Glenview Park District

Urban Forest Management Plan

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GREAT LAKES URBAN FORESTRY MANAGEMENT
A GRAF TREE CARE COMPANY

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Section 1 – Overview, Mission Statement, and Goals

OVERVIEW OF GPD'S URBAN FOREST MANAGEMENT PLAN

Glenview Park District, in Cook County Illinois currently manages 9,611 trees throughout its park system. Detailed tree data was collected for Glenview Park District's managed trees as part of a comprehensive tree inventory during 2011, and continues to be updated and managed by it's in house staff and a Forestry Consultant. Since the time of the initial inventory, over 2,500 Ash and other poor condition trees have been removed from the Park System, and another nearly 1,500 have been planted, resulting in an approximately 20% turnover of the tree population over the past decade. This inventory and tree maintenance effort is culminating in this Urban Forest Management Plan. The Plan will detail how Glenview Park District's urban forest resources will be managed for the benefit of the district and its constituents during the next 30 years, with a focus which begins in 2020, and projects out to 2050.

In terms of the condition of the Urban Forest in Glenview Park District (GPD), there are certainly many strengths, along with a few opportunities for improvement and updating. GPD has a very large sized tree population for a park district of its size, providing many benefits, and there is evidence of a very high level of maintenance. The diversity of tree species in GPD is very high overall, and of all of our clients, is one of the closest to being in compliance with the "20-10-5 Rule" detailed below. This greater overall diversity of the urban forest resource puts it at a lower risk of future mass tree loss due to introduced insects and diseases, and has produced a first rate Urban Forest.

In order to enhance the existing diversity, as well as to meet some of the challenges listed above, the following Urban Forest Management Plan will address each one of these challenges and create goals and milestones for each. Below is a broad view of the activities to come in the 2020-2050 period. Much further detail is given in the body of the report, with separate sections detailing specific tree-related activities, and how we propose they are achieved, along with standards and Best Management Practices for each.

We have created a proposed forestry program which will achieve the greatest benefit for the community, based on the available data we have from the inventory, as well as input from the partner committees and residents of GPD. However, all plans are subject to change based on new information, budgets, or other unforeseen circumstances. For this reason, we ask all readers to consider that this plan is to be a living, breathing document, and goals and strategies will be updated to fit circumstances as needed. This Plan will be reviewed every year, and residents, business owners, and other stakeholders will have an opportunity to provide input and help make it better during those annual reviews.

STATEMENT OF MISSION

It shall be the mission of this Urban Forest Management Plan to outline goals, budgets, and Arboricultural Best Management Practices for the Urban Forest in Glenview Park District. This will be done to provide the following benefits, among others, to the residents of GPD: Increase canopy cover, filter and reduce storm water runoff, create shade and energy savings, promote general health and wellbeing, provide a source of enjoyment and aesthetics, uptake carbon dioxide and filter pollutants, and increase property values. Trees that make up this Urban Forest consist of trees on park district property which exist for the enjoyment of the residents of Glenview. This plan also seeks to outline both the short and long term management of this urban forest resource in order to maximize the environmental and aesthetic benefits of GPD's Urban Forest, while minimizing risks and costs. These goals and practices are designed to be financially and programmatically sustainable, as well as flexible for GPD, both now and in the future as residents, Park Boards, and Staff change with time.

OVERVIEW OF GOALS

Listed below are the strategic goals of this Urban Forest Management Plan (herein referred to as "UFMP", or "the Plan"), as well as a brief discussion of how they shall be met. Every attempt was made to make these goals realistic and attainable, such that they do not place an undue burden on GPD, its residents, or its resources. Instead, the goals of this UFMP are to save money and provide greater benefits over time through proactive, as opposed to reactive, management. The Plan is also meant to be adaptable: New concepts, the introduction of new pests or pathogens, or changing climate (both social and meteorological) may all change the way the Urban Forest is viewed and managed. The goals of this document are subject to change based on the discovery of new knowledge, shifting budgets, or other circumstances.

The Plan is intended to be, and should be, reviewed periodically by GPD, its board of commissioners, and any other interested stakeholders acting in the best interests of the park district and its residents. The review process should include evaluation of progress made towards these goals. Goals may be altered after the review, as conditions warrant. This UFMP is written with the understanding that Government agencies, Administrations, and residents change over time, and therefore its goals and milestones require a large degree of flexibility. Since trees represent a long term (50-80 year) commitment, this Urban Forest Management Plan is intended to provide guidance and continuity through those changes, while also adapting to them as the need arises.

Create a Needs Analysis for the Current Tree Population Based on Strengths and Opportunities
Every tree population we see today is the result of decades of past management decisions. As time goes on, we as an industry increase our overall level of knowledge, skill, and efficiency in managing trees for maximum benefit. Based on that new knowledge, we sometimes discover that decisions made 20 or more years ago may appear in retrospect to have been incorrect, even though they might have seemed like a good idea at the time. For GPD's trees, it was the goal of this Plan to assess the current state of GPD's Urban Forest and examine its overall strengths and benefits, as well as look for opportunities for improvement.

Each aspect of the tree inventory data which was taken for GPD has been analyzed: How many trees, what condition they are in, how old they are, what needs do they have, and more were all examined to create strategic goals to improve the tree population for the benefit of the residents. Specific goals in terms of planting, removals, budgets, personnel, and maintenance were all addressed by acknowledging both strengths and opportunities / challenges and suggesting how they might be used to our advantage. These strengths and opportunities will be the guiding principles for the management strategies and specific goals outlined in each section below. In order to avoid repeating mistakes made in the past, the Plan shall also attempt to leave room for adaptive management when given new information.

Establish Goals in Order to Enhance Strengths and Realize Opportunities
In order to accomplish anything, goals are needed along the way to guide you through the process. Enhancing an established forestry program will require a series of achievable goals in order to be realized. This Plan seeks to accomplish those goals within a realistic budget and achievable timespan. It should be understood that goals are intended to change over time as GPD's capacity to manage the resource may increase or be reduced. The ability to adapt along the way is of great importance to this Plan.

In each section of the Plan, we shall include goals which incorporate both a budget and a time frame in which those goals can be accomplished. The goals when taken in total will, over time, create a fully operational and sustainable forestry program. This program will include tree planting, tree maintenance, and tree removal for GPD's Urban Forest, so that the tree population will be healthy, and provide the greatest benefits and least risk to the residents at a very efficient price point. To learn more about the budgeting and staff capacity of the District, see the individual goals in each section below, or turn to the budget table in section 14.

Document Tree Policies and Procedures
As a park district, GPD has a different set of standards compared to a municipality. Whereas municipalities have codes and ordinances, park districts traditionally have a more relaxed and informal approach to these things. That said, this UFMP will attempt as much as possible to work with the Village of Glenview's existing ordinances and policies, and create a set of written standards for the District to use going forward. This will serve to provide guidance for all future park boards, forestry employees, and residents, so that a general level of understanding is reached that can be interpreted going forward. To learn more about ordinances, turn to Appendix G.

Increase Overall Diversity by 2050 Through Tree Planting
Tree species diversity is one of the most important concepts in Urban Forestry today. The reason pests and diseases like Emerald Ash Borer (EAB) and Dutch Elm Disease were so devastating is that there were simply too many Ash and Elm trees. When EAB arrived, many communities' Ash population was 20% or more, resulting in mass tree loss. This can be avoided by planting a greater diversity of tree species, so that when new pests or pathogens are introduced, we only lose small amounts of specific tree species. Great diversity leads to great stability, and stability leads to reduced costs and increased benefits over time.

An achievable "Diversity Vision" has been created for 2050 which will see the tree population become even more diverse than it currently is, and drives this plan. With an above average diversity of tree species at current, this will present a challenge, as enhancing diversity of an already diverse tree population can be difficult. That said, we have created a diversity vision which accomplishes this goal, and will result in an extremely diverse tree population by 2050. Creating a long term tree planting plan is an integral part of this process.

Currently, several species are overplanted in GPD, and a primary focus of this plan will be to reduce those numbers overall. For this plan, trees will be planted which are underrepresented in the current population, and planted in such a manner that selects the right tree for the right site via targeted tree planting. Ideas such as bolstering production in their existing in-house liner nurseries, exploration of participating in the Suburban Tree Consortium buying program with the Village, and planting smaller stock will be explored. To learn more about tree planting and reforestation, turn to Section 7, and Appendices B and C

Maintain an Acceptable / Unacceptable Species List
The urban environment is a difficult place for a tree to live, but parks represent a unique opportunity for urban trees vs the street tree environment. Parks generally do not suffer from the same lack of soil, road pollutants, and homeowner stress that street trees do. This more tree-friendly environment provides the ability to plant tree species which are less urban tolerant with a higher degree of success, which makes increasing diversity a slightly easier task. That said, there are also trees which we want to limit or eliminate planting of. Trees which have very weak wood, which are known invasive species, which produce messy or foul-smelling fruits, or which create a public nuisance should also be avoided. Acceptable species are those which are adapted to our Midwest climate, are not invasive, and do not pose high risk. Included in this Plan is an "acceptable" and an "unacceptable" species list, which will detail specific trees which may be planted in GPD parks. GPD and its Board will review the list periodically in response to changes in species composition of the urban forest, weather events, and availability of new tree species. For more information on this, see the Acceptable Species list in Appendix A.

Manage Tree Removals
For public safety, or to prevent the spread of pests and pathogens, tree removal is an unavoidable part of urban forestry. During the inventory, 266 trees were identified as requiring removal, and 1 was listed as a hazard removal. Given GPD's current capacity, removing all of these trees within the next 2 years is well within GPD's capabilities. In addition, the tree population of GPD contains a large number of both Maple species as well as undesirable species (Cottonwood, Buckthorn, Black Cherry, etc). Many of these trees will begin to decline and require removal over the next 20 years, or as the name implies, are undesirable due to being weak-wooded, aggressive, or invasive. To keep the patrons of GPD safe, a tree removal program has been created in this Plan which budgets for the safe removal of many of these trees over the coming years and decades in order to maintain public safety, as well as ecological soundness.

Beginning this year, the trees identified for removal during the last inventory update will be removed, progressively removing underperforming or damaged trees annually, until no high-risk trees remain in public spaces. In addition, annual tree inventory updates will continue to identify trees requiring removal on an annual basis. Cost projections for tree removals have been made based on the number, age, and condition of trees in GPD for the next 30 years, so that long term budgeting projections can begin as soon as possible for GPD. Also included are ANSI and ISA safety standards, as well as suggested bid specifications to ensure the park district is hiring qualified contractors who will be held to the highest industry standards. For more information on GPD's proposed tree removal program, turn to section 6.

Increase the Capacity of Park District Staff and Contractors
We will look at the details of this goal in greater detail below, but GPD currently splits their pruning, planting, and removal work fairly evenly between contractors and in house staff, and wishes to continue this split. However, in order to get on the proposed pruning cycle we have proposed, significant increases in overall capacity would be necessary. Based on our analysis of their manpower and production, we would estimate that the park district would have to significantly increase its manpower and contracted resources in order to do this. A strategic goal of this Urban Forest Management Plan is to increase the capacity of the park district staff and contractors by 2050.

Enhance the Annual Maintenance Program
Properly maintained trees establish faster, grow quicker, and live much longer lives than trees which are not maintained, or improperly maintained. Since large trees provide the greatest benefits to the community (as will be demonstrated later), maintenance is a critical part of the proposed Urban Forestry program in GPD. Annual maintenance for trees will include critical tasks such as cyclical pruning of all trees. Pruning will be done in large part by GPD staff, with some outside assistance as needed from Certified Arborist contractors. Tree planting will be accomplished by contractors, in house staff, as well as local volunteer. 728 trees were identified in the inventory as requiring priority pruning, with an additional 94 being identified as Hazard Prunes. Our goal will be to prune all 822 of these trees within the first 3 years of this plan's adoption.

As GPD begins to increase its budgets and capacity for tree maintenance, we can begin to realize a cyclical pruning program in GPD. This program has been designed to ensure that all trees on park district property are pruned on a regular basis in order to maintain public safety and good aesthetics. Cycle prune programs are the hallmark of a sustainable Urban Forestry program for municipalities and street trees. Park districts should be no different, especially given the higher occupancy rates underneath trees. Street trees may occasionally have pedestrians, cars, or homes within the target zone, but parks specifically attract people to them where people are nearly always in target zones during daylight hours. This makes the maintenance of these trees much more important, and the cycle prune program should reflect that. For more information on tree pruning and maintenance, turn to sections 8 and 9.

Maintain an Accurate Tree Inventory on an Annual Basis

Managing an urban forest requires a clear understanding of the existing trees, their ages, conditions, and locations, so that GPD crews and contractors can perform maintenance work on these trees. With this concept in mind, GPD has been diligent about maintaining its current inventory on an annual basis since the original inventory was completed in 2011 by hiring a forestry consultant to update 25% of the park system's trees each year. This has allowed GPD to perform targeted tree planting, removals, and other maintenance activities over the past decade.

All inventories are a snapshot in time. With 9,611 trees in park district property, the tree inventory should continue to be maintained at a high level of accuracy so that it doesn't become out of date. To accomplish this, GPD has been supplied with a GIS-based tool which can be used by its public employees to manage the tree population from any computer, smartphone, tablet, or other mobile device. Additionally, several staff members are on staff to handle Arboricultural operations, including basic updates to the tree inventory. However, we also recommend that the inventory be updated periodically by a professional, non-volunteer Forestry Consultant, in order to keep the information at its most current on a district-wide scale. This will ensure that all trees are periodically assessed for DBH, risk, and maintenance needs in a manner consistent with professional standards. Maintaining tree data at a high level is vital in the execution of this Management Plan.

Proper Mulching of All New Plantings

As noted above, the urban environment is a difficult place for a tree to become established and to live a long, healthy life. Proper mulching can significantly increase a tree's ability to do this. Mulch helps to conserve water during the summer months by preventing it from evaporating from the soil. It also helps prevent weeds from growing around the tree and competing for water and nutrients, and keeps lawn equipment such as mowers and weed whips away from the trunk where they can damage the tree. Damage from mowers and weed whips in parks is often substantial, and maintaining mulch beds helps to avoid this. All new plantings will be properly mulched at the time of planting by either the planting contractor, or in house staff as specified. Another outcome of this plan is to educate staff about proper mulching care, and notify them when poor mulching techniques are being used. Of particular concern is the practice known as "Volcano Mulching" which has the opposite effect of proper mulching and can actually kill a tree over time. For more information on proper mulching, turn to section 9.

Incorporation of Best Management Practices in Tree Care Operations

"Best Management Practices" is a term which means being on the cutting edge of your industry. All contractors and in house staff working on tree care operations for the park district will be in compliance with the latest industry Best Management Practices, based on the appendices in this report. The ANSI and ISA Best Management Practices shall be integral parts of any in-house tree care operations or Request for Proposal (RFP) or bid documents when seeking qualified contractors. Full text of all referenced standards shall be made available to all GPD employees and contractors performing tree care operations. Public outreach and education shall be performed by the park district, as well it's Board of Commissioners and/or Tree Advisory Board, ensuring that residents understand these practices as well. This UFMP will be placed in the public domain for all residents to use as a reference.

Creation, Utilization, and Maintenance of a Tree Risk Assessment Policy

Trees create great benefits, but during a storm or other weather event, they may also pose a great risk. Tree limb failure can have catastrophic effect on people or property, and trees need to be well-managed and healthy to avoid that risk. This is particularly pronounced in a Park setting vs a street tree setting as noted above. A risk assessment policy has been created for GPD as part of this Plan. This policy will aid in identifying, documenting, and designating for removal or mitigation, trees which may pose a threat to public safety in a timely manner. This will reduce the overall level of Risk posed by trees, as well as exposure to liability from tree related incidents by reducing the frequency of those incidents. Basic risk assessment language and parameters are included in this document, and a basic Tree Risk Assessment Policy has been created in Section 11, and Appendix F.

Increase Urban Tree Canopy from 34.81% to 35%

The tree canopy is important to the community because more trees provide greater benefits such as decreased heating and cooling costs, pollution reduction, and storm water uptake. Tree lined parks are more attractive to homebuyers looking in neighborhoods with parks and green space, which increases home values, home ownership, and tax revenue. All of these factors benefit the community, so we want to increase tree canopy in Glenview overall. Currently, Glenview has a phenomenal 34.81% tree canopy coverage overall (public and private land), compared to other land cover types, such as grass, buildings, paved surfaces, and water. That said, there is always room for improvement.

Working with the park district's forestry staff as well as private landowners, we believe that a modest increase to 35% canopy cover is a realistic goal. We would like to see a Memorandum of Understanding between the park district and Village, so that canopy cover can be increased through a joint venture. Currently, the tree population in GPD provides over $1,061,325 in annual benefits to the community. We aim to demonstrate that this number will be higher with increases in overall Tree Canopy.

Based on preliminary data from the Chicago Region Trees Initiative's research, we believe that 35% canopy cover is a realistic goal for Glenview by 2050. This will be accomplished by increasing the number of trees in GPD parks, as well as improving tree care allowing trees to live longer, become larger, and create more canopy cover. Tree planting on private property will also be encouraged through public-private partnerships with local organizations and businesses. GPD has already partnered with the Metropolitan Water Reclamation District (MWRD) to encourage tree planting on private property. We seek to enhance these plantings even more through partnerships with private organizations, business owners, and other stakeholders. For more information on Urban Tree Canopy, tree benefits, and other such information, turn to sections 4 and 5.

Tree Preservation / Invasive Species Management

Many times, trees can become damaged by construction activities, costing the park district money, and eliminating the benefit the tree had to the community. As is common in many other public organizations, a basic tree survey and assessment should be conducted prior to the issuance of a permit for construction activities. A tree protection zone must be established and maintained during construction. Finally, tree removal, for trees of a certain size on the approved species list, should require prior approval by GPD during site planning. Likewise, the district should encourage the removal of invasive species from private land, either through incentive programs, or by utilizing volunteer workdays for park district property and adjoining residences. Though the park district represents a different type of land ownership from a municipality, tree protection is still a very important concept when it comes to managing the urban forest resource as the district continues to develop its properties. A strategic goal of this Urban Forest Management plan is to preserve quality trees during construction, and reduce the amount of invasive species within Glenview Park Property.

Incorporate Natural Areas Stewardship into Tree Care Operations

As is often the case with park districts, GPD owns a fair amount of land which is not manicured in a typical park fashion, but instead is managed as Natural Areas such as woodlands, wetlands, prairie, and other such ecosystems. The management techniques of these areas can often be vastly different, and trees are no exception. This plan aims to extend its reach into these areas, so that there can be synergy between parks used for recreation, and those whose goals are more conservation oriented. Every attempt has been made as we go through each section below to incorporate Natural Areas into this plan, and account for differences in these management styles, including equipment, staff, techniques such as controlled burning, and contractors, as well as tree species selections in these areas in our diversity vision. We will also look into how this plan can incorporate other flora and fauna to help create an ecosystem, and not just a built environment.

Increase Awareness of the Urban Forest in Glenview and Engage Stakeholders

The entire reason for the establishment of an urban forestry program in GPD is to improve the lives of the residents, business owners, and other stakeholders who want to see the Village be a healthier, happier community. In order to make this happen, we will be looking for partners in the community to provide support for this program. GPD staff will be reaching out to local garden clubs, philanthropic organization, residents, and business owners in order to make the forestry program as innovative and hands-on as possible. In this manner, residents and business owners in GPD can take ownership of this important and beneficial resource, and allow it to work for them, their families, businesses, and the good of the whole park district. For more on these innovative programs, and how you can get involved, turn to sections 12 and 13.

Section 2 – Definitions / Normative References

Aerial Device: Any piece of equipment expressly intended to elevate a human worker above the level at which they typically stand with their feet on the ground surface. Can include but is not limited to bucket trucks, scissor lifts, etc

Aggressive: A floral or faunal organism which is native (endemic) to the United States or northeastern Illinois, but which is known to outcompete other more desirable organisms

Arborist: An individual engaged in the profession of arboriculture who is educated, trained and licensed to provide for or supervise the management of trees and other woody plants

Arborist Trainee: Any person working under the direct supervision of an Arborist or Certified Arborist

Balled and Burlapped: A tree, shrub, or other plant prepared for transplanting by allowing the roots to remain covered by a ball of soil around which canvas or burlap is tied and secured with a basket.

Bare Root: Harvested plants from which the soil or growing medium has been removed

Best Management Practices (BMP): Methods or techniques found to be the most effective and practical means in achieving an objective while making the optimum use of resources

Caliper: Standard nurseryman's measure of tree diameter (size). Caliper measurement of the trunk shall be taken six inches above the ground up to and including four-inch caliper size. If the caliper at six inches above the ground exceeds four inches, the caliper should be measured at 12 inches above the ground.

Certified Arborist: An individual who has sufficient experience in the field of Arboriculture, and has been certified by the International Society of Arboriculture as being a Certified Arborist

Border Trees: Trees whose trunks, when measured at DBH, are situated on both public and private property

Branch Collar: The branch collar is the point where a branch joins the trunk or another branch. This is the area the arborist chooses to make a proper cut.

Climbing Line: Any rope or other such material explicitly intended for bearing the weight of a human being

Collected Plants: Trees or shrubs which have been sourced from private property for the intent of transplanting elsewhere

Compacted Soil: A high-density soil lacking structure and porosity, characterized by restricted water infiltration and percolation (drainage), and limited root penetration

Consumer Price Index: An index of the variation in prices paid by typical consumers for retail goods and other items

Containerized: A tree, shrub, or other plant prepared for transplanting, or grown in, a solid-walled container such as a plastic pots or wooden boxes

Contracted Staff: People working for the park district as part of an independently owned and operated private company which performs work for the park district, but who are not directly employed by the park pistrict

Controlling Authority: An agency, organization, or corporate entity with the legal authority and/or obligation to manage individual trees or tree populations

Crew Leader: Any personal who has by direction or implication been chosen to lead a team of In-House or Contracted Staff

Crown: The upper part of a tree, measured from the lowest branch, including all branches and foliage

Critical Root Zone (CRZ): The minimum volume of roots necessary for a tree to have health and stability

Cycle Pruning: The process of routine maintenance pruning of trees, not related to storm damage or other hazard or emergency related-pruning, that occurs on a set and predictable time scale set forth by the park district

Deadwood: Wood on a tree or shrub which is no longer biologically living and becomes brittle or prone to failure

Decline/Declining: Trees or shrubs which are experiencing symptoms of a general decline of health due to age, pest, or pathogen related issues

Desirable: A tree or other plant whose characteristics are sought after due to ecology, aesthetics, or public safety

Diameter or DBH: Diameter at Breast Height. A standard forestry measure of tree diameter (size), measured at 4.5' above ground level on the uphill side of a tree using a Diameter Tape or Biltmore Stick

Digging Machine(s): Any piece of mechanical equipment whose express purpose is to remove soil and plants from their current locations

Diseased: The status of a tree which has been negatively impacted by a pathogen, bacterial, fungal, viral, or similar lower life forms

Drip Line: The soil surface delineated by the branch spread of a single plant or group of plants

Drought: A period of two weeks or greater, during which there is less than one inch of rainfall, when the average daytime temperature during that same period exceeds 75 degrees Fahrenheit

Dutch Elm Disease: A fungal pathogen which causes the decline and death of specific species of Elm trees.

Dying: A tree which is in the process of biological death due to senescence, disease, infestation, or other such malady from which there is very little to no hope of long-term survival

EAB: Emerald Ash Borer. An invasive beetle pest which affects all Ash trees

Establishment Pruning: The pruning of a young tree in order to establish proper form and branching habit

Established Trees: Those trees which have been permanently planted for a period of no less than 6 months, and which have permanent roots established in the soil

Failure (tree failure): Breakage of stem or branches, or loss of mechanical support in the root system

Feeder Root: Any portion of the below ground portions of the tree whose purpose is to absorb water and nutrients

Floodplain: Land which has been determined to be periodically inundated with water from a nearby moving or static water body, such as a lake or river. Determined by the Federal Emergency Management Agency

Flush Cut: Either a pruning cut or final cut to remove a stump, for which the maximum acceptable distance from the ground or the branch bark ridge shall be no greater than 2 inches.

Full-Time: An employee who has regular employment through the park district and whose work hours exceed 36 hours in a week, and who is employed year-round

Fungal: Any of a group of spore-producing organisms feeding on organic matter, including molds, yeast, mushrooms, and toadstools

Grade: The level or pitch of a certain piece of land, as defined by the trees or shrubs which inhabit it

Hardscape: The nonliving or man-made fixtures of a planned outdoor area, such as sidewalks, retaining walls, street lamps, etc.

Hazard: A known and documented state of imperiling public safety

Healthy Tree: Any tree which is successfully adapting to its environment, and shows no signs of disease, pests, pathogens, or other such maladies, as determined by the park district

Host: An organism which is susceptible to a known pest or pathogen

Infested: The status of a tree which has been negatively impacted by pests

In-House Staff: Staff directly employed by Glenview Park District, on either a Full-Time or Part-Time Basis

Invasive: A floral or faunal organism which is not native (endemic) to the United States or northeastern Illinois

Job Site: Any geographic location where a person or persons will be performing activities related to the care and maintenance of Glenview Park District property

J.U.L.I.E.: The Illinois acronym for the underground utility locating service

Liner Nursery: A privately owned plant propagation facility which specializes in the growth of small trees which are intended to be planted for growth into a full form

Managed: A tree or shrub which is in an area of the park district which is routinely mowed and managed. Not a wild forest grown tree or shrub, or area containing such trees and shrubs

Manufacturer's Recommendations: Any expressly written instruction manual for a given piece of equipment that details how said equipment is supposed to be managed or maintained

Mineral Soil: Any substrate which is composed of a variety of rocks and minerals in various states of decomposition, leading to the development of a substance on which living plants may live

Mitigation: The process of diminishing risk

Monoculture: A population of trees in close proximity to one another (a single park, here) which is comprised of 3 species or less of trees and shrubs which is prone to pest or pathogen outbreak

Natural Resources: Flora, fauna, and other such living and non-living parts of the environment which Glenview Park District maintains

Nursery Stock: Woody Perennials which are of a "Tree Form" growth habit and are supplied by a nursery contractor for planting. Not established trees

Park District Property: Land which, by deed or title, belongs to Glenview Park District

Parkway Tree: Any woody plant within a Publicly-Owned right-of-way

Part-Time: An employee who has regular employment through the park district and whose work hours are less than 36 hours in a week, and who is employed year-round

Pathogen: A fungus, virus, or other such microscopic organism which causes decline or death of trees

Pest: An insect or other macrofaunal organism which causes decline or death of trees

Private Property: Land which, by deed or title, does not belong to Glenview Park District

Public Safety: The welfare and protection of the general public

Reforestation: The process by which trees are planted to replace trees which have been removed

Rigging Line: Any rope or other such material explicitly intended for bearing the weight of a tree limb. Not to be used for supporting a human being

Right-of-Way (ROW): The publicly-owned land on which a road, drainage ditch, trail, or other public access is built

Risk: A situation involving potential exposure to danger or endangering public safety

Root Protection Zone (RPZ): The area on the ground surrounding a tree in which excavation, compaction, and other construction-related activities should be avoided or mitigated

Saddle: A piece of equipment expressly intended to hold a human being above ground level with the assistance of a rope or other such device

Sanitation Pruning: The removal of tree limbs that have become diseased or infested, in order to prevent the spread of disease or infestation from spreading throughout the rest of the tree e.g., Dutch Elm Disease, Black Knot Fungus, etc.

Seasonal Employees: Those employees retained by the park district for less than 6 months out of the calendar or budget year

Shrub: Any woody perennial which has a multi-stemmed growth habit not consistent with being considered a tree. Can be subject to interpretation by Park District Staff

Sound Wood: Structurally sound, non-decayed, non-compromised wood in the trunk or Scaffold Branches

Staff: Those employees retained by the park district on a full-time basis with benefits provided

Structural Root: Any portion of the below ground portions of the tree whose purpose is to stabilize the plant against the forces of wind and gravity

TRAQ: Tree Risk Assessment Qualification. The International Society of Arboriculture's formal status of an individual who is qualified to assess the risk that trees may pose risk to the general public

Tree Protection Zone (TPZ): The area surrounding a tree in which excavation and other construction-related activities should be avoided

Tree Risk: The likelihood and consequences of failure of a tree or tree parts

Tree Risk Assessment: A systematic process used to identify, analyze, and evaluate tree risk

Underperforming: Trees which have systematic health and vigor issues resulting in poor health, architecture, or other such maladies as determined by Park District Staff

Undesirable: A tree which is not desired in the landscape due to ecological, aesthetic, or public safety reasons, as determined by the Park District Staff.

Unmanaged: A tree or shrub which is in an area of the park district which is not routinely mowed and managed. A wild forest grown tree or shrub, or area containing such trees and shrubs.

Urban Wood: Any tree or other woody perennial material which has been harvested for the sole purpose of long term storage in the form of furniture, recreational material, etc. Differentiated from "Reclaimed Wood"

Utility Arborist: A person explicitly trained in the management of trees and other plants in relation to energized power lines. Someone who is licensed to work with conflicts between trees and such energized power lines

Section 3 – Personnel

In order to streamline Urban Forestry Operations, tasks will be assigned to the Park District Arborist, Park & Facility Services Supervisor, Park Planner, Superintendent of Park & Facility Services, Executive Director, the Park Board of Commissioners, an Urban Forestry Consultant, and Tree Care Contractors. Below is a representation of tasks, and which of the above parties is responsible for these tasks. Please note that titles are listed, and not specific staff members. This is to ensure that as staff changes, the positions are highlighted instead of the exact staff names.

Park Board of Commissioners
The Park Board of Commissioners is the steward of this Urban Forestry Management Plan. As the representatives of the residents of GPD, the Board is tasked with ensuring the proper functioning of the Urban Forest so that all residents can realize its benefits. The Board is composed of elected officials of GPD, and can be tasked with making informed decisions as it pertains to decisions affecting the Urban Forest. The Board may seek guidance from the Executive Director, Superintendent of Park & Facility Services, Park Planner, Park & Facility Services Supervisor, Arborist, and Forestry Consultant, and use its opinions and independent research to make decisions that other Board members may not have specific knowledge in. The Staff is responsible for annually updating and approving the Urban Forestry Management Plan based on new information and new Board Members. The Board is also responsible for a review of issues associated with public property trees, and perform a more detailed assessment of finances and operations that can be reported back to the Board.

Park District Arborist
The Park District Arborist is responsible for implementing forestry programs with the approval and cooperation of the various governmental jurisdictions in GPD as identified by the Park Board of Commissioners, Forestry Consultant, Park & Facility Services Supervisor, Park Planner, Superintendent of Park & Facility Services and the Executive Director.

Park & Facility Services Supervisor
The Park & Facility Services Supervisor for the Glenview Park District is responsible for dictating the exact maintenance activities to be performed for the Urban Forest. The Park District Arborist reports to the Park & Facility Services Supervisor. This position will seek bids from qualified Tree Care Contractors to complete the work approved by the various agencies, as well as maintain the tree inventory when possible, and act as a representative for public concerns. At the request and/or approval of the Board the duties of the Park & Facility Services Supervisor may be performed by the Forestry Consultant, however, and the Park Board of Commissioners will be tasked with ensuring that no conflict of interest exists in doing so.

Superintendent of Park & Facility Services
Provides oversight into Park & Facility Services operations, including both parks and facilities. The Superintendent of Park and & Facility Services provides guidance and budget allocations to all of the positions listed in this section, and has overall direction on initiatives, but is also required to listen to all staff members to obtain a balanced perspective on potential projects and initiatives.

Tree Care Contractors
Tree Care Contractors are responsible for performing work identified by the Park Board of Commissioners, Forestry Consultant, and Park & Facility Services Supervisor, Park District Arborist in a timely, safe, and expeditious manner. The Tree Care Contractor must have at least one International Society of Arboriculture Certified Arborist on site when work is being performed, and guide and participate in the performance of Tree Trimming, Pruning, Removal, and Plant Health Care operations. Other operations, such as Tree Planting, Tree Watering, and Tree Mulching do not have to be performed under the direct supervision of a Certified Arborist.

Forestry Consultant
The Forestry Consultant is responsible for impartially assessing the tree population as to its various needs on an annual or biannual basis, at the discretion of the Board and the Park District Arborist. The Forestry Consultant communicates the needs of the trees to the Board and the Park District Arborist so that individual needs in terms of tree planting, removal, and maintenance can be performed. The Forestry Consultant may also function as the Park District Arborist during periods of the Park District Arborist's absence at the request of the park district.

Park Planner
The Park Planner is responsible for the final layout of new parks and the trees that come along with it. The Park Planner works with all of the above positions to determine the Master Planning process, and is responsible for ensuring that new plantings are done with the best interests of the community at large. Must work in coordination with the Park & Facility Services Supervisor and the Superintendent of Park & Facility Services to ensure that the goals laid out in the Plan are met. Must be responsible for planting choices, and not choosing aesthetics over diversity goals.

Current Status (2018) of GPD Forestry Crew Equipment and Production
As of this writing, GPD has a full time forester, a part time forestry staff member, and several seasonal employees who perform forestry-related work approximately 75% of the working year. The other 25% is devoted to other park district activities, such as general grounds maintenance, restoration ecology, etc. The Forestry crew is equipped with 1 Chipper, 1 Stump Grinder, 1 Skid Steer/Bobcat, 1 compact track loader with grapple and auger, 2 loaders, 1 Forestry Mower, and a variety of chip and hauling trucks. A review of the last year's worth of Forestry production data indicates the following:

	Trimmed-In House	Contractor Trimmed	Removed In House	Contractor Removed	Planted In House	Contractor Planted
2019	300	96	320	78	100	190
Budget	$29,660.00	$11,773.00	$28,514.00	$26,096.00	$17,500.00	$35,000.00
Avg / Tree	$98.87	$122.64	$89.11	$334.56	$175.00	$184.21

Strategic Goals

The above current capacity is very good overall for a rather small crew. That said, due to the nature of being a park district, the variance among the year to year production can vary quite a bit. Therefore one of the first goals will be to set specific guidelines as to how many trees are expected to be pruned, removed, planted, etc so that there is at least a minimum threshold. In addition, minimizing the contracted work and increasing staff capacity would be positive as well. With slight increases in manpower and equipment, GPD could be more proactive and cost-effective at maintenance.

Pruning

With a tree population of approximately 9,611 trees, approximately 400 trees are getting trimmed each year between in house and contracted staff, according the records above. This figure is based on a wide variance, as noted above, and is the equivalent of a 24 year pruning cycle, which is far greater than should be expected for cycle pruning. It would be beneficial to make this existing program more consistent and comprehensive, so that all trees, regardless of condition, are pruned on a 7 year cycle.

We believe the best way to accomplish this is by a hybrid approach. Trees which are in the most dire need of pruning will get pruned each year, as determined by keeping the tree inventory up to date, and identifying such trees. In addition, the park system should be broken down by tree population, again based on the inventory, into 7 zones or regions, and each region should be pruned each year regardless of tree condition. This hybrid approach will ensure that the tree population is maintained in a way that maximizes public safety and arboricultural best management practices. We have provided a sample map below of the proposed pruning zones in Appendix J.

