URBAN FORESTRY MANAGEMENT PLAN

MUNICIPALITY OF ANCHORAGE

MARCH 16, 2009

MUNICIPALITY OF ANCHORAGE
Live a Big Wild Life!

URBAN FORESTRY MANAGEMENT PLAN

FOR

MUNICIPALITY OF ANCHORAGE
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EXECUTIVE SUMMARY

Anchorage's Urban Forest Management Plan (UFMP) was initiated by the Alaska Department of Natural Resource Division of Forestry Community Forestry Program and funded by a USDA Forest Service grant and the Municipality of Anchorage (MOA) Parks & Recreation Department to facilitate the city's ongoing commitment to maintain, enhance, and preserve Anchorage's tree canopy.

The UFMP provides detailed information and recommendations to improve Anchorage's working community forest. Improving the community forest is no simple task. Improving Anchorage's street and park trees and conservation areas involves many objectives that will need to be funded and fulfilled if the community's vision for its trees is to be realized. The implementation of the UFMP will ultimately contribute to the quality of life in Anchorage through enhancements to the tree population.

The objectives of the management plan support the primary vision and mission of improving Anchorage's community through proper management of the city's most valuable asset – trees. The UFMP follows the program vision to retain a high quality of life by focusing on actions to increase the benefits and values of trees, and to improve on the responsible management of Anchorage's urban forest. Parks & Recreation Commission members, city administrators, elected officials, city staff, TREErific members, and citizens have this vision for the future of the Anchorage's urban forest:

MOA Urban Forestry Vision Statement

The MOA, recognizing the urban forest as an equal part of the community's infrastructure, will create, enhance, maintain, and sustain a vibrant, healthy and safe community forest resource for the benefit and enjoyment of Anchorage residents, visitors, and wildlife.

The UFMP supports the program mission statement. The objectives have been developed to address the challenges and issues that confront the city's trees and their stewardship. The objectives are dependent on one another and build upon the success of their implementation. Removing, pruning, planting, and preserving trees; educating stakeholders; and improving coordination and communication among citizens, tree committee, city staff and elected officials must be comprehensive for the UFMP to succeed.

MOA Urban Forestry Mission Statement

The mission of the Municipal Forestry Division is to provide proactive management and maintenance of all public trees and forests within the municipality and to provide quality customer service, education resources, and volunteer opportunities to enhance and enlighten the citizens of Anchorage. The urban forestry program will work to promote the use of a diverse mix of tree species throughout the community and manage for the prevention of insect, disease and exotic species outbreaks. We will manage our Urban Forest to ensure the long term safety, health and viability of trees within our community.

The UFMP provides for the development of a progressive long-range urban and community forestry program that will result in a healthier and safer forest in Anchorage. Acknowledging trees' major contribution to Anchorage, the goal of this management plan is to provide a strategic approach to sustaining community trees. The UFMP is a tool to be used for guiding the tree program and garnering support, cooperation and funding for the tree program.

MANAGEMENT GOALS

The UFMP establishes these management goals for the Municipality of Anchorage (MOA).

- Adopt and implement the Urban Forestry Management Plan.
- Increase urban forestry funding and expand staff levels to meet Society of Municipal Arborist accreditation standards.
- Implement a cyclic pruning program for young and mature trees.
- Remove high-risk trees.
- Create a master tree landscape plan; promote proper planting of new trees and diversification of species.
- Complete the comprehensive computerized inventory of all public trees.
- Create a tree ordinance to incorporate the recommendations and goals of the city's tree management plan, adopt the ordinance into the city code, and implement ordinance enforcement practices.
- Create the 'Arboriculture Specifications and Standards of Practice for the MOA' and incorporate the manual into MOA Standards and Specifications (M.A.S.S.)
- Provide education and public awareness of the importance of the trees to the community; educate city staff and the community on proper tree care; and encourage greater participation in tree steward activities.

These goals may change over time, both through completion of specific projects and through the changing nature and composition of the tree program and tree populations over the years.

MANAGEMENT RECOMMENDATIONS

These recommendations are based on program management goals and are preliminary steps to enhancing the urban forestry management program for the MOA. The following table contains a summary of the management goals contained in the UFMP.

TYPE	RECOMMENDATION	DESCRIPTION	PAGE
Program Planning	20-year strategic management plan	Create a 20 year strategic management plan.	11
	5-year management plan	Create four five year plans that are first level of operational planning	13
	Annual operating plans	Create annual plans to direct day-to-day operations	13
	Communications strategy	Create a strategy to capture key stakeholders and broader community input to the vision and goals for the 20-year plan	14
	Urban forestry citizens advisory committee	Establish a citizens advisory committee to advise commission, assembly, and citizens about program, and assist in plan development	15
	Master tree landscape plan	Develop a comprehensive planting plan that reflects both historic planting plans and current community values and desires.	15
	Management zones and zone rotation	Tree maintenance (planting, pruning, and removing) should rotate through the city each year on a two to five year rotation based on city resources.	17
Risk Management	Tree risk management plan	Inspect risk trees immediately and remove according to risk policy.	18
	Tree risk management policy	Develop and implement a city wide tree risk management policy.	21
	Risk tree abatement	All high risk trees should be inspected immediately and removed to reduce risk to residents, visitors, and facilities.	22
Maintenance	Tree pruning	Establish a proactive cyclic pruning program.	25
	Mature tree care	Establish a two to five year cyclic pruning program for mature trees	26
	Young tree pruning program	Implement a pruning program for new trees to establish structure and branch architecture	27
	Tree inspections	Establish an inspection routine using a trained PNW-ISA certified tree risk assessor to inspect trees regularly for	29

		risk and maintenance treatments.	
TYPE	RECOMMENDATION	DESCRIPTION	PAGE
Planting	Tree planting practices	Install new trees with root collar at grade level; treat circling and girdling roots at the time of installation.	30
	Tree planting and transportation management	Increase tree canopy along streets while encouraging appropriate species and placement	31
	Mulching	Apply mulch in 10 foot diameter circles to all new tree installations and recently planted trees to avoid mower and weed eater damage.	33
	Nursery stock procurement	Develop long-term strategy to acquire quality nursery stock, expand plant palette, and increase planting success. Establish an arboretum to display, test, and monitor new species	34
	Diversification	Install many varieties of trees. No single species should account for more than 10% of the population.	35
	Diameter distribution	Create a program that strives to increase the population of large stature trees.	37
Invasive Species Management	Invasive species control	Determine which species are invasive or will be invasive, phase out invasive species, and replant with desirable species.	38
Recycling Wood Waste	Recycle wood waste	Recycle tree residue for use as secondary products, mulch, biomass, fuel production or composting.	39
Tree Protection	Construction protection	Require contractors to use best arboriculture practices to protect trees in construction areas.	40
	Vandalism	Use public outreach and education to reduce vandalism and accidental tree injury.	40
	Young tree protection	Fence trees; install tree guards to prevent moose damage, vandalism and injury.	41
Public Outreach	Signage	Increase and improve signage around the city – add tree species labels and other descriptive signs.	42
	Tree guide	Develop a great tree walk for Anchorage's trees – provide patrons with maps and information to find large or unique trees and new species in the	42

		city.	
TYPE	RECOMMENDATION	DESCRIPTION	PAGE
	Community projects	Involve community civic groups, local businesses, schools, garden clubs and other organizations in tree projects.	42
	Tree stewardship	Establish a steward program to allow trained citizens to care for young trees.	42
Education	Community based social marketing and stakeholder participation	Use community based social marketing to determine issues relevant to citizens and how urban forestry program can address and solve those issues.	43
	Training	Initiate arboriculture training seminars, workshops and training programs for staff and citizens.	43
Management Information	Tree inventory	Inventory public trees to enhance short and long-term management of public trees.	44
	Data use and tree analysis	Use the inventory to track and report current planting, pruning, removal and other program maintenance history. Make tree data available to the public, to local schools for science projects and to other city departments.	45
Ordinance Review	Tree ordinance development	Write a tree ordinance with community input to reflect current arboriculture practices, address program goals, and meet community needs.	45
Downtown Trees	Design, planning, and planting	Revise designs to develop sites conducive to tree growth.	49
Tree-Sidewalk Conflict Resolution	Mitigate tree sidewalk conflicts using a variety of treatments	Reduce tree sidewalk infrastructure damage using tree-based, infrastructure-based, root based treatments or a combination of treatments.	53
Operational Review	Develop and enhance program functions, funding, staff	Improve program budget, policies, interdepartmental communication, staffing, staff training, and political support.	61
Program Actions	Short-term actions	Recommendations for short-term management actions	71
	Long-term actions	Recommendations for long-term management actions	73

The UFMP initiates an effort by the MOA to form systematic management strategies for the public tree population of Anchorage. Short and long term goals are addressed in detail in the UFMP and listed below.

SHORT-TERM ACTION ITEMS

There are five program management elements that must be addressed on an annual basis: Risk Tree Abatement, Mature Tree Care, Young Tree Care and Tree Planting, and Program Administration. Although each of these objectives is essential to the maintenance of the community forest, an annual plan should be established to determine where budget dollars will be spent. City staff and the UFMP recommendations have established public safety, responsible management of existing trees and tree planting as highest priorities.

LONG-TERM ACTION ITEMS

Long-range planning mainly concerns program enhancement and involves the completion of recommendations in the management plan. There are five program management elements that must be addressed to sustain the community's tree program and trees: Urban Forest Management Plan Adoption and Implementation, Urban Forest Management Plan Update, Increase Funds Spent on Community Trees, and Community Outreach and Education.

The recommendations and actions will help conserve Anchorage's tree resource and sustain the tree canopy for future generations. Although this commitment will come with costs, the long-term benefits are significantly greater and will result in a sustainable asset for the citizens of Anchorage today and tomorrow.

INTRODUCTION

In 2008, the Alaska Department of Natural Resources Community Forestry Program received a grant from the USDA Forest Service to assist the Municipality of Anchorage (MOA) to begin a public tree inventory and develop a management plan to guide the urban forestry program. The MOA also provided funds to match the grant and support the project.

The street and park trees of the MOA represent a considerable economic, social, recreational, and environmental asset to the community. Trees in urban areas are valued differently than their rural counterparts. Traditional forestry is the management of trees or stands of trees for timber production and other values including wildlife, water quality, and ecological health. Urban forestry is the management of trees and other forest resources in urban ecosystems for the environmental, economic, social, health, and aesthetic benefits trees provide society.

Tree Benefits

Community forests convey a number of quantifiable benefits which can be enhanced through management. A well managed urban forest provides valuable services such as improving air quality and contributing to storm water management. The application of the term "green infrastructure" to the urban forest is related largely to these types of services that the municipality would be paying for in other ways if the trees were not there to provide them. Trees in cities also contribute directly to the overall health and livability of urban areas by improving air and water quality, and buffering from the effects of wind all year round. In addition to these practical benefits, treed areas are also aesthetically pleasing and good places for natural recreation and relaxation.

For every dollar spent on tree planting and establishment, a 250% return on investment is provided back to the city in terms of the total services provided at tree maturity.

Environmental, economic and social urban forest services and values are well documented in scientific and technical journals. A summary of key values and benefits, and some supporting sources, is provided below.

- Trees provide benefits associated with physical, mental and social human health (Dwyer et al 1992; Ulrich and Parsons 1992; Sorte 1995; Grahn and Stigsdotter 2003; Kuo 2003).

- Trees help to conserve energy by indirectly mitigating climatic effects through providing evaporative cooling, windbreak and shading functions, thus reducing human dependence on power generation (Pouyat and McDonnell 1991; McPherson and Simpson 1994; Nowak 1994;).

- Trees improve air quality by producing oxygen, absorbing pollutants and sequestering carbon (Rowntree and Nowak 1991; Nowak 1992; McPherson et al 1999; American Forests 2007).

- Trees contribute to water quality and quantity improvement through storm water control, attenuation of peak flows, maintenance of base flow, erosion control and rainfall interception (Bernatzky 1983; Xiao et al 1998; Floyd 2002; American Forests 2007).

- Urban forests cool watercourses and mitigate noise and dust (Walton 1998)

- Trees provide habitat and food sources for wildlife such as fish, birds, insects, and small mammals (Tilghman 1987; Friesen et al. 1995).

- Urban forests create an appealing consumer environment in business districts (e.g., Wolf 2003, 2005).

- Trees increase property values (Behe et. al. 2005; Wolf, 2007;)

Average annual net benefits values per tree by size

Small	Medium	Large
$1 - $8	**$19 - $25**	**$48 - $53**

Source: *Society of American Foresters: Western Forester, January 2007*

Trees and forests are of vital importance to the environmental, social, and economic well-being of the MOA. The city's community forest provides numerous benefits that are both tangible and intangible. Community forests also convey a number of quantifiable public benefits that can be enhanced through management. Trees mitigate air pollution, provide climate control and energy savings, improve soil and water quality, reduce storm water runoff, increase real estate value, enhance downtown business, and control blowing dust (*a problem in spring and summer)*. They also provide wildlife habitat and can be a measure of community vitality. Current research is beginning to show that some of these benefits can lead to improved public health, especially for those with respiratory ailments. Trees enhance both the physical and spiritual landscape they inhabit.

Management Plan Benefits

In any given city nationwide, buildings and roads receive careful planning and scheduled maintenance. It is widely recognized that neglect of infrastructure planning and maintenance can result in deterioration leading to numerous potential expenses and risks. Why should trees receive any less planning, attention and care? Tree management plans help cities proactively manage their tree resources to avoid risk, reduce liability, cut maintenance costs and increase the value of trees. A comprehensive plan helps promote the future health and sustainability of the community's street and park trees, while providing a framework to make difficult decisions about tree removal, preservation, pruning and planting. Without a proactive approach to tree issues, Anchorage runs the danger of addressing tree issues reactively – and paying a steep price for maintenance, removal and liability associated with tree failures.

The MOA, in partnership with the State of Alaska Community Forestry program has taken the proactive step of creating a comprehensive UFMP. The UFMP was systematically developed by a comprehensive review of existing city documents,

specifications and standards, tree inventory data; through interviews with key staff and interested citizens, field observations, and by applying national arboriculture standards and best management practices. Field observations of trees along streets, in parks and in the downtown corridor were conducted. This is a customized UFMP for the MOA based on local conditions, resources, and priorities.

The UFMP is intended to provide strategies, goals, policies, standards, and actions to protect, enhance, expand, and preserve the working forest for the benefit of the community. The UFMP provides program coordination and improves the city's tree management in an equitable, economic, and sustainable manner. Moreover, the UFMP will be a valuable strategic planning tool, serve as a road map to enhance the urban forestry program, and become a part of the MOA's comprehensive city plan. Good tree management involves setting goals and objectives and developing specific management strategies to meet them. Implementations of the UFMP objectives are the foundation of an effective tree management program. It contains goals and objectives that will guide the MOA in its actions and decisions affecting public trees.

Urban forest managers can learn from the tradition of woodland forestry in developing systematic approaches to forest management, but they must do so within the context of the very specific benefits that urban trees confer as well as the constraints to maximizing these benefits. For most people the desire to protect and enhance green infrastructure comes from an intrinsic respect for nature and an aesthetic appreciation for trees – street and park trees provide shade, beauty, educational opportunities, and a link to the past.

In developing the UFMP the following assumptions were made:

- The citizens of Anchorage acknowledge and believe that trees benefit the economy, ecology, and livability of Anchorage.
- Trees are essential and contribute to the quality and vitality of the community and enhance its appearance.
- The MOA will actively manage the community trees and make operational decisions based on the best management practices used in the urban forestry and arboriculture industry.
- Tree risk management is vital to Anchorage.

This project follows a trend in urban forestry to move from reactionary management of individual trees—typically characterized by an emergency-response approach to problems and complaints—to a proactive, systematic, and strategic focus on an urban forest system as a whole. While limited municipal funds for forestry programs often constrain proactive tree care, management planning efforts can increase the efficacy and reach of scarce resources and have significant impact on the landscape.

Sharing the UFMP could further educational efforts by showing staff, elected officials, and citizens how science informs tree management as well as promoting city pride – Anchorage will be the only city in Alaska to have such a comprehensive plan. Knowledge gained from this UFMP should also be integrated into other city plans that impact trees. Issues discussed in the UFMP can be used to educate the citizens about the value of trees to the community.

The UFMP will help raise citizen awareness of the benefits of a healthy, diverse and well-managed urban forest. A strong management plan will serve as tool to be used for garnering public support, cooperation, funds, and help the community sustain its trees for future generations.

URBAN FOREST MANAGEMENT PLANNING

In natural forests trees in all stages of growth and decay are important to the functioning of the ecosystem, and even when left alone a forest will convey many benefits to humans. The same cannot be said of city and park trees. For example, activities such as mowing, leaf collection, vehicle and pedestrian traffic, vandalism and conditions such as soil compaction subject community trees to additional stresses. Intense visitor use necessitates pruning and prompt removal of high-risk trees to maintain high safety standards. A sustainable urban forest requires careful management in order to maximize the benefits of green infrastructure while addressing the direct and indirect human influences on the trees.

MANAGEMENT RECOMMENDATIONS

Community trees play an important role in the livability of the city. The community draws a wide range of benefits from the trees. The urban forest has been recognized as a visual amenity and for its environmental benefits for several decades, but has only recently begun to be considered as a vital component of a municipality's infrastructure, and given the specific label of "green infrastructure" or "natural capital" (e.g., Benedict and McMahon 2002; Wilkie and Roach 2004; Ewing and Kostyack 2005). As a result, in Anchorage as in many municipalities, resource allocation for management of urban trees has been relatively limited, and municipal staff have largely been occupied with responding to emergency situations and service requests rather than having the opportunity to pursue more proactive management practices.

As with any type of infrastructure, the urban forest requires regular maintenance and monitoring to ensure that it continues to function properly and provide benefits to its maximum capacity. Infrastructure such as roads and sewers that are neglected for many years can only be repaired at a great cost to the municipality and the people who live there. For the urban forest, this neglect typically comes in the form of failing to plant young trees to replace maturing populations, failing to adequately diversify tree species to protect against species-specific diseases, and failing to prune trees early on to limit the hazards posed by trees as they mature. Fortunately in Anchorage there are many opportunities to improve the urban forest through well-planned active management over time. This is one key area in which green infrastructure differs from built infrastructure; trees in cities, like other infrastructure, require maintenance to remain safe and viable but their value to the community generally increases over time as they mature so that they become less and not more of a liability.

Like machinery, buildings, skilled labor, and cash, natural assets such as forests, mountains, lakes, ranches, farms, and urban parks yield benefits that are key to our economic prosperity and quality of life. And, like other forms of capital, natural assets require careful stewardship and investment for their value to grow and pay dividends over the long-term. Just as we should not take other forms of capital for granted, we ignore the value of natural assets at our peril. – Wilkie and Roach 2004

The MOA, like so many municipalities, values its trees but has not, until recently, recognized that the Municipality should have a proactive, practical plan to ensure that the urban forest is managed to provide maximum benefits to the residents now and in the decades to come. **Management, maintenance and preservation of trees in the urban environment can only be achieved effectively through the development and implementation of a Strategic Urban Forest Management Plan that standardizes the policies and practices surrounding all activities related to trees. This report lays out the framework for and components of such a strategic plan, one that encompasses a long-term vision with short-term goals for the management of trees in the MOA. It is up to the municipality to provide the short and long-term support required to implement it.**

Employing the best management practices of the arboriculture and urban forestry industries, the following recommendations are for enhancing Anchorage's community forest program. Community Forestry Consultants, Inc. recommends the following management and maintenance recommendations to improve the health, quality, size, and diversity of the working forest of Anchorage. This section outlines the primary goals of this urban forest management plan.

PROGRAM PLANNING

The overall goal of strategic planning and management of the urban forest is to ensure a healthy, aesthetic, safe, and diversified tree cover that can provide a sustained supply of environmental, economic and social benefit to society. Research shows the average city tree lives only 32 years (Moll and Ebenreck 1989) and the closer to the city's center, the shorter the life of the average tree. To help address issues like these, a long range plan is essential for management of a resource that is by its very nature a long-term matter.

Strategic plans define long-term and short-term goals for the agency's urban forestry program. Management plans define how individual goals are achieved through action plans and timelines. Each goal must have an achievable and discernable outcome. The outcomes are the policy that the agency wishes to have representing their program. Both types of plans can define the overall program management goals of the agency.

The objective of this report is to provide a framework for a Strategic Management Plan that will set the parameters for a standardized approach to urban forest management designed to promote the growth of healthy, functioning trees. The aim is to fulfill this vision over a 20-year timeline.

Framework for the 20-year Strategic Management Plan (2009 – 2029)

A long term (20+ years) plan is intended to primarily provide guidance to the Urban Forestry Section of the Park & Recreation Department in the MOA using a tree information database, in conjunction with a management cycle approach which will monitor short to long term trends and serve as a tool for proactive management of the various issues and factors affecting MOA's trees.

This plan is also intended to provide guidance for the ongoing education of and coordination with the various stakeholders with whom MOA urban forestry staff must work for effective protection of the urban forest. This is intended to be an adaptive and "living" plan, creating a clear critical path for planning and activity, while still

accommodating changes in priorities related to economic and/or environmental conditions.

The highest level of the plan is the *20 Year Plan* which sets out the vision, goals and objectives that are to be achieved. These guiding principles are not set by this document but rather will be created through the public consultation strategy with community members and staff of the MOA. With these aspects of the Plan in place, the strategy to achieve them will be developed.

The *20 Year Plan* (2009 - 2029) will be used to oversee the implementation of urban forest management. Nested within this plan are four *5-year management* plans, the first being this UFMP. Each of these will incorporate strategies from the 20-year plan but will also build upon the successes or failures of the previous management Plan. Finally, each year there will be an *annual operating plan (AOP)* in which the details of the day-to-day activities are outlined (Figure 1).

Figure 1: Temporal structure of the Strategic Urban Forest Management Plan (source: A. Kenney).

The *20 Year Plan* should be consistent with and related to the MOA's official plans, but will also be directed by the goals and objectives that the community has established during the visioning process.

Five-Year Management Plans

The *20 Year Plan* will incorporate four *5-year management plans* that are the first level of operational planning. The intention is not to attempt to develop the specific details of all four plans at once. The goals and objectives of the strategy are incorporated into these plans as well as the immediate needs that are determined by reviewing the success or challenges of the previous five years of operations.

Each *5-year management plan* will outline objectives for the relevant period, which will direct the annual operating plans. Figure 2 illustrates the contextual structure and indicates the components that repeat throughout each plan (shaded). Those areas exist as a working document and will be revised accordingly based on the previous year's *5-year management plan* review; any revisions will be done in the fifth year of each plan.

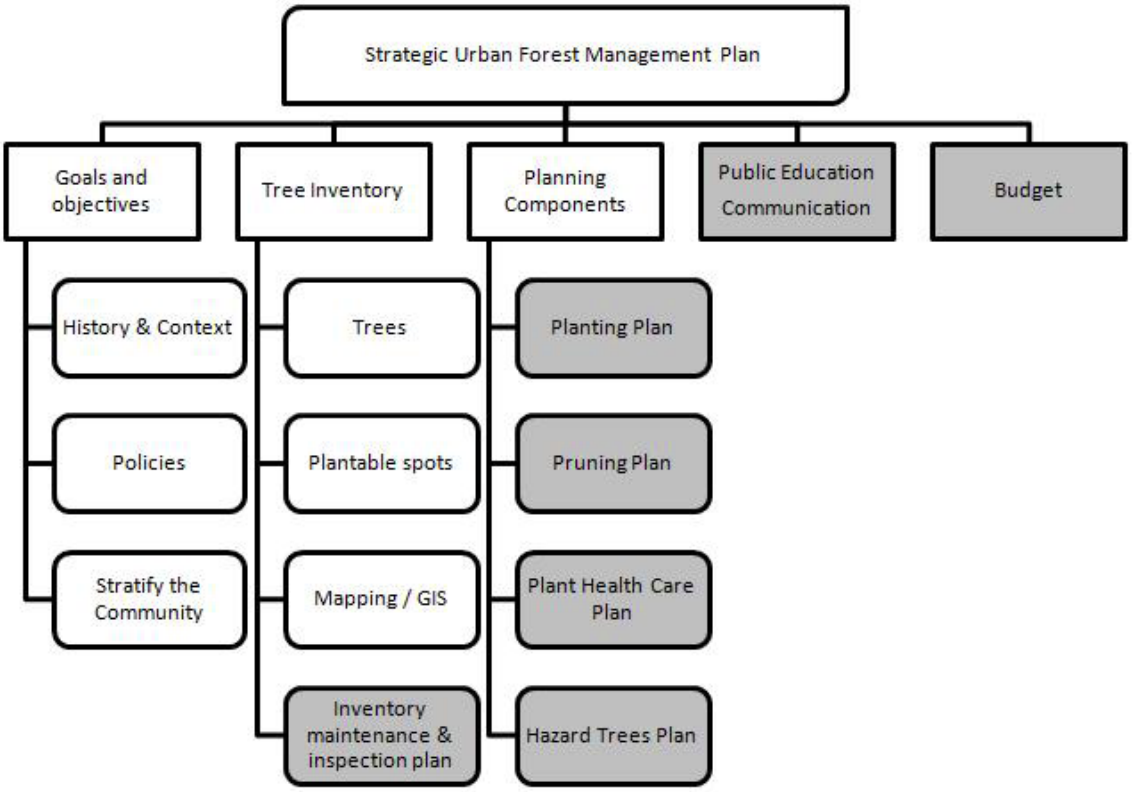


Figure 2: Contextual structure of the Strategic Urban Forest Management Plan. Components that repeat through each plan are shaded (Bardekjian-Ambrosii).

