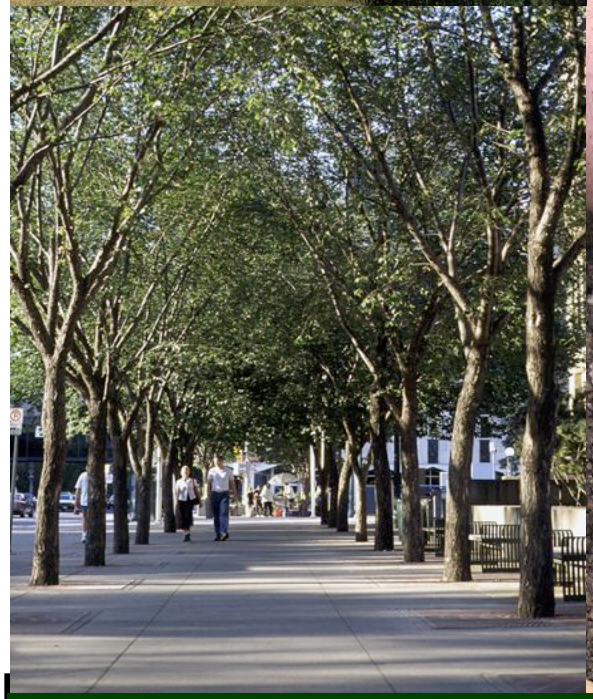

CALGARY…
A CITY OF TREES

Parks Urban Forest Strategic Plan

June 2007

www.calgary.ca/parks call 3-1-1

THE CITY OF CALGARY
Proudly serving a great city

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Photographer: Jason Cheever

"Great Horned Owl"

The ultimate goal of the urban forestry program is to achieve a sustainable urban forest.

Growing and maintaining Calgary's urban forest is the responsibility of the City of Calgary Parks. Parks provides and maintains the integrity of a high-quality, diverse park and open space system, which protects and enhances the urban forest and natural environment areas.

Treed View of Downtown Calgary

1. Executive Summary

Trees have never been more important to our healthy survival - on a global, national and local level. Urban trees provide social, environmental, economical, and aesthetic benefits. From sustaining our city, to protecting our health, trees affect much of the life on earth.

"Calgarians recognize and appreciate that parks, the urban forest and natural areas are significant to the environmental quality and the recreational fabric of Calgary. Trees serve to define the long term character of the city as a whole and the individual communities within it" (The City of Calgary, Open Space Plan).

Calgary's climate does not naturally support trees. To achieve and maintain a healthy sustainable urban forest, it is critical The City of Calgary, businesses, and homeowners plant the right trees - in the right place - in the right way - and then apply active, consistent and continuing management. The Parks Urban Forest Strategic Plan (UFSP) sets the framework for City staff and community partners to make smart decisions by providing the vision, values, outcomes, policies, and strategies needed to be successful.

The focus of urban forestry in the City of Calgary has changed over the last two decades from establishing the urban forestry program to now ensuring that both the program and the forest are sustainable. There are many new pressures on the health and sustainability of the urban forest and significant work has been undertaken to address these pressures. The approval of new residential street tree standards, the establishment of a new tree protection bylaw, the introduction of injection and barrier traps to manage pests, the introduction of watering bags and drip irrigation to water trees, and the establishment of the poplar life-cycle program are all examples of recent successes. There has also been significant involvement of the community in building and growing the urban forest through such municipal programs as the Community Model Forest, Neighbourwoods, the BirthPlace Forests, and ForEver Green.

Success will ultimately be achieved when we realize the following shared outcomes:

- Our trees are in good health;
- The urban forest is sustainable;
- The urban forest provides benefits to the community, is valued and respected; and
- There is a collaborative approach to building the urban forest.

In this plan are 15 guiding principles that provide the philosophical context for the outcome-based policies, strategies, and key action steps. Our approach to addressing these principles and achieving our outcomes is organized into three focus areas:

1. Achieve and Maintain Healthy Trees – Ensure the health of individual trees and shrubs and emphasize the overall health of the entire tree population. The urban forest asset must be managed by best practices that optimize tree health coupled with a detailed understanding of a tree's lifecycle. The urban forest must be cared for through a planned routine maintenance program. The sustainability of the forest is achieved through inspection of tree health and structure, preservation of trees during development and redevelopment, selection of proper species and sites, and ensuring the quality of planting stock.

2. Collaborate with the Community – A shared vision and support of the community is critical for creating and maintaining a sustainable urban forest on both public and private land. The City of Calgary recognizes it must build links, partnerships, and education programs that engage the public and other stakeholders in the stewardship and management of trees on public land. Since many urban trees are on private property, the actions of residents, commercial enterprises, and institutions are key influencers of urban forest sustainability.

3. Resource to Manage and Measure the Asset –The final critical element of a sustainable urban forest is adequate resources for the required tasks. Resources such as funding, skilled work forces in both the private and public sector, technical expertise, and an effective regulatory framework are necessary. It is also essential to measure and monitor change in the urban forest and provide the ability to adapt or adjust the program based on the evaluation and results. Essential tools required to "do the job right" include operational and strategic plans, skills, technology, standards, and performance measures.

In addition, this plan identifies high-level practices and targets to help achieve and measure our success. The plan has a 10-year implementation focus but its implications will go far beyond that period. Decisions made today about the urban forest have a huge impact on future generations and future decision making.

The City of Calgary Parks provides and supports environmental stewardship, education, programs and services that lead to:

An improved *quality of life* for all Calgarians – encouraging healthy lifestyles, supporting a sense of well-being, bringing people together and building strong communities that are accessible to everyone.

A strong, sustainable, livable city - protecting sensitive environments, encouraging bio-diversity, improving water and air quality and promoting environmental stewardship.

An enhanced image of our city – attracting business and tourism, and encouraging community pride.

"*The urban forest requires active and consistent and continuing management. The accrual of net benefits can only occur when adequate and reasonable care is provided.*"
The City of Calgary Open Space Plan, 2002

"When I first visited Calgary in September 1883, I was impressed with the possibilities of making it a City of trees…"

William Pearce
Letter to Mayor, Commissioner and Council of the City of Calgary
12 March 1918

2. Introduction

Calgary's urban forest is a remarkable achievement given that the city is located in an arid climate that doesn't naturally support trees. Historic photographs of Calgary show a landscape largely devoid of trees. The urban forest we have today is much closer to the "city of trees" envisioned by William Pearce in the 1890s. It is the result of the commitment of successive generations of Calgarians to planning, caring for, and protecting the forest. As early as 1899, Calgary City Council realized the importance of trees to the citizens, passed the first tree protection bylaw, and promoted tree planting within the city limits. Today, The City of Calgary Parks provides leadership, both within the Corporation and to the public, on the stewardship and long-term sustainability of Calgary's urban forest.

Step ahead half a century and imagine …

- As we look around, there is a balance between the built grey infrastructure and the living green infrastructure that makes Calgary a great place to live, work, and play.
- As we travel down a busy roadway we see the beauty of trees and when we reach our own community, trees line the streets. Healthy, vibrant trees, reflecting a wide variety of types and ages, enhance the vistas.
- Our business districts are welcoming and our public spaces reflect the prosperity of the community and the value citizens' place on trees in urban settings.
- People are walking, jogging, and cycling for pleasure and relaxation on neighborhood streets, parks, and pathways lined by trees providing shade and a sense of well being.
- We value the history and heritage that community trees represent.
- We protect nature and provide habitat and safe passage for a wide variety of wildlife.
- We carefully select, plant, and grow trees using the best practices and management techniques.
- We understand the interdependencies between citizens, communities, economies and ecosystems.
- Visitors to the city immediately sense an attractive inviting city with vibrant parks and open spaces.
- The community is involved in building the urban forest… schools, businesses, corporations, and families all are participating.

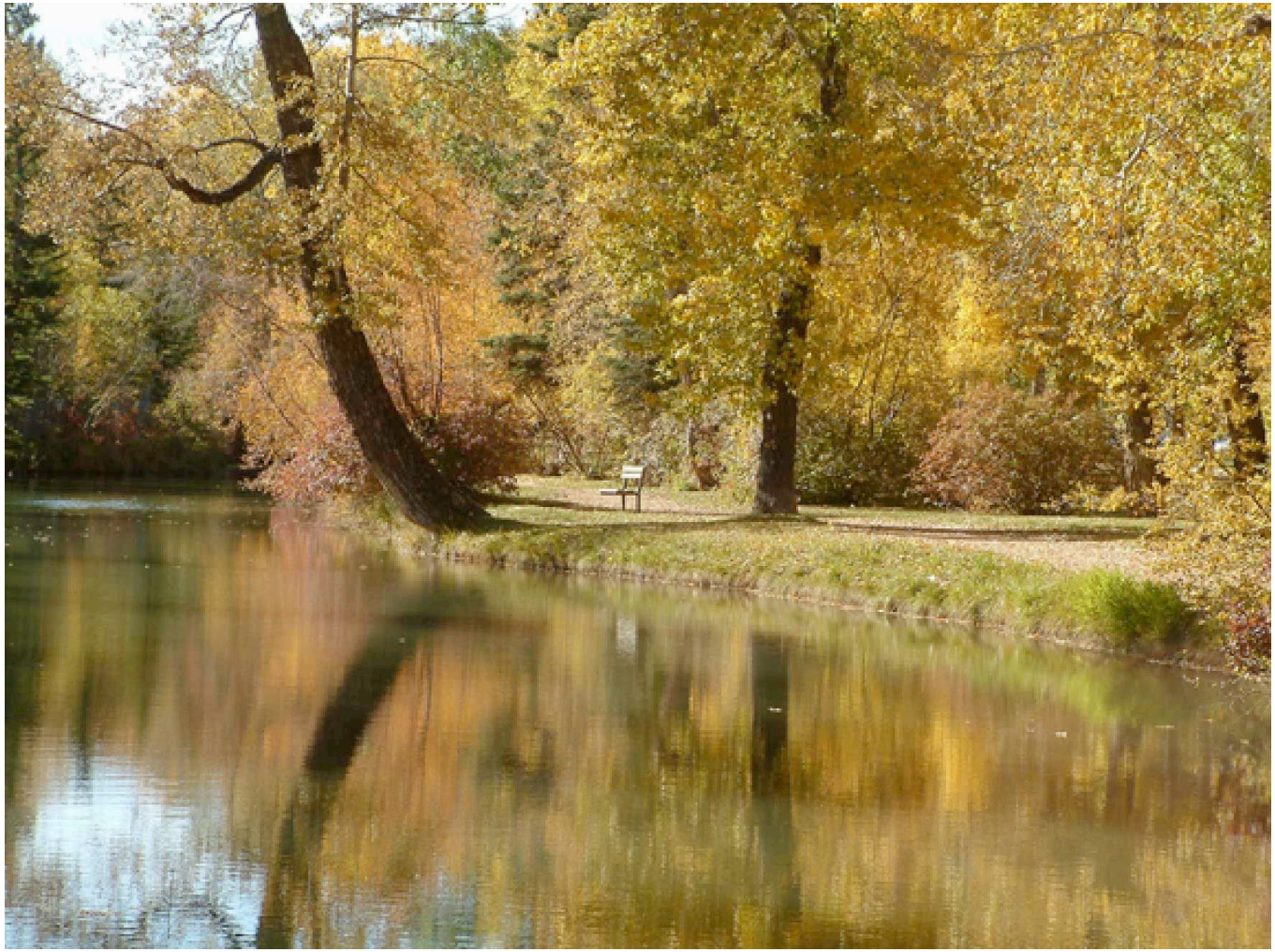
About the Plan

The Parks Urban Forest Strategic Plan (UFSP) provides vision and strategic direction for the growth, sustainability, preservation, and enhancement of the urban forest. It also provides common outcomes and principles for The City and its partners. The intent of this document is to drive future urban forest decision-making, to ensure a consistent, practical approach to the management and practices, and to realize our vision.