As mentioned above, increasing staff capacity, budgets, and equipment capabilities will ensure that such a program is possible. At current, with existing staff and equipment, GPD staff and contracting budgets are capable of pruning approximately 600 trees per year, which would represent a 16 year pruning cycle. While this is a significant improvement, in order to get to the 7 year cycle, increases in manpower, budgets, and equipment will be necessary. The proposed pruning program would increase the number of trees pruned each year to approximately 1,400 trees per year, requiring a doubling of current capacity and then some. We have factored this into our broad budget calculations below as long term goals. It is also worth mentioning that GPD is exploring the process of partnering with the Open Lands Tree Keepers program, so that a local group of volunteers can have some intensive training on pruning and maintenance of trees, so that the community can be involved with the park trees as well. With a tree population becoming younger overall, we believe this is possible.

Removal

The data shows that on average, approximately 398 trees are being removed annually by the forestry crew and contractors, with approximately 75% removed in house and 25% contracted. This number has been skewed over the past several years due to removal of Ash trees resulting from Emerald Ash Borer. But as time goes on, and the tree population becomes younger overall, we believe that removals should decrease significantly. Trees to be removed in the short term will be mostly overgrown and underperforming Maples, as well as Pine and Spruce trees which have been falling victim to a changing climate and increases in insect and fungal disease issues. Long term removals should mostly be associated with natural aging, storms, and future pest and pathogen issues.

We have detailed these Pine and Spruce issues in a separate report (see appendix K) which were identified during a recent inventory update that focused specifically on these issues. The removal numbers are projected to stay on the higher side for several years, but as the number of these Maples, Pine, Spruce, and small ornamentals declines, we expect the overall removal numbers to settle in to around 175 per year. We believe that based on the data, Glenview Park District's tree population should eventually become just under 11,500 trees, based on the projected numbers of planting and removals through 2050.

Planting

As of this writing, on average GPD plants approximately 300 trees and large shrubs per year. During the EAB years, this number was closer to 400, but as less budget has been spent on tree removal, more money has been spent on tree planting. That said, we would like to see the number of trees and large shrubs planted per year go to approximately 240 per year by 2050. Taken together, the 240 new plantings a year will outpace the 175 removals per year, and lead to tree population growth. GPD already has the capacity to plant this many trees, as evidenced in the summary table above, and we believe meeting or exceeding this goal should be relatively easy. GPD also has 2 liner nurseries it uses to grow some of its own plant material. Even a slight increase in production will ensure that GPD has the diverse selection of trees it will need to meet it's aggressive diversity goals.

As with the items mentioned above, we believe that this a small leap to make for a currently successful planting program. Particularly if the district maintains relationships with partner organizations who can assist in both donating and planting trees in the parks. GPD has been proactive in preparing a long term tree planting plan in 2015 which has already picked the best locations for an additional 500 trees throughout the parks, based on species requirements and site characteristics. This ensures the best chances of establishment and long term survival for the trees in question, as they will not be fighting against the site they're planted in, and are well suited to their conditions. We would recommend revisiting this program in the next several years to plan for the next 5 years worth of planting.

In House Vs Contracted Labor

As a general note about GPD performing slightly more of this work in house, as you will notice from the budget table above that the contractor rates are generally more expensive than the in house rates. There is good reason for this, as in-house staff generally handle smaller pruning and removals, while contractors handle larger more complex trees. However, there are 2 distinct advantages to performing more work using in house staff. The first is that GPD will have direct control over the quality of the work performed, and can ensure it is always done according to specifications. The second is that market rates for contracted work are currently at an all-time low due to tree pruning and removal market being saturated from the impact of Emerald Ash Borer. We saw these rates drop over 200% during the EAB era, and they are slowly back on the rise. This has already begun to rise as many people exit the market and it becomes less competitive. Performing the work in house helps to safeguard against these market fluctuations. As Glenview's tree population becomes younger with the removal of Ash and larger underperforming Maples and Hooneylocusts, the ability of GPD to handle more work using in house staff and volunteers will increase naturally as well.

Objectives and Goals

	2025 Milestone 1	2030 Milestone 2	2035 Milestone 3	2040 Milestone 4	2045 Milestone 5	2050 Final Goals
Administrative	Hire more seasonal forestry staff, begin forestry internship program	Train full time staff member to work 25% in forestry alongside forester and seasonal staff	Hire second full time forestry staff member to work with seasonal and part time staff	Purchase additional equipment / replace aging equipment	Purchase Additional Chipper / replace aging equipment	Goal: Maintain 2 full time forestry staff, 1 part time forestry person, and seasonal staff
Pruning	Increase trim capacity to 1250 trees/year by using forestry interns and volunteers	Increase trim capacity to 1350 trees/year, and have 70% be done in house	Increase trim capacity to 1400 trees/year with 2nd full time staff member.	Increase trim capacity to 1500 trees/year and have 70% be done in house	Increase trim capacity to 1600 trees/year and have 70% be done in house	Goal: Maintain 1600 tree/year pruning capacity, with 70% of the work done using in house labor
Removals	Reduce number of removals/year from 250 to 175	Perform 75% of removals in house with increased staff and better training	Perform 75% of removals in house with increased staff and better training	Perform 75% of removals in house with increased staff and new equipment	Perform 75% of removals in house with increased staff and new equipment	Goal: Maintain capacity to remove 175 trees per year using 75% in house labor and equipment
Planting	Change nursery stock standard to 1.75" and begin training crew on proper planting and care practice	Create relationships with volunteer organizations to assist in tree planting to reduce costs	Plant 190 1.75" trees/year with using 80% in house or volunteer labor	Plant 230 1.75" trees/year with using 80% in house or volunteer labor	Plant 240 1.75" trees/year with using 80% in house or volunteer labor	Goal: Maintain the ability to plant and care for 240 1.75" trees per year using 80% in house or volunteer labor

Section 4 – State of the Urban Forest

According to the latest update to the Tree Inventory, the tree population stands at 9,611 established trees. We shall examine this in greater detail below, as well as provide a specific plan to change the species composition over time.

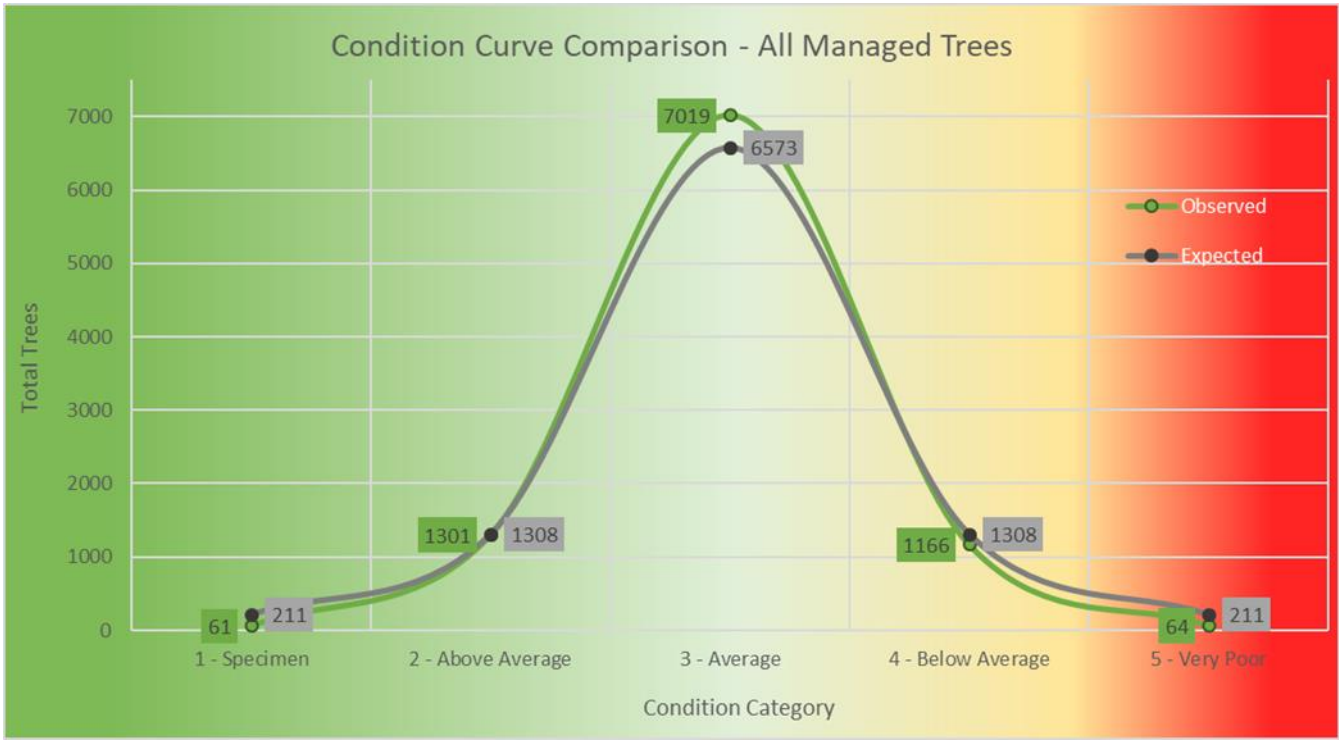
Basic Statistics – Managed Trees

Total Number of Managed Trees	9,611
Total Number of Species	136
Total Diameter Inches	93,407"
Average Tree Diameter	9.72"
Average Tree Condition	2.99 (Average)
Average Mature (8" and up) Tree Condition	2.88 (Above Average)

Condition Curve

During the tree inventory, we rated the condition of each tree using a 1-5 rating system. The rating criteria is as follows:

Condition 1	**Specimen** – Tree has no observable defects, wounds, diseases, and has textbook perfect form for the species. In addition, since young trees have a tendency to be trouble free, a condition 1 tree must by definition be greater than 16" DBH. These are legacy trees, and as such are rare.
Condition 2	**Above Average** – Tree may have a small amount of deadwood, or a very limited number of nonthreatening defects. The overall form of the tree must be good, and consistent for the species in question. These trees must be larger than 8" DBH for the reason listed above. Often the difference between condition 2 and 3 is growth habit.
Condition 3	**Average** – Tree has moderate amounts if deadwood, wounds, or other deficiencies, but is generally healthy. A wide variety of forms is acceptable for this group, which is meant to define the middle ground around which better or worse trees can be defined and identified.
Condition 4	**Below Average** – Tree has defects, deadwood, wounds, disease, etc. that are in imminent danger of causing a need for removal. Very poor form or architecture can put an otherwise healthy tree in this category as well, though generally it is reserved for health defects.
Condition 5	**Very Poor** – Tree must be removed. Physical or Health defects are too far advanced for the tree to be reasonably saved. Like condition 1 trees, these are relatively rare, as generally trees approaching this level are removed before they can get there.



The chart above represents the distribution of trees in each of the 5 categories. We have included the tree condition ratings we observed in the field, as well as a curve representing an "average" distribution so that comparisons can be made. The green line represents what we observed in the field, and the grey line represents a "normal" or average expected tree population.

The number of Specimen trees was less than predicted by statistics, but this is typical. In our rating system, Specimen trees must be 16" DBH or greater and in absolute perfect form with no defects to be considered for this status, and as such are fairly rare. The above average tree count was almost exactly where statistics would predict it to be, and this is no small feat considering as we will see below that over half of GPD's trees are less than 8". In our rating system, trees must be 8" DBH or larger to be eligible for Above Average status. As these younger trees age and are appropriately cared for, they will move into the higher condition categories, and we should look to see GPD's high standard of care result in very high numbers of above average trees

To that point, the average condition trees were significantly higher than where a bell curve predicted they would be. Given the younger tree population, this is expected due to our restrictions on giving trees an above average condition rating. As these trees age and are properly cared for, we expect them to move into the higher condition rating categories.

The Below Average trees are significantly below what the bell curve would predict, and this is indicative of a high standard of care. We know that since the original 2011 inventory, GPD staff have been hard at work removing not only poor condition Ash and Elm trees, but also other trees which were identified during each annual update as being on poor condition, and these trees were also removed when necessary. This number bears out that use of the data and commitment to a forestry program.

The Very Poor Condition trees are lower than expected by a fairly significant amount. This again speaks to the high standard of care being provided by GPD. They have been averaging removal of 350 trees per year as a whole, and now with Emerald Ash Borer behind them, these trees will likely be removed within the next year or 2. As these trees are removed, this number should decrease very quickly. We would recommend starting to address these trees with in-house labor first, and then moving on to contract the larger and more hazardous removals after that. We will examine the Maintenance recommendations below.

Going forward, GPD has an opportunity to even further improve the overall condition of its tree population. The identification and pruning or removal of existing poor condition or high risk trees, while planting a diverse group of species in open planting spaces will result in a high quality population. In the future, as the tree inventory data is updated, the average condition rating of 2.99 can serve as a metric by which GPD can benchmark its success in the maintenance strategies that result from the implementation of its Urban Forest Management Plan. As poor condition trees are removed and higher quality trees grow and are planted, this number will continue to decrease, corresponding to an even more positive trend in overall tree condition.

Age Class Analysis

In terms of the ages of trees in GPD, we have split the tree population into 8 “classes” of 6” diameter increments. This tells us how many trees are in each “Age Class”. Since trees are measured by Diameter at Breast Height (DBH) as a standard measure, this breakdown can help show where trees are in their life cycles. Some trees like Cottonwood and Silver Maple grow in diameter very quickly, up to 1” per year or possibly more. Other slower growing trees such as Oak and Hickory may only add ¼” or less every year. As a generalization, it can be said that most trees in the Midwest on average grow at around ½” per year.

The broad trend here is that GPD has a fairly stepwise age-class class distribution, with a very large number of young trees (0-6") and incrementally lower levels of larger trees. It is a fairly young tree population overall, with very few trees in the larger size categories. This is likely due to the age of Glenview's park system overall. As can be seen in the graphic on the right, Glenview's human population was only 6,142 people in 1950. This number tripled by 1960, and then tripled again by 1990. This rapid growth from 1950-1990 is borne out in the tree size classes. At an average of ½" growth per year, trees in the 25-35" ranges are those which existed at the beginning of this rapid growth. As Glenview expanded and increased its number of parks, new trees were planted, and these represent the trees less than 25" DBH in the population.

Year	Population
2018	47,258
2010	44,773
2000	41,847
1990	37,093
1980	32,060
1970	24,880
1960	18,132
1950	6,142
1940	2,500

Combine this all with the fact that many of the larger Elm and Ash trees which were among the earlier planted trees are likely now gone, and this is why you see this vacuum in larger trees. It has very little to do with level of care. Based on all of this, significant increase in tree planting budget is recommended so that GPD can not only continue to replace trees as fast as they are lost, but also increase the stocking density overall for the district. There is ample opportunity for planting of new trees in many areas where none ever existed, and this is one of the key reasons we believe that GPD can easily increase its tree population by nearly 20% over the next 30 years.

This situation presents management strengths and opportunities. In terms of strengths, we are always seeking to find ways to increase the number of trees in the older age classes, because larger trees provide greater benefits. With a large population of trees in the younger age classes, and with the proper care and adherence to this plan, GPD can expect a very large number of trees in the 25" DBH and greater ranges in 30 years. This will happen in large part because of the large numbers of young trees being planted right now to replace the large lost population of Ash trees. We have included a projected DBH range table later in the plan which bears this out. Trees in the younger classes respond much better to pruning, soil amendments, chemical treatments, and other such things which can aid in a longer life.

On the opportunities and challenges side of the equation, the total benefits to be had from the tree population in Glenview Park District will remain fairly low in comparison to other similarly sized park districts for some time as older trees die, new trees are planted, and the higher numbered cohorts take their time getting to the larger size classes. Additionally, there is much tree planting work to be done, as is shown in the numbers below, and this will take resources in several different areas. The Tree Planting portion of this plan will account for a large share of the overall 2020-2050 budgeting process.

Maintenance Status

During the inventory and its various updates, our field staff recorded a basic Maintenance status for each tree which broadly outlines what work needs to be performed in the coming years. These are broad generalizations, but supply enough data to begin creating work orders. During the inventory, 6,830 trees (81%) were identified as "Cyclical Prune". This means these trees have no immediate maintenance needs, and instead will simply need to be pruned on the park district's TBD pruning cycle as detailed below.

1,663 trees (10.4%) fell into the "Monitor" category. Monitor essentially means that the tree had some defect or emerging condition that needs further observation before it could be categorized elsewhere. Ash trees with some EAB damage not yet requiring removal, or trees with inconclusive symptoms of Dutch Elm Disease would be 2 examples of such trees. Additionally, many Pine and Spruce exhibiting signs of pathogens were also assigned this category. These trees do not need to be physically monitored constantly, but just checked on periodically. Essentially, they were trees that did not rightfully belong in any other category.

There were 728 (4.6%) trees which were listed as "Priority Prune". These trees either had excessive deadwood, were overgrown, or require pruning on a more immediate scale, typically defined as within 1-3 years. There were also an additional 94 trees listed as "Hazard Prune", and GPD should prune these trees as soon as is practicable. In the Pruning section below, we have prioritized these Hazard and Priority prune trees such that they can be pruned in the appropriate time scale, which is well within GPD's capabilities.

The 266 trees in the "Remove" category are those which are beyond reasonably retaining, but do not necessarily pose a high risk. These trees should generally be removed within 1-5 years. Additionally, there was 1 "Hazard Remove" tree. The hazard removal should be removed within 1 calendar year of this Plan's adoption, and once again, we have detailed these items in the "removals" section below.

There were 7 trees which were listed as needing a formal Risk Assessment, which is a very positive trait. Risk assessment will be addressed later in greater detail, suffice it to say that these trees are of higher quality and provide excellent benefits, but have some difficult-to-diagnose defects. A more thorough inspection is recommended for these trees before a final decision is made as to whether to retain or remove them.

Finally, the 22 trees in the "Priority Maintenance" category. Generally, these are trees which required cabling or bracing, chemical treatment, or other such non-pruning or removal-related care.

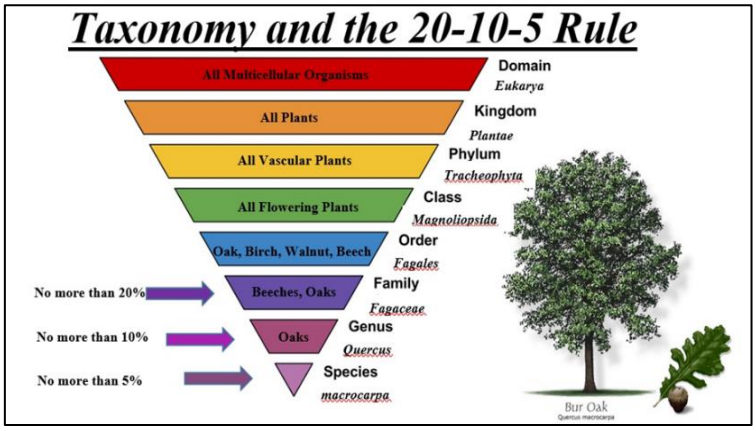
The strengths of the tree population in terms of maintenance include the very high number of trees in the Cyclical Prune category, as well as the low numbers in the Hazard Remove and Risk Assessment categories. This implies that the majority of GPD's trees are in good to fair condition, and will not require immediate budget allocation to deal with hazards. Also indicating a population in overall good condition are the relatively low number of trees in the Removal and Priority Prune classes. These trees will require budget allocation in the short term, but we have provided cost projections and procedures below so that GPD can start the process of budgeting for these activities.

Another positive trait was that according to Glenview's existing number of trees being removed each year, and data for tree pruning, we believe that all of the priority maintenance items can be taken care of quickly.

Diversity Analysis

Taxonomy is the method by which scientists classify plants, animals, and other life forms into distinct categories. A species is unique. There is only one type in that category, such as Burr Oak (*Quercus macrocarpa*), which refers to only one specific type of tree. A genus, however, is a group that may contain multiple species. All Oak trees, for instance, are in the genus *Quercus*. The further down the taxonomic ladder you go, the more similar things become. A graphic illustration of this is given here.

The more similar tree species are to each other, the higher the likelihood that an insect or pathogen is able to exploit every species of that genus. EAB is a classic example of this, as it affected every tree species in the Ash genus. The best prevention of tree loss we have is to limit the number of trees that a new pest or pathogen can affect. While diversity of species is important (such as white oak, red oak, bur oak, and pin oak), it is also important to achieve diversity on the genus and family level, so that Oaks, Hackberries, Hybrid Elm, and a large selection of trees are planted. A "20-10-5" rule for GPD's future tree plantings is recommended, which stipulates no more than 20% of any one family, 10% of any one genus, and 5% of any one species shall be planted during any one planting cycle. It will also be a long-term goal of the forestry program to have the tree population as a whole in compliance with the 20-10-5 Rule, although it may not be possible by the 2050 date we have utilized. This level of taxonomic diversity is consistent with today's arboricultural industry standards (see graphic to right).



The old paradigm of urban forestry was to create tree lined streets and parks in which every tree was the same type, shape, age, and height. This was thought to produce a symmetrical and uniform appearance. Urban foresters have now learned that once a pest or pathogen is introduced into a monoculture planting such as this, an epicenter of infestation is created that may cause serious damage, both ecologically and financially. Diversity in the urban forest helps to prevent and reduce the impacts of pests and pathogens. There are three aspects of diversity in the urban forest. We will examine these in detail, below.

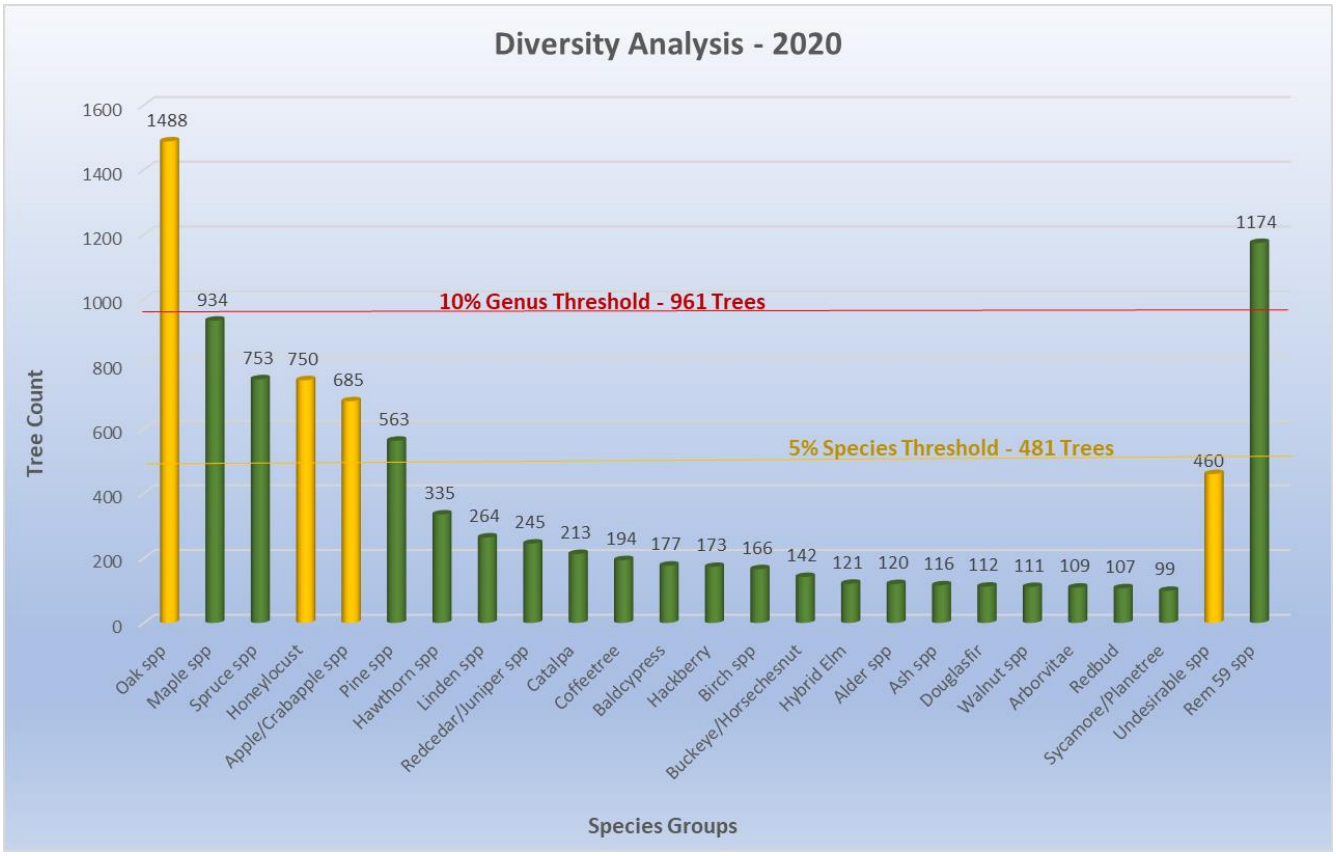
Current Tree Population

SPECIES	COUNT	% OF TOTAL	AVG DBH	AVG HEIGHT	AVG SPREAD	AVG COND
HONEYLOCUST	750	7.80%	18.21	40.19	29.42	2.93
APPLE-CRAB SPP	625	6.50%	7.52	12.42	12.16	3.11
OAK-BURR	514	5.35%	4.90	15.98	8.72	2.92
OAK-SWAMP WHITE	467	4.86%	5.44	16.46	9.47	2.91
PINE-AUSTRIAN	347	3.61%	12.70	28.00	17.39	2.87
HAWTHORN-SPP	335	3.49%	8.56	13.63	12.49	3.11
SPRUCE-NORWAY	272	2.83%	10.92	36.08	17.21	2.72
OAK-RED	248	2.58%	8.34	25.63	15.46	2.95
SPRUCE-SPP	247	2.57%	5.32	17.51	9.21	3.05
EASTERN REDCEDAR	243	2.53%	7.10	26.83	10.79	3.01
MAPLE-NORWAY	241	2.51%	13.20	33.17	22.29	3.08
SPRUCE-BLUE	231	2.40%	8.76	25.02	11.21	3.14
MAPLE-SILVER	229	2.38%	17.47	41.80	25.43	3.01
LINDEN-LITTLELEAF	228	2.37%	11.64	26.59	17.88	2.87
COTTONWOOD	222	2.31%	21.20	48.61	23.88	3.31
CATALPA	213	2.22%	6.54	19.98	10.77	3.02
KENTUCKY COFFEETREE	194	2.02%	7.05	20.40	12.19	2.90
BALDCYPRESS	177	1.84%	10.91	27.78	14.90	2.60
HACKBERRY	173	1.80%	9.59	23.66	15.80	2.91
MAPLE-SUGAR	156	1.62%	8.63	21.71	14.79	2.79
BIRCH-RIVER	133	1.38%	11.29	24.88	15.75	2.86
ELM-HYBRID	121	1.26%	4.80	17.39	8.92	2.98
ALDER-SPP	120	1.25%	8.62	22.50	10.99	3.04
BUCKEYE-OHIO	113	1.18%	10.43	28.29	18.11	2.84
DOUGLAS FIR	112	1.17%	4.66	14.44	6.42	3.07
ARBOR VITAE	109	1.13%	7.34	11.90	7.65	3.11
AMERICAN REDBUD	107	1.11%	5.04	12.77	9.51	3.10
WALNUT-BLACK	106	1.10%	12.15	39.86	22.81	2.79
PINE-SCOTCH	102	1.06%	12.43	27.40	16.81	2.81
MAPLE-RED	99	1.03%	10.91	28.25	16.11	2.96
PINE-WHITE	97	1.01%	11.98	36.49	19.43	2.76
IRONWOOD	89	0.93%	5.60	20.69	9.48	3.13
MAPLE-AUTUMN BLAZE	85	0.88%	7.96	27.35	13.64	2.81
AMERICAN HORNBEAM	84	0.87%	4.73	12.01	9.03	3.04
LONDON PLANETREE	83	0.86%	4.88	18.01	9.04	2.98
ELM-AMERICAN	76	0.79%	17.29	41.51	26.71	3.20
ASH-WHITE	75	0.78%	13.12	27.93	20.40	3.09
OAK-SHINGLE	74	0.77%	4.14	10.00	5.71	3.08
PEAR-CALLERY	71	0.74%	8.48	22.66	13.31	2.89
SERVICEBERRY-SPP	65	0.68%	5.22	10.93	8.81	3.00
APPLE-EDIBLE	60	0.62%	9.60	15.17	12.97	3.33

DOGWOOD-CORNELIAN	60	0.62%	4.12	9.74	7.19	3.03
GINKGO	58	0.60%	4.88	16.70	8.50	2.91
MAPLE-AMUR	58	0.60%	10.71	14.89	13.91	3.19
WILLOW-SPP	58	0.60%	22.59	31.56	26.88	3.24
BOXELDER	54	0.56%	14.89	36.35	21.92	3.78
ELM-SIBERIAN	53	0.55%	20.47	38.03	21.58	3.62
OAK-CHINKQUAPIN	50	0.52%	3.12	10.15	5.91	3.08
AMUR CORKTREE	43	0.45%	10.35	24.17	13.33	3.07
OAK-ENGLISH	42	0.44%	7.48	20.41	13.24	2.86
OAK-PIN	41	0.43%	19.80	44.49	30.00	2.59
MAGNOLIA-SHRUB	39	0.41%	4.13	10.00	8.08	3.03
POPLAR-SPP	39	0.41%	5.92	19.36	8.97	3.15
MULBERRY-SPP	38	0.40%	18.68	37.57	26.08	3.66
OAK-WHITE	38	0.40%	16.08	36.06	23.94	2.71
YELLOWWOOD	37	0.38%	5.32	16.22	11.35	3.08
LINDEN-AMERICAN	33	0.34%	14.15	38.64	22.88	2.64
DAWN REDWOOD	32	0.33%	5.22	10.37	5.56	2.84
MAPLE-MIYABEI	32	0.33%	3.38	13.75	7.03	3.00
BIRCH-WHITE	30	0.31%	5.07	19.41	12.35	3.03
YEW	28	0.29%	8.96	15.88	13.53	2.96
CHERRY-SPP	26	0.27%	7.65	14.23	11.15	3.38
FIR-SPP	26	0.27%	4.00	11.96	6.74	3.00
HORSECHESTNUT	26	0.27%	5.50	15.43	8.04	2.92
ASH-BLUE	25	0.26%	11.20	23.20	18.00	2.56
PLUM-SPP	24	0.25%	5.21	11.67	11.25	3.21
HICKORY-SHAGBARK	23	0.24%	12.43	38.70	20.65	2.43
TULIPTREE	23	0.24%	4.96	19.71	8.82	2.87
BEECH-AMERICAN	22	0.23%	3.27	12.50	7.27	2.91
MAPLE-HEDGE	22	0.23%	5.50	15.53	8.95	2.86
DOGWOOD-SPP	21	0.22%	4.95	7.86	6.67	3.00
FIR-CONCOLOR	21	0.22%	6.76	18.95	7.89	2.95
CHESTNUT-CHINESE	20	0.21%	9.75	21.88	12.50	2.60
HEMLOCK-EASTERN	20	0.21%	3.40	11.58	6.32	2.95
BEECH-EUROPEAN	19	0.20%	8.47	12.22	8.89	2.63
CHERRY-BLACK	19	0.20%	10.47	31.32	14.21	3.58
LILAC-SPP	19	0.20%	7.63	12.35	11.47	3.00
SWEETGUM	18	0.19%	6.17	14.67	7.00	2.89
SYCAMORE	16	0.17%	14.69	35.00	25.00	2.94
LILAC-TREE	15	0.16%	2.00	10.00	5.00	3.00
BLACKGUM	14	0.15%	3.57	10.00	5.50	3.14
SUMAC	13	0.14%	6.92	11.54	13.08	3.15
ZELKOVA	12	0.12%	5.08	17.86	10.71	3.00
ASH-GREEN	11	0.11%	7.45	23.18	12.27	4.09
HICKORY-PECAN	11	0.11%	2.00	10.00	5.00	3.00
PERSIMMON	10	0.10%	1.40	7.50	5.00	3.30
LARCH	9	0.09%	2.33	10.00	5.00	3.22
MAGNOLIA-TREE	9	0.09%	10.22	20.00	15.56	3.11

MAPLE-JAPANESE	9	0.09%	1.22	5.56	5.00	3.00
PINE-SWISS STONE	9	0.09%	9.89	25.56	13.89	3.00
OAK-HILLS	8	0.08%	1.13	5.63	5.00	3.13
PERSIAN IRONWOOD	7	0.07%	2.29	10.00	5.00	3.00
PINE-LIMBER	7	0.07%	2.86	10.00	5.00	3.00
WITCH HAZEL	7	0.07%	4.00	7.86	5.71	3.00
FRINGETREE	6	0.06%	2.83	6.67	5.83	3.00
LILAC-IVORY SILK	6	0.06%	2.00	10.00	5.00	3.00
AMUR MAACKIA	5	0.05%	2.20	9.00	5.00	3.00
BLACK LOCUST	5	0.05%	12.00	26.00	20.00	3.40
KATSURA	5	0.05%	13.40	40.00	30.00	2.40
PAWPAW	5	0.05%	1.00	5.00	5.00	3.40
VIBURNUM-SPP	5	0.05%	4.80	9.00	9.00	3.00
WALNUT-WHITE	5	0.05%	10.20	18.00	16.00	3.20
BUCKTHORN	4	0.04%	12.50	17.50	15.00	4.25
HAZELNUT-TREE	4	0.04%	7.75	20.00	10.00	2.75
MAGNOLIA-CUCUMBER	4	0.04%	7.25	17.50	8.75	3.50
OAK-SAWTOOTH	4	0.04%	3.00	12.50	5.00	3.50
ASH-SPP	3	0.03%	3.00	11.67	6.67	3.00
BIRCH-SPP	3	0.03%	2.00	11.67	5.00	3.00
BUCKEYE-YELLOW	3	0.03%	2.33	11.67	5.00	3.00
HARDY RUBBERTREE	3	0.03%	2.00	10.00	5.00	3.00
LINDEN-SPP	3	0.03%	4.00	13.33	6.67	3.00
SPRUCE-SERBIAN	3	0.03%	8.33	30.00	13.33	3.00
UNKNOWN	3	0.03%	4.00	15.00	8.33	3.00
WILLOW-CORKSCREW	3	0.03%	15.00	26.67	18.33	2.67
ASH-BLACK	2	0.02%	14.00	35.00	25.00	2.50
ELM-ENGLISH	2	0.02%	23.50	40.00	22.50	3.00
HICKORY-BITTERNUT	2	0.02%	7.50	30.00	12.50	2.50
HONEYSUCKLE	2	0.02%	13.00	15.00	17.50	3.00
JUNIPER	2	0.02%	2.00	10.00	5.00	3.00
MAPLE-PAPERBARK	2	0.02%	4.50	15.00	10.00	3.00
OAK-SPP	2	0.02%	1.50	10.00	5.00	3.00
PAGODATREE	2	0.02%	11.50	25.00	20.00	2.00
PEACH	2	0.02%	4.00	12.50	10.00	3.00
SIBERIAN PEASHRUB	2	0.02%	4.00	10.00	10.00	3.00
CEDAR OF LEBANON	1	0.01%	9.00	0.00	0.00	3.00
DOGWOOD-PAGODA	1	0.01%	3.00	10.00	10.00	3.00
ELM-SPP	1	0.01%	3.00	10.00	10.00	3.00
EUROPEAN HORNBEAM	1	0.01%	2.00	10.00	5.00	3.00
GOLDEN RAINTREE	1	0.01%	2.00	10.00	5.00	3.00
MAGNOLIA-SAUCER	1	0.01%	12.00	20.00	15.00	3.00
MAPLE-TRIFLORUM	1	0.01%	2.00	10.00	5.00	3.00
PINE-BRISTLECONE	1	0.01%	2.00	10.00	5.00	3.00
PLUM-PURPLELEAF	1	0.01%	3.00	10.00	5.00	3.00
POPLAR-WHITE	1	0.01%	16.00	30.00	20.00	3.00
SEVENTH SON FLOWER	1	0.01%	2.00	10.00	5.00	3.00
WILLOW-WEEPING	1	0.01%	31.00	50.00	30.00	4.00

As noted above, the GPD Tree population consists of 136 distinct tree species in its managed areas (not including private property), accounting for 9,611 total trees. The above table shows the percent of the total population each species makes up, as well as the average Condition, Trunk Diameter, and Height. To see which trees are performing well, we would look for trees with a Condition rating of less than 3, with a large average DBH, and/or Height and Spread. This population is shown graphically below:



Taxonomic (Species) Diversity

Why is it important to plant a diverse set of trees at the species, Genus, and Family levels? Simply put, it is to ensure that we will not fall victim to the extreme expenses of mass tree loss from pests and pathogens in the future. The reason Emerald Ash Borer was such a devastating expense for many communities was because their tree populations were over 20% Ash trees. When these trees died and had to be removed, those communities lost 20% of their trees. This comes with the obvious expenses of having to remove these trees and replace them. But it also comes with hidden expenses as well, namely the loss of the ecological services that those trees provided: Homes cost more to heat and cool, storm water infrastructure falls under heavier pressure, and increases in pollutants and greenhouse gases may be observed. For all of these reasons, a more diverse group of trees needs to be planted, such that we are never prone to losing more than 5-10% of our trees at any given time.

