structure, root invasive; Messy, seed pods;
cedar, deodar (*Cedrus deodara)*	xxXxxx		xxxx	xxx	x	x	Doesn't canopy over street; For large spaces; Generally performs quite well; With room for street;
cedar, Incense (*Calocedrus decurrens)*	xXxxx	x	xxx	xxx	xX	xxx	Cannot take poor drainage, needs additional irrigation at elevations lower than normal range (1500'); For large spaces; Not good in turf or poorly drained areas; Marginal in heat;
cherry, flowering (*Prunus serrulata)*	Xx	xx	x	xx	xx	xx	Beautiful, but hard to grow. Drainage, sunburn, borers, gummosis…; Not drought tolerant, borers; Marginal in heat;

Appendix 7.5 Regional survey on the performance of common tree species in urban settings

Common name	Good yard/ park (SVUFC)	Bad yard/ park (SVUFC)	Good street (SVUFC)	Good street (Rocklin)	Bad street (SVUFC)	Bad street (Rocklin)	Comments
Chinese pistache (*Pistacia chinensis)*	xxxXxx x		xxXxxX	xxxxx			Some concern from CNPS about re-seeding into wild lands, cannot take poor drainage; Common; Verticillium can be a problem;
Chinese tallow (*Sapium sebiferum)*	xxx	xxxx			xxxxxx	xxxxx	Re-seeds abundantly, invasive roots; Bad roots; Use with caution-roots/seedlings-invasive; Easy to grow, but surface rooting and invasive in wetlands; Weedy;
chitalpa (*X Chitalpa tash-kentensis)*	xx	xx		x	xxX	xxxx	Sparse canopy and aphids; Use with only best site conditions;
crab apple (*Malus* X)	xxxxx		xxX			xxxx	Newer varieties more disease resistant, good sizes for today's smaller yards; messy;
crape myrtle (*Lager-stroemia indica)*	xXxxxx		xXxxX	xxxxx			If tree-sized cultivar is chosen; Fauriei x indica hybrids for small shade; Generally good performer, small size ; overused;
cypress, Arizona (*Cupressus arizonica var. arizonica or C. glabra)*	xxx	xx	x	xxx	xx	xx	Interesting accent; Pest problems,; Caution with only drier conditions; Underused; Fire prone, cultivars can be attractive;
cypress, Italian (*Cupressus semper-virens*)	xxx	x	X	xx	xxx	xxx	Why bother, ugly, only use as screen; Windbreak only-not accent; Accent tree; Fastigiate growth form, Limited use;
elm, Chinese (*Ulmus parvifolia)*	?xxxxx		?Xxx	x	r	xxxx	DED found in Sacramento as per Dan Psykowski; OK: Requires early training; Caution on roots and brittle branches;
eucalyptus, red ironbark (*Eucalyptus sideroxylon*)	?	xxxx		x	xxxxX	xxxxx	High maintenance, needs frequent pruning to avoid branch breakage; Until lerp psylids controlled; Branch failure, pavement damage;
ginko (*Ginkgo biloba)*	xxxxxx x		xxxxx	xxx		xxx	Slow to start, trouble free; Needs to grow faster to survive many spots; Male only; GOOD drainage; Well behaved tree!;
hackberry (*Celtis* spp.*)*	xxxxxx		xXxxx	xxx		xx	European ok, others now get woolly aphids; Over-used; Aphid problem Bio control may reduce impact ; European only; had problems with diseases
hawthorne (*Crataegus phaeno-pyrum)*	xxxxx	x	xXX	xxx	xx	xx	Fireblight, hard to find quality stock due to early heading; Lavelle hawthorn useful, thorns, much pruning;

Appendix 7.5 Regional survey on the performance of common tree species in urban settings

Common name (Scientific name)	Good yard/ park (SVUFC)	Bad yard/ park (SVUFC)	Good street (SVUFC)	Good street (Rocklin)	Bad street (SVUFC)	Bad street (Rocklin)	Comments
honey-locust (*Gleditsia triacanthos inermis*)	?x	xxx		x	xxxx	xxxx	Tangled growth makes it costly to prune, often has dieback in Roseville; Toss up. Sparse canopies due to midges; Subject to sunburn damage, poor performance, pests; Brittle branches;
liquidambar (*Liquidambar styraciflua)*	xxxx	xx		x	xxXxxx	xxxx	Ok in non-lawn areas which are irrigated, large root system and "sputnik deathballs" limits usefulness; Dangerous structure, Pest problems,; Rooting concerns but very versatile; Parks only, too much root intrusion; Root/pavement damage, much space needed; Shallow roots, brittle limbs;
locust (*Robinia* spp.)	?	xxxxx	?		XxxX	xxxx	Purple Robe weak crotches and suckers, according to Bruce Hagen it is sensitive to armillaria; Robinia? Poor structure, early limb failure; Purple robe' structural problems, poor in lawns ;
magnolia (*Magnolia* spp.)	xXxxxx	x	xxxx	xxxxx	x		Evergreen or deciduous? Consider species and variety since they vary greatly; Evergreen and deciduous;
maple, red (*Acer rubrum*)	xxXxxx		xXxX	xxx	x		Good if there is enough room; Cultivars only; Water demanding;
mulberry, fruitless (*Morus alba*)	xXx	xxxx			xXxxx	xxxxx	Large roots; Dry conditions; Too big and invasive for most yards, but great for parks with lots of room; Pollen/allergies, pavement damage, otherwise ok;
oak, blue (*Quercus douglasii*)	xxxxx	x	Xxx	xxxxx	x		Attractive in dry location; Dry conditions; Too hard to grow, intolerant of most cultivated conditions; Slow, not in turf; Well behaved for dry soils;
oak, coast live (*Quercus agrifolia)*	Xxxxx		XxxX	xxxxxx			Does surprisingly well on the east side of the Sac. Valley; Messy, poor in turf; [Note: not recommended for Rocklin due to ecological issues related to native oak populations; see Section 6.2.1 and Table 6.2]
oak, holly (*Quercus ilex*)	xxxxx	x	xXX	xxx	xx	xx	Not for waterlogged soil; Pavement damage, poor in turf;
oak, interior live (*Quercus wislizeni*)	xXxxxx		xxxX	xxxxx		x	Fast growing, but rots young; Dry conditions; Messy, poor in turf;
oak, pin (*Quercus palustris*)	xxxxxx		xXxxX	xxxxx			Holds leaves in winter; Holds foliage in winter;

Appendix 7.5 Regional survey on the performance of common tree species in urban settings

Common name (Scientific name)	Good yard/ park (SVUFC)	Bad yard/ park (SVUFC)	Good street (SVUFC)	Good street (Rocklin)	Bad street (SVUFC)	Bad street (Rocklin)	Comments
oak, scarlet (*Quercus coccinea*)	xXxxxx		xxxxX	xxxxx		x	Holds foliage in winter;
oak, valley (*Quercus lobata*)	xxXxxx		XxxX	xxxx		xx	Ok if soil dries between irrigations; Messy, poor in turf;
olive (*Olea europaea*)	xXxxx	x	xX	xx	xxx	xxxx	Olives are high allergy and messy; Fruiting concerns/pollen; fruit; Messy, pollen;
palm, date (*Phoenix dactylifera*)	xX	xx	x		xX	xxxxxx	Pest problems; Take them back to socal; High maintenance;
pear, flowering (*Pyrus calleryana*)	xxxxx	x	xXx	xxxxxx	xx		Common-overused; Keep on top of the pruning; Overused, some varieties prone to mistletoe limbs break;
pecan (*Carya illinoi-nensis*)	xxx	xXx	xx	x	xxx	xxxx	Often have poor structure, nuts are messy; Dangerous structure,; Messy, pavement damage; Reseed;
pine, canary island (*Pinus canariensis*)	xxXxx	x	xX	xxxxxx	Xx		
pine, foothill (*Pinus sabiniana*)	xx	xXxx		xxxx	xxXxxX	x	Heavy cones can be a hazard; Digger Pine (Dangerous structure),; Too large; Hazardous with age; Structure, large cones;
pine, Italian stone (*Pinus pinea*)	xxx	xxx	xx		xxXX	xxxxxx	Poor structure; Too large;
plane, London (*Platanus acerifolia*)	xxxxx		xXxxX	x		xxx	Common-overused, high allergy, anthracnose and mildew common; Too widely planted at this time,; Varietal considerations; Overused, not encouraged for now; The right cultivar, e.g., 'Columbia'; *personally don't like*
plum, purple leaf (*Prunus cerasifera* varieties, including *Prunus* X *blireiana*)	xxx	xx	x	xxxxx	xX		Fruiting; We encourage high branched stock; short lived, pests;
poplar, lombardy (*Populus nigra 'Italica'*)		xxxxx		x	xxxX	xxx	Invasive roots, short lifespan; Limited use as windbreak/screen; Water demanding, canker disease;
redbud (*Cercis* spp.)	xxxxxx		XxX	xxxxxx	x		Well drained soils/dry for Western; Good size for most yards, keep out of lawn areas; Eastern? Poor performance;

Appendix 7.5 Regional survey on the performance of common tree species in urban settings

Common name (Scientific name)	Good yard/ park (SVUFC)	Bad yard/ park (SVUFC)	Good street (SVUFC)	Good street (Rocklin)	Bad street (SVUFC)	Bad street (Rocklin)	Comments
redwood, coast (*Sequoia semper-virens*)	xXx	xxx	xx	xxxxxx	xXx		If large enough space exists; Too widely planted at this time,; Not suited to foothills due to water needs at maturity; Needs space; High water needs, overused;
silk oak (*Grevillea robusta*)	x	xxxx		x	xxxX	xxx	Weak wood, frost sensitive; Dangerous structure,; Cold sensitive; Frost tender; Size, water-demanding;
silk tree (*Albizzia julibrissen*)	x	xxxxx			XxxX	xxxxx	Really messy flowers, re-seeds prolifically; Invasive/messy; Albizzia? Very messy, short-lived;
spruce, Colorado blue (*Picea pungens*)	xxx	x	x	xxxx	xX	x	generally poor performance;
tulip tree (*Liriodendron tulipifera*)	xxxxx	x	xXx	xxxxx	xxX		Sensitive to root disturbance and herbicide damage; Pest problems,; Needs lots of water to look good; Needs space/aphid problems; Needs space; Big time aphids, water-demanding, ok in deep, moist soils;
willow, weeping (*Salix babylonica*)	x	xxxxx			xxXxxx	xxxxxx	Brittle wood; Limited use with adequate space, wet conditions; Short lived; Short-lived, high maintenance, hazards; Large moist areas only;
zelkova (*Zelkova serrata*)	xxxxxx X		xXxX	x	x	xxxxx	Check newer cultivars;

Table 7.5-2. Other species of note based on long-term (30 years+) performance compiled from Sacramento Valley Regional Urban Forest Council member (SVUFC) responses.

