City & Borough of Sitka, Alaska

Urban Forest Management Plan

2013

Community Forestry Consultants
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Community Forestry Program

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A five-year strategy for managing and preserving public trees by using proper arboriculture practices and engaging partners to ensure the long term safety, health, viability, and aesthetic quality of public trees.

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EXECUTIVE SUMMARY

The City & Borough of Sitka (CBS) has, for the first time, completed an assessment of its urban forest. The assessment and this document were initiated by a grant from the Alaska Department of Natural Resource Division of Forestry Community Forestry Program in 2012 with funding from the USDA Forest Service and the Sitka Parks and Recreation Division. It will facilitate the ongoing commitment to maintain, enhance, and preserve Sitka's tree canopy and guide CBS staff, landowners, utility companies, developers, planners, and residents in making decisions about community trees.

Purpose of the Urban Forest Management Plan

An urban forest includes street and park trees and those planted in medians, parking lots, along sidewalks, and in other urban spaces. An urban forest management plan recognizes the impacts of tough urban conditions on natural landscapes and public trees and balances those impacts with the needs of humans who share this ecosystem. An ecosystem approach to urban forest management can help Sitka maintain its character and provide environmental, social, and economic benefits.

Managing, maintaining, and preserving urban trees can only be achieved effectively by implementing a plan that standardizes policies and practices for tree-related activities. This plan encompasses a long-term vision with short-term goals intended to be implemented over a five-year period.

Sitka's Urban Forest Management Plan (UFMP) is a guide for ensuring that public trees are appropriately cared for according to community goals. It is a five-year strategy to expand the urban forestry program to meet a range of policy, education, and management goals. The plan recommends prioritized actions based on inventory data, current urban forestry and arboriculture practices, and community input. It evaluates staffing needs and addresses program sustainability, funding, and community support.

The plan includes an evaluation of urban forest resources and their capacity to benefit the community. The interconnection between fisheries, air and water quality, erosion and sediment control, local climate, habitat functions, and culture can be followed from rural forests into the heart of the urban forest.

The capacity of the urban forest to provide benefits depends on how the resources managed. The UFMP will lead to better urban tree stewardship in a coordinated and cooperative approach with city and borough departments, program partners, and private landowners.

The plan was prepared through a comprehensive review of city regulations, standards and other adopted plans, discussions with key staff members, an assessment of financial resources, and an analysis of tree inventory data. As a strategic document, it should be incorporated by reference into policies and requirements of the Municipal Code, Comprehensive Plan, Parks and Recreation Plan, Visitor Industry Plan, and agreements with other government agencies. The UFMP suggests modifications and expansions to city codes to improve long-term tree stewardship. Any proposed code revisions will be reviewed and considered through future public processes.

Urban Forestry Vision

Sitka's residents value a thriving, sustainable community forest that will be effectively managed to improve the quality of life and sense of community and maximize environmental, economic, social, and aesthetic benefits.

Urban Forest Management Plan

The management plan supports the mission of improving Sitka through proper management of a valuable public asset – trees. The plan will guide the CBS as it partners with community members, organizations, and volunteers to:

- Encourage tree planting and stewardship;
- Preserve and protect existing trees;
- Promote public safety and tree health;
- Implement cost-effective and proper arboriculture maintenance of the urban forest;
- Increase public education and awareness of the value of urban trees; and
- Maximize the social, economic, and environmental benefits of the urban forest for current and future generations.

The UFMP promotes public trees as major and important urban infrastructure and outlines best practices to incorporate trees into the city fabric. It guides the development of a progressive long-range program that will result in a healthier and safer urban forest.

It is understood that woody shrubs and ground covers are part of, and integral to, the overall health of the urban forest, but the primary focus of this plan is on trees – the largest, longest-lived and most significant member of the landscape community.

Recommended Actions

Achieving the following will result in a healthy, safe, and productive urban forest in Sitka. Each is discussed in detail in the plan.

- Adopt and implement the Urban Forest Management Plan;
- Adopt a tree ordinance to incorporate the recommendations and goals of the UFMP and implement ordinance enforcement practices;
- Coordinate and integrate urban forestry goals into other public planning processes;
- Increase urban forestry funding;
- Continue to educate staff about current arboriculture work practices;
- Maintain the inventory of public trees;
- Create a tree planting plan and incorporate it into community planning;
- Promote proper planting of new trees and diversification of species;
- Implement a cyclic pruning program for young and mature trees;
- Eliminate trunk damage caused by lawnmowers and weed eaters;
- Increase public awareness of the importance of trees and of proper tree care; and
- Encourage greater public participation in tree planting and care.

Projected Annual Budget

The projected budget represents funding and supplies for planting, pruning, and removals by CBS staff and/or contractors, while meeting or exceeding current industry standards and best management practices. It is based on historical costs incurred by CBS for these activities. The budget considers the current needs of the program and provides a level of service that ensures that the urban tree canopy thrives**.** Although this commitment comes with costs, the long-term benefits are significantly greater and will result in a sustainable asset for Sitka far into the future.

Budget

Pruning: Average of 90 trees annually @ $20/tree	$1,800
Removal: Average of 5 trees annually @ $500/tree	$2,500
Planting: Average cost to plant five 2”-3” caliper trees $450/tree	$2,250
Supplies: Fertilizer, amendments, arborist tools, etc.	$3,900
TOTAL	**$10,450**

In addition, the Sitka Electric Department allocates approximately $14,000 annually for tree pruning and removal under power lines.

Figure 1. *Parks & Recreation staff saved valuable city assets by moving these Dolgo crabapples to Sealing Cover from the Centennial Hall parking lot during reconstruction in May 2013 .*

Tree Benefits

Figure 2. *Sitka's green infrastructure – its trees, open spaces, and views – contribute to its beauty and attractiveness to visitors and residents.*

Few features in urban areas can be said to boost property values, sustain fisheries, support retail activity, enhance tourism and visitor experiences, improve municipal health, protect water quality, reduce storm water runoff, counter climate change, and ensure roadway safety. Communities looking for these benefits may be surprised to find a solution right in their own backyards, along streets, and in parks – trees. Landscapes with trees, parks and open space, provide a wealth of benefits for CBS.

The urban forest has been recognized for its visual and environmental benefits for decades but has only recently been seen as a vital component of a community's infrastructure and given the specific label of "green infrastructure" or "natural capital." Nationwide, easy access to parks and open space has become a new measure of community wealth – an important way to attract businesses and residents by guaranteeing both quality of life and economic health. Due to the changing nature of business needs and the move toward tourism based economies, businesses locate or re-locate based on a community's quality of life.

Sitka is a center for trade and services and it is important that it remain competitive and attractive to residents, businesses, customers, and visitors. Increased recreational and community activity attracts new businesses, fosters expressions of creativity, and stimulates tourism. Networks of natural areas and trails give a city a reputation for being a good place to live and visit. These natural assets definitely contribute to the high quality of life in Sitka and throughout Alaska.

A number of scientific studies have quantified the environmental, ecological, economic, and social benefits trees provide in urban environments. A summary of key values and benefits and supporting sources is provided below.

Water Quality. Trees attenuate peak flows, maintain base flows, and control erosion.(Bernatzky 1983; Xiao et al 1998; Floyd 2002; American Forests 2007). According to one study, 37,500 tons of sediment per square mile per year comes off of developing and developed landscapes; urban trees could reduce this amount by 95% (Coder 1996). The U.S. Environmental Protection Agency report, *Using Smart Growth Techniques as Storm Water Best Management Practices*, identifies urban tree canopy as a means to reduce storm water runoff and the costs associated with its management. Maintaining vegetation and buffer strips between residential and commercial developments and anadromous streams protects water quality and reduces polluted runoff in valuable watersheds.

Annual service value of individual urban trees

Small trees: $1-8 Medium trees: $19-25 Large trees: $48-53

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

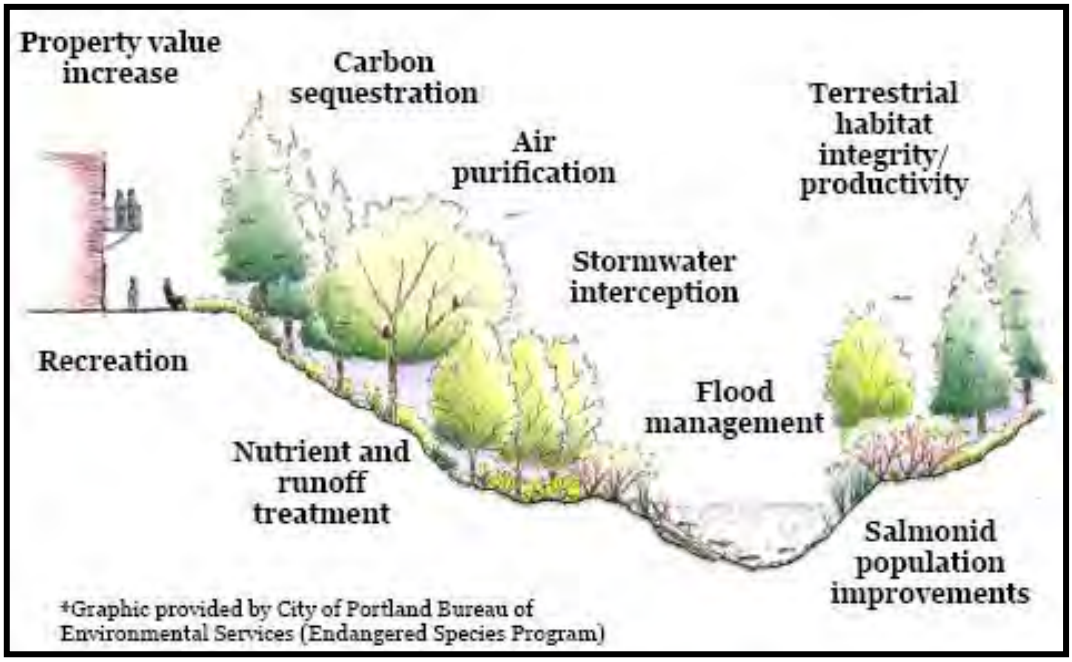

Figure 3. *Benefits and services provided by the urban forest.*

Air Quality. According to the Alaska Department of Environmental Conservation Division of Air Quality, particulate matter poses a dangerous threat to human health and the environment. Regional haze can impair visibility over a large area and air toxins such as carbon monoxide contribute to respiratory problems. Trees absorb the gaseous pollutants ozone, nitrogen oxide, and sulfur dioxide; and they filter particulate matter such as dust, ash, pollen, and smoke. Reducing these pollutants improves public health and reduces the severity of ozone-induced asthmatic responses and other respiratory illnesses.

Urban trees absorb carbon dioxide, a major greenhouse gas, at an approximate rate of 230 lbs. per year per tree. According to the U.S. Department of Agriculture, "one acre of forest absorbs six tons of carbon dioxide and puts out four tons of oxygen. This is enough to meet the annual needs of 18 people."

Landslide Prevention. Tree canopy and continuous vegetation can stabilize slopes and prevent and minimize the damage caused by landslides or avalanches. Tree root systems enhance the shearing strength of the soil, enabling it to resist landslides and erosion (O'loughlin 1974).

Salmon Forest. The economy of CBS is driven by salmon, and salmon benefit from the urban forest in the watershed and along the oceanfront. Salmon require the nutrients, clean water, and stability of a healthy forest to survive as young fish. A healthy forest supports a healthy ecosystem, which in turn supports a healthy economy for Alaskans.

Health & Well-Being. Trees improve the mental and physical states of residents and visitors. Trees foster safer, more sociable neighborhoods and have been shown to reduce levels of crime, including domestic violence. Views of nature reduce the stress response of both body and mind. Hospital patients with window views of trees recover significantly faster and with fewer complications than comparable patients without access to such views.

Public spaces with trees receive more visitors, increasing the frequency of casual social interactions and strengthening the sense of community. Trees along transportation corridors narrow a driver's field of vision, reducing traffic speeds and increasing pedestrian safety by providing a natural, physical barrier. Studies have found that urban roads lined with trees decrease driver stress, resulting in fewer incidents of road rage.