As can be seen above, GPD's tree population is very diverse. The chart shows all tree genera with over 1% of the population represented, and there are many unexpected genera in this list. In addition, the "Remaining 59 spp" bar to the far right of the chart is the second highest bar already, which shows a great deal of diversity even in the "less than 1%" group. The fact that there are 136 total species is very commendable, and GPD is able to apply for Level 2 Arboretum status through the ArbNet Program. That said, there are a few key issues towards the left side of the chart which must be addressed.

Maples, which are universally overplanted in the Midwest, make up for 9.7% of the overall tree population, which is approaching the 10% Genus threshold set forth in the "20-10-5" rule. That said, Glenview is also much lower in Maples than almost any other park district we work with, and this effort need to be continued. One of the goals of the Diversity Vision will be to begin targeting older and poor condition Maples for removal. That doesn't mean that no Maples should be planted, either. It just means that very few should be planted while a much larger number are removed, and the species of Maple being planted should be diversified.

Pines and Spruces are also approaching being overrepresented. Taken together, these 2 evergreen genera account for 13.7% of the total tree population. Again, this is not uncommon for park districts, where screening trees are important to screen streets and homes from parks, and create privacy. By their nature, parks typically have more evergreens. What GPD needs to start doing now is eliminating some of the older, diseased, and underperforming Pine and Spruce, and replanting with other evergreen species such as Doulas Fir, Concolor Fir, Eastern Redcedar, and other conifers. Pine and Spruce in particular are prone to many fungal diseases in our area, and have been having a difficult time with them due to cool, wet springs the past few years. GPD has already taken steps to review the health of these species and has undertaken a plan to remove, monitor or treat trees. There is still place to plant more of these tree species, but other evergreen selections should be considered.

Oak being overrepresented is not an issue as far as we are concerned. We also understand that there are several parks which account for a significant portion of these trees which are remnant Oak stands. These parks contain large stands of Mature Burr, Red, and White Oaks, and skew the numbers across the whole district. Plantings of additional Oaks in parks that are short on Oaks now is still encouraged, as is diversifying the Oaks which are being planted by using less common species such as Chinquapin Oak, Shingle Oak, and Black Oak. As Oak is on a general decline in Illinois and the Midwest, planting of Oaks in relatively high numbers is still recommended to offset losses in native Oak stands. That said, a slight decrease in Oak plantings is recommended going forward, particularly at certain parks where their numbers are already high.

Crab Apples and Honeylocust are also high, which once again is something that is very common with parks. Small ornamental trees are attractive and flowery, and provide park patrons with enjoyment, and Honeylocust is a very hardy urban tree. However, Crab Apples can be very prone to apple scab, a fungal pathogen which can almost entirely defoliate these trees by July every year, and Honeylocust is susceptible to Honey Locust Plant bug and lecanium scale. There are a wide variety of trees with which to begin replacing these Crab Apples with, such as Tree Lilac, Dogwood, Tree Form Hydrangea, Red Buckeye, Magnolias, and Smoketree, among others. For Honeylocust, Kentucky Coffeetree and improved varieties of Black Locust are nearly indistinguishable, and Lindens, Hackberries, and Hybrid Elms are all equally hardy.

Finally, there are a high number of undesirable species in the parks (Boxelder, Buckthorn, Black Cherry, Siberian Elm, Cottonwood, Mulberry, Willow, etc). We label these trees as undesirable because they are ecologically threatening, have extremely weak wood or poor architecture, have very messy fruits, or otherwise undesirable in our urban forest. While these trees do trees provide benefits, they generally present more of a liability than they do a benefit. Species such as Siberian Elm and Cottonwood can grow to be 80 feet tall, with extremely weak wood that can fail and cause public safety concerns. Species such as Black Cherry and Mulberry may be native trees, but they are very aggressive, produce messy fruits, and have very poor architecture making them unsightly and potentially hazardous. Since much Park land is often donated land in floodplains where no building can be done, it often comes with existing poor-quality trees when the land is donated or annexed by the District. This should also be a focus of future removal and replacement efforts, as we will detail further below.

Outside of these fairly common problem areas, there are also very high numbers of Birch, Hawthorn, Alder, Hackberry, Hybrid Elm, Buckeye, Douglas Fir, and Redbud, which is somewhat rare for an urban tree population. All of these trees are phenomenal park performers, and are not anywhere near exceeding their diversity thresholds. And as mentioned above, there are many other species in the "Remaining 59 Spp" bar to the right, which is actually far higher than we typically see in a Park or any Urban tree population, which is a great starting point. Many of the trees in this group currently are below the 1% threshold for the other species in this chart, but can be planted in high numbers going forward.

In terms of recommended species for new plantings, we have provided the general guidelines below in the "Future of the Urban Forest" section, but encourage GPD to continually evaluate its diversity levels. In terms of strengths, the diversity of the tree population is fairly high at the moment, and this comes with the benefit that no other species or genera approach their "20-10-5 Rule" limits, and GPD can plant virtually any recommended tree species without concern about exceeding those limits. There is tremendous room for growth, which just by itself is an opportunity.

When it comes to opportunities and challenges, they are few, all things told. The primary concern will be to get the district on a regular cycle of updating the tree inventory and performing maintenance and risk assessments based on that data. We would favor a "needs-based" pruning cycle over a zone-based geographical approach to performing cycle pruning. Additionally, due to the age and condition of many existing Maples, we have planned for a significant reduction in Maples by 2050, and the tree population will be well on its way to achieving the 20-10-5 goal.

Spatial Diversity

Spatial diversity is the concept of mixing tree species evenly over the whole population to increase distance between potential host organisms. The easiest way to slow the spread of any new pest or pathogen is to increase the distance between potential host trees. Every pest or disease, such as EAB or Dutch Elm Disease (DED), has a limited area to which it can spread in a given time frame. The more difficult it is to get to the next host tree, the less of a problem the pest or pathogen becomes, and the easier quarantining these pests and pathogens becomes.

In addition to the functional benefits provided by increasing spatial diversity, communities and neighborhoods that have implemented diverse planting over the past several decades have demonstrated that such diversity yields an arboretum-like landscape that is both functional and aesthetically pleasing. At present, the Spatial Diversity in GPD is very good, particularly given the overabundance of Maple trees in the population. A robust reforestation / tree planting plan planning phase has already been undertaken, and the planning staff at GPD have been in the habit of spatially diverse plantings for many years. This will ensure that new plantings will be designed in a manner that a highly spatially diverse tree population will be created, and the creation of areas of low spatial diversity will be avoided (monocultures).

Age-Class Diversity

Age-class diversity is also an important consideration. A healthy forest has trees of many ages. Young, intermediate and mature trees allow for regeneration, replacement and vigor in the overall forest community. A mixture of tree species, locations, and ages will lead to the greatest diversity, which will insulate the forest against pest and pathogen outbreaks. The urban forest is no different. The outdated urban forestry paradigm promoted even-aged tree plantings, so that all trees were approximately the same size and age. However, once these trees begin to decline, most will require removal and replanting almost simultaneously. This can leave an entire park or neighborhood without shade and aesthetics for nearly a decade.

The current approach of the urban forestry community is to strategically plant trees in parks over a longer timeframe. With this strategy, trees will grow to maturity in different stages, and decline at different times. When the dead trees are eventually removed, there will always be a variety of age classes on a block or in a neighborhood. This reduces the pressure to reforest an area immediately after removal, helping to manage costs and maintain budget cycles. A mixed age-class stand planting ensures that mature trees are always present in a park. It also will allow for strategic planting of trees based on the existing canopy.

In addition, we have discussed the concept of average tree lifespan with GPD staff. It is understood that some species of trees simply do not have a long lifespan. Crab Apples, Serviceberries, and Tree Lilacs (most of the smaller ornamentals) are examples of these trees, and this must be taken into account with a long term planting plan. Oaks and Hickories with lifespans of 100 years or more should not be taken into consideration on the same timeframes as these smaller ornamentals. That said, in our long term planting plan, we have decided to accept these lifespan issues at face value, and have not increased the total volume of planting shorter lived trees vs longer lived trees. It is understood that these trees will require replacement on a shorter scale, and the overall goal is to plant fewer of these trees in favor of larger and longer-lived species.

An additional benefit of mixed-age plantings is the ability to plant shade-loving trees as well as sun-loving trees. When a park is newly planted with trees of the same age, all the trees are essentially in full sun. This precludes the ability to plant shade loving trees, as they have a tendency to dry out in the summer sun. With mixed-age stands, shade-tolerant, medium height trees may be planted underneath the canopy of larger, mature trees. This calculated approach will be utilized for future tree removal and replacement, and help to create a more “staggered” urban forest, one that has mature trees, middle aged trees, and young trees in similar quantities.

<u>iTree Streets Analysis Results</u>

Glenview

Total Annual Benefits, Net Benefits, and Costs for Public Trees

2/18/2020

Benefits	Total ($)	Standard Error	$/tree	Standard Error	$/capita	Standard Error
Energy	51,064	(N/A)	5.31	(N/A)	1.06	(N/A)
CO2	5,845	(N/A)	0.61	(N/A)	0.12	(N/A)
Air Quality	13,485	(N/A)	1.40	(N/A)	0.28	(N/A)
Stormwater	122,322	(N/A)	12.73	(N/A)	2.55	(N/A)
Aesthetic/Other	825,779	(N/A)	85.92	(N/A)	17.20	(N/A)
Total Benefits	1,018,495	(N/A)	105.97	(N/A)	21.22	(N/A)

Total Standing Value of Glenview Park District Trees (Per 9th Guide to Plant Appraisal)

$8,071,174

iTree Eco Analysis Results

- Tree Cover: 74.03 acres
- Most common species of trees: Honeylocust, apple spp, Bur oak
- Percentage of trees less than 6" (15.2 cm) diameter: 42.3%
- Pollution Removal: 1.696 tons/year ($22.3 thousand/year)
- Carbon Storage: 2.971 thousand tons ($507 thousand)
- Carbon Sequestration: 57.63 tons ($9.83 thousand/year)
- Oxygen Production: 153.7 tons/year
- Avoided Runoff: 159.6 thousand cubic feet/year ($10.7 thousand/year)
- Building energy savings: N/A – data not collected
- Avoided carbon emissions: N/A – data not collected
- Structural values: $9.44 million

Summary of iTree Streets and Eco Values:

Annual Values	
Benefits to Residents	$1,018,495
Benefits to Environment	$42,830
Total	**$1,061,325**
Standing Values	
As a Commodity	$8,071,174
As an Ecological Resource	$9,947,000
Total	**$18,018,174**

As can be seen from the above tables, the tree population in the Glenview Park District currently provides approximately $1,018,495 in benefits every year, directly related to trees and their effective facilities, neighboring homes, businesses, and the environment. In additional, the value as a commodity and an ecological resource of the whole tree population is $18,018,174.

These benefits are measured as the Ecological Services these trees provide to Glenview residents and the environment, as listed above. These benefits can be viewed as income to the Glenview's residents, and so long as the trees are maintained well, they will continue to provide these benefits, and more. As trees grow in size, they also increase their benefits. For example, a 3" diameter tree provides less than $50/year in benefits, whereas as 20" diameter tree can provide up to $500 per year. The goal is to increase benefits of the tree population as a whole even more, to a point where the tree population essentially pays for it's own maintenance, and even yields "profits" in terms of ecological services.

The replacement value of trees was also calculated. Currently, the standing value of all trees in GPD's tree population is $8,071,174. This value is calculated using the industry standard reference, the *9th Edition Guide to Tree and Landscape Appraisal*, which is published by the Council of Tree and Landscape Appraisers.

The iTree Eco data takes into account the value of the trees in the absence of the effect on homes or businesses, and looks at trees more from an ecological perspective, mostly what the tree's value is in sequestering and storing Carbon as a resource. These numbers are based on peer reviewed science in both Arboriculture as well as Climatology and other disciplines. The goal in this Urban Forestry Management Plan is to create a tree population which maximizes all of these ecological services to Glenview residents by increasing the number of trees in the parks, and how long they live, while minimizing costs in order to create a healthy, well maintained, and beneficial tree population. The complete i-Tree Reports can be found in Appendix L at the end of this report.

Urban Tree Canopy Assessment

Based on data available from the University of Vermont, US Forest Service Northeast Research Station, and Morton Arboretum, a determination can be made as to what the total Urban Tree Canopy of GPD is. This is expressed as the percent of the park district covered by tree canopy, from an aerial assessment (2 dimensions). This assessment included 6 additional land cover types, including grass and shrub, bare soil, water, buildings, roads and railroads, and other miscellaneous paved surfaces. The result of this tree canopy assessment was that GPD contains 34.81% total tree canopy. The map of the canopy assessment appears on the following page.

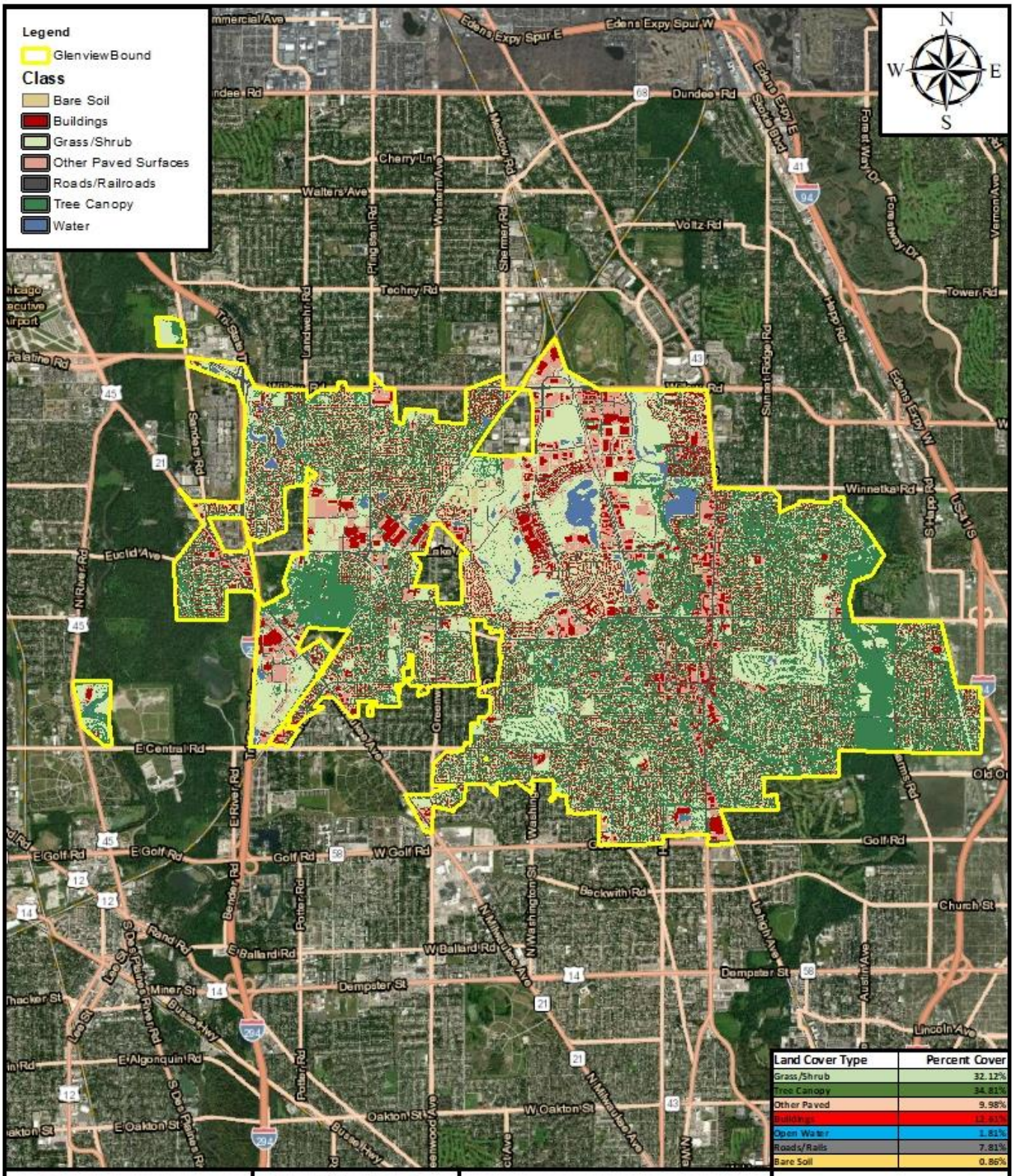
It should be noted here that the tree inventory itself was only conducted on publicly owned parks. Detailed tree information was not recorded for trees on private property. However, this Urban Tree Canopy Assessment does in fact include canopy cover on private property. Aerial images were used to estimate how much tree and other land cover types were in the park district using a software which is similar to Google Earth, but more powerful.

The goal is to increase and maintain the total tree canopy in Glenview to 35% by 2050, working in partnership with the Village as well as local business owners, schools, and other such stakeholders. This goal has been estimated by analyzing data from many different urban tree populations in the Chicago and Northwest Illinois regions, and is based on preliminary data from the Chicago Region Trees Initiative's (CRTI) Forest Composition Workgroup. With such a high canopy cover percentage in the first place, we believe that maintaining canopy, with only slight growth, is a reasonable and attainable goal.

This will ensure that existing trees will live longer and provide greater benefits. Tree planting and maintenance will also be encouraged on private property, by incentivizing residents and business owners to plant trees through public private partnerships, as well as attempting to provide outreach and education to residents through events such as Arbor Day and Earth Day celebrations. This goal will be monitored by using aerial imagery analysis. Every 5 to 10 years, the imagery will be reassessed, and a new canopy cover percentage will be calculated for Glenview.

The table to the right, and map on the following page, show the different land type classifications.

Land Cover Type	Percent Cover
Grass/Shrub	32.12%
Tree Canopy	34.81%
Other Paved	9.98%
Buildings	12.61%
Open Water	1.81%
Roads/Rails	7.81%
Bare Soil	0.86%



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URBAN TREE CANOPY ASSESSMENT GLENVIEW, IL

1 inch = 5,000 feet

0 1,200 2,400 4,800 7,200 Feet

Created On : 2/11/2020

Section 5– The Future of the Urban Forest

In this next section, a vision of what the tree population of GPD could become by 2050 was created, and compared and contrasted with the current population. Using the existing data, and then long-term vision based on best management practices and tree biology, we will then define exactly how GPD can move from where it is now to where it should be, by creating a customized Forestry program.

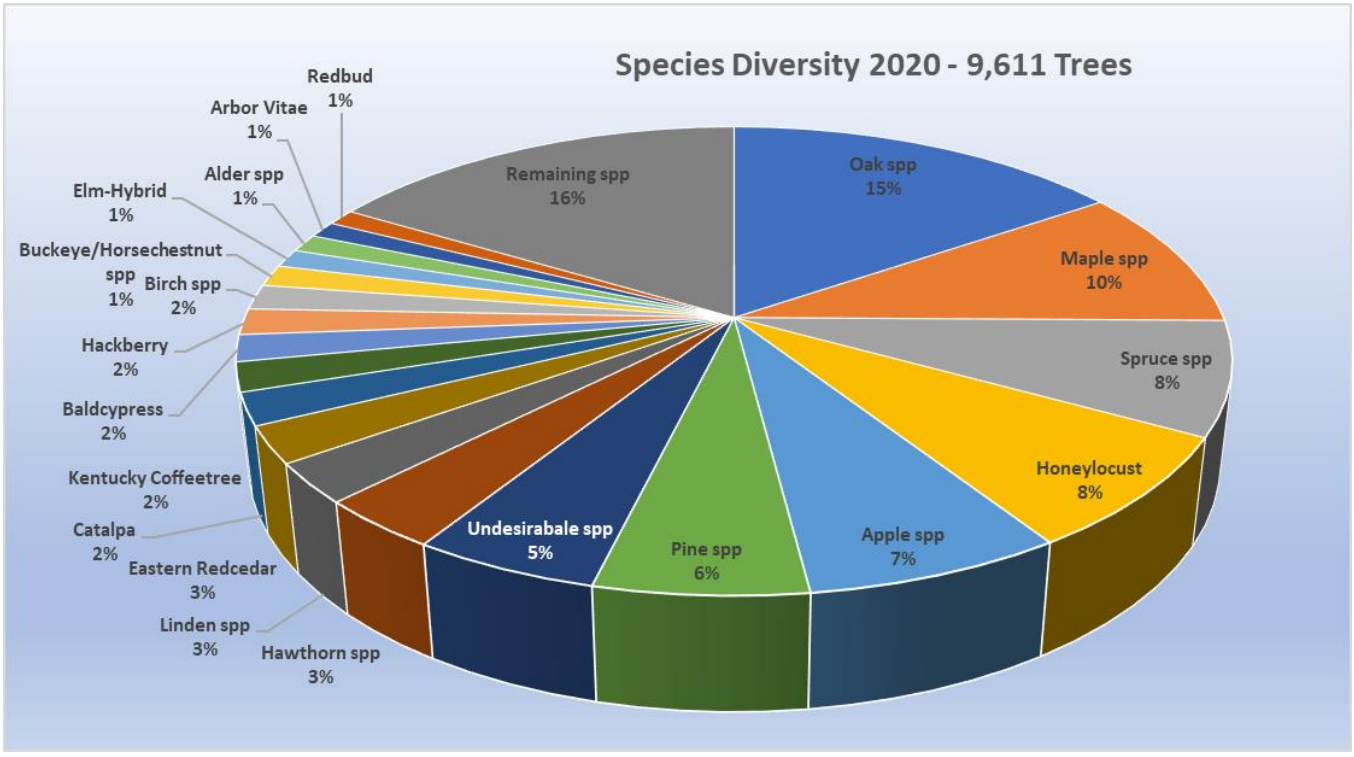
SPECIES	COUNT 2020	COUNT 2050
HONEYLOCUST	750	600
APPLE-CRAB SPP	625	450
OAK-BURR	514	400
OAK-SWAMP WHITE	467	400
PINE-AUSTRIAN	347	200
HAWTHORN-SPP	335	250
SPRUCE-NORWAY	272	150
OAK-RED	248	200
SPRUCE-SPP	247	150
EASTERN REDCEDAR	243	300
MAPLE-NORWAY	241	150
SPRUCE-BLUE	231	150
MAPLE-SILVER	229	100
LINDEN-LITTLELEAF	228	150
COTTONWOOD	222	100
CATALPA	213	250
KENTUCKY COFFEETREE	194	250
BALDCYPRESS	177	250
HACKBERRY	173	250
MAPLE-SUGAR	156	125
BIRCH-RIVER	133	200
ELM-HYBRID	121	250
ALDER-SPP	120	150
BUCKEYE-OHIO	113	175
DOUGLAS FIR	112	175
ARBOR VITAE	109	175
AMERICAN REDBUD	107	150
WALNUT-BLACK	106	40
PINE-SCOTCH	102	75
MAPLE-RED	99	125
PINE-WHITE	97	75
IRONWOOD	89	150
MAPLE-AUTUMN BLAZE	85	150
AMERICAN HORNBEAM	84	150
LONDON PLANETREE	83	150
ELM-AMERICAN	76	20
ASH-WHITE	75	40
OAK-SHINGLE	74	100
PEAR-CALLERY	71	10
SERVICEBERRY-SPP	65	150
APPLE-EDIBLE	60	100
DOGWOOD-CORNELIAN	60	90
GINKGO	58	150
MAPLE-AMUR	58	10
WILLOW-SPP	58	10
BOXELDER	54	0
ELM-SIBERIAN	53	0
OAK-CHINKQUAPIN	50	80

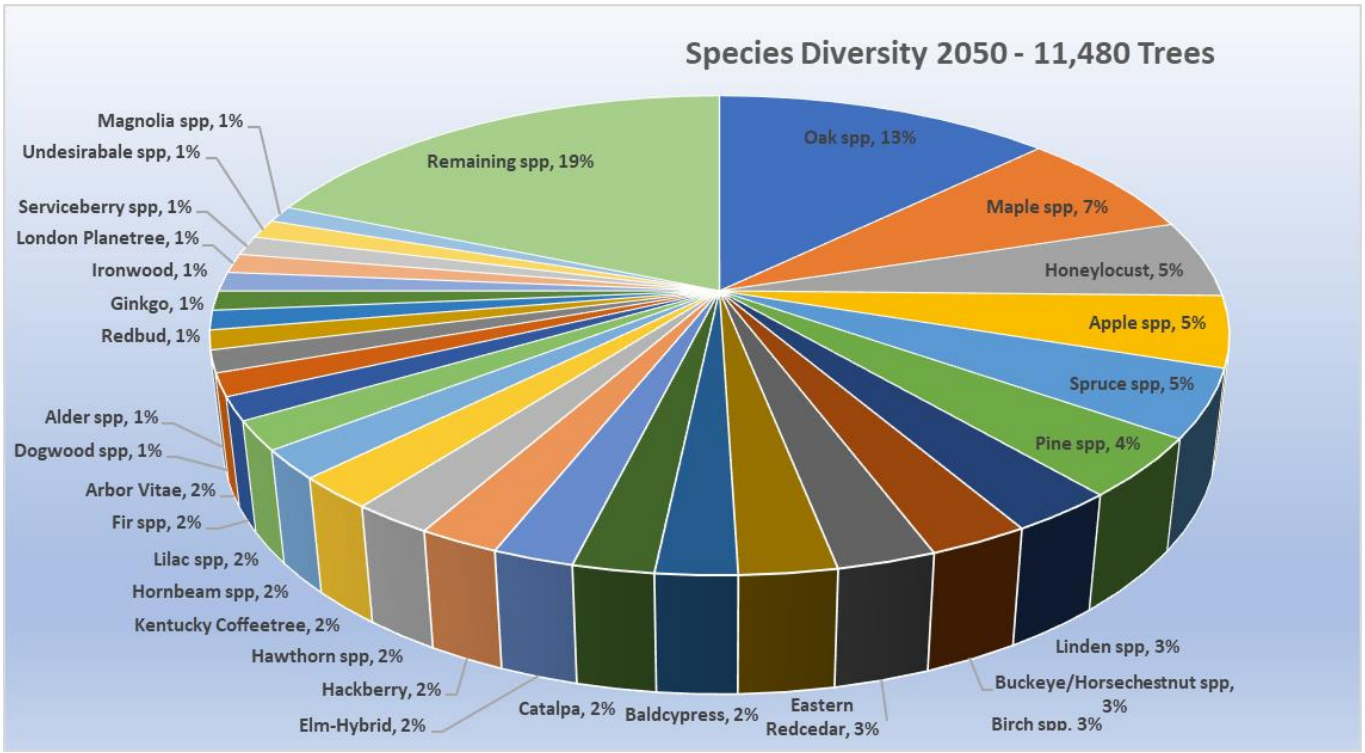
SPECIES	COUNT 2020	COUNT 2050
AMUR CORKTREE	43	25
OAK-ENGLISH	42	75
OAK-PIN	41	50
MAGNOLIA-SHRUB	39	60
POPLAR-SPP	39	10
MULBERRY-SPP	38	10
OAK-WHITE	38	75
YELLOWWOOD	37	75
LINDEN-AMERICAN	33	100
DAWN REDWOOD	32	60
MAPLE-MIYABEI	32	60
BIRCH-WHITE	30	75
YEW	28	50
CHERRY-SPP	26	50
FIR-SPP	26	80
HORSECHESTNUT	26	80
ASH-BLUE	25	10
PLUM-SPP	24	25
HICKORY-SHAGBARK	23	50
TULIPTREE	23	100
BEECH-AMERICAN	22	50
MAPLE-HEDGE	22	50
DOGWOOD-SPP	21	50
FIR-CONCOLOR	21	100
CHESTNUT-CHINESE	20	50
HEMLOCK-EASTERN	20	50
BEECH-EUROPEAN	19	50
CHERRY-BLACK	19	5
LILAC-SPP	19	50
SWEETGUM	18	50
SYCAMORE	16	5
LILAC-TREE	15	75
BLACKGUM	14	75
SUMAC	13	50
ZELKOVA	12	75
ASH-GREEN	11	5
HICKORY-PECAN	11	25
PERSIMMON	10	25
LARCH	9	75
MAGNOLIA-TREE	9	10
MAPLE-JAPANESE	9	10
PINE-SWISS STONE	9	20
OAK-HILLS	8	25
PERSIAN IRONWOOD	7	30
PINE-LIMBER	7	75
WITCH HAZEL	7	60
FRINGETREE	6	20
LILAC-IVORY SILK	6	100

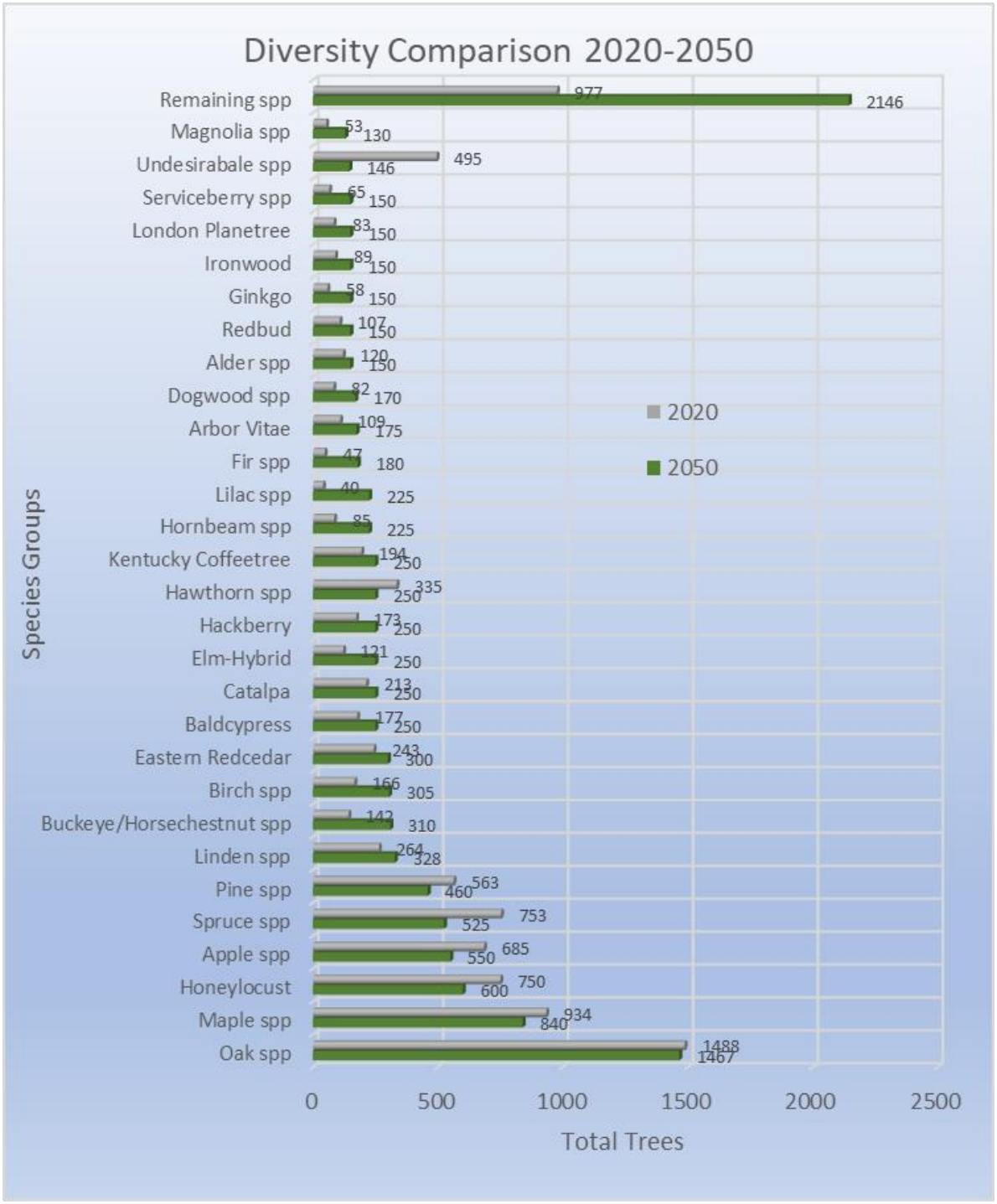
SPECIES	COUNT 2020	COUNT 2050
AMUR MAACKIA	5	75
BLACK LOCUST	5	30
KATSURA	5	30
PAWPAW	5	60
VIBURNUM-SPP	5	50
WALNUT-WHITE	5	5
BUCKTHORN	4	0
HAZELNUT-TURKISH	4	50
MAGNOLIA-CUCUMBER	4	30
OAK-SAWTOOTH	4	30
ASH-SPP	3	1
BIRCH-SPP	3	30
BUCKEYE-YELLOW	3	25
HARDY RUBBERTREE	3	30
LINDEN-SPP	3	3
SPRUCE-SERBIAN	3	75
UNKNOWN	3	3
WILLOW-CORKSCREW	3	5
ASH-BLACK	2	0
ELM-ENGLISH	2	1
HICKORY-BITTERNUT	2	30
HONEYSUCKLE	2	0
JUNIPER	2	30
MAPLE-PAPERBARK	2	30
OAK-SPP	2	2
PAGODATREE	2	30
PEACH	2	30
SIBERIAN PEASHRUB	2	30
CEDAR OF LEBANON	1	1
DOGWOOD-PAGODA	1	30
ELM-SPP	1	0
EUROPEAN HORNBEAM	1	75
GOLDEN RAINTREE	1	30
MAGNOLIA-SAUCER	1	30
MAPLE-TRIFLORUM	1	30
PINE-BRISTLECONE	1	15
PLUM-PURPLELEAF	1	30
POPLAR-WHITE	1	0
SEVENTH SON FLOWER	1	30
WILLOW-WEEPING	1	1
BUCKEYE-RED	0	30
HYDRANGEA-PEEGEE	0	30
LINDEN-SILVER	0	75
OAK-BLACK	0	30
PEAR-EDIBLE	0	30
ROSE OF SHARON	0	30
SMOKETREE	0	30
CAROLINA SILVERBELL	0	30

	Actively Remove
	Maintain Current Population
	Plant in Limited Quantities
	Plant in Abundance

Change in Species Composition 2020 – 2050







As can be seen from the above tables and chart, compared with the current species breakdown, the 2050 population will be more diverse and balanced than the current population. The Maple population will be reduced from 934 to 840 which represents a reduction of only around 100 net Maples. However, the goal will be to diversify the Maples as well, as no one species of Maple is overplanted right now, but taken as a whole they are an issue. We have also aimed to increase the numbers of Oak plantings over this same time period, although we should note here that as Oaks are disappearing in our native Illinois communities, this effort has more to do with balancing the Oaks across the taxonomic, age class, and spatial diversity as a whole. Yes, this will leave the number of Oaks even further above the 20-10-5 Rule limit, but we will plant them in parks deficient in Oaks now, and plant less common species.