Annual Operating Plans

Annual operating plans (AOP) will direct the day-to-day operations and can be used to project budget requirements for all aspects of maintaining the urban forest. The annual plan will include plans for planting, pruning, removals, inspections, plant health care and maintenance of the inventory. Initially, the annual plan will need to address priorities derived from the inventory, but eventually will be focused on proactive management objectives. The preparation of all 20 AOPs is the responsibility of the MOA.

Communications Strategy

The communications strategy is comprised of three distinct but interrelated components that if effectively implemented and pursued on an ongoing basis will support the MOA's overall community forest vision and mission. These components are: **(1) consultation, (2) education and engagement** and **(3) stewardship and hands-on involvement**, and are discussed in more detail below.

Effective implementation of this UFMP will require the "buy-in" and support from as broad a base as possible. This will include, but is not limited to: City staff (particularly those departments who need to work with, or around, trees), Assembly, Parks & Recreation Commission, Alaska DNR Community Forestry, individuals and groups involved in the protection and restoration of Anchorage's trees, (e.g., TREErific), private landowners, local industries, and local institutions with trees on their properties or properties where trees could be planted.

Once the initial draft of the strategic plan (i.e., the *20 Year Plan*) is complete, there will be a need to refine the goals and objectives through consultation with those considered key stakeholders in the development of a municipal urban forestry plan, as well as a need for periodic review of the status of the plan with these key stakeholders. The recommended components of the community consultations are described below, in order of priority:

- Soliciting community and key stakeholder input to the *20 Year Plan* goals and objectives at the outset of the process.

- Creation of an urban forestry **citizen's advisory committee** to provide input to the *20 Year Plan* and related *5-year management plans* on an ongoing basis.

- Conducting **public information sessions** to present the components and status of the 20 Year Plan, provide updates on the plan's implementation over time, maintain interest, and solicit input.

The primary objective of the consultations process is to gather support and input from stakeholders who have been directly involved in the development of the strategic plan, as well as interested parties who have not. The second objective of this process is to monitor the successes and failures of the plan and to provide input into the adaptive management process. While unanimous agreement is usually not attainable, general consensus around key issues should be the objective of the various consultations. Where this is not attainable, the MOA's senior operations staff in charge of Urban Forestry will need to make decisions since they are ultimately the ones directing and managing the work being undertaken. A third objective of these consultations should be to point private landowners to resources (e.g., information, technical support), and possibly incentives, for planting and properly maintaining trees on their own property.

Ongoing consultations not only provide a mechanism for gathering input, but they are also a vehicle for engaging and sustaining the involvement of individuals and groups who can contribute to the plan's success. Community involvement in the urban forest is a primary instigator for the development of this study, and continued collaboration between various members of the community and the MOA is essential for its success.

Of the three recommended components of community consultations, this is the only one that is to be undertaken strictly at the initial stages of the strategic planning process. Once a draft *20 Year Strategic Urban Forest Management Plan* has been developed, key stakeholders should have an opportunity to provide input to the plan's goals and objectives. This input could be solicited through facilitated group visioning sessions, from the Municipality's website, and through broader public information sessions. Representatives of the urban forestry citizen advisory committee should be specifically invited to such events.

The purpose of these events will be to capture key stakeholder and broader community input to the vision and goals for the *20 Year Plan*, and provide an opportunity to create or re-establish relationships with individuals and groups interested in being involved with ongoing implementation and review of the strategic plan. Results of these sessions should be documented and integrated into plan development.

Urban Forestry Citizens Advisory Committee

An Urban Forestry Citizens Advisory Committee (CAC) is a very useful resource for busy municipal staff working to develop and implement a management plan since it provides additional opinions from individuals who are interested in, and typically knowledgeable about, the subject at hand, and also helps maintain relationships with groups and individuals that may be able to assist with implementation.

The primary role behind a CAC for the MOA's UFMP, and the related *5-year Management Plans* would be to periodically (e.g., once a year) review the plans, and to track the status of the various recommendations.

The CAC should report to and be overseen by the staff member responsible for directing and overseeing the implementation of the UFMP. The Volunteer Coordinator could coordinate and facilitate these meetings.

Master Tree Landscape Plan

All cities and towns have a derived landscape, whether from an original master plan, an inherited design, or even carved from a remnant woodland stand. The longer a community has been established, the more likely it is to have accrued a number of landscape design inputs—some more admired than others, some more historically significant, and some in conflict with others. Anchorage—first established in 1915—has seen changes impacting the city from its inception. As such, it is an important cultural landscape, and planting and management strategies ought to be sensitive to this layered history. At the same time, these multiple legacies must be balanced against each other as well as with current community needs and arboriculture practices.

There is a clear need for master tree planting management plan to guide the arboriculture future of Anchorage's community trees. Such plans will minimize the unintended but gradual degradation of the urban forest over time, as well as maximize the potential for a sustainable and diversified tree canopy and the associated benefits. The trees in Anchorage—a relatively young, even-aged, limited, and undiversified population—are not only significant design elements but also represent the future canopy cover at this stage in their growth.

A challenge for the city is to plant enough new and replacement trees each year to maintain the delicate balance between design and canopy cover without negatively

impacting either. Without a clear plan to guide tree plantings, the city may gain trees but this balance will not be achieved.

Master tree planting management plans include input from local citizens, state agencies, organizations, businesses, MOA staff, affiliated green industry professionals, and elected officials. They are integrated with other comprehensive agency plans and create a blueprint for administration and management of the street and park tree planting program.

Removing, pruning, planting, and preserving trees; educating stakeholders; and improving coordination and communication among citizens, tree committee, city staff, and elected officials are critical components in the development of the master tree planting management plan. A master tree planting management plan will help department managers quickly determine how best to apply funding that often becomes available in small and unpredictable amounts. A plan should not only specify what (species) and where (location) but when (timeframe) and why (underlying goals).

The master tree planting management plan appropriate to Anchorage, and most likely to be approved, will be written with a thorough understanding of the natural resource, agency resources and operation, political-economic climate and legal framework of the agency. It is important to consider the values of the community and managers in the master tree planting management plan development process.

Implementing a master tree landscape planting plan and using inventory data to prioritize planting and maintenance establishes a systematic program which actually reduces costs. This is primarily because systematic maintenance in general leads to healthier trees that require less expensive maintenance over the long run than unhealthy, high risk trees. A healthy and well maintained forest does not come about by accident. The health and stability of Anchorage's trees can only be achieved through careful planning and systematic maintenance of the tree population. Maintenance practices and standards for new tree plantings should be a component of the master tree landscaping plan as well as strategies for funding maintenance programs.

Tree planting in a city can significantly impact that community’s landscape for years to come. Yet planting decisions, including the selection of species and location, are often made without the benefit of a long-term strategy or plan. Tree planting might occur as part of a larger capital construction project, or be driven by a donor request or the need for a volunteer project. Each of these common scenarios has occurred in Anchorage—as in many cities and towns—over the years.

Current community values are an important consideration in the master tree planting management plan. It is important to consider the values of residents and department managers in the decision making process. Greater collaboration and dialogue can often result in a greater consensus for a given set of actions, with the result that the urban forest has a better chance of thriving. The locations, types of trees (flowering, evergreen, deciduous), and underlying urban forest goals should all be discussed in this process.

The ultimate mature size of trees should be considered when selecting species planted near buildings, utilities, monuments and active recreation areas. Trees can impact these

built features both positively and negatively through shading, dropping flowers or fruits and framing.

The master tree landscape planting document defines the long-term direction the agency will take to develop a diverse and appropriate tree population and the choice of species the agency intends to plant. The importance of a planting plan as an element of a tree program is that it demonstrates a policy that, over time will reduce the planting of high risk trees, increase the planting of high-quality, low risk trees, diversify the species population, and place trees more appropriately in the landscape. The infrastructure constraints of every street and park are also defined to guarantee that tree health and structure are optimized over the life of the tree.

As the inventory of existing trees is gathered, places where trees could be planted should also be noted. These sites are potential spots where the urban forest can be enhanced and where the first possibilities lie for increasing the number of trees in the community. Knowing the number of available planting sites can also help when the community is budgeting for, and ordering new trees.

The approach of incorporating current community values and the best management practices of arboriculture is likely the only one that will resolve conflicting designs and desires to move decision makers toward a proactive planting plan. This approach is strongly recommended.

Management Zones and Zone Rotation

Anchorage tree management issues can be divided into three general categories: those that need to be addressed immediately such as dead or high risk trees; chronic issues (pruning, lawn mower and weed eater damage, pest inspection); and planning (planting and construction). The zonal management approach is a framework for systematically addressing the needs of individual trees over a specific area and time period. By placing the city into zones on a rotation, routine management issues including tree inspection, removing, pruning, and planting, as well as site condition amelioration programs, can be approached sequentially. Acute needs, such as high risk conditions, should always be addressed right away.

Anchorage can be divided into management zones that were selected qualitatively based on the level of human use, tree species composition, street and trail delineation, or recreation use type. One zone may consist of all the park trees adjoining the trails system. These trees are considered separately because they present different management concerns.

Management zone maintenance is an effective method to complete entire tree maintenance requirements of several parks in a region or neighborhoods in a city. It reduces risks, ensures all trees are pruned and inspected on a regular cycle before hazards occur and creates a systematic pruning schedule that reduces costs.

For example, the park system can be divided into management units to facilitate efficient use of limited resources. Further, individual parks can be divided into management zones that were selected qualitatively based on the level of human use, tree species composition, adjoining infrastructure, recreation use type and maintenance needs. One zone may consist of all the park trees surrounding pavilions, meeting centers or ball

fields. These trees are considered separately because they present different management concerns.

The MOA may devise management zone maintenance by assigning crews to specific areas to complete work in that area. Still, work must be prioritized in the areas to address the issues as described by the general work categories.

RISK MANAGEMENT PLAN, PROGRAM, POLICY, AND RISK ABATEMENT

The mitigation of high risk trees is an essential component of any municipal forestry program. A challenge for Anchorage is to develop a tree risk program, tree risk management plan, tree risk policy, and begin to mitigate the risk associated with public trees. The goal of a risk management program is to develop a comprehensive mitigation program that will increase the safety for the residents, MOA staff, and visitors to the community. Public safety is the major concern for urban forest managers.

Figure 3- High risk tree with targets present

Tree Risk Management Plan

Certain conditions in trees increase the likelihood of a tree's structural failure, in whole or in part. Tree risk management can be described as a process of inspecting trees for defects and assessing whether a failure of a defective part could cause injury to people or cause damage to property. In traditional tree risk literature, the terms "hazard" or "hazardous" describe trees with defects.

However, where the consequences of failure are low, a structurally unsound tree represents no hazard. The term "hazard" should be reserved for trees that have significant structural defects *and* have a significant target that would be hit if a failure should occur. Using this definition, not every tree that has a defect is hazardous. Once described as a hazard, a tree will conjure the image of a risk of immediate failure.

It is preferable to use terms such as "low", "medium" or "high" risk to describe tree defects. These descriptions can help determine how soon a tree will require corrective maintenance actions. A tree rated "high risk" may require immediate attention; a tree with a low risk rating is a lower priority and may be addressed during regular maintenance pruning. A high-risk tree or hazard tree is any tree or tree part that demonstrates a risk of failure with the presence of an adjacent target. A high-risk tree involves a tree with the potential to fail, an environment that may contribute to that failure and a target (person or object) that would be injured or damaged (Figure 3).

There are many approaches to assessing defects and rating the risk potential of trees. Some trees may appear hazardous even to a layperson, but many others only appear that way when viewed through a trained eye or when tested using more sophisticated

technologies. It is important that tree risks are identified in the inventory process and then prioritized for repair or removal in the first stages of an implementation plan.

Tree risk assessment can also be used as an educational tool to demonstrate the necessity for urban forest planning. With proper planting and aftercare combined with regular pruning and periodic inspections, there is less chance for weaknesses or defects to become hazardous. Proper management will lead to permanent reductions in liability.

When discussing tree risk management, agency policy is presented in a variety of documents. Each document is an essential element of the agency's larger urban forestry management program, and each plays a very specific role. Elements of defensible tree risk management program and policy are defined by:

- Public policy, tree ordinances, tree law in the MOA, and the state of Alaska
- Urban forestry strategic and management plans
- Arboriculture standards and specifications
- Planting plan
- Tree risk management plan

The tree risk management plan can be a component of the tree management plan. More times than not, it is a separate document. The tree risk management plan defines the agency's complete tree risk program. It articulates the agency's total policy on risk trees. As a minimum, it contains these eight elements:

- Tree risk policy statement
- Resource assessment
- Goals
- Action Plan/Outcomes
- Risk zone maps
- Tree failure log
- Annual risk committee meeting
- Staff training log

The tree risk policy statement articulates in broad terms the overall mission of the agency's tree risk management program. It acknowledges responsibility to maintain safe public areas; identifies the manager of the tree risk program and lists any resource constraints on the program. The Anchorage Municipal Assembly approval of the policy statement is imperative because it affirms the program and guarantees that staff decisions will be supported by agency officials and staff. The policy statement allows the forester to make fully informed, unbiased decisions even in the midst of political pressure.

Resource assessment is the process of evaluating the agency's tree resource, operational program and resources available (budget, staff, equipment, etc.) Documentation of the resources is the basis through which all goals, action plans and outcomes are derived. It is the basis for policy development.

Goals define the short and long term direction of the program. The clear and measurable goals presented below are examples of important elements of tree risk management program.

- Acquire PNW certified tree risk assessor status for staff member
- Hire certified arborists on staff or in contractual situations for tree maintenance activities.
- Implement a priority based risk tree removal action plan.
- Develop a tree risk zone map.
- Provide tree risk training for staff.
- Implement a cyclic pruning program.

An action plan outlines the sequential steps required to successfully realize each goal. The action plan addresses each of the following questions. What needs to be accomplished? Who will accomplish it? And when will it be accomplished? There must be a definitive outcome for each action plan. This process gives tangible outcomes to pursue, affords the best opportunity to meet the goal, and allows for critical review. It also demonstrates a clear process if litigation occurs.

A tree risk zone map is an integral part of the agency tree risk policy. There are hundreds of trees along the streets and in each park and limited resources to manage and mitigate tree issues. A risk zone map, using arboriculture industry practices and agency parameters, allows staff to apply, refine, and improve the overall tree program for the agency. The same risk assessment and risk management parameters applied in both high use areas and remote, under used areas of a park with little or no distinction between the enormous differences in use results in resources being used in remote areas that may not have required action while high use areas are neglected. Assessment schedules and risk abatement responses consider the tree, the target and the level of use and are adapted to address the level of risk associated with agency parameters.

A tree risk zone map helps prioritize work, assures imminent risk issues are treated first, and utilizes limited resources efficiently and judiciously. It allows staff, from management to field operations, to better understand the issues of risk and their individual roles in the larger risk management program for the agency. It can be created easily using TreeWorks™.

A tree failure log allows staff to better understand the circumstances surrounding failures in their particular park or region. When the situation allows for it, staff should, as a team, carefully assess the circumstances surrounding a failure. Staff knowledge, experience, skills and abilities to interpret defects and cause of failures in the future increase significantly through observation and investigation of failure events. A tree failure log also documents significant failures and demonstrates the agency takes every opportunity to learn from actual events. It provides an opportunity for the agency to participate in the International Tree Failure Database to further allow a greater number of people in the industry to learn from these failure events.

The annual tree risk committee allows staff to review the risk program to critically evaluate the program over the last year. Staff can determine whether goals are being met or not met, address why and what to change in the program so that goals and desired outcomes are realized. The creation of a tree risk committee assures that there is a clear process for the agency's risk program to be critiqued, modified if necessary and implemented.

A staff training log verifies that staff is receiving ongoing and pertinent continuing education. It serves as documentation if litigation occurs and demonstrates the agency is taking a proactive rather reactive risk management program.

Tree Risk Management Policy

A primary outcome of a risk management program is the development of a documented policy or course of action for dealing with risk management of public trees.

The importance of a documented tree risk policy cannot be emphasized enough. There are two main reasons for having a documented policy. First and foremost, it clearly defines the direction and actions of the agency will follow to manage their tree resource for risk. Second, if implemented, a documented policy is the basis for any defense if litigation were ever to occur due to a tree, or tree part failure.

In the implementation of a municipal tree-risk reduction program conflict naturally arises between the city foresters, who are trained to identify potentially hazardous trees, and citizens, who have little or no knowledge about tree risk potential but who may have strong emotional attachments to trees. The conflict may escalate when citizens prevail upon elected officials, such as the mayor, commission members, or assembly persons, to reverse removal decisions.

Tree risk reduction policies are established to protect not only residents, but all users of the public space where city trees reside. Policy is not written with only the current residents or administrations in mind, but to guarantee a consistency of response spanning such fluctuations in political climate. Veering from an established risk reduction policy to avoid short-term conflicts with homeowners thus destroys the very reason for having a policy in the first place and can place government agencies in a difficult legal position.

One of the greatest difficulties faced by urban foresters in implementing tree-risk management strategies is the reluctance of many communities to take full responsibility for the trees on public property. In fact, however, there are few legal routes for communities to avoid such responsibility.

Policy is not only interpreted by the written word, but also by an agency's actions. To take action which is contrary to a written policy, or take no action at all, negates and nullifies the actual written policy. This leaves the agency liable and exposes agency actions to interpretation.

Tree risk policy is defined by public policy, tree ordinances and tree law in the MOA and the state of Alaska; forestry strategic and management plans; arboriculture standards and specifications; planting plan; and a tree risk management plan.

As the owner of thousands of trees the MOA has a responsibility to create and maintain a safe and useful urban forest for its constituents. In a legal sense the MOA has a 'duty of care'. Dunster and Murray (1997) state that "…the owner of one or more trees has some degree of legal responsibility (the duty) to exercise common prudence (the standard) in maintaining his or her trees in such a way that they will not fall down or otherwise fail in a manner likely to cause damage to other property or people." In the absence of a state or federal standard, the MOA must establish its own standards and specifications of care for trees.

The municipal government has a legal duty to exercise reasonable care to protect the public from foreseeable risks. City managers, administrators, staff and elected officials must demonstrate reasonable care to minimize the risk associated with trees in public areas. It is imperative for all city departments to follow established risk management policies.

Risk Tree Abatement

Risk tree abatement of high risk trees includes inspection and evaluation of the trees, pruning and new tree plantings. To manage risk effectively communities must address difficult questions. While fear of liability may ultimately be the force driving the formation of risk management policy, professional assessment and correction of hazardous situations should be its foundation. The MOA is currently collecting its municipal tree inventory and tree asset maintenance with TreeWorks™. Forestry staff has developed a list of attributes to be collected for street trees.

This initial assessment gathered from the inventory will identify potential risk or hazardous trees to be inspected in more detail by staff specifically trained in risk assessment. The more detailed inspection then determines whether further testing or inspection is required or if the tree should be removed.

Depending on the number of risk trees that are identified in the inventory, there may be an initial need for a dedicated forestry crew to deal with tree risk management. This could delay the full implementation of the proposed block pruning program, depending on staff and resource availability. The municipal tree inventory must be complete before making this determination.

Once the inventory is completed, there will also be a need for the continued assessment of risk trees. Assuming that all trees with some risk factor will not be immediately removed, trees that are retained should be inspected on a scheduled basis. The determination of which trees should be inspected and how often should be part of the development of a tree risk management plan once the tree inventory is completed. Dedicated and qualified staff will be required for tree inspections. Tree risk inspections should be performed by a PNW certified tree risk assessor.

With the initiation of the block pruning program, at a minimum, each tree will be re-inspected once every five years. Pruning crews will systematically work through blocks and when they are assessing pruning needs they can also evaluate risks. Any new risks can be added to the database and then further inspections can be requested if required. Simple hazard abatement through pruning can be addressed as part of the cyclic pruning program.

The other area of concern for risk assessment is in natural areas and greenbelts and along MOA's more than 250 miles of municipally-owned trails. The only way to effectively assess risk in these areas is to walk the trails and look for tree risks over the trails or trees that could fall onto the trails from the sides. This is labor-intensive and will require additional staff time if it is to be undertaken on an annual basis.
Once a tree has been identified as having a failure-prone defect and a target is present, there are a variety of approaches to managing the risk associated with that defect. In general, serious defects are more likely to be found in large trees than in small trees.

Recognizing that large trees with large canopies provide exponentially more benefits than small trees, efforts should be made to maintain large trees through techniques such as cabling, bracing, and corrective pruning rather than removing them. This will allow time for younger trees to develop the mature canopies that can maintain the stream of benefits for the community. Some of the most common approaches for hazard abatement are:

1. **Remove dead wood** - Trees with this recommendation have large pieces of deadwood over a sidewalk, road, front yard, trail or other high-use area. These large pieces of deadwood should be taken out of the trees before they fall out.

2. **Bracing and Cabling** – Bracing stabilizes larger tree components such as scaffold branches with included bark. Cabling of trees can be used to stabilize parts of the crown that could be prone to failure. Trees that have been cabled require a more-frequent inspection cycle. Generally, these trees should be inspected once a year to ensure the integrity of the cabling system and that the risk level of the tree has not changed.

3. **Crown reductions** – The aim of crown reductions is to shorten the height of tall crowns or to shorten the length of long horizontal limbs with too much weight at the ends. By reducing the length or the height, the safety of the pruned part will be increased. This prescription is used for older trees to try to keep them standing while new trees can be planted to replace them. Crown reduction cuts should be made back to a healthy side branch that is at least one-third the diameter of the reduced part. This may not always be possible for some trees and a smaller side branch may have to be selected. It should be noted that for many older trees this is the last maintenance that can be performed before the tree is finally removed. Crown reductions are often undertaken in conjunction with cabling.

4. **Tree removal** – If there is no corrective action that can be taken then some trees will have to be removed.

Risk reductions are best accomplished by reducing the number of poor quality species and eliminating high risk features such as trunk splits, trunk, basal and root decay and included bark crotches. By removing these species when the opportunity arises, the municipality minimizes expenses by avoiding the greater cost of removal once the trees are in an advanced stage of structural decline.

The municipality should develop specific guidelines for when and under what conditions trees may be removed. An ISA publication entitled “A photographic guide to the Evaluation of Hazard Tree in Urban Areas” by Matheny and Clark is a source of information for risk management guidelines. The rating system used in the PNW-ISA TRACE course provides a numeric scale for rating tree risk.

The municipality may wish to follow the criteria listed below for tree removals. The four situations in which tree removal are appropriate are

- if the tree is dead
- if the tree is irreversibly affected by disease or insects (particularly epidemic diseases such as spruce bark beetle) or in significant decline
- if the tree or tree parts represents a risk to fail

- or if there is unavoidable conflict between tree(s) and construction.

Figure 4 – Park tree damaged by lawn mowing equipment that has extensive basal and root decay. These trees are a risk to fail and located in areas of seasonal high use. They should be assessed and rated for risk.

Trees exhibiting high-risk external features such as death; cracks; splits; trunk, root or crown decay; included bark and other weak branch unions; poor tree architecture; and major crown dieback should be mitigated before the tree or parts of the tree fail.

The primary management priority for the city in the short term is the reduction of high risk trees in public areas.

Currently in MOA, as in many other United States municipalities, the assessment of risk is the responsibility of Urban Forestry staff. The Supervisor of Urban Forestry inspects trees drawn to his attention or identified through operational activities. There is no systematic inspection process to identify trees at risk largely due to the current lack of staff and resources.

Taking a city-wide tree inventory and implementing an urban forest management strategy creates an opportunity to develop a more comprehensive risk management plan to address the MOA's responsibilities with respect to "duty of care". We recommend the following steps for the development of that plan:

- All city urban forestry staff acquires certified tree risk assessor qualification.
- Complete the municipal tree inventory.
- Query the TreeWorks database to determine the numbers and locations of low, medium, and high risk trees.
- Determine an acceptable level of risk with input from urban forestry staff and decision-makers such as city managers, assembly, mayor, legal department, risk manager, and others.
- Determine the staff and resources available to address tree risk issues.
- Develop a tree risk management plan.