While managing public trees has real costs for CBS, the protection and expansion of the urban forest will yield increased environmental, economic and social benefits. This plan specifies a number of actions the CBS can take to maximize these benefits and engender community involvement and activism.

Urban Forestry Mission

The City & Borough of Sitka is dedicated to managing, maintaining, and preserving public trees by informing the community, protecting and expanding the public tree resource, using proper arboriculture practices, and engaging partners to ensure the long term safety, health, viability, and aesthetic quality of public trees.

City & Borough of Sitka's Urban Forestry Program

The trees, landscapes, and open spaces now enjoyed were preserved or planted by individuals, CBS staff, garden clubs, Tree and Landscape Committee members, and youth groups who worked to enhance the livability of Sitka. In the 1960s, the city redeveloped the waterfront and created the green corridor that residents and visitors enjoy today. In 2013, this area is once again being upgraded with the addition of a sea walk and reconstruction at Centennial Hall grounds and Crescent Harbor parking lot.

Sitka is one of eight cities in Alaska that have the TREE CITY USA designation. Sitka has maintained its TREE CITY USA status since 2003 by demonstrating a commitment to managing urban tree resources.

Tree maintenance has always been the responsibility of the Parks and Recreation Division and is funded from the CBS general fund. There is no dedicated budget for urban forestry and limited arboriculture equipment. The CBS does not have a position designated specifically as city arborist, however, the Parks and Recreation Supervisor who oversees tree maintenance is an International Society of Arboriculture (ISA) Certified Arborist and Pacific Northwest Chapter ISA Certified Tree Risk Assessor.

The scope and complexity of arboriculture responsibilities currently exceeds the capacity of resources and staff. The Division is critically understaffed with only three positions to manage 54 developed sites and 109 acres of developed parks, grounds, and ball fields. Often urban forestry activities must take lower priority in context of all the maintenance demands. This reality illustrates a major limitation to CBS's overall ability to protect and expand urban tree resources.

URBAN FOREST MANAGEMENT PLANNING

In natural forests trees in all stages of growth and decay are important to 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, which are subjected to tough, unnatural conditions and impacts. Their health and vitality are compromised by limited soil volume, compacted soils, restricted root space, and damage caused by mowers, vehicle and pedestrian traffic, vandals, and pollutants. 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.

A long range plan is essential for managing a resource that is by its very nature a long-term investment. This plan provides a framework for management for a five-year period. Community Forestry Consultants, Inc. offered the following recommendations to improve the health, quality, size, and diversity of the working forest of CBS. Recommendations are based on the best management practices of the arboriculture and urban forestry industries.

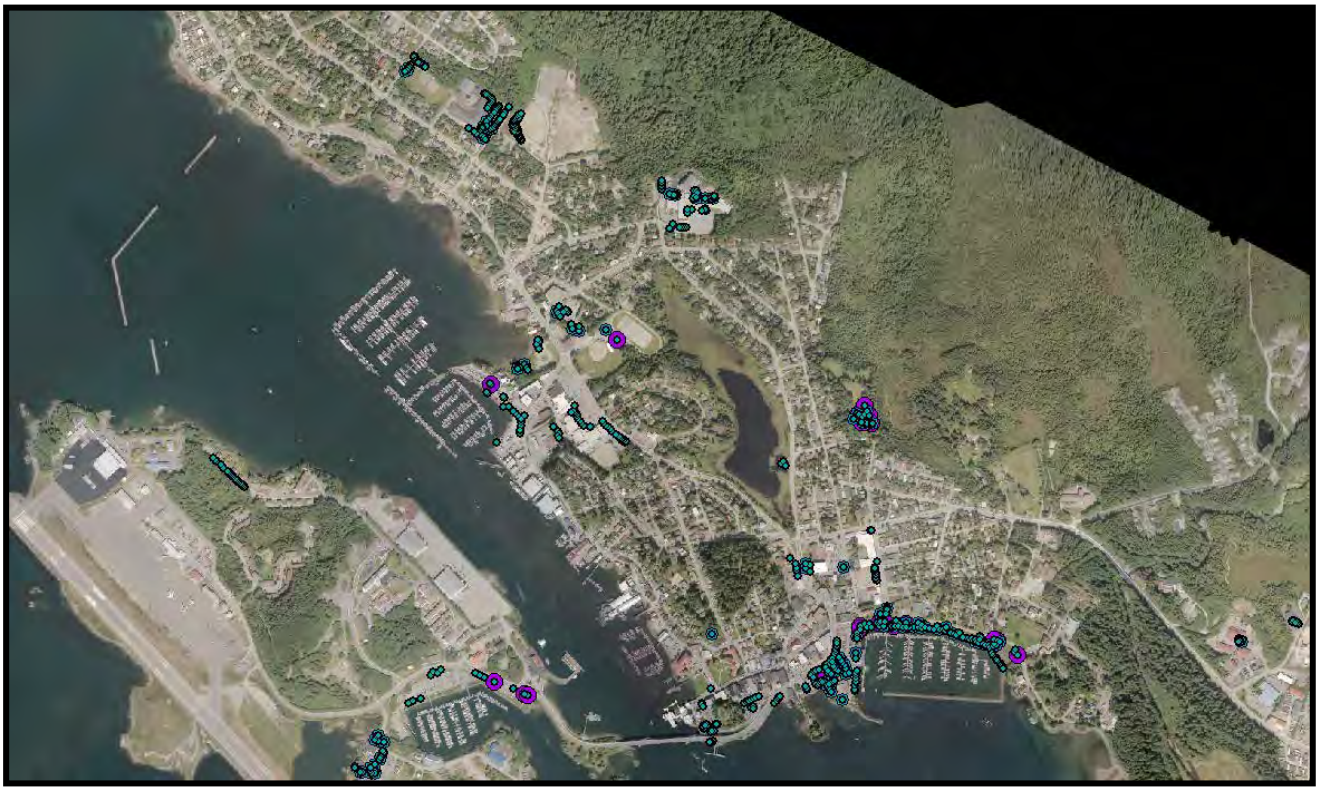

Figure 4. *Areas where trees were inventoried in 2012.The green dots represent over 600 trees in public areas.*

Tree Inventory

Whether managing a retail store or natural resources, an inventory is critical. Without an inventory of the resource and its condition, the kind of work needed to maintain and manage it for the future is unknown. An inventory is the foundation of an effective urban forestry program and allows managers to identify current and potential problems and plan for budgets, removals, planting, pruning, and other maintenance. An inventory is an objective and quantifiable record of the condition and value of Sitka's trees. Using and regularly updating the tree inventory moves the urban forestry program into proactive rather than reactionary management.

An inventory provides the number and location of public trees, including high-risk trees, and available planting sites. It helps identify insect or disease problems, pruning needs, and work priorities. It determines the value of public trees, which can emphasize the program's importance. An inventory can be used to monitor tree conditions and to provide quick and accurate answers to management questions, such as where and how many trees should be planted each year.

Figure 5. *Parks & Recreation Supervisor Shawn McLeod collects inventory data*.

Over the years, changes will be seen in the number, age, condition, and species of trees. The inventory will identify the most successful species and planting sites, as well those with problems. This information will enable staff and the Tree & Landscape Committee to better plan and prioritize tree work.

In cases of liability a well-maintained inventory can be used demonstrate that there was no negligence in the inspection or care of the trees. An inventory will also improve the chances of receiving grants and other assistance by providing documentation of the extent and worth of street and park trees.

Maintaining the tree inventory and using TreeWorks™ to prioritize maintenance establishes a systematic tree maintenance program which actually reduces costs because systematic maintenance leads to healthier trees that require less expensive maintenance over the long run. A computerized tree inventory aids in reducing the subjectivity of tree management decisions and stimulates proactive responses.

Inventory Objective:

- Current and up-to-date inventory of public trees maintained to provide accurate data needed to manage the urban forest.

Sitka Tree Inventory Summary

City staff, volunteers, Alaska DNR staff, and an Urban Forestry consultant inventoried trees at 21 sites in city parks, at harbor facilities, schools and other public facilities. Additional sites may be inventoried in the future and the inventory will be updated as trees are planted, removed, and maintained.

Data results:

Trees inventoried:	636
Appraised value of trees inventoried:	$1,016,820
Trees requiring pruning:	462
Trees requiring removal:	19
Number of different species:	40

Condition/Standard	Percent	Tree Count
Excellent /90%	0.2	1
Good /80%	30.5	194
Fair/70%	64.0	407
Poor/50%	4.7	30
Very Poor/30%	9.4	4
Dead/0%	0.0	0
Total		**636**

Appraised Value

Urban trees are valued differently than the timber value of their forestry counterparts or trees in undeveloped areas. Appraised value of urban trees is based on the species, trunk diameter, condition, and location of the tree. Public trees represent a considerable economic, social, recreational, and environmental asset to the community. The 636 trees inventoried in CBS have a total appraised value $1.017 million (Table 1).The graph shows the number of trees in a range of dollar values. The majority of trees inventoried are in the small diameter class size and species that are rated lower by industry standards. Consequently, most of CBS's trees fall into the $1 to $2000 range on the graph.

There may be an additional 500 street and park trees in CBS that could raise the value of this asset to $1.25 million. Trees in undeveloped areas will also raise the appraised value as these areas develop and the trees are viewed as urban landscape trees. Trees are the only public assets that increase in value as they age, however, the value increases only if they receive proper care.

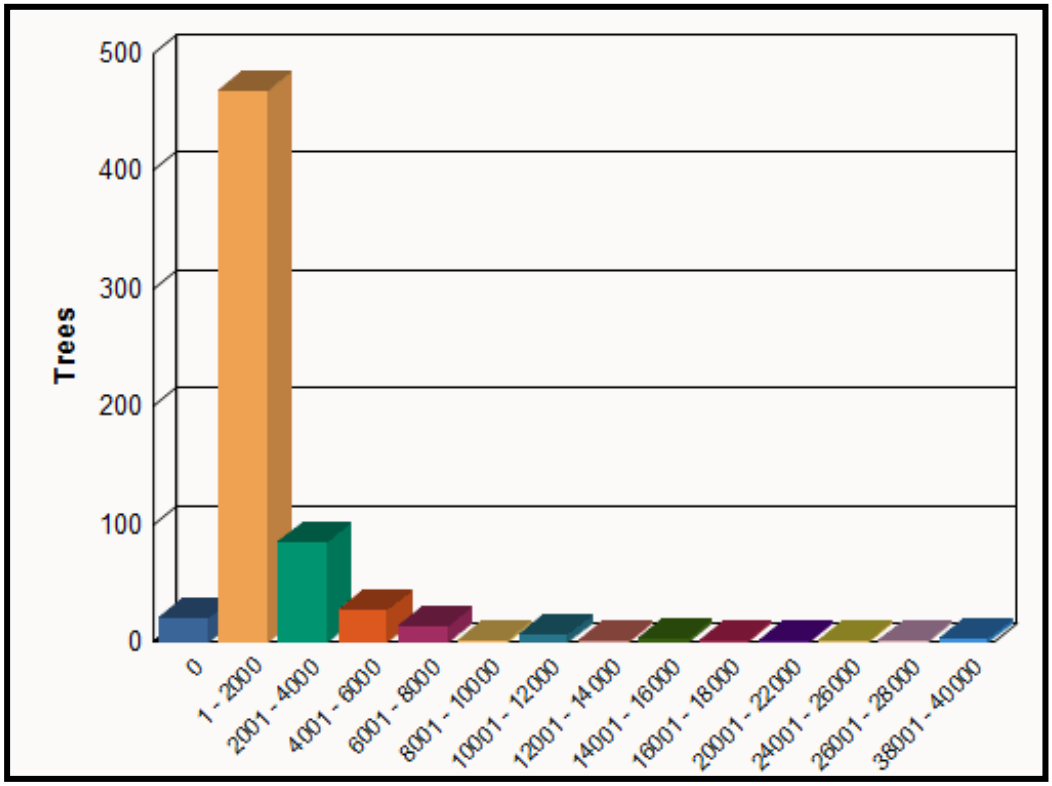

Table 1. *The appraised value of inventoried trees was determined from the Council of Tree & Landscape Appraisers Guide for Plant Appraisal, 9th Edition.*

Management Plan

The UFMP can demonstrate to staff, elected officials, and citizens how science informs tree management and promote civic pride. It will help raise citizen awareness of the benefits of a healthy, diverse, and well-managed urban forest. A strong management plan will serve as a tool for garnering public support, cooperation, and funds, and help the community sustain its trees for future generations.