Another goal is to have the majority of the undesirable species removed by 2050 as well. The presence of undesirable species is a common issue in Parks, as much park land is often donated floodplain, and comes with existing trees such as Cottonwood, Box Elder, Mulberry, and Black Cherry, among others. We will also significantly reduce Pine, Spruce, Crabapple, and Honeylocust plantings to open up room for significant diversification.

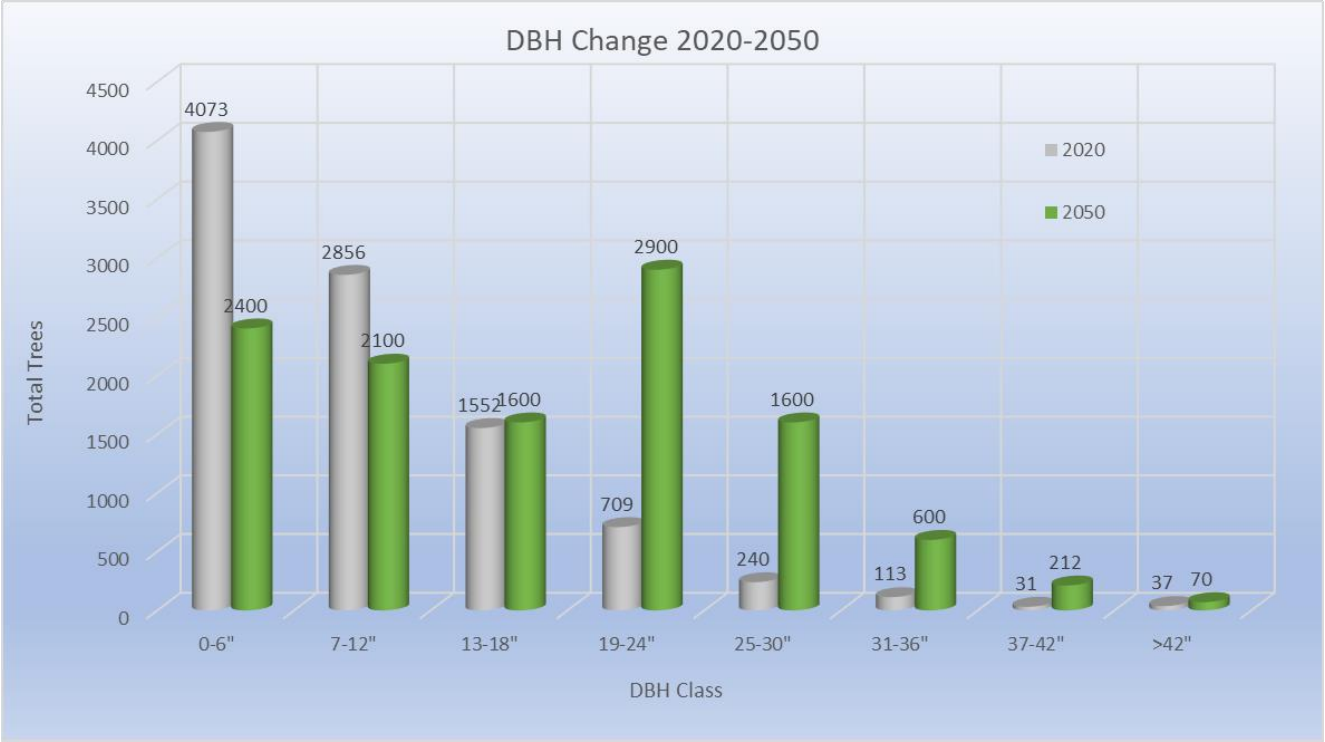
Increases in every other species across the population have also been projected. Among the largest increases in number will be in the "less than 1% representation" group, which will jump from its current status of 977 to over 2,100 trees. What this means effectively is that the greatest species diversity will exist in trees genera and species with less than 100 members each in the parks, and only around 20 species or genera will be heavily represented in the parks.

In order to arrive at these figures, the existing tree population was analyzed first for how many of each tree species would require removal based on the inventory, plus natural aging and decline over the coming 30 years. After this, we estimated how many of each species would be required to replace these removed trees, fill open planting spaces, and even factored a 15% new planting failure rate into our projections, so that our species composition projections and tree removal estimates account for failure of new plantings.

All told, we expect the managed tree population of GPD to increase form its current number of 9,611 trees to nearly 11,500 trees by 2050. This represents an increase of nearly 20% in the total numbers of trees in the Glenview Parks system. We believe this is an attainable goal, and will further examine the stocking density of the tree population below.

The Benefits of Larger, Healthier Trees

As expressed above, larger trees provide greater benefits to the community. They create more shade to reduce cooling costs, absorb more storm water to defray infrastructure improvement costs, create greater buffers against cool winter winds to reduce heating costs, and absorb and sequester more carbon than smaller trees do. For the 2050 vision of the tree population, we utilized a variety of methods to arrive at the proper age-class distribution. We utilized the current population structure, as listed above, and then anticipated high rates of survival based on new planting practices which would involve a "right tree/right site" approach (as detailed in the Reforestation section below), as well as increased survivorship of existing trees due to improved management and care practices. Predicted growth, survivorship, and eventual tree losses were based on current species composition and future plantings and removals. This allowed the creation of a GIS File of what the tree population, including species and size, will look like 30 years from now, and generated the below chart of predicted age class distribution, as well as a projected iTree Benefits summary further below.



One can readily see from the above chart that the existing tree population (pale bars) has the unusual trait of having many trees in the smaller ranges, with very few trees in the larger diameter ranges. As mentioned above, it is likely due to a time when the park district was expanding and gaining new lands for its use, and the population growth that Glenview experienced from the 1960's through the 2000's. As can be seen from our projections, it is that goal of this plan to begin a policy of increased new tree plantings, not just to replace trees being lost to old age or disease, but also to increase stocking density overall by filling in areas currently devoid of trees.

These estimates were done based on the assumption that increased levels of care for existing trees would enable them to survive longer. We have also factored in the shorter lived trees to these estimates, though it may not be obvious at first. It is assumed there will be a steep drop off at the 13-18" age class as these shorter lived trees turn over. Newly planted trees are also predicted to show decreased mortality, as they will be planted using detailed information matching planting site condition to specific species requirements. The numbers themselves were projected by hand, based on our prior experience, and the methods detailed below.

	2020	2030	2040	2050
0-6"	4073	1900	2300	2400
7-12"	2856	3700	1750	2100
13-18"	1552	2400	3200	1600
19-24"	709	1250	2000	2900
25-30"	240	600	1000	1600
31-36"	113	150	350	600
37-42"	31	55	100	212
>42"	37	16	33	70
TOTALS	9611	10071	10733	11482

For projections of future age classes of trees, a ½" per year growth rate was roughly estimated by assuming that it would take an average tree 10 years to go from one age class to the next (6" = appx 10 years growth). Also utilized were the number of trees to be planted and removed annually, as calculated below in the Tree Planting and Tree Removal sections below. Based on all of this, as well as our best professional opinion, these were the numbers arrived at. It should be mentioned as well that as time goes by, these projections will change. These are simply rough estimates for the purposes of this Plan, and will be adaptively managed through time.

Projected Tree Population Value

	2019	2050 (2019 Dollars)	% Change	In 2050 Dollars (Projected)
Annual Benefits	$1,018,495	$1,222,195	+20 %	$2,322,170
Replacemet Value	$8,071,174	$9,658,410	+20 %	$18,402,275

As of current, the tree population provides $1,018,495 in annual benefits. With simple changes introduced in this plan in terms of proper reforestation planning for new trees, mulching, proper water management, and pruning, benefits can be increased by $203,700 with only minimal additional investment, and simple attention to tree maintenance. This gain of $203,700 (in 2020 dollars) will be come with substantially increased benefits for residents and businesses. Adjusting for Consumer Price Index (3% per year increase), this broadly translates into approximately $387,030 in 2050 dollars.

Taken a a whole, these benefits will cover 100% of the costs associated with trees in any given budget year, many times over. In this case, the tree population will actually become a net "provider" of "income" to the community, covering its own cost of care, and then providing additional benefits in terms of ecological services. The replacement value of the tree population will increase to approximately $18.4 Million dollars in 2050 dollars.

It is often easy to view the ecological services provided by trees as being strictly theoretical, and not a provider of actual hard dollars. However, the value provided by trees is concrete and actually very easy to conceptualize:

Energy Savings: During the summertime when temperatures are warm, large trees create shade. As we all know, temperatures are cooler in the shade. Cooler temperatures cause air conditioners to have to work less, which reduces the amount of energy a household utilizes. During the winter when temperatures are cold, winter winds cool your home and rob it of heat. Trees act as windbreaks and reduce winds by up to 30%, causing heating systems to use less natural gas, saving energy and money. For parks, this benefit is not always maximized due to many trees being far from homes. But in the cases where they do, there is a tremendous benefit.

Carbon Dioxide (CO2): The amount of CO2 which is put into the atmosphere each year has a direct correlation with global climate change. That change causes more severe storms, greater drought conditions, loss of species, and many other costly outcomes. In short, reducing CO2 from our atmosphere lessens these effects. Since trees uptake CO2 and act as a sink, putting carbon into long term storage in its woody tissues, they remove it from our atmosphere, creating a net benefit to society, and saving money.

Air Quality: Many industrial processes and vehicle emissions put harmful chemicals into our air. These chemicals can cause or worsen poor health conditions such as heart disease, asthma, and lung disease. In addition, these airborne pollutants can mix with water in the atmosphere and create nitric and sulfuric acid, causing acid rain, which can destroy fisheries and contaminate water supplies. Trees absorb these compounds with their leaves and other tissues, and prevent them from remaining ambient in the atmosphere. Reductions in these chemicals results in overall better health, reducing the cost of healthcare to society, and saving communities money.

Storm water: We often take our water systems in our municipalities for granted. The cost of delivering fresh water to homes, as well as removing and treating wastewater and storm water is immense. One of the greatest costs comes when either these systems are overwhelmed, such as during flooding, which can cause millions of dollars of damage to homes and vehicles, or when these systems need to be replaced from years of handling large volumes of water. Fortunately, trees take water from the soil and put it back into the atmosphere through the process of Transpiration, so the more trees we have, the less flooding we see, and the less strain is put on our storm water infrastructure, resulting in fewer repairs and replacements. In addition, tree canopy slows down rainfall's effects on flooding by "intercepting" it with leaves and branches, delaying how quickly rainfall can become runoff and floodwater. All of this adds up to massive savings for a community.

Aesthetic/Other: up to 15% of the value of a property can be attributed to its trees and other landscaping. Tree lined streets are much more appealing to homebuyers than streets devoid of trees, resulting in increased home sales, and therefore increased tax revenue, or increased tax revenue with which to fund initiatives relating to trees, attract new businesses, etc.

Current Budget Table

Below is the current forestry budget for major activities in GPD forestry. This is based on a detailed review of the financial information we were provided about in house staff time and pay rates, as well as invoices from contractors. This table serves as the basis for the remaining financial analysis in all future sections:

	Trimmed-In House	Contractor Trimmed	Removed In House	Contractor Removed	Planted In House	Contractor Planted
2019	300	96	320	78	100	190
Budget	$29,660.00	$11,773.00	$28,514.00	$26,096.00	$17,500.00	$35,000.00
Avg / Tree	$98.87	$122.64	$89.11	$334.56	$175.00	$184.21

In addition, the following table shows long term data we have for the overall tree population, including number of trees, trees planted and removed, and total and average tree diameter. It is interesting to note the changing levels of tree removal and tree planting as Glenview went through the EAB era. We now believe that budgets allocated to planting and removal can actually be significantly reduced, in favor of increasing expenditures on routine maintenance such as pruning.

	2011	2012	2013	2014	2015	2016	2017	2018
Total Trees	9606	9336	9676	9504	9563	9694	9754	9611
Trees Removed	N/A	440	416	338	304	226	261	468
Trees Planted	N/A	170	157	139	179	194	223	290
Total Diameter Inches	99,060"	93,671"	93,081"	90,328"	103,211"	98,978"	97,483"	93,407"
Average Tree Diameter	10.31"	10.03"	9.61"	9.51"	10.79"	10.21"	9.99"	9.72"
Average Tree Condition	3.12	3.05	3.07	3.06	3.06	3.03	3.01	2.99

Return on Investment

It should also be mentioned here that the Return On Investment (ROI) for an individual tree is strongly favorable over the life of a tree in terms of investment in planting, care, and removal vs the benefits the tree provides. As we strive to justify the expenditures on trees and tree care, it is important that administrators and Board members are aware of this.

On the following page, we have provided an ROI calculation sheet. This sheet breaks the tree's lifetime down into three phases, based on the anticipated costs of pruning in the budgets section(s) below. These phases are the young (3-12" DBH), mature (13-24" DBH), and full grown (25-36") ranges shown below.

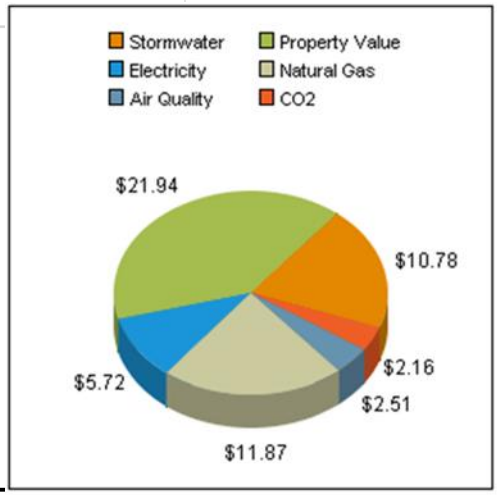
Data was taken from the iTree algorithm, and applied towards the average benefits provided by a tree at each of these life stages, and multiplies it out over the 20 year period each phase accounts for. We also looked at costs for planting, watering, routine maintenance, emergency maintenance, and eventual removal of that tree over 60 years. The results are pictured to the right, with the calculations below.

Total Investment	**$4,150.00**
Total Return	**$8,585.00**
Total ROI Over 60 Years	**106.87%**

Return on Investment: Years 1-20 (3-12" Diameter)

Costs	
Initial Purchase and Installation	$250.00
Watering for 2 Years	$100.00
Pruning - 6x @ $25/prune	$150.00
	$500.00

Benefits	Avg/Year	Over 20 Years
Electricty	$5.72	$114.40
Natural Gas	$11.87	$237.40
Property Value	$21.94	$438.80
Stormwater	$10.78	$215.60
Air Quality	$2.51	$50.20
CO2 Reduction	$2.16	$43.20
		$1,099.60

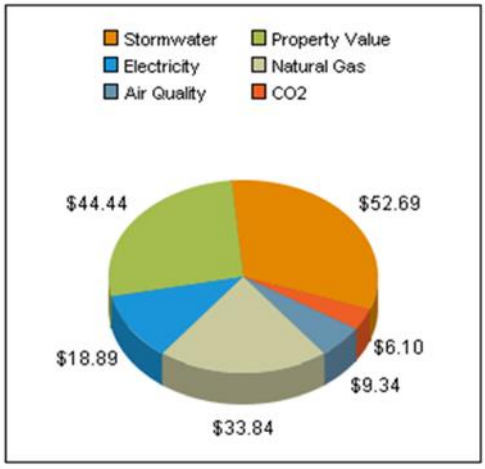


ROI Years 1-20 = 120%

Return on Investment: Years 21-40 (13-24" Diameter)

Costs	
Pruning - 6x @ $100/prune	$600.00
Emergency Maintenance (2x)	$500.00
	$1,100.00

Benefits	Avg/Year	Over 20 Years
Electricty	$18.89	$377.80
Natural Gas	$33.84	$676.80
Property Value	$44.44	$888.80
Stormwater	$52.69	$1,053.80
Air Quality	$9.34	$186.80
CO2 Reduction	$6.10	$122.00
		$3,306.00



ROI Years 21-40 = 200%

Return on Investment: Years 41-60 (25-36" Diameter)

Costs	
Pruning - 6x @ $150/prune	$900.00
Emergency Maintenance (2x)	$650.00
Eventual Cost of Removal	$1,000.00
	$2,550.00

Benefits	Avg/Year	Over 20 Years
Electricty	$24.37	$487.40
Natural Gas	$46.47	$929.40
Property Value	$17.01	$340.20
Stormwater	$102.01	$2,040.20
Air Quality	$14.28	$285.60
CO2 Reduction	$4.87	$97.40
		$4,180.20

ROI Years 41-60 = 63%

Section 6 - Tree Removals

Milestones	2020	2021	2022	2023	2024	2025-2030	2031-2040	2041-2050
Trees Removed	267	250	200	150	175	175/year	175/year	175/year
Notes	1 Hazard Remove + 266 Removals from Inventory	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals
Removal Cost (2020)	$56,500	$53,000	$42,500	$31,750	$37,000	$37,000	$37,000	$37,000
Removal Cost (CPI)	$56,500	$53,000	$42,500	$31,750	$37,000	$42,500	$48,900	$56,250

The first step towards attaining GPD's forestry goals will be to remove trees which are diseased, dying, or present a hazard. At present, there are 267 trees which have been called for removal during the inventory. Of these, 1 is listed as a Hazard Removal, and is recommended to be taken down during the remainder of 2020 to prevent potential public safety issues from arising. A goal of this Urban Forestry Management Plan is to have all identified trees marked as Removals be removed by mid 2021, or within 1 year of adoption of this plan. We believe that during the coming year, these trees can readily be removed based on the tree data listed above. As GPD has historically removed between 226 and 468 trees each year, we do not believe that removal of 267 presents a challenge financially or operationally. It is also worth mentioning that 110 of these 267 trees (41%) are less than 10" in diameter, and likely could be handled in house by Glenview Parks staff.

After this initial 1-year period, in order to attain the goals set forth in the Diversity Standards, the number of trees removed each year will actually fall slightly. This is due to the fact that remaining Ash trees, Pine and Spruce suffering from fungal and disease issues, undesirable trees, and many poor condition short lived ornamentals which require removal are already on the removal list in that 267 trees. This is where we praise GPD for staying vigilant about maintaining its inventory to identify these trees. Starting around 2024/2025, we anticipate that the background rate of tree removal will be approximately 175 trees per year.

Continual reevaluation of the tree population on an annual or semiannual basis by the Park District Arborist or Forestry Consultant will specify which trees require removal. These numbers, detailed above, are meant to be placeholders for budget calculations and diversity standards. It cannot be stressed enough that this does not require that 175 trees be removed each year, and in fact removal totals will vary from year to year. We anticipate they will likely be lower than 175 in most years. Each year, as GPD builds its program, trees should be evaluated on a case by case basis.

For purposes of projection, costs have been estimated using real rates of in house and contracted services for tree removal and stump grinding, based on current market pricing and in house record keeping in the table above. Rates could certainly be found lower than this in a competitive bid process or by using in house labor. As is the case with all cost projections for this Plan, no cost increase is assumed for the first 5 years, and a 3% annual cost increase is assumed thereafter. Once again, this is a very conservative estimate based loosely on Consumer Price Index, and actual costs are likely to be lower than projected. In addition, for trees in 2025 and beyond, these are anticipated averages of trees to be removed on an annual basis.

Exact numbers of trees to be removed may be significantly more or less, as can be seen from the annual removals table above. These numbers were calculated for budget forecasting only. One of the most important goals for the program, which is already functioning at a very high level, is to be able to allocate resources where they are most needed. Since Glenview has replaced most of it's lost Ash trees by this point, and will significantly reduce the number of large trees to be removed, we felt that focusing more on routine maintenance as opposed to planting and removals was a prudent idea. Pruning, as we will mention below, is a maintenance item that the more you perform it early, the less it needs to be performed later in life when the tree is larger and more difficult and expensive to manage.

Tree Removal Activities

Safe Removal of a Tree to an Appropriate Flush Cut

Tree removal can be a very dangerous activity which puts people, property, and workers in harm's way. Thus, all tree removal activities on GPD's public property shall be performed under the guidance of a Certified Arborist or Arborist Trainee. This may be the supervision of the Park District Arborist, or a Certified Arborist with the contractor who has been hired to remove the tree. The safe removal of a tree involves the removal and safe lowering of all portions of the secondary branches, scaffold branches, and finally the trunk of a tree by either a tree climber or a bucket truck operator. The stump must be flush cut such that the highest portion of the cut is no greater than two inches from the highest part of the ground surface to prevent a tripping hazard on public property.

Stump Grinding

Within a reasonable amount of time following the removal, stumps and roots shall be removed using an approved stump grinding machine, such that the stump is ground to a minimum depth of 6 inches, and no surface roots are visible to the naked eye. If the site is to be planted with a new tree, that depth shall be increased to 12 inches below the soil surface. This will ensure that a new tree may be successfully planted near the site of the removed tree, and that no re-sprouting will occur from the old stump. The depths to which the stump must be ground may be altered by GPD depending on individual management needs for specific circumstances or contracts. Until such time as the planting space be fully restored, the stump hole will be filled and compacted to ground level using the debris resulting from the stump removal.

Planting Site Restoration

Once the tree has been safely removed and the stump has been ground out, the open planting space must be fully restored if a tree is not scheduled to be planted in or adjacent to the old hole within six weeks. Site restoration consists of removing a portion of the stump chips from the hole, mixing with a quality mineral topsoil, tamping down to match the surrounding grade, spreading grass seed over the top of the topsoil, and securing green turf blanket over the topsoil. This will ensure that grass grows back to restore the aesthetics and function of the park, and prevent tripping hazards from the removal scar. It should be noted here that given the nature of parks, it is not always recommended nor feasible to put a tree back where one was removed, and often a better site can be selected for a new plant than one which was removed. That said, restoration of the removal site to either turfgrass or native vegetation cover is of great importance.

Reasons for Tree Removal

Removal of trees on public spaces is never taken lightly, but it is an unavoidable reality of managing large tree populations. When the trunk, branches or roots fail, a standing tree can cause personal injury or even fatality, and even small dead trees can be an eyesore, and increase risk to park patrons. Old trees can hold great sentimental value, and many people become attached to these neighborhood icons. However, there are times when their presence creates a public hazard, and it is at those times that action must be taken to ensure public safety. It's also important to remember that the removal of a tree today is the promise of a new tree for tomorrow!

Removal of trees on GPD property shall always be at the discretion of the Park District Arborist and/or Forestry Consultant. Trees will never be removed without sound reason from the Park District Arborist or Forestry Consultant, and likewise will never be removed based solely upon the request of a resident with no evidence of a need for removal. Residents may request a tree to be assessed for reasons NOT covered below, and such a request will be reviewed by the Park District Arborist or Forestry Consultant. Such requests may be granted and paid for under the annual forestry budget if sufficiently funded. However, trees with higher programmatic need for removal based on public safety will always hold a higher priority. Under no circumstances will GPD be responsible for maintenance or removal of trees which are not in their park property. Trees with over 51% of their trunk diameter in the property owner's land are the sole responsibility of such property owner, though branches which overhang into the park property may be cut back to the property line by the park district legally.

Dead or Dying

If a tree is biologically dead or nearly dead, it will require removal. Trees which are standing dead, have approximately 70 percent dead crown or greater (as determined by ocular estimate), or have less than approximately 40 percent sound wood in the cross-section of the trunk shall be removed as expediently as practical. The exact determinations of these quantities shall be at the discretion of the Park District Arborist or Forestry Consultant.

Diseased or Infested

Diseases are caused by viral, fungal, or bacterial pathogens. Infestations are caused by insects or other small animals. Dutch Elm Disease and Oak Wilt, for example, are fungal diseases that kill Elm and Oak trees when they are infected. Emerald Ash Borer is an insect which kills Ash trees by infesting them. The prompt removal of diseased or infested trees limits the exposure of other nearby trees. The removal of one tree may save dozens of others. Trees deemed to be diseased or infested by the Park District Arborist or Forestry Consultant shall be removed as expediently as possible to slow the spread of insects and diseases.

High or Extreme Risk
"Tree Risk" is the potential of a tree or tree part to impact a nearby person or piece of property and cause damage, injury, or fatality. This topic is of great interest in Arboriculture today, and the insurance industry is becoming increasingly involved in the business of assessing and managing the risk posed by trees. Litigation involving trees is also on the rise. Trees identified as being in elevated risk categories will be subject to removal to maintain public safety. If such risk can only be safely mitigated by tree removal, as opposed to pruning or other measures, then their timely removal is critical because high risk trees expose the public or property to potential harm. This is particularly pronounced in a park district setting, where children are often in close proximity to potentially hazardous trees during daylight hours.

The Park District Arborist, Forestry Consultant or any other TRAQ Qualified Risk Assessor must assess the tree and prepare a Tree Risk Assessment Report which will document the details of the situation, prior to removal. Often, risk can be mitigated by removing a portion of the tree, restricting access to the tree, or other corrective measures, if the tree is a very high value tree in a high location value area. If the entire tree is deemed to be at high or extreme risk of failure, however, the entire tree shall be removed as a means of reducing its residual risk to zero.

Emergency / Storm Damage Removals
A tree shall be removed if it has been severely damaged and/or compromised by lightning, wind, or another such natural disaster. "Severely storm-damaged" shall be generally defined as a tree which has lost 33% or more of its crown due to wind damage, has a large crack or other wound in the trunk resulting from high winds, has a lean of greater than ten degrees from vertical, or has sustained a lightning strike. The Park District Arborist or Forestry Consultant shall determine the need for removal of a tree based on storm damage, although in an emergency situation such as a tree impacting a person, vehicle, home, power lines, or other such emergency, GPD reserves the right to perform any actions necessary to abate public hazards so long as they are in compliance with all relevant Arboricultural standards and practices.

Damage from Construction or Vehicle Strike
The Park District Arborist or Forestry Consultant shall assess trees that have been impacted by a vehicle strike or large piece of construction equipment. If the tree has suffered physical damage or extreme root compaction and is likely to decline and become high risk, it will be brought to the attention of the Natural Resources Superintendent for approval before being scheduled for removal. The decision will be based on the best professional judgement of the Park District Arborist, Natural Resources Superintendent, or Forestry Consultant.

Reasonable Resident Request
If a tree has non-terminal pest or pathogen issues, moderately poor structure or is in somewhat poor condition, a resident may inquire about the removal of the tree. Such requests will be reviewed by the Park District Arborist and/or Forestry Consultant, and evaluated on a case-by-case basis. If the tree shows significant potential to decline or pose a threat in the near term, GPD may agree to the removal within the next five years. Note that young and/or healthy trees will generally not be considered eligible for this program. Priority will always be given to trees in danger of threatening public safety.

Overplanted and Underperforming
No healthy tree shall be removed for the sole reason of having been overplanted. With the new Forestry program, GPD will be adopting industry best management practices for diversity in the urban forest with the goal of building a diverse urban forest. Overplanted species listed as being in "poor condition" during their most recent visual assessment will be reviewed to assess further decline or recovery. Those trees in noticeable decline shall be removed at the discretion of the Park District Arborist and/or Forestry Consultant. This will only be used as a preventative measure so that these trees do not continue to decline to a point where they become hazardous, and not used as a reason to remove an otherwise healthy tree.

Tree Removal Requirements and Standards

All of the following requirements and standards shall be met during tree removal activities:

Glenview Park District

1. All personnel directly involved with process of chainsaw operation, climbing, bucket truck operation, and rigging limbs shall be provided with sufficient training and experience to perform such duties while employed by GPD, as either Grounds and Forestry staff, or performing work as a contractor employed by the park district.

2. Only qualified utility arborists may perform tree removal operations within ten feet of an electric utility line. GPD employees or contractors may complete the process of trunk removal and stump grinding only if the remaining portion of the tree is greater than ten feet from a transmission line. When higher voltage lines are encountered, please reference the ANSI Z133 standard for minimum approach distance.

3. The park district will not remove healthy trees in order to meet diversity goals, unless the tree poses a risk to persons or property.

4. GPD shall not perform or assist, programmatically or financially, with the removal of trees on private property. Public/Private tree ownership is defined by Ordinance as having 51% or greater of its trunk diameter within the public right of way. GPD does reserve the right to prune overhanging limbs from private property back to the property line.

ANSI Z133.1 Arboriculture Safety Standards

All of the ANSI Z133.1 safety standards shall apply to all tree care operations outlined in the remainder of the Urban Forestry Management Plan. A full text of this manual will be made available to all GPD employees and contractors involved with tree care operations.

1. All tools and equipment utilized during tree care operations, including those not specifically mentioned below, shall be inspected and maintained by qualified personnel in accordance with the manufacturer's care instructions.

2. All staff shall be trained in the proper use, inspection, and maintenance of said equipment.

3. Certified arborists or arborist trainees shall conduct job briefings daily prior to tree care operations of any kind and the information shall be communicated to all workers.

4. All activities performed on any job site for any activity outlined in this Urban Forestry Management Plan shall comply with all applicable OSHA guidelines and standards.

5. Traffic and pedestrian control shall be established around the job site prior to the beginning of tree care operations.

6. Emergency contact information and a safety kit conforming to the ANSI Z308.1 standards shall be made available to all workers. All employees shall have basic instruction on the use of CPR and First Aid.

7. Personal Protective Equipment (PPE) shall be required when there is a reasonable probability of injury or illness on the job site. Such a determination will be made by the Certified Arborist or Arborist Trainee prior to the beginning of tree care operations each day, and PPE shall be made available. PPE shall be well-maintained in accordance with the manufacturer's requirements.

8. Head protection shall conform to ANSI Z89.1, face and eye protection shall conform to ANSI Z87.1, respiratory protection shall comply with ANSI Z88.2, and leg protection shall always be worn when using a chainsaw.

9. Flammable liquids shall be kept a minimum of ten feet from open sources of flame or high heat and shall be stored in approved containers.

10. All Park District Staff and contractors working near electrical hazards shall be qualified to do so and shall be educated in the full ANSI standards for Electrical Hazards and Line Clearance.

11. Vehicles and mobile equipment shall be inspected and maintained by qualified personnel in accordance with the manufacturer's requirements and shall be equipped with all standard safety devices, decals, and instructions, and shall be operated within all federal, state, and local motor vehicle codes and ordinances.

12. Aerial devices shall be inspected and maintained by qualified personnel in accordance with the manufacturer's requirements, and shall be equipped with all standard safety devices, decals, and instructions.

13. Aerial devices shall be stabilized by wheel chocks, outriggers, or stabilizers as necessary for the device, and shall never be used to lift, hoist, or lower logs or equipment unless specifically designed to do so.

14. Aerial devices shall be equipped with fall protection devices and permanent load ratings, both in accordance with ANSI/SIA 92.2 or 92.5, as applicable to the specific aerial device.

15. No aerial device shall be allowed to make contact with electrical conductors, and minimum approach distances shall be maintained in accordance with the ANSIZ133.1 Standard.

16. All brush chippers shall be inspected and maintained by qualified personnel in accordance with the manufacturer's requirements, and shall be equipped with all standard safety devices, decals, and instructions.

17. Sprayers and related plant health care equipment shall be inspected and maintained by qualified personnel in accordance with the manufacturer's requirements, and shall be equipped with all standard safety devices, decals, and instructions

18. Sprayer tanks or other similar enclosed spaces shall not be entered unless performed through a confined-space entry plan in accordance with OSHA 1910.46 Requirements, including air-quality testing, training, and PPE.

19. Chain saws and other similar portable power tools shall not be operated unless the manufacturer's safety devices are in proper working order. Such safety devices shall not be removed or modified.

20. Forestry staff shall have a minimum of two points of attachment to the tree or aerial device while operating a chainsaw at all times, unless the hazard posed by the second point of attachment poses a greater hazard than utilizing one point of attachment.

21. A visual hazard assessment, including a root collar inspection, shall be performed by a certified arborist or arborist trainee prior to climbing, entering, or performing work in or on any tree, and a second crew member shall be within visual or voice communication at all times during arboricultural operations that are in excess of 12 feet from the ground surface.

22. All ropes, saddles, carabiners, and other similar climbing equipment shall be: a) approved for use in the tree care industry by the manufacturer, b) have a minimum breaking strength or load capacity of 5,000 lbs., c) be inspected before each use, d) Equipment shall be removed from service when it shows signs of excessive wear or deterioration.

23. All pruning, removal, and rigging operations shall have a designated drop zone where limbs, trunks, and tools can be dropped from aloft without impacting pedestrians or passersby. A visual or verbal communication system between the employee aloft and the employee(s) on the ground shall be established to determine when the employee aloft will safely drop tree parts or tools.

24. Any tree parts which cannot be safely dropped or controlled from aloft shall have a separate rigging line tied to them to help control their fall. The tree shall be inspected for structural stability prior to the establishment of a rigging system in the tree. When trees appear to have defects that could jeopardize the ability to safely use a rigging system to drop or control a limb, an alternate plan shall be implemented.

25. All equipment utilized in rigging shall meet the load ratings for the limb being rigged, and a qualified employee, trained in proper rigging procedure shall determine the rigging procedure and equipment to be utilized. Any equipment which has been damaged or overloaded shall be removed from service.

26. When felling (removing) a tree, a crew leader shall make the determination of what equipment is necessary, and how many crew members are to be directly involved in drop zone operations. A well-established escape route shall be planned for involved workers prior to the beginning of felling operations. Any non-involved workers shall be beyond twice the height of the trunk or tree being removed during felling operations.

27. Notches shall be used on all trees and trunks greater than five inches in diameter during felling operations, and should conform to the standards set forth in the ANSIZ133.1 Standard.

28. Loose clothing, ropes, lanyards, and saddles shall not be worn during any tree care activity where the risk of entanglement with tools or machinery is possible, particularly with brush chippers.

Section 7 – Tree Planting

Milestones	2020	2021	2022	2023	2024	2025-2030	2031-2040	2041-2050
Trees Planted	150	160	170	180	190	190/year	230/year	240/year
Planting Cost (2020)	$60,000	$64,000	$68,000	$72,000	$76,000	$80,000	$92,000	$96,000
Planting Cost (CPI)	$60,000	$64,000	$68,000	$72,000	$76,000	$92,000	$105,800	$121,670

Simply removing trees will not fulfill our vision, however. Planting of new trees must happen in order to increase our diversity and canopy cover. At present, GPD has ample space for new plantings in its parks, and Graf has created a tree planting / reforestation plan to add over 1,850 trees to the gross population figure by 2050. For the costs of planting, we have used $400 per tree, installed. This is a very conservative estimate, and likely the park district may be able to find less expensive material. Particularly if volunteer labor is employed, and smaller trees planted, these costs could reduce by 50% or greater. However, in order to present a fully contracted, maximum price figure, it was decided to use a standard market price for purchase and installation. This cost also includes the cost of watering the tree for 2 years, whose importance can't be overstated.