These are the key points to consider. For a more comprehensive approach the MOA should refer to a recent publication by the USDA Forest Service titled "Urban Tree Risk Management: A Community Guide to Program Design and Implementation". This publication is available at: http://www.na.fs.fed.us/spfo/pubs/uf/utrmm/.

MAINTENANCE

Pruning plans are essential, not only to ensure healthy, aesthetically pleasing trees but also to increase public safety and to decrease public or private liability. A variety of requirements can inform pruning plans, some more desirable than others. Common factors that determine pruning priorities are residential or business requests and emergency pruning. This kind of "reactive management" is most common in jurisdictions where no planning exists. Scheduling pruning based on these factors may actually increase liability for damages because many hazards remain unidentified until a failure occurs.

Healthy trees confer numerous benefits, yet poorly maintained trees can pose a considerable risk to the surrounding community. Broken branches and even entire trees can fall down, especially during inclement weather. In paved areas roots can cause cracks and buckles in pavement which may be tripping hazards. Leaves can clog gutters and fruits can rot and smell. While the benefits of trees far outweigh the costs, careful maintenance is needed to manage risks that are often predictable, detectable, and preventable. Excluding immediate, acute problems (blow downs, pest outbreaks, and extreme vandalism) tree maintenance should be performed following a two to five year pruning cycle based on a management zone rotation plan developed by city staff.

Tree Pruning

As trees mature, branches grow and thrive while others naturally decline and die. In a natural forest, this branch dieback goes relatively unnoticed. In a municipal setting, safety and aesthetic concerns demand a higher level of maintenance. Young trees may need live wood removed or pruned to create a strong branching structure as the tree grows. Large dead branches must be pruned from a mature tree's canopy. Other branches may be pruned to preserve or create views.

Tree health can be greatly increased by regular pruning, especially when the tree is young. Immature trees that are not pruned can develop many structural problems such as weak branch structure, crossing branches, and co-dominant leaders (International Society of Arboriculture 2005). If corrected early, the tree can develop a strong support structure with a healthy canopy. This in turn will reduce the necessity of more expensive

and often intrusive corrective pruning during the normal life of the tree. If tree condition is improved at a young age and maintained during the tree's life, there will be less need for a reactive approach to pruning.

Currently, the MOA operates pruning crews primarily on a reactive basis. For the most part, crews respond to departmental or citizen requests that MOA trees be pruned due to safety concerns (personal communication, Wade Collins, 2008). As this is not the most efficient or effective way to maintain tree health, we recommend the MOA shift towards a more proactive approach to enhance the health of the urban forest, including both street trees and those located in parks. To develop an effective tree pruning program, MOA needs to build capacity to be able to prune all MOA public trees in a systematic manner as well as responding to emergency pruning and safety concerns in good time. Emergency response must be coordinated with other MOA emergency response planning.

Most communities try to implement a two to five year pruning cycle. The ability to implement a cyclic pruning program is limited by the staff and financial resources of the city and most cities and towns cannot afford to contract services for all trees. There are options available to deal with budget constraints. For example, pruning of trees with diameters larger than 16 inches near high use areas may be an initial management recommendation. The objective is to start and maintain a cyclic pruning program within the fiscal and personnel resource constraints of the city.

Industry standards such as ANSI 300, 133 or 60.1 define the standards and terms of arboriculture; specifications and best management practices determine how the agency applies the standards to manage its trees. The standards and specifications are applied universally to all public trees regardless of who is doing the work – staff or contractor. The standards and specifications guarantee that, if invoked, a healthy, structural sound urban forest will be perpetuated. The standards and specifications also demonstrates the agency is implementing currently accepted practices by the urban forestry and arboriculture professions. The arboriculture specifications should, at a minimum, include specifications for removal, pruning, planting, species, tree preservation, risk rating system and inventory methodology.

Pruning treatments should follow the best management practices established by the ISA, ANSI Z133.1 and ANSI A300 standards and employ ISA certified arborists or certified tree workers to perform tree maintenance. In addition to ANSI standards, the city should develop pruning specifications that serve to define treatments for different species, ages of trees, pruning techniques and other pruning issues.

Proper pruning adds value to the landscape and is one of the few active management techniques that helps a landscape appreciate in value while minimizing liability concerns. Proper pruning, with an understanding of tree biology, can maintain good tree health and structure while enhancing the aesthetic and economic value the community forest creates for Anchorage.

Mature Tree Care

The benefits and values of trees are maximized when trees reach maturity and become established in their growing location. To maintain this high level of benefits for a longer period, the city should commit to providing regular scheduled maintenance to its mature

trees and prepare for other, non-routine arboricultural treatments as needed. A comprehensive mature tree care program primarily centers on routine or preventive pruning, and the ability to provide fertilization, irrigation, insect and disease control, and cabling and bracing when necessary.

Routine pruning should occur on a cyclical basis for the entire tree population once all priority maintenance removal and pruning activities have been completed. If funds do not exist, the routine pruning program can begin after the priority tasks have been completed. This activity is extremely beneficial for the overall health and longevity of street and park trees. Through routine pruning, potentially serious problems can be avoided because the trees can be closely inspected during these pruning cycles. Proper decisions can be made on declining trees, and any trees that become potential hazards can be managed appropriately before any serious incidents occur.

If regular pruning is planned in a systematic manner, crews and equipment can work much more efficiently than if pruning is only done by request. The cost difference can be dramatic. The ISA has compared efficiencies of both methods and found planned pruning to be at least twice as productive. When crews examine the urban forest in a management zone pattern for possible hazards and tree health problems, there is a reduction in citizen calls for emergency pruning (Luley et al. 2002). Additionally, the crews often find problems that would not have been reported by residents. The management zone pruning method can also focus on certain species that may require more attention; this is common when a pest needs to be controlled, for example. Management zone pruning maintains a greater safety level in the urban forest and can decrease liability for the municipality (McGauley et al 2000).

A regular pruning cycle is a critical component of an effective community forestry program. Regular pruning of the city's trees will improve the condition rating of a large number of trees, reduce the potential for storm damage to trees, reduce the risk associated with community trees and demonstrates proactive management of the city's tree resources.

Young Tree Pruning Program

There are an increasing number of newly planted or young trees in Anchorage. More new trees will be added as high-risk trees are removed and to diversify the existing tree population. It is critical then to understand the proper maintenance techniques required to ensure the longest and safest service life of these trees. The major components of a young tree care program are pruning, mulching, and watering.

Training pruning is used to develop a strong structural architecture of branches so that future growth will lead to a dominant central leader, strong branch attachment and proper branch spacing along the trunk. It also consists of the removal of dead, dying, diseased, interfering, conflicting, and/or weak branches.

Many young trees may have branch structure that can lead to potential problems as they grow, such as double leaders, many limbs attaching at the same point on the trunk, or crossing/interfering limbs. When trees are small, these problems can be remedied easily and inexpensively.

If structural problems are not corrected while trees are young, they can lead to poor branch attachment (Figure 5). Trees with poor branch attachment can become safety risks as they grow larger and could create potential liability for Anchorage in the near future.

Figure 5 – Amur chokecherry with co-dominant scaffold branches.

All newly planted trees should receive their first training pruning the third year following planting. Training pruning should not be done when a tree is planted, because it is already under stress from transplanting and needs as much of its leaf canopy as possible in order to manufacture food and increase root growth for proper establishment in its new site. Only dead or broken branches should be removed at the time of planting, and in the next two years.

The training pruning program would also be accomplished on a cyclical basis, but the work would be scheduled during a three year cycle rather than the two to five year cycle for the routine pruning of larger established trees. As mentioned above, newly planted trees should receive their first training pruning three years after planting. This work can be accomplished throughout the year.

Proper training in young tree structural pruning would be required for Anchorage staff or volunteers responsible for this task. Additionally, these workers would require an understanding of the growth-habits of the various species being planted, as well as an understanding of tree biology, anatomy and physiology.

This type of work is also highly suitable for properly trained summer interns, part-time employees, and/or volunteers. Since no bucket truck is required, city staff or volunteers can perform this work at any time. Training pruning can be accomplished from the ground with a minimum amount of equipment. The city should develop an organized, documented approach to cyclical tree maintenance that can be easily managed by city staff and properly trained volunteers, if budgetary issues are a concern.

An optimum time to perform this pruning is late winter–early spring prior to bud break. The leaves are gone allowing clear visibility of the branches and trees will react positively to pruning at this time of year. Also it is usually a time of the year when city work loads are less demanding.

Tree Inspections

Tree inspection is a systematic process of assessing the tree or parts for potential to fail and injure or for potential maintenance needs. The city should answer these questions regarding tree inspections.

- Who is performing the inspections?
- Who is qualified to perform the inspections?
- What is to be inspected and in what area?
- What is the frequency of inspection?
- When should the inspections occur?

Inspections are the first line of defense in proactive risk management and maintenance programs. The city can prioritize tree inspections and corrective actions needed based on a process that divides the city into zones; establish inspection methods and schedules according to the zones; and implement corrective actions in a reasonable and timely manner. The evaluation cycle or inspection interval may be annually or two per year, one during the summer to include leaves and one during the dormant season. Mature trees and species with known failure histories may need to be inspected more frequently. Occurrence of tree or branch failures between inspections will indicate the adequacy of the interval between inspections. Additional inspections should be made following storm events.

Preliminary inspections can be accomplished by staff during normal work routines. Trained volunteers can also be used for basic inspections. However, the city will benefit and reduce the possibility of structural defects being missed by using a certified tree risk assessor for tree inspections. Inspections should follow consistent protocol established by the city; the problems should be documented and appropriate arboriculture recommendations made or future monitoring as necessary.

PLANTING

The opportunity to plant trees exists in every park and on every street. Each year communities are transformed by planting tens of thousands of trees in parks, landscapes and along city streets. It is a common activity promoted by cities, local and national trade, and professional and citizen organizations. These new trees are the future environmental, economic and social workhorses for our communities.

An annual planting program will maintain a healthy and sustainable community forest. A comprehensive planting plan that identifies the planting needs throughout the city should be developed. The plan will provide a systematic means and criteria for consistent direction to determine types and frequencies of tree plantings. The plan should include available planting spaces, recommended species, planting specifications and maintenance requirements for new trees.

The key to maintaining a healthy, sustainable community forest is the implementation of regular, annual tree plantings, regardless of grant money or catastrophic events. A large number of trees do not need be planted, but a consistent annual addition of trees to the community forest is critical to maintain a perpetual canopy. **The annual quantity of trees to plant is directly dependent on the quantity of trees the city can maintain.**

Tree Planting Practices

Across the country we are striving to restore our community forests but the road from nursery to working forest is arduous. The sight of new trees struggling rather than thriving in the landscape is common whether the site is residential or commercial, public or private.

The current installation practices used in Anchorage are planting trees too deeply. Root collars are buried and trees are dying or declining rather than thriving. Installation practices need to change to reduce mortality and increase longevity at the outset (Figure 6).

Figure 6 – Nursery stock too deep in the root ball and planted too deeply.

In general, the tree-planting holes should be relatively shallow (typically slightly less deep than the measurement between the root collar and the bottom of the root platel) and quite wide (three to five times the diameter of the root system). Care should be taken so that the root collars of the new trees are at the same level or slightly higher than the surrounding soil grade (Figure 7).

In most situations, it is not recommended to add soil amendments to the planting holes, as this can lead to differences between texture and structure of soils inside the planting holes and the surrounding soil. Such differences can lead to either water being wicked away from or accumulating in the planting holes.

Tree staking or guying should be the exception and not the rule. Tree staking hardware should only be installed when necessary to keep trees from leaning (*e.g.,* windy sites) or to prevent damage from pedestrians and/or vandals. Stakes should only be attached to trees with a loose, flexible material, and all staking material must be removed as soon as the root system anchors the tree.

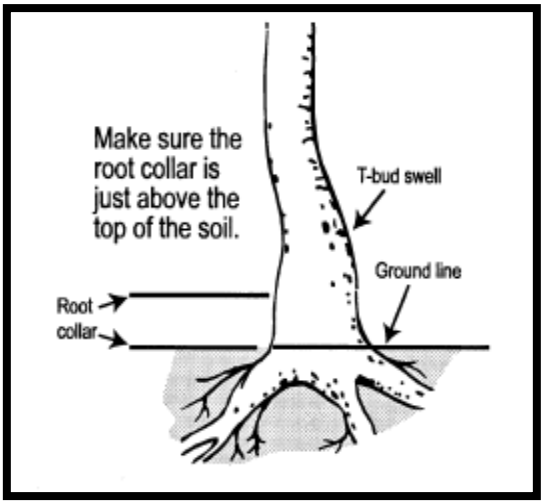


Figure 7 – Root collar at grade level

Bare rooting, or the removal of field soil or container substrate, at planting and transplanting has many advantages that can address the above mentioned structural root depth and defective root system problems. Bare rooting also has advantages relative to other production, harvesting, shipping, and planting and transplanting components, with the following being a compilation of the major advantages across all phases of plant handling:

- Root defects and structural root depth can be corrected prior to tree harvest if bare rooting occurs during each propagation or production stage, or during planting or transplanting.
- Root pruning stimulates new root growth.
- Field soil and container substrate can be retained at the production nursery.
- Transmission or transport of soil-borne weeds, insects, and pathogens can be minimized.
- May help in dealing with quarantines relative to soil-borne insects and pathogens.
- Trees may be less expensive and easier to store at the nursery prior to shipping.
- Trees will be less expensive to ship and therefore potentially less expensive to the buyer.
- Trees can be transported into more confined spaces if both their branches and their roots can be compressed.
- Trees will be easier to handle from a weight perspective.
- Planting holes will be easier to dig and will require less heavy digging equipment (with a side advantage of reduced soil compaction).
- Removes problems that can result from incorrect installation handling of balling burlap, ropes, and straps, and wire baskets.
- Resolves soil and container substrate disparity or hydrologic discontinuity problems.
- Root systems are more uniformly moistened by “mudding in” (creating a soil slurry to settle into and atop the bare root system), and large air pockets are removed.
- All structural and absorbing roots are in contact with the planting site soil, not just the roots/root tips on the outside of the root ball.
- “Mudding in” creates greater direct root anchorage and reduces the need for supplemental stabilization (staking or root anchoring). This in turn reduces maintenance cost and potential tree and human hazards when no stabilization method needs to be removed.
- Fewer injuries should occur to green industry personnel.
- Potential to increase the period of time of the tree guarantee or warranty.
- Trees with poor quality roots can be refused or returned with proof of the structural defect or root depth problem.

An additional, non-production or installation advantage noted by the author when employed as a municipal arborist was increased volunteer participation in tree planting activities due to the lighter weight, more consumer friendly bare root tree.

There is a need to plant the appropriate size for each location. Smaller caliper, low branching trees planted in the downtown are already suffering severe damage such as broken branches. It may be a better choice to start with larger caliper trees in the downtown corridor. In sites like buffer strips along the highways where there are no pedestrians or other conflicts and a goal to restore to natural forest type, smaller diameter trees are cheaper to purchase and would likely adapt and establish faster. Current code requires 8 foot spruce trees as a minimum to create quicker screening but watering by adjacent property owners is so minimal that trees don’t grow for years or die.

Tree Planting and Transportation Management

The MOA has traffic and development plans that acknowledge the growing use and dependence on automobiles and the need to provide better planned and constructed vehicular access around and through the MOA.

These plans include the use of trees and landscaping as a traffic-calming device. Studies across the country confirm that the presence of a tree-lined street and a canopy cover does indeed slow traffic. The presence of trees sends direct and indirect messages that drivers should slow down. In addition to contributing to traffic management goals, the trees and landscaping enhance the character of the street and the neighborhood, which, in turn, improves the quality of life in the MOA.

The MOA allows tree planting to occur on the right-of-way. This is a great opportunity to increase tree canopy cover by planting trees appropriately on the public streets in the MOA. The issue of tree placement on the right-of-way is now one that should be addressed and resolved by the MOA. Public safety must be balanced with maximizing new tree plantings in MOA.

Typically, municipalities set standards for the clear sight distances between trees and intersections of various road types, *e.g.*, residential, arterial, or collector and minimum planting distances from curbs. They also set standards for clear sight distances between trees and other right-of-way features, such as driveways, traffic signs, street signs, parking meters, snow storage areas, and street lights.

The City of Spokane, Washington has the following specifics in their Municipal Code:

- Plantings may not exceed thirty inches in height or hang lower than ninety-six inches within the clear view triangle at street intersections on corner lots and at driveway entries to public streets. The clear view triangle is defined in SMC 11.12.050(C). The director of engineering services may further limit the height of plantings, landscaping structures and other site development features within the clear view triangle or may expand the size of the clear view triangle as conditions warrant.

- No person may erect, install or maintain a fence, hedge or other improvement on the corner of a lot so as to obstruct the view of travelers upon the streets, as specified in this section.

- Except as provided in SMC 17G.010.100(A)(3), no person may install or maintain any fence, vegetation or structure within the right-of-way of any public way.

- Subject to the authority of the city engineer to make adjustments and special requirements in particular cases:

    - no fence exceeding a height of thirty inches above the curb may be inside the:

        - right isosceles triangle having sides of fifty feet measured along the curb line of each intersecting residential street; or
        - right triangle having a fifteen-foot side measured along the curb line of the residential street and a seventy-five foot side along the curb line of the intersecting arterial street, except that when the arterial street has a speed limit of thirty-five miles per hour, the triangle has a side along such arterial of one hundred twenty-two feet; or
        - right isosceles triangle having sides of seven feet measured along the right-of-way line of an alley; and:

- the inside line of the sidewalk, or
- if there be no sidewalk, a line seven feet inside the curb line.

- no fence may be closer than twelve feet to the curb of an arterial street.

Other cities, such as Cincinnati, Ohio, use the following specifications in their tree planting, road improvement, and subdivision specifications and contract:

Before nursery orders are finalized, Natural Resource Management Section (NRMS) staff and contractors lay out location of all planting holes with suitable marks. Marks are 2-inch-wide arrows made on curbs that extend at least 1 foot onto street pavement. Locations meet the following standards:

Tree located:
1. Centered between curb and sidewalk, at least 2 feet from curb line unless designated otherwise by NRMS.
2. At least 10 feet from driveways, handicap ramps, and fire hydrants.
3. If by metered parking spaces, 4 feet in front of meter, near rear wheel space.
4. No closer than 5 feet behind or 10 feet in front of signs. Trees located to keep signs visible.
5. At least 5 feet from marked water, gas, electric, telephone, cable TV, and sanitary sewer service branches.
6. To keep traffic signals and street lights visible and at least 10 feet from these structures and utility poles.
7. No drainage ditches and at least 10 feet from storm sewer inlets.
8. At least 30 feet from intersections, measured from point where curb changes direction.

Another approach to this potential conflict is to simply review each and every tree planting on a case-by-case basis to customize and accommodate unique circumstances and conditions that occur on different rights-of-way in the jurisdiction.

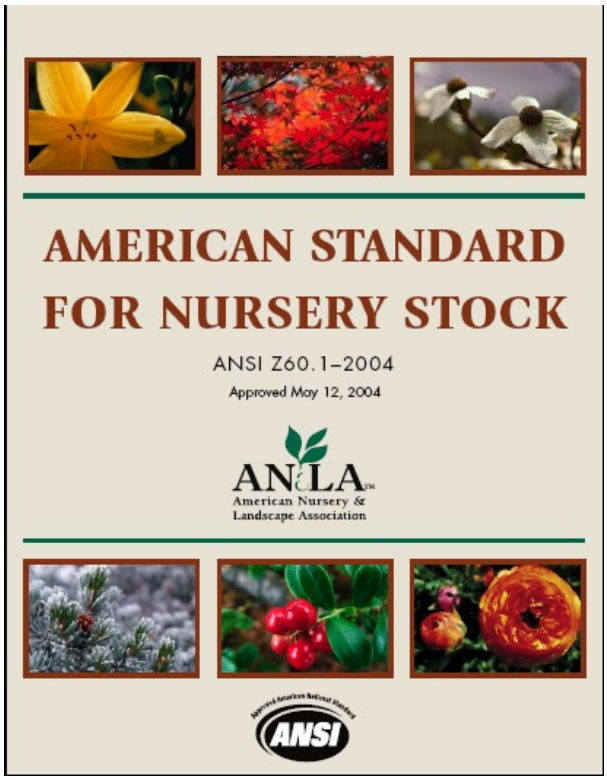
Figure 8 – Incorrect mulch applications can degrade trunk tissue causing tree mortality.

Mulching

Mulch should be applied to the surface of the soil around each newly planted tree. Mulch should never be piled up around the root collar (creating mulch volcanoes), but rather should be pulled away from the root collar (Figure 8). Mulch that buries the root collar provides shelter for insects, fungi, and mammals that could damage the tree. Mulch should be applied to an area three times the diameter of the root system to a depth of two to four inches. Mulch not only suppresses competition from grass and weeds, but also provides a zone where turf maintenance is not needed, thereby keeping lawn mowers and string trimmers safely away and thus preventing mechanical damage. Mulch also helps to hold moisture in the surface of the soil where most of the feeder roots are to be established.

A Strategy for Nursery Stock Procurement

The MOA should develop a long-term strategy for nursery stock procurement to enable the administration to request appropriate species rather than relying solely upon the available stock. This will allow the MOA to exert more control over its species diversity and to select the use of species that will thrive in an urban setting. A number of resources exist to assist in the selection of species. The MOA should develop its own list based on its long-term objectives, but with built-in flexibility to accommodate changing needs and challenges.



In many jurisdictions, species selection for plantings is limited by availability of stock at the local nurseries. The common experience in MOA has been that, even if a community wants to plant native species, there are limited supplies of these trees when they are needed. Often the plant material is harvested from wild stands. The plant material does not meet American Standard for Nursery Stock (ANSI Z60.1) and may damage the native stands during harvest. Often these plants contain weeds, some invasive, that create ongoing maintenance problems from the date of planting.

If the long-term planting stock requirements can be forecast, contracts can be negotiated with the reputable nurseries and the community can demand the species, size, production methods, and quality of trees to meet the goals and objectives of the strategic plan. Without this level of planning, the community must often be satisfied with the stock that the nurseries can supply or local harvest of poor quality woodland material. Long-term planning will make it possible for growers to accommodate planting needs for native species grown from local seed sources. Specification for planting stock quality and planting procedures should be clearly defined. Recommendations for other species, particularly those native to the region, will become available as a result of the performance tracking and species suitability trials recommended below.

The MOA should promote the establishment of native species in appropriate areas. Similarly, stock procurement strategies should promote the use of locally adapted seed sources. Special care should be taken to plant native species near woodland areas that may be susceptible to invasion from non-native stock (McGauley et al 2000). This should not be construed to promote the use of native plant material where introduced species would be more suitable and adaptable.

Nursery stock quality has a significant impact on the survival and long-term growth of planted trees. All nursery stock procured for establishment in the MOA must follow the

American Standard for Nursery Stock (ANSI Z60.1 – 2004), future MOA nursery stock specifications, and MASS guidelines. All planting stock must be inspected by MOA staff before it is accepted for planting. This will ensure the best possible chance for survival and growth in a harsh urban setting.

The trees should be planted according to the Arboriculture Specifications and Standards of Practice for the MOA. When trees are planted by an external agency, contractor or subcontractor, MOA urban forestry staff must inspect them at the time of planting. Also, there must be a minimum of three years of post-plant maintenance (by the contractor) for newly planted trees. At the termination of the warranty period MOA urban forestry staff must re-inspect planted stock and determine if the warranty conditions have been met. New tree maintenance should follow the guidelines suggested by Arboriculture Specifications and Standards of Practice for the MOA.

In light of the changing growing environment and the identification of species and cultivars more suited to these ever-changing conditions, the MOA must continuously explore opportunities to incorporate new selections into their tree establishment program. Several long-term performance trials should be set up throughout the MOA in order to test the suitability of a wider selection of species and new cultivars for establishment in the MOA. By monitoring these trials the MOA can identify the best choices for planting.