Botanical and common name	Good yard/park	Bad yard/park	Good street	Bad street	Comments
Acer burgeranum, (trident maple)	xXx		XXx		Great flexible tree!; No address in foothills. All added trees grow very well in area; Good maple for smaller area
Acer campestre (Hedge maple)	x		X		
Acer ginnala (Amur maple)	x		X		
Acer truncatum (Shantung Maple)	x				
Arbutus unedo (Strawberry tree)	x				Fruit messy, hummingbirds love flowers, can take xeriscape to moderate water
Cercis (eastern or western redbud)	x		X		
Koelreuteria paniculata, (Goldenrain tree)	xx		Xx		Fast growth and strong wood, pods somewhat messy, good for solar gain as it drops it's leaves early and gets them late
Tilia (Linden)	X		X		
Magnolia x soulangiana (saucer magnolia)	x				Will not stay as a standard, great blooms
Nyssa sylvatica (tupelo, blackgum)	xX		XX		In moist places; Great color, females fruit
Quercus suber (cork oak)	x				Great accent

Table 7.5-3. Other species of note without good long term data yet compiled from Sacramento Valley Regional Urban Forest Council member (SVUFC) responses.

Botanical and common name	Good yard/park	Bad yard/park	Good street	Bad street	Comments
Betula nigra (river birch)	X				
Chionanthus retusus (Chinese fringe tree)	x		x		Grows mod-fast, beautiful flowers, females fruit
Ulmus spp (new Dutch Elm Disease-resistant elms)	x		x		Check with Schmidt Nurseries for some nice varieties
Platanus racemosa (California sycamore)	x		x		California native
Quercus castaneaefolia, (chestnut leaf oak)	x		x		Grows fast, can take lawn irrigation
Quercus rubra (red oak)	x		X		
Quercus macrocarpa (bur oak)	X				
Quercus phellos (willow oak)	Xx		Xx		Grows fast, can take lawn irrigation, good fall color
Quercus shumardii (Shumard oak)	x		X		
Tilia americana (American linden)	X		X		
Tilia cordata (Littleleaf Linden)	x		X		
Nyssa aquatica (water tupelo)	x		x		

Appendix 7.6. Selected trees from the California Invasive Plant Council inventory.

The California Invasive Plant Council (Cal-IPC) maintains an inventory of invasive plant species that can adversely impact native ecosystems in California. The most recent version of the Cal-IPC inventory of invasive plants (Cal-IPC. 2006. California Invasive Plant Inventory. Cal-IPC Publication 2006-02. California Invasive Plant Council: Berkeley, CA.) is available online as a printable document and as an interactive database at http://www.cal-ipc.org. The table below lists a number of tree species found in the 2006 Cal-IPC inventory that may be invasive in or around the Rocklin area.

Scientific name	Common name	Rating of threat[1]	Areas invaded and notes
Ailanthus altissima	tree of heaven	Moderate	Riparian areas, grasslands, oak woodland. Impacts highest in riparian areas.
Crataegus monogyna	hawthorn	Moderate	Riparian habitats, woodland. Limited distribution. Impacts appear to be minor.
Elaeagnus angustifolia	Russian olive	Moderate	Interior riparian. Impacts more severe in other western states. Current distribution limited in CA.
Eucalyptus globulus	Tasmanian blue gum	Moderate	Riparian areas, coastal grasslands, scrub. Impacts can be much higher in coastal areas.
Ficus carica	edible fig	Moderate	Riparian woodland. Can spread rapidly. Abiotic impacts unknown. Can be locally very problematic.
Myoporum laetum	myoporum	Moderate	Coastal habitats, riparian areas. Mostly along the southern coast. Abiotic impacts unknown.
Olea europaea	olive	Limited	Rarely escapes in CA but is a concern due to the possibility of spread into riparian areas.
Robinia pseudoacacia	black locust	Limited	Riparian areas, canyons. Severe impacts in southern states. Impacts minor in CA.
Sapium sebiferum	Chinese tallow tree	Moderate	Significant potential for invading new ecosystems. Riparian areas. Impacts severe in southeast US. Limited distribution, but spreading rapidly regionally.
Schinus molle	Peruvian peppertree	Limited	Riparian. Limited distribution. Impacts largely unknown in CA.
Schinus terebinthifolius	Brazilian peppertree	Limited	Riparian. Very invasive in tropics. Abiotic impacts unknown, but appear significant locally.
Sesbania punicea	scarlet wisteria tree	High	Significant potential for invading new ecosystems. Riparian areas

[1] Level of threat is based on a combination of the invasiveness, ecological impacts, and distribution of the plant.

Appendix 7.7. Tree planting and care informational handouts for Rocklin homeowners and businesses

Where to plant your new tree

Position your new tree to maximize benefits and minimize potential problems

You can't rearrange trees in your yard like you can move your furniture, so it pays to carefully consider a number of factors before you decide where to plant your new tree(s).

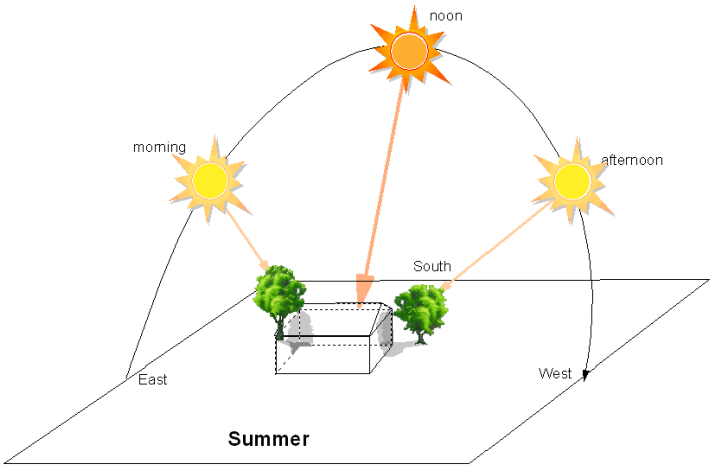
Give your tree enough space for its mature size.

Don't be fooled by the size of the tree at planting.

- Where possible, plant trees 10 ft away from underground utilities including water, sewer, and gas pipes as well as underground electric, phone, and cable lines, and 20 ft from light standards.
- Plant only small trees such as crape myrtle under high voltage power lines. The mature height of the tree should be at least 10 ft less than the height of high voltage wires directly overhead.
- Plant trees far enough from buildings, sidewalks, driveways, and foundations to avoid problems. Trees that will be large at maturity (such as London plane) will need more room than small trees (such as crape myrtle) and should be planted farther from underground and aboveground utility lines and structures.

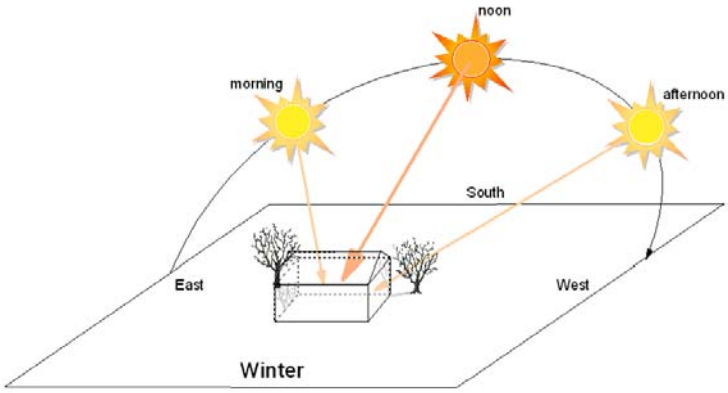
Maximize your energy savings.

Walls shaded by trees are generally 15 degrees cooler than unshaded walls. Shade on a window prevents heat buildup inside more effectively than curtains or blinds.



- Walls facing east and west receive maximum exposure to sun during the middle of summer and are the most important parts of your house to shade. At midday in midsummer, the sun is very nearly directly overhead, so it is difficult to shade south-facing walls at that time of the year.
- You can cool your local area by using trees to shade sidewalks, patios, and pavement to reduce the amount of heat that is reflected from and stored in these surfaces.
- Shading your air conditioner in the summer will improve its efficiency and save energy.
- Use deciduous trees to provide summer shade on your house. They will lose their leaves in fall, allowing winter sun to warm the house to reduce your heating costs.

- Evergreen trees produce shade in winter too, so plant them toward the north side of your property if possible, to decrease the amount of shade your house receives in the winter.



Other things to consider...

- Appropriately placed trees can provide visual screening and privacy, but don't place evergreen trees where they will block lines of sight needed for safety (such as near intersections and driveway entrances).
- Virtually all trees will drop leaves, twigs, seeds, or other materials at some point during the year. Avoid placing trees where falling debris will cause major maintenance problems.

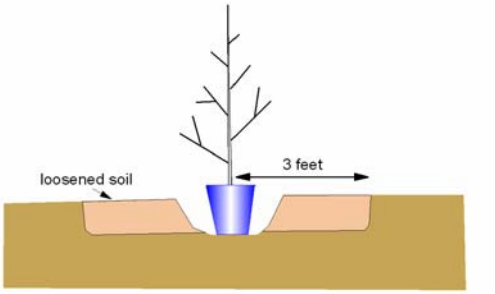
How to plant a new container-grown tree

When to plant - Fall and winter are the best seasons to plant in our area. Planting during this period allows more time for tree roots to become established so that they can meet the water needs of the leaves in hot weather. Trees can be successfully planted in spring and summer, but proper watering is especially critical for trees planted during hot weather.

Picking good planting stock - In general, the smaller the tree, the easier it will be to establish successfully. Larger trees take longer to become established. Ideally, the top should have a single main stem with branches distributed along it. Avoid trees whose main stem has been cut back or which have been excessively pruned up ("lollipop" style) or have large, unhealed pruning wounds on the trunk. A properly-grown tree will be thicker at the base and taper gradually toward the top. Avoid any tree that shows large circling roots near the trunk. Such roots will never straighten out. Also avoid trees with decayed or mushy roots.

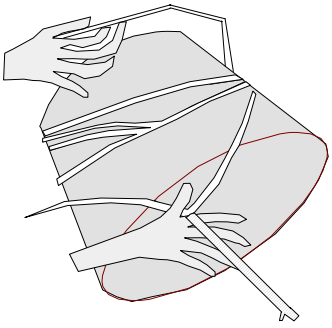
Preparing a site and planting your tree - Investing a little time and effort at planting will pay off in terms of faster tree establishment and better growth and vigor. A good quality tree may still perform poorly if it is not properly planted in a well-prepared site.

1. Prepare the soil at the planting site. Soils in subdivisions are highly compacted during construction, and tree roots cannot grow in such highly compacted soil. Most tree roots grow in the upper 1.5 to 2 feet of soil and spread far beyond the tree's canopy. Your tree will perform best if you can loosen the soil in the rootzone to a depth of at least 1 ft and a distance of at least 3 ft from the trunk in all directions. You can do this by spading and turning over the soil with a shovel in the same manner that one prepares the soil in a garden. You can also use power equipment to do the job. Soil augers, trenchers, or backhoes are the most effective for big jobs. Most rototillers do not till deep enough.