Management Objectives:

- Long-term management of public trees that enhances ecosystem health and function. Management includes structural pruning of young trees, cyclical pruning of older trees, line-of-sight and height clearance pruning of street trees, removal and replanting, and tree risk identification.
- Coordination with the Planning and Public Works departments and the Alaska Department of Transportation addresses tree-related infrastructure conflicts between trees and grey infrastructure such as streets, sidewalks and utilities.
- The GIS-based inventory to manage the composition, character, and distribution of the urban forest is maintained.
- Industry-appropriate storm and risk tree response protocols are maintained.
- The UFMP is reviewed and updated as needed on a 5-year cycle.
- Opportunities to market and expand the use of wood waste by-products from removals are explored; products could include lumber, mulch, and compost.

Annual Operating Plan

An annual operating plan prioritizes day-to-day operations based on inventory data and the management plan. It should include more detailed information than the management plan, for example, the approximate numbers of trees to be planted, pruned, and removed. It also includes any special projects, education events, inspections, or other plant health care planned.

Initially, the annual plan will address priorities from the inventory but eventually will focus on proactive management objectives. An example of an annual work plan schedule is provided in Table 2 on the following page.

PROGRAM ACTIVITY	J	F	M	A	M	J	J	A	S	O	N	D
Planning												
Work priorities												
Organize activities												
Modification												
Tree Removals												
Review inventories												
Field inspections & survey trees												
Announce/hold public hearings												
Schedule tree crews - Conduct removals												
Stump grinding/ reseeding												
Permit inspections												
Tree Pruning												
Review inventories												
Field inspections & survey												
Schedule crew and prune												
Permit inspections												
Tree Planting												
Review inventories & potential planting sites												
Notify adjacent property owners												
Purchase trees												
Install trees												
Water trees												
Permit inspections												
Community Education & Outreach												
Education programs												
Report to CBS Assembly												
Arbor Day Recognition												
Staff Training												
Professional development												
Safety training												

Table 2. *Example of annual work plan schedule. A description of activities should also be included.*

Education, Outreach and Stewardship

An effective urban forestry program depends on a broad base of support from staff, elected officials, and members of the public who are interested in or impact public trees.

Education, Outreach, and Stewardship Objectives:

- Information about the benefits of appropriate plants, the negative effects of invasive species, and the practice of "Right Plant, Right Place" is readily available.
- Events such as Arbor Day and Earth Day celebrations promote the benefits of trees and recognize advocates and volunteers.
- Partnerships with organizations whose goals support those of CBS are fostered.
- Promotional and technical information is available in multiple media including the CBS website.
- Coordination with schools and other organizations promotes youth education related to urban forestry.
- Partnerships with the Alaska Community Forestry Program, schools, and universities, and professional organizations support urban forestry training programs.
- Communication with CBS decision-makers about the benefits of trees and the urban forestry program's objectives and performance is effective.
- Volunteer and stewardship opportunities such as planting or pruning programs inform and engage residents in urban forestry issues.
- Professional development opportunities strengthen the skills of volunteers, tree committee members, and staff.

Sitka Tree and Landscape Committee

A tree committee fulfills one of the criteria to become a Tree City USA and is a valuable resource for busy city staff. It provides opinions from individuals who are interested in, and often knowledgeable about, the subject at hand, and also helps maintain relationships with others who can assist staff.

Figure 6. *Sitka Tree & Landscape Committee members planted and maintain trees at Kimsham Park and other parks and schools.*

Sitka is fortunate to have an active and supportive committee. The seven-member Sitka Tree and Landscape Committee (STLC) was established by the CBS Assembly. It was instructed to:

- Study and make recommendations to the assembly…regarding the needs or renovations necessary to existing landscape areas or facilities in terms of trees and landscaping;
- Investigate sites and make recommendation to the assembly…for new trees and landscaping or areas which they deem necessary and/or desirable for such purposes; and
- Plan, institute and maintain tree and landscape projects within the city and borough. (CBS General Code 2.54.060)

Other important roles for the STLC are to perform a periodic review of plans, to track the status of recommendations, and to evaluate progress towards management goals. The committee reports to and is overseen by the staff member responsible for directing implementation of the UFMP.

The committee's level of dedication to urban forestry is exemplified by its 12 years of dedicated service, which has included 12 major projects that planted 190 trees, numerous educational events and workshops, and two major beautification projects. The committee's many activities have brought the value of trees to the forefront in community thinking.

The STLC will continue to support and involve the public in the tree program by helping CBS staff:

- Develop a community tree planting plan, annual work plan, and budget;
- Design and organize tree plantings;
- Solicit funds, including grants and donations;
- Develop or review a public tree ordinance; and
- Organize Arbor Day celebrations and other educational events.

Tree Risk Management

Public safety is the major concern for urban forest managers who have a legal duty to exercise reasonable care to protect the public from foreseeable risks. This includes monitoring and acting to eliminate danger from a tree or limb that could cause property damage, injury, or death; trees that block traffic sight lines and signs; or tree roots that raise sidewalks, invade segmented pipes, or otherwise disrupt activities. The human and financial impacts of failures far outweigh the costs of preventive care.

Guiding principles for tree risk management:

- Trees provide a wide variety of benefits;
- Trees are living organisms and naturally lose branches or fail;
- The risk to human safety is extremely low; and
- Tree owners have a legal duty of care.

The goal of tree risk management is to provide a systematic and defensible approach to risk assessment and management. Proper planting and care combined with regular pruning and inspections will lower the likelihood of weaknesses or defects becoming hazardous.

Tree risk management uses policies and practices to identify, evaluate, mitigate, monitor, and communicate risk. Some level of risk must be accepted to experience the benefits that trees provide but cities can strike a balance between tree risk and benefits.

Figure 7. *Mountain ash in Crescent Park with codominant stems and included bark. This defect is easy to fix when a tree is young but can cause the tree to split apart as it grows.*

Fortunately tree failure that causes damage, injury, or death is rare. Tree failures during normal weather conditions are often predictable and preventable; however, any tree, whether it has visible weaknesses or not, will fail if the forces applied exceed the strength of the tree or its parts. Most trees inventoried were a small species or have not reached their mature size and pose few liability concerns; however, it is important to manage for future risk. Staff identified 19 trees for removal.

Major defects and conditions that Increase potential for tree failure:

- Dead parts
- Broken and/or hanging branches
- Cracks
- Weakly attached branches and codominant stems (Figure 7)
- Cavities or decayed wood
- Unusual tree architecture – lean, balance, branch distribution, and lack of taper
- Inadequate root support

While safety is the priority for risk management it may not be the only basis used to establish acceptable levels of risk. Budget, a tree's historical or environmental significance, public perception, and other factors may come into the decision making process. Trees with an identified risk factor that are not immediately removed should be inspected on a scheduled basis by an ISA Certified Tree Risk Assessor. A tree risk plan identifies which trees will be inspected and how often.

A cyclic pruning program will help abate risk because each tree will be inspected at least once every cycle and risk factors can be evaluated. Any new risks can be added to the database and further inspections scheduled.

Actions that can abate risk and reduce exposure to liability:

- Complete and maintain a tree inventory and record dates of inspections, condition of inventoried trees, and pruning and other maintenance needs;
- Conduct annual inspections of public trees and keep accurate records;
- Remove hazardous tree branches as they become known;
- Hire trained, ISA Certified, and insured tree care professionals who follow arboriculture industry practices for maintenance on public trees;
- Maintain CBS personnel with risk assessment credentials and continue to participate in training on risk management, safe arboriculture procedures, first aid, and safe equipment use;
- Maintain visual clearance for intersections and traffic signs and signals;
- Respond promptly to requests related to possible hazards;
- Implement a risk tree removal plan based on levels of risk; and
- Implement a cyclic pruning program.

Tree Inspections

No one is able to predict every tree failure because conditions affecting trees change constantly. Conducting a tree risk assessment neither assures nor requires perfection but it does ensure that all reasonable efforts have been made to identify extremely and potentially high-risk trees at the time of assessment.

Tree risk assessment is a systematic process to identify, analyze, and evaluate tree risk by assessing the tree or its parts for the likelihood of a failure and the consequences of a failure impacting a target (Figure 8). Inspections are the first line of defense in risk management and maintenance. Parks and Recreation staff inspect trees drawn to their attention or that are identified through operational activities but a process for systematic inspection intervals would be an improvement.

One effective way to prioritize tree inspections and corrective actions is to divide the city into zones; establish inspection methods and schedules according to the zones; and implement corrective actions in a reasonable and timely manner.

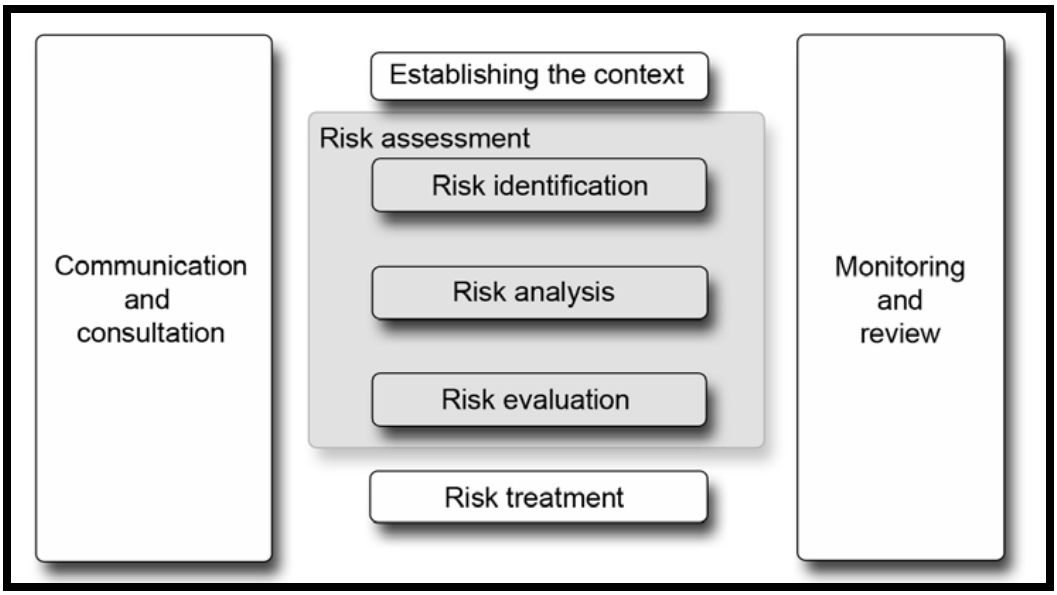

Figure 8. *Contribution of risk assessment (highlighted) to the risk management process.*

The evaluation cycle may range from one to five years depending on the age of the tree, level of risk, specific conditions, CBS goals, resources, and/or regulations. Mature trees and species with known failure histories may need to be inspected more frequently. The number of tree or branch failures between inspections will indicate the adequacy of the interval period.

Inspection intervals of 18 months alternating between leaf on and leaf off provide opportunities for assessment during different growing seasons. An advantage to risk assessment during leaf off allows for a clear view of tree structure. Additional inspections should be made after storms.

The CBS will reduce the possibility of structural defects being missed by using an ISA Certified Tree Risk Assessor who follows protocols established by the arboriculture industry and described below. Problems should be documented and appropriate recommendations made or future monitoring scheduled as necessary.

ISA Tree Risk Assessment Protocol:

- Determine a level of assessment,
- Assess and evaluate the likelihood of tree failures and impacts,
- Assess and evaluate the consequences of tree failure impacting targets, and
- Categorize a risk rating using a set of matrixes (Figure 9).