As a means of attaining the goals of increasing canopy cover to 35%, and increasing overall diversity significantly, this plan calls for the addition of over 1,850 trees over the coming 30 years. Many of these will be replacements for existing trees which are expected to be removed during that time period. Others will fill sites never occupied by trees before. We also did build a 10-15% failure rate into these calculations as well, typical of most new tree plantings. These trees will be planted by Park District Staff, contractors, and even volunteers who have been properly trained. The Plan has specifically been formulated to plant trees where they will have the best chances to establish based on their planting sites and species requirements.

For the goals and milestones shown above, the program began with planting the approximately 150 trees which GPD typically plants each year as part of its normal operations. Each year thereafter, a gradual increase is called for in new plantings, until by 2025 the park district is planting nearly 240 trees per year. We want to be able to offset the number of removals each year while also growing the tree population. As seen in the above table, Glenview has historically over the past 9 years planted between 150 and 290 trees, with plantings increasing recently as Ash removals have subsided. In this respect, we find these goals to be attainable.

The number of trees planted will also hinge greatly on the number of trees removed. We anticipate that the actual number of trees removed and planted may likely be lower than our projections, however we still wanted to use conservative estimates. The District already has 2 small liner nurseries it currently maintains to supply a limited amount of its own stock, and we believe expanding production in these nurseries could significantly impact planting costs. We will examine money saving proposals for tree planting in further detail in the long-term goals section below.

Reforestation Planning

We believe that a Master Reforestation Plan for Glenview Park District, performed in 2015, has been a noteworthy investment in the future so that GPD can plan its tree plantings over the coming decades. Each Park was visited, and GPS locations added where forestry consultants saw a need for a tree. Generally, we evaluated areas which needed shade primarily, such as near sportsfields, benches, and playground equipment. After these needs were met, focusing on aesthetic plantings, such as near park entrances or other high location value areas was done. After that, screening from nearby residences was considered, and finally, strictly aesthetic trees were planned for. The goal of this project was to maximize the use value of the trees while also matching the right tree to the correct site, and also to increase diversity throughout the park district, with consideration given to species diversity, spatial diversity, and age class diversity as mentioned above. Thus far, this program has been successful, and GPD has used it as a template for new plantings, while also adjusting annually.

Each planting site had a variety of data collected on it per the below specifications. Trees were generally not selected in the field, but rather from the office. Species which best meet the criteria spelled out below were selected for each site. It should be mentioned here that in order to grow the tree population to the approximately 11,500 trees from the current population size of 9,611 we must plant many more trees than we remove. We anticipate that reforestation planting should take place on a periodic timetable over the coming decades as trees are removed, and the parks can be reevaluated for need as things develop.

Reforestation Data Collection

The following were the data which was collected during the reforestation planning process:

Soil Volume

Soil volume is an approximate measure of the below ground growing space at the planting site.

Small	Soil volume less than approximately 25ft^3
Medium	Soil volume between approximately 25 ft^3 and 500 ft^3
Large	Soil volume greater than approximately 500 ft^3
Prohibitive	Soil volume is insufficient to support tree planting

Growspace

Growspace was evaluated based on the proximity of the planting site to structures, other trees, power lines, and other such potential obstacles. An attempt was made to determine what the site conditions might be as the tree matures.

Small	Tree has (or will have) 40 feet or less of available growspace
Medium	Tree has (or will have) 40 – 60 feet of available growspace
Large	Tree had 60 feet or more (unlimited) growspace
Prohibitive	Site did not have enough growspace to justify a new planting

Light Level

Light level was based on the amount of sun or shade that a planting site was currently experiencing, or was anticipated to experience in the future. Site conditions have to be relatively constant to make this determination, and are subject to future storm damage, construction, tree removals, etc.

Full Sun	Tree has access to abundant sunshine
Partial Shade	Tree is (or will soon be) in shade for at least 25-50% or more of the daylight hours
Full Shade	Tree was in full shade for at least 75% of the daylight hours

Soil Moisture

Soils will be evaluated by use of GIS data layers of Hydric Soils, FEMA Floodplain, and NWI Wetlands data, as well as firsthand observation. In areas where the soils had been heavily modified since the GIS data was last updated, staff ignored GIS data and record the soil type based on best professional judgment, and in rare occasions, basic sampling.

Dry	Soils are in a high elevation area on the landscape or far from water sources
Mesic	Soils are of moderate moisture during an average growing season
Hydric	Soils are wetter throughout most of the year during an average growing season
Poor	Soils are rocky, compacted, or otherwise of very low quality
Prohibitive	Soils are not adequate to support a viable root system

Loading

Loading of either salt pollutants or nutrients was assessed. High salt areas were generally along major roadways, in plowed and salted parking lots, near low spots in the terrain, near retention basins, or near intersections. High nutrient areas were generally near facilities such as sports fields that require frequent fertilization, stormwater retention ponds, or near floodplains.

None	No significant salt or nutrient loading was observed
High Salt	Significant amount of road salt (or similar) was observed or inferred
High Nutrient	Significant amounts of Nitrogen, Phosphate, etc were inferred
High Salt And Nutrient	Significant Salt and Nutrient loads were observed or inferred
Low Nutrient	Site was in a location where access to nutrient would be very limited

Sheltered

The degree of which a tree will be protected from prevailing winds, snow, and other cold-weather elements.

None	Planting site is 0-10% sheltered
Low	Planting site is 10-25% sheltered
Moderate	Planting site is 25-50% sheltered
High	Planting site is 50-75% sheltered
Very High	Planting site is 75-100% sheltered

Recommended Form

Recommended form is based upon general terms describing the shape and habit of mature tree species' canopies. Oftentimes, there are certain situations in which particular tree forms would be better suited to complement the existing landscape and/or hardscape, such as columnar trees in narrow parkways, or spreading trees in wide parkways.

Any	Any tree form would be suitable for the site
Globose	Large, regular and rounded canopy, resembling a globe
Spreading	Horizontal branching resulting in a large and wide canopy
Columnar	Column shaped canopy where horizontal growspace is less than 20’
Vaselike	Higher branching form where branches grow at sharp angles from the trunk, flaring outward
Pyramidal	Broad, cone-shaped or triangular canopy
Small	Small mature height (<30’)

Planting Site Assessment
Species diversity, spatial diversity, and age-class diversity were all taken into account for the Reforestation Plan, but diversity standards should be reviewed periodically to determine how much closer GPD is getting to compliance with the 20-10-5 Rule. Strategic goals to increase that ability to meet that criteria shall continually be set. These benchmarks can be monitored with each passing season. The success of a tree depends on where and how it is planted. The Park District Arborist or Urban Forestry Consultant shall assess planting sites not included in the Reforestation Plan before trees are purchased and installed, to ensure the correct tree is being planted for the correct site. Each tree planted represents a 25-75 year commitment or more, and due diligence shall be performed before making that commitment. A list of acceptable species to be planted for all land use types appears as Appendix A at the end of this report.

Nursery Stock Procurement
Nursery stock quality is also a key to a tree’s long-term success. No amount of planning can help a tree which was purchased in poor health. The Park District Arborist or Urban Forestry Consultant shall visually inspect and select every tree which is to be planted on park district property, in order to minimize the possibility of installing poor quality nursery stock. As a cost saving measure, specifications should be for material no smaller than 1.75” caliper, with good form for the species, planted as either balled and burlapped, or minimum 5-gallon containerized stock. Currently, there is a shortage of good nursery stock available from growers due to the high numbers of trees being sought to replace Ash trees lost to Emerald Ash Borer. For this reason, we strongly recommend that GPD inspect all stock, and not to accept substitutions in their requested species.

One of the goals which will be detailed below, and based on conversations with GPD staff, is to bolster the production of their 2 in-house liner nurseries so that GPD can grow an increased share of their own trees. The park district also has several hundred trees which are ready to be transplanted due to a recent land transfer. This alleviates many issues when it comes to both diversity standards as well as availability of stock. It should also come with a dramatic decrease in costs, as in-house grown stock does not have a profit margin built in per se, and requires only minimal manpower in order to curate.

Tree Transport and Planting
Proper transport and planting procedures determine a tree’s success after planting. During transport from the nursery to the planting site, trees should be covered by a landscape tarp to avoid them desiccating during the drive. Additional, anti-transpirant sprays can be used which perform much the same function, and keep the tree from drying out.

During planting, trees planted too deeply will suffer from root compaction and trunk decay. Trees planted without properly dug holes may suffer from stunting. Trees planted without proper removal of packaging materials may develop girdling roots. Trees planted too high may have surface root desiccation. Trees improperly staked or with improper trunk protection may suffer from trunk wounds or girdling of the entire trunk. The standards and Best Management Practices for tree transport and planting are detailed later in this section. Trees may be planted by a local volunteer work force so long as the workers have been adequately trained by the Park District Arborist or Forestry Consultant prior to planting trees.

Tree Spacing and Visibility Requirements
Minimum tree spacing between Large/Medium/Small sized deciduous shade trees should be no less than 40 feet on center in any direction, generally speaking. This will allow trees to grow to their full potential without heavy competition for water and nutrients with neighboring trees, and without limited space for crown growth. In addition, no tree shall be planted within 10 feet of a driveway, intersection, traffic control device, or known below ground utility. Trees may be planted under aboveground powerlines, but must be from the “Small” selections listed in the Acceptable Species list below. Evergreens are acceptable for parks, schools, municipal campuses, and waterways, but should be avoided when adjacent to a road due to visibility issues.

In certain circumstances, such as creating screening or establishing permaculture guilds, these spacing guidelines may be fluid, since the objective of these specific things requires that trees be planted closer together. And in fact there is research showing that close spacing is beneficial in some cases. These specific circumstances will be evaluated on a case by case basis by the Park District Arborist or Forestry Consultant.

Watering

Watering of trees is absolutely essential to their establishment, growth, and survival, particularly during the first 2 years of their lives. One of the reasons for the $400 per tree cost, which is higher than retail costs for the tree alone, is that we have built the cost of watering into the budget figures. We highly recommend that when a tree site is selected for planting, that it is also planned for a 2 year watering program to avoid the tree desiccating before it is able to properly establish. We anticipate that watering will be performed by in-house crews, but contracting this work out should also be considered. The reforestation plan has also built site hydrology in, so that water usage can be moderated by proper species selection. That said, the District should monitor how many trees it can water, so that tree planting does not exceed ability to water new stock.

Challenges of Urban Plantings

Urban planting sites are a difficult environment for a tree to thrive in, and thus it can be expected that approximately 15% of new plantings fail each planting cycle. GPD's contracts for tree planting should include a 1-2 year replacement warranty for any new trees that fail to thrive in their new environment. For trees grown in-house at a liner nursery, the same failure rate should also be expected. It should be understood that urban tree plantings can pose an uphill battle in many ways, due to limited soil volume, salt runoff, airborne pollutants, and other factors. With park district property, this is less of a factor. But given the diverse nature of the GPD's existing tree population, we must plant more sensitive trees to raise diversity, and this comes with the risk of tree loss due to cold weather, salt and nutrient loading, etc. New planting mortality is to be expected.

Tree Planting Requirements and Standards

Glenview Park District

1. Planting sites shall be determined and monitored using the park district's tree inventory, in conjunction with staff input.

2. New planting sites shall be ideally ten feet away from utility structures and a minimum of six feet from manholes and utility structures, driveways and hardscapes.

3. Choice of species for planting over the next 31 years shall be done so according to the park district's existing taxonomic, spatial, and age-class diversity goals. A diverse and resilient urban forest shall be created, such that it minimizes exposure to financial, environmental, and health risks while maximizing aesthetics, environmental benefits, and ecosystem services to its residents.

4. All planting stock shall be grown within 150 miles of the park district/planting site. Stock should ideally be sourced from the park district's in house nursery when possible.

5. Acceptable nursery stock shall conform to the following standards:
   - **A.** Minimum of 1.75-inch caliper, measured at six inches from the trunk flare
   - **B.** Root ball conforms to ANSI Z60.1 Standards for Nursery Stock
   - **C.** Less than 10% deadwood in the crown
   - **D.** Architecture consistent for the species, cultivar, or variety in question
   - **E.** No included bark or other such narrow branch attachments, unless consistent with species or variety
   - **F.** Free of pests or pathogens
   - **G.** Approved species list for GPD

6. Planting and digging of certain species shall only occur at certain times of year, in accordance with nursery industry best management practices and professional judgement. These times are subject to the professional opinions of both GPD and its approved contractors.

7. JULIE shall be contacted, and all utilities located a minimum of three days before planting is scheduled to begin.

8. A minimum of a one-year replacement guarantee shall be extended from approved nurseries and plantsmen for all new contracted (not in house) plantings rated to hardiness zone five or lower.

9. Glenview Park District also has a 50/50 cost share memorial program, but shall only accept donated trees which do not violate the goals of this plan, such as diversity and invasive species standards. Residents pay 100% of the wholesale cost of the tree and placard, and GPD staff provide the planting labor and equipment.

ANSI Z60.1

1. All root ball and container sizes for all balled and burlapped stock shall conform to the Z60.1 standards for width and depth, such that they encompass enough of the fibrous root system as necessary for the full recovery of the plant upon installation.

2. All bare root stock shall conform to ANSI Z60.1 standards for minimum root spread.

3. All containerized stock shall conform to ANSI Z60.1 standards for plant and container size, as specified by the park district, and shall be healthy, vigorous, well-rooted and established in the container in which it is growing. The root system shall reach the sides of the container, but shall not have excessive growth encircling the inside of the container.

4. All collected plants (those grown on unmanaged land) shall be so designated, and shall be considered to be nursery-grown stock when they have been successfully reestablished in a nursery row and grown under regular nursery cultural practices for a minimum of two growing seasons.

5. The trunk or stem of the plant shall be in the center of the ball or container, with a 10% overall variance in location.

6. The use of digging machines in both the packaging and installation of trees is considered an acceptable nursery practice.

ANSI A300 – Part 6

1. Planting sites and work sites shall be inspected for hazards by the park district prior to the beginning of work each day. If portions of the work site are outside of the original scope of work, the controlling authority shall be notified immediately.

2. Location of utilities, obstructions, and other such hazards above and below ground shall be taken into account prior to planting and transplanting operations. These include, but are not limited to, gas, electric, sewer, communication, drainage, and signage.

3. The following shall be taken into consideration prior to transport and planting: Requirements of individual trees, compass orientation of field-grown trees, site feasibility assessments, soil assessment, and drainage assessment.

4. Tools for planting and transplanting shall be properly labelled or purchased for their intended use, and be maintained in accordance with the manufacturer's recommendations

5. The system used to move and store the plant shall minimize desiccation and other damage to the crown, trunk or rootball, and the health and vigor of the plant shall be maintained during these periods.

6. The hole to be dug for all new plantings shall be a minimum of 150% larger than the rootball or container diameter, as deep as the root flare of the tree to be planted, and shall have sides from which soil has been loosened in order to aid in root penetration.

7. For balled and burlapped trees, all rootball supporting materials shall be removed from the upper third of the rootball, and removed from the planting hole prior to final backfilling.

8. Prior to planting, container root balls shall be managed by approved methods such as, shaving the root ball, slicing the root ball, and redirecting or removing encircling roots.

9. Backfill shall comprise of either the same soil created when the hole was excavated, or a similarly amended mixture to meet a specific objective, and shall be applied in a layered fashion to reduce future settling and prevent air pockets.

10. Mulch shall be applied at a depth of two to three inches, near - but not touching - the trunk of the tree, and extending to the perimeter of the planting.

11. Support systems such as guy-wires or stakes shall not be installed except where needed, and shall be removed when no longer required for stability in the hole.

1. Timing of planting shall be determined based on the species, and the best professional opinion of the employees of or contractors working for GPD.

2. All employees and contractors employed by or working for GPD shall be familiar with the following types of planting types, and when it is appropriate to use each:
   A. **Bare-Root:** Field-grown, and dug without soil during the dormant season
   B. **Balled and Burlaped:** Field grown and packaged with a soil ball, using burlap, twine, and a retaining basket of some kind
   C. **Tree Spade:** Transplanted using a mechanical tree spade to hold the soil ball during transport
   D. **In-Ground Fabric Bag:** Field grown with the root mass contained in a semi-permeable fabric bag
   E. **Container Grown:** Grown above ground in containers of various shapes, sizes, and materials

3. Trees packaged with root balls must have their first structural root within two inches of the soil surface. Trees with deeper structural roots will not perform well when transplanted, and should be avoided when selecting nursery stock.

4. Trees with root balls shall be handled by the ball, not the stem, to ensure no damage occurs to the root-soil interface or to the stem itself**.**

5. Trees with leaves shall be transported with a fabric tarp to minimize desiccation, and have had their root balls wetted prior to transport.

6. Sites shall be tested for drainage, nutrient levels, and pH prior to planting (or prior to species selection, if possible).

7. Container stock shall be removed from its container. For balled and burlapped trees, wrappings shall be left on until the tree is in the hole; wrapping shall then be removed from the 1/3 to 1/4 of the wire basket and burlap from the top of the ball. For all types, ensure any encircling (girdling) roots are removed, and root ball is shaved as necessary.

8. As soil is added, wet and tamp each layer down to ensure good moisture and reduction of air bubbles.

9. Do not prune trees at time of planting, unless to remove dead, dying, diseased, or cracked branches, as it may take away from root development to have the tree attempt to heal these above-ground wounds.

10. The use of trunk wrap may be considered in areas with harsh winters, specifically on trees with thin bark, such as London Planetree and certain Maple species.

Section 8 – Tree Pruning

Average Cost of Eventual 7 Year Cycle Prune, Based on Projections and Species Composition

Milestones	2020	2021	2022	2023	2024	2024-2030	2031-2040	2041-2050
Trees Pruned	400	422	600	700	900	1250/year avg	1,400/year avg	1,600/year avg
Notes	94 Hazard and 306 Priority Prunes from inventory	Remaining 422 Priority Prunes from inventory	Begin 1/2 of first Cycle Prune	Finish 1st cycle prune	Increase pruning capacity	Cycle pruning based on inventory updates	Cycle pruning based on inventory updates	Cycle pruning based on inventory updates
Cost (2019)	$44,300	$46,750	$66,450	$77,500	$99,500	$138,500	$155,000	$175,000
Cost (CPI)	$50,200	$62,750	$75,300	$87,850	$100,400	$159,275	$178,250	$201,250

When maintaining a tree for its greatest benefits and lowest risk, tree pruning is one of the most cost-effective maintenance activities to be performed. Pruning accomplishes several very important things for a tree. It reduces the risk of failure, provides clearance for utilities or other structures, reduces wind resistance and wind damage, maintains overall tree health, and improves overall aesthetics. And the more pruning a tree gets, the less it needs over the long term, making pruning something that actually winds up decreasing in cost over the long term.

For the goals and milestones, once again we began with the most critical needs the park district has right now, those being the trees identified as Hazard Prunes and Priority Prunes in the inventory. For the next 5 years, it is recommended that GPD slowly increase the number of trees pruned each year. After this point, a final increase to the capacity of approximately 1250 trees per year will allow the park district to prune all of its trees on a 7-year cycle. Please note that there are increases every 10 years thereafter, but this is due to the changing size of the tree population from 9,611 up to 11,500. Tables for these changes are provided below:

2020: 1,250 Trees Pruned/Year – 9,600 Trees on a 7 Year Cycle

	Total Trees	Avg %	Cost/Tree	Pruned/year	Cost/year
Evergreen	2096	21.81%	$25	273	$ 6,815.11
Large (>24")	5031	52.35%	$150	654	$ 98,149.26
Medium (13-24")	1099	11.43%	$100	143	$ 14,293.52
Small (1-12")	1385	14.41%	$50	180	$ 9,006.61
					$ 128,264.49

2030: 1,400 Trees Pruned/Year – 10,000 Trees on a 7 Year Cycle

	Total Trees	Avg %	Cost/Tree	Pruned/year	Cost/year
Evergreen	1500	15.00%	$25	210	$ 5,250.00
Large (>24")	5800	58.00%	$150	812	$ 121,800.00
Medium (13-24")	1200	12.00%	$100	168	$ 16,800.00
Small (1-12")	1500	15.00%	$50	210	$ 10,500.00
					$ 154,350.00

2040: 1,500 Trees Pruned/Year – 10,750 Trees on a 7 Year Cycle

	Total Trees	Avg %	Cost/Tree	Pruned/year	Cost/year
Evergreen	1500	13.95%	25	209	$ 5,232.56
Large (>24")	4250	39.53%	150	593	$ 88,953.49
Medium (13-24")	3000	27.91%	100	419	$ 41,860.47
Small (1-12")	2000	18.60%	50	279	$ 13,953.49
					$ 150,000.00

2050: 1,650 Trees Pruned/Year – 11,500 Trees on a 7 Year Cycle

	Total Trees	Avg %	Cost/Tree	Pruned/year	Cost/year
Evergreen	1500	13.04%	25	215	$ 5,380.43
Large (>24")	4000	34.78%	150	574	$ 86,086.96
Medium (13-24")	3500	30.43%	100	502	$ 50,217.39
Small (1-12")	2500	21.74%	50	359	$ 17,934.78
					$ 159,619.57

As mentioned several times above, this will become one of the more expensive annual expenditures, but one which pays off significantly over time. And since Glenview is in a position to reduce it's overall plantings and removals, this will be well worth the investment to keep the tree healthy, and providing a healthy Return on Investment.

Pruning Activities

Refining of Pruning Cycle

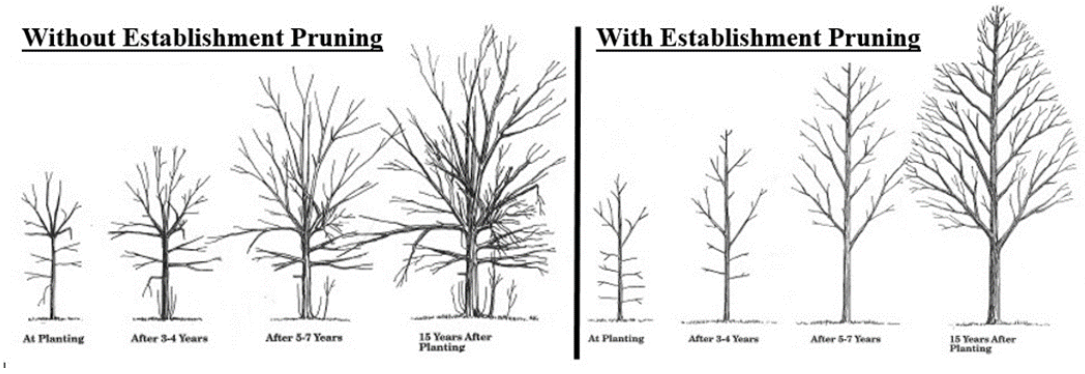
Currently, the park district is behind schedule on its cycle pruning program due to Emerald Ash Borer related activities absorbing a disproportionate amount of time and resources. However, as of 2019 the park district has been attempting to get back to its cycle pruning program. Currently the, the park district prunes 400 trees per year, on a needs-based basis. Though we are recommending getting away from a purely zone-based approach to cycle pruning, we have provided estimates based around the ability to prune on a 7-year cycle. This number will likely become much lower based around the results of the inventory updates. The cost to update the inventory annually will be significantly offset the tree maintenance activities.

It is very important to note here that the Forestry Consultant will help to refine the pruning activities to be performed, and that costs will be significantly lower than those listed due to a targeted approach. All too often in municipal and park district circumstances, we wind up pruning trees which do not need to be pruned based on geography. The cost to keep the inventory data up to date will more than be offset by the reductions in necessary pruning.

Pruning of Young Trees

For the purposes for this Plan, a young tree will be considered to be 12" DBH or younger. Young trees are still trying to acclimate to their sites. The pruning of young trees has different goals and outcomes than the pruning of larger, mature trees. The standard nursery stock has been meticulously pruned for four to ten years to have a single trunk, and the specific branching patterns which are considered common to the various tree species. Without proper establishment pruning, these trees might have multiple trunks, poor branch structure, and overall poor form and architecture.

Pruning of young trees to establish proper form is one of the most cost-effective maintenance activities. It is an inexpensive task that does not require a great amount of staff or volunteer time, and saves thousands of dollars in pruning and maintenance costs later in the tree's life. As mentioned above, due to not having to climb trees or use dangerous equipment, young trees may be pruned by Park District Staff, or even well-trained local residents, with proper training from the Forestry Consultant, the pending relationship with the Open Lands Tree Keepers program, or other qualified partner organizations



Pruning of Mature Trees
A mature tree, for the purposes of this Plan, is generally considered to be greater than 12 inches in diameter. Mature trees are established in and acclimated to their sites. The pressure these trees face from their environment generally comes from above-ground factors such as pests, pathogens, man-made structures, other trees, windstorms or lightning strikes. Pruning is performed to abate or mitigate these above-ground issues. Natural aging and/or death are additional reasons these trees are pruned. Pruning of mature trees may mitigate a short-term risk, such as after a storm; or pruning may be done to maintain a tree's long-term health and structure. In the wild, trees loose limbs to wind and disease frequently. Allowing trees to self-prune over time is not advisable in an urban setting. Safety factors may arise, and the process of self-pruning may bring up aesthetic issues in an urban environment. Mature public trees should only be pruned by professional Certified Arborists.

Private Property Trees
The park district shall not be responsible for the pruning of trees located on private property. Per the proposed policy, this would mean that trees with 51% or greater of their trunk diameter on private property would be considered to be privately owned trees. The park district reserves the right to prune portions of trees overhanging public property, but is under no obligation to do so, and will perform such pruning at the discretion of the Park District Arborist and/or Forestry Consultant

Reasons for Pruning

Establishment Pruning
Establishment pruning is the single most cost-saving measure in tree care as it establishes good form and branch structure for the life of the tree. Establishment pruning of newly planted trees should be performed a minimum of one time prior to the tree reaching six inches in diameter. Once established, the tree will only require periodic cycle pruning to maintain an appropriate form for the urban forest. As mentioned above, because establishment pruning can be done without the use of dangerous equipment, the use of well-trained volunteers can be an effective means of pruning these young trees. GPD has considered the option of using the Open Lands Tree Keepers program to assist in the pruning of young trees. In addition, there is a local volunteer steward group called "REAP" which could be used to prune these younger trees as well based on input from the Forestry Consultant, Park District Arborist, and Natural Areas Superintendent.

Cycle Pruning
As noted above, trees should be pruned on a cyclical basis as preventative maintenance. That said, a zone-based approach vs a needs based approach should be carefully considered. Annual tree inventory maintenance is already performed which will identify specific trees to be pruned. The cost savings gained from these updates has significant cost savings from performing a purely zone-based pruning approach. For purposes of estimation, we have used a 7 year geographic zone based approach, but one that also evaluates the tree population each year to take care of "out of cycle" parks. We believe actual costs should be much lower than those spelled out in the budget table above, particularly given potential volunteer labor.

Emergency / Storm Damage Pruning
Emergency pruning is nearly always necessary in order to mitigate severe risk, such as limbs which have fallen and present an imminent hazard, have impacted a structure, are interfering with a utility, or are hanging and in imminent danger of doing any of the above. Emergency and Storm Damage Pruning shall be conducted at the discretion of the park district, with the best interests of the public in mind. This is the one occasion on which the tenets of this Plan may be left to interpretation. When life or property are in imminent danger due to conditions associated with a downed tree or tree part, the park district may take whatever remedial action is practical and reasonable to mitigate such imminent risk.

Sanitation Pruning
When a tree has been diagnosed as having been diseased or infested, sanitation pruning may be employed to maintain the tree while removing the diseased or infested portions. Such a technique is only effective when the host tree is infected/infested with certain pests and pathogens. Generally, removal will be the most cost-effective and safest option to avoid endangering other nearby trees. Diseases such as Black Knot fungus, Dutch Elm Disease, and Fire Blight are just a sampling of maladies which may be aided by sanitation pruning. See the appendices for a more formal discussion of these pests and pathogens.

Removal of High Risk Limbs
At times, a tree as a whole may not pose a high risk, but a single limb may have defects that make it hazardous. At these times, the removal of such limbs or parts may render the tree as low risk again, without causing permanent damage to the tree. This option may also be considered when a privately-owned tree is overreaching the park district property. In this circumstance, the at risk limbs may be pruned back to the property line.

Pest or Pathogen Outbreak
The response to a tree becoming diseased or infested will generally be to remove the tree, or possibly prune the diseased or infested parts of the tree out. These are simply less expensive measures than attempting chemical treatment. Pest or Pathogen outbreak may be a reason for a number of the aforementioned activities, including tree pruning.

Tree Pruning Requirements and Standards

Glenview Park District

1. All activities directly related to the operation of a chainsaw, bucket truck, limb rigging, or tree climbing shall be performed by a qualified employee, or under the supervision of a certified arborist or arborist trainee.

2. No pruning or maintenance activity that takes place within ten feet of a power transmission line shall be accomplished by a GPD employee unless certified as a qualified Utility Arborist.

3. No cabling, bracing, or other such support systems should be installed in park district-owned trees, either by the GPD, its residents, or any contractors. Exception may be made by obtaining prior written approval of the park district, or by Park District Staff if the tree has historic or ecological value

4. No heading, pollarding or espalier pruning shall be conducted on park district-owned trees, and no wound dressings shall be used under any circumstances, without a permit and prior written approval of the park district.

5. The need for pruning and maintenance of individual trees and parks shall be at the discretion of the park district and its designated contractors.

6. The park district shall maintain at all times a Certified Arborist or Certified Arborist Trainee, and preference shall be given to in house, qualified labor for tree pruning activities

ANSI A300 - Part 1

1. A designated Arborist or Arborist Trainee shall visually inspect each tree before beginning work. If any condition is observed above and beyond the original scope of work, said condition shall be reported to the controlling authority before any work begins.

2. Pruning cuts which remove a branch at its point of origin shall be made close to the trunk or parent branch without cutting into the branch-bark collar or leaving a stub.

3. Pruning cuts made to reduce the length of a limb or parent stem shall be made at a slight angle relative to the remaining stem, and not damage the remaining stem. If pruning to a lateral branch, the lateral should be large enough to assume the terminal role.

4. Final cuts shall be made such that the result is a flat surface, with the adjacent bark firmly attached.

5. Not more than 25% of the foliage shall be removed during an annual growing season, depending on the tree species, size, age, and condition. If more frequent pruning due to utilities, vistas, or health considerations is necessary, removal of the tree should be considered as an alternative to pruning.

ISA BMP Manual

1. All employees or contractors directly involved with the pruning of trees shall be familiar with the following pruning types and how they are to be used in conjunction with one another:

1. **Pruning to Clean**: Selective removal of dead, diseased, detached, cracked, and broken branches
2. **Pruning to Thin:** Selective removal of small live branches to reduce crown density
3. **Pruning to Raise:** Selective removal of branches to provide vertical clearance
4. **Pruning to Reduce:** Selective removal of branches and stems to decrease the height or spread of a tree or shrub
5. **Structural Pruning:** Selective removal of live branches and stems to influence the orientation, spacing, growth rate, strength of attachment, and ultimate size of branches and stems
6. **Pruning to Restore:** Selective removal of branches, sprouts, and stubs from trees and shrubs which have been topped, severely headed, vandalized, lion-tailed, storm damaged, or otherwise damaged

2. Every effort shall be made to time pruning of individual tree species to be done in accordance with best management practices for the tree species in question. All pruning work shall be done so at the discretion of GPD and its approved contractors.

Section 9 – Other General Maintenance

Maintenance Activities

Retaining a Consultant

The task of updating an urban forestry program presents new challenges and learning curves, contracts to negotiate, bids to put out, resident concerns expressed, and many other experiences which will require the assistance of a professional. It is highly recommended that GPD retain a professional Urban Forestry consultant who can assist the park district in navigating this territory, and help to advise GPD staff in their roles as Urban Foresters.

The forestry consultant should ideally be involved in sourcing contractors and vendors for tree pruning, removal, and planting operations, assisting in maintaining the tree inventory, coaching staff on tree health and risk assessments, assisting in explaining policies to residents and new board members, preparing contract and bid specifications, and teaching residents how to help the park district in caring for their trees. The importance of this early relationship cannot be overstated, particularly because of the role that residents will play in caring for new trees.

Chemical Applications

Trees, like people, sometimes contract pests and pathogens. Often these pests and pathogens can be controlled with a simple chemical application just as illnesses in humans can be controlled with medication. This practice is referred to as Plant Health Care. When financially practical, chemical control for common pests or pathogens may be utilized as a preventative or curative method for such ailments, and increase the aesthetics and benefits of the tree population.

At present, Plant Health Care applications are a very high priority for GPD, and we include it as an important line item on our budget sheets. Repeated treatments against Emerald Ash Borer have been an annual investment in the tree population. Recent weather events such as drought and prolonged cool and wet temperatures have exacerbated many fungal diseases such as Apple Scab, Diplodia Tip Blight, and Rhizosphaera Needlecast, resulting in tree deaths from these pathogens.

Moving forward, GPD may opt to be even more proactive about its Plant Health Care program, including using Mycorrhizae and organic materials such as BioChar in order to be giving trees proper access to nutrients and water. Ultimately, making more informed selections through the reforestation planning process is the best tool we have, but some budget must always be allocated for reactive treatments as well. We have included a Plant Health Care appendix in this plan detailing some major pests, and our approach to them.

No resident of Glenview shall be allowed to chemically treat any trees within the park system, and treatment shall be at the discretion of GPD alone. Treatments must be performed by a Certified Arborist who holds an Illinois Pesticide Applicators license. Additionally, trees being treated may still be removed at the discretion of the park district.

Water Management

The importance of water in the establishment, growth, and survivorship of trees cannot be overstated. Most trees adapted to our climate zone (USDA Zone 4) are also adapted to the amount of moisture we have in an average year. However, younger trees with less expansive root systems are susceptible to prolonged drought. Young trees often need additional watering, which is an essential maintenance activity and can increase the likelihood of the survival of newly planted or younger trees on the parkway. As we anticipate nearly 800 additional trees over the course of the next 31 years, this concept becomes very important. As recommended above, a watering program paid for by the park district should be an integral part of the tree planting program, and costs have been added to the estimates based on such watering. It is also recommended that as part of the park district's watering program, local volunteers from the partners section below, as well as TreeKeepers, be engaged.

Mulch

Proper applications of mulch are necessary and cost-effective maintenance activities. Mulch has many benefits, including eliminating weed growth in the root zone, protecting the tree trunk and root flare from lawn maintenance equipment, allowing water to percolate into the soil thereby reducing evaporation rates and drought stress, and creating a naturally acidic and fertile soil environment. Turf grass that we often see competes for resources such as water and nutrients, and mulch eliminates this competition. But not all mulching is beneficial. The practice known as "Volcano Mulching" is the poor practice of piling mulch against the trunk of the tree in excess of 3" deep. This causes moisture build up against the trunk, which is not adapted to wet environments, and can cause severe decay of the trunk tissue, and ultimately death. Material such as crushed limestone, red volcanic rock, or rubber pellets can alter the soil chemistry in an undesirable way, and cause dieback or tree death.

Fortunately, mulch is a commodity most communities can get for free so long as they are pruning and removing a fair number of trees each year. It is recommended that GPD establish a marshalling yard within park district limits where pruning and removal contractors can dump wood chips. These chips can be made available for free to the district. This arrangement works very well for all parties involved: Pruning and removal contractors do not have to pay crew time to continually dump chips and pay for disposal, residents get free woodchips, and the planting contractor doesn't have to upcharge the park district for mulch when new trees are planted. All newly planted trees should have mulch applied appropriately. A longer term goal for GPD should be to mulch all trees 12" DBH and smaller, but for now, mulch for all newly planted trees, and preventing volcano mulching should be the 2 primary concerns.