The UFSP is a non-statutory plan, approved by City Council and is aligned with Council's 2006 Priorities, the 2002 Calgary Open Space Plan and the Parks Water Management Strategic Plan.

Although, the focus of this plan is the urban forest on land owned or controlled by The City of Calgary, trees on private land are an important part of the urban forest and many of the same principles and strategies apply.

The Parks Urban Forest Strategic Plan framework, as illustrated in Appendix 2, demonstrates the relationships, flow, and intent of the various parts of the plan.



The City of Calgary, Parks Urban Forest Strategic Plan, 2007

Calgary's Growing Tree Population

170,000 roadway trees

190,000 park trees

1,000,000 residential trees

7,000,000 native trees

"Increased tourism, savings in waste and water treatment, savings in health care costs due to healthier citizens, and the city's ability to attract new businesses and skilled labour all flow from Calgary's vibrant natural capital. It makes good business sense for us to value and protect out parks, rivers, forests and grasslands."

Todd Hirch, Calgary's Natural Assets, CALGARYINC, April 2006

Effects of Roadside Character on Drivers' Stress Levels

Drivers who continuously view built-up strip mall environments are slower to recover from stressful situations. Drivers viewing natural environments such as forests or golf courses are quicker to recover from stressful situations.

Adapted from Tree Link, Number 19, Summer, 2001, Washington State Department of Natural Resources

3. The Importance of Trees

Trees are a valuable part of our communities. Not only are they beautiful, but they add color to a vista, provide privacy and security, and add a sense of serenity and character to our surroundings. Trees clean the air, reduce storm water runoff and erosion, save energy, create wildlife habitat, and generally contribute to the quality of life of residents.

Urban trees require our help to reach a size where they can provide benefits to society. These benefits far outweigh the costs associated with caring for these trees, as our urban forest provides valuable environmental, economic, aesthetic, social, and historic benefits to our community.

Table 3.1 Urban Forest's Environmental Benefits

Total Carbon Storage	400,000 tons
Net Sequestration	16,980 tons

Urban Forest's Annual Air Pollution Removal

Pollutant	Quantity Removed	Value
Particulate	194 tons	$1,165,000
Ozone	171 tons	$ 875,000
Nitrogen Dioxide	97 tons	$ 655,000
Sulfur Dioxide	29 tons	$ 48,000
Carbon Monoxide	11 tons	$ 11,000
Total Air Pollution Removal	502 tons	$2,745,000

US Forest Service Urban Forests Effects Model: Calgary Study - 1998

4. Calgary's Urban Forest - Present and Future

The urban forest in Calgary includes all trees and associated vegetative understory including all trees and shrubs intentionally planted, naturally occurring, or accidentally seeded. Trees found in parks, river valleys, streets, roadways, natural environment parks, and commercial and private lands are all part of the urban forest. The City of Calgary, through Parks, has played a fundamental role in the growth and management of the urban forest since its inception.

The success of the urban forest is remarkable because Calgary is located in an arid climate that does not naturally support trees. Calgary's temperatures can fluctuate rapidly throughout the year. Annual precipitation is low and droughts occur. Chinook winds are a distinctive feature of the local climate and these winds have a dramatic impact on the range of vegetation that is able to survive in Calgary. Warm, dry chinook air causes trees to lose moisture that cannot be replaced when the soil is dry or frozen during the winter months. Trees and other plants, unable to thrive in the presence of rapid temperature fluctuations and drought conditions, are generally unable to survive in Calgary. These conditions dramatically limit the range of vegetation that can be grown in Calgary without human intervention.

The once virtually treeless landscape now incorporates trees and shrubs. The current urban forest is the result of the commitment of successive generations of residents to planning, caring for, and protecting the forest. Early pictures of Calgary show a landscape devoid of trees. Over time, the landscape within the city has been completely modified from its original form.

Much of the credit for interest in planting trees in the city must go to William Pearce. He developed an experimental farm and irrigation system and encouraged people to come see his operation and progress. As early as 1887, Pearce encouraged the public to improve the appearance of the city through the planting of trees and his home, now know as the Pearce Estates, remains a public centre.

Interest in the urban forest has grown along with the city and The City of Calgary has played a fundamental role in growing the urban forest since its inception. Until now, the growth and development of the urban forest has been guided by the Urban Forest Management Policy and Implementation Strategies for the City of Calgary (1988). This document outlined policy and targets for the establishment of a formalized urban forestry program within the City of Calgary. The last major directive of the 1988 plan was completed in 2001, with the centralization of the Urban Forestry program within Parks.

Among the most valuable trees in Calgary is a pair of American elm in Rideau Park appraised at $33,000 each.

The total value of the urban forest in Calgary based on groomed parks and along roadways is estimated to be more than $400 million dollars.

Calgary's canopy cover is now 7%.

With the completion of the 1988 plan, the Park's Urban Forestry program has shifted its focus from program establishment to program sustainability, developing new approaches and processes to address changing demands and pressures on the forest population. These new pressures include the need to protect trees during development, to control new pests and diseases impacting forest health, to conserve water and resources, to manage aging segments of the tree population, and to manage greater citizen interest and involvement as well as unprecedented urban growth and development.

Significant work has been undertaken to address these pressures. Council approved the Tree Protection Bylaw (23M2002) with the aim of protecting Public trees impacted by development. New low environmental impact techniques and products such as injection and barrier traps have been deployed to manage forest pests. More effective methods of watering trees such as tree watering bags and drip irrigation systems are now in common use. The poplar tree population is systematically managed though a life-cycle program, which aims to maintain the quality of life provided by the urban forest in communities through a program of planned removal and replacement. Perhaps the most important program change since 2001 has been involving the community in building and caring for the urban forest. Some of the best examples of community involvement initiatives are partnership tree planting programs such as BirthPlace Forest program and ForEver Green programs, as well as the community tree stewardship programs, Neighbourwoods, and Community Model Forests.

Today, the urban forest continues to be a defining factor of the cityscape. Challenges in the management of Calgary's urban forest lie ahead. The growth of the urban forest has paralleled the growth of the city. The unprecedented pace of this growth in recent years has affected the ability of The City to ensure a sustainable forest for the long term. New policies are needed to rationalize the course of action by The City so that residents can continue to reap the social, economic, and environmental benefits of the urban forest.

Forest within Calgary (UFORE 1998)

Land Use	Estimated Trees	Canopy Cover (% land use)
Low density residential	940,000	10.8
Medium density residential	69,000	14.1
Direct control	320,000	5.6
Industrial	55,000	1.8
Commercial	29,000	6.4
Institutional	830,000	15.3
Agricultural	109,000	7.0
Urban Reserve	7,795,000	5.4
Recreational	1,738,000	7.8

Sustainability *"is the enhancement of human wellbeing by using, developing and protecting resources at a rate and in a manner that enables people to meet their current needs while also providing future generations with the means to meet their needs while simultaneously meeting environmental, economic and community aspirations."*

- The Society of American Foresters

The Future

The life of an urban forest is measured in decades and centuries, not years and decisions made now, it will come to fruition years into the future. In order to achieve a long-lived and sustainable urban forest, a shared vision is essential. New management practices are being developed across North America and around the world as cities place increasing social, environmental, and economic value on forests. A comprehensive management strategy is needed to support and guide The City of Calgary Parks as it continues the work underway, plans for new programs, and directs the future growth of the urban forest.

Policy Challenges

The rapid growth of Calgary and the renewed climate of awareness of environmental management have presented new challenges. If changes are not made to meet the challenges, there will be erosion in the size and health of Calgary's urban forest. We need to manage the more intense use of urbanized open space, natural areas, and parks. New challenges include the:

1. Declining number of large trees;
2. Growing gap between supply and demand for trees;
3. Increasing negative impact on tree health from drought;
4. Increasing development pressures on the urban forest;
5. Increasing use of reactive (rather than proactive) planning measures; and
6. Multifaceted ownership of trees and the City's limited authority over private trees.

Policy Alignments

The development of policies aimed at ensuring long-term sustainability must consider the outcomes of similar initiatives completed or underway. Some of the recent work considered includes:

1. **SMART GROWTH**
   Smart Growth is planned expansion and development that serves the community, the economy, and the environment. Many sustainable urban forest principles, policies, and practices are compatible with, and directly support the principles of, Smart Growth.

2. **TRIPLE BOTTOM LINE**
   Calgary's City Council adopted the Triple Bottom Line Policy in September 2005. This policy directs that municipal administration analyze and ensure the economic, environmental, and social value of their policies and programs. The Parks Urban Forest Strategic Plan contributes to the triple bottom line by providing environmental benefits such as clean air, reduced carbon emissions, and sustainable wildlife

habitat. Socially, trees provide communities with a distinct character and provide aesthetic, psychological, and recreational benefits. From an economic perspective, trees add to property values, save energy costs, and create an enhanced civic image that attracts economic activity and tourism.