Likelihood of Failure and Impact	Consequences of Failure			
	Negligible	*Minor*	*Significant*	*Severe*
Very Likely	Low	Moderate	High	Extreme
Likely	Low	Moderate	High	High
Somewhat Likely	Low	Low	Moderate	Moderate
Unlikely	Low	Low	Low	Low

Figure 9. *Tree risk matrix (ISA 2013)*

Tree Maintenance

One key area in which green infrastructure differs from built infrastructure is that trees generally increase in value over time if maintained properly. As with any type of infrastructure, trees require regular maintenance and monitoring to provide maximum benefits. While the benefits of trees far outweigh the costs, careful maintenance is needed to manage risks that are detectable and preventable.

Adopting and following standards and specifications helps perpetuate a healthy, structurally sound urban forest and also demonstrates that CBS is implementing current and accepted industry practices. The specifications should, at a minimum, cover removal, pruning, planting, species selection, tree preservation, risk rating system, and inventory methodology.

Industry standards such as ANSI A300, Z133.1, or Z60.1 define arboriculture standards and terms. Specifications and best management practices determine how the city applies these standards. The same standards and specifications apply regardless of who does the work – CBS staff, a contractor, or volunteers.

Other helpful sets of standards are the ANSI Standards for Arboricultural Operations—Pruning, Trimming, Repairing, Maintaining, and Cutting Brush—Safety Requirements (ANSI Z133.1, 2000) and the ANSI Standards for Tree Care Operations—Tree, Shrub, and Other Woody Plant Maintenance–Standard Practices, Pruning (ANSI A300(Part 1), 2008, Pruning). These safety and pruning standards are designed specifically for tree care operations and should be incorporated into CBS standards for tree care.

The inventory provides data on tree maintenance that is needed (Table 2). Of the 636 trees inventoried, more than 55% (376 trees) require some type of pruning. The most common defect is co-dominant stems, which can be corrected by subordination pruning. Three percent (19 trees) require removal, due primarily to structural defects such as trunk damage caused by mowers and weed eaters that led to decline of the tree.

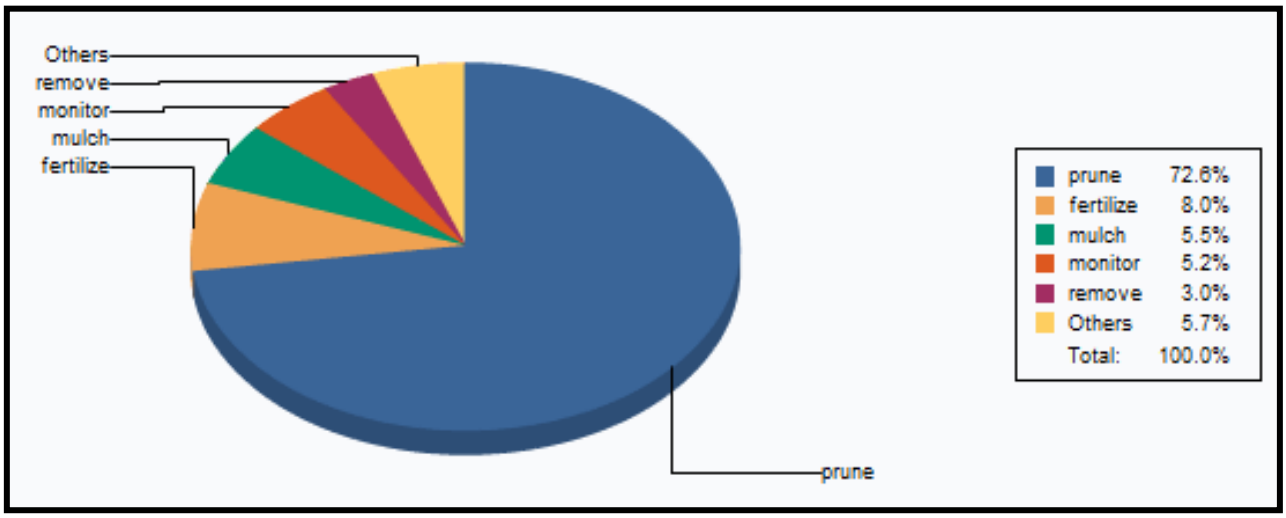

Table 2. *Tree maintenance tasks identified during the inventory.*

Tree Maintenance Objectives:

- Tree maintenance and pruning follows the best management practices established by the ISA, ANSI Z133.1 and ANSI A300 standards. All maintenance and pruning is done or overseen by an ISA Certified Arborist or Certified Tree Worker.
- Pruning specifications, in addition to ANSI, are adopted that define treatments for different tree species and ages, pruning techniques, and other issues as appropriate.
- Industry-appropriate pruning and planting standards are maintained, promoted, and applied through staff and volunteer training and reference in city codes and outreach materials.
- Mower and weed eater operators are knowledgeable about equipment operation around trees and take care to avoid causing damage.
- The tree population is monitored for insect pests and diseases, particularly invasive species.

Pruning

Setting and enforcing standards for pruning is crucial to providing correct and consistent plant health care. It also sets a good example of tree care for the community. Regular, cyclic pruning maintains a greater safety level in the urban forest and can decrease liability for the municipality (McGauley et al 2000). The International Society of Arboriculture pruning standards are divided into four categories: crown cleaning, crown thinning, crown raising, and crown reduction. Crown restoration, pruning for views, and other types of pruning are considered specialty pruning.

The ability to implement a cyclic pruning program is limited by the staff and financial resources and most cities cannot afford to contract services for all trees. One way to deal with budget constraints is to contract pruning of large trees with significant structural defects near high use areas while having CBS staff or trained volunteers prune small trees. The objective is to start and maintain a cyclic pruning program within the fiscal and personnel resource constraints.

Excluding immediate, acute problems (blow downs, pest outbreaks, and extreme vandalism, pruning should follow a two- to five-year pruning cycle based on the management plan. Pruning cycles can also focus on certain species that require more attention; this is common when a pest needs to be controlled, for example.

With a regular pruning cycle, crews and equipment work more efficiently than if pruning is done only by request or in case of emergency. 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 trees regularly for possible risks and tree health problems, there are fewer citizen calls for emergency pruning (Luley et al. 2002). Additionally, the crews often find problems that would not have been reported by residents.

Mature Tree Care

Large trees are the most significant component of the CBS's urban forest and they create a canopy that provides a high level of benefits. Maintaining these benefits for a longer period requires regularly scheduled maintenance and non-routine treatments as needed. Comprehensive care centers on routine or preventive pruning and, when necessary, fertilization, irrigation, insect and disease control, and tree cables and braces. Inadequate care for large trees can be expensive as it leads to more trees in poor health and with higher risk of failure.

Young Tree Care

Young trees require more frequent care than older trees but proper maintenance will ensure the longest and safest service life of these 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. It is worth the investment as the loss of new trees can quickly exceed the cost of fencing, trunk protectors, and maintenance. Planting larger caliper trees may alleviate some problems with animals or vandals from the outset.

The Sitka Tree & Landscape Committee is very successful at supporting volunteer efforts to care for recently planted trees. Volunteers can be trained in basic tree maintenance, provided with tools (a hose, trowels, garbage bags, gloves, etc.) and given the responsibility of caring for adopted tree. This promotes citizen involvement and awareness of the urban forest. Individuals, families, Master Gardeners, civic organizations, and school groups could adopt newly planted trees. A Tree Steward program would also provide service by trained volunteers.

Young Tree Pruning

There are many newly planted or young trees in CBS and more will be added as trees are removed, development changes, and to diversify the existing tree population. The most important period for pruning to promote sound structural development of the trunk and branches is when the tree is young. Tree health can be greatly increased by regular pruning to remove crossing branches and co-dominant leaders. This encourages a strong structure and healthy crown and will reduce the need for more expensive and intrusive corrective pruning later in the life of the tree (Figure 10). It is always easier and less expensive to prune a young, small tree than a large, older tree. Proper pruning, with an understanding of tree biology, can maintain good tree health and structure while enhancing aesthetic and economic value, and minimizing liability concerns.

Newly planted trees should generally receive their first training pruning the third year following planting. Very limited pruning should 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 to manufacture food and increase root growth for establishment in its new site. Only dead or broken branches and co-dominant stems should be removed at the time of planting and in the next year or two.

Many young trees have branch structure that leads to problems as they grow, such as codominant stems, many limbs attaching at the same point on the trunk, or crossing/interfering limbs. If structural problems are not corrected while trees are young they can become safety risks as they grow larger and create potential liability.

Pruning young trees to obtain good structure requires an understanding of the growth-habits of different species and of tree biology, anatomy, and physiology. This type of work is suitable for properly trained summer interns, part-time employees, and/or volunteers since it can be accomplished from the ground with a minimum amount of equipment.

Training pruning should be done on a three-year cycle rather than the two- to five-year cycle for larger established trees (Figure 10). This work can be done throughout the year. An optimum time to perform this pruning is late winter to 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.

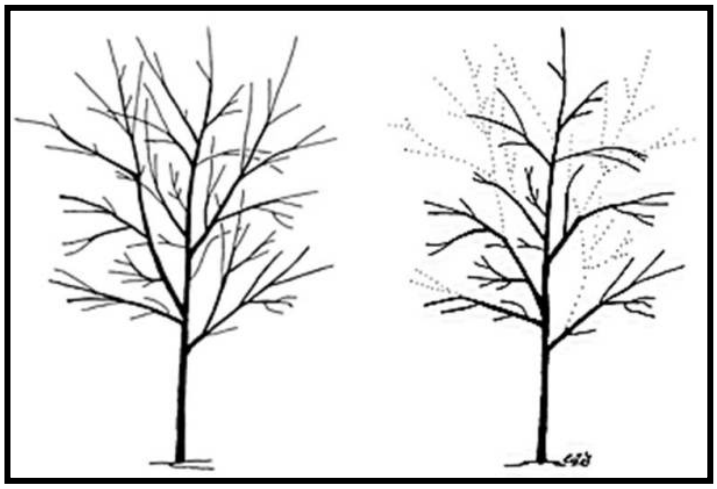

Figure 10. *Proper pruning cuts made to develop good structure in young trees.*

Tree Protection

It is impossible to constantly police every street and park tree. It is possible, however, to raise awareness about tree health and to increase people's respect for public trees. Educating residents, park patrons, tourists, and schoolchildren about street and park trees may reduce incidents of vandalism (such as girdling, peeling, and carving bark) and encourage reporting of observed tree damage.

Preventing 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, locking a bike to a tree, urinating on a tree, hammering a nail into a trunk, or dumping hot coals at the base of a tree can 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.

Tree protection objectives:

- Public trees that add value to the community are preserved and protected.
- Public trees are safe, healthy, and long-lived.
- Recognition that every tree cannot and should not be saved during development because some trees with structural problems or poor quality are not salvageable.
- Injury prevention is a priority as it is more effective than treating damage that often cannot be repaired or reversed.
- Creation and promotion of a nomination-based, voluntary memorial or heritage tree program to recognize and protect unique, landmark, or other notable trees.
- Tree-friendly development and land use practices are supported by reviewing and reinforcing policies to preserve mature, significant trees and plan for appropriate replanting.
- Property owners are educated to value native plant communities and to prevent unnecessary tree removals.
- Municipal codes related to urban forestry are followed consistently and revised as community needs change.

Figure 11. *Mulch around trees reduces damage from lawn equipment and is a cost-effective way to protect the public investment in trees.*

Figure 12. *There are many places in Sitka where trees could be planted.*

Urban Forest Expansion

Guiding principle for the CBS tree-planting program:

- Plant the number of trees each year that CBS staff, the Sitka Tree & Landscape Committee, and other volunteers can maintain.

There are many sites on CBS-owned properties where trees could be planted. A large number of trees are not needed each year but a consistent annual addition is critical to maintaining a perpetual canopy. New trees are not only significant design elements now but the future environmental, economic, and social fabric for the city. Planting enough trees each year to increase the canopy is a challenge but removals without replacement and planting small trees in large spaces will lead to net canopy loss.