Section 10 - Tree Preservation and Management During Construction

In many municipalities, ordinances exist to protect trees and shrubs prior from construction activities. The intent of such ordinances is to protect the benefits those tree and shrubs provide to the community. Since the park district does not deal with tree protection in a standard sense, we have included some recommendations below. Trees and shrubs are community resources that provide many benefits including the enjoyment of nearby property owners, as storm water benefits, energy savings, carbon sequestration and increased property values. Therefore, tree and shrub protection and preservation during construction activities on park district land represents an investment in the community. Ensuring the protection and preservation of these assets while minimizing burdens to the park district is essential. The requirements and standards set forth here are consistent with many similar communities in the Midwest.

Tree protection and preservation during periods of construction involves protecting trees from damage caused by construction activities. This damage includes physical and chemical damage to the trunk, branches, and roots. Damage may be caused by equipment such as backhoes, skid steers, or other appendage-type equipment.

Tree Preservation Requirements and Standards

Glenview Park District

1. A tree survey shall be performed by a qualified individual prior to the beginning of any development activities on park district owned land. The survey shall detail the size, species, and condition of each tree six inches DBH and greater OR managed landscape tree (intentionally planted, non-volunteer tree) of any size.

2. The Tree Survey and a Tree Protection Plan shall be submitted GPD and all relevant architects, engineers, and workers, detailing the following:
   A. Trees to be removed
   B. Trees to be preserved
   C. Location and size of the Tree Protection Zone (TPZ) for each tree

3. The Tree Protection Zones for each tree shall be visibly delineated by the site engineer, using orange snow fencing or other high visibility exclusion material. When such a delineation is not possible, all workers on site shall be made aware of the TPZ verbally.

ANSI A300 – Part 5

1. Tree management plans and specifications for tree management shall be written and administered by a certified arborist qualified in the management of trees and shrubs during site planning, development, and construction. Such activities may include, but are not limited to: demolition, grading, building construction, walkway or roadway construction, excavation, trenching and boring, or other such activity which has the potential to negatively impact trees.

2. The management of trees and shrubs shall be incorporated into the following phases of the site development process:
   A. Planning
   B. Design
   C. Pre-Construction
   D. Construction
   E. Landscape
   F. Post-Construction

3. During the Planning phase, an assessment of tree and shrub resources on the site shall be performed by a certified arborist. The assessment shall identify the species, condition, and size of each tree and shall be incorporated into the site design. Trees to be retained or protected shall appear on site design maps. Trees on neighboring property which could also be impacted should also be considered.

4. During the design phase, a tree management report shall be developed for trees to be conserved on the site, and shall be included in the construction plans and specifications, which may include, but are not limited to:
   A. Trees to be retained
   B. Tree and Root Protection Zones
   C. Tree Protection Zone barriers
   D. Tree Protection plans
   E. Soil erosion control
   F. Soil compaction controls
   G. Staging and storage areas
   H. Other relevant on-site activities

5. Grading and demolition plans shall include all trees to be retained and removed, as well as the tree protection plans for working around trees to be retained. Plans shall also include equipment routes for avoiding the TPZ. Consequences for non-compliance shall be specified.

6. During the pre-construction phase, all tree protection plans shall be effectively communicated to all parties involved with the site development, and tree protection zone barriers shall be in place prior to the beginning of any construction activities.

7. The TPZ shall be delineated around all trees to be protected during construction, and shall be based on the size, species, and condition of the tree and its root system. Six to 18 times the diameter of the tree is generally considered to be acceptable. Deviations from this diameter may be made at the discretion of a certified arborist. Activities which could damage tree roots or compact soil should be avoided in the TPZ

8. Fencing or other visible barriers to the TPZ shall be installed prior to site clearing, grading, and demolition, and maintained throughout the construction and landscaping phase. When this is not feasible, alternate methods may be considered.

9. During the construction phase, compliance with tree protection plans shall be monitored by a certified arborist, and any damage to tree barriers or trees, or non-compliance shall be reported to the project manager or owner, or other controlling authority.

10. When removing vegetation or pavement during demolition, equipment used adjacent to the TPZ shall be specified to avoid damage to the tree and the surrounding soil, and soil protection measures shall be in place prior to vehicle or heavy traffic in or near the TPZ.

11. Storage or disposal of construction materials or hazardous materials shall not occur in the TPZ.

12. Fill within the TPZ shall not be permitted without mitigation to allow for proper air and water availability to existing roots. If fill cannot be avoided in the TPZ, compaction of fill shall be avoided, and consideration shall be given to a permanent well installation to protect the tree and its roots.

13. During the landscape, irrigation, and lighting phase, levels of compliance shall be documented and reported by a certified arborist. Non-compliance shall be reported to the project manager.

14. During the post-construction phase, a remedial and long-term maintenance plan shall be specified for existing and new landscaping, to ensure success of preservation efforts and newly planted landscaping.

15. Pruning shall be considered to reduce wind sail when necessary. It should not be considered to compensate for root loss.

16. Mulch shall be applied to as much of the tree protection zone as possible, in order to create a favorable soil environment for root recovery after construction activities.

1. A cost-benefit analysis shall be conducted during the planning phase. In some cases, money may be better invested in tree planting post-construction.

2. The species and age of tree shall be evaluated by a certified arborist, so that trees in good condition with desirable characteristics are preserved, but those in poor condition or with undesirable characteristics are not.

3. A tree inventory and tree management report shall be conducted during the planning phase, and a certified arborist shall work closely with developers to ensure best management practices are being met for both parties.

4. Effort shall be made to retain groups of trees, such that there is a wind and solar buffer around the highest quality trees if possible.

5. The Critical Root Zone (CRZ) is the area around the tree trunk where roots essential for tree health and stability are located. A Tree Protection Zone (TPZ) is an arborist-defined area around the tree which should include the CRZ, as well as additional area to ensure future stability and growth. The TPZ is subject to the professional opinion of the certified arborist.

6. An attempt shall also be made to preserve native soil for landscape planting as native soil with horizons and development is preferred over fill or black dirt.

7. If a sufficient TPZ cannot be established, a 6-12" layer of hardwood mulch, 3/4-inch plywood mat over a four-inch layer of hardwood mulch, or other such measures shall be temporarily installed over the CRZ in order to prevent root and soil compaction.

8. Trunk protection shall be installed on trees very close to construction activities, and should consist of 2x4 or 2x6 planks, strapped snugly to the tree trunk with wire or other strapping, preferably with a closed-cell foam between the trunk and the planks.

9. When roots over one inch cannot be avoided, they shall be pruned, not left torn or crushed. Acceptable methods of pruning are:
   A. Excavation using supersonic air tools, pressurized water, or hand tools, followed by selective root cutting
   B. Cutting through the soil along a predetermined line with a tool specifically designed to cut roots
   C. Mechanically excavating the soil (backhoe or similar) and selectively pruning remaining roots.

10. Wells, tree islands, retaining walls, and other such structures or strategies shall be considered as alternatives to any cut/fill work in the CRZ or TPZ.

11. Monitoring shall take place during construction and post-construction phases, and any non-compliance should be reported to the proper controlling authority right away, so that timely remediation or mitigation efforts may be undertaken.

Section 11 - Tree Risk Assessment Policy

Trees provide ecosystem and aesthetic benefits. Whether they are healthy, unhealthy, structurally sound, or in imminent danger of failing, all trees pose some degree of risk. Determining the acceptable level of risk, along with effectively managing that risk, is a key priority for forestry operations. As a tree manager, GPD always must assume some degree of risk. It is up to the park district to track that risk to ultimately decide how to take steps to mitigate trees which pose such risk in a manner which is responsible both economically as well as in the interest of public safety.

Levels of Risk Assessment

These Risk Assessment Levels are based on the International Society of Arboriculture (ISA) Tree Risk Assessment Qualification (TRAQ) protocols, as well as the ANSI A300 Part 9 (Tree Risk Assessment) Standards. These levels are general guidelines, and as such, may be open to a certain degree of interpretation. The TRAQ forms can be found in the appendix at the end of this plan. All trees in GPD were assessed for risk during the inventory, however these assessments were rapid assessments based on the TRAQ protocols, and as such do not represent any formal level of TRAQ risk assessment, and are not legally binding descriptions of risk. They are instead intended to provide GPD with data showing a need for a more detailed assessment on trees assessed to have an elevated risk level such as High or Extreme risk.

Level 1 Assessment

Also called a "limited visual assessment", which is the typical "tree inventory" assessment, whereby a tree has a basic analysis of obvious physical defects and condition. The assessor walks to or drives by the tree, assesses it for defects, evaluates the risk posed by the subject tree, and reports the results of the assessment to the tree owner. Often, prior to a recommendation, a more detailed (Level 2 or Level 3) assessment will be required to gather additional data.

Level 2 Assessment

A Level 2 Assessment, also called a "basic assessment", is a synthesis of the information collected during a detailed visual inspection of the tree and the surrounding site. Such an inspection requires a 360 degree walk around, and may include the use of simple tools, such as binoculars, magnifying lenses, mallets, probes, and trowels, or shovels. The goal is to get a more complete picture of the tree in its environment.

Level 3 Assessment

A Level 3 Assessment, also called an "advanced assessment", provides detailed information about specific tree parts, targets, and risk associated with each potential interaction. It typically requires specialized training and equipment, such as bucket trucks, resistographs, tomographs, and other equipment. This is the most detailed and time-intensive type of assessment.

Considerations in Assessing Risk

Likelihood of Tree Failure Impacting a Target

A large part of determining the likelihood of a tree failure impacting a target is ascertaining the occupancy rate, or the amount of time that targets are within the Target Zone with the potential to be impacted by a tree failure. A large tree in the middle of a corn field could fail with little impact, but that same tree in a playground will have significant impact. In many roadways, motor traffic is present day and night. Many of the park district's 9,611trees are located in proximity to playground equipment or other areas where people congregate. This makes the likelihood of a failed tree impacting a person fairly high. Though parks are generally vacant at night and during the winter months, their level of occupancy is nearly constant during daylight hours in the warmer months, and should be treated as such.

Consequences of a Tree Failure Impacting a Target

The potential consequences of the tree failure impacting a target are a cumulative function of both the value of the target and the characteristics of the tree and the type of failure it is likely to experience. Whereas the previous step was concerned with occupancy rates of an impact area, this step examines the consequences of the impact on a target and assumes that the target is always present, and Occupancy Rate is not considered. To follow with the above example, it is assumed that if a parkway tree were to fail, that a car, utility line, and person (anything that likely could be there) are all underneath it at the time of failure, and the consequences to those targets is evaluated. Consequences are generally considered to be "minor" for targets that can be easily replaced or repaired, such as outbuildings, tool sheds, and other similar targets. When a tree failure can cause injury, fatality, power outage, or other such outcomes, the consequences are considered to be "severe" (see the table below).

It should be noted that for the consequences of failure to be considered as part of this risk assessment system, specific to the District, the branch must have a minimum of a 3-inch diameter at the base. A smaller requirement would present an unrealistic and burdensome standard for inspection.

Weather

Every tree, no matter how healthy, can fail from wind velocity or other impacts such as lightning damage, ice loading or soil saturation. Weather events generally cause tree or tree part failures for trees which have preexisting defects. Extreme weather events, by contrast, can cause the failure of healthy trees. For all Tree Risk Assessments, Risk shall be assessed assuming "normal" weather conditions. It should be noted that "normal" weather conditions for northeastern Illinois include gusty winds, thunderstorms, snow, and even an occasional ice storm. It is the extremes of these events that should be considered abnormal.

Glenview Park District Tree Risk Assessment Policy

Glenview Park District is adopting the following risk assessment protocols; however, the implementation of these protocols requires the exercise of judgment and discretion by the staff assigned, including but not limited to the exercise of judgment and discretion as to the priority of actions to be taken, interim steps, and other risk management activities:

1. Glenview Park District maintains a tree inventory detailing the species, size, and condition of all trees on its property, as well as the level of risk posed by each tree. This UFMP recommends that the trees listed as being in elevated risk categories during the initial inventory be audited on an ad hoc basis. During these audits, the Park District Arborist and/or Forestry Consultant shall inspect these trees and shall identify trees potentially posing an unacceptable level of risk. Such trees identified shall either be scheduled for a more detailed risk assessment (Level 2 or 3), or shall be mitigated, either by pruning, bracing, or removal, as soon as practical following the assessment.

2. During subsequent years, staff shall perform limited visual assessments on an ad hoc basis by inspecting trees during the normal course of daily operations. Trees which may appear to present an elevated risk level shall be scheduled for a more detailed risk assessment (Level 2 or 3), or shall be mitigated, either by pruning, bracing, or removal, as soon as practical following the assessment.

3. Upon notification from a resident of a concern about a potentially high-risk tree, the Park District Arborist and/or Urban Forestry Consultant shall perform a Level 2 or Level 3 Risk Assessment within (10) business days of the notification by the resident. If the tree is determined to have a risk rating above "Moderate" (as determined by TRAQ and ANSI A300 pt 9 Standards), a decision shall be made by the Park District Arborist and/or Forestry Consultant as to what the appropriate mitigation measures are, if any.

4. All trees deemed to be in need of mitigating actions (removal, pruning, etc.) shall be documented in writing by the Park District Arborist and/or Urban Forestry Consultant. The documentation shall include the date the assessment was performed, the species, size, and condition of the tree, and a brief narrative detailing which parts of the tree are likely to fail, the likelihood of failure, the likelihood of impacting a target, the consequences of tree or tree part failure, and the overall tree risk rating, per the ISA's TRAQ system of risk assessment.

5. A minimum branch diameter of three inches, by ocular estimate, shall be the standard to which this risk assessment policy applies. Assessing all branches smaller than three inches represents an undue burden to the park district.

TRAQ Forms can be found in Appendix F at the end of this report.

TRAQ Tree Risk Assessment Matrices

Likelihood of Tree Failure Impacting Target

Likelihood of Tree Failure	**Likelihood of Impacting Target**			
	Very Low	**Low**	**Medium**	**High**
Imminent	Unlikely	Somewhat Likely	Likely	Very Likely
Probable	Unlikely	Unlikely	Somewhat Likely	Likely
Possible	Unlikely	Unlikely	Unlikely	Somewhat Likely
Improbable	Unlikely	Unlikely	Unlikely	Unlikely

Risk Rating Matrix

Likelihood of Failure and Impact	**Consequences**			
	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

These 2 Tables are used to calculate risk in the following manner:

Matrix 1. Likelihood matrix.

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

Matrix 2. Risk rating matrix.

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

Section 12 - Strategic Partnerships

Partnerships have become a very effective means of getting important forestry projects funded when tax funding may present a shortfall, or when additional volunteer labor is needed. These typically involve either public-private partnerships, or partnering with other public entities. The following are groups which will be strategic partners of Glenview Park District in enacting the goals of this plan.

Village of Glenview

The Village of Glenview has a substantial forestry program and existing set of ordinances that it uses to run it's forestry operations. As a park district, GPD is subject to these ordinances as well, and does not necessarily have codified ordinances of it's own. Therefore, strategic partnership with the Village will be integral to the enaction of this plan. One of the various means by which partnership would benefit both entities would be the purchase of trees through the Village's relationship with the Suburban Tree Consortium. Also, after storm events, having a memorandum of understanding between the Village and the park district would enable both groups to share resources and staff in order to get work done rapidly after weather events. The park district collaborates with the Village on natural areas in town, including Gallery Park and properties along the North Branch of the Chicago River.

Living Lands and Waters

Living Lands and Waters is a nonprofit group based out of Moline, IL. They devote their time to cleaning up the Mississippi River, as well as large scale tree plantings. These trees have by and large been planted on private property, but as we look to the future, we would like to see some of these seedlings become established on school grounds, and also in the park system. Seedlings are generally very small trees, but smaller trees grow and establish faster than larger stock. This partnership will go a long way towards increasing tree population size in the parks as well as on school district and private property.

Open Lands Tree Keepers

Openlands is an organization devoted to preservation and enhancement of natural resources in the Chicagoland area and Illinois in general. One of their primary programs is known as "TreeKeepers", where Openlands staff train volunteers on basic tree pruning and maintenance, so that this volunteer pool can be used to assist public organizations in maintaining their trees. Though TreeKeepers generally only operates in the City of Chicago proper, we are in talks with them at the moment to see if they would be willing to run this course and get a trained pool of volunteers in the western suburbs, including Glenview. This would be a tremendous benefit to GPD, as trained volunteers could assist in pruning of young trees, which as mentioned above is one of the best cost savings measures in Urban Forestry, as it prevents small issues form becoming larger issues later in a tree's lifespan.

Cook County Forest Preserve District

The Cook County Forest Preserve District owns and maintains 26,000 acres of forest preserves in Cook County, many of which are located in close proximity to GPD parks. They also have a Community Partner program through which entities can donate time and money to the forest preserve district. The Grove staff currently coordinate the Glenview Nature Network that informs community members about stewardship opportunities and volunteer workdays at both the parks and preserves. The Nature Network also highlights birds and plants that may be present, as well as having the staff do educational days for some of the volunteer groups.

Local Schools

The park district works with five different School Districts, which creates a first tier opportunity for reaching out to the younger generation to show the importance of trees and green infrastructure in their lives. This is an excellent opportunity to impact young people's view of green infrastructure, and perhaps open up career paths they may otherwise not have realized, as they make important decisions about colleges and vocations. We have seen tremendous opportunities for local educators to bring staff into classrooms to teach, as well as school staff to bring students out into the field to learn. Trees provide amazing education opportunities in the way of biology, ecology, chemistry, social studies, mathematics, and many other disciplines. Using this to everyone's mutual advantage has the potential to create excellent outcomes for all involved.

The TREE Fund

The TREE Fund is a nonprofit research based organization which supplies grants to students and organizations involved with urban forestry, arboricultural, and other tree and environmentally oriented disciplines. Recently, TREE Fund grants have been given out to municipalities and other public entities seeking to use their data for betterment of the urban forestry community. Given the immense amount of research that Glenview Park District has done on their own tree population, we believe that we likely have a publishable study in our reaction to Emerald Ash Borer, as well as multiyear tree data on pests and pathogens affecting Pine and Spruce trees. Partnering with the TREE Fund would represent a leveraged benefit of the work we have done to date, and allow our staff compensated time to perform the actual science.

Section 13 - Additional Goals

There are no strategic timelines set forth here for these programs. As the more crucial goals of the Urban Forestry program in GPD are met or exceeded, these are goals to be discussed by Glenview Park District and its Board of Commissioners as time and budgets become available. Nonetheless, we do believe that many of these programs represent some of the most progressive Urban Forestry policies in the current climate, and that they should all be seriously considered for implementation.

Establishment of GPD Propagation Nursery

The park district currently has a propagation nursery at Community Park West. The park district can grow a share of its own park trees, using much smaller trees obtained from wholesale nurseries at a fraction of the cost of a full-sized tree. Small trees ("whips") can be purchased wholesale, and then grown to maturity in GPD. It represents a quality investment that results in significant cost savings over the long term. Trees can be purchased when small, and grown to plantable size (minimum of 1.75" diameter) on park district-owned land. The amount of time required for the care of young trees is minimal, and at an average cost of $250 per tree, the park district could save a significant amount of money in their tree nursery planting program. Therefore, the park district should look for any opportunities to expand their nursery tree capacity.

Suburban Tree Consortium / Contract Growing Arrangement

One of the keys to a successful Reforestation Plan or Tree Planting Program is the availability of high-quality nursery stock from local sources. A new approved species list has been developed to that end, as well as the tree species that are prohibited on public property. Having this information is an enormous advantage for the park district..

This knowledge, however, does not guarantee the availability of those specific trees when the time arrives to fill a particular site. One way to assure the availability of the stock the park District wants each year is to have trees contract grown by a nursery (or nurseries), and reserved specifically for GPD. In this manner, the park district will not have to compete with the commercial and residential landscape industries or retailers purchasing trees from wholesale nurseries. Trees are ordered in annual increments, typically following a "fifth year out" model. Each year, GPD would purchase the trees previously ordered for that year, and place an order for the "fifth year out". This gives the supplying nursery time to procure, plant, and bring the agreed upon trees to the size and branching habit specified.

Currently, the Village of Glenview participates in the Suburban Tree Consortium, which seeks to perform exactly this service. In addition to growing some of their own trees, we believe it would be beneficial for the park district to coordinate with the Village, and order trees together. This will allow the park district to use the wholesale pricing and contract growing available through the Suburban Tree Consortium without having to establish a relationship independent of the village. It should be noted here that the STC likely would not plant the trees for the district, but would act as a supplier only.

Tree Donation Program
The park district currently has a Tree Donation program where someone can pay to have a tree planted in a park of their choosing. In addition, they have the option of purchasing a small aluminum plaque which can be hung from a low branch of the tree with any inscription they want. These trees are typically planted in memory or in honor of a loved one, or to celebrate a milestone. The Reforestation Plan portion of this project should be used as a guide in determining what the options are for a donation tree that is mutually agreed upon by both the donor and the park district. We believe that publicizing and expanding this program when practical would lead to increased tree planting and decreased costs for the district. Species must be approved by the park district, to ensure that the species is not too large for the planting site, or otherwise a very poor fit for the site. We must also try to stay in keeping with the diversity standards that we have established earlier in the plan, hence why species selection must be controlled to some degree. We do not want to offer memorial trees of species which are already overrepresented in the tree population.

Private Property Tree Planting Incentive Programs
Tree planting on private property is a strategic outcome of this Urban Forestry Management Plan. Though the park district has no formal jurisdiction to plant trees on private property, the benefits of tree planting on private property are substantial in terms of energy savings, storm water benefits, and other benefits. The park district should consider incentivizing residents and business owners to plant trees on their property. The already successful partnership with Living Lands and Waters could serve as a template for accomplishing this goal. Current examples of this are the tree seedlings from MWRD that are given out during the Farmer's Market at Wagner Farm.

Use of Permaculture Guilds and Food Forests in Tree Plantings and Landscape Design
Permaculture is the concept of using communities of plants that all work well ecologically or chemically together to enhance the overall area. This stands in stark contrast to the view of plants solely from an aesthetic standpoint where each plant contributes to the whole, but is not necessarily functionally related to it's fellow plants and trees. These groupings are often referred to as "guilds",and there are several well-established guilds that can be taken advantage of by GPD, as well as many more potential guilds that can be experimented with going forward. A simple example of a guild would be planting legumes as a soil stabilizer near fruit trees (instead of mulch) so that the legume provides nitrogen to the fruit tree, increasing it's yield and making it healthier overall. This very progressive approach to planting communities of plants and trees vs just standalone plants is a very interesting concept, and one that GPD should take advantage of.

A large part of building permaculture guilds is to have food plants as part of the guild in additional to other types of functional plants. To this end, we are starting to see an uptick in the planting of Apple, Edible Pear, Peach, and some nut producing species in parks. For a long time, such species were not traditionally planted in parks due to the fruits attracting undesirable insects and being relatively messy. However, as society has become more focused on local food production in the past decade, the popularity of these "food forests" have flourished, and their popularity with residents has overcome their downsides. Parks are now doubling in some respects as mini orchards, and the fruit trees have become an attraction. Again, we believe that both a part of permaculture guilds, as well as being standalone trees, that fruit and nut trees should be planted in some of the parks. There are clearly some species such as Chestnut which can have hazardous husks and should not be utilized. However, many species of fruit and nut trees are hardy to our area, and will increase overall species diversity, and will make for attraction to the parks.

Though the concept of permaculture and food forests will not work for every park or certainly for every tree planting, there will certainly be areas which can be used as test cases for both of these concepts. Integrating these concepts with community gardens in the parks is another avenue of urban agriculture and permaculture that could be very popular with residents. And as we will discuss below, the use of guilds as it pertains to natural areas will become very important as well, where we are building native communities instead of just installing native plants, and there is a major difference between those concepts. Even without food-producing plants, it should still be the goal of GPD to try and build multilayered canopies and forest communities to try and emulate the natural order of our native Illinois plant communities.

Diversification in Evergreen Plantings
Too often with park districts, we see overplanting of only a few species of evergreens, namely White and Austrian Pines, and a handful of Spruce species. This is done to screen the parks from neighboring residences as well as provide winter interest, but there are many more evergreen species which should be considered for this purpose. These Pine and Spruce species have a tendency to be susceptible to a variety of pest and pathogen issues, such as Zimmerman Pine Moth, Diplodia Tip Blight, Rhizosphaera Needle Cast, and a whole other group of secondary issues as well.

As part of the preparation for enacting this Urban Forestry Management Plan, and due to the severe issues with many of the pathogens listed above, Graf staff performed a Pine and Spruce Management Plan for GPD in the winter of 2018. This was in many ways similar to the Emerald Ash Borer Management Plans that we have created in the past for Ash trees. Trees were evaluated for severity of issues being suffered, and a triage based approach was put into place.

This will ensure that trees which are under tremendous pest and pathogen stress will be removed over the coming years, a small subset of younger trees will be chemically treated so they can be retained, and trees which have not been overly affected will remain in place with monitoring and updating as necessary. As part of this plan, we anticipate the removal of 31 Pine and Spruce in the short term due to pest and pathogen issues, as well as continued removals based on the inventory updates due to future pest and pathogen issues, as well as natural senescence of these trees.

In their place, we have called for the planting of a variety of different evergreens. Austrian Pine is not native to the United States, Colorado Blue Spruce is (as the name implies) not very well adapted to Illinois soils, and all of these trees are overplanted in the GPD population. Instead, we have suggested the use of alternative evergreens. These include trees such as Douglas Fir, Concolor Fir, Eastern Redcedar, Eastern Hemlock, and a more diverse set of native pine trees such as Virginia, Red, and Ponderosa Pine. These trees can be slightly more specific about where they will survive and thrive, but using the targeted reforestation approach above, we have selected locatiosn where these trees will be more likely to establish and lead long, healthy lives in the park setting. This will alleviate the diversity issues, as well as hopefully the pest and pathogen issues which the park district is currently subject to. In addition, as will be discussed below, evergreens tend to be good habitat for native birds and other wildlife, and a diverse selection on these trees will lead to a diverse wildlife contingent in the parks.

Reductions in use of Small Short Lived Ornamental Trees

One of the other issues which has been a problem for not only GPD, but many similar park districts in Illinois is the overuse of shart lived ornamental trees such as Crab Apple, Serviceberry, and Callery Pear, among others. These trees have great aesthetics and smaller stature, and therefore are generally overused in parks because they fit in smaller spaces, and are popular flowering trees in the spring.

The issue comes about in 2 respects. First, we want trees to provide maximum benefits to the park district and the community, and as mentioned above, many times these smaller ornamentals are only there for 25 years, and never get to a large stature. They are also prone to many diseases such as Apple Scab and Fire Blight. In the case of Callery Pear, this tree is soon going to be placed on the Illinois Invasive Plant list, since they have begun to escape cultivation, and have become very aggressive in our natural areas. Callery Pear may soon be the next European Buckthorn, and it's planting should be eliminated. While these smaller ornamentals are certainly necessary trees in the landscape, we would like to see their numbers decreased overall in favor of full sized shade trees with a longer lifespan and greater benefits provided to the community.

We would also recommend, and have included in the reforestation plan, using a more diverse group of smaller trees for this purpose. Trees such as Pagoda and Corneliancherry Dogwoods, Japanese Tree Lilac, Witch Hazel, Persian Ironwood, Yellowwood, Smoketree, and others have excellent aesthetic qualities as well, and generally have far fewer pest and pathogen issues than their more common counterparts. Part of this management plan will be to make a shift from smaller ornamental trees to larger shade trees, and the diversification of the smaller ornamentals being used.

Synnestvedt Arboretum at Flick Park

In 1985, the Glenview Park District acquired land from the former Synnestvedt Nursery to expand Flick Park. The Synnestvedts were considered one of the premier landscape companies in the Midwest, and they had a display garden so that people could see how the plants would grow over time. This garden was preserved when the park was developed, and has become a 'mini arboretum'. This is an area where some more exotic species can be planted as specimens and learning tools. With the level of GIS technology the district currently possesses, a digital map can be created that will allow residents and parkgoers to be able to access the inventory via smartphone or tablet, and learn about the trees in the arboretum as they walk around it.

Incorporate More Tree Plantings into Natural Areas, Remove Non-Native and Aggressive Trees

Glenview Park District currently owns and manages approximately 38 acres of their parks where the dominant species are either invasive species (such as European Buckthorn) or very aggressive natives (such as Cottonwood and Black Locust). These area areas which have tremendous potential for enhancement through the removal of these undesirable species, and planting with native grasses, wildflowers, and of course trees. Many times, in native plantings, trees are often ignored in favor of the Illinois native prairie species which are typically planted. However, Illinois is home to many native communities other than prairie, and tree plantings can be a very important part of enhancing these areas.

Native communities such as Oak/Hickory Woodlands, Savanna, Floodplain Forest, and even some wetlands can all be enhanced through the use of native tree plantings. As GPD takes to the important task of eliminating these invasive and aggressive trees form their existing natural areas, care should be taken to replant desirable trees in their place. And as mentioned above in the permaculture section, we want to mimic the natural ecosystem in these areas. Tree planting plans should include diverse canopies, with herbaceous vegetation, understory trees, and canopy trees all incorporated into the planting plan. These diverse native plantings will in turn attract diverse wildlife, including many pollinator species such as bees and butterflies which have been on the decline in recent years.

All of this said, one of the main goals in opening up this 38 acres by removing invasive and aggressive species will be to have more usable space, so overplanting of trees is not necessarily the best option as well. But using the removed material to create woodchipped trails and planting of native forbs, grasses, and trees accomplishes both goals of increasing usable space while also increasing Illinois Native species cover and tree canopy cover.

Use Trees as Wildlife Habitat (Pollinators and Birds)
Evergreen trees have always been a safe haven for birds and owls during all seasons of the year in Illinois, as are standing dead trees ("snags"). In addition, many trees provide fodder for pollinating species such as bees and butterflies. Tree species such as apples, basswood, cherries, black locust, catalpa, horse chestnut, tulip tree, and the willows are all insect pollinated, and will attract beneficial insects. As GPD looks to engage residents more, having beneficial wildlife becomes more important. It is also recommended that in a safe manner, certain dead trees be cut back but retained for bird nesting. There would not be opportunities to do this in the parks, but rather in the natural areas at the Grove, that are remote and far enough away from walking paths. These standing snags are often an integral part of native landscaping plans, though they must be monitored to ensure they do not pose a public hazard. The use of things like Bat and Owl boxes to attract these creatures can be done on larger trees.

That said, the goal should also be to attempt to reduce "nuisance" wildlife, such as excess deer, opossums, squirrels and the like. Though these are certainly native wildlife, they can have a tendency to harm trees and desirable native species, as well as pose health hazard in some cases. The planting in natural areas of deer resistant native species may achieve this goal as well.

Wood Utilization Program
As the UFMP recommendations take effect over time, a considerable amount of material will be generated that may be suitable for use as urban timber. Urban timber is generally defined as saw logs generated from urban tree removal operations. Larger and longer logs are suitable for dimensional lumber production (such as 2x4's, etc.), and smaller material may be used to produce many other products. Forming strategic partnerships with local sawmills, woodworkers, and carpenters would be an important early goal of this program, while creating a market for the finished goods will be an ongoing goal. And of course, the gfeneration of woodchips for mulching new plantings is important as well, however a higher use value for quality wood is always desirable.

Urban timber can be utilized to mill suitable wood into a large variety of products including pallet blanks, shipping material, dimensional lumber, fine furniture, and artisan pieces. In order to successfully upcycle urban timber into usable lumber, several steps must be followed in order to produce logs suitable for milling. Optimum urban timber production will include specifications for tree removal operations that will produce saw logs of the proper dimension and quality. Specifications for the construction of public buildings that require a specified amount of upcycled, local urban timber for either interior or exterior applications may qualify for LEED certification points, and raising awareness of the benefits of the urban forest in general, creating a saleable product that can serve as a revenue stream. A sample Urban Timber Harvesting specification in appendix I.

OAKtober Event
The Chicago Region Trees Initiative has created the OAKtober program, which serves to bring awareness to Oak Ecosystem Recovery. It also acts like a Fall version of Arbor Day. One option is to hold an OAKtober event each year to commemorate this important topic, as well as dovetail with ~~the~~ a fall plant sale and seedling giveaway. This program could be incorporated in to our existing Harvest Fest program, which already draws many participants each fall. This enables us to reach out directly people who are at the Harvest Fest already to continue to make residents aware of the importance of trees in their lives.

Planting of Fruit Trees at Wagner Farm
Each year at our Wagner Farm complex, where we grow many fruits and vegetables, we hold a farmer's market throughout the summer. As a means of expanding this, we are considering planting several varieties of fruit trees at Wagner Farm that could function as additional offerings for our farmer's market. Trees such as Apples, Pears, Peaches, Cherries, and others could be planted and maintained. This will not only provide a traditional tree resource, but a food resource as well. When taken in tandem with the Permaculture objectives spelled out above, we believe this would be a high profile and enjoyable way for residents to interact with trees at our parks.

See following page for projected budgets

Section 14 - Projected Budget

REMOVALS	**Milestones**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025-2030**	**2031-2040**	**2041-2050**
	Trees Removed	267	250	200	150	175	175/year	175/year	175/year
	Notes	1 Hazard Remove + 266 Removals from Inventory	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals	Update Inventory for New Removals
	Removal Cost (2020)	$56,500	$53,000	$42,500	$31,750	$37,000	$37,000	$37,000	$37,000
	Removal Cost (CPI)	$56,500	$53,000	$42,500	$31,750	$37,000	$42,500	$48,900	$56,250

PLANTINGS	**Milestones**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025-2030**	**2031-2040**	**2041-2050**
	Trees Planted	150	160	170	180	190	190/year	230/year	240/year
	Planting Cost (2020)	$60,000	$64,000	$68,000	$72,000	$76,000	$80,000	$92,000	$96,000
	Planting Cost (CPI)	$60,000	$64,000	$68,000	$72,000	$76,000	$92,000	$105,800	$121,670

PRUNING	**Milestones**	**2020**	**2021**	**2022**	**2023**	**2024**	**2024-2030**	**2031-2040**	**2041-2050**
	Trees Pruned	400	422	600	700	900	1250/year avg	1,400/year avg	1,600/year avg
	Notes	94 Hazard and 306 Priority Prunes from inventory	Remaining 422 Priority Prunes from inventory	Begin 1/2 of first Cycle Prune	Finish 1st cycle prune	Increase pruning capacity	Cycle pruning based on inventory updates	Cycle pruning based on inventory updates	Cycle pruning based on inventory updates
	Cost (2019)	$44,300	$46,750	$66,450	$77,500	$99,500	$138,500	$155,000	$175,000
	Cost (CPI)	$50,200	$62,750	$75,300	$87,850	$100,400	$159,275	$178,250	$201,250

FORESTRY CONSULTANT	**Milestones**	**2020**	**2021**	**2022**	**2023**	**2024**	**2024-2030**	**2031-2040**	**2041-2050**
	Notes	UFMP / Inv Updates	Inventory Updates / Risk Management	Inventory Updates / Risk Management	Inventory Updates / Risk Management	Inventory Updates / Risk Management	Reporting Updates / Inventory Overhaul	Inventory Updates / Risk Management	Inventory Updates / Risk Management
	Cost (2020)	$10,000	$10,000	$10,000	$10,000	$10,000	$20,000	$10,000	$10,000
	Cost (CPI)	$10,000	$10,000	$10,000	$10,000	$10,000	$23,000	$11,500	$13,225

Plant Health Care (PHC)	**Milestones**	**2020**	**2021**	**2022**	**2023**	**2024**	**2024-2030**	**2031-2040**	**2041-2050**
	Notes	Ash / Pine /Spuce Treatment	Ash / Pine /Spuce Treatment	Ash / Pine /Spuce Treatment	Ash / Pine /Spuce Treatment	Ash / Pine /Spuce Treatment	TBD PHC	TBD PHC	TBD PHC
	Cost (2020)	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000	$10,000
	Cost (CPI)	$10,000	$10,000	$10,000	$10,000	$10,000	$11,500	$13,225	$15,250

TOTALS	**TOTALS - 2019 $**	**$180,800**	**$183,750**	**$196,950**	**$201,250**	**$232,500**	**$285,500**	**$304,000**	**$328,000**
	TOTALS - CPI 3%	**$180,800**	**$183,750**	**$196,950**	**$201,250**	**$232,500**	**$328,275**	**$357,675**	**$407,645**

Section 15- Summary / Conclusion

The mission of this Urban Forestry Management Plan is to create a more robust, diverse, and resilient tree population within the Glenview Park District system over the coming 30 years. Throughout this document, we have addressed the current status of the Park District's Forestry Program, as well as documenting goals and milestones, both financial and programmatic, to get the park district to it's ultimate goals. These goals include high levels of species diversity, maintaining a forestry program which decreases costs and maintains public safety, and involving the public and other partner organizations in higher-level programs which benefit both the urban forest, and the residents and businesses which reside within Downer's Grove.