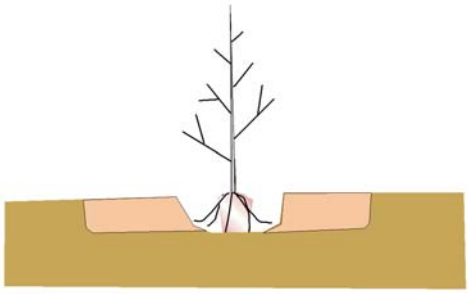


2. Dig the hole. Once you have turned over the soil at the planting site, digging the actual planting hole will be fairly easy. The hole should be no deeper than the depth of the tree's root ball. The tree root ball should rest on firm soil at the center of the hole so that the tree will not settle excessively. Make the planting hole about twice as wide as the pot to allow for spreading of roots away from the rootball.

3. Unpot the tree. Carefully remove the tree from the pot to avoid breaking off roots. Unwind all circling roots. Circling roots will not straighten themselves out and can eventually strangle the tree as they expand. Kinked, circled, or knotted roots that cannot be straightened out should be cut off cleanly with sharp pruning shears. Because roots are critical for tree survival and establishment, try to minimize the amount of root removal and damage.

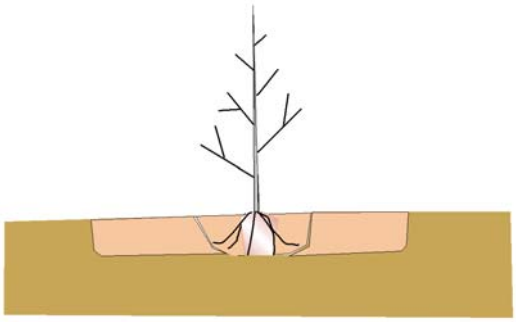


4. Set the tree. Gently place the tree in the planting hole, laying roots out so they radiate away from the trunk. Don't allow roots to kink or double back at the edge of the hole - expand the hole so that roots can spread out if necessary. Make sure that when the tree is set in the hole, the top of the root ball is slightly above the final grade of the soil. The root crown (where the first roots emerge from the trunk) should be set a bit higher than the surrounding soil so that water doesn't pool next to the trunk.

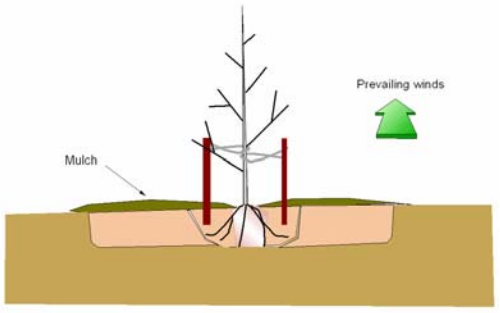


How to plant a new container-grown tree

5. Backfill the hole. Add soil to the planting hole and firm it down moderately with your hand to remove large air gaps. Avoid creating a sharp boundary between the container soil and the surrounding soil by gently breaking up the container soil as you refill the hole. Be sure that the tree is set at the proper height as you fill the hole. After the soil settles, the soil line of the tree in the pot should be the same as the final planted soil line. Once the hole is filled, water the rootball area with a low flow from a hose to settle the soil. If the top of the root ball sinks below grade after watering, gently pull it back up to level.

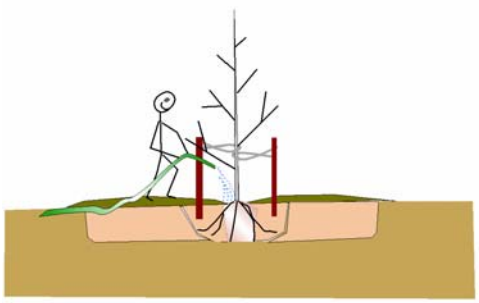


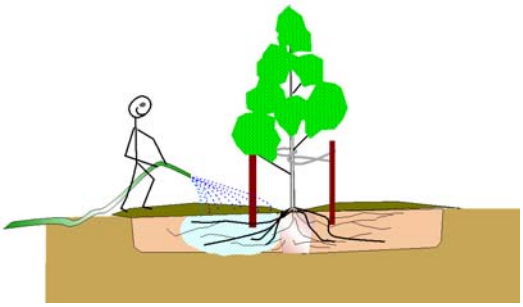
6. Stake only if necessary. Remove the pot stake, if any, that came with the tree. If the tree appears stable, staking is not needed (this is more likely to be the case for smaller trees). If staking is necessary, hold the trunk with one hand to find the height at which the unsupported top can stand up on its own and will spring back to a vertical position if lightly flexed. Position flexible support ties (no wires) about 6 inches above that point. A loose fitting figure 8 cushions the tree from rubbing against the stake and allows for some movement that stimulates the tree to develop taper. Use 2 stakes, placed in a line perpendicular to the prevailing wind direction. Place stakes beyond the container root ball, and cut stakes off about 2 inches above the ties to keep the trunk and branches from rubbing on the stakes. Remove support ties and stakes as soon as the tree becomes established, normally within one year of planting. Additional stakes or fencing may be needed around the tree to provide protection from people, pets, and equipment.



7. Mulch your tree. Use 3 to 4 inches of an organic mulch, such as bark or wood chips, to cover the soil surface at the planting site, but keep the mulch depth to 1 inch or less next to the trunk. Mulch should extend at least 2 to 3 ft away from the trunk on all sides. Mulch will help your tree get established by moderating soil temperatures, suppressing weed growth, and conserving soil moisture. If planting in a lawn, turf should be kept at least 2 to 3 ft from the trunk of newly planted trees because it suppresses tree growth.

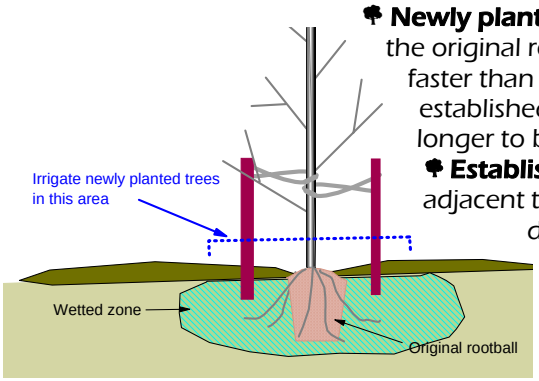
8. Water your tree. Until new roots grow into the soil of the planting site, your tree will be dependent on the water that is held in the original root ball area. Especially if you are planting in late spring or summer it is critical that this root ball area does not dry out. In areas with clay soils, the surrounding soil will pull moisture out of the porous soil mix the tree is potted in, so your tree may dry out much more quickly than you expect. Check and, if needed, water your new tree right at the root ball every few days for the first several weeks during the growing season. The soil around the rootball should remain moist though not saturated. Within several months, when sufficient numbers of roots have grown into the loosened, mulched soil surrounding the rootball, you can direct your irrigation to that area. If you plant in fall or winter, you will probably need to water your new tree every two to four weeks during its first summer, more often in especially hot periods. If your tree is planted in spring or later, you may need to water at least once a week throughout the first summer. When irrigating, apply enough water to thoroughly wet the root zone to a depth of at least a foot, but don't water so often that the soil stays waterlogged.





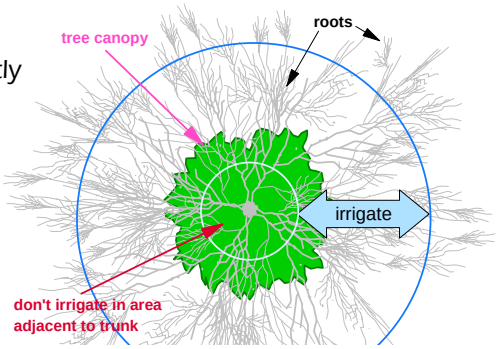
Watering your tree

Where to irrigate



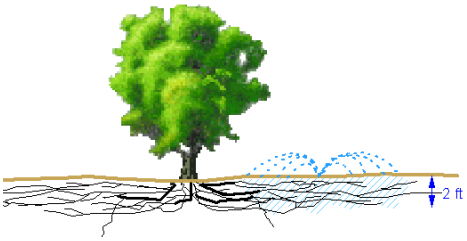
Newly planted trees: Until new roots grow into the soil of the planting site, water the original root ball area and just beyond this area. The root ball area may dry out faster than the surrounding soil. A newly planted tree may take 1-2 years to become established. Larger container stock trees may take longer to become established than smaller stock.

Established trees: Don't irrigate the area directly adjacent to the trunk - this can increase the risk of disease. Roots extend far beyond the edge of canopy or drip line. Water in the outer half of the area under the canopy and beyond the edge of the canopy. ⇨



How to irrigate

You can apply water effectively using sprinklers, drip irrigation, or a hose running on the soil surface. Regardless of how you apply the water, follow these basic rules.



Water deeply rather than frequently. Because most tree roots are found in the upper 18 - 24 inches of the soil, this is the zone that should be wetted up in each irrigation cycle. Each deep irrigation will meet a tree's water needs for between 10 days to 4 weeks during the hottest part of the summer, depending on the tree species and soil type.

Stop watering when runoff starts. Water infiltration into compacted soils and soils high in clay can be very slow - as little as 1/4 inch per hour. If water starts to pool or run off, stop irrigating, let the water soak in, and start watering again. Repeat on/off cycles until you apply enough water to wet the soil to 18-24 inches. This may take a number of cycles over several consecutive days.

Don't saturate the soil for long periods. Water displaces air in the soil, so long periods of soil saturation can suffocate growing roots. Take a long enough break between irrigation cycles to allow the free water to be absorbed. If in doubt, probe or dig to make sure that the soil isn't soggy below the surface.

How much water does my tree need?

Tree irrigation needs change over time. The amount of irrigation your tree will need can be affected by:

Tree age - A newly planted tree will need more frequent irrigation than an established tree because its root system is more limited.

Root damage - An established tree that suffers root loss or damage (for instance, due to trenching within the root zone) may need additional irrigation until new roots grow to replace those that are destroyed.

Time of the year - The need for irrigation is greatest in mid to late summer, when temperatures are the highest and most of the moisture stored in the soil over the winter has been depleted.

Weather conditions - In drought years, soil moisture is used up earlier in the season, so the period of peak water need is longer. Some trees that do not normally need irrigation may benefit from irrigation in drought years. In very wet years, irrigation may not be needed until early summer.

Soil conditions - Water used by trees is stored in the soil. Soil type, depth, and condition influence how much water can be stored in the soil, and consequently how often you may need to water. Soils that have more clay hold more water and can be irrigated less frequently. Sandy soils hold relatively little water and need more frequent irrigation.

Species - Some tree species require no additional irrigation once established, whereas others will do poorly without consistent irrigation throughout the summer.

Typical irrigation requirements (inches of applied water per month) for high, medium and low water use tree species in Rocklin under average weather conditions.