A tree-planting plan will minimize the unintended but gradual degradation of the urban forest over time and ensure a sustainable and diversified tree canopy and the associated benefits. A planting plan should specify the species, location, timeframe, and goals for planting. It may also address landscape design and how the landscape should look and function in the future. A plan will also help managers quickly determine how best to apply funding that may become available in small and unpredictable amounts. Integration with other plans and input from local citizens, state agencies, organizations, businesses, planners, developers, CBS staff, green industry professionals, and elected officials will create a blueprint for a planting plan that has community support.

Tree planting objectives:

- Tree and shrub planting is increased on CBS-owned property including parks, along roads, around public facilities, and other developed sites.
- Site development proposals maximize tree planting and preservation opportunities.
- Tree planting and preservation on private property are encouraged.
- Final selection of trees and their placement is made in the field while considering the many elements of that landscape, including infrastructure and utility limitations.
- Tree species planted meet design criteria, are biologically adapted to site conditions, and well suited for the level of care they will receive.
- A street tree plan is used to create a unified vision and image for Sitka. Prominent landscapes such as the downtown business district and main entrances and exits are identified for tree and flower planting as part of an overall planting and landscape plan.

Tree Planting Practices

Across the country it is common to see new trees that are struggling rather than thriving whether the site is residential or commercial, public or private. Trees in most cities have been planted too deeply so that root collars are buried. Planting trees that are free of root defects and with the root collars at grade level will result in trees that are safer and much longer lived (Figure 14).

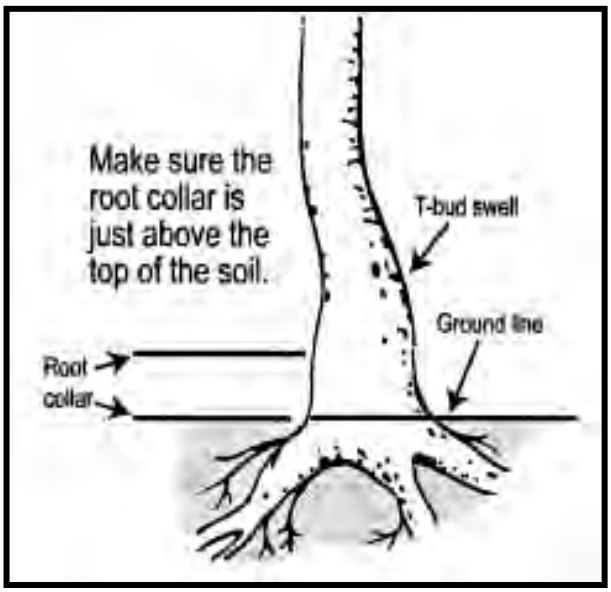

Figure 14. *Root collar at grade level.*

Holes for trees should be relatively shallow (typically a little less deep than the measurement between the root collar and the bottom of the root plate) and wide (3 to 5 times the diameter of the root system). Care should be taken so that the root collars are at the same level or slightly higher than the surrounding soil grade (Figure 15).In most situations, soil amendments should not be added to the planting hole as this can lead to differences in texture and structure between soils inside the planting hole and the surrounding soil. Such differences can cause water to be wicked away from, or accumulate in, the planting hole

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 13. *Beech tree planted too deeply.*

Mulch should be applied to the surface of the soil around each newly planted tree. It provides a zone where turf maintenance is not needed, thereby keeping lawn mowers and string trimmers safely away and thus preventing mechanical damage to the tree. Mulch also moderates soil temperature, reduces compaction, improves the soil, can suppress competition from weeds, and holds moisture near the surface where most of the roots are located.

Mulch should be applied to an area three times the diameter of the root system to a depth of two to four inches. Coarse textured mulch is best because if the texture is too fine it may reduce oxygen that the roots need to thrive. Woodchips straight from a chipper make good mulch.

Mulch should never be piled around the trunk (creating mulch volcanoes), but rather pulled 6 to 8 inches away from the trunk. Mulch that buries the trunk flare provides shelter for insects, fungi, and mammals that can damage the tree and it holds moisture against the trunk that can cause decay (Figure 16).

Figure 14. *Mulch in photo on left has correctly been removed from near the trunk. In photo on right the mulch is incorrectly piled against the trunk.*

Species Diversification

Sitka's 2012 tree inventory included 636 trees and 40 different species.(See Appendix for complete list of species). This appears to be a diverse population but distribution figures indicate the population is dominated by a few genera. Over 65 percent of the trees are represented by six genera - maple, arborvitae, spruce, flowering crabapple, mountain ash, and pine. Species diversity in new plantings throughout the city should be a primary concern.

The dangers of planting monocultures have proven to be devastating throughout the United States as over planted genera were lost to insects and diseases. An older, common industry guideline for maintaining species diversity in urban settings is the 10-20-30 rule. That is, there should be no more than 10 percent of any one species, no more than 20 percent of any one genus, and no more than 30 percent of any one family in the total tree population (Santamour, 1990). A safer recommendation is to plant no more than 10 percent of any one genus as diseases and insects usually affect the entire genus and not one species.

Diversity is an important measure of a forest's resilience. A more diverse forest, both in 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, these changes or infestations can significantly impact a large percentage of the population.

Genus	Tree Count	Percent
Maple	110	17.3
Arborvitae	98	15.4
Spruce	78	12.2
Crabapple	65	10.0
Mountain ash	58	9.0
Pine	34	5.3
Hemlock	33	5.2
Alder	26	4.1
Linden	23	3.6
Others	193	17
Total	**636**	**100**

Objectives to increase species diversity:

- A diversity of tree species is planted with a goal of no more than 10 of any one genus.
- Species that have high maintenance costs, invasive characteristics, high storm damage potential, or a history of failure are avoided.

Diameter Distribution

Table 3 depicts the diameter distribution for the trees inventoried. It indicates that CBS has planted many trees recently and they are still young or that many small trees have been planted that never will reach a large diameter.

If all the trees within a particular area are about the same age they will mature and decline more or less at the same time leaving that area with a deficient canopy plus the expense of replanting. To mitigate these impacts, the CBS should take steps to increase the age class and species distribution where possible and plant more species that will become large trees. For example, many western cities have established the following standard for desired age structure:

- 40% young: < 6 inches diameter at breast height (DBH)
- 30% maturing: 6 – 12 inches DBH
- 20% mature: 12 – 24 inches DBH
- 10% old: > 24 inch DBH

Sitka's tree population ranges for the same categories are:

- 50% young: < 6 inch DBH
- 30% maturing: 6 – 12 inches DBH
- 16% mature: 12 – 24 inches DBH
- 3% old: > 24 inches DBH

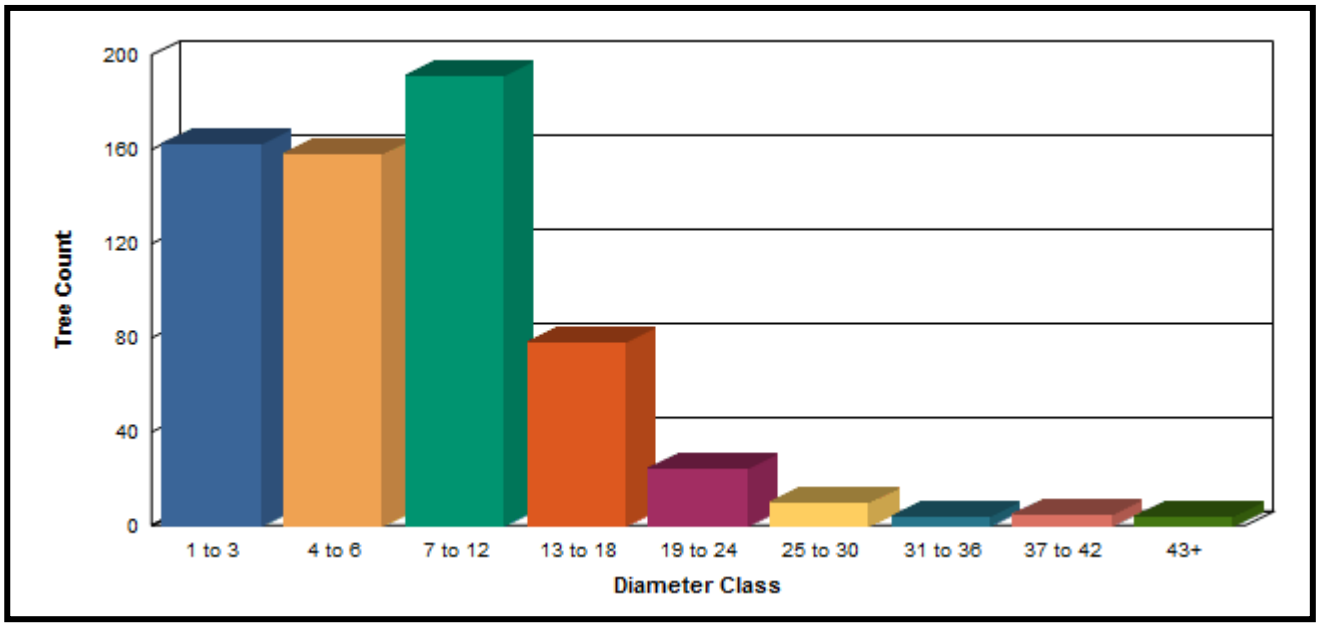

Table 3. *Diameter distribution of inventoried trees (Diameter in inches at breast height – 54 inches above grade level).*

Downtown Tree Planting

Streets and sidewalks constitute a large percentage of Sitka's impervious surface, generating polluted runoff. Increasing vegetation within rights-of-way and using other low-impact development practices can reduce stormwater runoff and create greener business districts and neighborhoods. Techniques to accomplish this include using pervious pavers and installing rain gardens, traffic circles, and medians planted with vegetation. These also help calm traffic and create a better balance between vehicles, pedestrians, and bicycles, and are part of a complete streets approach.

"Complete streets" is a term used to describe streets designed to enable safe, attractive, and comfortable access for all users. As CBS grows, complete streets would provide public open space that integrates landscaping, street and sidewalk lighting, transit facilities, street furniture, water features, and public artwork. Complete streets design supports tree planting and maintenance and other goals of the UFMP.

Trees in small city business districts influence retail and shopping behavior in positive ways. The results of several studies suggest that shoppers consider them 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" or pits in the sidewalk, where they grow poorly and die young due to insufficient soil volume, oxygen levels, and water availability (Figure 17). The sidewalk pits enclosed with iron grates to create a surface for pedestrian travel often girdle the trunk as the tree grows, damaging the tree they were intended to protect. Grates also lead to trip-and-fall hazards that may cause injuries.

An American Forests article published in the early 80s stated that an oak or maple 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 only four years in a downtown planting pit. Thirty years after the article was published the same design mistakes are being made in cities across the United States.

Figure 15*. Trees in pits are usually short-lived.*

One of the biggest challenges is to provide sufficient soil space for root growth and tree health in a situation where space is at a premium. The downtown business area is under constant competition for space for sidewalks, signs, benches, trash receptacles, roads, utilities, and landscaping. The trend is to downsize the urban forest and plant smaller trees however this results in fewer benefits. The key to success is to integrate trees into the design up front.

Even when trees survive poor site conditions they tend to have stunted growth, pest and disease problems, and vandalism. A tree with insufficient space may also be improperly pruned to provide clearance. Stressed trees often decline and die, creating a public eyesore in the process. It is not surprising that the public has a poor opinion of many downtown trees when they fail to reach their potential to provide beauty and environmental benefits.

Development and redevelopment of property can mean additional planting opportunities or it can mean the loss of established trees to new buildings, parking lots, and street redesign. During development, care must be taken to protect trees that are healthy and structurally sound whether on public or private property.

Trees planted in the downtown business district add greatly to the economics and aesthetic appeal of the city but tree selection must take into consideration the need for shoppers to view storefronts. Tree canopies should be open and the branching habit must be high enough to allow pedestrians to walk comfortably beneath the trees. Other options are tall, narrow growing species. These trees can provide beauty, a look of uniformity, and a formal appearance to the shopping district but should not be overused.