This document is meant to be adaptively managed, and will be reviewed and updated as new information becomes available. It is also meant to be a clear explanation to the public that GPD has the public's best interests in mind when making decisions as it pertains to trees and their relative benefits and risks. To that end, this document is not intended to be a monolith of understanding, and certainly as new pests and pathogens are introduced, new trees are available for planting, new organizations and partners become available, staff changeover occurs, and other such unforeseen factors are encountered, that the forestry program has a strong guiding light.

The effort that Glenview Park District has put into it's trees over the past 100 years has been considerable. And the primary focus of this document is to ensure that this effort will be maintained and budgeted for, regardless of the headwinds that may come about. It should be reviewed and edited periodically to ensure that the goals are being met or altered based on new information. Trees have tangible and important benefits that will impact not only Glenview, but as a communal resource, will impact the Midwest in general. To that end, we say the following:

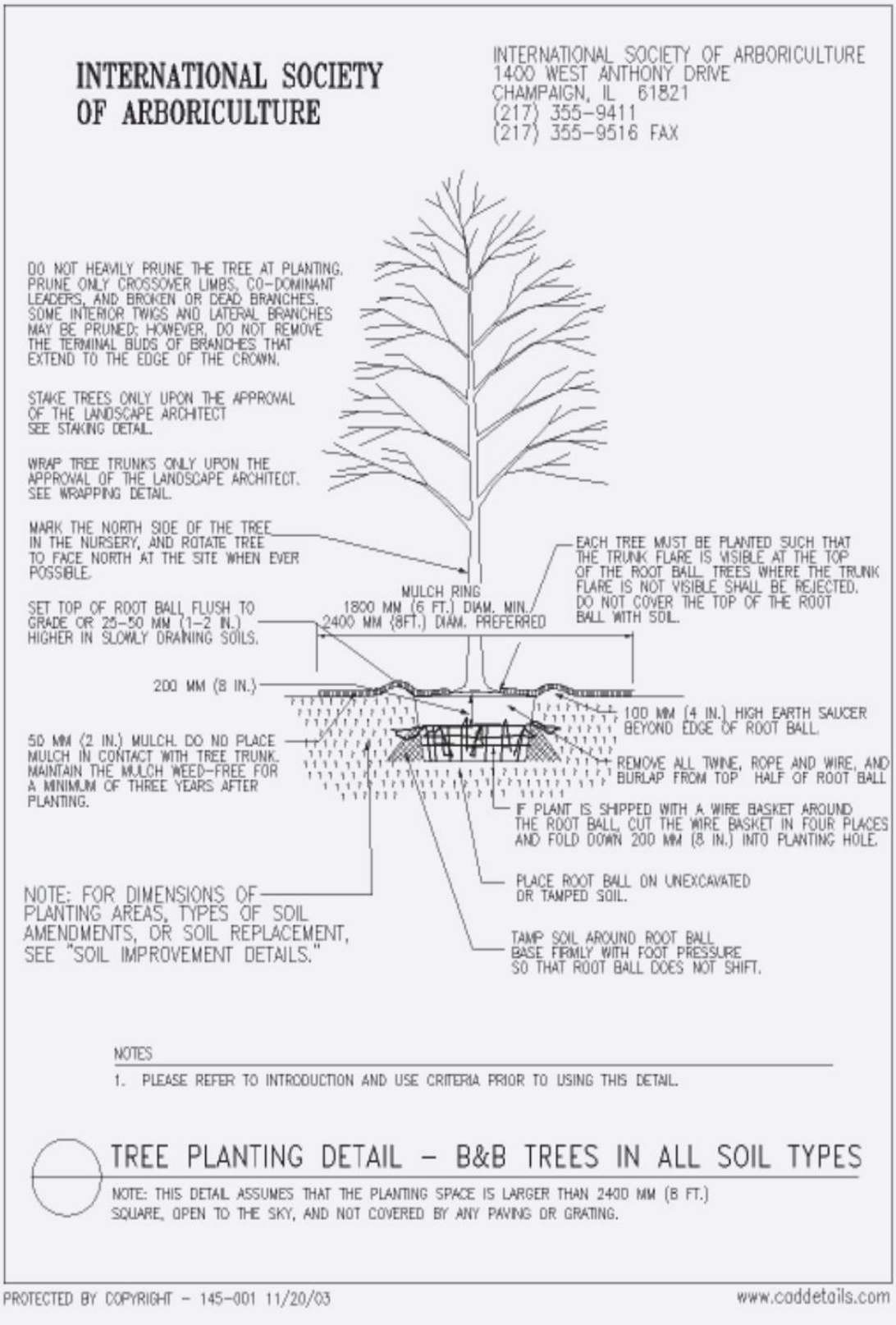
Glenview Park District maintains a strong commitment to it's trees, and all of the beneficiaries which they contribute to. We have done our best to ensure that these trees, people, and institutions which stand to benefit from these trees are done so with the best of intentions. We will continue our commitment to our portion of the Urban Forest, and hope this document provides guidance along that path. We thank the community, granting organizations, and all stakeholders for their steadfast commitment to this end, and hope that in the future, however long that may be, this document provides the greatest good for the longest term possible.

Appendix A: Acceptable and Unacceptable Species

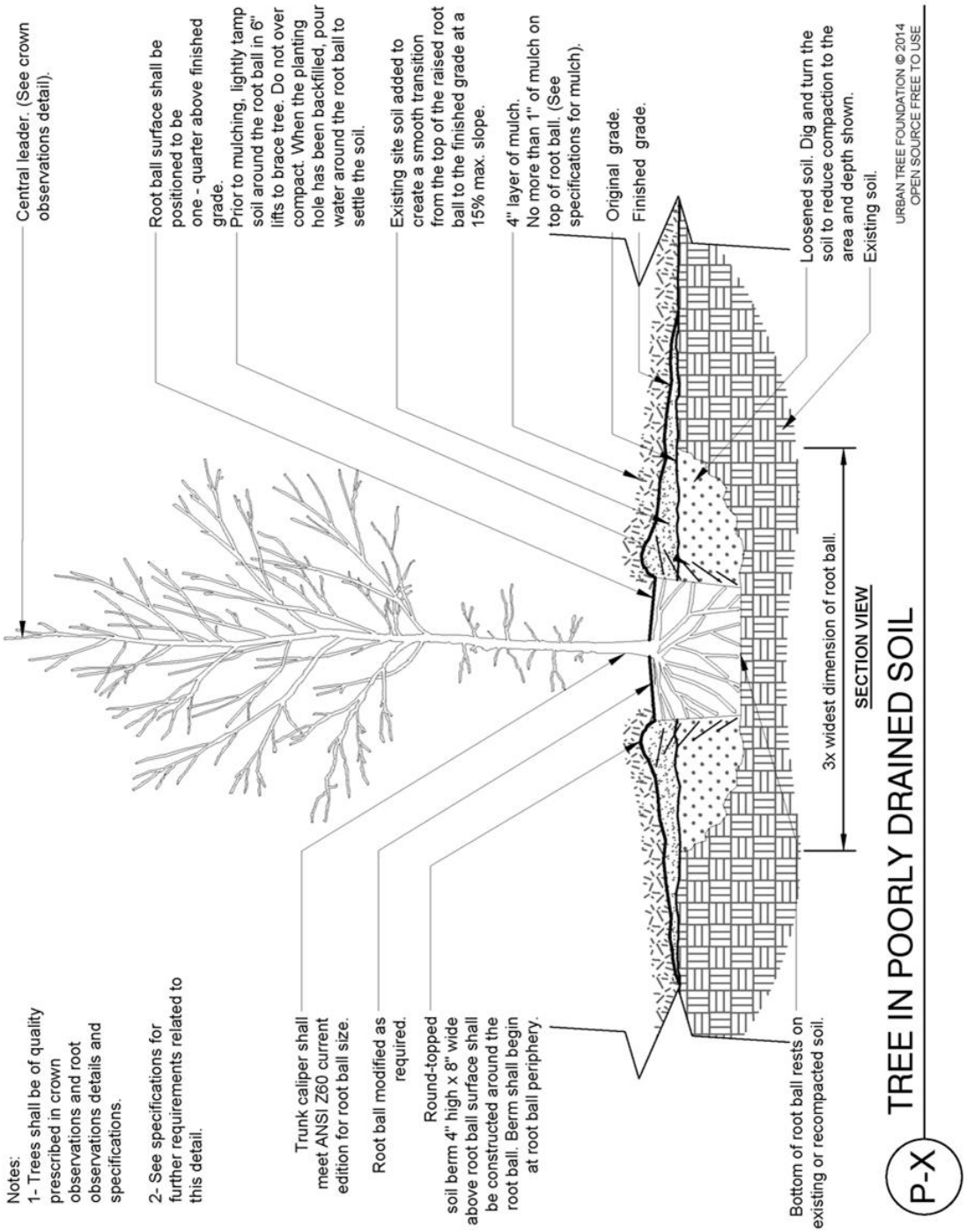
Species not appearing on this list can be approved or disallowed by consensus of the Tree Advisory Board, acting under the supervision of the Park District Arborist and/or Forestry Consultant

NOT APPROVED	APPROVED SPECIES			
	Large Trees	Medium Trees	Small Trees	Evergreens
AILANTHUS	BALDCYPRESS	ALDER	AMERICAN REDBUD	ARBOR VITAE
AMUR CORKTREE	BEECH-AMERICAN	AMUR MAACKIA	BUCKEYE-RED	DOUGLAS FIR
ASH-EUROPEAN	BEECH-EUROPEAN	BIRCH-RIVER	DOGWOOD-SPP	EASTERN REDCEDAR
ASH-GREEN	BLACK LOCUST	BIRCH-WHITE	HAWTHORN-COCKSPUR	FIR-CONCOLOR
ASH-WHITE	BUCKEYE-OHIO	BLACKGUM	HAWTHORN-SPP	HEMLOCK-SPP
BOXELDER	BUCKEYE-YELLOW	ELM-CHINESE	LILAC-TREE	JUNIPER-COMMON
BUCKTHORN	CATALPA	HARDY RUBBER TREE	ROSE OF SHARON	PINE-AUSTRIAN
BURNING BUSH	DAWN REDWOOD	HAZELNUT-TURKISH	SERVICEBERRY-SPP	PINE-MUGO
CHERRY-BLACK/PIN	ELM-HYBRID	HORNBEAM-AMERICAN	SMOKETREE	PINE-WHITE
COTTONWOOD	GINKGO*	HORNBEAM-EUROPEAN	APPLE-CRAB	SPRUCE-BLUE
ELM-AMERICAN	HACKBERRY	IRONWOOD	APPLE-EDIBLE	SPRUCE-NORWAY
ELM-SIBERIAN	HICKORY-SPP	KATSURA	CHERRY-ORNAMENTAL	SPRUCE-SPP
HONEYSUCKLE	HONEYLOCUST	MAPLE-HEDGE	LILAC-SHRUB	YEW
MAPLE-NORWAY	HORSECHESTNUT	MAPLE-MIYABEI	MAGNOLIA-SAUCER	
MAPLE-SILVER	KENTUCKY COFFEETREE*	MAPLE-PAPERBARK	MAPLE-AMUR	
MULBERRY-SPP	LARCH	MAPLE-SHANTUNG	MAPLE-JAPANESE	
PEAR-CALLERY	LINDEN-AMERICAN	MAPLE-TRIFLORUM	PEACH/NECTARINE	
POPLAR-SPP	LINDEN-LITTLELEAF	OAK-CHINKQUAPIN	PLUM-SPP	
POPLAR-WHITE	LONDON PLANETREE	OAK-ENGLISH	WITCH HAZEL	
PRINCESS TREE	MAPLE-SUGAR	OAK-SHINGLE	HYDRANGEA-PEEGEE	
RUSSIAN OLIVE	OAK-BURR	PERSIAN IRONWOOD		
WALNUT-ANY	OAK-PIN	YELLOWWOOD		
WILLOW-SPP	OAK-RED	GOLDEN RAINTREE		
	OAK-SWAMP WHITE	MOUNTAIN ASH		
	OAK-WHITE	PEAR-EDIBLE		
	PAGODATREE	SASSAFRASS	Do Not Plant	
	PERSIMMON	SEVENTH SON FLOWER		
	SWEETGUM		Plant limited quantities	
	SYCAMORE			
	TULIPTREE		Plant in abundance	
	ZELKOVA			
	CHESTNUT-CHINESE	* - Male Only		
	MAGNOLIA-CUCUMBER			

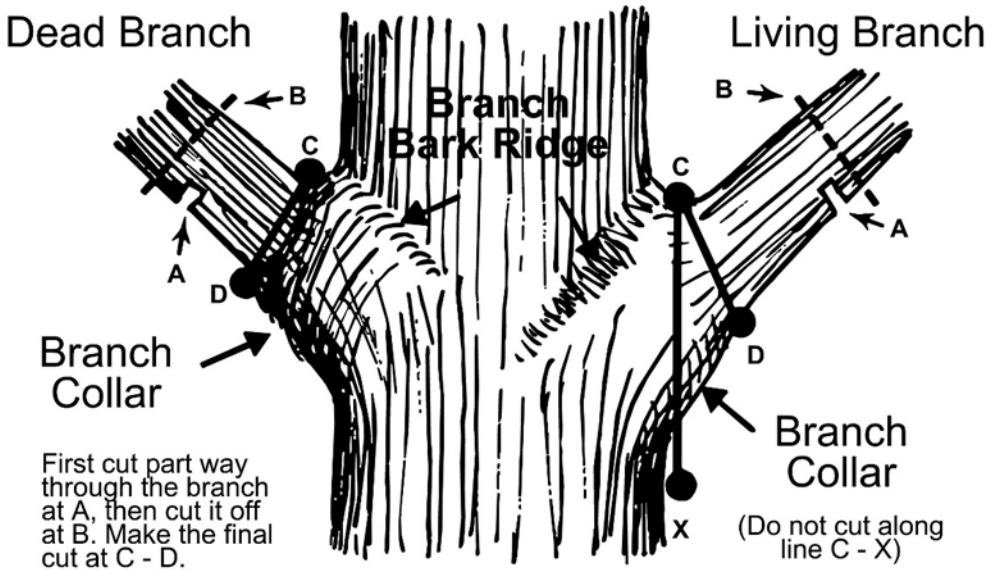
Appendix B: Balled and Burlapped Planting Detail



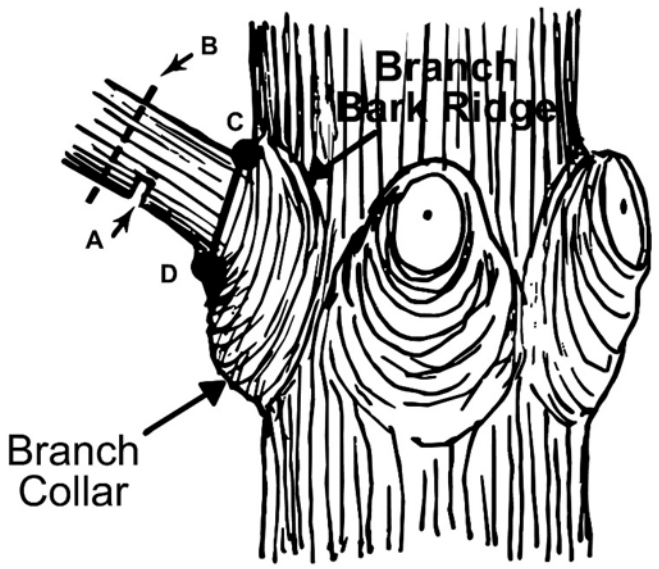
Appendix C: Container Planting Tree Detail



Proper Pruning Principles

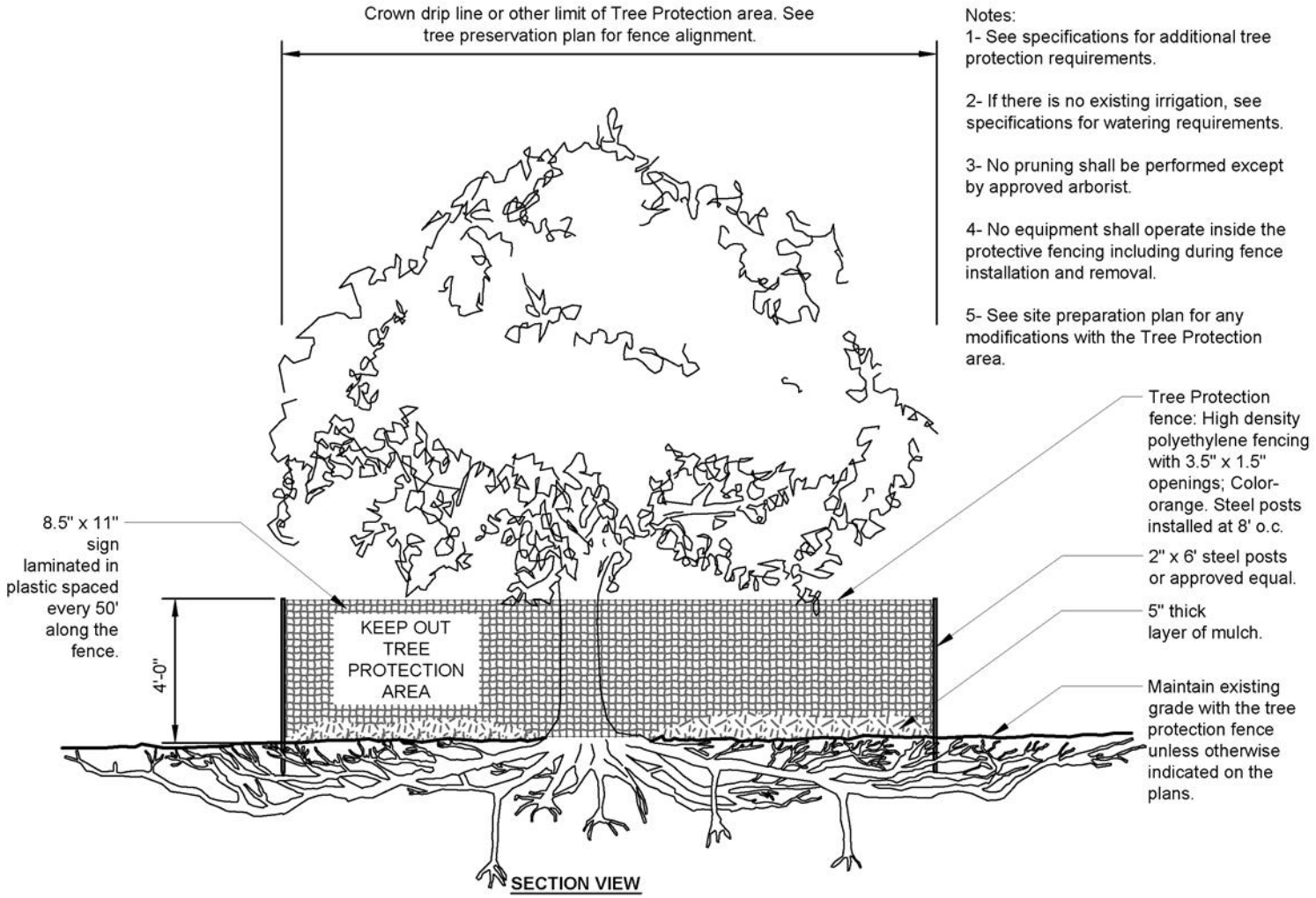


Hardwoods



Conifers

Arbor Day Foundation®



S-X TREE PROTECTION

Appendix F: ISA TRAQ (Tree Risk Assessment Qualification) Form

Basic Tree Risk Assessment Form

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

Target Assessment

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

Site Factors

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

Tree Health and Species Profile

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

Load Factors

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

Tree Defects and Conditions Affecting the Likelihood of Failure

— Crown and Branches —

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

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

Main concern(s) _____

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

— Trunk —

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

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

— Roots and Root Collar —

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

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

Risk Categorization

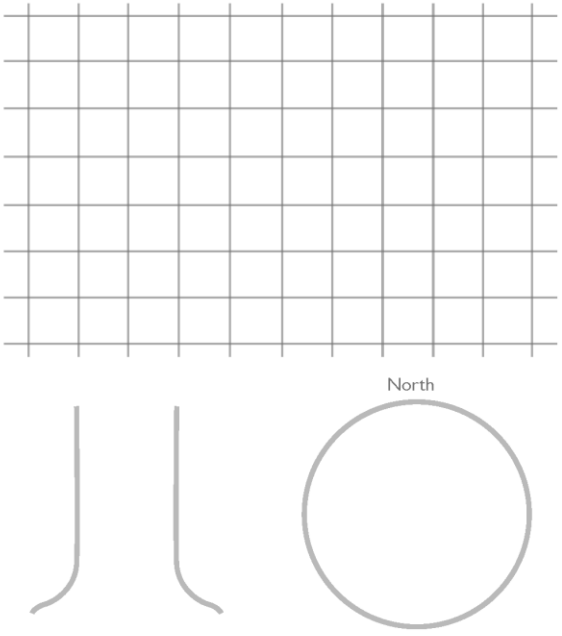
Condition number	Tree part	Conditions of concern	Part size	Fall distance	Target number	Target protection	Likelihood: Failure: Improbable	Failure: Possible	Failure: Probable	Failure: Imminent	Impact: Very low	Impact: Low	Impact: Medium	Impact: High	Failure & Impact (from Matrix 1): Unlikely	Somewhat	Likely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

Matrix 1. Likelihood matrix.

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

Matrix 2. Risk rating matrix.

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



Notes, explanations, descriptions _____

_____

_____

_____

_____

Mitigation options _____ **Residual risk** _____

_____ **Residual risk** _____

_____ **Residual risk** _____

_____ **Residual risk** _____

Overall tree risk rating Low ☐ Moderate ☐ High ☐ Extreme ☐ **Work priority** 1 ☐ 2 ☐ 3 ☐ 4 ☐

Overall residual risk Low ☐ Moderate ☐ High ☐ Extreme ☐ **Recommended inspection interval** _____

Data ☐Final ☐Preliminary **Advanced assessment needed** ☐No ☐Yes-Type/Reason _____

Inspection limitations ☐None ☐Visibility ☐Access ☐Vines ☐Root collar buried Describe _____

APPENDIX G: Contract Formulation

Tree Maintenance Contract Formulation

As large-scale tree maintenance tasks will primarily be accomplished by use of a Tree Care Contractor as defined above, the following are guidelines for developing the most efficient and cost-effective contracts for park district-wide tree trimming, tree removal, and stump removal contracts. As part of the bidding process, minimum requirements and capacities for contractors, equipment, and employee qualifications will be established as part of the bid documents for the various tasks, and addressed by specific contract language. Sample contracts are attached.

Tree Pruning

Contracts for pruning park district tree populations that have not been maintained on a regular basis should concentrate on that segment of the population that poses the most potential risk, and/or that segment that will benefit most from pruning operations. Those populations have been defined as part of this UFMP, and will be addressed as a priority. Once those situations have been resolved, a cycle-pruning program should be established in order to improve and maintain the urban forest as a whole. Most effective pruning cycles range in length from four to seven years. As we have noted many times above, however, we believe that a zone-based approach is not proper for GPD. We believe that updating of the inventory on a cyclical basis will identify the trees for which maintenance is needed most, and that maintenance can be carried out in any given year it is identified. This approach will stretch the park district's budget much further than pruning each tree every 4-7 years whether it needs it or not. The cost of the inventory updates will more than be offset by the reduction in maintenance costs.

Contract Timing

While many tree species may be safely pruned at any time during the year, all trees may be safely pruned during the dormant season. Dormant season pruning is usually defined as December 1st through the end of March. Dormant season pruning reduces the amount of material generated, minimizes the potential spread of communicable disease, and allows superior access to trees by equipment and workers. Contract completion may be extended or reduced depending on weather conditions and response of trees to weather patterns.

Contract Length

Contracts may be let on an annual or multi-year basis. While annual contracts may be able to take advantage of short-term economies, multi-year contracts enable prospective bidders to take advantage of economies of scale, commit resources and manpower over longer periods, and schedule activities far in advance. As such, long-term contracts offer the potential of lower cost, increased efficiency, and allow beneficial relationships to develop over time by eliminating the need to regularly apprise new contractors of standard adherence and performance expectations. When developing multi-year contracts, the first year of the contract is awarded to the lowest responsible bidder, and subsequent year's work awarded based on satisfactory completion of the previous year's work. In this manner, acceptable contracts may be extended, while agreements with contractors who perform poorly are avoided. Typical contact length is three years – the initial year plus two renewal years. The time frame may be extended beyond that point by mutual agreement between the park district and the Contractor. Pricing for subsequent year's work will be in accordance with a specific, agreed upon Consumer Price Index (CPI). Increases in unit pricing for subsequent years will be capped at a maximum of 5%, regardless of the CPI increase. If the agreed upon CPI decreases, the previous year's unit prices will be applied to the extension year.

Contract Specifications

As specified elsewhere in the UFMP, all pruning shall follow the *ANSI A300 (Part 1) - 2008 Pruning* Standard and the ISA's *Best Management Practices: Tree Pruning (2008)* for the purpose of crown cleaning, crown thinning, crown raising, and structure development, or as amended. Contractors will be supplied with lists of trees to be pruned based on information generated by the inventory data. Minimum numbers of trees pruned in given time frames, size class definition, and overall completion dates will be addressed by specific contract language.

Tree Removal

Many of the principles that apply to the development of tree pruning contracts apply to tree removal contract preparation as well, with the exception of timing. Trees that pose the highest risk to the community, its residents, and property should be addressed as a priority. Those trees have been identified elsewhere as part of this UFMP.

Budget
As part of the inventory data collection process, trees requiring immediate removal have been identified and quantified. Those trees posing the most potential risk to the community, its residents, and property should be removed as a priority. As those trees are removed, trees requiring removal for other reasons documented as part of this UFMP may be scheduled. At a minimum, sufficient funds should be allocated to accomplish the removal of those trees initially identified as potential high-risk.

Contract Timing
All trees identified as potential high-risk by the inventory data should be removed immediately. A typical time frame for completion of a given list of tree removals usually specifies completion within ten business days of the receipt of the list. Specific time frames for completion of removals will be determined by explicit contract language. Trees that have been identified for removal but do not pose significant potential risk may be scheduled separately as time or budgets allow. Alternatively, lower priority removals may be grouped into a separate contract for dormant-season removal at alternative, off-season pricing.

Contract Length
Contracts may be let on an annual or multi-year basis. While annual contracts may be able to take advantage of short-term economies, multi-year contracts enable prospective bidders to take advantage of economies of scale, commit resources and manpower over longer periods, and schedule activities far in advance. As such, long-term contracts offer the potential of lower cost, increased efficiency, and allow beneficial relationships to develop over time by eliminating the need to regularly apprise new contractors of standard adherence and performance expectations. When developing multi-year contracts, the first year of the contract is awarded to the lowest responsible bidder, and subsequent year's awarded based on satisfactory completion of the previous year's work. In this manner, satisfactory contracts may be extended, while agreements with contractors who perform poorly are avoided. Typical contact length is three years – the initial year plus two renewal years. That time frame may be extended by mutual agreement between the Park District and the Contractor. Pricing for subsequent year's work will be in accordance with a specific, agreed upon Consumer Price Index(CPI). Increases in unit pricing for subsequent years will be capped at a maximum of 5%, regardless of the CPI increase. If the agreed upon CPI decreases, the previous year's unit prices will be applied to the extension year.

Contract Specifications - As specified elsewhere in this UFMP, all equipment to be used and all work to be performed shall be in full compliance with the most current revision of the *ANSI Z133.1-2012 Safety Requirements for Arboricultural Operations*, or as amended. Minimum numbers of trees to be removed, specific time frames, and overall completion dates will be quantified, and addressed by specific contract language.

Stump Removal
Many of the principles that apply to the development of tree pruning and removal contracts apply to stump removal and restoration contract formulation as well, again with the exception of timing. Stump removal and restoration should occur as close to the date of removal of the tree as possible.

Budget - As part of the inventory data collection process, existing parkway stumps have been identified and quantified. As trees are removed through completion of the Tree Removal Contract, inventory updates will produce a list of stumps to be removed and restored. At a minimum, sufficient funds should be allocated to accomplish the removal and restoration of existing stumps and those resulting from the first year's removal contract. The Contract will specify the removal all tree stumps and buttress roots to a point eight inches (8") below the adjacent ground level. and removal of all surface and sufficient subsurface roots as may be necessary to eliminate "humps" in the parkway adjacent to the stump. The area then shall be restored with topsoil to the level of the adjoining grade and seeded.

Contract Timing – Existing stumps should be removed as soon as possible, and those generated by the removal contract be ground and restored as the removal contract progresses. A typical timeframe for stump removal and restoration is within twenty (20) workdays of receipt of the stump removal list. Specific time frames for removal and restoration completion will be determined by explicit contract language.

Contract Length – Contracts may be let on an annual or multi-year basis. The stump removal and restoration contract may be let in conjunction with, or separate from, the removal contract. If a single contractor submits the low quote on both operations, that contractor may be awarded both contracts. While annual contracts may be able to take advantage of short-term economies, multi-year contracts enable prospective bidders to take advantage of economies of scale, commit resources and manpower over longer periods, and schedule activities far in advance. As such, long-term contracts offer the potential of lower cost, increased efficiency, and allow beneficial relationships to develop over time by eliminating the need to regularly apprise new contractors of standard adherence and performance expectations. When developing multi-year contracts, the first year of the contract is awarded to the lowest responsible bidder, and subsequent year's awarded based on satisfactory completion of the previous year's work. In this manner, satisfactory contracts may be extended, while agreements with contractors who perform poorly are avoided.

Typical contact length is three years – the initial year plus two renewal years. That time frame may be extended by mutual agreement between the Park District and the Contractor. Pricing for subsequent year's work will be in accordance with a specific, agreed upon Consumer Price Index(CPI). Increases in unit pricing for subsequent years will be capped at a maximum of 5%, regardless of the CPI increase. If the agreed upon CPI decreases, the previous year's unit prices will be applied to the extension year.

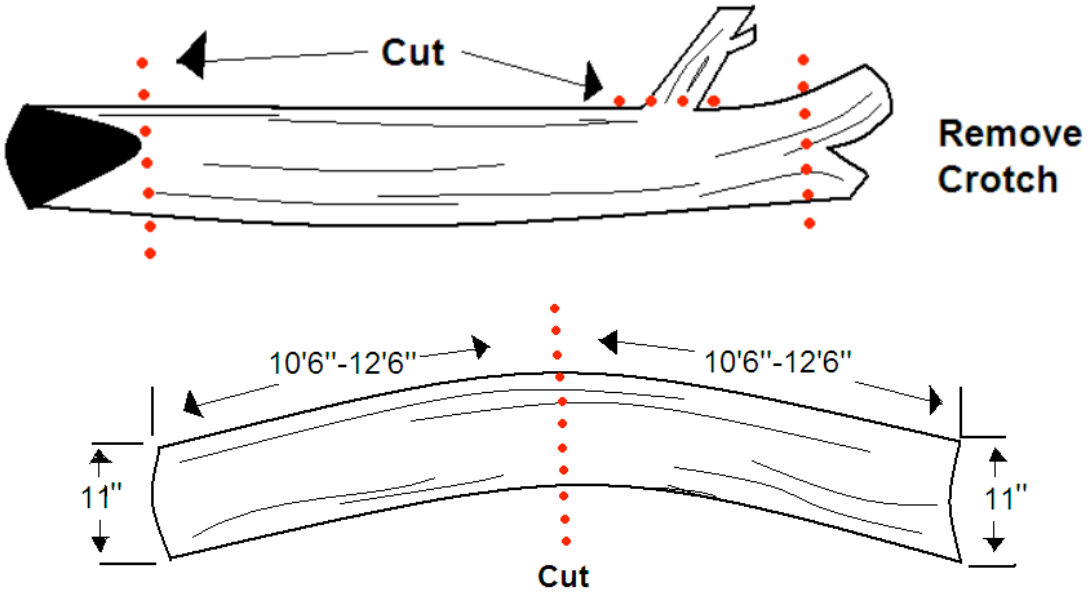
Contract Specifications - As specified elsewhere in this UFMP, all equipment to be used and all work to be performed shall be in full compliance with the most current revision of the *ANSI Z133.1-2012 Safety Requirements for Arboricultural Operations*, or as amended. Site appearance, disposal of grindings, backfilling, and seeding specifications will be addressed by specific contract language.

APPENDIX H: Urban Timber Harvesting

Log Removal Specification for Urban Timber Harvesting

This tree removal standard shall not take precedence over applicable industry safe work practices and shall be implemented by a qualified arborist, urban forest manager, and /or practitioner who, through related training or on-the-job experience, or both, are familiar with the standards, practices and hazards of recovering urban forest products and the equipment used in such operations. Additionally:

- Logs shall be felled to obtain minimum 8', 10', or 12' lengths with an additional 6" of trim on each log to a minimum diameter of 11" inside the bark. Maximum log length shall be 20'6".
- If a tree must be removed in sections, every effort should be made to retain the lowest log, at the longest possible length that can be safely felled.
- Branches should be trimmed flush with the bole/trunk, root flares should be trimmed flush with the bole/trunk, and the ends of the log should be square.
- Logs shall be flush cut with no crotches or splits. All obvious defects such as decay, large holes, and rot shall be removed.
- Logs with significant sweep shall be cut in order to eliminate as much sweep as possible while yielding the longest possible straight logs to ensure logs are flush for proper milling.



APPENDIX I: PLANT HEALTH CARE APPLICATIONS AND SAFETY

Pests and Applications

Glenview Park District Recognizes the following pests and pathogens to be among those which may warrant treatment during the course of the growing season in order to maintain trees health, aesthetics, and benefits provide to the community:

Emerald Ash Borer (EAB) – EAB is an insect pest which affects all species of the Ash tree genus (*Fraxinus*) in the United States. It kills the tree by having insects chew through the cambium tissue and effectively girdle the tree, causing it to not be able to get nutrients and water up to it's leaves. This results in tree death several years after infestation.