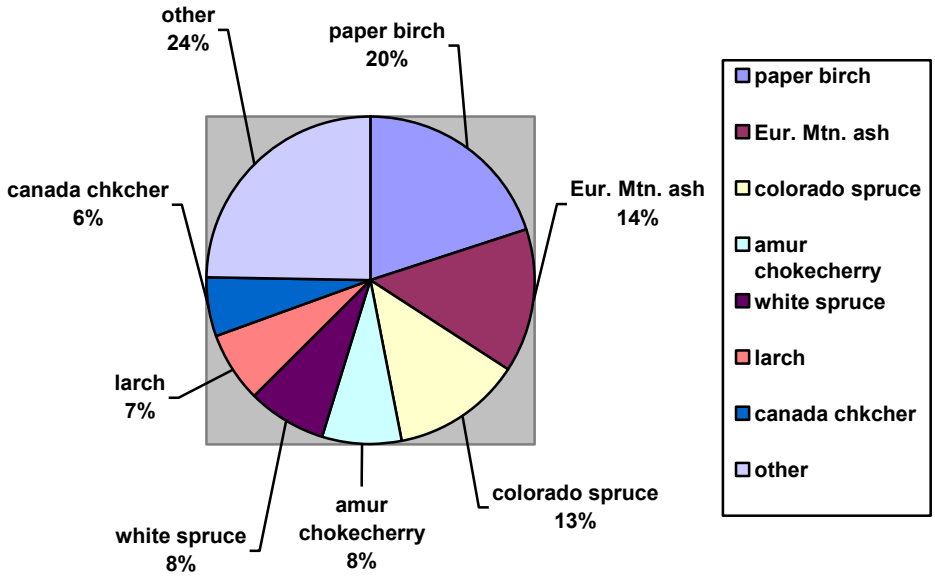
Arboreta are common in many municipalities and they offer a place for people to learn about different trees from around the world using living specimens. Additionally, they are often used for research. For example, the arboretum at the Center for Urban Horticulture University of Washington collects plant material suitable for planting zones in the Northwest from across the world to test for hardiness and ornamental features.

An urban arboretum is also an excellent place to display plant material suitable for different site environments such as trees beneath utility lines or a street tree exhibit featuring trees in different parking strip widths. The MOA should consider developing plans to create an arboretum using species that are tolerant to the climate of the region in which MOA is located and the general growing conditions typical of urban environments. The arboretum should be situated in a cemetery, large park or campus where there is ample room to plant new trees.

Diversification

The 2008 partial inventory of selected street and park trees included over 1400 trees. This is a small percentage of the total tree population and limited to a few sites representative of the total population. There were 29 different species found in the partial inventory.

SPECIES DISTRIBUTION



This appears to be a diverse population but species distribution figures indicate the population is dominated by a few species. Seven species accounted for more than 75% of the total population. Birch was the dominant species at 20% of the population. Prunus species accounted for more than 18% of the total population.

Species diversity in new plantings should be a primary concern. The dangers (*e.g.*, disease and insects) of planting monocultures have proven to be devastating throughout the United States. The goal should be to maintain species diversity throughout the city. A common guideline for maintaining species diversity in urban settings is the 10-20-30 rule. That is, no one species should make up more than 10 percent of the trees in a population, no more than 20 percent of any one genus, and no more than 30 percent of one family in the total tree population (Santamour, 1990). When planning the expansion of the community forest, the MOA should use this ratio as a guiding principle.

The MOA should emphasize a diversity of species in the planting program. Many species should be avoided that have high maintenance costs, invasive characteristics, high storm damage potential or a history of failure.

Different species offer different amenities for the city and parks. Some trees grow very large and provide a great deal of shade, others grow tall and narrow, and still others remain small. Some trees flower profusely ("showy ornamentals"), others have tiny, almost invisible flowers. Some trees stay green year round; others drop their leaves in the fall. Trees may attract birds and insects by providing food or habitat. There are very rare species which can become "specimen species" in a park or along a city street. New landscape plans should consider a balance of all these offerings. Biological and environmental site characteristics, maintenance needs, historic plantings, staff and community input should be considered in the landscape planning process.

Diversity is an important measure of a forest's resilience. A more diverse forest, both in total number of species represented and in their relative abundance, is better able to

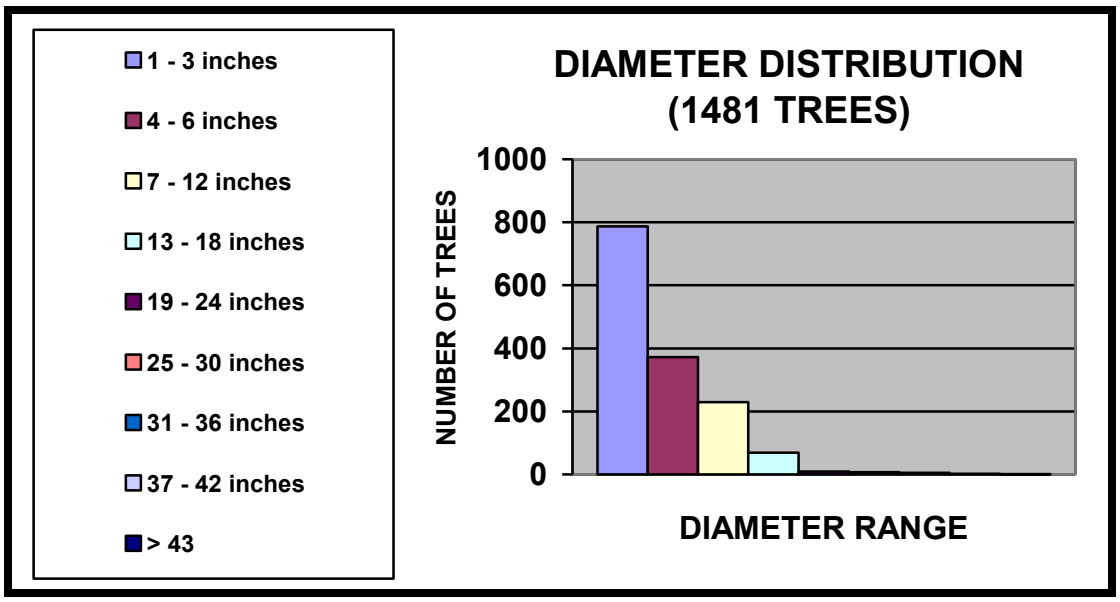
adapt to environmental changes as well as disease and insect infestations. When just a few species dominate the composition of a tree population, these changes or infestations will significantly impact the entire population.

Diameter Distribution

The graph below depicts the diameter distribution for 1,481 trees inventoried from the MOA tree population in graph form. The vertical axis represents the number of trees and the horizontal axis represents diameters in four inch class increments. The tree population is concentrated in the smallest (1 to 3 inch) diameter classes. The graph mimics a population that peaks in the smallest diameter classes and gradually decreases as diameters increase. In other words, it represents a population that will perpetuate itself for some time in the future since there is an abundance of trees in the lower diameter classes to replace the trees that are over mature. This scenario may be ideal if it represents a species the community wishes to retain in its community forest. On the other hand, if it represents a species such as Prunus, it is not a good trend since the city is trying to control the spread of this species.

In Anchorage, this diameter trend may indicate that trees do not live beyond a very few years and are replaced so often that nothing reaches a larger size. This may be an indication of other problems such species choice, nursery stock quality, planting practices, and post-plant maintenance.

The optimum diameter distribution for trees considered for retention in the population has the largest number of trees in the smallest diameter classes. As each group of trees within a specific diameter class matures, the numbers within the group diminish through attrition. To perpetuate a specific species, the largest representation must be in the smaller diameter classes. Generally, for any given species, twice as many trees need to be planted as are removed in any one year in order to maintain the exponential shape of this graph. Species that the city wants to preserve in perpetuity should mimic the ideal diameter distribution.



A well distributed age-class helps maintain a stable canopy cover. If all the trees within a particular area or neighborhood are approximately the same age they will mature and decline more or less at the same time, leaving that area with a deficient urban forest canopy. In many parts of the MOA, young trees of similar age class dominate the landscape. To mitigate the impacts of an even age canopy maturing at the same time, MOA should take steps to increase the age class and species distribution where possible.

For example, the City of Davis, CA established the following standard for desired age structure:

- 40% young (< 6 inch DBH)
- 30% maturing (6 – 12 inch DBH)
- 20% mature (12 – 24 inch DBH)
- 10% old (> 24 inch DBH)

At present, MOA has only 1.0% large-stature trees. Management activities should strive to improve this to at least 10% of all trees in MOA.

INVASIVE SPECIES MANAGEMENT

Undesirable woody plants arrive in the landscape as or with nursery stock or grow from seed as volunteers. A tree is considered to be invasive when it meets any of the following definitions:

- An invader plant is an indigenous or exotic plant species having a detrimental effect on the growth of commercial tree species, giving rise to particular management problems or growing where it is not wanted (LeRoux 1981).
- Invasive plants are naturalized plants that produce reproductive offspring, often in large numbers, at considerable distances from parent plants and thus, have the potential to spread over considerable areas (Richardson et al. 2000)
- Invasive species are species that are able to survive, reproduce and spread, unaided, and sometimes at alarming rates, across the landscape (van Wilgen et al. 2001)

Perhaps the greatest threats to the future health of urban forests are alien invasive species. As international trade accelerates, the number of introduced species has dramatically increased. Alien species are defined as “species of plants, animals and micro-organisms introduced outside their natural past or present distribution. Alien species become invasive when they establish and spread in a new environment, and threaten the native species, the environment, the economy, or some aspect of society.

Each region of the United States has several species that are considered to be invasive. In the Midwest areas, mulberry, tree of heaven, willow, poplar, Siberian elm, silver maple, and eastern red cedar are considered to be invasive. In Alaska, some Prunus species fit the definition for invasive woody plant. Once established in a natural area, European bird cherry, (Prunus padus) is invasive, often difficult to manage, and can permanently alter ecosystem composition and function. There is a need for prevention, better management, and quicker responses to invasive plant material.

Invasive species create a management problem for the MOA. The MOA will need to determine which species in the region are either currently invasive or will be invasive. These species will need to be phased out particularly on sites where they are considered a threat. The development and promotion of alternative trees and collaboration with nursery stock suppliers, garden centers, and citizens will encourage the control of invasive species. Site management of invasive species involves:

- Inventory/Site analysis – Inventory data provides information about the severity of the problem, identifies which trees can be removed for risk, disease or insect pest issues immediately, and begins to allocate additional resources for removal of invasive species.
- Encourage reduction in use of the species as a landscape plant and encourage elimination or least corrective action of impacted sites.
- Replant with desirable species based on site analysis and community needs.

Currently there is no comprehensive program or policy with regards to the monitoring and management of invasive pests. The MOA staff try to monitor for invasive pests, but have a limited ability to react to infestations should they be discovered. The MOA should develop a comprehensive management plan to deal with invasive plants.

The MOA should create a list of trees not recommended for street tree planting and a list of trees prohibited for planting areas.

RECYCLING WOOD WASTE AND CHIP DISPOSAL

Tree removal is typically the most expensive tree maintenance operation on a per tree basis. Other costs associated with tree removal include stump removal and wood waste disposal.

Currently, most of the wood generated from park tree removals brings little economic return to tree management budgets. The growing concern about the environment and over burdened landfills, coupled with an opportunity to augment the forestry budget, should prompt the agency to the possibility of processing waste wood as a revenue generating activity.

There are many opportunities today to recycle tree residue. The following options are available for agency use.

- Mulch (new tree installation, trails, landscape beds)
- Biomass fuel production
- Small scale sawmill operators (building materials)
- Secondary product production (park benches, furniture, wood sculptures)
- Woodworker associations (knotted and twisted wood pieces)
- Composting
- Firewood

Which option(s) to apply and implement will depend on MOA laws, agency policies and resources. An internal review and revisions of existing laws and policies governing agency wood waste utilization can improve the agency's ability to sell this material (USDA, NA-TP-02-94).

TREE PROTECTION

The primary goal of tree protection is the long-term survival and stability of a tree or group of trees. It is not about trying to save every tree during development and construction because some trees are not salvageable due to structural problems or poor quality species. It is about preserving and protecting trees that add value to the property or because the community demands trees be preserved and protected.

Arboriculture practices cannot repair construction damage or vandalism to a tree or reverse degradation of its growing environment. Our industry has a limited ability to cure these injuries or accumulated stresses to trees. The focus to reach our goal of tree protection is to prevent injury to trees.

Construction Protection

Construction in and around trees can lead to chemical and physical injury to tree trunks, soil compaction in the root zone, severed roots, smothered roots, split or broken branches, and new exposure to the wind and sun. When construction is necessary it is important for everyone involved in designing, contracting, and managing a project to understand tree preservation and to use best practices in tree protection.
The best way to protect trees from construction damage is to prevent damage to the tree and the surrounding soil. Identify arboriculture treatments such as pruning, irrigation, fertilization, mulching, and pest management that may be needed prior to construction activities and to invigorate trees (Matheny and Clark, 1998).

A tree protection zone should be established and fenced off and contractors should be prohibited from moving or working within the fences. In order to prevent soil compaction and root injury, the fence should be placed at least as wide as the tree canopy's drip line but often wider. If the rooting area cannot be off limits, mulch the soil under the tree canopy heavily to reduce compaction.

Driving near trees should be minimized; site access and equipment storage areas should be clearly delineated prior to the start of construction. Trenching near trees should be eliminated and trees should be protected from physical mechanical damage with tree wrap or tree guard.

Monitor trees during construction to evaluate and treat any damage or change in health to trees that occur and to document any conditions that result from construction damage. If trees are injured during construction they should be tended to immediately.

Vandalism

It is impossible to constantly police every street and park tree. It is possible, however, to raise awareness in the community about tree health and to increase people's respect for the trees in the community. Educating residents, park patrons, and school children about street trees or trees in the parks may reduce incidents of tree vandalism (such as girdling and peeling bark, and harvesting bark) and encourage reporting of observed tree damage.

Accidental tree damage is also primarily a matter of education. Most people do not realize that slamming a car door (or fender) into a tree, urinating on a tree, hammering a nail into a trunk, or dumping hot coals at the base of a tree may all cause irreparable

damage that can eventually lead to hazardous conditions and tree mortality. Even walking on a tree's roots, when done by hundreds of people a day, can seriously injure a tree.

Programs that raise the public's awareness of the trees in the community through emphasizing their benefits they provide can help influence resident and visitor behavior. See the education and outreach sections of this UFMP for more information on this topic.

Young Tree Protection

As more young trees are planted along streets or in the parks, the need for a young tree maintenance program will rise. Young trees require more frequent care than older trees. Depending on conditions they may need to be watered, mulched, pruned, and/or protected with temporary fencing, as they are more susceptible to vandalism and adverse environmental conditions.

Moose and beaver are literally the biggest tree pests in the MOA. Fencing is the only practical, long-term solution for larger pests. Trunk protectors used during the winter season will avoid damage from smaller rodents and beaver. It is worth the investment, as a year's worth of new tree planting losses from large and small animals can quickly exceed the cost of fencing, trunk protectors, maintenance and upkeep. Planting larger caliper trees from the onset may alleviate some problems with moose.

Encourage volunteers to adopt young trees in the parks and their neighborhood. Volunteers trained in basic tree maintenance, and watering techniques, provided with tools (a hose, trowels, garbage bags, gloves, etc.) and are given the responsibility for the care of the adopted tree. This program promotes citizen involvement in tree care and awareness of the urban forest. This program could be implemented in Anchorage for street or park trees – individuals, families, or school groups could adopt newly planted trees. The MOA should take advantage of the Tree Stewards program to organize and utilize the opportunity this group provides for more volunteer hours.

PUBLIC OUTREACH

Support from elected officials and the citizens are critical to implement and maintain an effective comprehensive urban forest management program. The citizens own both the public and private community forests, and without greater political support and increased citizen understanding and commitment, urban forest management in Anchorage may not reach its full potential.

With hundreds of visitors using Anchorage's parks at the height of the summer season, there are many opportunities to involve the community in the management of Anchorage's trees. The parks are full of trees, not in the best condition, but trees are one reason why people use and enjoy Anchorage parks.

Through a range of projects from increasing the potential for passive awareness (signs), to active recruitment for tree care through stewardship programs, the city can continue to focus on bringing street and park trees, the benefits they provide and the maintenance needed to the attention of residents and patrons. Possible public involvement initiatives include the following:

- Establish a citizen's advisory tree committee with official standing at the parks commission or assembly to provide an on-going opportunity for citizen input into the Planning and implementation of the five-year plans and urban forestry program.
- Reach out to existing groups. Community groups such as the Elks, Rotary, Chamber of Commerce, Lions, Future Farmers, 4-H, local chapters of the Society of American Foresters and American Society of Landscape Architects, TREErific, Anchorage Waterways Council, and local businesses are usually very active and interested in community projects. Many of these groups would undoubtedly be interested in projects relating to forest health, and city administrators should make an effort to reach out to them.
- Encourage environmental projects that benefit the street and park trees. Interns from local high schools or colleges could be recruited and ensure that course credit or work study support is offered when they work on community trees. This benefits the community and strengthens ties to local schools.
- Offer a forum for community participation in park and street tree design decisions. Hold workshops for public input into planting decisions and street and park design.
- Use signage for education and increased awareness. Increase and improve signage around the parks, whether relating to tree species identification, self-guided tours, information on tree protection, and other useful and informative subjects.
- Develop a "Tree Walk" brochure for trees of Anchorage that highlights the city's most significant trees or new and unique species along with their natural and cultural requirements and history.
- Encourage stewardship. Promote a Stewards for Young Trees program within the community, setting up regular workshops for steward training and allowing civic or school groups to "adopt" newly planted trees (see Young Tree Maintenance).
- Link urban forest issues to other recreational activities. Establish a bird watching group, for example, that can build nest boxes and emphasize the value of trees in the riparian habitats of the city. Develop a partnership with Audubon.
- Celebrate Arbor Week with a series of plantings at schools and parks hosted by elected officials.

Building a connection between citizens and street and park trees is the foundation for long-term stewardship and sustaining the community forest.

EDUCATION

Education is one of the best tools available to keep staff and citizens of Anchorage informed of the benefits of trees and the proper care of trees. The citizens of Anchorage have a strong sense of community and take an active interest in city programs and projects. The community forest is linked to the people of the city. Education and personal involvement of as many community members as possible is critical to the success of a sustainable community forest. Education about proper tree care and participation in the community tree program can translate into more tree benefits for the city and a willingness to support the tree program in the future. There are a variety of professionals in the region that can offer technical advice, literature, workshops and other assistance for the city.

The entire community benefits from an extensive, healthy and safe forest. Yet without an informed, involved populace, such a forest is difficult to attain. Individual trees require proper care in order to thrive, while the community forest as a whole, benefits

from long-term planning. Community involvement is essential because of all that is required for quality care of the urban forest.

Community Based Social Marketing

Since individual landowners own most of the urban forest, it is imperative that MOA's urban forest education strategy contributes to real behavioral change towards the forest. Public education initiatives commonly attempt to influence positive changes in behavior by presenting people with the most environmentally sound options, often through the use of media advertising or the distribution of printed materials. Increasing awareness and knowledge about the urban forest is necessary to encourage public interest and involvement in action plans. However, current research reveals that this is not always enough to inspire positive action (McKenzie-Mohr 2000; Robinson 2002).

In particular, information-based approaches do not address the real concerns and barriers that people have with changing their behavior; therefore, these types of programs often have little success. To affect real change in a society, researchers have found that individual interests and situations, including environmental, economic, social, and cultural situations, need to be considered (McKenzie-Mohr 2000; Jacobsen 1999). Residents must see a direct connection between their own needs and the benefits of changing their actions in order to believe the change is worthwhile and to take steps towards changing their behavior (Jacobsen 1999).

An effective education strategy, therefore, needs to address the barriers to behavioral change rather than only build awareness (McKenzie-Mohr 2000; Robinson 2002, Wondolleck and Yaffee, 2000). The field of community-based social marketing actively works to enable residents through encouraging supportive services and infrastructure in addition to providing information (McKenzie-Mohr 2000; Robinson 2002).

After barriers have been identified, and a specific strategy planned, the next step in the community-based social marketing approach is to conduct a pilot test, and then to evaluate its effectiveness, prior to broad implementation of the strategy. Both identifying barriers and conducting pilot tests are often skipped in designing and implementing an education strategy. Although they can add to the cost and length of the program, they are crucial if the desired level of behavioral change is to be achieved in the long term (McKenzie-Mohr 2000; Wondolleck and Yaffee, 2000). Indeed, the community-based social marketing approach tends to be more cost-effective than standard information-intensive campaigns because it more successfully contributes to the desired level of behavioral changes (McKenzie-Mohr 2000; Wondolleck and Yaffee, 2000).

In summary, the community-based social marketing tool can be used successfully to influence and create behaviors among all residents that will enhance and protect MOA's urban forest. The MOA is poised to become a leader in this area because this technique, while employed successfully in other disciplines, has yet to be applied specifically to the community forest. An excellent reference for understanding these concepts is 'Enabling EcoAction: a handbook for anyone working with the public on conservation', by Les Robinson and Andreas Glanznig.

Training

It is important that staff be properly trained in the duties that are assigned. The care and maintenance of trees is no exception. Arboriculture and tree care maintenance and

operations are very specialized fields of work. Many years of education and training are required to perform competently and safely in the field and without harm to the trees. Tree care performed to Anchorage's public trees should be accomplished by ISA certified arborists or certified tree workers.

Annual training is a mandatory element in keeping staff updated on the latest safety methods and practices in the arboriculture industry. Staff training is essential for working safe, efficient, following the best management practices of the arboriculture industry, and for advancing Anchorage's urban forestry program into the future.

MANAGEMENT INFORMATION

The partial inventory and management plan is a starting point for continued active management of the working forest resource of Anchorage. The comprehensive nature of this management plan is intended to serve as a baseline for future data collection and management plans. By carefully documenting changes in the forest structure (plantings, removals, pruning operations, incidents of vandalism, etc.) the urban forester will be able to assess the success of the program over time. To assist in the future implementation of the UFMP and development of the urban forestry program, a complete inventory of public trees is needed. The MOA has started collection of a city-wide inventory of public trees using TreeWorks™, an ArcGIS tree management software.

Tree Inventory

Fundamental to a tree management program is the inventory. Tree inventories are the foundation of an effective tree management program. Tree inventories help vegetation managers identify current and potential problems and plan for budgets, removals, pruning, planting and other maintenance requirements. A tree inventory is a means by which a vegetation manager can acquire and retain pertinent information about the condition and value of Anchorage's tree resources. The inventory data supplies objective and quantitative information that can be used to document estimates for funding, personnel and equipment. The tree inventory moves the urban forestry program into proactive management.

A complete assessment of the tree population is necessary to obtain accurate, functional data necessary to manage the urban forestry program.

Completing the tree inventory and using TreeWorks™ to prioritize maintenance establishes a systematic tree maintenance program which actually reduces costs. This is primarily because systematic maintenance in general leads to healthier trees that require less expensive maintenance over the long run than unhealthy, high-risk trees. A computerized tree inventory aids in reducing the subjectivity of tree management decisions and stimulates proactive responses.

While it is theoretically still possible for communities to conduct very simple inventories without a computer, realistically, managing and maintaining tree inventories of any size is extremely difficult without one. A computerized data collection system should be used to collect tree data, store data and manage current and historical tree information.

Data Use and Tree Analysis

TreeWorks™ can be used to refine inspection procedures, aid in reducing the subjectivity of tree management decisions, stimulate proactive responses, track maintenance and guarantees problematic trees are visited regularly. TreeWorks™ tree management software can supply the tree manager with data tables, reports, maps and work orders to be used for removal schedules, service requests, project bidding, contract reports and other tree management functions. The tree management software is an effective, efficient day-to-day and long-range management tool.

A good forest management program should exist outside of the individuals who apply it. Trees typically live far longer than humans do and certainly longer than the average human career-span. As a result, urban forest managers should consider the long-term consequences of their data management, and should record forest changes with the understanding that the information may be useful decades from now.

The inventory data can serve to educate citizens and increase their participation in stewardship programs by providing access to the data for school science projects, planting projects and other public tree activities. Staff can present quantifiable data to city administration and assembly for justification of program activities and budgets.

ORDINANCE REVIEW

Ordinances are regulations enacted by government for the benefit of the community or citizens and when dealing with trees are usually tree ordinances. Ordinances define the legal interaction between the public, the agency and its trees. They define what a private individual can and cannot do to a public owned tree. Examples of tree risk policies that are best addressed through public policy or ordinances include:

- High-risk trees on private property that may affect public area
- A definition of boundary trees
- Defining inappropriate tree-related activities
- Defining the role of the agency forester to implement policy
- Referencing arboriculture standards and specifications

The MOA code section 24.70 contains components of a tree ordinance. These components lack comprehensiveness and do not provide an orderly judicial support of the urban forestry program or the trees of MOA. The MOA code lacks provisions recommended and found in other city tree ordinances. The common elements and a brief description of each element follow in Table one. Table two on page 48 shows the common elements in selected ordinances from other cities.

It is apparent many common elements are not present in Anchorage's ordinance. The MOA's tree ordinance requires revisions to existing components and to address issues missing in most city and city tree ordinances. The following additions or revisions are examples of proposed revisions and additions:

1. The code lacks a purpose section. It does not clearly state the mission and objectives of the urban forestry program or the program ordinance. It does not mention the intent of the ordinance is to address public tree management. A purpose section defines the intent and objectives of the ordinance.