3. COUNCIL'S PRIORITIES - 2006-2008 LOOKING AHEAD MOVING FORWARD

The outcomes, principles, and policies of the UFSP directly support the achievement of several Council Priorities including: building a great city; improving mobility; delivering accessible municipal services; strengthening Calgary's voice; and, enhancing, protecting, and respecting our environment.

4. OTHER EXISTING CITY POLICIES

a. Land Use Bylaw
b. City Centre Open Space Management Plan
c. Open Space Strategy for Established Communities
d. Open Space Plan

5. Shared Values, Vision, and Outcomes

In today's business world, a strategic framework is necessary to achieve significant success. The Parks Business Unit works to create and sustain a vibrant, healthy, safe, and caring community as a planner, protector, facilitator, educator, and provider of parks and open space. Our shared values shape our actions; our outcomes describe the result or change we want to see. Our values and outcomes, together with our vision, provide the foundation for our approach.

Shared Values

1. **HEALTHY PEOPLE, ENVIRONMENT, AND COMMUNITIES** – We respect and understand the interdependencies between citizens, communities, and ecosystems.
2. **SAFE AND SECURE EXPERIENCES FOR CALGARIANS AND STAFF** – We ensure that the urban forest risk is managed and potential conflicts reduced.
3. **SHARED STEWARDSHIP** – We promote proud, caring, effective, and inclusive community involvement in the meaningful planning, learning, and management of limited community resources to ensure a healthy urban forest.
4. **ACCOUNTABILITY AND THE BEST USE OF RESOURCES** – We use an open, committed, strategic, outcome-based approach that manages financial, human, and natural resources efficiently and effectively.
5. **SUSTAINABILITY** – We promote long-term practices and high standards of excellence that include a meaningful role and connection for all Calgarians in caring for our urban forest – good decisions for today and tomorrow.
6. **KNOWLEDGE AND EDUCATION** – We employ an innovative, continuous improvement and best practice approach to urban forest management and service.
7. **QUALITY OF LIFE** – We believe that a healthy, well-managed urban forest provides psychological, social, economic, environmental, and aesthetic benefits to the community and promotes great public spaces and place - enriching lives and providing an attractive, livable city of Calgary.

Shared Vision

Calgary's urban forest is a sustainable asset contributing to the environmental, social, and economic wellbeing of current and future generations.

Shared Outcomes

1. **A HEALTHY URBAN FOREST** - Trees in good health, able to withstand drought and pests and achieve a long life span.
2. **A SUSTAINABLE URBAN FOREST** - A diversity of species, types, and ages of trees in every community.
3. **A BENEFICIAL URBAN FOREST** - The urban forest makes a positive contribution to the community aesthetics, social, environmental, and economic progress.
4. **A VALUED URBAN FOREST** - The urban forest is an essential component of Calgary's overall infrastructure and is valued and respected by the community.
5. **A COLLABORATIVE APPROACH TO BUILDING AND CARING FOR OUR URBAN FOREST** - There is an increase in urban forest partnerships and networks resulting in an urban forest that is built and fostered together.

6. Our Approach

The City of Calgary Parks' approach to achieve urban forest sustainability focuses on three primary areas, as illustrated in figure 1 (page 19).

1. ACHIEVE AND MAINTAIN HEALTHY TREES

The first focus area in maintaining a sustainable urban forest is ensuring the health of individual trees and shrubs as well as emphasizing the overall health of the entire tree population. The forest asset must be managed by best practices that optimize tree health and cared for through a planned routine maintenance program, coupled with a detailed understanding of tree life cycles. The sustainability of the forest is achieved through inspection of tree health and structure, preservation of trees during development and redevelopment, proper species and site selection, and ensuring the high quality of planting stock.

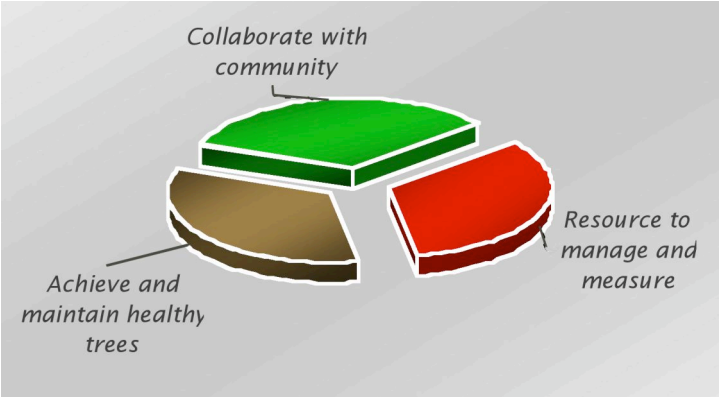
2. COLLABORATE WITH THE COMMUNITY

A shared vision and support of the community is critical for creating and maintaining a sustainable urban forest on both public and private land. The City of Calgary recognizes it must build links, partnerships, and education programs that engage the public and other stakeholders in the stewardship and management of trees on public land. Since many urban trees are on private property, the actions of residents, commercial enterprises, and institutions are key influencers of urban forest sustainability.

3. RESOURCE TO MANAGE AND MEASURE THE ASSET

The final critical element of a sustainable urban forest is adequate resourcing for the required tasks. Resources such as funding, skilled work forces in both the private and public sector, technical expertise, and an effective regulatory framework are necessary. It is also essential to measure and monitor change in the urban forest and provide the ability to adapt or adjust the program based on the evaluation and results. Essential tools required to "do the job right" include operational and strategic plans, skills, technology, standards, and performance measures.

Figure 1.
Urban Forest
Sustainability



"…Thousands of today's homeowners have personally experienced the difficulties of successful tree planting, and appreciate how long it takes to produce a good tree.

With this in grained knowledge it is hoped that Calgarians will jealously guard, and defend the heritage of mature trees in this city." - Morris Barraclough, From Prairie to Park, Century Calgary Publications, 1975.

7. Guiding Principles and Policies

The principles and policies will guide the actions of The City of Calgary (Parks and other City business units) and its partners – both community based, not-for-profit organizations, and private, for-profit corporations.

Organized under the three focus areas of a sustainable urban forest, the **Guiding Principles** are statements of intent that guide the planning, planting, and maintenance and preservation of trees. They provide a philosophical context for the outcome-based policies and key action steps.

ACHIEVE AND MAINTAIN A HEALTHY TREE RESOURCE

Healthy trees are the first focus area in achieving a sustainable urban forest; without trees there is no forest. The life span of trees in the urban forest is limited by growing conditions and selection of planting locations. Tree planting and landscaping must take into account soil moisture availability and management, rooting and growing volume, hardiness and appropriateness of species, ecological niche, species diversity, and expected longevity.

PRINCIPLE 1: MANAGE TREES IN GROOMED PARKS, NATURAL ENVIRONMENT PARKS AND ROADWAYS FOR HEALTH, SAFETY, AND FUNCTION

Strategy 1.1: Maintain Tree Health

Maintaining tree health means growing the urban forest in a way that improves longevity, thereby allowing the tree to provide maximal benefits. One of the ways to achieve longer tree life is to ensure that good growing conditions exist. These conditions include good, thoughtful design and site consideration, stocking and planting techniques, and establishment care. These conditions are important to all parties engaged in planting and establishing the urban forest. They apply to the planting and maintenance of trees by the developer in new developments, by The City along roadways and in parks, and by property owners' trees on private land.

There are 360,000 trees planted on roadways and in groomed parks in Calgary. It is anticipated, that on an average, 3% of the trees in an urban forest can be expected to die annually.

Trees are pruned to remove dead branches, insect and disease infestation, and to improve tree health and structure. Trees are also pruned for visibility and public safety. The City of Calgary Parks' Urban Forestry section's pruning program has two main approaches to pruning: planned and reactive. Planned pruning is a systematic program, which is carried out on a cyclic basis over a period of several years. The frequency of pruning varies with the age, condition and species. Typically, trees are pruned to a standard that takes into account clearances, visibility, risk management and overall tree health and structure. Reactive pruning is typically in response to citizen or safety needs. Often, only a portion of the tree is pruned, to address a specific concern such as a broken branch or to clear a utility line, sidewalk, traffic sign, or control device.

The Urban Forestry section also provides other arboricultural services such as tree risk assessment, pest monitoring, tree fertilization, soil amendment, and structural reinforcement.

Practices:

Maintain the health and safety of existing trees through a program of tree health care, pruning and removal.

Trees are pruned for the following reasons: overhead utility clearance, public safety, tree health, and tree structure.

Strategy 1.2: Ensure Public Safety and Liability

One of the primary reasons for the existence of the urban forest program is managing public safety. Policies and definitions are required to direct the swiftness and degree of response. The Urban Forestry section also needs to have a planned, consistent program of risk inspection and mitigation. Examples of significant tree risks are traffic visibility and sign and signal obstruction and catastrophic tree structurally failure.

Policy 1: In an emergency situation where trees are threatened or pose a public safety hazard, the Director of The City of Calgary Parks (in consultation with the Director of Roads as required) shall have the authority to cancel events and/or close parks, pathways, roadways or other public spaces.

Practices:

Emergency public tree hazards are mitigated within 24 hours of being reported to Urban Forest personnel.

Respond to urgent public tree hazards within 7 days of being determined by Urban Forest personnel.

Annually inspect 20% of all trees over 20 cm in diameter in groomed parks and roadways for safety, health and structure.

PRINCIPLE 2: PRESERVE THE EXISTING FOREST

Strategy 2.1: Healthy Trees are Generally Not Removed

Trees in the natural forest fall randomly and unpredictably as a result of natural forces. The “falling of trees” in the urban forest must be managed because of the risk of injury and property damage.

Policies and standards are required to determine when a tree shall be removed from City land. Currently, Council allows the removal of trees that are dead, severely diseased or otherwise hazardous, and, on an opportunity basis, of severely pruned trees in conflict with overhead electrical lines. In principle, trees should be replanted in a suitable location close to where they were removed.

Policy 2: When there are no reasonable alternatives, public trees may be removed for the following reasons:

- Public safety such as un-repairable structural defects, traffic visibility and safety setbacks;
- Tree is dead or in declining health or harbors a declared pest;
- Tree has a condition rating of less than 40%;
- Tree has less than 5 years of safe useful life remaining;
- Utility repairs, overhead utility clearance or a repeated history of utility conflicts;
- Capital construction of roads and utility infrastructure with compensation for loss of assets;
- Private development where there are no reasonable alternatives and provided the City is compensated for loss of assets and a public process takes place.