Tree water use	March	April	May	June	July	August	September	October	Total
High	1.5	3.5	6	8.2	9.2	8.2	5.9	2.8	45.4
Medium	0.3	1.8	3.7	5.4	6.2	5.5	3.9	1. 5	28.2
Low	0	0.1	1.3	2.7	3.1	2.8	1. 9	0.1	11.8

One inch of applied water (= 1 inch water depth) equals 62.3 gallons per 100 square feet (a 10 ft by 10 ft area).

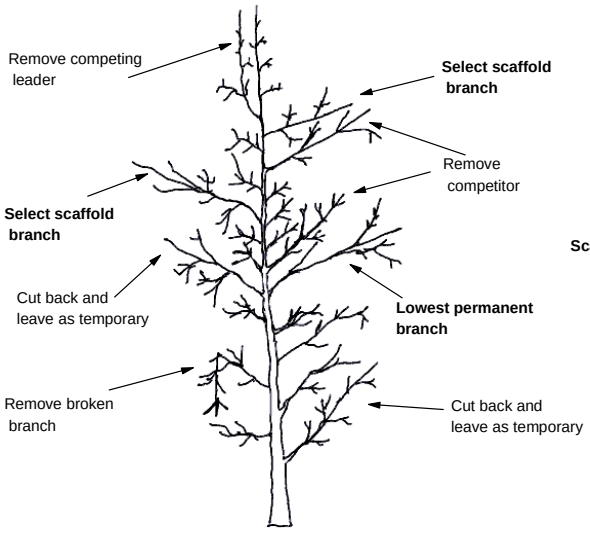
Pruning guidelines

Why should you train young trees?

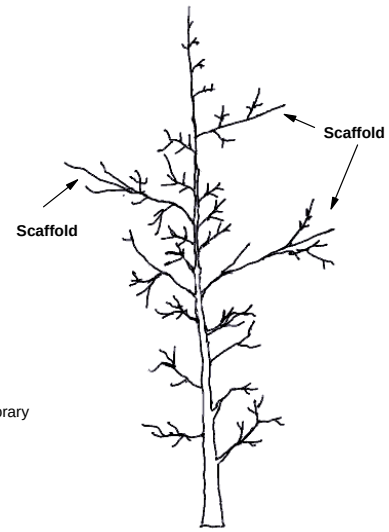
1. **Improve structural strength**: remove branches that will be more prone to breakage as tree grows
2. **Reduce future maintenance**: good branch distribution and structure will reduce need for future maintenance and will make any needed maintenance easier.
3. **Increase tree longevity**: properly trained trees are less likely to suffer branch breakage that can shorten tree life

Five steps for training young trees

Step	What	When	How
1.	Remove broken, diseased, dying, or dead branches	Start at planting and repeat as necessary	◔ Remove only as much as needed to correct the problem
2.	Select a central leader and remove competing leaders	Start at planting and repeat as necessary	◔ Generally the strongest and most vertical stem should be selected as the leader
3.	Select the lowest permanent branch	By the fourth or fifth year after planting; need to wait until tree is tall enough	◔ Height is based on necessary clearance: typically 8 ft over sidewalks ◔ You can use string to mark the branch for future reference
4.	Select main (scaffold) branches and remove or cut back competing branches	After lowest permanent branch is selected	◔ Distribute main branches around the trunk evenly on all sides ◔ Space main branches 12 to 18 inches apart up and down the trunk - use larger spacing for trees that have greater mature height ◔ Main branches should be no more than half the size of the trunk at the attachment point and should not contain **included bark** (bark that becomes pinched between branches that diverge at a narrow angle) ◔ Lateral branches along the main branches should not be closer than 2 feet from the trunk
5.	Select and maintain temporary branches below the lowest permanent branch	Starting at planting	◔ Remove temporary branches that: - become 1½ inches in diameter - are 1/3 the size of the main stem at the point of attachment - are within about 4 inches of selected scaffolds ◔ Shorten temporary branches to suppress them



Before pruning



After pruning

◔ Don't remove any more branches than are needed to accomplish steps 1-5.

◔ Don't remove more than about 1/4 of the tree canopy in a single year. Commonly, no more than 5% to 10% of the canopy needs to be removed in a given year during training.

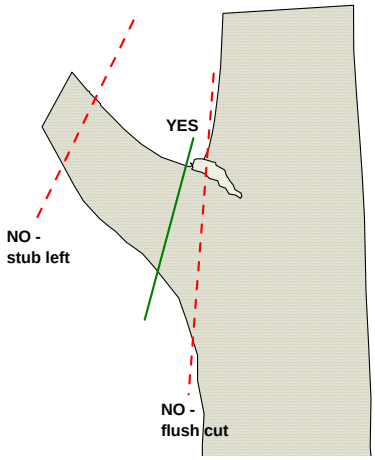
Pruning guidelines

When should I prune?

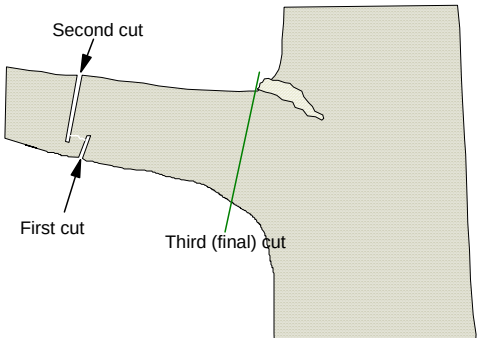
- The best time to prune can vary somewhat by species. It is best to prune most trees during the dormant season (December to February), or as close to the dormant season as possible. For mature native oaks, pruning during the dry season (late spring to late summer) is preferred to reduce the chance that decay fungi will invade new pruning wounds. Light pruning and removal of dead wood can usually be done anytime. Avoid pruning during the spring growth flush.

Proper pruning cuts

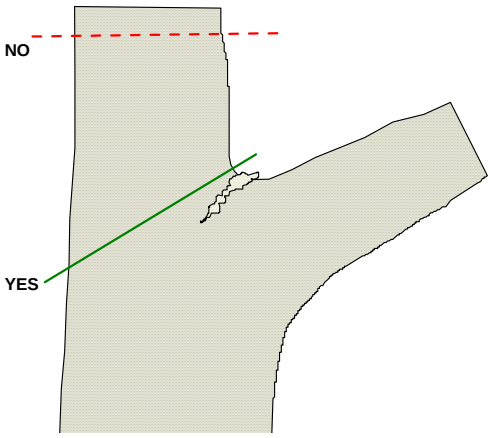
- When removing a branch, cut all the way back to the main stem without leaving a stub, but don't try to cut flush to the main stem. A small collar of tissue is often present around the base of the stem - cut to the outer edge of that collar.



- When removing a branch with a saw, first cut part way into the branch on the underside about a foot from the area where the final cut will be made. Then cut through the branch from the top. This will remove most of the branch without tearing the bark beyond the cut. Finally, cut the remaining stub off cleanly near the main stem, supporting the stub if necessary to avoid tearing the bark when the cut is made. Pruning in this fashion will result in the smallest possible pruning wound.



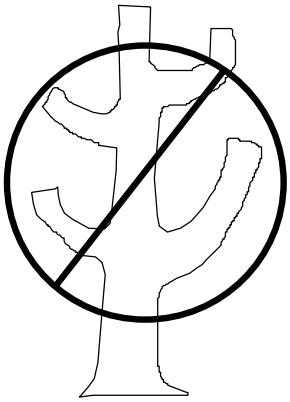
- When reducing the length of a branch, place the cut next to a side branch that is at least 1/2 the diameter of the removed stem.



Don't top your tree!!

Topping (cutting large branches back to stubs) is bad for both you and your tree.

- Topping typically removes 50 - 100% of the leaf-bearing crown of the tree. This seriously weakens the tree, and can lead to branch decay and possibly tree death.



- After topping, trees respond by producing excessive numbers of fast growing shoots from latent buds. These sprouts are poorly attached to the stubbed branches and develop into branches that are prone to break off, especially in high winds.
- Topped trees require more maintenance than properly-pruned trees. Corrective pruning is required to make topped trees less hazardous, but can never really restore the tree to its previous form.

How do I choose an arborist or tree care service?

Recommendations from the International Society of Arboriculture (http://www.isa-arbor.com)

What to look for in an arborist or tree care firm:

- Membership in professional organizations such the International Society of Arboriculture (ISA) or the American Society of Consulting Arborists (ASCA).
- Certification through the ISA Certified Arborist program.
- California State Contractors license (for jobs over $500.00) and proof of insurance.
- A list of references (Don't hesitate to check.)
- Avoid using any tree company that advertises topping or recommends that a tree be topped or uses tree climbing spikes to climb trees that are being pruned. Knowledgeable arborists know that topping is harmful to trees and is not an accepted practice. Climbing spikes can damage trees, and their use should be limited to trees that are being removed.

Appendix 7.8. Guideline Specifications for Nursery Tree Quality

These guidelines were produced by a committee comprised of municipal arborists, urban foresters, nurserymen, U.C. Cooperative Extension horticultural advisors, landscape architects, non-profit tree groups, horticultural consultants, and others. They are available online at http://urbantree.org/specs.asp.

Guideline Specifications for Nursery Tree Quality

Selecting Quality Nursery Stock

A committee comprised of municipal arborists, urban foresters, nurserymen, U.C. Cooperative Extension horticultural advisors, landscape architects, non–profit tree groups, horticultural consultants, etc., developed the attached specifications to ensure high quality landscape trees. After more than a year of work, they succeeded in drafting a document entitled Specification Guidelines for Container–grown Trees for California. This document will be published and the guidelines promoted throughout the nursery and landscape industry. Its intent is to help landscape professionals develop their own comprehensive and detailed specifications to ensure that they obtain high quality container–grown nursery trees. The document is also intended to help nursery professionals in their efforts to improve the quality of trees grown in California. These specifications can be modified for specific simulations.

The following people worked on the **Guideline Specifications for Nursery Tree Quality:**

David Burger	UC Davis, Department of Environmental Horticulture, Davis
Barrie Coate	Consulting Arborist, Los Gatos
Larry Costello	UC Cooperative Extension, Half Moon Bay
Robert Crudup	Valley Crest Tree Company, Sunol
Jim Geiger	Center for Urban Forest Research UC Davis, Davis
Bruce Hagen	California Dept. of Forestry & Fire Protection, Santa Rosa
Richard Harris	UC Davis Department of Environmental Horticulture, Davis
Brian Kempf	Urban Tree Foundation, Visalia
Jerry Koch	City of Berkeley Division of Urban Forestry, Berkeley
Bob Ludekens	L. E. Cooke Company, Visalia
Greg McPherson	Center for Urban Forest Research, UC Davis, Davis
Martha Ozonoff	California ReLeaf, Sacramento
Ed Perry	UC Cooperative Extension, Stanislaus County
Markio Roberts	Caltrans, LDA Maintenance Division, Oakland

Illustrations:

Front page, c) temporary branches C. Trunk Taper Illustration by Edward F. Gilman, Professor, Environmental Horticulture Department, IFAS, University of Florida.
All other Illustrations adapted from Integrated Management of Landscape Trees, Shrubs and Vines, Fourth Edition, 2003, Harris, Clark, Matheny
Photos: Brian Kempf
For more information contact Brian Kempf 559–713–0631 or brian@urbantree.org

Guideline Specifications for Nursery Tree Quality

I. PROPER IDENTIFICATION

All trees shall be true to name as ordered or shown on the planting plans and shall be labeled individually or in groups by species and cultivar (*where appropriate*).