CBS plans that recommend trees and landscaping in the downtown business district include:

- Visitor Industry
  - 2.13.54. To enhance the visitor experience in Sitka by providing conveniences and information and by improving the scenic qualities of the townscape, as follows:
    - A. Support efforts to clean up and landscape publicly owned portions of the downtown area. This includes lawns, landscaped areas and street trees.
- Greenspace and Landscaping
  - 2.13.41. To create and maintain a program of urban landscaping which includes:
    - A. Landscaping for all public facilities.
    - B. A street greenery program, especially in the Central Business District.
  - 2.13.42. Support the Tree and Landscape Committee's implementation of a Community Forestry Program and the Sitka Landscape Plan
  - 2.13.43. Provide information and guidance to the public about the benefits of trees and landscaping, about proper tree selection and pruning.

Objectives for managing trees in the downtown core and in other commercial areas:

- Trees in the downtown core and commercial areas are preserved and protected.
- Additional trees are planted to improve the appearance and function of downtown and create a sense of welcome.
- High priority spaces along sidewalks, in front of the movie theater, and along the asphalt pathways linking downtown to the waterfront are improved through the addition of appropriate trees.

TREE ORDINANCE

In recognition of the many benefits conveyed by trees, many local governments adopt street and park tree ordinances that, for the most part, apply to publicly owned trees and nuisance trees on private property. Properly applied ordinances are tools that help communities protect trees and preserve green space. Ordinances can be designed to address the differences in management for trees located near streets, in parks, around public and commercial buildings, and in neighborhoods.

Enacting laws and policies that prohibit and/or direct specific actions are not a popular way to influence behavior. However, sometimes an issue is so important and complex that legislation and policies are appropriate tools to protect citizens and property.

Tree ordinances reflect the values of a community and the worth of its trees. An ordinance encourages tree maintenance to secure air purification, noise and dust abatement, storm water management, water quality, property value enhancements, beautification, public health, safety and other benefits trees provide.

Fostering Community Support

There is a great deal of support from the Sitka Tree & Landscape Committee and other residents for community trees. Community support is critical to the effectiveness of an ordinance, from its development through its evaluation.

A balanced tree ordinance:

- Involves a variety of interested civic groups, businesses, developers, planners and homeowner associations in its development;
- Is created through a process accessible to all groups who want to participate;
- Is based on the best available data and information deemed relevant by all stakeholders;
- Satisfies the interests and values of multiple stakeholders through creative management strategies; and
- Spreads the benefits and costs of tree management among members of the community.

Ordinance Development, Review, and Revision

Each municipality must author a tree ordinance based upon its own particular needs, financial and personnel resources, political and public acceptance, and abilities; it cannot rely entirely on model ordinances from other places. The ordinance can detail CBS's responsibilities for public trees, tree protection and preservation, enforcement and penalties for violations, and planting guidelines.

Although ordinances vary widely in form, content, and complexity, an effective tree ordinance will:

- Establish and legalize a public tree management program and policies;
- Provide reference to permanent procedures and legal authority;
- Establish a permit review, approval, and appeal process for tree removal, planting, and pruning;
- Specify arboriculture standards for municipal tree planting, pruning, and other tree work;
- Establish the nature and degree of public responsibilities to community trees;
- Ensure that the people who perform work on municipal trees are well qualified.
- Meet the criteria for Tree City USA designation.

Too many tree ordinances are stand-alone laws that are not incorporated into other development codes and, consequently, go unnoticed by the development, planning, and economic communities. Tree ordinances, landscaping provisions, tree protection and planting requirements, street tree provisions relating to the right-of-way, and other tree regulations should be kept within the same chapter in the code when possible or at least cross-reference one another.

Tree ordinances do not assure that public trees will be improved or even maintained. Tree ordinances simply provide the city an opportunity to set policy. The degree of regulation and levels of enforcement or authority are tailored to each community's capacity and resources. It provides clear authorization for CBS to manage public trees. If these activities are not integrated into an overall management strategy, problems are likely to arise. Figure 18 describes elements commonly found in a municipal tree ordinance. Appendix A contains resources for writing ordinances and the Alaska Community Forestry Program has other resources.

Relationship to Other Planning Documents

The following documents were reviewed for policy direction and goals as they pertain to protecting and managing the urban forest. The UFMP is a stand-alone management tool but it complements other CBS plans and policies. Trees offer solutions for every objective defined in these plans.

The CBS Comprehensive Plan Update, adopted in 2007: The Comprehensive Plan directs land use planning and development policies. It also establishes specific policies related to economic growth, housing, transportation, water quality, public facilities and services, maintenance of subsistence lifestyles, access to natural resources, and park amenities, and encourages landscaping for public facilities. The comprehensive plan specifically mentions support of the Tree and Landscape Committee and educating the community about the benefits of trees. The UFMP should be referenced, if not incorporated into, the Comprehensive Plan as trees are important to its successful implementation.

Sitka Visitor Industry Plan, adopted 2007: Sitka appeals to a range of travelers and tourism creates jobs, business opportunities, and tax revenues. This plan aims to improve public spaces and enhance visitor experiences by adding flowers and landscaping downtown and in harbor areas and parks. Trees are important amenities of city habitat and street and park design.

Sitka Health Summit: Annual Meeting: The summit formed to study successful revitalization projects in other regions and to craft a project that will bring similar benefits to CBS. The November 2012 Health Summit goal of Downtown Revitalization includes support for trees, tree issues, and trees in the downtown corridor as an important component of accomplishing this community goal.

Elements Commonly Found in Municipal Tree Ordinances	
Element	**Explanation**
Location	Defines section in municipal code where ordinance should be placed (public works, parks and recreation, zoning, or planning departments)
Purpose	The goals and objectives of the ordinance. These are crucial to implementation, enforcement, and defense of the ordinance if challenged.
Authority	Source of local government's authority to regulate; relevant 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	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.
Permits and Plan Review Process	Establishes actions that will require permits such as tree planting, pruning, and removing. Explanation of how a new/proposed development or other action will be reviewed. Should detail information to be submitted with permit requests, such as site survey of trees and proposed building locations.
Incentives	Methods that can be used to achieve conservation and 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 roots.
Nuisance Trees	Provides authority to remove trees on private property that are diseased or threaten public safety.
Maintenance after Development	Specification of required maintenance of trees and vegetation after project has been completed, often includes replacement for damaged or 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.

Figure 16. *Elements commonly found in a municipal tree ordinance.*

OPERATIONS

Budget

There is limited CBS funding dedicated toward tree planting, maintenance, and removals; staff and support personnel; training; and equipment. This is a challenge for making consistent improvements to public trees. Currently Parks and Recreation funds maintenance for park, street, and public facility trees; removal of risk trees that threaten private property; storm related emergencies; and capital projects. Equipment is limited and sometimes is borrowed from other city departments.

To compete successfully with other municipal services, a proposed budget should accurately estimate the program's annual costs and justify the need for annual and long-term funding. Obtaining public funds can be difficult. Key points include the following:

- Budgeting happens every day of the year. Keep key decision makers and the public well informed about the program's accomplishments and needs. Involve them in tree planting and other activities.
- Citizens are reluctant to support new programs or increased taxes. Elected officials must be persuaded that an urban forestry program is a wise investment and supported by the public. The budgeting process should be educational as most municipal officials are not familiar with the benefits or technical details of urban forestry.
- A cost-effective urban forestry program will better compete for scarce budget dollars. The program's costs can be reduced through sound administrative practices such as employee training, accurate record keeping, preventive maintenance, and selecting well-adapted trees for planting. Contracting out services can also be cost effective. For instance, a consulting arborist or urban forester can be hired part time, on a retainer, or on a cost-sharing basis with other communities or agencies. These costs may be lower than a full-time salary.
- Public participation and grassroots support can help generate funding. The media and service organizations can disseminate information about the value of urban forestry.
- The budget should adapt to changing needs as work is completed. New programs may need a larger proportion of the budget for tree maintenance and removal, and public education. Established programs may dedicate more funding for tree planting.

The Society of Municipal Arborists, a trade association that sets accreditation criteria for municipal forestry programs, is the standard for measuring funding for urban forestry programs. The following percentages are examples from established programs that may be modified for the particular needs of CBS. The values represent percentages of the CBS proposed budget of $10,450.

- About 20% of the urban forestry budget should be allocated for tree removal. ($2,090)
- About 40% should be allocated for tree maintenance such as pruning, watering young trees, mulching, and controlling insects and diseases. ($4,180)
- Public safety and caring for existing trees should take priority over planting trees. Only about 20% of the annual budget of an established program should be allocated for tree planting. ($2,090)
- Administrative activities should receive about 20% of the budget. For new programs, more of the budget will be spent obtaining authorization, gaining legislative and public support, and educating the public. ($2090)

All work should be accomplished by ISA Certified Arborists and meet or exceed current industry standards and best management practices. The figure of $10,450 considers the current needs of the program and represents a goal to maintain, sustain, and ensure the urban tree canopy thrives.

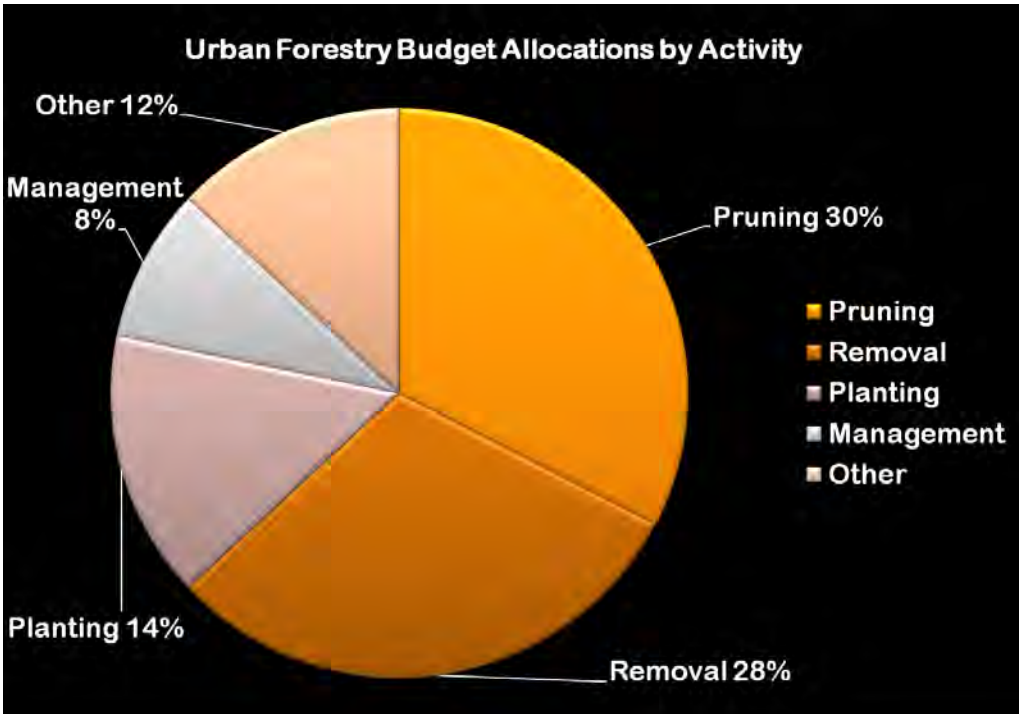

Figure 17. *General annual budget allocations for urban forestry programs.*

Projected Multi-Year Maintenance Budgets

General tree budget allocations found in urban forestry programs across the U. S. are shown in Figure 19. It indicates a priority for taking care of existing trees before substantially adding to the tree population. Actual program budgets and funding should be based on needs and priorities detailed in the tree inventory and UFMP. See Appendix for an example of an annual budget worksheet.

The Arbor Day Foundation sets the minimum funding for meeting TREE CITY USA standards as $2.00 per capita for urban forestry. CBS has a population of approximately 9,000 residents, which means spending about $18,000 each year on various tree activities to meet the TREE CITY USA criteria. The value of grants, in-kind donations, and volunteer time may be included in this amount.