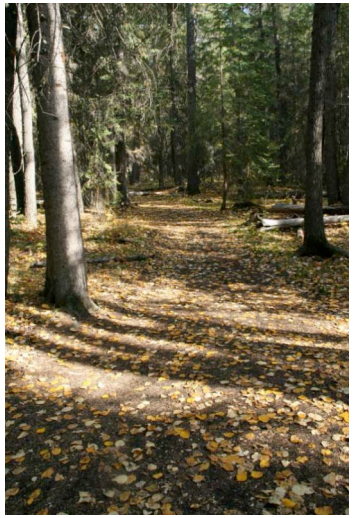
Policy 3: Tree pruning and removal is not permitted for:

- Mitigation of minor nuisances such as fruit, seeds, fluff, pollen, sticky bud caps, leaves, minor pest infestation, etc.;
- Mitigation of landscape damage;
- Creation of views and clearance for advertising signs.

Practice:

Policy Exception for Poplar Trees - An adjacent residential property owner may request the removal of a poplar tree of significant nuisance provided the following conditions:

- *The property owner undertakes a process to obtain community input regarding the removal;*
- *The City of Calgary Parks approves the removal;*
- *The property owner pays the cost of the removal and replacement (asset value).*



Strategy 2.2: Protect Native Forests and Trees

There are naturally occurring forests growing along Calgary's rivers and other locations where suitable soil and moisture conditions exist. A healthy native forest is one that is intact and has functioning natural processes. Unfortunately, natural processes such as flood, fire, and ground water movement that sustain and regenerate native forest have been disrupted by urbanization, leading to a decline in the size and health of the native forest. In order to reverse the impacts of urbanization, human intervention is required to replace the lost natural processes. One of the more significant impacts of urbanization on the native forest is fragmentation creating remnant stands. This fragmentation impacts not only the sustainability of the remaining trees but also creates discontinuity of wildlife habitat. Human settlement and urbanization has facilitated the introduction of exotic and invasive species into the native forest. The species may have an impact on the health of the native forest. The characteristics of these species need to be understood and controlled where necessary.

Practice:

Protect remnant forests within natural environment parks.

Transitions from native forest to built form should be sensitive to the needs of the forest and human environment.

Encourage the preservation of an intact forest ecosystem.

Strategy 2.3: Protect Trees Through Legislative Means

For trees to achieve a long life, they must be protected from human activities. The death of mature trees is often the result of human activity such as construction damage, vehicle impacts, and vandalism. This damage is often the outcome of people's lack of knowledge about the effects of their activities. Therefore, public education is important. However, along with education, there must be deterrents and consequences for damaging trees. The City currently has a tree bylaw which outlines deterrents and consequences such as processes for the recovery of damages. This bylaw must be periodically reviewed and updated to maintain its effectiveness. Trees located on recognized historic sites are subject to heritage legislation and evaluated on a case-by-case basis. There should also be legislative empowerment to address tree hazards on private land which may threaten the users of roadways or parks.

Practice: Maintain a tree protection bylaw.

PRINCIPLE 3: PROTECT THE HEALTH OF THE URBAN FOREST POPULATION

Strategy 3.1: Manage Urban Forest Pests

Alien and invasive species can do great damage to the urban forest. Preventing the introduction of pests is an important component in protecting the health of the urban forest.

Outside of those growing in natural environment parks, most of Calgary's trees are exotic species, introduced from other areas. Calgary is fortunate that few pests from these exotic species have traveled with their hosts. As a result, Calgary's urban forest is a more or less isolated island of trees and there are relatively few tree pests of any significance. However, this isolation does not preclude the inevitability of a disastrous pest outbreak that could devastate a segment of the tree population. Introduced pests are particularly worrisome because the natural checks on the pest's population such as parasites and disease are often absent. Unfortunately, over time, more and more exotic pests will inevitably be introduced into Calgary. A program of constant monitoring must be in place to detect the presence of exotic pests and address any outbreaks before they become catastrophes.

Strategy 3.2: Anticipate and Prepare for Natural Disasters and Invasive Pests

The urban forest is subject to the impacts of natural forces (such as weather) and biological pressures (such as pests and diseases).

Drought, wind, and ice storms and other weather disasters can have significant impact on the urban forest and create a high risk for tree loss, property damage, and public safety. It is critical to have emergency response plans in place to be able to deal effectively with natural disasters.

The federal and provincial governments regulate invasive pest species. The City needs to work co-operatively with the federal and provincial governments to help manage invasive pest outbreaks and public expectations (as such an outbreak could lead to the removal of thousands of trees.) The City's Integrated Pest Management (IPM) Plan contains policies guiding pest management in the publicly owned urban forest. Since the development of IPM plan, a national industry initiative has commenced to prevent the spread of pests and pathogens through the movement of nursery stock.

Natural disaster is defined as "an emergency that is overwhelming to resources, infrastructure, or social support networks." - Jones, 2001: Alberta Disaster Services

Practice:

Maintain up to date emergency response plans for drought, invasive insects and weather phenomena.

Provide information to the public about urban forest and tree pest issues.

Respond to control significant tree pests on City land.

Ensure program activities comply with the Integrated Pest Management Plan.

NEW *Plant trees that comply with the Canadian Nursery Certification Institute's Domestic Phytosanitary Certification Program standards (DPCP) for tree purchases and supply (Five years to phase in).*

PRINCIPLE 4: DIVERSIFY TREE SPECIES AND TREE AGES WITHIN THE URBAN FOREST

Strategy 4.1: Ensure a Diversity of Tree Ages

A sustainable urban forest population is comprised of trees of differing ages. Maintaining a diversity of ages allows the continued provision of a broad range of benefits and provides population stability, allowing a generation of trees to succeed and replace the previous generation. In the natural environment, this replacement of generations occurs through natural forces. However, in Calgary's urban environment, trees owe their existence to human forces. Therefore, human intervention is required for the establishment of successive generations.

Several communities in Calgary currently contain large numbers of similar types and ages of trees, known as an even-aged stand. In an even-aged stand, all the trees are the same age and they can be expected to die at more or less the same time. Such a tree population crash would leave these communities devastated and without mature trees. A tree life-cycle program should be initiated and inter-planting of new generations of trees should be undertaken in communities with even-aged stands.

Strategy 4.2: Ensure a Diversity of Tree Species

The more tree species and varieties growing in the urban forest: the greater the overall genetic diversity. The degree of genetic diversity in a population is an indicator of how adaptable that population is to changes in the environment. The mix of tree species should also include both large and small canopy trees. Large canopy trees provide greater environmental benefits than small canopy trees. Small canopy trees can provide aesthetic accents, but provide less environmental benefit. Also, some species are more adapted to Calgary's climate, for example, trees native to the Calgary region have adapted to our climate and indigenous pest cycles.

The International Society of Arboriculture, Prairie Chapter, maintains a list of the relative adaptability of trees species in Alberta. This species rating is a reflection of a tree species' adaptation to the local conditions.

Targets

Designs for tree planting on public land should accommodate and facilitate an average 50-year life span for trees in groomed parks and roadways and an average 25-year life span for sidewalk vaults.

The species mix of the urban forest should contain both long and short-lived tree species.

Tree age class targets for established communities should be that no more than 10% of the trees are over-mature and no less than 10% of trees are young.

The species diversity for trees planted in groomed parks and roadways should be that no more than 15% of trees represent any one genus, no more than 10% of trees represent any one species, and no more than 7% of trees represent any one cultivar.

The average species rating for trees planted in groomed parks and roadways should be 80%.

PRINCIPLE 5: OPTIMIZE ENVIRONMENTAL, SOCIAL, ECONOMIC, AND AESTHETIC BENEFITS THROUGH TREE-SUPPLY TARGETS

Strategy 5.1: Set and Achieve Canopy Targets

The Urban Forest Management Policies and Implementation Strategies for The City of Calgary (1988) sets a tree supply standard based on Calgary's human population. The policy calls for one tree for every two Calgarians. Based on a count of individual trees in groomed parks and along roadways, there is currently a 120,000 tree deficit. Strides have been made to lower the tree deficit through a combination of developer, City, community, and partnership tree planting. While the "one tree for two Calgarians" standard is relatively easy to understand and has encouraged tree planting, it does not encourage the long-term sustainability of the urban forest or encourage understanding of environmental benefits. A supply standard that considers overall tree biomass and canopy cover is a better measure for ensuring the urban forest is sustainable and provides an optimal level of environmental benefits.

Targets

The per capita tree supply standard is one tree either along a roadway or in a groomed park for every two Calgarians.

The urban forest on public and private lands should increase by 1% per decade with an ultimate canopy cover target of 20%.

The total vegetation biomass should be sufficient to offset 0.5% of the city's carbon emissions.

PRINCIPLE 6: PROMOTE AND PLANT TREES TO OPTIMIZE AESTHETIC, SOCIAL, ENVIRONMENTAL, AND ECONOMIC BENEFITS ON PUBLIC AND PRIVATE LANDS

Strategy 6.1: Encourage Tree Planting Early in the Development Process

Healthy, sustainable trees provide many types of benefits depending on where the trees are situated. Park trees, for example, provide the benefit of carbon storage only, whereas trees on residential streets can provide both carbon offset and carbon storage. The goal of tree-planting strategies is to find an optimal placement of trees that balances potential positive and negative aspects.

In new subdivisions, encouraging tree planting early in the development process means that tree-planting locations should be identified in Outline Plans to optimize tree planting opportunities and benefits. Locations for trees need to be identified early in the planning and assignment of utility alignments. It is also important to coordinate the placement of trees with street furnishings, pavement, utilities and crossings and driveways.

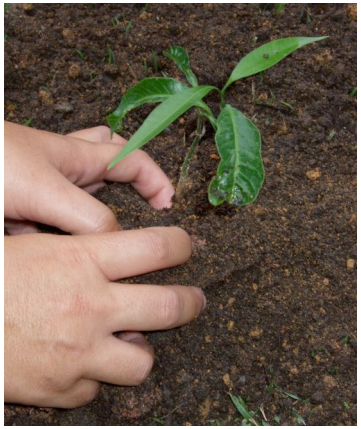
Policy 4: Tree planting intentions and opportunities are to be indicated at Outline Plan stage.

Policy 5: Driveway crossings are to be aligned to allow space for tree planting.

Practice:

Plant trees strategically, balancing the use of land and provision of environmental benefits.

Tree preservation is a priority in the designs for new development.