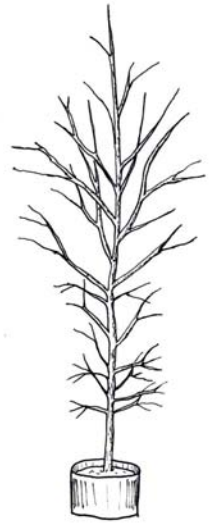


Illustration by Edward F. Gilman, Professor, Environmental Horticulture Department, IFAS, University of Florida.

II. 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.

III. TREE CHARACTERISTICS AT THE TIME OF SALE OR DELIVERY

A. TREE HEALTH

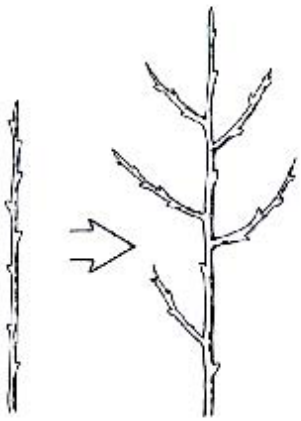
As typical for the species/cultivar, trees shall be healthy and vigorous, as indicated by an inspection for the following:

1. Trees shall be relatively free of pests (*insects, pathogens, nematodes or other injurious organisms*).
2. An inspection of the crown, trunk, and roots shall find the following characteristics:

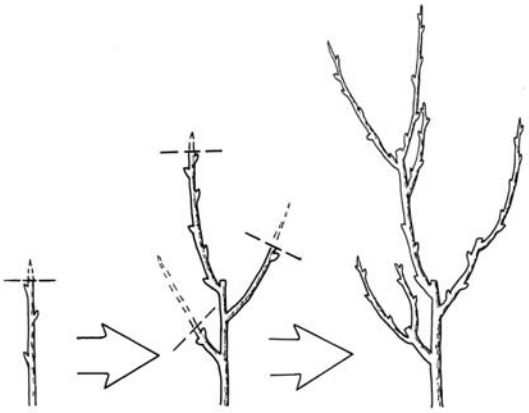
a. Crown Form: The form or shape of the crown is typical for a young specimen of the species/cultivar. The crown is not significantly deformed by wind, pruning practices, pests or other factors.
b. Leaves: The size, color and appearance of leaves are typical for the time of year and stage of growth of the species/cultivar. Leaves are not stunted, misshapen, tattered, discolored (*chlorotic or necrotic*) or otherwise atypical.
c. Branches: Shoot growth (*length and diameter*) throughout the crown is typical for the age/size of the species/cultivar. Trees do not have dead, diseased, broken, distorted or other serious branch injuries.
d. Trunk: The tree trunk should be fairly straight, vertical and free of wounds (*except properly–made pruning cuts*), sunburned areas, conks (*fungal fruiting bodies*), wood cracks, bleeding areas, signs of boring insects, galls, cankers/lesions and girdling ties.
e. Tree height and trunk diameter are typical for the age, species/cultivar and container size.
f. Roots: The root system is free of injury from biotic (*insects, pathogens, etc.*) and abiotic agents (*herbicide toxicity, salt injury, excess irrigation, etc.*). Root distribution is uniform throughout the soil mix or growth media and growth is typical for the species/cultivar.

B. CROWN

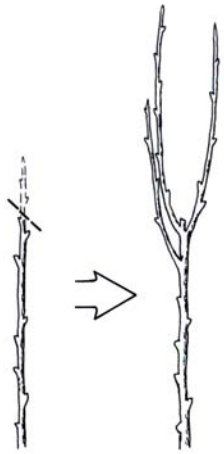
1. **Central Leader**: Trees shall have a single, relatively straight central leader and tapered trunk, free of codominant stems and vigorous, upright branches that compete with the central leader. If the original leader has been headed, a new leader at least ½ (*one–half*) the diameter of the original leader shall be present.



Maintaining a single, centeral leader is preferable.



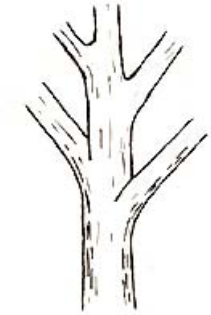
Heading and retaining a leader is acceptable.



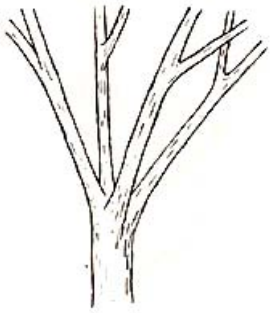
Heading without retaining a leader is unacceptable.

2. **Main Branches** (*scaffolds*): Branches should be distributed radially around and vertically along the trunk, forming a generally symmetrical crown typical for the species.

a) **Main branches**, for the most part, shall be well spaced.

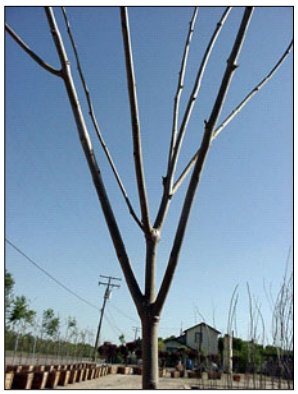


preferable



unacceptable

preferable



unacceptable

b) **Branch diameter** shall be no greater than 2/3 (*two thirds*) the diameter of the trunk, measured 1" (*one inch*) above the branch.

preferable

unacceptable

preferable

unacceptable

c) The attachment of scaffold branches shall be free of **included bark**.

preferable

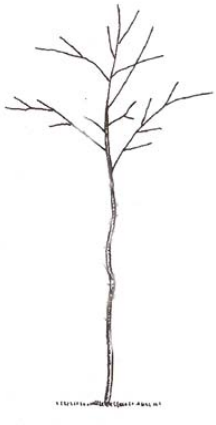
unacceptable

preferable

unacceptable

3. **Temporary branches:** Temporary branches should be present along the lower trunk, particularly for trees less than 1–1/2" (*one and one–half inches*) in trunk diameter. They should be no greater than 3/8" (*three–eighths inch*) in diameter. Heading of temporary branches is often necessary to limit their growth.

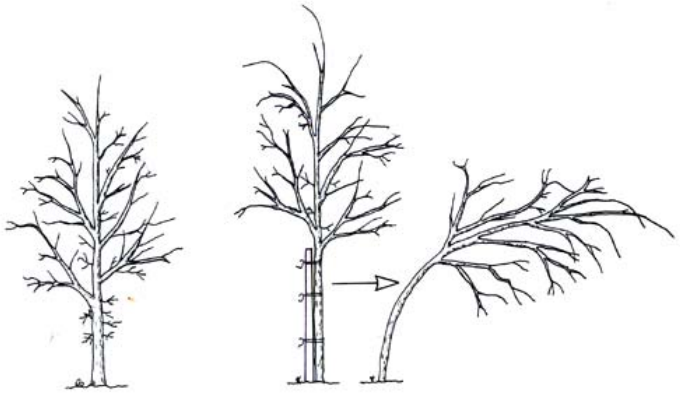

Good

Not as Good

C. TRUNK

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



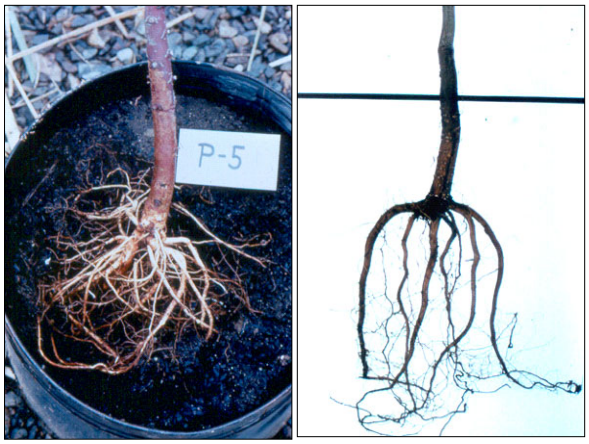
2. The **trunk shall be free of wounds** (*except properly–made pruning cuts*), sunburned areas, conks (*fungal fruiting–bodies*), wood cracks, bleeding areas, signs of boring insects, galls, cankers and/or lesions.

3. **Trunk diameter** at 6" (*six inches*) above the soil surface shall be within the diameter range shown for each container size below:

Container Size	Trunk Diameter (*inches*)
# 5 (gallon)	0.5" to 0.75"
# 15 (gallon)	0.75" to 1.5"
24 inch box	1.5" to 2.5"

D. ROOTS

1. 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.



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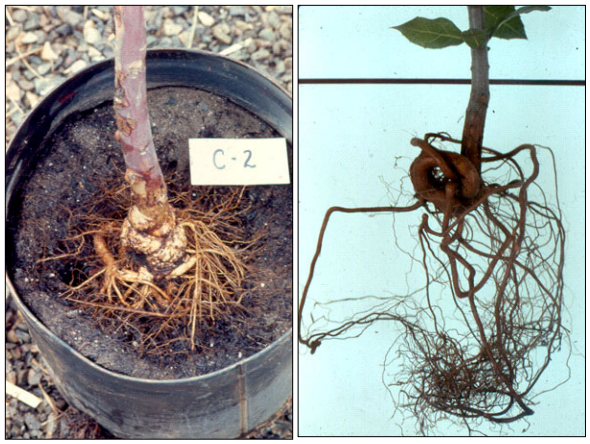


unacceptable

2. The tree shall be **well rooted** in the soil mix. When the container is removed, the rootball shall remain intact. When the trunk is carefully lifted both the trunk and root system shall move as one.

preferable

unacceptable

3. The **upper–most roots** or root collar shall be within 1" (*one inch*) above or below the soil surface.

preferable

unacceptable

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

preferable

unacceptable

E. MOISTURE STATUS

At time of inspection and delivery, the rootball shall be moist throughout. The crown shall show no signs of moisture stress as indicated by wilted, shriveled or dead leaves or branch dieback. The roots shall show no signs of excess soil moisture conditions as indicated by poor root growth, root discoloration, distortion, death or foul odor.

V. INSPECTION

The buyer reserves the right to reject trees that do not meet specifications as set forth in these guidelines or as specified by the buyer. If a particular defect or substandard element or characteristic can be easily corrected, appropriate remedies shall be required. If destructive inspection of a rootball(s) is to be done, the buyer and seller should have a prior agreement as to the time and place of inspection, minimum number of trees or percentage of a species or cultivar to be inspected and financial responsibility for the inspected trees.

DELIVERY

The buyer should stipulate how many days prior to delivery that notification is needed.

GLOSSARY:

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.

Crown – The aboveground part of the tree including the trunk.

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

Girdling root – A root that partially or entirely encircles the trunk and/or buttress roots, which could restrict growth and downward movement of photosynthate and/or water and nutrients up.