Objectives for gaining adequate funds for the urban forestry program:

- An annual report, work plan, and budget inform elected officials about urban forestry work done and funding needs.
- An annual meeting is held to discuss CBS and STLC accomplishments, plans for the future, and funding required to meet program goals.
- News articles feature worthy activities such as tree planting, removals, pruning, and funding needs.
- A memorial or heritage tree program raises funds for tree planting and care.
- Civic organizations and businesses are regularly encouraged to participate in and support urban forestry activities and events.
- State and other grants that could provide support are identified.
- Tree solutions to community problems, such as storm water abatement, are highlighted.

There is no magic formula for determining how much funding is needed for a proactive, sustainable urban forestry program. The simple answer is that there should be sufficient funding for program management , equipment, staff training, community education and outreach, and for staff or contractors to carry out preventive tree maintenance and emergency response.

PROGRAM ACTIONS

Short-Term Actions

Although each of the five actions is essential to the maintenance of the community forest, an annual operating plan sets priorities for the budget. CBS staff has identified as **high priorities**:

- public safety,
- responsible management of existing trees, and
- tree planting.

1: Maintain Tree Inventory

Maintain the inventory using TreeWorks™ software to provide an accurate accounting of public trees. Using accurate, consistent inventory data and professional interpretation and planning leads to healthier, safer, trees with lower maintenance costs and increased benefits to the community.

2: Proper Tree Maintenance

After planting an appropriate species at a site that can support adequate growth, employ maintenance practices such as mulching, watering, and pruning for three to five years. Early and proper pruning will lead to long-lived, healthy and safe mature trees that will need less frequent and less costly pruning in later years.

Provide additional staff training on the growth habits of the species being planted, and tree biology, anatomy, and physiology. This training may be provided by urban forestry consultants, the Alaska Community Forestry Program, and the Pacific-Northwest Chapter of the International Society of Arboriculture, among others.

3: Program Support and Administration

Sitka has demonstrated its concern for and dedication to urban forestry by establishing and supporting activities of the Tree and Landscape Committee for 12 years. Other indications of a commitment to urban forest management are the completion of a computerized public tree inventory and landscape plan in 2012, ISA arborist training for staff; a line item in the budget for tree and landscape activity, and Sitka Health Summit support for downtown beautification.

Elected officials are keys to the growth and success of the CBS's urban forestry program. 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.

The citizens own both the public and private urban forests, and increased political support and citizen understanding and commitment will result in an effective urban forest management program that reaches its full potential.

4: Tree Planting

The health and stability of the city's future forest depends on judicious tree selection, location, and tree planting today as well as regular maintenance of young trees. The key for success is to plant the number of trees each year that CBS staff, the STLC, and other volunteers are able to maintain.

To ensure that newly planted trees thrive and are healthy, provide planting standards - guidelines with references to technical publications. Extensive information about the size of planting pits, staking, and other planting practices has been developed by International Society of Arboriculture. The Alaska Community Forestry Program can provide other resources and training to ensure success. For a copy of Plant a Tree: An Alaskan Guide to Tree Selection, Planting & Care, see http://forestry.alaska.gov/pdfs/PlantATreeWeb2011.pdf

Long-Term Actions

Enhancing the program and completing management plan recommendations are long-term actions. There four actions must be addressed to sustain the community's tree program and trees.

1: Adopt and Implement the Urban Forest Management Plan

Adopt the five-year plan and review it annually to determine progress, review accomplishments, develop annual operating plans, and plan future activities. Long-range planning time horizons can be several years or a decade but five years is a realistic time frame for implementing the goals and recommendations of the UFMP.

2: Increase Staff and Funds for Community Tree Management

Currently, there is limited funding for tree planting, site inspections, preventive tree maintenance, risk management, cyclical pruning, staff training, support personnel, equipment and citizen education. CBS requires additional staff, equipment, and other resources to maintain an efficient and cost effective program over the long term.

3: Continue Community Outreach and Education

The citizens of Sitka will need information and training to accomplish the recommendations of the management plan. Staff and the STLC have hosted many educational and outreach events, produced tree information brochures, and hosted annual Arbor Day events for the last 12 years as well as activities in schools.

Examples of strategies and activities that have been successful and need to continue are:

- Opportunities for residents, civic organizations, and other groups to participate in tree planting and maintenance.
- Educational materials about trees and other natural resources provided to schools, particularly grades three through ten.
- Arbor Day and Earth Day celebrations with the involvement of public officials and school children—as reminders of the importance of the community forest.
- Workshops on tree selection, planting, and care for community residents.
- Making commercial arborists and the utility company aware of community expectations for high quality work on public and private trees.
- Involve local stakeholders and decision makers in urban forestry. The number one reason people volunteer is because they are personally asked.
- Publicly acknowledge support from local businesses, utility companies, and other organizations for special projects.

4: Develop and Adopt a Tree Ordinance

A review of CBS documents found several issues not addressed in city code. An effective tree ordinance must serve three functions:

- Provide authority,
- Define responsibility, and
- Establish minimum standards for management and maintenance.

A tree ordinance suited to CBS should be written with a thorough understanding of the natural resource, cultural traditions, political-economic climate, and legal framework of the community. The inventory and UFMP can provide the basis for support and the need to develop an ordinance.

CONCLUSION

Community Forestry Consultants, Inc. and the Alaska Community Forestry Program have completed the assignment of evaluating and making recommendations regarding Sitka's community forest. This management plan provides the framework for a successful urban forestry program using the best management practices available in the urban forestry and arboriculture industries.

The plan should be considered a living, working document. The recommended objectives should be reviewed annually and adjusted for the following year. The entire document should be reviewed on a five- or ten-year basis to determine if management and urban forest conditions have changed significantly.

The recommendations will help conserve Sitka's trees, increase their value to the community, and sustain the tree canopy for future generations. The focus should go beyond the individual tree to trees throughout the city…..to the working community forest. 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 CBS today and tomorrow.

APPENDIX A – 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 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 planning.
http://www.greenlaws.lsu.edu/sitemanager.htm

U.S. Landscape Ordinances: An Annotated Reference Handbook
by Buck Abbey, D. Gail Abbey
This comprehensive reference brings together and explains the planning ordinances that govern the landscapes of 300 U.S. cities. The author demystifies the complex planning laws that regulate such areas as the design of parking lots, vehicular use areas, landscape buffers, and tree plantings.

Guide to Writing a City Tree Ordinance – Model Tree Ordinances for Louisiana Communities
http://www.greenlaws.lsu.edu/modeltree.htm

Developing a Successful Urban Tree Ordinance
Charles C. Weber, Alabama Forestry Commission

Tree City USA Bulletin #9 How to Write a Municipal Tree Ordinance.
Tree City USA Bulletin # 31 Tree Protection Ordinances
National Arbor Day Foundation
Contact the Alaska Community Forestry Program for a free copy (Stephen.nickel@alaska.gov)
http://www.arborday.org/programs/treecitybulletinsbrowse.cfm

Guidelines for developing urban forest practice ordinances Bell, P.C., Plamondon, 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

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. This is a guide for preparing new, or revising old, municipal tree ordinances.

General Code Publishers
www.generalcode.com/webcode2.html

American Legal Publishing Corporation
http://www.amlegal.com/library

LexisNexis Municipal Codes
http://municipalcodes.lexisnexis.com

Municipal Code Corporation
www.municode.com

Appendix B – Annual Community Tree Budget Worksheet

Annual Community Tree Budget Worksheet

Year:

Materials			
Trees *(Multiply number of trees ____by the average cost per tree $_____.)*	$		
Stakes, soil, mulch, fertilizer	$		
Pesticides/herbicides	$		
Computer inventory software	$		
Administrative and public education materials (copies, brochures, educational books)	$		
Other	$		
Materials subtotal		$	
Equipment and buildings use			
(Divide total cost by years of service life and add maintenance, utilities, and fuel costs.)	$		
Office space			
Equipment storage/building	$		
Climbing gear	$		
Pruning tools, chain saws, handsaws	$		
Trucks/aerial lifts, backhoe/front-end loader, leaf collection equipment, chipper, stump grinder	$		
Spray equipment	$		
Equipment rental (types _____)	$		
Other	$		
Equipment and building subtotal			$
Services (municipal, volunteer, and contracted)			
Salaries and fringe benefits *(based on % of employees' time spent working with trees)*	$		
Tree board volunteer time	$		
Labor (paid or volunteer) or total cost of services			
(When using volunteer labor, estimate the wage based on task.)	$		
Planting *(Multiply hours____by average wage $_____.)*			
Pruning *(Multiply hours____ by average wage $_____.)*	$		
Removal of trees and stumps *(Multiply hours____ by average wage $_____.)*	$		
Tree inventory *(Multiply hours____ by average wage $_____.)*	$		
Emergency storm damage cleanup *(Multiply hours____ by average wage $_____.)*	$		
Mulching, watering, fertilizing *(Multiply hours____ by average wage $_____.)*	$		
Leaf and branch cleanup *(Multiply hours____ by average wage $_____.)*	$		
Leaf composting *(Multiply hours____ by average wage $_____.)*	$		
Insect control *(Multiply hours____ by average wage $_____.)*	$		
Utility pruning and other services *(Obtain estimate from company and pro-rate per year.)*	$		
Consultant services	$		
Educational programs	$		
Delivery/transportation charges	$		
Administration: (permit review, grant writing, Arbor Day planning, site inspection, etc.)	$		
Memberships in tree organizations (ISA, SMA, etc.)	$		
Other	$		
Services subtotal			$
Other			
Unpaid insurance claims for damaged trees	$		
Grant funds expended, if not included above	$		
Total expenditures (Use this amount in Tree City USA formula.):			$

This fact sheet was prepared by Penn State with guidance from the Pennsylvania Urban and Community Forestry Council and support from the Pennsylvania Department of Environmental Resources (DER) Bureau of Forestry. 1995

APPENDIX C – Potential Trees for Sitka

The list below is composed of species that are not native to but may be hardy in Sitka. Diversification and willingness to try new species are the keys to a successful planting program. Choose specific cultivars with care as susceptibility to insects and diseases varies. Some hawthorns have severe blight in SE Alaska; select cultivars with demonstrated resistance. Avoid overuse of any one genus or species to discourage diseases and pests. For more information on trees, shrubs, and vines for Sitka, go to http://www.alaskaplants.org/.

Small Trees – Less than 25' mature height

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 of yellow and red in fall. Fragrant, but not showy flower. Very adaptable to a wide range of soils and tolerant of some shade.

Paperbark Maple
Acer griseum
Height: 20-30
Spread: 15-30
Hardiness: Zone 4
Small oval tree with low branching or multi-stemmed form; beautiful cinnamon-red exfoliating bark; blue-green trifoliate leaves turn red in fall; good winter aesthetics; tolerant of acid or alkaline soils with good drainage; good specimen tree or used in mass.

Full Moon Maple
Acer japonicum
Height: *15-20*
Spread: *15-25*
Hardiness: Zone 5
Small rounded tree; attractive green foliage divided into 7 to 11 irregularly serrated lobes; vibrant yellow and red fall colors; numerous deep red flowering corymbs in May. Needs sheltered location especially 'Aureum'. Grows as understory tree in its native range. Prefers moist, well-drained organic, acidic soil, full sun to partial shade.

Miyabe Maple
Acer miyabei
Height: 25-30'
Spread: 20-30'
Hardiness: -30
Upright oval to rounded tree; leaves are 3 to 5 lobed, dark green with a pale yellow fall color. Tolerates some dryness and prefers full sun. No serious pests; good choice for a small shade tree.

Pacific Sunset Shantung Maple
***Acer truncatum x A. platanoides* 'Warrenred'**
Height: 25'
Spread: 25'
Hardiness: -30
Upright, spreading, rounded crown tree with a regular branching pattern having dark green, glossy leaves and outstanding yellow-orange to bright red fall color; hardy tree with great potential for urban areas.

Autumn Brilliance Serviceberry (treeform)
***Amelanchier x grandiflora* 'Autumn Brilliance'**
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 (treeform)
***Amelanchier laevis* 'Cumulus'**
Height: 25'
Spread: 20'
Hardiness: -30
A serviceberry with a distinct upright and oval tree habit, fleecy white flowers in spring and a yellow to orange-scarlet fall color. Smooth gray bark.