Drought is a normal part of Calgary's climate. Moisture levels are not sufficient to sustain most species of trees without supplemental watering. The ability of trees to survive predictable and inevitable drought cycles and to better conserve soil moisture, need to be addressed.

Strategy 6.2: Select Tree Planting Sites with Sufficient Soil Moisture

Generally, Calgary is a difficult place to grow trees. Our climate is typified by drought cycles and drying Chinook winds. These climatic conditions naturally encourage the establishment of grasslands. There are natural occurring stands of trees along the rivers and sheltered locations, but these sites have a landform that protects the trees and enhances soil moisture availability.

Just as in the natural environment, the key to establishing trees in urban and suburban Calgary is the availability of soil moisture. Soil moisture management must be part of the initial tree planting design and is essential to tree establishment. Unlike in more favorable climates, natural precipitation cannot be relied on to support trees and extra water must be some how provided. The provision of supplementary water can be costly, in terms of labour, irrigation infrastructure, water hauling, and land forming and soil preparation. However, these inputs are unavoidable and necessary for long-term tree survival. Tree planting designs should minimize the cost and operational need for labor and water hauling.

Practice:
Use the following priority to select the locations for tree planting:

- *Class A and B parks and roadways with central control irrigation systems;*
- *Natural Environment parks where trees might naturally occur;*
- *Parks, residential streets, and other classes of roadways where community partners undertake watering responsibilities;*
- *Parks and roadways designed to conserve soil moisture;*
- *Parks and roadways with irrigation systems manually operated by City of Calgary forces; and*
- *Non-irrigated parks and roadways,*

Strategy 6.3: Promote Tree Planting to Enhance Roadways such as Residential Streets, Commuter Routes, and Bypasses

Current roadway landscaping needs to better reflect the pride Calgarians take in the visual appeal, social dynamics and economic stature of their city. Provision of quality landscapes and trees along commuter and tourist routes is an investment and requires enhanced maintenance.

Strategy 6.4: Promote Trees as Tools to Retain Customers in Commercial Districts

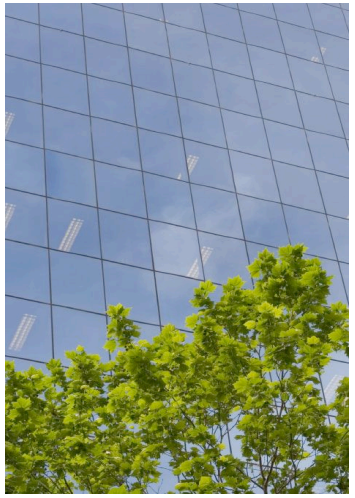
Trees improve the aesthetics of commercial districts and make them more pleasant places in which to shop, do business, and to work. They do this by providing aesthetic, psychological, and economic benefits. Trees help soften the harsh edges of buildings and a give a natural green contrast to the built form. Trees also contribute to pleasant walking experiences and offer natural respite.

Calgary's Centre City is the economic engine of the city and of the province. There should be a high-quality, aesthetically pleasing streetscape that reflects the wealth generated in this area. The Centre City and commercial districts are also important tourist and entertainment destinations and should have an appealing and inviting look. High-quality streetscapes require a continuous and focused maintenance effort. Centre City and commercial streetscapes require at least ten times the annual per-tree maintenance investment as compared to trees along a residential streetscape.

The Centre City in particular is lacking an aesthetically cohesive streetscape. There is no block-by-block planting and species plan, but rather the streetscape has developed on an ad hoc and fragmented basis. A downtown streetscape plan would help define a sense of place and give direction for future development.

Practice:
Trees in the Centre City receive a high level of maintenance.

Tree planting in commercial districts is guided by social, economic, and environmental outcomes.



Municipal Building

Roadway Commercial Landscaping - Driver Preferences

* Least – No vegetation exposed, harsh edge; adjacent commercial properties, completely visible

** Better – Vegetation interrupts prominence of view of commercial buildings and frames views

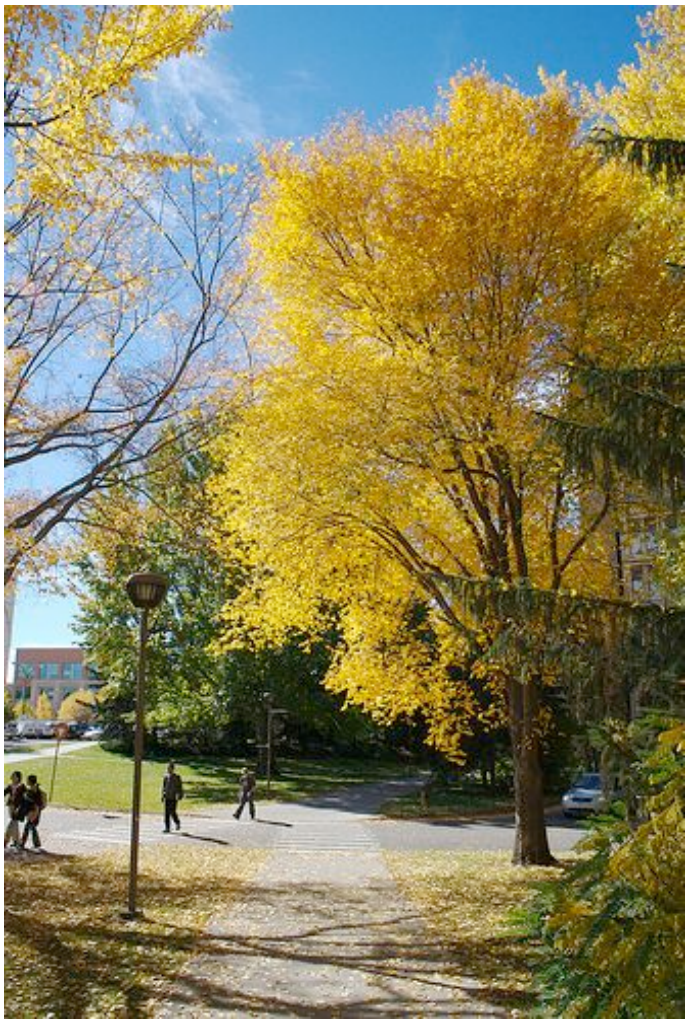
*** Best –Vegetation screens view of commercial buildings

Center for Urban Horticulture, University of Washington, Wolf, 2000

The Poplar Lifecycle Program ensures that as trees within communities draw near the end of their lifespan they are removed and replaced in a strategic manner over a number of years.

Five hundred to 800 poplar trees are removed yearly creating openings in the urban forest canopy in which a second or successive generation of trees can be planted.

Strategy 6.5: Manage Poplar Trees



Poplars at the University of Calgary

Policy 6: Poplar trees cannot be planted on roadways within 6 meters of the curb, except when the Director of Parks and Director of Roads give conditional approval. (Conditions may include: A clear succession plan for when the trees are no longer suitable for the location and a guarantee of resources when removals could occur.) NEW

Pioneer species such as poplars are often considered to be more aggressive than other species. However, pioneer species are useful in the urban environment as they help modify the soil and microclimate conditions so that other less aggressive species may more successfully establish themselves. Pioneer species grow more rapidly than other types of species. This means the species can more rapidly deliver the benefits larger trees. Unfortunately, as pioneer species mature, their characteristic rapid growth and aggressive nature may also create conflicts with other elements in their environment such as sidewalks and curbs. If pioneer species can be removed before they create conflicts, they can make valuable contributions to the landscape and environment.

Practice:
Management of poplar trees should mimic natural succession processes.

PRINCIPLE 7: ENCOURAGE THE PLANTING AND PROTECTION OF TREES ON PRIVATE LAND

Strategy 7.1: Promote Planting, Protection and Preservation of Trees on Private Land

It is important that property rights are respected in the process of management of the urban forest. Council, in the Tree Protection Bylaw, identified the protection of trees on City of Calgary owned or controlled land to be of high importance. Discussions during the development of the Tree Protection Bylaw also touched upon the absence of enabling language in the Municipal Government Act to allow The City to protect trees on private land. At that time, protecting trees on private lands was identified as a desirable outcome. Trees on private land are an important component of the urban forest. The City currently has two areas of influence over trees on private land. The City has an obligation to enforce the Provincial Pest Act and The City has the ability to require trees as part of the Land Use Bylaw's landscaping requirements.

Practice: The City of Calgary Parks' role includes advocating for the planting, promoting, and preserving the urban forest on private lands.

COLLABORATE WITH THE COMMUNITY

The second focus area for a sustainable urban forest is having an involved and caring community. Community includes community organizations, all City business units, the development industry, utility providers, businesses, property owners, and individuals sharing our common vision and values for growth and management of the resource. The community framework needed must include:

- Increasing citizen's and other stakeholder's knowledge of the benefits and value of trees; and
- Equipping citizens, City administrators, developers, and other stakeholders with the necessary knowledge to make decisions that optimize the benefits trees provide and to provide opportunity for tree stewardship by citizens.

It is essential that there is a broad understanding and support for a sustainable urban forest among stakeholders. Working together is the central core of The City of Calgary's Urban Forest program. It takes the involvement and interest of all members and aspects of the community and the Corporation to ensure the health and sustainability of our forest.

The **Community Model Forest Project** (CMFP) seeks community feedback in creating a management plan to address issues around urban forest sustainability, while promoting partnerships to reach environmental targets.

The **Neighbourwoods Program** encourages Calgarian's to actively participate in the protection and enhancement of the urban forest in their communities by providing them with the framework needed to look after the trees near or adjacent to their home, whether the trees are owned privately or on municipal land.

PRINCIPLE 8: INCREASE COMMUNITY AWARENESS, KNOWLEDGE, AND INVOLVEMENT IN THE BENEFITS AND GROWING OF THE URBAN FOREST

Strategy 8.1: Create Opportunities and Tools for Citizens and Communities to Play a Role in the Stewardship of their Urban Forest

If the community is to become an effective partner in growing and nurturing the urban forest, a program of community engagement is essential. The program should create awareness in the community of the benefits and importance of the urban forest. There should also be opportunities for the community to grow, nurture, and manage the urban forest.

Practice:
The Urban Forest program provides community awareness and education, tools, and shared stewardship opportunities.

Strategy 8.2: Facilitate Community Enhancement

There are instances where individuals or community groups wish an enhanced level of service or maintenance of the urban forest assets. Usually, the enhancement requested is a greater frequency of services such as pruning or tree planting.