2. The definitions section should be expanded to include definitions for industry terms such as species, pruning or street tree and public terms such as right-of-way or planting strip. The definition section needs expansion to cover more industry terms not familiar to the public.
3. A recommended species list and a prohibited species list section should be referred to by a document name to clarify the use and ability to update the list as industry planting standards and specifications change.
4. There are no sections that refer to permit requirements for tree maintenance activities. These sections could be consolidated into one section that clarifies the permit process for all public tree maintenance activities.
5. The ordinance should be expanded to include other pest infestations or disease infections that are considered incurable and epidemic such as spruce bark beetle. Severe maintenance treatments such as topping may be included in this section.
6. An Urban Forestry Specifications and Acceptance Criteria for Nursery Trees documents dealing with planting, pruning and removing standards or specifications should be written and referenced in the ordinance. Neither of these documents is cited in the ordinance. A separate document such as "The MOA Arboriculture Specifications and Standards" could capture the content of both these documents and consolidate the standards and specifications into one concise document. Separation of these documents from the ordinance allows for incorporation of changes in industry standards and best management practices without revisions to the ordinance.
7. The incorporation of a Risk Management Policy in the tree ordinance is strongly recommended as part of the city's tree risk management program. A risk management policy ensures continuity in the risk management program despite changes in the political and administrative components of the city.
8. A tree ordinance provides an opportunity to establish policy and back it with force of law if necessary. The infraction and damages section should address mutilation, damage, vandalism, illegal removals and improper pruning, etc. Penalties, fines and other levies should be based on the appraised value of the tree(s) as determined using the Council of Tree and Landscape Appraisal Guide, 9th Edition.
9. As a general rule the fundamental program guidelines such as tree committee establishment and other more static items should be included in the ordinance. Industry standards and specifications that are subject to change as the arboriculture industry evolves should be placed in separate documents which can be cited in the ordinance.

Table 1 - COMMON ELEMENTS FOR ORDINANCE EVALUATION

Element	Explanation
Purpose	The goals and objectives of the ordinance. These are crucial to implementation, enforcement, and defense of the ordinance if challenged.
Authority	The source of the local government's authority to regulate – usually its own police powers and relevant state statutes (enabling legislation).
Definitions	Terms and phrases with special meaning within the body of the ordinance. Clear, concise definitions are important to ordinance comprehension.
Designation of Administrative Responsibility	The specification of a position, department, or committee responsible for enforcing the ordinance and carrying out specified duties. Ideally, limits of authority and responsibilities are clearly defined.
Plan and/or Permit Review Process	Explanation of how a new/proposed development or other action will be reviewed. Should detail information to be submitted with permit or platting requests, such as site survey of trees and proposed building locations.
Incentives	The methods that can be used to achieve conservation & compliance with ordinance (e.g. preserved trees credited to required project landscaping).
Preservation	What is to be preserved and how it is to be accomplished. There are many approaches to this, such as retaining ≥30% of existing tree canopy.
Construction Protection Measures	Specific measures required to protect trees during construction activities. Usually involves providing a protective zone for trunk and root structures.
Maintenance After Development	Specification of required maintenance of trees and vegetation after project has been completed, often including replacement for damage-killed trees.
Appeals	Provides for possible flexibility with a process for appealing decisions, which serves as a check on authority, but can potentially undermine management.
Enforcement	Provision for enforcement, and penalties for ordinance violations. May include fines, imprisonment, withholding of permits, work stoppage, etc.

Table 2 -COMMON ELEMENTS PRESENT IN SELECTED ORDINANCES

City	Purpose	Authority	Definitions	Designation of administrative responsibility	Permit Review Process	Incentives	Preservation	Construction Protection Measures	Mainter after Develo
Bellevue	✓	✓	✓	✓	✓	✓	✓	✓	✓
Bellingham	✓	✓	✓	✓	✓				
Bothell	✓	✓	✓	✓	✓	✓	✓	✓	✓
Anchorage									
Clarkston	✓	✓							
Colville		✓	✓	✓					✓
Covington	✓	✓	✓	✓	✓	✓	✓	✓	✓
Ellensburg		✓	✓	✓	✓				
Enumclaw	✓	✓	✓	✓	✓				
Grandview		✓	✓	✓	✓				
Kelso	✓	✓	✓	✓	✓	✓	✓	✓	✓
Lacey	✓	✓	✓	✓	✓	✓	✓	✓	✓
Olympia	✓	✓	✓	✓	✓	✓	✓	✓	✓
Omak	✓	✓	✓	✓				✓	
Port Townsend	✓	✓	✓	✓	✓	✓	✓	✓	✓
Pullman	✓		✓	✓	✓	✓	✓	✓	✓
Redmond	✓	✓	✓	✓	✓	✓	✓	✓	✓
Spokane	✓	✓	✓	✓	✓	✓			✓
Vancouver	✓	✓	✓	✓	✓	✓	✓	✓	✓
Walla Walla	✓	✓	✓	✓	✓	✓	✓	✓	✓
Woodinville	✓	✓	✓	✓	✓	✓	✓	✓	✓

Tree ordinances provide the city an opportunity to set policy and back it with the force of law when necessary. It provides clear guidance for planting, pruning, removing and other maintenance on street, park, golf and other public trees.

The ordinance should be flexible enough to fit the needs and circumstances of the city. The inventory data can provide the quantitative evidence for ordinance policy development.

Arboriculture and tree care maintenance and operations are very specialized fields of work. Many years of education and training are required to perform competently in the field and without harm to the trees. **Tree care performed to Anchorage's public trees should be accomplished by International Society of Arboriculture (ISA) certified arborists or ISA certified tree workers. The language of the ordinance should reflect this standard of tree care.**

There are many existing tree ordinances and tree ordinance-writing resources. A comprehensive list is provided in Appendix B.

DOWNTOWN TREES

City streets are not just thoroughfares for motor vehicles. They often double as public spaces where people walk, shop, meet, and generally participate in many social and recreational activities that make urban living enjoyable. Urban foresters, designers, and planners encourage streetscape tree planting to enhance the livability of urban streets. Large, high quality trees play important roles in community improvement. Trees are as much a part of the city infrastructure as roads, buildings, and street lights. Extensive research has documented the environmental, social, and economic benefits of large trees for communities, municipalities, and regions.

Trees in small city business districts influence retail and shopping behavior in positive ways. The results of several studies suggest that trees are good for business. Shoppers prefer trees and consider trees an important amenity. They spend more, shop longer, and are willing to pay more for goods in business districts with mature, healthy trees.

Yet, city trees are too often placed into "tree coffins", cutouts in the sidewalk with an insufficient soil volume, oxygen level and water availability for roots, where trees grow poorly, live fast, and die young. The sidewalk cutouts are enclosed with iron grates to create a contiguous surface for pedestrian travel. The iron grates usually girdle the trunk as the tree grows, damaging the tree they were intended to protect, and often lead to trip-and-fall hazards for people causing severe injuries. Also many of the trees in downtown Anchorage are planted

below grade where soil temperatures are colder. This places tree roots in a colder environment and also places the tree branches at a lower level which increases pedestrian conflicts.

Some common procedures exacerbate tree problems. For decades, it's been common to plant street trees in "tree pits." But if these excavations are too small, the root system cannot support the tree for more than a few years, according to James Urban, an authority on trees in built-up areas. The lack of room for roots stunts the tree's growth, and soon the tree begins to die, says Urban, principal of Urban Trees and Soils in Annapolis, Maryland.

The trees may lift up adjacent sidewalks which lead to risk issues for the city. Confined to ever-smaller cutouts and planting strips, it is no wonder that roots carve out their space at the expense of sidewalks, curbs, and driveways. The typical public works response is tree removal or aggressive root pruning which often leads to a slow, agonizing tree mortality or tree failure. If the trees are removed the city is left with vacant tree pits. When this happens, trees lose and cities lose.

While some trees are associated with sidewalk damage, research in many cities has shown that trees are minor contributors to sidewalk failures. The soil type and soil's suitability for sidewalk construction and root growth have a bearing on tree-sidewalk conflicts.

Those trees that do survive tend to experience stunted growth, pest and disease problems, mutilation described as pruning for clearance issues, exposure to road pollution, and vandalism. The trees are stressed and often decline and die, creating a public eyesore during the process. It is not surprising that some city officials and the public have a poor opinion of trees in downtown business districts and along city streets. The trees never reach their potential to provide the benefits for city dwellers.

One of the biggest challenges for arborists, urban foresters, city planners, landscape architects, soil specialists, engineers, and public works staff is to provide sufficient soil space for root growth and tree health, in a situation where space is at a premium. The trend is to downsize the urban forest and plant smaller trees.

Figure 9 – Trees and other infrastructure compete in downtown areas for space. Two trees planted at the same time- the smaller one in a tree pit, the larger one in a planting bed with more soil volume.

The MOA downtown business corridor is under constant competition for space. Many infrastructure items must share the

same space and co-exist (Figure 9). The key site condition factor to consider in resolving tree-sidewalk conflicts is to integrate trees into the infrastructure design up front. The fundamental solution to most city tree problems is simple: Give each tree access to more and better soil.

The downtown business district is the heart of Anchorage. As might be expected in the downtown, several organizations, property owners and tenants are stakeholders in the management of trees. Most of the downtown is planted with trees, many are recent installations, and most are planted in tree pits. Development and redevelopment of property in the downtown can mean additional planting opportunities or it can mean facing the loss of established trees to development of buildings, parking lots and street redesign.

When development does occur where trees currently grow, great care must be taken to protect those trees that are healthy and structurally sound whether on public or private property.

An American Forests article published in the early 80's stated that an oak or maple tree is capable of living up to 400 years in the forest, up to 80 years on a college campus, up to 30 years in a heavily used park, up to 20 years along a city street and about 4 years in a downtown planting pit. Thirty years after the article was published, the same design mistakes are still being made in cities across the United States. There are several challenges when planting trees in any downtown area:

- Limited Planting Space. This is one of the greatest challenges to maintaining a healthy urban forest in the downtown district. Small tree wells are the norm in downtown Anchorage (Figure 10). These are typically concrete walls on all sides; four feet square and leave little space for root expansion necessary for vigorous tree growth.

- Availability of Irrigation. The trees in the downtown were installed without an automatic irrigation system. They do not have automated irrigation, so rely on adjacent property owners for water, natural rainfall, or use of expensive water trucks. Water is vital to ensure trees thrive. Lack of water is a primary stress to the tree and often leads to poor growth, premature defoliation and death. Installation of automated irrigation should be required on new development and new tree

Figure 10 – Trees located in small tree pits.

wells or water filtration systems that capture run off for trees before sending it down the drains.

- Difficult Growing Conditions. In any location tree growth is limited by the conditions present in its surroundings. In the downtown, limited growing space, poor soil, heat and exposure to sun and wind impose stress on trees. Incorporating new designs that find more growing space for trees and selecting trees more tolerant of harsh growing conditions will definitely help.

- Owners and Tenants. Some business and property owners perceive trees to be an obstacle to business operations because trees create litter, block visibility of signs and displays and are difficult to maintain. The latest research indicates that trees in downtown corridors increase business, increase shopping time spent and increase the amount spent per visit (Wolf 2005). Trees and business owners in downtown corridors can co-exist and provide benefits to each other.

- Poor Maintenance. Many people do not understand how trees grow or how to best care for them. Trees in downtown areas often go without any regular care. Some trees are topped to clear signs and they become a liability to the adjoining property and the city. Education is crucial to helping owners, tenants and contractors understand proper pruning and tree care can create assets rather than liabilities.

- Tree Grates and Guards. As trees grow and mature, their trunks can come into conflict with the grates covering the planting hole. Roots from the trees often grow into the soil under the sidewalk, cracking and heaving the concrete (Figure 11). Grates can girdle trunks in a short time without maintenance. If left in place, the grates can damage the trees they were meant to protect. The grates are also trip hazards. Their use should be limited and temporary.

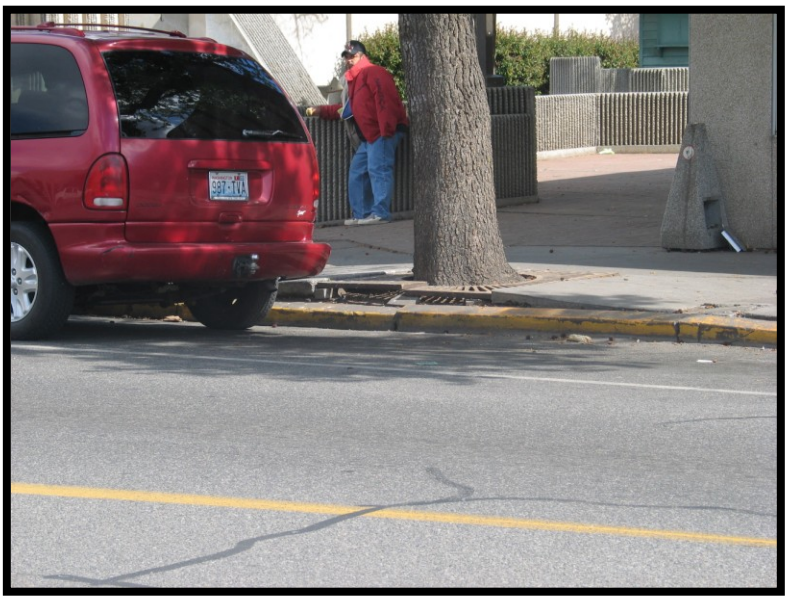


Figure 11 – Tree grates girdle trunks and create trip hazards.

Often, the downtown and other business districts are selected as high priority areas to increase the beauty and attractiveness. Traditionally, downtown trees were installed according to traffic engineering design standards that did not consider the biology and culture requirements of trees. The business district of Anchorage is characteristic of this design concept. Unfortunately, little can be done to improve the current planting spaces without a major change to the infrastructure.

Tree plantings in the downtown business district and Anchorage add greatly to the economics and aesthetic appeal of the city. Tree selection for business and shopping areas must take into consideration the need for shoppers to view storefronts, as well as the need to provide enough shade for shoppers. Tree canopies should be open, as in thornless honeylocusts (Gleditsia triacanthos inermis). **The branching habit must be high enough to allow pedestrians to walk comfortably beneath the trees.** Other options are tall, narrow growing (fastigiate) species. These trees can provide beauty, a look of uniformity, and a formal appearance to the shopping district.

TREE-SIDEWALK CONFLICT RESOLUTIONS

Methods to reduce infrastructure damage have been varied and numerous, with both preventive and remedial strategies employed. Three groups of strategies have been used based upon their action approach: tree-based strategies; infrastructure-based; or root zone-based. Often a combination of action types is used on the same tree to mitigate infrastructure conflicts.

Tree-based Strategies to Reduce Infrastructure Damage

Species selection is an important consideration in any planting situation and particularly important in downtown business districts. Matching a suitable species with the planting space is the first step in the process. Other considerations include drought tolerance, litter, maintenance requirements, and mature size. The trend is to plant small stature trees but studies have shown that ultimate tree stature is not a good indicator of potential for hardscape damage. It is more important to consider the mature size of the trunk flare and buttress roots of the tree when selecting species for limited spaces.

Root system characteristics or root architecture is another tree-based strategy to consider when selecting plant material. There is very little scientific research available about the root architecture differences between species or the differences within a species and the influence rootstocks may have on root architecture. Yet, there is some empirical experience that can be applied. Ash trees generally have a wide, lateral root system while oak trees tend to have an oblique root system. Ash trees may not be suited for downtown corridors because of their root architecture. However, other factors influence plant choice such as soil type, drought tolerance, and litter. Ash would be a suitable candidate for a downtown tree if these factors were the primary criteria. The point is many factors influence species choice for downtown sites.

Infrastructure-based Strategies to Reduce Infrastructure Damage

Infrastructure damage is often caused by trees that outgrow their planting space. The objective of design strategies is to maximize the distance between trees and infrastructure in order to minimize the potential for conflict. Infrastructure-based strategies focus on prevention of problems. For new trees, providing adequate space by using larger planting spaces, tree islands, or narrower streets are key preventive strategies. The goal is to eliminate some hard surface when possible.
For established trees, creating additional space using curving sidewalks and pop-outs, or eliminating sidewalks altogether are remedial strategies to consider. Bridges and ramps over existing root systems is an alternative but compliance with the Americans with Disabilities Act (ADA) must be considered.

Planting spaces of appropriate size for the desired species is critically important. The larger the planting space, the lower the potential for damage from trunk expansion, buttress root development, or surface root development. Various researchers have suggested planting strips be 10 feet wide and cutouts be 6.5 feet by 6.5 feet.

Although tree height provides some guidance in matching trees and planting space size, measuring the trunk diameter at ground level gives a direct assessment of the minimal planting space needed for a species. This measurement includes both the trunk flare and root buttress growth. To accommodate species with a surface-rooting characteristic, additional space beyond that needed for trunk diameter at ground level will be required.

Curving sidewalks away from the tree increases the distance between the tree and the sidewalk and the damage potential decreases. Sidewalk meandering—realigning the sidewalk's direction of travel—enables the community to provide more growing space for trees in an aesthetically appealing way. The amount of growing space created can be substantial and, therefore, sidewalk meandering is usually the most feasible way to retain large, mature trees. Also, increased distance from sidewalk edge to lateral roots or trunk flare allows for root pruning, when necessary, to occur further from the trunk, which reduces direct contact between the sidewalk and tree roots or trunk. Sidewalk meandering often requires permission from the abutting property owner to dedicate more of their property to the public right-of-way.

Figure 12 - Re-routing sidewalks around existing, large trees is a successful option.

Pop-outs or bulbs are similar to curving sidewalks (Figure 12). Space can be increased for newly planted or existing trees by removing a section of curb and extending the planting space into the street. Sidewalk cutouts or "borrowing" space from the adjacent sidewalk creates sidewalk cutouts. This alternative minimizes the sidewalk width for a limited distance adjacent to the tree. The cutout provides a larger grow space for trees and reduces the size of the pruned roots and their proximity to the root flare. Borrowing has limitations, as the room for tree expansion before infringing on the free passage of pedestrians is minimal. Furthermore, the ADA imposes strict regulations as to the amount of free space provided.

Figure 13 – Sidewalk ramping raises the sidewalk over the root system.

Sidewalk ramping allows existing roots to remain intact by re-pouring concrete over the roots to create a gradually sloped ramp (Figure 13). It is used when removal of roots would compromise the stability of a high quality tree. Damaged sidewalk slabs are removed and 4-6 inches of topsoil is placed on top of the existing grade. A sand or foam backer is placed adjacent or around the subject roots. A new sidewalk is then installed on top of this new base material. This option enables the sidewalk to be replaced in its original position. Sidewalk ramping does not prevent future damage but can delay it by five years or more.

Concrete slabs of nonstandard size or shape can increase the space available for established trees. This technique serves as a design alternative to the curving sidewalk but produces a similar result.

Infrastructure-based strategies can also include the use of certain materials that provide a larger, uncompacted soil volume, such as pervious concrete, asphalt, decomposed basalt, stone dust, pavers, or rubber sidewalks, instead of concrete.

Figure 14 - The sidewalk cutout option can be used in some scenarios on downtown streets. The trees are shown before mulch was applied.

Flexible paving comes in many forms, which include:

- Interlocking pavers
- Common brick and pavers
- Rubber bricks

Flexible paving is used in conjunction with root pruning when retaining original grade is required and when the level of the paving surface is ramped above or lowered below existing grade. The selected flexible paving material is installed over a compacted sand base. Cities have utilized rubberized, reusable brick in different dimensions that is bonded together with specialized glue. Some of the newer rubberized pavers do not require glue to bind them, but instead use specially designed dowels, which hold the pavers together. Although the use of flexible paving does not prevent future damage, it does provide more time between repairs making repairs easier and less costly.

These materials may be used as alternative cover treatments when removing tree grates.

Figure 15 - Rubber sidewalk installation.

Concrete modifications usually involve expansion joint materials such as dowels, rebar and sleeves, and articulating sidewalk joints. Sidewalk grinding can be employed as temporary measure that restores the offset or heaved portion of a sidewalk to original grade.

Root-based Strategies to Reduce Infrastructure Damage

Root-zone based strategies often use root guidance systems or soil replacement, modification, and management techniques. They include continuous trenches, engineered or structural soils, root channels or paths, steel plates, Silva cells, and root barriers.
Root pruning may be considered an option but it is a serious wound to the tree and may affect the stability of the tree. Age, tree condition, species, root size and location, and proximity to the trunk should be considered before using root pruning as a treatment.

Figure 16 - Root pruning should be limited or not used.

Figure 17 - Root channels can be used to direct root growth.

There are limitations and constraints associated with each strategy. Typically the solution to avoiding infrastructure conflicts in downtown areas involves a combination of techniques. Trees, in light of our ecological problems, are now being recognized as significant solutions to some of our urban problems. Trees are a necessary component of urban corridors, not just street side ornaments. Too often trees are not integrated into the infrastructure design up front. Consequently a large amount of money is spent on mitigating root-hardscape conflicts.

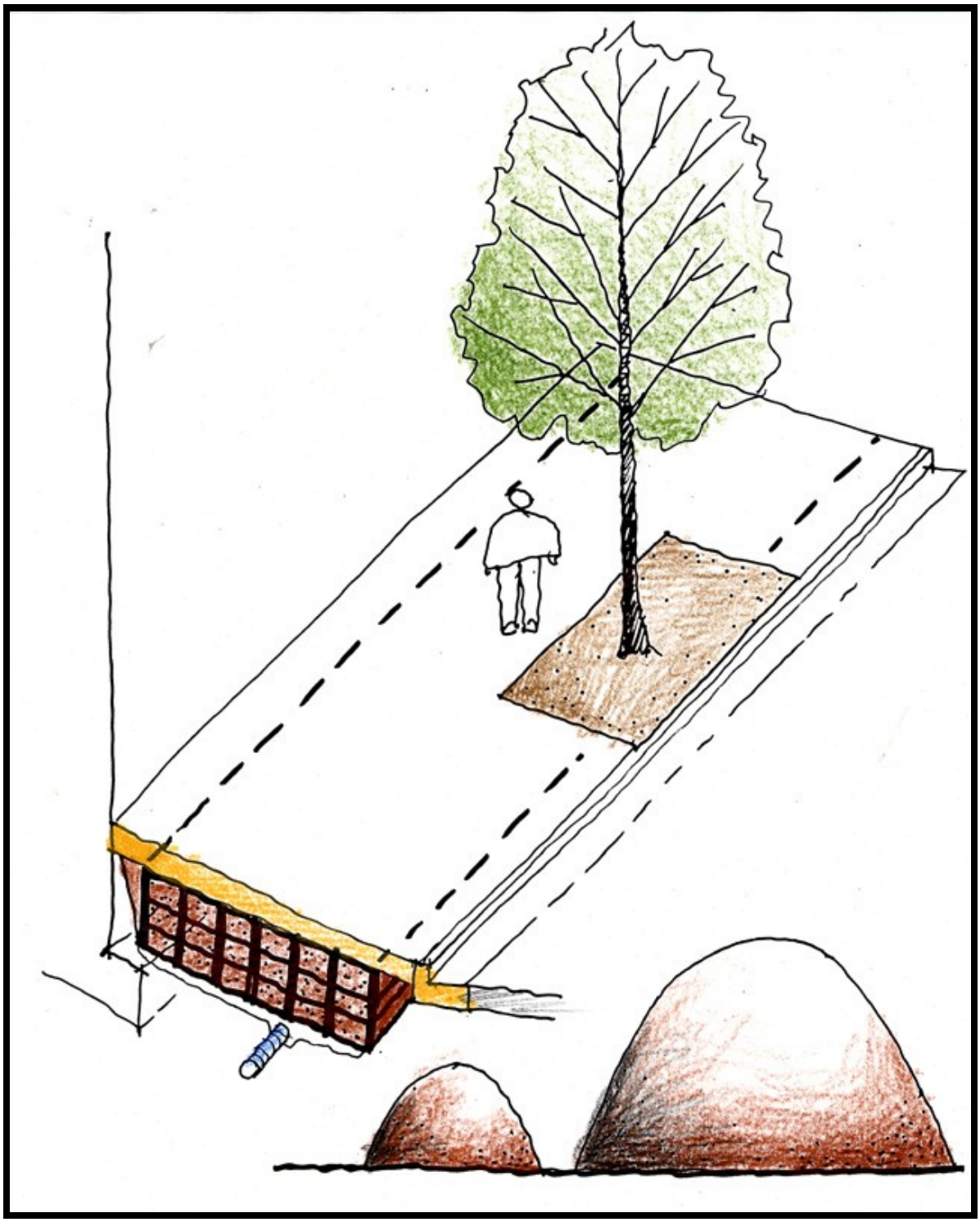


Figure 18 - Silva cells utilize a modular framework of interlocking cells. An underground planter is constructed which is backfilled with a large volume of high quality, uncompacted soil. The cells meet load bearing standards and can also help manage storm water on site.