Included bark – Bark embedded within the crotch between a branch and the trunk or between two or more stems that prevents the formation of a normal branch bark ridge. This often occurs in branches with narrow-angled attachments or branches resulting from the loss of the leader. Such attachments are weakly attached and subject to splitting out.

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

Leader – The dominant stem which usually develops into the main trunk.

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

Root collar – The flared area at the base of a tree where the roots and trunk merge. Also referred to as the "root crown" or "root flare".

Shall – Used to denote a practice that is mandatory.

Should – Used to denote a practice that is recommended.

Scaffold branches – Large, main branches that form the main structure of the tree.

Temporary branch – A small branch that is retained temporarily along the lower trunk of young trees. Temporary branches provide photosynthate to increase trunk caliper and taper and help protect it from sunburn damage and mechanical injury. Such branches should be kept small and gradually removed as the trunk develops.

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

Appendix 7.9. How to Prune Trees (USDA Forest Service Publication NA-FR-01-95)

This guide to pruning was produced by the Northeastern Region of the USDA Forest Service is also available online at http://www.na.fs.fed.us/spfo/pubs/howtos/ht_prune/prun001.htm. It contains much of the same information found in the copyright-protected ANSI A300 pruning standards, but can be freely reproduced for distribution.

NA-FR-01-95

USDA Forest Service

Northeastern Area State and Private Forestry

HOW to Prune Trees

Peter J. Bedker, Joseph G. O'Brien, and Manfred M. Mielke
Illustrations by Julie Martinez, Afton, MN

Introduction

The objective of pruning is to produce strong, healthy, attractive plants. By understanding how, when and why to prune, and by following a few simple principles, this objective can be achieved.

Why Prune

The main reasons for pruning ornamental and shade trees include safety, health, and aesthetics. In addition, pruning can be used to stimulate fruit production and increase the value of timber. Pruning for *safety* (Fig. 1A) involves removing branches that could fall and cause injury or property damage, trimming branches that interfere with lines of sight on streets or driveways, and removing branches that grow into utility lines. Safety pruning can be largely avoided by carefully choosing species that will not grow beyond the space available to them, and have strength and form characteristics that are suited to the site.

Pruning for *health* (Fig. 1B) involves removing diseased or insect-infested wood, thinning the crown to increase airflow and reduce some pest problems, and removing

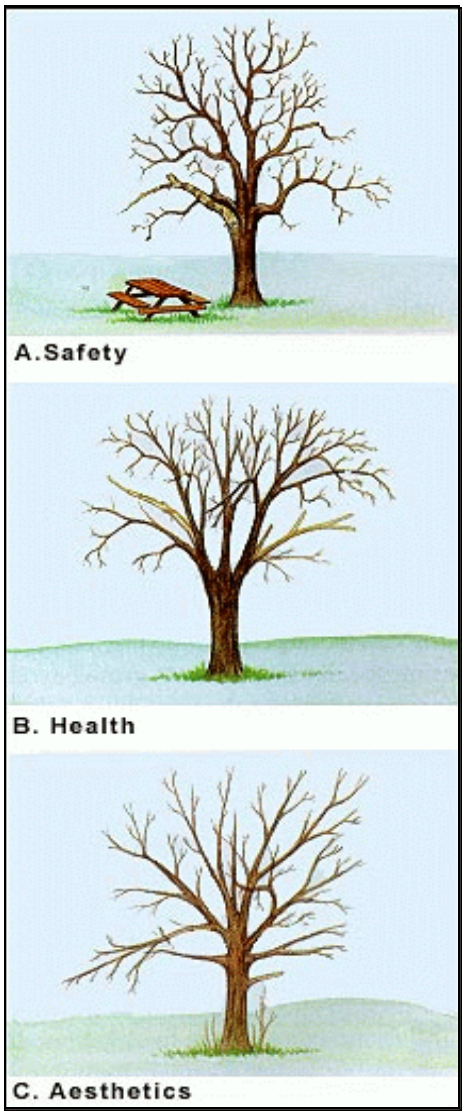


Figure 1. Reasons for pruning.

crossing and rubbing branches. Pruning can best be used to encourage trees to develop a strong structure and reduce the likelihood of damage during severe weather. Removing broken or damaged limbs encourage wound closure.

Pruning for *aesthetics* (Fig. 1C) involves enhancing the natural form and character of trees or stimulating flower production. Pruning for form can be especially important on open-grown trees that do very little self-pruning.

All woody plants shed branches in response to shading and competition. Branches that do not produce enough carbohydrates from photosynthesis to sustain themselves die and are eventually shed; the resulting wounds are sealed by **woundwood** (callus). Branches that are poorly attached may be broken off by wind and accumulation of snow and ice. Branches removed by such natural forces often result in large, ragged wounds that rarely seal. Pruning as a cultural practice can be used to supplement or replace these natural processes and increase the strength and longevity of plants.

Trees have many forms, but the most common types are pyramidal **(excurrent)** or spherical (**decurrent)**. Trees with pyramidal crowns, e.g., most conifers, have a strong central stem and lateral branches that are more or less horizontal and do not compete with the central stem for dominance. Trees with spherical crowns, e.g., most hardwoods, have many lateral branches that may compete for dominance.

To reduce the need for pruning it is best to consider a tree's natural form. It is very difficult to impose an unnatural form on a tree without a commitment to constant maintenance.

Pollarding and **topiary** are extreme examples of pruning to create a desired, unnatural effect. Pollarding is the practice of pruning trees annually to remove all new growth. The following year, a profusion of new branches is produced at the ends of the branches. Topiary involves pruning trees and shrubs into geometric or animal shapes. Both pollarding and topiary are specialized applications that involve pruning to change the natural form of trees. As topiary demonstrates, given enough care and attention plants can be pruned into nearly any form. Yet just as proper pruning can enhance the form or character of plants, improper pruning can destroy it.

Pruning Approaches

Producing strong structure should be the emphasis when pruning young trees. As trees mature, the aim of pruning will shift to maintaining tree structure, form, health and appearance.

Proper pruning cuts are made at a node, the point at which one branch or twig attaches to another. In the spring of the year growth begins at buds, and twigs grow until a new node is formed. The length of a branch between nodes is called an internode.

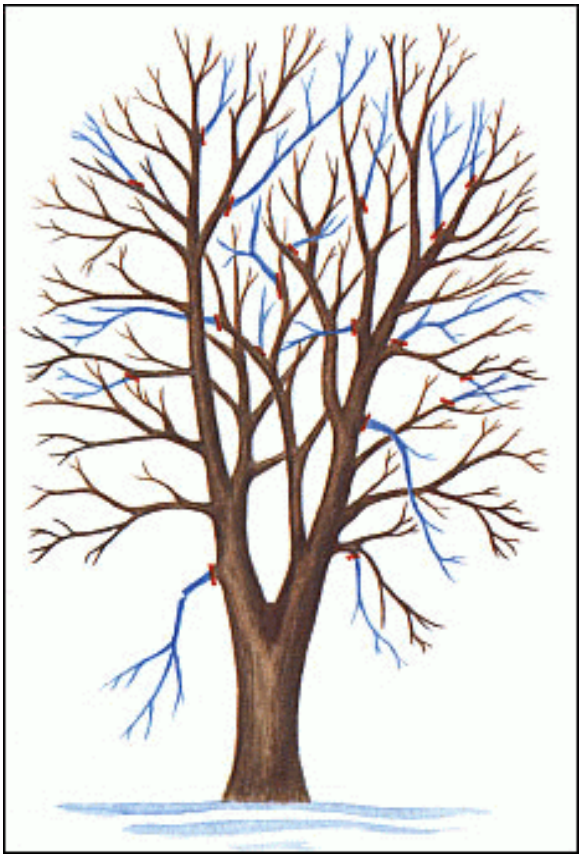


Figure 2. Crown thinning - branches to be removed are shaded in blue; pruning cuts should be made at the red lines. No more than one-fourth of the living branches should be removed at one time.

The most common types of pruning are:

1. *Crown Thinning* (Fig. 2)

Crown thinning, primarily for hardwoods, is the selective removal of branches to increase light penetration and air movement throughout the crown of a tree. The intent is to maintain or develop a tree's structure and form. To avoid unnecessary stress and prevent excessive production of epicormic sprouts, no more than one-quarter of the living crown should be removed at a time. If it is necessary to remove more, it should be done over successive years.

Figure 3. Types of branch unions.

Branches with strong U-shaped angles of attachment should be retained (Fig 3A). Branches with narrow, V-shaped angles of attachment often form **included bark** and should be removed (Fig. 3B). Included bark forms when two branches grow at sharply acute angles to one another, producing a wedge of inward-rolled bark between them. Included bark prevents strong attachment of branches, often causing a crack at the point below where the branches meet. Codominant stems that are approximately the same size and arise from the same position often form included bark. Removing some of the lateral branches from a codominant stem can reduce its growth enough to allow the other stem to become dominant.

Lateral branches should be no more than one-half to three-quarters of the diameter of the stem at the point of attachment. Avoid producing "lion's tails," tufts of branches and foliage at the ends of branches, caused by removing all inner lateral branches and foliage. Lion's tails can result in sunscalding, abundant **epicormic sprouts**, and weak branch structure and breakage. Branches that rub or cross

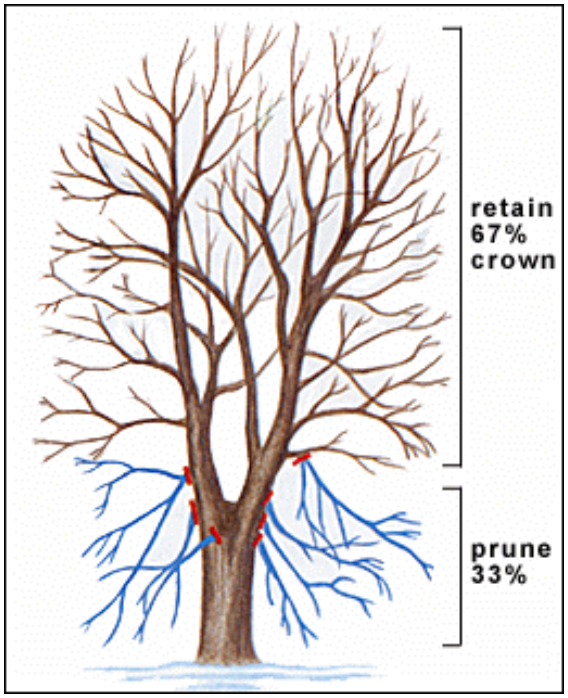


Figure 4. Crown raising - branches to be removed are shaded in blue; pruning cuts should be made where indicated with red lines. The ratio of live crown to total tree height should be at least two-thirds.

another branch should be removed.

Conifers that have branches in whorls and pyramidal crowns rarely need crown thinning except to restore a dominant leader. Occasionally, the leader of a tree may be damaged and multiple branches may become codominant. Select the strongest leader and remove competing branches to prevent the development of codominant stems.