Practice:
Permit property owners and community groups, at their own expense, to prune or plant a tree on City land provided they:

- *Obtain written authorization for the work from The City of Calgary Parks and other authorities as necessary;*
- *Hire only contractor(s) pre-approved by The City of Calgary, to work on municipal land;*
- *Comply with The City of Calgary Parks' specifications for trees and complete work to The City of Calgary Parks' standards; and*
- *Agree to undertake maintenance activities such as watering.*

Strategy 8.3: Invite Community Input

As shared vision, values and outcomes are important in the establishment of a sustainable urban forest. Community stakeholders must be given an opportunity to provide input to urban forest programs and outcomes.

Practice: The Urban Forest program is to provide opportunity for stakeholders to give input into the program.

PRINCIPLE 9: PROMOTE EDUCATIONAL PARTNERSHIPS.

Strategy 9.1: Build Partnerships with Post-Secondary Educational Institutions to Encourage Research and Development of the Urban Forest and Tree-Health Knowledge Bases

Co-operation with universities, colleges, and researchers can contribute to the understanding and sustainability of Calgary's urban forest. Co-operation with educational institutions through participation in internship programs helps individuals develop professional skills that will allow them contribute to the urban forest. The Urban Forest program should be seen as leading and participating in locally relevant research and innovation. One vehicle often employed for local research and education is the establishment of an arboretum.

Practice: The City of Calgary Parks promotes urban forest education and research.

An **arboretum** is "a place where trees, shrubs and herbaceous plants are cultivated for scientific and educational purposes."

LANTA is a voluntary trade association for the ornamental horticultural industry across Alberta and Saskatchewan. LANTA members are involved in various sectors of the ornamental horticultural industry, and the association represents Arborists, Garden Centres, Landscape Contractors, Lawn Care Applicators, Nurseries, and Sod Producers.

STOPDED The Society to Prevent Dutch Elm Disease is a non-profit organization to preserve and protect Alberta's elm trees from Dutch elm disease (DED). Members include federal, provincial and municipal representatives, nurserymen, landscapers, commercial and municipal arborists, research scientists, and other interested Albertans.

PRINCIPLE 10: BUILD REGIONAL CO-OPERATION

Strategy 10.1: Support Regional Urban Forest Initiatives

Calgary's urban forest does not exist in isolation; it is part of the forest continuum. Canada's National Forest Strategy states that Canada has one forest; the National Forest Strategy also identifies the urban forest as one of their strategic areas. Policies and actions by others outside of The City of Calgary can have great influence on the urban forest inside of the city limits. For example, policies of neighboring municipalities may limit or enable the growth and development of Calgary's urban forest.

Canadian National Forest Strategy is a consensus document that guides Canadians in their ongoing work in sustainable forest management. A strategy for all Canadians, it reconfirms the country's collective commitment to work together towards the goal of a sustainable forest, nationwide.

Practice: The City of Calgary Parks has a role in fostering regional co-operation for urban forest issues.

RESOURCE TO MEASURE AND MONITOR

The third focus area of a sustainable urban forest is the actual attainment and management of the resources. The management of the resources includes regulatory and administrative tools to protect the urban forest, standards and practices, and staff skill.

PRINCIPLE 11: ADHERE TO PROFESSIONAL AND QUALITY STANDARDS

Strategy 11.1: Adopt and Follow Sustainable Forest Management Practices

There are internationally established standards applicable to urban forest and, in addition, to commercial forest management. Some of the standards originate in climates more favorable to tree growth than Calgary and must be modified for local growing conditions.

The City of Calgary is committed to ISO 14001, a set of international standards that specify the requirements for services, processes, materials, systems, conformity assessment, and managerial and organizational practice. Within the standard is a report, ISO/TR 14061 which outlines the criteria and objectives for "a sustainable forest." Although this report is meant for commercial forest management, the basic principles apply to the urban forest. Compliance with ISO 14061 would demonstrate The City of Calgary's commitment to sustainable urban forest practices.

Practice: The City of Calgary Parks, Urban Forestry program is based on principles of sustainable resource management.

Strategy 11.2: Adopt Industry Standards and Best Practices

The arboricultural and landscaping industry develops best practices and standards, at the international, national, and local levels. The City of Calgary Parks reviews these standards and adapts them as appropriate to our local conditions. Sources of standards and best practices include the International Society of Arboriculture, American Society of Consulting Arborists, American National Standards Institute, Canadian Standards Association, universities and colleges, Alberta Construction Association, and other municipalities. There are also certificates issued by government and other regulatory bodies, such as Codes of Practice for pesticide application and Tree Risk Assessor. The City of Calgary Parks actively encourages the development of local best practices and standards.

Tree Canada Foundation is a charitable organization that works with volunteers to plant and care for trees in neighbourhhoods, schoolyards, parks and countryside. Tree Canada leaves a living, breathing legacy for generations to come.

ISA Certified Arborist & Master Arborist receives their designation after participating in an education program and passing an exam on current tree care practices.

Practice:

The Urban Forestry program is guided, where appropriate, by standards developed by industry groups, safety and standards organizations and regulators.

The Urban Forestry program actively encourages local industry to develop best practices and standards.

Strategy 11.3: Encourage Qualified Workers in the Urban Forest

An important indicator of the sustainability of the urban forest on both public and private land is the knowledge and skill level of the people working in the forest and with the trees. Expertise in the urban forest can be achieved through setting minimum qualifications and encouraging continuous learning.

Practice:

The Urban Forestry section facilitates periodic training opportunities.

Contractors and consultants working in the urban forest are encouraged to meet minimum qualifications.

Strategy 11.4: Monitor and Measure the Urban Forest

The urban forest is the collective individual trees, shrubs, and grasses growing in the urban environment on both private and public lands. Together these “individuals” make up the urban forest population. Just like the characteristics of the human population are regularly measured through a census, the tree population should also be periodically studied.

The collection of information should take two forms:

1. An inventory of trees and their attributes - useful for management and operational decision-making. The inventory should be regularly updated and maintained.

2. Measurement that looks at the population as a whole and is repeated over a longer period of time. This group of measurements includes canopy cover and leaf area index.

Practice:

The City of Calgary Parks maintains an inventory of trees on municipal land and conducts long-term tree population studies.

Replacement Cost - This method is used when the plants are of a size that can be replaced. The value is based upon; the cost of replacing the same species of the same size and quality, the cost of replacing one large plant with several smaller plants or the cost of replacing a large plant with a smaller plant and a cash settlement.

Trunk Formula - This method is used when the plant is too large to be replaced. This value uses the cost of replacing the largest locally available plant and adjusting it for the size difference, the condition and location of the appraised tree.

PRINCIPLE 12: DETERMINE TREE VALUE THROUGH A FAIR AND CONSISTENT VALUATION SYSTEM

Strategy 12.1: Use Industry Accepted Methods of Valuing Trees

The trees in the urban forest have economic and amenity value that should be determined through a fair and consistent valuation system. The Council of Tree and Landscape Appraisers currently promote several methods that have application in determining the value.

Policy 7: The City of Calgary requires compensation for damages to public trees.

Policy 8: The City of Calgary standard for valuing trees is the Council of Tree and Landscaping Appraisers' "*Guide for Plant Appraisal*" (as updated from time to time by The International Society of Arboriculture).

Policy 9: Base compensation requirements for damage or loss of public trees by private development and construction, public works and the general public is based on values derived from methods outlined in the "*Guide for Plant Appraisal*."

PRINCIPLE 13: USE THE PRODUCTS OF THE URBAN FOREST

Strategy 13.1: Recycle Waste Materials

In addition to providing services, the urban forest can also produce products. In the naturally occurring forest, the leaves, branches, and trunks are decomposed where they fall and the nutrients recycled back into the forest. However, in the urban forest, leaves, branches, and trunks are not allowed to decompose where they fall, instead they are moved to another location. The City of Calgary Parks, as a rule, recycles waste material generated through removal, pruning, and planting operations. The products produced are incorporated back into the urban forest, though activities such as mulching and tree planting.

Practice: Waste materials produced by Urban Forestry's operations are recycled.

PRINCIPLE 14: INCLUDE A GREEN INFRASTRUCTURE COMPONENT IN PUBLIC WORKS PROJECTS

Strategy 14.1: Invest in Green Infrastructure

The green infrastructure is too often secondary to the “grey” infrastructure. The green infrastructure is the living skin of the city and includes vegetation cover, soil, air, and water. The grey infrastructure is the built form of the city and includes pavements, buildings, and utilities. Both green and grey infrastructures are critical to Calgarians’ quality of life and to the livability of the city. In many cases, the grey infrastructure has replaced the natural ecological processes, for example storm sewers have taken the place of streams to drain the land. Often, investment in infrastructure is limited only to the built form of the city. However, there is also a need to invest in green infrastructure to bring balance into the urban ecosystem and urban watersheds. A green infrastructure investment policy needs to be developed by the City in concert with stakeholders.

Practice:

The City should take a holistic ecosystems approach to the planning and development of green and grey infrastructure.

PRINCIPLE 15: MANAGE THE TREES AND URBAN FOREST ON MUNICIPAL LANDS ACCORDING TO A COMMON VISION AND OUTCOMES

Strategy 15.1: Support and Promote the Urban Forest Program as a Centre of Excellence that Provides Support for All City of Calgary Tree-Related Activities

City of Calgary Parks' maintains trees growing in parks and along roadways. Trees on other City lands are also part of the City-owned urban forest and need to be managed. The Tree Protection Bylaw assigns City of Calgary Parks the role of the primary steward of City trees. For reasons of tree health and public safety, all trees on City land need to be managed to the same standard. Parks' role as a steward is to provide the necessary expertise and set the standards by which trees on City lands are maintained. It is particularly important that City business units and partners have regular input into the Urban Forest program.

Practice:

The Corporate Tree Committee includes Business Unit representatives from Parks, Roads, Transportation, Water Services, Land Use Information and Mapping, Planning and Building, Environmental Management, Animal & Bylaw Services, Corporate Properties, Law (as required), Enmax and other utility providers.

Appendix 1: Parks Urban Forest Strategic Plan, Policies, Practices and Targets

	Principle	Strategy	Policy	Practices & Targets
1.	**Manage trees in groomed parks, natural environment parks, and roadways for health safety and function.**	**1.1: Maintain tree health.**		Maintain the health and safety of existing trees through a program of health care, pruning, and removal. Trees are pruned for the following reasons: overhead utility clearance, public safety, health, and tree structure.
		1.2: Ensure public safety and liability.	1. In an emergency situation where trees are threatened or pose a public safety hazard, the Director of The City of Calgary Parks (in consultation with the Director of Roads, as required) shall have the authority to cancel events and/or close parks, pathways, roadways, or other public spaces.	Emergency public tree hazards are mitigated within 24 hours of being reported to City of Calgary, Urban Forestry personnel. Respond to urgent public tree hazards within seven days of being determined by Urban Forestry personnel. Annually inspect 20% of all trees over 20cm in diameter in groomed parks and roadways for safety, health, and structure.