Several new practices are being used in conjunction with the extensive construction and renovation occurring in the downtown (E.g. Silva cells, large raised planters, and moveable planters for trees in places they can't be planted). Tree grates are beginning to be removed, trees in pits are being raised to grade level, mulch installation, and planting a greater variety of species is happening in the downtown currently. In each of these scenarios it is critical to start with quality nursery stock and plant the tree correctly. Without these first steps an accurate assessment of these practices cannot be made. It is important to assess each of these tree planting treatments under conditions that have followed the best management practices of the arboriculture industry consistently. It provides MOA information about which treatments or combination of treatments succeeds in the downtown corridor.

OPERATIONAL REVIEW

Operational reviews may evaluate many components of an organization's forestry program. Reviews provide summaries of existing conditions, identify short-comings, and ultimately suggest goals, guidelines, and rationale that, once adopted will serve as a gauge for the standardization and optimization of program resources.

MOA's goal is to have a larger, healthy, diverse, and functional urban forest and thriving residential and business communities. The dynamics of balancing urban forest management and other MOA infrastructure needs, responsibilities, and assets are diverse and complex and suggest a dedicated, interdisciplinary, flexible approach and organization. However, the current constraints for comprehensive and effective urban forest management in MOA can be considered formidable.

Budget

The lack of dedicated and adequate financial resources for the urban forestry program precludes making significant improvements to the program. Currently, there is no line item or designated regular funding for tree planting, preventive tree maintenance, increased staff and support personnel, or equipment.

Existing public funds for urban forest management are dispersed among various departments for various tasks, and are usually expended only on an emergency basis, by limited citizen requests, for individual capital projects, or for limited aspects of urban forest management, such as development site inspection. The Urban Forester position does not have management authority over dedicated funds for comprehensive urban forest management activities, nor control and input on the expenditures made by other departments.

Policy

The MOA has no over-arching administrative or regulatory policy for managing the public urban forest. The MOA Code briefly mentions public trees and prohibits their damage. MOA primarily uses this as the basis for policies, regulations, and enforcement of urban forest protection during development.

There is no ordinance detailing the MOA's responsibilities for public trees, protection of public trees, enforcement and penalties for violations, or planting guidelines and processes. Without an ordinance or formal policy authorized by the Assembly or without

an administrative policy from the Mayor, there is only limited coordination, inefficiencies, and marginal urban forestry management. Independent departments and agencies can continue to function and interact with little or no cooperation from each other. Coordination of MASS and other land use regulations is limited. This can lead to inefficient duplication or overlapping of efforts and/or the opposite, under lapping, where areas of responsibility and needs are not met.

The lack of a MOA urban forestry management policy can allow MOA agencies to operate with conflicting or inadequate urban forest management standards. The lack of a policy also means there is no measure by which to judge the MOA's actions as successes or failures.

Fragmentation

Although several MOA departments consider some aspect of urban forest management, planning, and control to be within their scope, they actually concentrate on only a part of the urban forest and lack a comprehensive perspective. Fragmentation, or separation defined by organizational boundaries and agency-specific missions, may keep the MOA's departments from interacting in meaningful and productive ways to protect and enhance the urban forest.

Communication within and between the City's own departments is as important as communication to the City's residents and other key stakeholders, and so it will be critical to have representation from departments outside urban forestry operations who deal with trees in their planning and operations. However, this involvement will likely be inadequate to ensure that current policies and practices with respect to tree resources in the MOA are communicated to various department managers (and their staff) and so the MOA should explore mechanisms for more inter-departmental coordination regarding proper protection and management of the MOA's tree infrastructure (i.e., its trees) and educate all the departments involved in planning and approving developments (or redevelopments) in the MOA about them.

The urban forester works for the Parks & Recreation Department currently and manages trees in parks and along streets, leaving other municipal trees outside of parks to other departments or agencies. This leads to confusion within city departments and in the minds of the citizens of the MOA as to who is responsible for municipal tree management. It promotes the use of different standards and practices within city departments and creates confusion among contractors working on projects that impact trees in the MOA. Standards and specifications of tree care in the MOA should be uniform across the city whether dealing with internal departmental issues, or external contractors or agencies, and residents. The creation of the urban forestry position and development of urban forestry program provides a resource to direct and manage all public tree issues in the MOA. The responsibility for public trees should reside with the urban forestry program.

Leadership

The effectiveness of an agency is, in part, a function of its leadership. Without strong, supportive leadership, or if the leadership of the urban forestry program is not in an empowered position in the organization, urban forestry goals will struggle to be met. Whether in direct or indirect control, centralized or decentralized, the MOA's

administrative leadership of urban forestry needs to be recognized, focused, dedicated, and supported.

Technical and Professional Resources

An adequate complement of professionals who, individually or collectively, understand the technical, operational and administrative factors in urban forest management is needed to prescribe and monitor the MOA's urban forestry activities, enforce policies and regulations, apply technical standards and practices, and review plans that affect the forest resource. Without this professional component in sufficient numbers, urban forest management decisions and actions often default to inadequately prepared decision-makers, which can have long-term, negative consequences for the forest resource.

Political Support

Support from elected officials and the citizens are critical to implement and maintain an effective comprehensive urban forest management program. The citizens own both the public and private urban forests, and without greater political support and increased citizen understanding and commitment, urban forest management in the MOA may not reach its full potential.

Extrapolated Maintenance Costs

There are 1,481 trees inventoried in the partial inventory conducted in the fall of 2008. All require some form of arboriculture treatment. The primary treatments are removal and pruning. Of the 1,481 trees, 1,030 require a pruning treatment of some type. There were 308 trees inventoried that require removal.

An average of three hours of labor is required to complete a crown prune for each of the trees or an estimated total of 3,090 labor hours is required to complete the maintenance on these trees. The hours are based on industry standards for pruning. Pruning specifications assumed a fine pruning standard to treat the maintenance issues associated with each tree. Fine pruning consists of removal of dead, diseased, interfering, co-dominant branches or weak branches, one half inch in diameter or greater.

The removal of trees may average six hours per tree for the size of trees inventoried in the partial inventory. A total of 1,848 labor hours is required to complete the removal of 308 trees. The total labor hours required for completing removal and pruning of 1,338 trees is 4,938 hours. A two-person arborist crew (current staff level) would work more than 2,400 hours to complete the work required on the 1,338 trees.

The following assumptions are made for the purpose of forecasting staffing and budgets. If we assume the work year is based on a seven hour work day during a 250 day year as a way to ignore the non-working lunch, breaks and weekend day hours. For a two-person arborist crew to accomplish each task associated with the sample inventory trees would require approximately several years of work on the trees. This does not consider equipment preparation, supporting grounds staff personnel, travel, on-site set up, pre-work tree inspections and other preparation before arboriculture work begins.

Arboriculture industry contract labor rates vary across the country. In eastern Washington hourly arboriculture labor rates average $80.00 per hour. In western Washington hourly rates average $125.00 per hour.

Using a $100.00 per hour average labor rate would require an expenditure of $309,000.00 ($100.00 x 3,090 hours) to perform pruning maintenance work on the trees in the sample inventory. The removal cost for 308 trees at $100.00 per hour (1,848 hours) is $184,800.00. It would cost approximately $600.00 per removal and $300.00 per prune for each tree. These figures are for contractual work and do not include expenses such as salaries, administrative costs or travel that would be incurred for in-house crews.

If we assume a total public tree population of 50,000, system wide inventory extrapolation based on a 21% removal rate (10,500 tree removals) and a 69% pruning rate (34,500 tree prunes) of the 1,481 trees inventoried thus far would require $16,650,000.00 for maintenance treatments of 50,000 public trees.

Agency Staffing and Equipment

The current forestry field staff is composed of a municipal forester, a volunteer coordinator, and possibly five seasonal staff. The position description definitions provided by city staff are similar to other communities' municipal arborist classifications. Salaries, ($35,000.00 annually) including administrative overhead are comparable to industry standards.

Society of Municipal Arborists (SMA) is one of the leading professional trade organizations in the arboriculture industry. The SMA accreditation program sets minimum standards for tree care in municipal and urban forestry and provides a voluntary system of self-regulation which sets standards for urban forestry programs. Some of the **minimum** standards established by the SMA include:

- All trees should be pruned at least once every 10 years
- No more than 10,000 trees per climbing arborist on staff
- Each climber receive a minimum of 20 hours of arboriculture and pesticide training per year, including training in aerial rescue, CPR, first responder training, and attending courses on all subjects related to arboriculture certification.
- A street and park tree master Plan

It is clear that current MOA resources are not sufficient to address tree issues in a reasonable, timely and safe environment if the maintenance requirements and tree conditions found in the sample inventory were extrapolated to the entire community tree population.

The personnel, equipment resources and budgets of the forestry operations are not sufficient to meet the management and maintenance needs of the MOA street, park, trail, and forest system. A review of tree maintenance needs, maintenance schedules, crew configurations, personnel, equipment and training required to manage and maintain the tens of thousands of trees in the system finds agency resources insufficient. Current resource levels have placed the agency in a reactive management position that

increases the liability of the agency and exposes staff to an increased risk of accidents attempting to deal with high-risk trees.

Agency crews are operating in reactive mode. Many agencies operate under a mode of crisis management when it comes to tree care maintenance and correcting/removing high risk trees. Information from many U.S. cities shows that the cost per unit of maintenance is generally twice as high with crisis management that it is when maintenance is performed on scheduled or programmed basis (World Forestry Center 1993). In addition to higher maintenance costs, relying on crisis management may lead to injuries or deaths to park users and hazardous work environments for crews that eventually remove high risk trees.

For example, we can assume there are approximately 50,000 trees located along streets, in parks, and near trails in the MOA system. SMA standards recommend one climbing arborist for every 10,000 trees. MOA would need to employee five arborists to meet minimum SMA standards. The annual wage cost would be $175,000.00.

Two three-person arboriculture crews, each equipped with an aerial lift truck and chipper would provide service to all parks on ten year pruning cycle. Aerial lift trucks and chippers cost approximately $150,000.00 and $30,000.00 respectively. If both crews were supported with equipment, the cost would be $300,000.00 for aerial trucks and $60,000.00 for chippers.

Staffing estimates require a more complete park tree inventory, analysis of workload versus available resources (staff, equipment, budget, training, support services, etc.) in order to provide an assessment of agency needs. The data collected in the sample inventory is not sufficient to develop long-range staffing recommendations.

However, the sample inventory data is sufficient to recommend the agency create regional arbor crews to improve efficiency and initiate proactive risk mitigation and pruning programs. The regional location, crew composition, equipment and budget are listed in Table 3. The budget includes onetime capital equipment purchases and annual wages based on costs mentioned previously in the UFMP.

REGION	CREW TYPE	EQUIPMENT	BUDGET
MOA Urban Forestry Department – north crew	1 – 3 person aerial lift/climb crew	Aerial lift truck with dump box and chipper	$285,000.00 ($180,000.00 equipment included in figure)
MOA Urban Forestry Department – south crew	1 – 3 person aerial lift/climb crew	Aerial lift truck with dump box and chipper	$285,000.00 ($180,000.00 equipment included in figure)
MOA Urban Forestry Department – City wide	Volunteer Coordinator	Office space with 4x4 full-size pickup truck	$85,000.00 ($35,000.00 equipment included in figure)
MOA Urban Forestry	Administrative Assistant	Office Space	$30,000.00

TABLE 3

Projected Multi-Year Maintenance Budgets

Typical tree budget allocations found in urban forestry programs across the United States allocate funding in these areas (Figure 19). These are approximations but provide an accurate representation of fund allocations. The priority should be to take care of what you have before substantially adding to the street tree population.

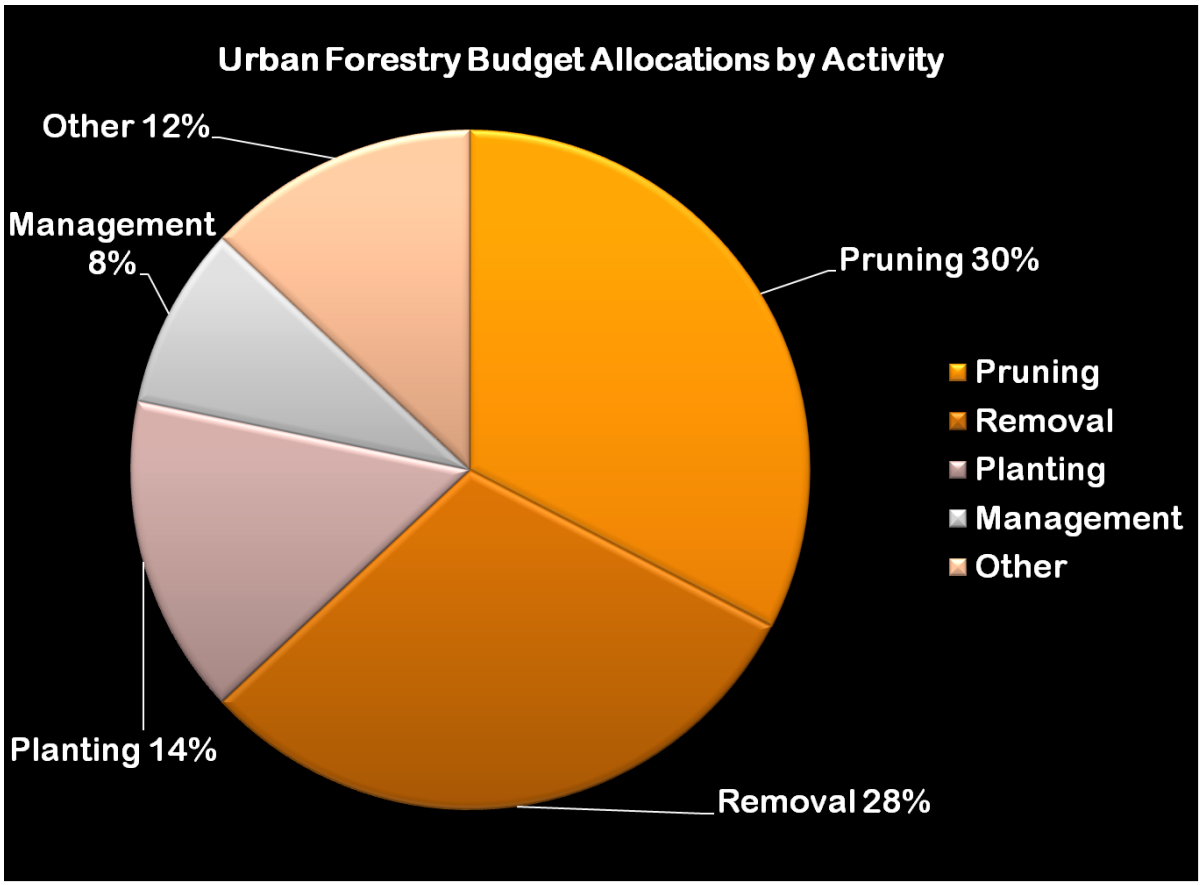


Figure 19 – Typical fund use in urban forestry tree budget allocations

The budget recommendations reflect levels of service that resolve staffing, equipment and resource issues mentioned previously in the UFMP. Levels of service are quantifiable measures of capacity, such as acres of park land per capita, labor hours per tree pruning based on DBH or visitor use per day. A budget plan is a function of the agency's priorities and preferred level of service toward achieving urban forestry objectives in the UFMP.

The MOA must decide on an operating level of service it wishes to provide and accept the level of risk associated with the decision. The current level of service associated with risk tree abatement and pruning is a reactionary response to tree failure and is exposing the agency to a very high level of risk.

A systematic approach accurately identifies moderate to high risk trees, and initiates the timely removal or corrective treatment of hazardous trees. The level of service

associated with proactive management defines and funds specific goals such as eliminate hazard trees in ten years or prune cyclically every five years.

If 21% of the entire tree population is projected for removal and 69% of the tree population requires pruning treatment, workload estimates based on total tree population can provide budget estimates to develop levels of service that may be adopted by the agency.

Again, we can assume there are approximately 50,000 public trees located in the MOA. The assumption generates 10,500 removals and 34,500 prunes. The operating budget is calculated using removal and prune times of six hours per removal and three hours per prune. A $100.00 hourly labor rate is used in the budget calculations.

Following is a summary of the varying levels of service (LOS) that could be established for risk tree abatement and tree pruning. **The LOS that is in bold and underlined represent the current level of service provided today.**

Risk Tree Abatement:

- **LOS 1 – Remove trees on a request/reactive basis**
- LOS 2 – Eliminate removal trees in 5 years (2,100 trees per year)
- LOS 3 – Eliminate removal trees in 10 years (1,050 trees per year)
- LOS 4 – Eliminate removal trees in 20 years (525 trees per year)
- LOS 5 – Eliminate removal trees in 50 years (210 trees per year)

Tree Pruning:

- **LOS 1 – Provide reactive pruning for public trees**
- LOS 2 – Prune public trees once every 5 years (6,900 trees per year; no more than 5,000 trees per climbing arborist)
- LOS 3 – Prune public trees once every 10 years (3,450 trees per year; no more than 10,000 trees per climbing arborist)
- LOS 4 – Prune public trees once every 20 years (1,725 trees per year; no more than 20,000 trees per climbing arborist)
- LOS 5 – Prune public trees once every 50 years (690 trees per year, no more than 50,000 trees per climbing arborist)

	LOS – 1	**LOS – 2**	**LOS – 3**	**LOS – 4**	**LOS – 5**
Program Areas	**Operating Budget**	**Operating Budget**	**Operating Budget**	**Operating Budget**	**Operating Budget**
Removal Tree Abatement	$7,000.00	$1,260,000.00	$630,000.00	$315,000.00	$126,000.00
Tree Pruning	$50,000.00	$2,070,000.00	$1,035,000.00	$517,500.00	$207,000.00
Annual Totals	$57,000.00	$3,330,000.00	$1,665,000.00	$832,500.00	$333,000.00

TABLE 4

The National Arbor Day Foundation suggests $2.00 per capita for urban forestry funding criteria to meet TREE CITY USA standards. The funding criterion includes many activities that do not involve tree maintenance. Anchorage is Alaska's largest city with 42 percent of the state's population or approximately 260,000 residents. The urban forestry budget based on TREE CITY USA standards is approximately $520,000.00 which places the program between LOS 4 and 5.

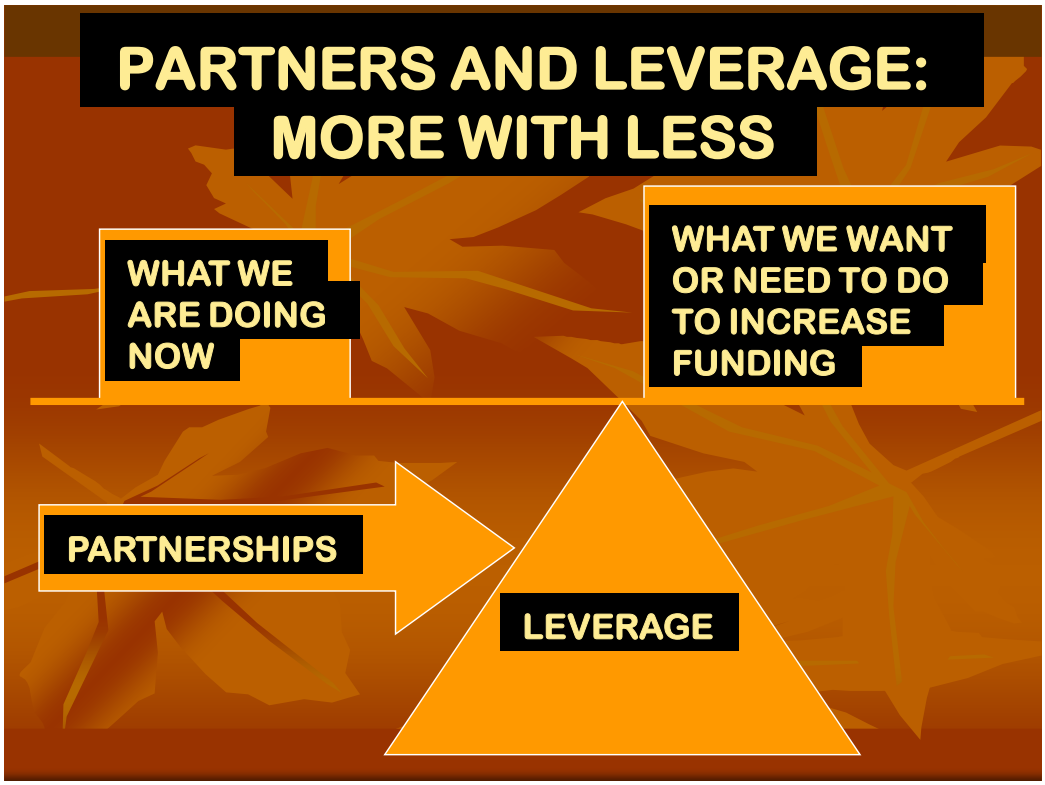
Anchorage has TREE CITY USA status and will receive the growth award this year for an increase in spending and hiring an urban forester. So funds are being spent to achieve the designation but not necessarily on urban forestry program priorities outlined in the UFMP. Much of the spending criteria are met by counting funds spent on Department of Transportation tree planting as part of road construction and building projects. The trees become the responsibility of the MOA after the state's 2-year warranty period. The trees are often not maintained during this 2-year warranty period and it is typical for MOA to receive these trees in poor condition, often planted too deeply, in planting beds full of weeds, and in need of water. This may meet TREE CITY standards but the manner in which it is met imposes a budget and maintenance burden on the MOA.

Program Funding

The consulting team reiterates that to implement this UFMP and to realize the benefits of a healthy urban forest all aspects of this UFMP must be adequately supported with human and financial resources. Traditional funding comes from the city's general fund. An average of approximately 3/10 of one percent of municipal budgets across the United States goes to urban forestry programs. This source of funding is in competition with all other city services and often urban forestry is considered an amenity rather than a necessity.

Urban forestry must generate enough interest in the stakeholders to position the program for recognition and sufficient funding. The program must change how stakeholders think about urban forestry and alter their beliefs about urban forestry. The role of urban forestry staff is not to move trees up the city list of importance. It is more critical to demonstrate how trees can help each city function whether it is police, fire, storm water management, riparian sites or air quality. Urban forestry must be thought of as a solution to community problems and an economic engine worthy of city funding. Urban forestry provides essential benefits, opportunities for investment, solutions to city problems, and connections to people. Many of the objectives and recommendations of the UFMP will assist in generating these outcomes.

Alternative funding sources for community forestry programs are about associative re-positioning or changing who you partner with to leverage resources. In the graphic below 'What we are doing represents' tax dollars supporting our programs. These are dwindling and sporadic from year to year. By developing partnerships with various groups we can leverage their resources to get 'What we want or need to do to increase funding'. Examples of partnerships and alternative fund sources are listed below the graphic.



Examples of alternative funding sources:

- Grants
  - Government
  - Private
- Fees/Backcharges: Charge the department for your services, or the department that has more funds for the work done. Provide solutions to other departments' problems and charge for it.
- Inter-governmental charges: Maintenance fee recovery for road bond projects or right-of-way projects.
- Captial Improvement Funds: Trees as infrastructure cited in ordinances (Austin and Houston, Texas)
- Direct Charges
- Mitigation Payments: You damage or destroy trees, you pay for it. Use ISA appraisal formulae to recover costs of damage or destruction of public property (trees).
- Special Events
  - Festivals
  - Tree Run/Walk
  - Christmas Tree Recycling
  - Business Grand Openings and Building Dedications
  - Birthday Milestones: First, 40th, 50th, etc.
  - Arboretum Plantings and Dedications
  - Community Entrance Tree Planting
  - Church Planting Projects

- Civic Group Planting Projects

- Sales, Merchandising & Promotions
  - Historical Tree Merchandise
  - Trail of Trees/Tree Books
  - Tree Give-A-Ways
  - Firewood/Lumber/Nuts/Fruits and Other Tree Products
  - Memorial, Anniversary, and Tribute Trees
  - Sweepstakes/Contests
- Donations
  - Individuals
  - Utility Bill Donations
  - Donation Cans at Events
  - Trust In Agency Funds
  - Tourism Industry
  - Business Sponsorships
  - Event Sponsors
  - Carbon Credits
  - In-Kind By Citizens (NeighborWoods programs)

Other examples of funding mechanisms:

Missouri: Funding is stable and dedicated through a constitutional amendment which directs 1/8 of one cent sales tax to support the management of fish, forest, and wildlife. The funding generated by this amendment cannot be diverted for other state priorities. Passed in 1976 this amendment does not sunset.

Charge every vehicle owner in the state $1.00 per vehicle, with those funds going to the state program for community tree planting initiatives. After all, the majority of our pollution is vehicular.

Wisconsin: The entire forestry program, of which urban is a part, is funded through a statewide property tax, currently capped at .17 mil ($17 per $100,000 of property valuation) which was enacted in 1923. This has been a stable funding source, though the rate of increase has slowed with the flattening of the housing market.