American Hornbeam
Carpinus caroliniana
Height: 25'
Spread: 25'
Hardiness: -40
Small tree with irregular spreading habit and 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
Small, dense oval canopy 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
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
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.

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, with an informal outline. Leaves are thick, turning yellow in fall. White flowers are fragrant, 4-6 inches wide.

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.

Royal Star Magnolia
***Magnolia 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. Excellent ornamental tree for small sites.

Flowering Crabapples
***Malus* sp. (red/pink 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.

'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 that 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 and an abundance of white flowers make 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 are but a precursor to the golden fruits which adorn this tree through winter making it a show stopper.

'Professor Sprenger'
Height: 20'
Spread: 20'
Stark upright habit makes for a larger more stately 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, mark it 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.

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. Excellent selection for streets and landscapes, given size, color display and remarkable resistance to pests and disease.

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 to 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 yellow to red 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

Fraser Fir
Abies fraseri
Height: 30'-50'
Spread: 20-25
Hardiness: Zone 4
Needles dark green with a silvery underside; cones purplish at maturity; popular Christmas tree. Not tolerant of wind; prefers acidic, moist, well-drained soils; shade tolerant, especially as young trees, but grows best in full sun.

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. Be cautious of overuse.

Parkway Maple
***Acer plantanoides* 'Columnarbroad'**
Height: 40'
Spread: 25'
Hardiness: -40
Narrow oval form with a good central leader. Dark green leaves turn yellow in fall. Very hardy; excellent maple for city use due to its narrow shape and well behaved branching.

Emerald Queen Maple
***Acer plantanoides* 'Emerald Queen'**
Height: 50'
Spread: 40'
Hardiness: -30
Well shaped, dense, oval habit with upright spreading branches; green-leaves. Tolerates environmental extremes; yellow fall color.

Superform Maple
***Acer plantanoides* 'Superform'**
Height: 45'
Spread: 40'
Hardiness: -30
Broadly oval to rounded form. This tree was selected for its symmetrical and uniform growth. Leaves are green with yellow fall color. The trunk is straight and develops 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. Adaptable to a variety of environmental conditions, poor soils and exposed sites. 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 used 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. 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
One of the best red maple cultivars; vigorous, symmetrical growth, developing into pyramidal to oval form. 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. Thrives near water and performs well in poor soils. Good alternative to willows and other poplars. The 'Pyramidalis' cultivar has an excellent narrow form suited to confined spaces.

European Hornbeam
Carpinus betulus
Height: 25 - 40'
Spread: 25 - 35'
Hardiness: -20
Pyramidal shape, dense, dark green leaves. Fall color is usually yellow but during cold winters can turn dark red. Heat and drought resistant. 'Fastigiata'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 between cultivars. It is said that the right cultivar of this tree can enhance any landscape. When planting lower branching trees 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
Variety of forms, usually oval. Bark is grayish-brown aging with diamond furrows with slender ridges. Leaves are pinnately compound in a range of greens and varied fall colors. Most cultivars selected or bred with disease and pest resistant characteristics. Widely used; good for urban plantings.
'Autumn Purple'
Rounded habit, purple fall color.
'Champaign County'
Dense oval habit, yellow fall color. Thick trunk and strong branches.
'**Rosehill'**
Upright oval, bronze/red fall color. Strong central leader.

Green Ash
Fraxinus pennsylvanica
Height: 45 - 50'
Spread: 25 - 35'
Hardiness: -30
Variety of forms, usually oval. Bark is grayish-brown aging with diamond furrows with slender ridges. Leaves in a range of greens and yellow fall color. Cultivars selected or bred with disease and pest resistant characteristics, Tendency towards irregular growth has been reduced. Widely used; good for urban plantings.
'Bergeson'
Strong, upright growth, oval. Tends to be smaller.
'Cimmaron'
Narrow oval. 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. Most marketed trees are male due to the offensive smell of fruit. Uniquely lobed leaves bright green on both sides, changing to golden yellow in fall; outlived most of its pests.

'Autumn Gold'
Uniform and balanced pyramidal tree; spreads 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 cultivars listed.

American Hophornbeam
Ostrya viginiana
Height: 30 - 45'
Spread: 25'
Hardiness: -30
Rounded oval shape; slender branches, sometimes arch up or down. Leaves are bright green; turn yellow to brown in fall often persisting for 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 are lustrous green with a brief display of yellow or bronze in fall. Bark of mature trees is unusual and quite striking. Remarkably free of pests, pH adaptable, drought and pollution tolerant; 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
Changes from pyramidal to rounded outline at maturity. Leaves differing from other mountain ash, 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 especially in urban areas. Leaves 4 to 8 inches long and wide in a range of greens. Bark is gray to brown with narrow lateral furrows. Wood is soft and easily prunes but elastic enough to handle most weather extremes. Blocks sun in its shadow so place appropriately.
'Boulevard'
Dense, narrow, pyramidal with ascending branches. Yellow in fall.
'Legend'
Rounded pyramidal habit, yellow fall color.
'Lincoln'
Slender, upright, compact form with light green leaves, 25' by 15' in 25 years.
'Redmond'
Full pyramidal form, uniform with large leaves and red branches provide winter interest.

Littleleaf Linden
Tilia cordata
Height: 40 - 45'
Spread: 45'
Hardiness: -30
Pyramidal, rounding with maturity. Leaves are smaller than *T. americana*, 2 to 3 inches long and wide, (except Glenleven) finely serrated and yellow in fall. Trunks are usually straight and bark smooth. Likes well drained alkali soils, but pH adaptable and tolerates pollution. 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, rise 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 green 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, mature bark has white ridges and gray furrows. Fruit debris may be a nuisance. Prefers moist, rich, deep soils of bottomlands. Use as boulevard and park tree.

Medium Trees – 50' or taller at mature height

Grand Fir
Abies grandis
Height: 60-100
Spread: 25-30
Hardiness: Zone 4
Beautiful symmetrical tree; thick-foliage is deep shiny green; strong, orange/citrusy fragrance

Subalpine Fir
Abies lasciocarpa
Height: 60-75
Spread: 15-20
Hardiness: Zone 3
Grayish-green needles with pale midrib; stiff branches; symmetrical form; young cones purple, and may be retained several years. Tolerates a variety of soil types; somewhat shade tolerant.

Black Maple
Acer nigrum
Height: 60 - 75'
Spread: 40 - 55'
Hardiness: -25
Similar to sugar maple with darker green leaves that tend to look droopy. Fall color is consistently in shades of yellow. Some say black maple can survive harsher conditions than sugar maple.
'Green Column'
Upright narrow oval, 20' spread; great fall color.

Sugar Maple
Acer saccharum
Height: 60 - 75'
Spread: 40 - 55'
Hardiness: -25
Tree branches upright developing into a large oval to rounded canopy. Foliage is medium green turning bright yellow and burnt orange with red tones in fall. Use in large lawns, parks and islands of green, avoid confined or pollution prone sites.
'Green Mountain'
Broadly oval; very cold tolerant; reliable fall color.
'Commemoration'
Oval to rounded; thick, dark green leaves.
'Endowment'
Columnar form; well suited for small urban sites.
'Legacy'
Very symmetrical form; thick stem and branches; drought tolerant.

Tulip Tree
Liriodendron tulipifera
Height: 70 - 90'
Spread: 35 - 50'
Hardiness: -20
Tree develops quickly with a tall straight trunk; several large sinuous branches develop a narrow oval frame. The leaves are tulip like, medium green changing to yellow and golden in autumn.

Black Walnut
Juglans nigra
Height: 50 - 75' (100')
Spread: 50 - 75'
Hardiness: -20
Develops a rounded well formed crown devoid of branches one- to two-thirds up the tree. Leaves are finer than butternut and less furry. Bark is brown to grayish black and roughly diamond shaped. May inhibit the growth of other plants nearby. Tolerates dry conditions Useful on streets where ground clearance is needed but best in parks due to dropping fruit.

Cucumbertree Magnolia
Magnolia acuminata
Height: 50 - 80'
Spread: 40 - 80'
Hardiness: -25
Pyramidal when young, aging to a broad-rounded outline with massive spreading branches often arching towards the ground. Dark green foliage; flowers smaller than some magnolias but abundant. Use in parks, golf courses and open areas where it has room to spread.

Dawn Redwood
Metasequoia glyptostroboides
Height: 60 - 100'
Spread: 25 - 40'
Hardiness: -20
Deciduous conifer, tall pyramidal or conical. Large basal spread. Bright green foliage, renewed each year. Rapid growth; tolerates wet sites if drainage is good. In winter the skeletal frame of larger trees is starkly majestic. Definitely needs large space to reach mature size.

Bloodgood London Planetree
***Platanus x acerifolia* 'Bloodgood'**
Height: 50 - 80'
Spread: 40 - 60'
Hardiness: -15
Broadly pyramidal, rounding with thick spreading branches at maturity. Large basal spread. Large maple like leaves turn yellow in fall. Peeling bark creates a brown/cream mottling with year round interest. Better resistance to anthracnose disease than other sycamores but may be a problem if over used.

White Oak
Quercus alba
Height: 60 - 80'
Spread: 50 - 70'
Hardiness: -30
Pyramidal, maturing to a broad, majestic crown. Leaves bluntly lobed, dark green to blue-green; fall color varies from brown to red. A challenge to transplant and establish but worth the effort.

Swamp White Oak
Quercus bicolor
Height: 50-60
Spread: 50-60
Hardiness: Zone 3
Grayish-brown flaky bark; acorns in fall; grows in damp soil.

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

Red Oak
Quercus rubra
Height 60-75
Spread: 60-75
Hardiness: Zone 4
Rounded form; leaves 5-9" long with 7 to 11 pointed lobes, brown to red fall color; fruit is medium brown acorn with flat cap; bark is smooth dark brown to black, ridged when mature; shallow root structure, negligible taproot. Prefers sun and wet soils but tolerates a variety of soils and some shade. In the wild often found in wet areas in partial shade. Fast growing.

APPENDIX D – Tree Species Recorded in the City & Borough of Sitka Inventory

	Common Name	Botanical Name
1.	Subalpine fir	*Abies lasiocarpa*
2.	Vine maple	*Acer circinatum*
3.	Paperbark maple	*Acer griseum*
4.	Japanese maple	*Acer palmatum*
5.	Norway maple	*Acer platanoides*
6.	Red maple	*Acer rubrum*
7.	Red alder	*Alnus rubra*
8.	Katsuratree	*Cercidiphyllum japonicum*
9.	Hawthorn	*Crataegus species*
10.	Alaska yellow cedar	*Cupressus nootkatensis*
11.	European beech	*Fagus sylvatica*
12.	European ash	*Fraxinus excelsior*
13.	Green ash	*Fraxinus pennsylvanica*
14.	Goldenchain tree	*Laburnum x watereri*
15.	Crabapple species	*Malus species*
16.	Apple	*Malus species apple*
17.	Dawn redwood	*Metasequoia glyptostroboides*
18.	Norway spruce	*Picea abies*
19.	White spruce	*Picea glauca*
20.	Serbian spruce	*Picea omorika*
21.	Sitka spruce	*Picea sitchensis*
22.	Bristlecone pine	*Pinus aristata*
23.	Lodgepole pine	*Pinus contorta*
24.	Limber pine	*Pinus flexilis*
25.	Austrian pine	*Pinus nigra*
26.	White pine	*Pinus strobus*
27.	Black cottonwood,	*Populus trichocarpa*
28.	Cherry	*Prunus cerasus*
29.	Sargent cherry	*Prunus sargentii*
30.	Japanese cherry	*Prunus serrulata kwanzan*
31.	Plum species	*Prunus species*
32.	Douglas fir	*Pseudotsuga menziesii*
33.	Black oak,	*Quercus velutina*
34.	Willow	*Salix species*
35.	European mountain ash,	*Sorbus aucuparia*
36.	Eastern arborvitae,	*Thuja occidentalis*
37.	Western red cedar	*Thuja plicata*
38.	American linden	*Tilia americana*
39.	Littleleaf linden	*Tilia cordata*
40.	Western hemlock	*Tsuga heterophylla*
41.	Mountain hemlock	*Tsuga mertensiana*

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