	Principle	Strategy	Policy	Practices & Targets
2	**Preserve the existing forest.**	**2.1: Healthy trees are generally not removed.**	2. When no reasonable alternatives exist, public trees maybe removed for: - Public safety such as un-repairable defects, traffic visibility, and safety setbacks; - Tree is dead or in declining health, or harbors a declared pest; - Tree has condition rating of less than 40%; - Tree has less than 5 years useful life remaining; - Utility repairs, overhead utility clearance, or a repeated history of utility conflicts; - Capital construction of roads and utility infrastructure with compensation for loss of assets; - Private developments where there are no reasonable alternatives, and provided the City is compensated for loss of assets and a public process takes place.	Policy Exception for Poplar Trees - An adjacent residential property owner may request the removal of a poplar tree of significant nuisance provide the following conditions: - The property owner undertakes a process to obtain community input regarding the removal; - The City of Calgary Parks approves the removal; and, - The property owner pays the cost of the removal and the replacement (asset value).

	Principle	Strategy	Policy	Practices & Targets
			3. Tree pruning and removal is not permitted for: - Mitigation of minor nuisances such as fruit, seeds, fluff, pollen, sticky bud caps, leaves, minor pest infestation, etc.; - Mitigation of landscape damage; - Creation of views and clearance for advertising signs.	
		2.2: Protect native forests and trees.		Protect remnant forests within natural environment parks. Transitions from native forests to built form should be sensitive to the needs of the forest and human environment. Encourage the preservation of an intact forest ecosystem.
		2.3 Protect trees through legislative means.		Maintain a tree protection bylaw.
3.	**Protect the health of the urban forest.**	**3.1: Manage urban forest pests.**		Maintain up to date emergency response plans for drought, invasive insects, and weather phenomena.
		3.2: Anticipate and prepare for natural disasters and invasive pests.		Provide the public with information about urban forest and tree pest issues.
				Respond to control significant tree pests on City land.
				Ensure program activities comply with the Integrated Pest Management Plan.

	Principle	Strategy	Policy	Practices & Targets
				Plant trees that comply with the Canadian Nursery Certification Institute's Domestic Phytosanitary Certification Program standards (DPCP) for tree purchases and supplies (five years to phase in).
4.	**Diversify the tree species and trees ages within the urban forest.**	**4.1: Ensure a diversity of tree ages.**		Designs for tree planting on public land should accommodate and facilitate an average 50-year life span for trees in groomed parks and roadways and an average 25-year life span for sidewalk vaults.
		4.2: Ensure a diversity of tree species.		The species mix of the urban forest should contain both long- and short-lived tree species.
				Tree-age class targets for established communities should be no more than 10% of the trees are over-mature and no less then 10% of trees are young.
				The species diversity for trees planted in groomed parks and roadways should be that no more than 15% of trees represent any one genus, no more than 10% of trees represent any one species, and no more than 7% of trees represent any one cultivar.
				The average species rating for trees planted in groomed parks and roadways should be 80%.
5.	**Optimize environmental, social, economic, and aesthetic benefits through tree-supply targets.**	**5.1: Set and achieve canopy targets.**		The per capita tree supply standard is one tree either along a roadway or in a groomed park for every two Calgarians.
				The urban forest on public and private lands should increase by 1% per decade with an ultimate canopy cover target of 20%.

	Principle	Strategy	Policy	Practices & Targets
				The total vegetation biomass should be sufficient to offset 0.5% of the city's carbon emissions.
6.	**Promote and plant trees to optimize aesthetic, social, environmental, and economical benefits on private and public land.**	**6.1: Encourage tree planting early in the development process**	4. Tree planting intentions and opportunities are to be indicated at Outline Plan stage.	Plant trees strategically, balancing the use of land and provision of environmental benefits.
			5. Driveway crossings are to be aligned to allow space for tree planting.	Public tree preservation is a priority in the designs for new development. Street and roadway designs should give consideration to tree planting opportunities.
		6.2: Select tree-planting sites with sufficient soil moisture.		Use the following priority to select the location for tree planting: - Class A and B parks and roadways with central control irrigation systems; - Natural Environment parks where trees might naturally occur; -Parks, residential streets, and other classes of roadways where community partners undertake watering responsibilities; - Parks and roadways designed to conserve soil moisture; - Parks and roadways with irrigation systems manually operated by City of Calgary forces; and - Non-irrigated parks and roadways.

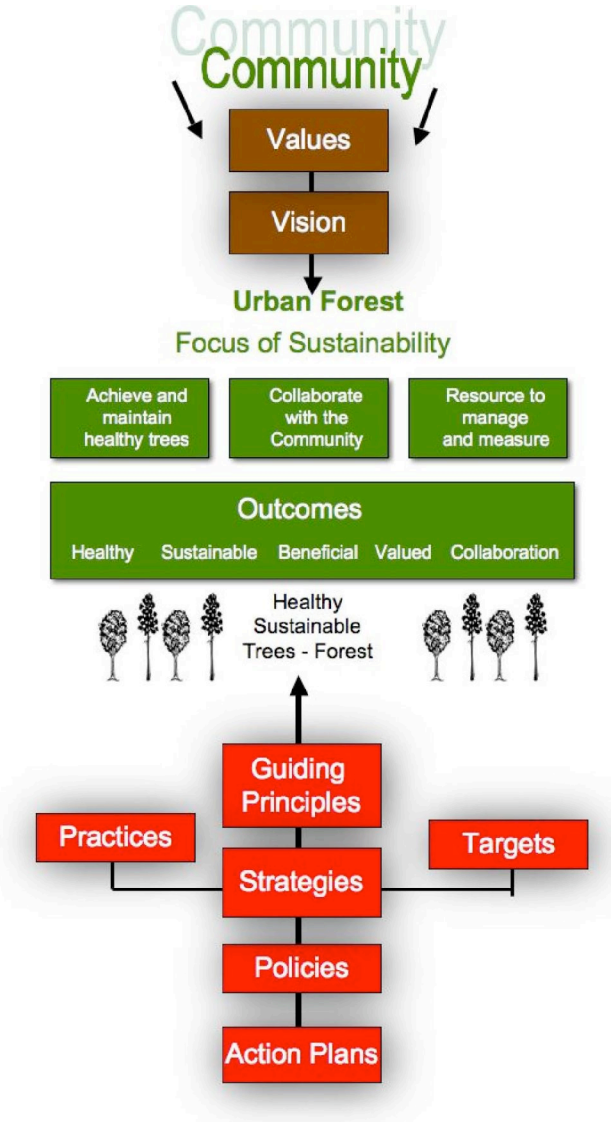
	Principle	Strategy	Policy	Practices & Targets
		6.3: Promote tree planting to enhance roadways such as residential streets, commuter routes, and bypasses.		Residential streets in the inner city, established, and new communities are to be tree lined wherever possible. Boulevard tree planting corridors on residential streets in new subdivisions are encouraged.
		6.4: Promote trees as tools to retain customers in commercial districts.		Trees in the Centre City receive a high level of maintenance. Tree planting in commercial districts is guided by social, economic, and environmental outcomes.
		6.5: Manage poplar trees.	6. Poplar trees cannot be planted on roadways within six meters of the curb, except when the Director of Parks and Director of Roads give conditional approval. (Conditions may include a clear succession plan for when trees are no longer suitable for the location and a guarantee of resources when removal could occur.)	Management of poplar trees should mimic natural succession processes.
7.	**Encourage the planting and protection of trees on private land.**	**7.1: Promote planting, protection, and preservation of trees on private land.**		The City of Calgary Parks' role includes advocating for the planting, promoting, and preserving the urban forest on private lands.

	Principle	Strategy	Policy	Practices & Targets
8.	**Increase community awareness, knowledge, and involvement in the benefits of growing the urban forest.**	**8.1: Create opportunities and tools for citizens and communities to play a role in the stewardship of the urban forest.**		The Urban Forest program provides community awareness and education, and tools and shared stewardship opportunities.
		8.2: Facilitate community enhancement.		Permit property owners and community groups, at their own expense, to prune or plant a tree on City land provided they: - Obtain written authorization for the work from The City of Calgary Parks and other authorities as necessary; - Hire only contractor(s) pre-approved by The City of Calgary, to work on municipal land; - Comply with The City of Calgary Parks' specifications for trees and complete work to The City of Calgary Parks' standards; and - Agree to undertake maintenance activities such as watering.
	8.3: Invite community feedback.			The Urban Forest is to program provide opportunity for stakeholders to offer input.
9.	**Promote educational partnerships.**	**9.1: Build partnerships with post-secondary educational institutions to encourage research and the development of the urban forest/tree-health knowledge bases.**		The City of Calgary Parks supports urban forest education and research.

	Principle	Strategy	Policy	Practices & Targets
10.	**Build regional co-operation.**	**10.1: Support regional urban forest initiatives.**		The City of Calgary Parks has a role in fostering regional co-operation for urban forest issues.
11.	**Adhere to professional and quality standards.**	**11.1: Adopt and follow sustainable forest management practices.**		The City of Calgary Parks, Urban Forestry program is based on principles of sustainable resource management.
		11.2: Adopt industry standards and best practices.		The Urban Forestry program is guided, where appropriate, by standards developed by industry groups, safety and standards organizations and regulators.
				The Urban Forestry program actively encourages local industry to develop best practices and standards.
		11.3 Encourage qualified workers.		The Urban Forestry section facilitates training opportunities for staff.
				Contractor and consultants working in the urban forest are encouraged to meet minimum qualifications.
		11.4 Monitor and measure.		The City of Calgary Parks maintains an inventory of trees on municipal land and conducts long-term tree population studies.
12.	**Determine tree value through a fair and consistent valuation system.**	**12.1: Use industry accepted methods of valuing trees.**	7. The City of Calgary requires compensation for damages to public trees.	The City of Calgary Parks' role includes advocating for the planting, promoting, and preserving of the urban forest on private land.
			8. The City of Calgary standard for valuing trees is the Council of Tree and Landscaping Appraisers' "*Guide for Plant Appraisal*" (as updated from time to time by the International Society of Arboriculture).	