Utility Initiative: The Municipal Tree Restoration Program involves funding from local utility companies for the removal of poor quality trees under power lines and replacement with more suitable species.

California: The state's Realty Transfer Tax provides regular funding to the Department of Conservation and Natural Resources, of which the Bureau of Forestry is a part, but until the present administration, none of that funding has ever been appropriated for urban forestry.

The MOA has taken a bold step in hiring an urban forester, conducting an inventory, and developing a management plan. To accomplish the mission and to achieve and sustain the community forestry goals, the MOA must fully commit to all aspects of this strategic management plan. The costs associated with the implementation of the management plan must be developed within the context of the overall financial structure and

administration of the MOA. On adoption of this strategic management plan it is imperative that the MOA develop long-range budget forecasts for its implementation.

PROGRAM ACTIONS

Actions and recommendations required to work toward the management goals that are prioritized and undertaken by the city staff working in concert with the tree council, contractors and citizens of Anchorage.

Short-Term Action Items

There are five program management elements that must be addressed on an annual basis: Risk Tree Abatement, Mature Tree Care, Young Tree Care, Tree Planting and Program Administration. Although each of these programs is essential to the maintenance of the community forest, an annual operating plan should be established to determine where budget dollars will be spent. City staff and the tree committee have established public safety, responsible management of existing trees and tree planting as highest priorities.

Priority 1: High-Risk Tree Management

High-risk tree management is the removal of dead or dying trees and trees that have structural issues that may cause the tree or tree parts to fail. This is the highest budget priority due to potential public safety concerns. Trees with a high risk of failure or risk of losing major branches may cause property and/or personal injury.

Situations where injury or property damage has occurred from falling trees are not isolated and are well documented in the media on a regular basis. In addition to the potential for personal injury or property damage, the probability of the responsible parties being held liable for any injuries or damages increases. Such lawsuits can and have resulted in costly judgments against the defendants.

Public safety must be the primary concern in Anchorage. Tree removals and pruning are a vital part of safety risk mitigation. The general tree population in Anchorage is in fair condition; there are large trees with varying degrees of risk factors existing in the scaffold limbs, trunks, and roots. Many of these trees are damaged from lawn mowers and weed eaters hitting the trunk repeatedly. Consideration must always be made of area usage and the risk of falling limbs or trees to persons and property when putting a removal and pruning plan into action.

External indicators of increased risk trees, such as obvious root zone activity, decay fungi, or included bark, require special attention to meet the public's safety needs. Trees that display decay fungi or obvious signs of wood decay should be carefully monitored and evaluated for safety concerns and risk management. Trees with poor structure, such as those with co-dominant leaders or multiple trunks, can pose a greater failure risk than trees with good structure. All public trees in Anchorage (especially trees in the large-size diameter class) with signs of decay and/or poor structure should be examined annually for signs of impending failure.

Priority 2: Mature Tree Care

Large trees are the most significant component of the city's community forest. They form a canopy over streets, parks and private properties. A mature tree is a costly management element, but it is important because of safety and tree health issues. The consequences of lack of care for large trees are the creation of more hazardous trees and poor tree health.

Systematic pruning of large trees reduces maintenance costs, increases the value of the trees and is a clear demonstration the city is exhibiting reasonable care in maintaining its trees. Cyclic pruning shifts forestry management from reactive to proactive. The overall condition of Anchorage's trees will be increased by improving the quality of pruning, storm damage will be greatly reduced and the cost to prune trees will decrease as problems are addressed before they become costly. The city should establish a pruning cycle of two to five years.

Priority 3 and 4: Young Tree Care and Tree Planting

Young tree care and new tree planting are essential parts of the community forest management. The health and stability of the city's future forest depends in large part on judicious tree selection and tree planting today, as well as regular maintenance of young public trees. Early pruning performed properly will lead to long-lived healthy and safe mature trees. Pruning young trees properly produces substantial cost savings to the city. Training young trees can provide a strong branching structure that requires less frequent pruning as the tree matures. Improved stewardship to increase the health and survival of recently planted trees is one strategy for increasing cost-effectiveness.

Proper training in young tree structural pruning would be required for Anchorage staff responsible for this task. Additionally, these workers would be required to understand the growth-habits of the various species being planted, as well as tree biology, anatomy, and physiology. This training can be received through several sources, including urban forestry consultants, the state's Community Forestry Program, and the regional chapter of the International Society of Arboriculture. The tremendous aesthetic and financial benefits to be gained in the years to come from proper pruning of young trees are a strong incentive for educating tree crew personnel concerning proper pruning techniques. The added knowledge gained by the individuals could augment the sense of professionalism in their jobs.

Priority 5: Program Support and Administration

The city's concern for and level of dedication to urban forestry is exemplified by the recent hiring of an urban forester, existence of some tree staff, and the development of the UFMP. Anchorage-TREErific members support the development of an urban forestry program.

However, the elected officials are keys to the growth and success of the Anchorage's urban forestry program. As the ultimate policy-making group and representatives of the citizens, the mayor, assembly, and commissions can have direct influence over the current and future management of the urban forest. They can approve new and improved tree ordinances, support increases in program funding, support additional staffing levels, and generally make urban forestry issues a priority for the city.

Support from elected officials and the citizens are critical to implement and maintain an effective comprehensive urban forest management program. The citizens own both the public and private urban forests, and without greater political support and increased citizen understanding and commitment, urban forest management in Anchorage may not reach its full potential.

Program administration refers to the supervision, scheduling, coordination, planning and education for the city's tree program. These tasks are varied and numerous and should be addressed through the coordinated effort of city administration and staff and an advisory tree board. Much of the field work will be performed through contractual agreements with consultants and commercial tree care firms. It is the responsibility of the city administration, urban forestry staff, park staff, tree council and residents to ensure that the best management practices are used for treatments to the city's trees.

Long-Term Action Items

Long-range planning mainly concerns program enhancement and involves the completion of recommendations in the management plan. There are five program management elements that must be addressed to sustain the community's tree program and trees: Community Forestry Management Plan Adoption and Implementation, Community Forestry Management Plan Update, Increase Funds Spent on Community Trees and Community Outreach and Education.

Priority 1: Adoption, Implementation and Updates of the Five-Year Community Forestry Management Plan and Development of the 20-Year Plan.

The UFMP is straightforward and comprehensive, and contains appropriate goals and activities for this community. The objectives of the UFMP are clear and far-sighted. The goal is to change the forest as it is today into one that reflects the goals of the management plan. The five year plans should be reviewed annually to determine progress, review the activities accomplished, aid in the development of annual operating plans, and plan for future activities to complete the UFMP recommendations. This ensures important components of the UFMP are accomplished and progress is made towards achieving a sustainable tree program. Long-range planning time horizons can be several years or a decade, but five years is most commonly used and is a realistic time frame for implementation of the goals and recommendations of the UFMP.

Priority 2: Increase Staff and Funds Spent On Community Trees

Community trees are a local responsibility. Federal assistance, state assistance, donations and special grants provide important help for community tree activities. However, no source of funds should be considered a substitute for including trees in the MOA's budget. Abundant, healthy trees are of value to the entire city. A tree program is as much a city responsibility as streets, water and fire protection. Incorporating trees into the mainstream of the MOA's fiscal responsibility should be a goal in Anchorage's strategic planning for the future.

The lack of dedicated and adequate financial resources for the urban forestry program precludes making significant improvements to the program. Currently, there is no line item or designated regular funding for tree planting, preventive tree maintenance, risk management, cyclical pruning, increased staff and support personnel, or equipment.

The staffing levels and resources for urban forest management should be increased. A truly proactive and comprehensive urban forest management program requires trained and dedicated staff to oversee management and operational activities. The important duties of tree planting, tree maintenance, risk assessment, site inspections, project management, contract administration, citizen education and public outreach require a sufficient level of staffing, equipment, and other program resources.

An adequate complement of professionals who, individually or collectively, understand the technical, operational and administrative factors in urban forest management is needed to prescribe and monitor the MOA's urban forestry activities, enforce policies and regulations, apply technical standards and practices, and review plans that affect the forest resource. Without this professional component in sufficient numbers, urban forest management decisions and actions often default to inadequately prepared decision-makers, which can have long-term, negative consequences for the forest resource.

Anchorage's urban forestry needs have reached a point where the future management of the city trees requires City Arborist positions, support staff, and funds for contractors or consultants with the ability to augment the services provided by urban forestry staff. A job analysis could be performed to determine if new or existing job classifications should be created, whether existing staff could be trained and reassigned or if new hiring is needed, and what level of funding is needed to support the positions. An operational review of urban forestry activities could be performed to document work processes, work quantities, personnel, use or absence of arboricultural standards, and to inventory existing equipment, tools, and office equipment. The findings and recommendation of both the job analysis and operational review are critical sources of decision-making information and baseline data for judging whether to hire a City Arborist or retain the services of an urban forester.

Priority 3: Community Outreach and Education

Collaboration is necessary for a tree program to serve the physical, social and ecological needs of the city's infrastructure and contribute to the community. The citizens of Anchorage will need to be informed and educated to ensure the success of a tree program and to carry out and accomplish the recommendations of the management plan. Education is one of the best investments to garner support for the tree program. Workshops, stewardship programs and collaboration with volunteers, schools, and other civic groups can serve as a conduit for support of the program.

Priority 4: Tree Ordinance Development

A review of the city's documents exposed several issues not addressed in the city's land use regulations. Tree ordinances to be effective must provide three functions: provide authority, define responsibility and establish minimum standards for management and maintenance. The tree ordinance suited to Anchorage, and most likely to be approved in Anchorage, is written with a thorough understanding of the natural resource, ethnic tradition, political-economic climate, legal framework of the community, and the need to manage with an ecological perspective the supports the green infrastructure.

Most forestry programs exist as a reflection of community interest in trees and operate as specified in the tree ordinance. Passage or revision of an ordinance can be a complex issue. There are many diverse groups that have a stake in tree ordinances. I

recommend a broad base of community support be developed prior to attempting to develop the ordinance. A tree inventory can provide the basis for support and the need to develop the current ordinance.

Priority 5: Downtown Tree Design and Planting

The urban forest can and does have a great impact on the long-term economic viability of Anchorage. Many recommendations in the UFMP will improve tree structure and health and provide better management of the urban forest to support businesses in Anchorage.

Well-planned tree planting in retail districts would improve the visual and physical experience of being in Anchorage by providing unity, screening undesirable views, and providing shade and beauty for customers.

Trees and landscaping would be a primary element for creating a hierarchy of gateway treatments that will define and designate distinct areas of Anchorage for visitors. Tree-lined streetscapes, especially those planted with large canopy trees where possible, are currently limited in Anchorage, but are needed to celebrate and preserve the character of the city.

Work with property owners, tenants, city officials and traffic engineers to create a downtown planting plan that considers tree diversity, maintenance limitations, microclimate constraints, aesthetics and business concerns. Establish designs that ensure trees thrive in the downtown core and assess new planting designs and techniques tried recently.

CONCLUSION

Community Forestry Consultants, Inc. has completed its assignment of evaluating and making recommendations regarding the community forest of Anchorage. This management plan provides the city with the framework to implement the best management practices for the community forest. The management and maintenance needs for a successful urban forestry program have been determined from the best management practices available in the urban forestry and arboriculture industry.

Timely action needs to be taken to prevent tree failures, preserve tree resources and maintain the trees of Anchorage. Trees are valuable assets to the community. The healthier the trees are in the community the more the city's livability is improved. To realize these benefits, tree planting, pruning and removing; increased education, preservation and volunteerism is needed. The focus goes beyond the individual tree to trees throughout the city…..to the working community forest.

The recommendations will help conserve Anchorage's tree resource and sustain the tree canopy for future generations. Although this commitment will come with costs, the long-term benefits are significantly greater and will result in a sustainable asset for the citizens of Anchorage today and tomorrow.

APPENDIX A – Suggested Sections for the Anchorage Tree Ordinance

24.70 PURPOSE.

A. The city council recognizes that the design of the urban environment must ultimately be for the benefit of the quality of life of the human inhabitants, and that a healthy urban forest is a key component of the quality of life. The focus of the urban forestry program will be on balancing the needs of the community with the needs of the urban forest. The purpose of this article is to promote and protect the public health, safety and general welfare by

    1. providing for the supervision of the planting, pruning, removal and maintenance of trees, shrubs and other plants within the public rights-of-way and public places of the City and
    2. education of and assistance to citizens to promote a healthy urban forest.

B. It is also the intent of the city council that the City

    1. promote the restoration and preservation of desirable trees and shrubs;
    2. advocate for the establishment and retention of adequate tree planting spaces while considering the community desire for urban aesthetics; and
    3. protect residents from damage caused or threatened by the improper planting, maintenance, or removal of trees and shrubs.

24.70 ENFORCING AUTHORITY.

A. Establishment.
The urban forestry program is established within the facilities management department, which exercises jurisdiction over trees and shrubs within the public rights-of-way and other public places.

B. Responsible Official.
The director of facilities management is designated as the responsible official for administering the urban forestry program. The director may designate an employee as the urban forester to perform the duties to administer the program.

C. Authority.
    1. The director regulates and permits the planting, pruning, removal, replacement and maintenance of all trees and shrubs within the public right-of-way and other public places.
    2. The director with the advice and assistance of the tree committee will prepare the Arboricultural Manual and will present the manual to the park board and city council for adoption.
    3. The director with the advice and assistance of the tree committee will prepare the Anchorage Arboriculture Standards and Specifications Manual and will present the UFMP to the city assembly for adoption.

4. The director examines all trees and shrubs in the City to determine whether they are contagiously diseased, dead or hazardous, obstructing the right-of-way, or posing a threat to public safety, having the right to take samples from trees and shrubs for laboratory testing.
5. The director with the advice and assistance of the tree committee will develop a plan for assisting property owners with their trees within the rights-of-way, which plan includes educational programs and criteria for financial assistance.
6. The director will develop educational programs for the public promoting proper urban forestry practices.
7. The director will facilitate the establishment of a citizen advisory committee to facilitate citizen participation in the urban forestry program**.**

24.70 DEFINITIONS

Arboricultural Manual" Defined.

"Arboricultural manual" means the Arboricultural Specifications and Standards of Practice for the MOA which contains regulations and standards for the planting, pruning, removal and maintenance of trees and shrubs on public property and a program for developing and improving the tree, shrub, and other plant resources of the community.

"Commercial Tree Work" Defined.

"Commercial tree work" means any work performed on street or public trees by a person retained by the property owner or public utility.

Director" Defined.

"Director" means the director of the facilities management department or his or her designee.

"Risk Tree" Defined.

"Risk tree" means any tree or tree part that poses a high risk of damage to persons or property.

"Pruning" Defined.

A. "Major pruning" means the pruning or cutting out of branches three inches in diameter or greater; root pruning; or cutting out of branches and limbs constituting greater than fifteen percent of the tree's foliage bearing area. The work shall retain the natural form of the tree.

B. "Minor pruning" means pruning or cutting out of water sprouts, suckers, twigs, or branches less than three inches in diameter, or which constitutes less than fifteen percent of the tree's foliage bearing area. The work shall retain the natural form of the tree. Removal of dead wood**,** broken branches and stubs are included within the definition of minor pruning. Minor pruning may be performed by the property owner without obtaining a permit from the City.

"Public Place" Defined.

"Public place" means property owned in fee by the MOA.

"Public Utility" Defined.

"Public utility" means any organization that has a franchise to utilize the public rights-of-way.

"Right-of-Way" Defined.

"Right-of-way" means that strip of land

A. dedicated to, or over which is built, public streets, sidewalks or alleys, or

B. used for or dedicated to utilities installation within the right-of-way.

The "right -of- way" is an easement over the land of the adjoining property owner.

"Severe Crown Reduction" Defined.

"Severe crown reduction" means the specific reduction in the overall size of a tree and/or the severe internodal cutting back of branches or limbs to stubs within the tree's crown to such a degree as to remove the normal tree canopy and disfigure the tree. Severe crown reduction is not a form of pruning.

"Street Tree" Defined.

"Street tree" means any tree or shrub located within the public right-of-way.

"Planting Strip" Defined.

"Planting strip" means the area within the right-of-way easement, generally the lawn between the curb and sidewalk**;** also known as the "parking or tree lawn strip**".**

24.70. ABUTTING PROPERTY.

Maintenance Responsibilities.

A. By the Abutting Property Owner.

The property owner is responsible for the following:

1. Protection of tree health by obtaining all permits as required by this article for planting, removal, or pruning of street trees. The property owners may perform minor pruning of street trees on their property without obtaining a permit;
2. Care and maintenance of the planting strip to ensure proper health of the trees;
3. Removal and replacement of street trees which are topped or improperly pruned if the director determines that a tree's health is severely degraded;
4. Care and maintenance of trees on his or her own property in such a way as to not cause a hazard to the public safety or to the health of public, landmark, or street trees.
5. Removal of trees located on the owner's property that have been declared a public nuisance or hazard.

B. By the Urban Forestry Department.

The Urban Forestry department shall maintain all street trees located on planting strips adjacent to streets listed on the City maintenance responsibility list which shall be developed by the director. The department shall not be responsible for maintenance or replacement of street trees or other vegetation on streets not on the maintenance responsibility list.

Commercial Tree License.

A. Any person retained to prune, plant, or remove a street tree or shrub, must be licensed to perform commercial tree work by the City unless such person is supervised by the holder of a license.

B. A license to perform commercial tree work is issued to each applicant who meets the following qualifications:
   1. is, or has an employee who is, an arborist certified through the International Society of Arboriculture;
   2. has not been found in violation of any requirements of Chapter 24.70 within the preceding year;
   3. maintains liability insurance in the amount established by the director of risk management.

C. The license expires one year from the date of issuance, or sooner if the liability insurance lapses.

D. Licenses required by this section are Class III licenses under Chapter PMC Title 12.

E. The City may revoke the license when the licensee commits any of the following acts or omissions:
   1. knowingly violates any of the provisions of Chapter 24.70 or any of the standards established in the arboricultural manual;
   2. knowingly combines or conspires with another person by permitting one's license to be used by such other person unless employed by the licensee.

Revocation shall be for a period of one year for the first violation, two years for the second violation, and permanent for the third violation.

24.70 ISSUANCE OF PERMIT.

Street Tree Permit Required.

A. Pruning and Removal of Trees.

No person may perform major pruning of trees, or cause or authorize any person to prune or remove trees, in planting strips, rights-of-way, or other public places without first filing an application and obtaining a street tree pruning/removal permit from the City.

1. Application Data.

The application must state the location, number and kind of trees to be pruned or removed; the kind of maintenance or other work to be done and such other information as the director may find reasonably necessary to a fair determination of whether a permit should be issued.

2. Standards for Issuance.

The director issues the permit if in his or her judgment the proposed work is consistent with the ordinance and the proposed method and workmanship are satisfactory.

3. Time.

Any permit issued shall contain a date of expiration and the work must be completed in the time allowed on the permit.

4. Major Pruning.

The City requires that the pruning be performed by a person licensed by the City pursuant to Section on Commercial Licensing.

B. Planting of Trees.

No person may plant a tree in any city right-of-ways without first obtaining a street tree permit from the City.

C. Notice of Completion.
A notice of work completion concerning tree planting, removal, or major pruning must be given by the permit holder within five days to the director for inspection. Inspection shall be completed within ten working days.

D. Annual Permit for City Departments and Utilities with Easements or Franchises within the Rights-of-Way.
City departments and utilities may apply for an annual permit to perform pruning, planting, or removal of trees within the rights-of-way. The permit application must include an annual plan that identifies work that will be done during the year. The permit holder must file quarterly reports which will identify all work done on street trees and trees in public places.

E. Emergency Pruning and Removal.
If immediate removal or major pruning is required to protect the health and safety of the public, tree work to mitigate the immediate hazard may be performed without a permit. The director must be notified on the first working day after the tree work is begun and a permit must be obtained. In the case of a declaration of emergency notification may be made within a reasonable time**.**

F. The director may decline to issue a permit, or revoke a permit issued, to any person who refuses or neglects to comply with any of the provisions of this code.

24.70 REMOVAL OF TREES AND SHRUBS - PROCEDURE.

Removal of Trees and Shrubs.

A. The director may authorize removal of or may remove trees and shrubs situated within the rights-of-way whenever one or more of the following criteria are met.
   1. The tree or shrub is hazardous or is otherwise in violation of this section.
   2. The tree or shrub is damaging public improvements or public utilities and removal is necessary because of the installation of or potential or actual damage to, a sidewalk, parkway, curb, gutter, pavement, sewer line, underground utility, or other municipal improvement.
   3. There is infection or infestation of trees or shrubs with a disease or pest detrimental to the growth, health, or life of such trees and which infection or infestation cannot be controlled or removed.
   4. The vegetation obstructs rights-of- way.
   5. The tree's health is severely degraded because of improper pruning, including severe crown reduction.

B. When the construction services department determines that vegetation obstructs a public right-of-way, it notifies the director. Unless an emergency requires immediate abatement by the City, the director follows the procedures in Section for pruning or removal.

C. As a condition of removal, the director requires replacement with trees or shrubs that are appropriate for the location, unless replacement is not possible.

D. If a tree is to be removed at the order of the director, unless immediate removal is necessary to protect public health and safety, he or she notifies the property owner and tenants thirty days prior to the proposed date of removal. The notice states the reason(s) for the removal and the proposed date of the removal.

E. For City projects which will require removing one or more trees, the Department will notify the property owner and tenants thirty days prior to the proposed date of removal. A copy of the notice shall also be delivered to the office of neighborhood services within the same time frame.

Tree Risk Management Policy.

The City has an active policy to maintain the safety of people and public lands from potentially hazardous trees. The City will strive to eliminate, in a timely fashion, any tree or shrub deemed hazardous. When resources limit the City's ability to remove high-risk trees, the City will prioritize trees based upon the risk. The standard for rating the degree of hazard of a tree will be the International Society of Arboriculture twelve-point hazard evaluation system. Initial strategies will focus on removal of high-risk trees

Tree Protection, Conservation and Preservation.

A. All street and public trees near any excavation, demolition, or construction of any building, structure, street, or utility work, must be sufficiently guarded and protected by those responsible for such work as to minimize potential injury to said trees and to maximize their chance for survival. When street and public trees are near the project, any construction permits issued by the City must be approved by the director, who may require protective measures as specified in the Arboricultural Manual.

B. No person may destroy, injure, or deface any street tree or tree on public property by any means, including, but not limited to the following methods:

1. impede the free passage of water, air, or fertilizer to the roots of any tree, shrub, or other plant by depositing vehicles, concrete, asphalt, plastic sheeting, or other material detrimental to trees or shrubs on the tree lawn or on the ground near any tree;
2. pour any toxic material on any tree or on the ground near any tree;
3. cause or encourage any fire or burning near or around any tree;
4. severely reduce the tree crown except when pruning of trees under utility wires or obstructing the right-of-way as allowed by a permit issued by the director. Removal or replacement is preferred to severe crown reduction;
5. carve, or attach any sign, poster, notice, or other object, on any tree, or fasten any rope, wire, cable, nails, screws, staples or other device to any tree except as used to support a young or broken tree; however, nothing in this section shall be construed in such a manner that it forbids lighting of a decorative or seasonal nature, provided that such lighting is not attached in such a way as to cause permanent damage to the tree;
6. Plant trees reaching an expected mature height of twenty-five feet or more under utility lines.

C. No person may prevent, delay, or interfere with the director, or his or her designee, or any City employee in the execution or enforcement of the provisions of this article.

D. Any person responsible for a violation of this section must pay the cost of repairing or replacing any tree or shrub damaged by the violation. The value of trees and shrubs is to be determined in accordance with the latest revision of the Guide for Plant Appraisals as published by the International Society of Arboriculture (ISA).

E. In addition to remedies under section 24.70 PENALTY, violation of this section is a Class 1 civil infraction. The director has the discretion to issue a warning for a first-time violation.

24.70 PENALTY. Violation of or failure to comply with any of the provisions of this chapter shall be subject to a fine not to exceed five hundred dollars **in addition to the appraised value or cost to repair or cure or method of valuation as determined in the current edition of the Guide for Plant Appraisals.** When violations are of a continuing nature, each day the violation continues shall be a separate violation.