2. *Crown Raising* (Fig. 4)

Crown raising is the practice of removing branches from the bottom of the crown of a tree to provide clearance for pedestrians, vehicles, buildings, lines of site, or to develop a clear stem for timber production. Also, removing lower branches on white pines can prevent blister rust. For street trees the minimum clearance is often specified by municipal ordinance. After pruning, the ratio of the living crown to total tree height should be at least two-thirds (e.g., a 12 m tree should have living branches on at least the upper 8 m).

On young trees "temporary" branches may be retained along the stem to encourage taper and protect trees from vandalism and sun scald. Less vigorous shoots should be selected as temporary branches and should be about 10 to 15 cm apart along the stem. They should be pruned annually to slow their growth and should be removed eventually.

3. *Crown Reduction* (Fig. 5)

Crown reduction pruning is most often used when a tree has grown too large for its permitted space. This method, sometimes called **drop crotch pruning**, is preferred to topping because it results in a more natural appearance, increases the time before pruning is needed again, and minimizes stress (see drop crotch cuts in the next section).

Crown reduction pruning, a method of last resort, often results in large pruning wounds to stems that may lead to decay. This method should never be used on a tree with a pyramidal growth form. A better long term solution is to remove the tree and replace it

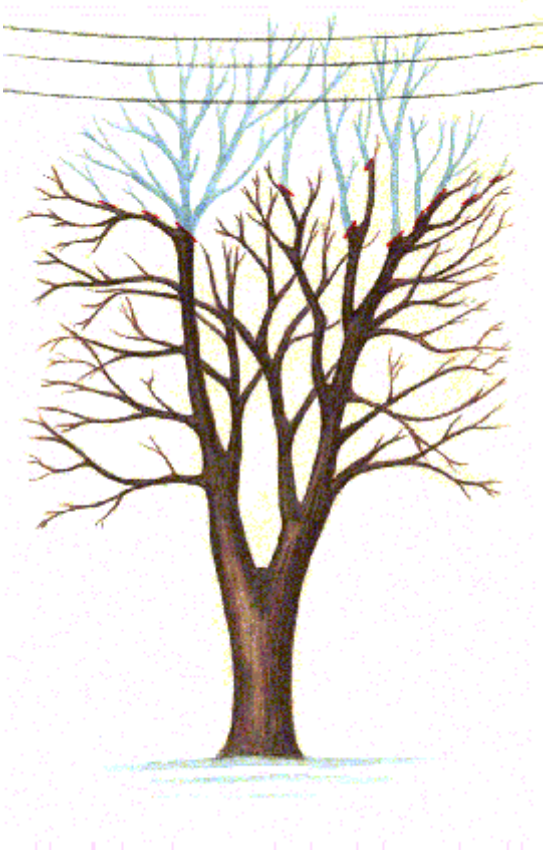


Figure 5. Crown reduction - branches to be removed are shaded in blue; pruning cuts should be made where indicated with red lines. To prevent branch dieback, cuts should be made at lateral branches that are at least one-third the diameter of the stem at their union.

with a tree that will not grow beyond the available space.

Pruning Cuts

Pruning cuts should be made so that only branch tissue is removed and stem tissue is not damaged. At the point where the branch attaches to the stem, branch and stem tissues remain separate, but are contiguous. If only branch tissues are cut when pruning, the stem tissues of the tree will probably not become decayed, and the wound will seal more effectively.

1. *Pruning living branches* (Fig. 6)

To find the proper place to cut a branch, look for the **branch collar** that grows from the stem tissue at the underside of the base of the branch (Fig. 6A). On the upper surface, there is usually a **branch bark ridge** that runs (more or less) parallel to the branch angle, along the stem of the tree. A proper pruning cut does not damage either the branch bark ridge or the branch collar.

A proper cut begins just outside the branch bark ridge and angles down away from the stem of the tree, avoiding injury to the branch collar (Fig. 6B). Make the cut as close as possible to the stem in the **branch axil**, but outside the branch bark ridge, so that stem tissue is not injured and the wound can seal in the shortest time possible. If the cut is too far from the stem, leaving a branch stub, the branch tissue usually dies and woundwood forms from the stem tissue. Wound closure is delayed because the woundwood must seal over the stub that was left.

The quality of pruning cuts can be evaluated by examining pruning wounds after one growing season. A concentric ring of woundwood will form from proper pruning cuts (Fig. 6B). **Flush cuts** made inside the branch bark ridge or branch collar, result in pronounced development of woundwood on the sides of the pruning wounds with very little woundwood forming on the top or bottom (Fig. 7D). As described above, stub cuts result in the death of the remaining branch and woundwood forms around the base from stem tissues.
When pruning small branches with hand pruners, make sure the tools are sharp enough

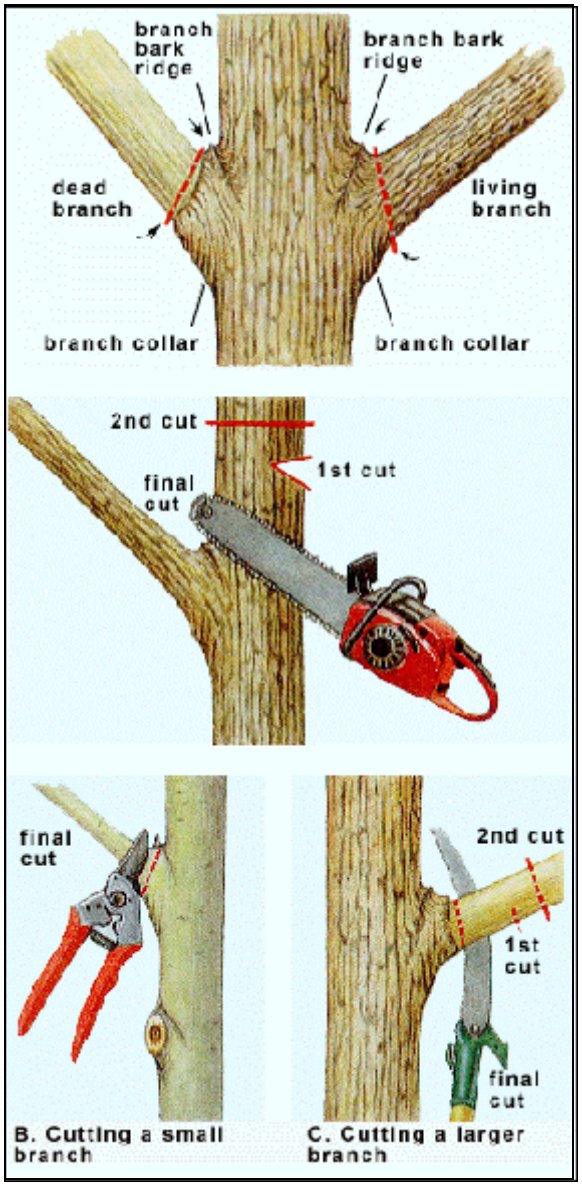


Figure 6. Pruning cuts

to cut the branches cleanly without tearing. Branches large enough to require saws should be supported with one hand while the cuts are made. If the branch is too large to support, make a three-step pruning cut to prevent bark ripping (Fig. 6C).

1. The first cut is a shallow notch made on the underside of the branch, outside the branch collar. This cut will prevent a falling branch from tearing the stem tissue as it pulls away from the tree.
2. The second cut should be outside the first cut, all the way through the branch, leaving a short stub.
3. The stub is then cut just outside the branch bark ridge/branch collar, completing the operation.

2. *Pruning dead branches* (Fig. 6)

Prune dead branches in much the same way as live branches. Making the correct cut is usually easy because the branch collar and the branch bark ridge, can be distinguished from the dead branch, because they continue to grow (Fig. 6A). Make the pruning cut just outside of the ring of woundwood tissue that has formed, being careful not to cause unnecessary injury (Fig. 6C). Large dead branches should be supported with one hand or cut with the three-step method, just as live branches. Cutting large living branches with the three step method is more critical because of the greater likelihood of bark ripping.

3. *Drop Crotch Cuts* (Fig. 6D)

A proper cut begins just above the branch bark ridge and extends through the stem parallel to the branch bark ridge. Usually, the stem being removed is too large to be supported with one hand, so the three cut method should be used.

1. With the first cut, make a notch on the side of the stem away from the branch to be retained, well above the branch crotch.

2. Begin the second cut inside the branch crotch, staying well above the branch bark ridge, and cut through the stem above the notch.
3. Cut the remaining stub just inside the branch bark ridge through the stem parallel to the branch bark ridge.

To prevent the abundant growth of epicormic sprouts on the stem below the cut, or dieback of the stem to a lower lateral branch, make the cut at a lateral branch that is at least one-third of the diameter of the stem at their union.

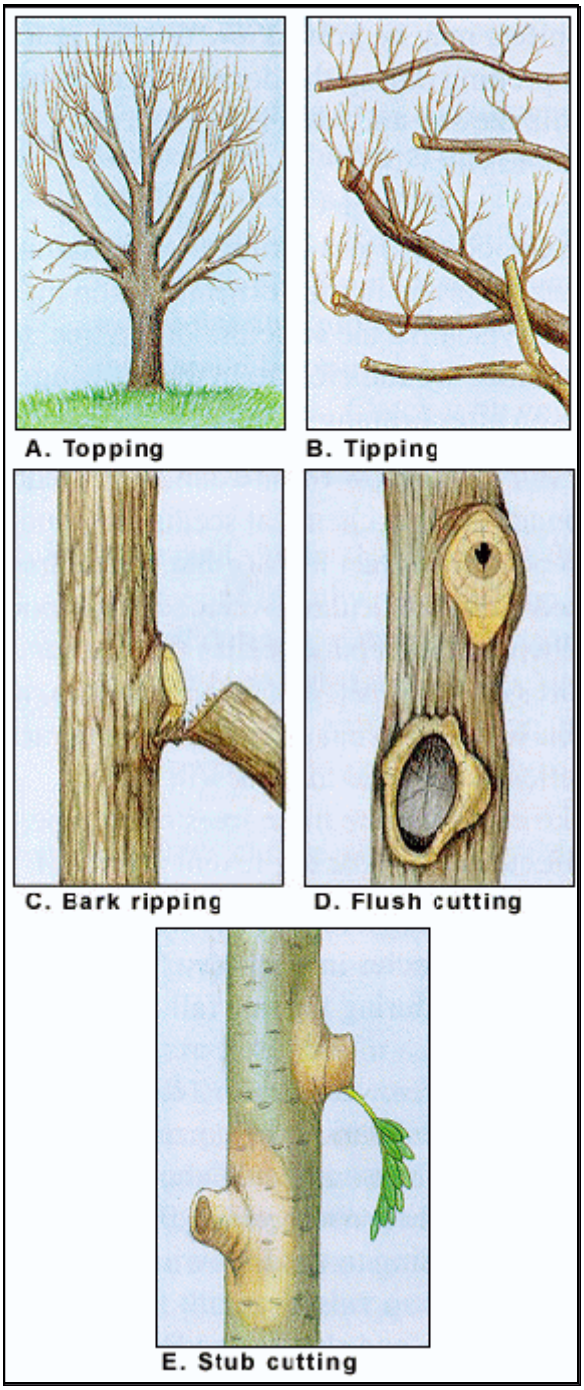
Pruning Practices That Harm Trees

Topping and **tipping** (Fig. 7A, 7B) are pruning practices that harm trees and should not be used. Crown reduction pruning is the preferred method to reduce the size or height of the crown of a tree, but is rarely needed and should be used infrequently.