	Principle	Strategy	Policy	Practices & Targets
			9. Base compensation requirements for damage or loss of public trees by private development and construction, public works, and the general public is based on values derived from methods outlined in the "*Guide for Plant Appraisal*."	
13.	**Reuse the waste products of the urban forest.**	**13.1: Recycle waste materials.**		Waste materials produce by Urban Forestry's operations is recycled.
14.	**Include a green infrastructure component in public works projects.**	**14.1: Invest in green infrastructure.**		The City should take a holistic ecosystems approach to the planning and development of green and grey infrastructure.
15.	**Manage the tree and urban forest on municipal land according to a common vision and outcomes.**	**15.1: Support and promote the Urban Forest Program as a Centre of Excellence that provides support for all City of Calgary tree-related activities.**		The Corporate Tree Committee includes Business Unit representatives from Parks, Roads, Transportation, Water Services, Land Use Information & Mapping, Planning & Building, Environmental Management, Animal & Bylaw Services, Corporate Properties, Law (as required), Enmax, and other utility providers.

Appendix 2: Parks Urban Forest Strategic Plan Framework



Appendix 3: Glossary

A

Age class: A distinct group of trees of similar ages.

Arboretum: A botanical tree garden where trees are maintained for educational and display purposes.

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

B

Best management practices: A best management practice is a technique or methodology that, through experience and research, has proven to reliably lead to the desired result.

Biological diversity: Refers to the variety of life on three different levels: the variety of ecosystems (ecosystem diversity); the variety of species (species diversity); and the variety within species (genetic diversity).

Biomass: The dry weight of all organic material, living or dead, above or below the soil surface.

Business revitalization zone (BRZ): A program by which businesses in an area can jointly raise and administer funds to improve and promote their businesses.

C, D

Canopy cover: The area covered by tree or forest foliage.

Centre City: The Downtown and Beltline communities of the city (i.e. south of the Bow River, north of 17thAvenue S., east of 14th Street S.W., and west of the Elbow River.

Centre of excellence: A centralized function formed by merging certain activities in one centre so they can be managed with greater competence and skill than if activities are fragmented over a number of subsidiaries.

Collaborative approach: working together with one or more other people or stakeholders.

Condition rating: A score quantifying the health and structure of a tree.

Cultivar: A cultivated variety of a plant. A named plant selection from which identical or near-identical plants can be produced; usually by vegetative reproduction or cloning (International Society of Arboriculture, 1997).

E, F

Ecosystem: A dynamic system of plants, animals, and other organisms, together with the non-living components of the environment, that functions as an interdependent unit.

Forest: A complex community of plants and animals in which trees are the most conspicuous members.

G

Genus: A taxonomic category grouping one or more related species.

Green infrastructure: The natural framework and systems that support air quality, water, soil, vegetation, and wildlife.

Grey infrastructure: The built framework and systems that support air quality, hydrology, transportation, housing, and

commerce.

H, I, J, K

Habitat: The environment in which a population or individual lives; includes not only the place where a species is found, but also the particular characteristics of the place (e.g., climate or the availability of suitable food and shelter) that make it especially well suited to meet the life cycle needs of that species.

Health monitoring program: A systematic evaluation of individual trees as well as the overall tree population.

Heritage tree: A tree that has historical significance or that has special qualities such as size, age, form, or genetics.

Integrated pest management: (IPM) System of decision making about controlling pests and their damaging effects.

Interplant: The planting of young trees in amongst older trees.

L, M, N

Leaf area index: The ratio of the total area of all leaves on a plant to the area of ground covered by the plant.

Microclimate: The environmental (weather) conditions around or within an individual plant or planting; these conditions can be modified by immediate area influences of sun, wind, exposure, aspect, and reflected and re-radiated heat.

Model forest: A forest or designated area including forests and woodland for which an integrated management plan is created and implemented to achieve multiple objectives on a sustainable basis.

Mulch: Any material, such as straw, sawdust, leaves, plastic film, and loose soil, that is spread on the surface of the soil to protect the soil and plant roots from the effects of raindrops, soil crusting, freezing, and evaporation (Brady and Weil, 1996).

Native forestland: Land that has a natural vegetation cover of trees and understory.

O, P, Q

Optimize: A balancing of diverse outcomes.

Outcome: Describes the change or the result we want to see.

Outline plan: The initial stage of the subdivision planning process that ensures that there is a workable distribution of land uses, open space, road networks, etc.

Over mature: Tree or stand that has passed the age of maturity where the rate of growth has diminished and the trees are weakened.

Parkway: A road with specific design features intended to provide a pleasurable diving experience. A parkway may also include other design features for aesthetic, recreational, pedestrian, and cycling experiences.

Partnership: A working arrangement, formal or informal, between two or more parties working together for a common purpose.

Pest: An organism capable of causing material damage. Forest pests include invertebrates, noxious fungi, bacteria, and viruses.

Phytosanitary: Measures aimed at preventing the spread of plant-infesting organisms such as insects and diseases

Policies: Definitive statements directing City Administration's course of action.

Population: A group of organisms of the same species inhabiting a particular geographical area at a particular time.

Principle: A statement of intent that guide the planning, planting, maintaining, and preservation of trees.

Pruning: The systematic removal of branches of a plant - usually a woody perennial such as a tree or shrub.

R

Remnant forest: Patches of trees and understory remaining from what was once contiguous forestland.

Riverine forest: On a large scale, it is the brand of forest that has a significant influence on a stream ecosystem or is significantly affected by the stream. On a smaller scale, it is the forest at the immediate edge of the stream, where specialized plants and animals form a distinct community.

S, T

Species: Genetically similar individuals capable of producing fertile offspring.

Stewardship: Environmentally and socially responsible use, management, and development of forest resources to maintain and enhance the value of the forest for present and future generations.

Stress: Unfavorable deviation from normal; the action on a body of any system of forces whereby strain and deformation results. In arboriculture, stress is the adverse alteration of tree health by abiotic or biotic factors.

Succession: Changes in the species composition of an ecosystem over time, often in a predictable order. In forests, it refers to the sequence of one community of plants gradually replacing another.

U-Z

Understory: The lower level of vegetation in a forest. Usually formed by ground vegetation (mosses, herbs and lichens), herbs, and shrubs, but may also include subdominant trees.

Urban forest: Includes all trees and associated vegetative understory in the city including trees and shrubs intentionally planted, naturally occurring or accidentally seeded within the city limits. Trees found in parks, river valleys, streets, roadways, natural areas, commercial, and private lands are all part of the urban forest.

Appendix 4: Bibliography

NSI/IESNA RP-8-00 Reaffirmed 2005 *Roadway Lighting: American National Standard Practice for Roadway Lighting*. Illuminating Engineering Society of North America, 2000.

Architectural Graphic Standards. 10th Ed. Hoke J.R. Ed., John Wiley and Sons Inc., 2000.

Calgary Tree Canopy Cover: A Select Comparison Between 1969 and 2003. The City of Calgary Parks, 2006.

CAN/CSA-Z809-02: *Sustainable Management: Requirements and Guidance: A National Standard of Canada.* Canadian Standards Association, 2003.

City of Calgary Parks Business Plan: 2002 – 2004. The City of Calgary, 2002.

Community Services & Protective Services Business Plan: 2006 – 2008. The City of Calgary, 2006.

Compendium of Best Management Practices for Canadian Urban Forests. Tree Canada Foundation, 2006.

Connecting People with Ecosystems in the 21st Century: An Assessment of Our Nation's Urban Forests. U.S. Department of Agriculture Forest Service, date unknown.

Dictionary of Natural Resource Management. Dunster J. and Dunster K., UBC Press, 1996.

Edmonton's Urban Parks Management Plan: 2002-2016. The City of Edmonton, 2006.

Getting to Smart Growth: 100 Policies for Implementation. Smart Growth Network, Date unknown.

"A Guide: Developing a Street and Park Tree Management Plan", Northeast Center for Urban and Community Forest. Retrieved from http://www.umass.edu/urbantree.

Guide for Plant Appraisal. 9th Ed. Council of Tree and Landscape Appraisers, The International Society of Arboriculture, 2000.

Guide to Writing Resource Objectives and Strategies. Ministry of Forests, Victoria, British Columbia, 1998.

Green Space Acquisition and Stewardship in Canada's Urban Municipalities: Results of a Nation-Wide Survey. Evergreen Common Grounds, Date unknown.

Indicators of Sustainable Community: A Status Report on Long-Term Cultural, How Cities Use Parks for Green Infrastructure. American Planning Association, 2003. Retrieved from www.planning.org/cpf.

Economic, and Environmental Health for Seattle/King County. Sustainable Seattle, 1998.

ISO/TR 14061 *Information to Assist Forest Organizations in Use of Environmental Management System standards ISO 14001 and ISO 14004.* International Organization for Standardization, 1998.

Live. Connect. Grow: Parks, Recreation and Cultural Services: A Master Plan for 2005-2015. City of Richmond, 2005.

Looking Ahead, Moving Forward: Council's Priorities: 2006 – 2008. The City of Calgary, 2006.

"A Model of Urban Forest Sustainability." Clark J.R., Methany N.P., Cross G., and Wake V., Journal of Arboriculture 23:1, 1997.

Northern Mountain and Prairie Community Tree Guide: Benefits, Costs and Strategic Planting. McPherson G.E. and Simpson J.R. Center for Urban Forest Research, USDA Forest Service, Pacific Southwest Research Station, 2003.

Open Space Plan. The City of Calgary Parks, 2002.

Our Common Future: World Commission on Environment and Development. Bruntland G.H., et al. Oxford University Press, 1987.

Our Common Grounds – Parks and Recreation Strategic Plan. City of Toronto, 2004.

People Places and Play Spaces: City Parks. The City of Calgary Parks, 2004.

Planting Trees For Carbon Credits: A Discussion of the Issues, Feasibility, and Environmental Benefits. Freedman B. and Keith T., Tree Canada Foundation, 1995.

"Plus 1136: The SFM Essentials: An introduction to CAN/CSA-Z809-02" in Sustainable Forest Management: Requirements and Guidance. Canadian Standards Association, 2005.

Taking a Closer Look: Green Essentials. Planning Commissioners Journal. Retrieved from \www.plannersweb.com.

Urban Forest Management Policy and Implementation Strategies for The City of Calgary. City of Calgary Parks & Recreation, 1988.