APPENDIX B – Tree Ordinance Writing Resources

Guidelines for Developing and Evaluating Tree Ordinances: Bernhardt, E.A. and Swiecki, T.J.;California Dept. of Forestry and Fire Protection;(http://www.isa-arbor.com/tree-ord/ordintro.htm).
Tree City USA Bulletin #9: How to Write a Municipal Tree Ordinance: National Arbor Day Foundation; (http://www.arborday.org/programs/treecitybulletinsbrowse.cfm).
Tree City USA Bulletin # 31: Tree Protection Ordinances: National Arbor Day Foundation; (http://www.arborday.org/programs/treecitybulletinsbrowse.cfm).
U.S. Landscape Ordinances: An Annotated Reference Handbook; by Buck Abbey, D. Gail Abbey; This comprehensive reference brings together and explains the planning ordinances which govern the landscapes of 300 U.S. cities.
Tree Ordinance Development Guidebook; Georgia Forestry Commission; (http://www.gfc.state.ga.us/CommunityForests/documents/2005TreeOrdinance-100.pdf).
Landscape Ordinances Research Project; A resource home page for urban design, city planning, urban forestry, site design, landscape architecture, architecture, site engineering, land use law and land development--highlighting legal standards and technical requirements for site development plan; (http://www.greenlaws.lsu.edu/sitemanager.htm).
Guide to Developing a Community Tree Preservation Ordinance; Presented by the Community Tree Preservation Task Force of the Minnesota Shade Tree Advisory Committee, this guide describes the planning process, typical ordinance elements, and resources available for the task; (http://www.mnstac.org/RFC/preservationordguide.htm).
Guide to Writing a City Tree Ordinance – Model Tree Ordinances for Louisiana Communities; (http://www.greenlaws.lsu.edu/modeltree.htm).
Research Article – Kathleen Wolf; (http://www.cfr.washington.edu/research.envmind/Roadside/Trees_Parking.pdf).
Developing a Successful Urban Tree Ordinance; Charles C. Weber, Alabama Forestry Commission.
Guidelines for Developing Urban Forest Practice Ordinances; Bell, P.C., Piamondon, S., and Rupp, M.; Oregon Department of Forestry, Forest Practices Program; Urban and Community Forestry Program. This guide is designed to assist cities and counties in the development of urban forest practice regulations; (http://www.oregon.gov/ODF/URBAN_FORESTS/docs/Other_Publications/UrbanFP.pdf).

Urban and Community Forestry: A Guide for the Northeast and Midwest United States; Ascerno, M. et al., U.S. Forest Service, Northeastern Area State and Private Forestry; This manual updates a 1990 edition which focused on the interior western region of the U.S. and includes chapters on history, benefits (aesthetic, social, recreational, wildlife, economic, and physical), programs, inventories, planning, ordinances and policy, site evaluation, tree selection and planting, soils, and maintenance; 210 pp; Undated; probable publication date, 1992.
Municipal Tree Manual; Hoefer, P.J., Himelick, E.B., and DeVoto, D.F., Urbana, IL, International Society of Arboriculture. 42 pp; Prepared in cooperation with the Municipal Arborists and Urban Foresters Society; The purpose of this manual is to be a guide for preparing new, or revising old, municipal tree ordinances.
Practice Tree Preservation; Zoning Practice, July 2006, From APA, Issue #7.
Tree Conservation Ordinances; APA Report #446 with Scenic America, Copyrighted 1993, Christopher J. Duerksen, Suzanne Richman; (http:www.amazon.com/Tree-Conservation-Ordinances-Duerksen/dp/9994880802).
Community Trees: Tree Ordinances for Iowa Communities; Wray, P., Iowa State University, Cooperative Extension Service (http://www.extension.iastate.edu/Publications/PM1429b.pdf).
General Code Publishers (on-line ordinance clearinghouse); (www.generalcode.com/webcode2.html).
LexisNexis Municipal Codes (on-line ordinance clearinghouse); (http://municipalcodes.lexisnexis.com).
American Legal Publishing Corporation (on-line ordinance clearinghouse); (http://www.amlegal.com/library).
Municipal Code Corporation (on-line ordinance clearinghouse); (www.municode.com);(http://www.municode.com/resources/code_list.asp?stateID=49).
TreeOrd software; Unique software for cities is available to help them develop ordinances that will ensure the future of their community forests. TreeOrd, an interactive CD-ROM, was developed by the Tree Trust with a grant from the USDA Forest Service. The cost is $60 plus shipping and handling; (http://www.mnstac.org/RFC/tree_order_form.PDF).

APPENDIX C – Potential Landscape Plant List

The plant list below is composed of many species not in the tree population of Anchorage. These trees may be hardy to the Anchorage, and are not natives but will adapt to the area. Diversification and willingness to try new species are the keys to a successful planting program. Another source of cold hardy plant material is available at http://www.ndsu.nodak.edu/forestservice/comm_forestry/doc/08-09/TreesforND1-08.pdf

Small Trees – Less than 25' mature height for narrow parking strips and under utility lines

Hedge Maple
Acer campestre

Height: 25-35'
Spread: 20-30'
Hardiness: -25
Tree with a dense, round canopy. Leaves are deep green with a yellowish fall color. Extremely adaptable, tolerant of dry soils and compaction. Excellent street tree in residential areas and for use under power lines. Noted for its corky, ridged and furrowed bark.

Amur Maple (treeform)
Acer ginnala

Height: 20'
Spread: 20'
Hardiness: -50
A small, hardy tree with rounded outline, glossy green leaves changing to shades or yellow and red in fall. Fragrant, but not showy flower. Very adaptable to a wide range of soils and tolerant of some shade.

Miyabe Maple
Acer miyabei

Height: 25-30'
Spread: 20-30'
Hardiness: -30
An upright oval to rounded tree. The leaves are 3 to 5 lobed, dark green with a pale yellow fall color. Tolerates some dryness and prefers full sun. No serious pests and a good choice for a small shading tree.

Pacific Sunset Shantung Maple
Acer truncatum x A. platanoides 'Warrenred'

Height: 25'
Spread: 25'
Hardiness: -30
An upright, spreading, rounded crown tree with a regular branching pattern having dark green, glossy leaves and an outstanding yellow-orange to bright red fall color. A hardy tree that has great potential for urban areas.Red

Autumn Brilliance Serviceberry
Amelanchier x grandiflora 'Autumn Brilliance' (treeform)

Height: 20'
Spread: 15'
Hardiness: -30
Tree form of serviceberry with an upright spreading crown, white flowers and a reliable, bright red fall color. The fruit is edible. Tolerates some drought.

Cumulus Allegheny Serviceberry
Amelanchier laevis 'Cumulus' (treeform)

Height: 25'
Spread: 20'
Hardiness: -30
A serviceberry with a distinct upright and oval tree habit, fleecy white flowers in spring and a yellowish to orange-scarlet fall color. Smooth gray bark.

American Hornbeam
Carpinus caroliniana

Height: 25'
Spread: 25'
Hardiness: -40
A small tree with an irregular spreading habit, with a rounded outline. Dark green leaves change to yellow, orange and scarlet in the fall. Smooth, gray, irregular twisting bark adds interest in winter. Will grow in heavy shade and wet soils.

Lavalle Hawthorn
Crataegus x lavallei

Height: 25'
Spread: 20'
Hardiness: -40
A small, dense oval canopy tree with shiny dark green foliage turning to bronzy copper-red in the fall. Usually thornless or with small one inch thorns. Quite free of rust and very adaptable.

European Euonymus
Euonymus europaeus

Height: 15-30'
Spread: 10-20'
Hardiness: -30
A narrowly upright tree in youth broadening as it ages with a rounded outline when mature. Early leaf out with a flat dark green color turning from yellow to reddish purple in fall. Fruits ripen pink to red in September and are quite attractive.

Amur Maackia
Maackia amurensis

Height: 25'
Spread: 25'
Hardiness: -25
A small round headed tree. Leaves emerge a silvery gray and gradually become dark green. Fragrant pale white flowers light the tree in July and August. Bark peels with maturity exposing a shiny amber to brown color, becoming curly in texture. Prefers moist, well drained soil, but is quite adaptable to environmental conditions.

Merril Loebner Magnolia
Magnolia x loebneri 'Merrill'

Height: 30'
Spread: 30'
Hardiness: -30
An upright habit becoming round with age. Leaves are thick and rigid, dark green and turn yellow in fall. Flowering peaks in April, where the tree resembles a white cloud covered with fragrant snowy blossoms. A vigorous grower and cherished landscape tree.

Yulan magnolia
Magnolia denudata

Height: 35'
Spread: 30'
Hardiness: -30
Tree with spreading branches somewhat irregular, producing an informal outline. Leaves are thick and resilient turning yellow in fall. Flowers are fragrant, white and 4-6 inches wide, blooming in spring. New nursery stock.

Galaxy Magnolia
Magnolia x 'Galaxy'

Height: 20 - 25'
Spread: 15'
Hardiness: -20
A tree form magnolia with a strong central leader and pyramidal to oval shape. The foliage is lustrous green and flowers are large, 8 to 10 inches wide, blooming in spring on bare stems, pink outside and white inside. Good selection for a landscape or street where space is limited or confined.

Royal Star Magnolia
Magnollia stellata 'Royal Star'

Height: 20'
Spread: 15'
Hardiness: -30
A hardy, compact, rounded tree with deep green foliage and yellow fall color. The large fragrant flowers bloom in early spring, before the leaves break. An excellent ornamental tree for small sites in urban landscapes.

Flowering Crabapples
Malus sp. (Red Flowers)
Hardiness: -20 (-30)

'Adams'
Height: 20'
Spread: 20'
Dense and rounded symmetrical habit. Pink flowers, red persistent fruit.

'Amazam' American Masterpiece
Height: 25'
Spread: 18 - 20'
Pyramidal habit. Bright red leaves emerge and mature to dark maroon. Brilliant red flowers change to unique pumpkin orange fruits in fall that persist through winter.

'Bechtel' Klehm's Improved Crab
Height: 15 - 20'
Spread: 15 - 20'
Rounded form, dense dark green foliage, turning orange to orange red in fall. Large double pink flowers cover the tree in spring. Improved strain for disease resistance. Seldom fruits, very tidy tree.

'Centzam' Centurion Crabapple
Height: 20'
Spread: 15'
Narrow upright habit, spreading slightly with maturity. Purple emerging leaves changing to bronze-green. Rose-red flowers ripen to bright red fruits persisting through the winter.

'Prairifire' Prairifire Crabapple
Height: 20'
Spread: 20'
Upright spreading habit becoming rounded. Reddish stems with foliage changing from purple to red hued green. Excellent color change from crimson buds to dark pink flowers to deep red fruits which persist through winter.

Flowering Crabapples
Malus sp. (White Flowers)
Hardiness: -20 (-30)

'Adirondack'
Height: 18'
Spread: 10'
Densely upright inverted cone shape. The cut of this cultivar combined with an overabundant white flowers in spring makes this a "standard" to which other flowering crabs are compared. Bright red fruits carry interest through winter.

'Hargozam' Harvest Gold Crab
Height: 25'
Spread: 15'
Upright, moderately columnar habit. White flowers in spring are but a precursor to the golden fruits which adorn this tree through winter making it a show stopper in the landscape.

Professor Sprenger'
Height: 20'
Spread: 20'
Stark upright habit makes for a larger more stately looking tree than other crabs. Red buds bloom white with pink tones ripening to orange-red fruits and endure on the noble frame through winter.

'Sentinel'
Height: 20'
Spread: 12'
Vase shaped, an unusual form for a crab makes its mark as an excellent street tree under power lines. Flowers are white with a touch of pink , fragrant,

with bright red fruits that carry through the winter.

like drops of rain from this elegant tree.

Persian Parrotia
Parrotia persica

Height: 20 - 30'
Spread: 15 - 25'
Hardiness: -20
Small single stemmed tree with upright to wide spreading branches, oval outline. Pink to purple emerging leaves blend to glossy green and turn a beautiful succession of yellow to orange to red in fall. An excellent selection for streets and landscapes, given size, color display and remarkable resistance to pests and disease.

Sargent Cherry
Prunus sargentii

Height: 30'
Spread: 30'
Hardiness: -30
Upright spreading branches forming a rounded crown. Pink flowers clusters usher in spring, followed by large dark green leaves which, in fall, change to a striking mix of bronze and orange-red. The bark is a beautiful mahogany color and holds year round interest. One of the hardier ornamental cherries.

Columnar Sargent Cherry
Prunus sargentii 'Columnaris'

Height: 35'
Spread: 15'
Hardiness: -30
Upright, columnar to narrowly vase shaped at maturity. Flowers, foliage and bark with the same attractive qualities as the species. The narrow habit lends itself for street tree use.

Prairie Gem Pear
Pyrus ussuriensis 'Mordak'

Height: 25'
Spread: 20'
Hardiness: -30
Densely branched and compact tree with a round canopy. Leaves are bright green, thick and leathery turning golden yellow in fall. White flowers blanket the tree in early spring. Excellent pear for urban Plantings.

Ivory Silk Lilac
Syringa reticulata 'Ivory Silk'

Height: 25'
Spread: 15'
Hardiness: -20
Tree form lilac, oval and compact with upward curving branches. Foliage is dark green, flowering when young. Displays large white flower clusters in early July.

Medium Trees – 25 to 50' mature height

Fairview Maple
Acer Plantanoides
'Fairview'

Height: 45'
Spread: 35'
Hardiness: -30
Upright oval form, slightly tapered. An improved 'Schwedler' (red-leaf) type, more narrow and upright. Leaves emerging garnet purple and mature to bronze-green. Care should be taken not to encourage diseases and pests by overuse of Maple cultivars.

Parkway Maple
Acer Plantanoides
'Columnarbroad'

Height: 40'
Spread: 25'
Hardiness: -40
Narrow oval form with a good central leader. Leaves are dark green and turn yellow in fall. Very hardy Norway cultivar and an excellent maple for city u se due to it's narrow shape and well behaved branching. A healthy tree performs well along wide streets and corridors of green. Be cautious about overuse.

Emerald Queen Maple
Acer Plantanoides
'Emerald Queen'

Height: 50'
Spread: 40'
Hardiness: -30
Forms a well shaped, dense, oval habit with upright spreading branches. A excellent green-leafed cultivar for Urban Planting. Can tolerate environmental extremes and has consistent yellow fall color.

Superform Maple
Acer Plantanoides
'Superform'

Height: 45'
Spread: 40'
Hardiness: -30
Broadly oval to rounded form. As the name suggests this tree was selected for its symmetrical and uniform growth. Leaves are green with yellow fall color. The trunk is straight and develops an excellent branch structure, very formal and solid looking maple.

Sycamore Maple
Acer pseudoplatanus

Height: 40'
Spread: 30'
Hardiness: -30
Upright spreading branches and a slightly irregular rounded crown. Leaves are dark green with no discoloration on the lower surface. Adaptable to a variety of environmental conditions, poor soils and exposed sites. Makes an excellent, informal street tree.

Armstrong Maple
Acer rubrum
'Armstrong'

Height: 45 - 55'
Spread: 15'
Hardiness: -30
Rapidly growing columnar tree. Leaves light green turning orange in fall. The bark becomes a beautiful silver-gray as the tree matures. Widely utilized in urban Plantings where space is limited for spreading types.

Bowhall Maple
Acer rubrum 'Bowhall'

Height: 40'
Spread: 15'
Hardiness: -30
Tightly formed columnar cultivar. An excellent selection for street Plantings. Nice contrast to broader species with medium green foliage. Smaller and slower to mature than 'Armstrong' with better fall color.

Northwood Maple
Acer rubrum

Height: 40'
Spread: 35'
Hardiness: -40
Broadly oval to rounded shape. Foliage is medium green. The tree can tolerate harsher winters than most, but fall color is not as reliable as other Red Maples. The trunk is rectilinear with strong branch connections. Selected from the University of Minnesota.

Red Sunset Maple
Acer rubrum
'Franksred'

Height: 45'
Spread: 35'
Hardiness: -30
Hailed as one of the best Red Maple cultivars. Trees have vigorous and symmetrical growth, developing into pyramidal to oval forms Good branch angles display dark green leaves transforming to brilliant shades of red and orange in Fall.

Black Alder
Alnus glutinosa

Height: 40 - 50'
Spread: 30 - 35'
Hardiness: -30
Fast growing tree with a broadly pyramidal habit, somewhat irregular. Dark green leaves change to yellow in the fall. These trees thrive near water and perform well in poor soils. Good tree for an alternative to willows and other poplars. The 'Pyramidalis' cultivar has an excellent narrow form and recommended for confined space areas.

European Hornbeam
Carpinus betulus

Height: 25 - 40'
Spread: 25 - 35'
Hardiness: -20
Pyramidal shape, quite dense with dark green leaves. Fall color is usually yellow but

during cold winters can turn dark red. Heat and drought resistant.
'Fastigiata', a columnar cultivar, is taller, but only spreads 15', making it preferable for confined urban spaces.

European Beech
Fagus sylvatica

Height: 40 - 50'
Spread: 15 - 40'
Hardiness: -20
Stately tree, narrowly compact to densely pyramidal to broadly oval, branching close to the ground. Leaf color varies dramatically between cultivars. It is said that the right cultivar of this tree can enhance any landscape. Care should be used with Planting lower branching trees to avoid creating a traffic nuisance.

'Fastigiata'
Fastigate Beech
Trees deep green, tight form makes it one of the most striking columnar trees.

'Riversii' Rivers Purple Beech
Broadly oval habit, foliage has striking purple shades, spring through summer.

'Zlatia'
Golden Beech
Upright pyramidal habit, young leaves are yellow maturing to golden green.

White Ash
Fraxinus americana

Height: 45 - 55'
Spread: 30 - 40'
Hardiness: -25
A variety of forms usually oval. Bark is ash-gray to grayish-brown aging with diamond furrows with slender ridges. Leaves are pinnately compound with a range of green and a variety of fall colors. Most cultivars have been selected or breed with disease and pest resistant characteristics. The trees are widely used and make good selections for urban Plantings.

'Autumn Purple'
Rounded habit, purple fall color. Signature purple ash.

'Champaign County'
Dense oval habit, yellow fall color. Thick trunk and strong branches.

'Rosehill'
Upright oval habit, bronze red fall color.
Strong central leader.

Green Ash
Fraxinus pennsylvanica

Height: 45 - 50'
Spread: 25 - 35'
Hardiness: -30
A variety of forms usually oval. Bark is ash-gray to grayish-brown aging with diamond furrows with slender ridges. Leaves have a range of green and yellow fall color. Cultivars have been selected or breed with disease and pest resistant characteristics, the tendency towards irregular growth has been reduced as well. The trees are widely used and make good selections for urban Plantings. Care should be taken not to encourage diseases and pests by overuse of any tree species.

'Bergeson'
Strong, upright growth, oval. Tends to be smaller in size.

'Cimmaron'
Narrow oval habit, Glossy green foliage, brick red fall color

'Patmore'
Symmetrical branching, oval canopy. Yellow in fall.

'Summit'
Uniform branching, narrowly oval with a good leader. Yellow fall color.

Maidenhair Tree
Ginkgo Biloba

Height: 40 - 55'
Spread: 15 - 35'
Hardiness: -25
Young trees are irregularly shaped, but finish broadly symmetrical. Usually all marketed trees are male due to the offensive smell of the female trees in fruit. The leaves are uniquely lobed and bright green on both sides, changing to bright to golden yellow in fall. Having outlived most of its enemies Ginkgo is a fine specimen for urban Planting.

'Autumn Gold'
Very uniform and balanced pyramidal tree. Spreading at maturity.

'Magyar'
Narrow pyramidal form with a strong central leader. Well spaced branches.

'Princeton Sentry'
Narrow tapering growth almost columnar. Tallest of the three.

Honeylocust
Gleditsia

Height: 35 - 45'
Spread: 35 - 40'
Hardiness: -20
Usually a tree with a squat trunk and open spreading branches. Cultivars are thornless, or have very few thorns. Often overused in landscapes which can promote pest and disease problems.

'Halka'
Heavy caliper and full even crown with an oval form. Yellow in fall.

'Moraine'
Rapid growth with a vase shape and rounded outline. Golden fall color.

'Shademaster'
Irregular vase with rectangular outline. Good form for street use. Yellow in fall.

'Skyline'
Broadly pyramidal, good branch angles. Form lends itself to urban design.

American Hophornbeam
Ostrya viginiana

Height: 30 - 45'
Spread: 25'
Hardiness: -30
Rounded oval shape made up of slender branches, sometimes arching up or down. Leaves are bright green turning yellow to brown in fall often persisting adding winter interest along with the hop like fruits. Tolerates dry conditions and free of major disease and insect problems.

Amur Corktree
Phellodendron amurense

Height: 30 - 45'
Spread: 40 - 50'
Hardiness: -30
Broadly spreading tree, leaves deep to lustrous green with a brief display of yellow or bronze in fall. The bark of mature trees is unusual and quite striking. Remarkably free of pests, pH adaptable, tolerant to drought and pollution making it a great urban tree if given enough space to fill out.

'His Majesty'
Male, free of seed litter. Thick leathery leaves on stout branches.

Korean Mountainash
Sorbus alnifolia

Height: 40 - 50'
Spread: 20 - 30'
Hardiness: -30
Form changing from pyramidal to rounded outline at maturity. Leaves differing from other mountain ashes, look more beech like, as does the trunk. Striking tree with an excellent combination of form, foliage, flowers, fruit and bark. Considered the best of the Mountain Ashes.

American Linden
Tilia americana

Height: 35 - 50'
Spread: 20 - 35'
Hardiness: -40
Tall stately trees, cultivars generally smaller in size especially when used in urban areas. Leaves are generally 4 to 8 inches long and about as wide in a range of green shades. Bark is gray to brown with narrow lateral furrows. The wood is soft and easily prunes, but is elastic enough to handle most weather extremes. These trees will entirely block the sun in their shadow so place them appropriately.

'Boulevard'
Dense, narrow pyramidal habit with ascending branches. Yellow in fall.

'Legend'
Rounded pyramidal habit, yellow fall color.

'Lincoln'
Slender, upright and compact form with light green leaves, 25' by 15' in 25 years.

'Redmond'
Full pyramidal form, uniform with large leaves and red branches, winter interest.

Littleleaf Linden
Tilia cordata

Height: 40 - 45'
Spread: 45'
Hardiness: -30
Trees are pyramidal, rounding with maturity. Leaves are generally smaller, 2 to 3 inches long and wide, (except Glenleven) finely serrated and turn yellow in fall. Trunks are usually straight and bark smooth. Likes well drained alkali soils, but pH adaptable and tolerates pollution well. Makes an excellent selection for any urban Planting.

'Chancellor'
Fastigiate in youth, becoming pyramidal with age. Good branch development.

'Corzam' Corinthian Linden
Narrowly pyramidal, 15' spread. Yellow in fall. Excellent tree for limited space.

'Glenleven' Glenleven Linden
Fast growing with a straight trunk, leaves twice the size of 'Greenspire'

'Greenspire'
Single straight leader, good branch angle. Tolerates difficult conditions.

'Olympic'
Very symmetrical pyramid form, better branching than some other cultivars.

Kentucky Coffeetree
Gymnocladus dioicus

Height: 50 - 65'
Spread: 40 - 50'
Hardiness: -30
Sharply ascending branches, rising to form a narrow oval crown. The bark is unique, developing on young stems. Spring leaves are late to emerge, their pinks and purples are a nice contrast to greening trees. Seldom bothered by pests or disease, pollution tolerant and strong, upright growth make this an excellent street tree.

'Stately Manor'
Male selection, no seed pods.

Butternut
Juglans cinerea

Height: 40 - 60'
Spread: 30 - 50'
Hardiness: -30
Round topped tree with wide spreading crown of large horizontal branches and stout laterals. Leaves are dark green and woolly, white ridges and gray furrows make up the mature bark. Fruit debris may be a nuisance. Performs well in the rocky, dry and limestone based soils, a prevalent soil type in Spokane. Usable as Boulevard and Park tree.

LARGE TREES – 50' OR LARGER AT MATURE HEIGHT

Catalpa
Catalpa speciosa

Height: 60 – 90'
Spread: 60 – 75'
Hardiness: -30
Narrow, oval-upright, open and irregular habit with light to medium green foliage. Coarse texture in all seasons. Showy, white flowers in June. Drought tolerant tree.

Hackberry
Celtis occidentalis

Height: 50 - 75' (100')
Spread: 40 - 50'
Hardiness: -50
Cold tolerant tree will uncommonly obtain heights of 100 feet, but in urban settings usually does not exceed 60'. Rounded or vase shaped crown with graceful splaying of the branches. No spectacular foliage or flower display, more the trees unique character and ability to tolerate adverse conditions that make it an excellent choice for a Park or Boulevard.

White Oak
Quercus alba

Height: 60 - 80'
Spread: 50 - 70'
Hardiness: -30
Juvenile shape is pyramidal maturing with a broad and majestic crown. Leaves are bluntly lobed, dark green to blue-green. Autumn color varies from brown to red. A challenge to transPlant and establish, but worth the effort.

Bur Oak
Quercus macrocarpa

Height: 55 - 80'
Spread: 50 - 70'
Hardiness: -40
Weakly pyramidal or oval to start, developing into a large broad-rounded tree with a massive trunk. Foliage is partially lobed, dark green above and grayish below, turning yellow-brown to purplish in fall. Corky bark on smaller branches adds interest. Adapts to a wide range of soil types, drought and pollution tolerant, makes an excellent tree for urban areas where acorn debris can be managed.

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