Topping, the pruning of large upright branches between nodes, is sometimes done to reduce the height of a tree (Fig. 7A). Tipping is a practice of cutting lateral branches between nodes (Fig. 7B) to reduce crown width.

These practices invariably result in the development of epicormic sprouts**,** or in the death of the cut branch back to the next lateral branch below. These epicormic sprouts are weakly attached to the stem and eventually will be supported by a decaying branch.

Improper pruning cuts cause unnecessary injury and bark ripping (Fig. 7C). Flush cuts injure



stem tissues and can result in decay (Fig. 7D). **Stub cuts** delay wound closure and can provide entry to canker fungi that kill the cambium, delaying or preventing woundwood formation (Fig. 7E).

When to Prune

Conifers may be pruned any time of year, but pruning during the dormant season may minimize sap and resin flow from cut branches.

Hardwood trees and shrubs *without showy flowers*: prune in the dormant season to easily visualize the structure of the tree, to maximize wound closure in the growing season after pruning, to reduce the chance of transmitting disease, and to discourage excessive sap flow from wounds. Recent wounds and the chemical scents they emit can actually attract insects that spread tree disease. In particular, wounded elm wood is known to attract bark beetles that harbor spores of the Dutch elm disease fungus, and open wounds on oaks are known to attract beetles that spread the oak wilt fungus. Take care to prune these trees during the correct time of year to prevent spread of these fatal diseases. Contact your local tree disease specialist to find out when to prune these tree species in your area. Usually, the best time is during the late fall and winter.

Flowering trees and shrubs: these should also be pruned during the dormant season for the same reasons stated above; however, to preserve the current year's flower crop, prune according to the following schedule:

- Trees and shrubs that flower in early spring (redbud, dogwood, etc.) should be pruned immediately after flowering (flower buds arise the year before they flush, and will form on the new growth).
- Many flowering trees are susceptible to fireblight, a bacterial disease that can be spread by pruning. These trees, including many varieties of crabapple, hawthorn, pear, mountain ash, flowering quince and pyracantha, should be pruned during the dormant season. Check with your county extension agent or a horticulturist for additional information.
- Trees and shrubs that flower in the summer or fall always should be pruned during the dormant season (flower buds will form on new twigs during the next growing season, and the flowers will flush normally).

Dead branches: can be removed any time of the year.

Pruning Tools

Proper tools are essential for satisfactory pruning (Fig.6). The choice of which tool to use depends largely on the size of branches to be pruned and the amount of pruning to be done. If possible, test a tool before you buy it to ensure it suits your specific needs. As with most things, higher quality often equates to higher cost.

Generally speaking, the smaller a branch is when pruned, the sooner the wound created will seal. Hand pruners are used to prune small branches (under 2.5 cm diameter) and many different kinds are available. Hand pruners can be grouped into by-pass or anvil styles based on the blade configuration. Anvil style pruners have a straight blade that cuts the branch against a small anvil or block as the handles are squeezed. By-pass pruners use a curved cutting blade that slides past a broader lower blade, much like a scissors. To prevent unnecessary tearing or crushing of tissues, it is best to use a

by-pass style pruner. Left- or right-handed types can be purchased.

Slightly larger branches that cannot be cut with a hand pruner may be cut with small pruning saws (up to 10 cm) or lopping shears (up to 7 cm diameter) with larger cutting surfaces and greater leverage. Lopping shears are also available in by-pass and anvil styles.

For branches too large to be cut with a hand pruner or lopping shears, pruning saws must be used. Pruning saws differ greatly in handle styles, the length and shape of the blade, and the layout and type of teeth. Most have tempered metal blades that retain their sharpness for many pruning cuts. Unlike most other saws, pruning saws are often designed to cut on the "pull-stroke."

Chain saws are preferred when pruning branches larger than about 10 cm. Chainsaws should be used only by qualified individuals. To avoid the need to cut branches greater than 10 cm diameter, prune when branches are small.

Pole pruners must be used to cut branches beyond reach. Generally, pruning heads can cut branches up to 4.4 cm diameter and are available in the by-pass and anvil styles. Once again, the by-pass type is preferred. For cutting larger branches, saw blades can be fastened directly to the pruning head, or a separate saw head can be purchased. Because of the danger of electrocution, pole pruners should not be used near utility lines except by qualified utility line clearance personnel.

To ensure that satisfactory cuts are made and to reduce fatigue, keep your pruning tools sharp and in good working condition. Hand pruners, lopping shears, and pole pruners should be periodically sharpened with a sharpening stone. Replacement blades are available for many styles. Pruning saws should be professionally sharpened or periodically replaced. To reduce cost, many styles have replaceable blades.

Tools should be clean and sanitized as well as sharp. Although sanitizing tools may be inconvenient and seldom practiced, doing so may prevent the spread of disease from infected to healthy trees on contaminated tools. Tools become contaminated when they come into contact with fungi, bacteria, viruses and other microorganisms that cause disease in trees. Most pathogens need some way of entering the tree to cause disease, and fresh wounds are perfect places for infections to begin. Microorganisms on tool surfaces are easily introduced into susceptible trees when subsequent cuts are made. The need for sanitizing tools can be greatly reduced by pruning during the dormant season.

If sanitizing is necessary it should be practiced as follows: Before each branch is cut, sanitize pruning tools with either 70% denatured alcohol, or with liquid household bleach diluted 1 to 9 with water (1 part bleach, 9 parts water). Tools should be immersed in the solution, preferably for 1-2 minutes, and wood particles should be wiped from all cutting surfaces. Bleach is corrosive to metal surfaces, so tools should be thoroughly cleaned with soap and water after each use.

Treating wounds

Tree sap, gums, and resins are the natural means by which trees combat invasion by pathogens. Although unsightly, sap flow from pruning wounds is not generally harmful; however, excessive "bleeding" can weaken trees.

When oaks or elms are wounded during a critical time of year (usually spring for oaks, or throughout the growing season for elms) -- either from storms, other unforeseen mechanical wounds, or from necessary branch removals -- some type of wound dressing should be applied to the wound. Do this immediately after the wound is created. In most other instances, wound dressings are unnecessary, and may even be detrimental. Wound dressings will not stop decay or cure infectious diseases. They may actually interfere with the protective benefits of tree gums and resins, and prevent wound surfaces from closing as quickly as they might under natural conditions. The only benefit of wound dressings is to prevent introduction of pathogens in the specific cases of Dutch elm disease and oak wilt.

Pruning Guidelines

To encourage the development of a strong, healthy tree, consider the following guidelines when pruning.

General

- Prune first for safety, next for health, and finally for aesthetics.
- Never prune trees that are touching or near utility lines; instead consult your local utility company.
- Avoid pruning trees when you might increase susceptibility to important pests (e.g. in areas where oak wilt exists, avoid pruning oaks in the spring and early summer; prune trees susceptible to fireblight only during the dormant season).
- Use the following decision guide for size of branches to be removed: 1) under 5 cm diameter - go ahead, 2) between 5 and 10 cm diameter - think twice, and 3) greater than 10 cm diameter - have a good reason.

Crown Thinning

- Assess how a tree will be pruned from the top down.
- Favor branches with strong, U-shaped angles of attachment. Remove branches with weak, V-shaped angles of attachment and/or included bark.
- Ideally, lateral branches should be evenly spaced on the main stem of young trees.
- Remove any branches that rub or cross another branch.
- Make sure that lateral branches are no more than one-half to three-quarters of the diameter of the stem to discourage the development of co-dominant stems.

- Do not remove more than one-quarter of the living crown of a tree at one time. If it is necessary to remove more, do it over successive years.

Crown Raising

- Always maintain live branches on at least two-thirds of a tree's total height. Removing too many lower branches will hinder the development of a strong stem.
- Remove basal sprouts and vigorous epicormic sprouts.

Crown Reduction

- Use crown reduction pruning only when absolutely necessary. Make the pruning cut at a lateral branch that is at least one-third the diameter of the stem to be removed.
- If it is necessary to remove more than half of the foliage from a branch, remove the entire branch.

Glossary

Branch Axil: the angle formed where a branch joins another branch or stem of a woody plant.

Branch Bark Ridge: a ridge of bark that forms in a branch crotch and partially around the stem resulting from the growth of the stem and branch tissues against one another.

Branch Collar: a "shoulder" or bulge formed at the base of a branch by the annual production of overlapping layers of branch and stem tissues.

Crown Raising: a method of pruning to provide clearance for pedestrians, vehicles, buildings, lines of sight, and vistas by removing lower branches.

Crown Reduction Pruning: a method of pruning used to reduce the height of a tree. Branches are cut back to laterals that are at least one-third the diameter of the limb being removed.

Crown Thinning: a method of pruning to increase light penetration and air movement through the crown of a tree by selective removal of branches.

Callus: see woundwood.

Decurrent: a major tree form resulting from weak apical control. Trees with this form have several to many lateral branches that compete with the central stem for dominance resulting in a spherical or globose crown. Most hardwood trees have decurrent forms.

Epicormic Sprout: a shoot that arises from latent or adventitious buds; also know as water sprouts that occur for on stems and branches and suckers that are produced from the base of trees. In older wood, epicormic shoots often result from severe defoliation or radical pruning.

Excurrent: a major tree form resulting from strong apical control. Trees with this form have a strong central stem and pyramidal shape. Lateral branches rarely compete for dominance. Most conifers and a few hardwoods, such as sweetgum and tuliptree, have excurrent forms.

Flush Cuts: pruning cuts that originate inside the branch bark ridge or the branch collar, causing unnecessary injury to stem tissues.

Included Bark: bark enclosed between

branches with narrow angles of attachment, forming a wedge between the branches.

Pollarding: the annual removal of all of the previous year's growth, resulting in a flush of slender shoots and branches each spring.
Stub Cuts: pruning cuts made too far outside the branch bark ridge or branch collar, that leave branch tissue attached to the stem.

Tipping: a poor maintenance practice used to control the size of tree crowns; involves the cutting of branches at right angles leaving long stubs.

Topping: a poor maintenance practice often used to control the size of trees; involves the indiscriminate cutting of branches and stems at right angles leaving long stubs. Synonyms include rounding-over, heading-back, dehorning, capping and hat-racking. Topping is often improperly referred to as pollarding.

Topiary: the pruning and training of a plant into a desired geometric or animal shape.

Woundwood: lignified, differentiated tissues produced on woody plants as a response to wounding (also known as callus tissue).

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"How to Prune Trees" was written to help people properly prune the trees they care about. If you doubt your ability to safely prune large trees, please hire a professional arborist. Information in this publication can be used to interview and hire a competent arborist.