Treatment for Emerald Ash Borer involves either a direct trunk injection of insecticide concentrate, or a soil drench (root application) with insecticide and fertilizers, or at times a combination of both. This insecticide in combination with fertilizer both kills the larval stage beetles, as well as provides the tree with additional nutrients to be able to heal the beetle damage.

Zimmerman Pine Moth - Zimmerman Pine Moth (ZPM) attacks most Pine species, but Austrian and Scotch Pines are particularly susceptible. The female ZPM lays eggs in midsummer near the edges of previous wounds. The larvae overwinter and begin feeding the following spring. They first feed on the bark and then bore into the cambium. The tunneling girdles the branches and causes dieback. After several years of damage, the trunk may weaken and break off. Signs of infestation include large masses of frass and resin in the branch whorl area on the trunk. These masses are often off-white or yellowish (see photo).

To control ZPM, apply an insecticide to the trunk and branches in early spring during larval activity and again in midsummer during egg-laying. Remove dead trees promptly, as they can serve as hosts and a center of infestation.

Diplodia Tip Blight - Many Pine species can be infected by Diplodia Tip Blight (DTB), but in our region Austrian and Scotch Pine are the most susceptible. DTB is more likely to occur when trees are stressed and near infected susceptible species. The disease first appears as browning of needles at the tips of shoots (see photo). Needles are often shorter than normal, and sometimes droplets exude from infected needles. Small black fruiting bodies of the fungus can be seen at the base of needles. Fruiting bodies also form on scales of seed cones and on bark of infected shoots. Often the damage appears in the lower part of the tree, but shoots throughout the tree may show damage. Repeated infection of branch tips results in deformed tree growth and loss of vitality. The fungus can also cause cankers, with excessive and obvious sap exudate.

Management of DTB includes not planting susceptible trees near mature infected Pines. On infected trees, remove any dead or cankered wood and cones. Mulch and water as needed to reduce stress. Fungicide spray requires three timely applications: 1) when buds begin to elongate/swell 2) just before the new needles begin to emerge from the fascicle sheath, and 3) 10 to 14 days later. Lastly, consider avoiding the use of the most susceptible Pines in landscape plantings.

Apple Scab – Apple Scab is a complex fungus which affects most species of Crab Apples, as well as some Serviceberries, Hawthorns, and Pears. It is often found alongside a very similar and related fungus called Cedar Apple Rust. This fungus infects the leaves and fruits of these trees, and often they lose their leaves and become entirely defoliated by the early summer. Though rarely if ever fatal, our parks contain a great number of all of these species, and it results in a very poor aesthetic when there are many small ornamental trees which appear nearly dead in the middle of August.

Control of Apple Scab is very similar for control of Diplodia Tip Blight, and involves 3 applications of fungicide: 1) Right when buds begin to break in spring 2) 2 Weeks later when tree has half of it's leaf emerged 3) 2 weeks after that just before or during flowering. Cultural treatments are also effective such as raking up dead leaves so spores have nowhere to live. This would actually make a wonderful volunteer activity for some of the various volunteer groups GPD already works with.

Other Potential Pests and Disorders May Include

PEST/PATHOGEN	AFFECTED SPECIES	TREATMENT
Dutch Elm Disease	American Elm	Fungicide infusion at the root flare with large water volume
Thousand Cankers Disease	Walnut Species	None known yet, possible fungicide injection
Japanese Beetle	Linden, Birch, Others	Leaf spray of diluted insecticide during flight season
Iron / Manganese Chlorosis	Maples, Birches, Others	Soil or trunk injection of Iron and Manganese
Scale Insect	Many	Spray or trunk injection with insecticide
Bur Oak Blight	Burr Oak	Fungicide injection in trunk
Oak Wilt	Red Oak Family	Root trenching / fungicide injection

Pesticide Safety

When applying any Plant Health Care application to any public site, Glenview Park District shall observe the following:

1. Marking of the site to be sprayed or applied to with white flags or other signage clearly allowing park patrons to know what is being applied.

2. Chemicals shall only be applied by a licensed Illinois Department of Agriculture Operator or Applicator, who is wearing the appropriate Personal Protective Equipment based on the label of what is being applied to the site.

3. Chemicals shall be applied at the label rate for the pest or pathogen being controlled, and in keeping with the manufacturer's instructions, and shall be stored in accordance with the manufacturer's instructions.

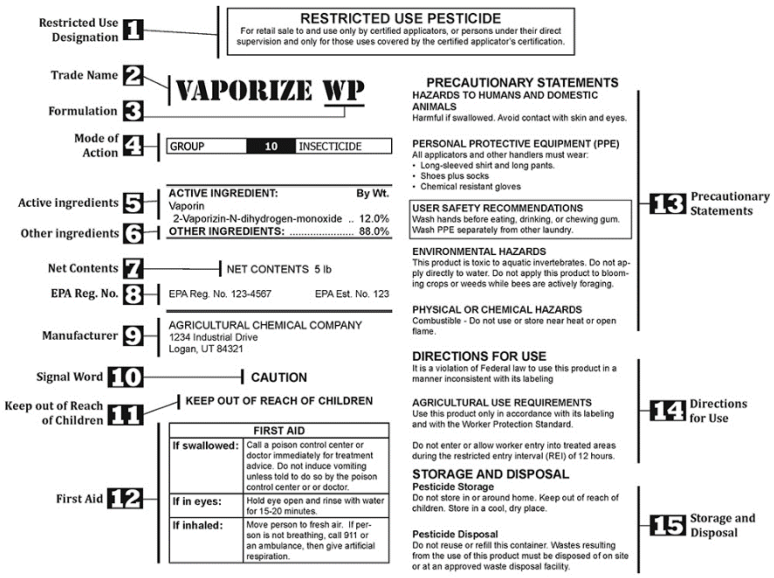
4. Aerial sprays shall not be applied when the wind speed or wind gusts exceed 15 miles per hour during the course of the day, in order to avoid overspray

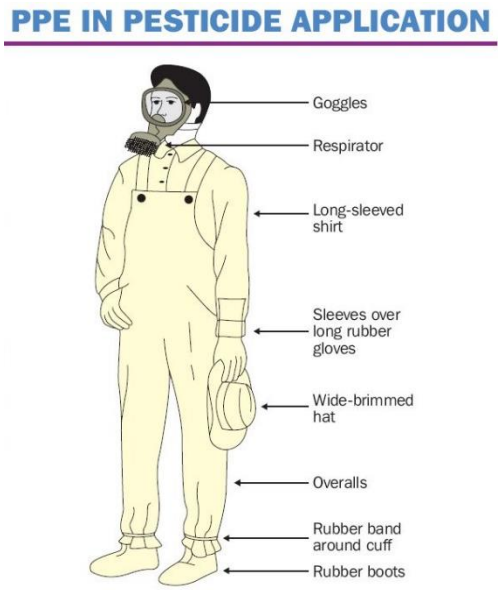
5. No chemical applications shall be performed when temperatures exceed 85 degrees Fahrenheit, in order to avoid volatilization of chemicals resulting in non-target organisms being affected.

6. All Personal Protective Equipment and Application Equipment shall be maintained in accordance with the manufacturer's instructions and applicable ANSI standards for such equipment.

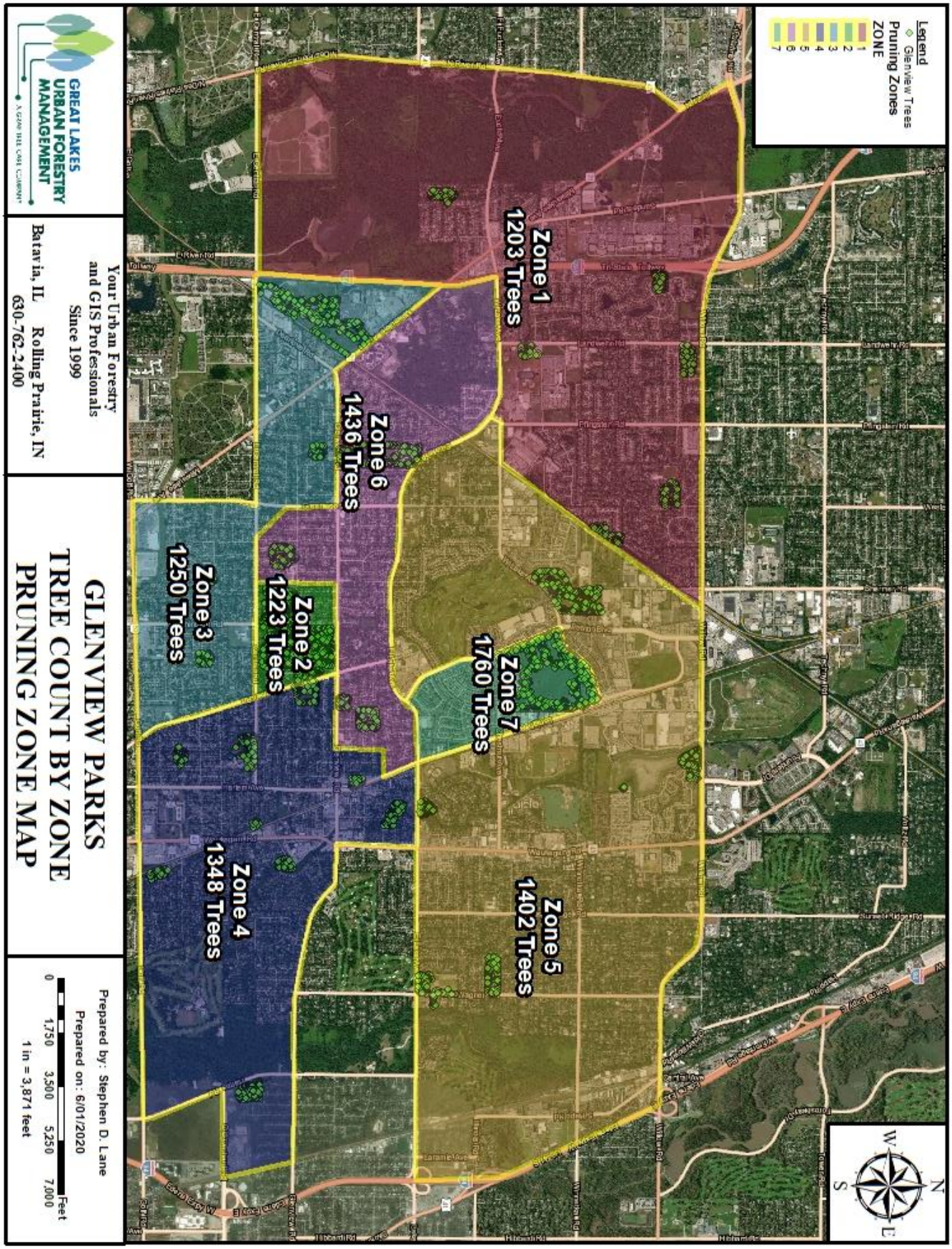
7. Tanks shall be triple rinsed when switching between applications and only approved tank mixes shall be acceptable when multiple chemicals are being mixed together.

8. Care shall be taken by all employees to wash hands and clothes as needed to avoid unnecessary exposure to any chemicals.





Appendix J: Proposed Pruning Zone Map



Glenview Park District
2018 Pine and Spruce Evaluations

Prepared By:
Leslie A. Delles – Certified Municipal Arborist – IL-9199AM TRAQ
September 28, 2018

Introduction

On July 16, 2018, Certified Arborists from Graf Tree Care, Inc. began a comprehensive evaluation of all the Pine and Spruce trees on the properties of Glenview Park District (GPD). This evaluation resulted in the assessment of 1,385 Pine and Spruce Trees on 26 properties. GPD has been experiencing a higher than normal rate of decline in their Pine and Spruce trees in recent years and has partnered with Graf Tree Care to create a management plan to address the situation and to help prioritize actions to be taken. Signs of foliar fungal pathogens, and the poor aesthetics that come as a result of the decline, were found at varying levels among much of the Pine and Spruce population, particularly in Austrian Pine, Scotch Pine, Blue Spruce, and White Spruce trees. A minor pest infestation was also observed at much lower levels on Austrian Pine and Scotch Pine trees, as well as a fungal canker in Blue Spruce. These pathogens and pests will be described in detail below.

Diplodia Tip Blight

Many Pine species can be infected by Diplodia Tip Blight (DTB), but in our region and in GPD in particular, Austrian and Scotch Pine are the most susceptible. DTB is more likely to occur when trees are stressed and near infected susceptible species. DTB can be particularly problematic in landscape plantings where trees have planted outside of their natural environmental requirements and tolerances. The disease first appears as browning of needles at the tips of shoots (see photo). Needles are often shorter than normal, and sometimes resin droplets exude from infected needles. Small black fruiting bodies of the fungus can be seen with the unaided eye at the base of needles, just under the fascicle or sheath tissue. Fruiting bodies also form on scales of two-year-old seed cones and on bark of infected shoots. Often the damage appears in the lower part of the tree, but shoots throughout the tree may show damage with time. Repeated infection of branch tips results in deformed tree growth and loss of vitality. The fungus can also cause cankers, with excessive and obvious sap exudate. Branches that become girdled will die. Sapwood may become discolored with a dark brown stain.

The fungus overwinters in infected cones, shoots, and needles. Spores are released in the spring during rainy periods, therefore the disease is usually more severe in wet springs. New shoots are susceptible to infection from two weeks after bud break until about mid-June. The fungus penetrates the needles and quickly causes necrosis. Second-year seed cones are infected in late May or early June and serve as a reservoir of future spores. Research on Austrian and Scotch Pines in Illinois and Kentucky indicates that the pathogen resides on and within symptomless shoots from both diseased and apparently healthy pines. These symptomless infections may become active during periods of tree stress and result in branch dieback.

Management of DTB includes the following actions. The fungus affects needles directly, but can also infect wounded tissue, therefore care should be taken to avoid wounding trees and pruning or shearing should not take place during wet weather when spores are being released. Do not plant susceptible trees near mature infected Pines. On infected trees, remove any dead or cankered wood and cones, if possible, however removal of cones may not be practical on large trees. Mulch and water as needed to reduce stress. Fungicide spray requires three timely applications: 1) when buds begin to elongate/swell 2) just before the new needles begin to emerge from the fascicle sheath, and 3) 10 to 14 days later. Lastly, consider avoiding the use of the most susceptible Pines in landscape plantings.

Rhizosphaera Needle Cast

Rhizosphaera Needle Cast (RNC) most commonly occurs on Blue Spruce, but some other Spruce and Pine species can be infected. Norway Spruce is resistant to the pathogen. Initial symptoms occur in late summer as yellowing of first-year needles. These rapidly turn brown or purple-brown, but do not fall from the tree until the following summer or autumn, 12-18 months after the initial infection. The fungus produces pycnidia in the needles, which appear as black pinhead-sized bodies that occur in rows down the needles. These will extend above the surface of the needle when moist and can be seen with a good hand lens. If not visible on dry needles, they will develop in 24-48 hours when infected needles are kept in a bag with a moist paper towel. The discoloration and defoliation generally occur on lower branches first and gradually move up the tree, but can also appear scattered throughout the tree. Severely infected trees will have healthy looking needles only at the tips of branches.

The fungus overwinters in fruiting structures on infected needles. Spores are released from spring until autumn. They readily infect young needles but can also infect older growth on trees under stressful growing conditions. Infection will occur more rapidly under warm, wet conditions.

Management of RNC includes the following actions: Cultural practices that will help reduce this disease include the use of healthy planting material and the continual inspection of trees for signs of the disease. Premature needle drop is a symptom that warrants follow-up inspection. Good air circulation will help to prevent infection, therefore maintaining adequate spacing between trees and keeping surrounding vegetation mown and pruned is necessary. Chemical controls are effective if the disease is not too severe. Fungicide spray requires three timely applications: 1) when buds begin to elongate/swell 2) when the needles are half elongated, and 3) when the needles are fully elongated. Because this fungus requires 12 to 18 months for symptom expression, at least two years of fungicide spray are often required. Lastly, consider avoiding the use of the most susceptible Spruces in landscape plantings

Zimmerman Pine Moth

Zimmerman Pine Moth (ZPM) attacks most Pine species, but Austrian and Scotch Pines are particularly susceptible. The female ZPM lays her eggs in midsummer near the edges of previous wounds. The larvae overwinter and begin feeding the following spring. They first feed on the bark and then bore into the cambium. The tunneling girdles the branches and causes dieback. After several years of damage, the trunk may weaken and break off. Signs of infestation include large masses of frass and resin in the branch whorl area on the trunk. These masses are often off-white or yellowish (see photo). To control ZPM, apply an insecticide to the trunk and branches in early spring during larval activity and again in midsummer during egg-laying. Remove dead trees promptly, as they can serve as hosts and a center of infestation.

Cytospora Canker

Cytospora Canker is most common in Blue Spruce, but other conifers have been observed as hosts. Lower branches usually show symptoms first, with a progression of symptomatic branches moving up the tree. Needles turn purplish brown on entire branches rather than just branch tips. Whitish resin (see photo) can be found on older infected branches and this resin becomes more noticeable as needles drop. A canker is present and can be found by exposing the discolored inner bark, which will be brown. Small, black, pinhead-sized fungal fruiting bodies form within the cankered bark and cankered branches die. It is common to see infected Spruces lose lower branches over a period of years until the tree is unsightly.

The fungus overwinters as fruiting bodies and mycelia in cankered bark. Spores are released during the growing season and infect branches of the same or nearby trees at wound sites. Spores of the fungus are moved by wind, rain, or vectors of the fungus, including insects, birds, and humans. The fungus grows in the inner bark, girdling and killing branches. This disease commonly affects stressed Spruce and drought-stressed trees are particularly susceptible. The fungus usually attacks trees that are at least 15 years old.

Spruce trees should be managed for optimum vitality to help avoid stress and therefore Cytospora infection. If Cytospora has been a problem in an area, consider planting species other than Blue Spruce which are highly susceptible to this disease. It is best to avoid wounding trees, but when cankers appear they must be removed. Remove diseased branches, preferably in late winter or in dry weather and disinfect pruners between cuts. Never prune trees in wet weather. There are currently no effective chemical control measures for Cytospora Canker.

Secondary Pathogens

Some secondary pathogens that affect Pine and Spruce trees should also be mentioned. Dothristroma Needle Blight, which is a fungus similar to DTB usually affects poor condition Pines that already have DTB and/or ZPM. Oftentimes if DTB clears up, so does Dothristroma, so it is not commonly recognized as a strong pathogen. Pine Wilt Nematode is a devastating pathogen, and usually a death sentence for Austrian and Scotch Pine, but it is quite rare. Spruce trees can also develop SNEED, Sudden NEEdle Drop, which is similar to RNC, though less common. In Spruce trees, Spider Mites are common, but rarely get to a point where they cause significant damage to the tree. As mentioned, these are all more secondary diseases, which affect stressed and weakened trees that are already affected by the major pests/pathogens DTB, ZPM, or RNC. Our evaluations targeted the more problematic major pests/pathogens.

Overview

By far and large, both DTB and RNC are widespread in GPD parks and it is actually more unusual to find a Blue Spruce or Austrian Pine that does not exhibit some degree of foliar fungus. ZPM and Cytospora Canker are present in some of the parks, but at a minor and non-concerning level. Fortunately, DTB and RNC can be managed through chemical fungicide sprays, however with the large number of Spruce and Pine in the GPD system, it would be impractical and cost prohibitive to treat every tree for foliar fungi. The goal of our evaluations and this management plan was to identify higher quality Spruce and Pine trees that were in highly visible or higher traffic areas and therefore had higher location values. We also identified trees that were planted in a way as to have functionality in the landscape. These identified trees, which provide higher value for GPD and its patrons and neighbors, were designated as those which would benefit most from fungicide treatments to protect from foliar fungal pathogens. This selective process also attempted to keep in mind budget constraints and our goal was to keep treatment costs as reasonable as possible. The next section will highlight our observations at each GPD property, while also discussing our reasoning for recommending treatment, monitoring, or removal. In the sections that follow, we will explain the evaluation statistics, annual costs, and options for a longer term management program.

It is important to mention the fact that signs and symptoms of foliar fungal pathogens such as RNC and DTB can vary greatly from year to year depending on weather conditions. Oftentimes, springs with higher than average rainfall will result in higher levels of DTB being observed in Pine trees. In a similar fashion, summers with higher than average rainfall will result in higher levels of RNC in Spruce trees. Since treatments for these pathogens need to occur early in the spring, before we have any indication on how badly the pathogens will affect trees later in the year, there will always be a degree of uncertainty when developing a treatment set. A mid-summer evaluation of Pine and Spruce trees should be part of an ongoing, and likely evolving, management plan.

Glenview Park District 2018 Pine and Spruce Evaluations Park Narratives

Central Tot Lot

There are no Pine or Spruce trees at Central Tot Lot.

Cole

Many Austrian Pine trees have been lost in recent years at Cole due to DTB. In an effort to preserve the remaining good to fair condition Austrian Pines with higher location values, we have recommended to treat 5 Austrian Pines at Cole to control the foliar fungus. Three of these are on the east side of the park along the tennis club parking lot and two are on the north side of the park along the path. Two young Blue Spruce, one on the north side and one on the east side, have moderate signs of RNC and foliar fungus treatment is recommended to control this pathogen and preserve these trees. Since these trees are small, treatment cost should be relatively low and worth the expense in order to protect GPD's investment in purchasing and planting these young trees. One Blue Spruce near the playground is in fair condition and has a higher location value therefore fungicide treatment is recommended. Three Blue Spruce near the playground and one Serbian Spruce on the southwest corner of the tennis court have significant dieback and removal is recommended. Removal is also recommended for 3 low location value Austrian Pines near the southwest corner of the tennis club building and 1 poor condition Austrian Pine on the east side of the tennis club parking lot. In general, the White and Scotch Pine trees at Cole are in good condition.

CPW

All of the White Pine trees at CPW are in good to fair condition. There are 2 Blue Spruce trees (see right) near the high-traffic corner of Zenith Dr and Milwaukee Ave, one of which has significant dieback and should be removed. The other has minor signs of RNC and fungicidal treatment is recommended. At the corner of Zenith Dr and the CPW entrance driveway, there are 2 Austrian Pines which have healthy canopies (see photo on cover page), however they are being girdled by cables (see left) installed to stake the trees when they were planted years ago. If these girdling cables can be successfully removed, we highly recommend fungicide treatment to protect these good-condition and high location value trees from DTB.

In the parking lot islands, most of the Spruce trees have limited growing space and one tree was recommended for removal due to severely limited growing space. Two of the parking lot Spruce have been recommended for fungicide treatment due to minor RNC. Lastly, one small Spruce along the driveway is recommended for removal due to severe dieback.

Countryside Lane
Of the 4 Pine/ Spruce trees at Countryside Lane, only the Austrian Pine on the west side of the playground is recommended for fungicide treatment to control DTB due to its higher location value. One of the Norway Spruce trees has been struck by lightning and should be monitored

Cunliff
The Norway Spruce and White Pine trees at Cunliff are generally in good to fair condition. No trees at Cunliff were recommended for treatment and only one Blue Spruce should be removed due to limited growspace and dieback.

Crowley
At Crowley, a White Pine at the southwest corner of the tennis courts has severe dieback and should be removed. Six good to fair condition Austrian Pines with higher location values have been recommended for fungicidal treatment to control DTB. Three of these are southwest of the park building near the central ball field, two are near the southeast ball field (see right), and one is near the park entrance/ sign bed and playground. The two Austrian Pines that are near the southeast ball field also are showing signs of ZPM and treatment to control this pest is also recommended for these trees.

Diederich
Six young Blue Spruce along the east side of Diederich have minor to moderate signs of RNC and foliar fungus treatment is recommended to control this pathogen and preserve these trees.

Flick
There is a significant population of Pine and Spruce trees at Flick Park. Overall, the White Pines, Scotch Pines, and Norway Spruces at Flick are in good to fair condition and none have been recommended for treatment or removal.

There is very little evidence of ZPM at Flick and no Pines were recommended for treatment to control ZPM. Fungicide treatment to control DTB has been recommended for a number of the good to fair condition Austrian Pines (see left) that line the entrance drive due to their high visibility and location value. Treatment is also recommended for a limited number of Austrian Pines in more heavily used areas of the park. Unfortunately, most of the Blue Spruce trees (see right) that stand in the western section of the Arboretum have significant dieback along with limited growing space, and removal has been recommended for most of these based on the higher traffic along the Arboretum path. Early signs of Cytospora Canker were also observed on a small number of the Blue Spruce at Flick. A limited number of trees throughout the park were recommended for removal due to overcrowding and severely limited growing space and a small number of poor condition Pines and Spruces were also recommended for removal. The Austrian Pines along the west side of the park are in fair condition with minor signs of DTB but were not recommended for treatment due to overcrowding along this border. These trees should be monitored and possibly be treated in the future if deemed appropriate. Treatment was recommended for 5 Blue Spruce on the east side of the pool due to their value of serving as a screen for the adjacent residential neighbors. The line of Blue Spruce, Norway Spruce, and White Pine serving as a screen in the northwest corner of the park should be monitored and action taken if deemed necessary and preservation of the screen is desired.

Gallery

On the south side of Gallery Park along the driveways leading to Park Center, 11 Austrian Pines (see left) and 3 young Blue Spruce trees (see right) have been recommended for treatment to control foliar fungus. These trees are showing minor to moderate signs of DTB and RNC, respectively, and have high location values and visibility along the busy driveways. Two of the Austrian Pines in this part of the park have been recommended for removal due to overcrowding and decline. In the central part of the park south of the fountain, there are four good condition Blue Spruce with minor signs of RNC and these are recommended for fungicide treatment due to their high location value. On the north side of the park, north of the tennis courts, 10 Austrian Pines and 4 White Spruce form a natural screen between the courts and West Lake Ave. Due to their functionality and higher location value, these 14 trees are recommended for treatment to control foliar fungi. Also, two of these Austrian Pines have minor signs of ZPM and treatment to control this pest should be considered. There are a significant number of Pine and Spruce trees along the east side of the park that are in good to fair condition, however treatment is not recommended due to their lower location values. Two of the Austrian Pines along this border are dead and should be scheduled for low priority removals. We recommend that the remainder of these trees be monitored and removed and replaced as necessary.

Glenview Ice Center

At Glenview Ice Center, the 2 Austrian Pines that are on the island between the entrance and exit driveways have minor to moderate needle tip dieback are recommended for fungicide treatment to control DTB due to their good condition and their high location value and visibility along Landwehr Rd. The Blue Spruce along the west side of the building is in poor condition and should be removed (see right). The Swiss Stone Pines on the property are in fair to poor condition, however removal or treatment is not warranted at this time.

Glenview Park Golf Club

There is a significant number of Pine and Spruce trees in the GPGC population. An effort was made to focus on preserving younger trees, high quality trees, or trees with higher location values and/or importance and functionality on the course of play. In all, a total of 73 Pine and Spruce trees were recommended for foliar fungus treatment and 54 are recommended for removal. The photos below illustrate some of the Pine and Spruce which we recommended for treatment.

Hawthorn Glen
The 4 Spruce or Pine trees at Hawthorn Glen are all in fair condition and have low location value and limited growing space. No treatments or removals are warranted at this time.

Indian Knoll
There are no Pine or Spruce trees at Indian Knoll.

Indian Trail
Seven Blue Spruce trees at Indian Knoll have been recommended for removal due to significant dieback. These removals are not high priority as these trees are not posing any risks, particularly those on the west side of the park. The white sap runs associated with Cytospora canker is widespread on the Blue Spruce trees at Indian Knoll and for this reason, fungicide treatment to control RNC is not recommended at this time. Through sanitation pruning of diseased branches during dry weather, proper soil drainage, and fertilization to improve vigor, Cytospora canker can be managed and GPD may opt to use fungicide to combat RNC once the canker is deemed under control.

Jackman

Jackman is a busy and well used park and almost all of its trees could be considered as high location value. Jackman has lost quite a few Austrian Pine trees in recent years, however 5 of the 7 remaining Austrian Pines (see left) are in good to fair condition and fungicide treatment to control DTB is recommended. The other 2 Austrian Pines are in poor condition and should be removed. Lastly, the 2 Blue Spruces at Jackman are showing signs of RNC and treatment is recommended. The White Pine and Norway Spruce trees at Jackman are in good to fair condition.

Jennings
At Jennings, a hedgerow of Austrian Pines stands along the railroad tracks fence line. Most of these trees have limited growing space and minor signs of DTB and/or ZPM. Treatment of this number of trees would be cost prohibitive due to the number of trees and logistically difficult due to the significant overcrowding and is therefore not recommended at this time, however three of these Pines are recommended for removal due to severely limited growing space. On the north side of the park, there are 5 Austrian Pine trees which form a screen for a residential neighbor. Two of these have significant dieback due to DTB and removal is recommended. The remaining 3 have minor signs of DTB and fungicidal treatment is recommended. Lastly, 2 higher location value Austrian Pines (see right) along the path on the east side of the basketball court are recommended for fungicide treatment to control DTB.

Johns

There are two good condition Austrian Pine trees (see left) at the southwest corner of the sand volleyball courts at Johns which have minor needle tip dieback. These trees are in good condition and have higher location value therefore foliar fungus treatment is recommended. In the northwest part of the park, two Austrian Pines have been recommended for removal due to severe dieback. Also, one Norway Spruce in this area, as well as two Austrian Pines on the east side of the sand volleyball courts, have girdling cables from stakes installed long ago and an attempt to remove these cables should be considered, otherwise tree removal may be necessary.

Ladendorf

Most of the Norway Spruce trees at Ladendorf are in good to fair condition and require no maintenance at this time. There are, however, three Norway Spruces with severe dieback that have already been marked for removal by GPD. The sole limited growspace Blue Spruce at Ladendorf has moderate signs of RNC and Cytospora canker and should be monitored and removed as deemed necessary.

Manor

Ten of the Norway Spruce trees at Manor have significant dieback and removal has been recommended. Three of these ten have already been marked for removal by GPD. The remaining Norway Spruce and White Pine trees are in good to fair condition.

Park & Facility Services East

At Park & Facility Services East, 3 young Spruce trees near the administration building are recommended for treatment to control RNC. On the west side of the park, a Norway Spruce tree with significant dieback should be removed. The remaining Pine and Spruce trees are in generally good to fair condition.

Prairie Club

Our recommendations for Pine/Spruce treatment at Prairie Club focused on the better condition trees with higher location values and visibility particularly those near the entrance driveway, those around the parking lot (see below left), and those screening the maintenance building from the golf course and from West Lake Ave. The trees recommended for treatment for foliar fungi included Austrian Pines, White Spruces, and Scotch Pines. A very small number of Austrian and Scotch Pines which exhibited yellow oozing associated with ZPM were also recommended for treatment for the pest. Four poor condition trees, 3 Austrian Pine and 1 Blue Spruce, were recommended for removal due to significant dieback. Two Austrian Pines (see below center) are north of the parking lot, the other is at the entrance driveway, and the memorial Blue Spruce (see below right) with extensive Cytospora canker is north of the practice green. There are a variety of good to fair condition conifers with lower location values on both the west and east sides of the course. It would be impractical to treat only some of these trees and cost prohibitive to treat all of them, therefore we recommend these be monitored regularly and removed and replaced if necessary.

Roosevelt

With the relatively large number of Pine and Spruce trees at Roosevelt, our recommendations were focused on protecting the better condition and higher location value trees and removing the underperforming, low-location value trees. That being said, Roosevelt is a busy, well-used park with many amenities and a significant number of trees would be considered as high location value. Two poor condition Spruces in the northwest part of the park, and 10 poor condition Pines and Spruces (see left) in the southern part of the park have been recommended for removal due to decline and/or limited growspace. The younger Austrian Pine in the southwest corner of the park has yellow sap oozing associated with ZPM and treatment for the pest is recommended. A good condition and higher location value Scotch Pine at the northwest corner of the pool has signs of DTB and ZPM and treatment for both is recommended. The 16 trees recommended for foliar fungus treatment at Roosevelt are a combination of Austrian Pine (see right), Scotch Pine, and White Spruce which have higher location value and are in good to fair condition.

Rugen

At Rugen, two recently planted Blue Spruce trees are showing moderate signs of RNC and treatment is recommended to control the foliar fungus. Also, three Austrian Pine trees shading a bench along the path in the southwest part of the park have higher location values and treatment to control DTB should be considered. One of these Pines has moderate signs of ZPM and treatment to control this pest is also encouraged.

Sleepy Hollow

The 5 White Pines and 1 Norway Spruce at Sleepy Hollow are generally in good condition. The Scotch Pine near the parking lot and the park building has signs of both DTB and ZPM and treatment for both has been recommended due to the higher location value of this tree.

Swenson

At Swenson, a natural screen of Pines, Spruces, and Douglas Firs has been planted around the skating rink. The Norway Spruce trees are generally in good condition. All of the Blue Spruce trees (see right) have signs of RNC and 11 of these have been recommended for treatment to control the foliar fungus in order to preserve the screen. Removal of 8 of the Blue Spruce trees around the rink has been recommended so as to relieve overcrowding and improve air flow. Fungicide treatment to control DTB has been recommended for 2 Austrian Pines and 1 Scotch Pine that also make up part of the natural screen. Lastly, the 3 high location value Austrian Pines (see left) near the park entrance on the north side of the rink should be treated for DTB and the northernmost of these trees should also be treated for ZPM due to the yellow sap oozing associated with this pest. The remaining Pine and Spruce trees have lower location values and/or limited growspace and treatment is not warranted at this time.

Tall Trees

Generally, the White Pine and Norway Spruce trees at Tall Trees are in good to fair condition. One White Spruce near the north side of the park should be removed due to severe dieback. One Austrian Pine, also on the north side, is recommended for foliar fungus treatment due to its higher location value next to the adjacent residential property.

Wagner Farm
There are no Pine or Spruce trees at Wagner Farm.

West Fork (renamed Thomas J. Richardson)
Along most of the south side of West Fork, there is a dense natural screen (see right) made up of a variety of conifers separating the well-used park path from the adjacent, upscale neighborhood. Most of the Blue Spruce, Austrian Pine, White Spruce, and Serbian Spruce among this hedgerow of trees have signs of foliar fungus. A small number of Spruce trees were recommended for removal to reduce overcrowding and improve air circulation. Most of the remaining conifers that are susceptible to foliar fungus were recommended for treatment due to the high value of this natural screen to the residential neighbors. In a dense Pine/Spruce stand such as this, not treating any of the trees could result in extensive tree mortality. Given the proximity of these trees to one another, it would be most efficient to treat the largest number that budgets allow. In addition to the hedgerow trees discussed above, 15 additional Spruce and Pine (see left) trees in high value or visibility locations throughout the rest of the park were also recommended for fungicide treatment.

Willow
On the west side of the tennis courts at Willow, there are 7 Austrian Pine trees which have minor to moderate signs of DTB. One of these also have minor sap oozing associated with ZPM. Due to their high location value and acceptable condition, these trees are recommended for fungicide treatment and the one with yellow oozing is also recommended for treatment to control ZPM. The mature Blue Spruce (see left) in the center of the traffic turn-around circle is recommended for removal due to advanced needle dieback, significant canker, and poor aesthetics. One of the Norway Spruce (see right) trees on the north side of the playground has been struck by lightning and has a severe trunk wound with significant dieback on that side of the tree and removal is recommended. The remaining Norway Spruce trees are in good to fair condition. Four of the Blue Spruce at Willow have been recommended for removal due to severely limited growing space and advanced dieback. The remaining Blue Spruces may require eventual removal due to overcrowding and limited growing space, particularly along the northern border.

Statistics by Recommendations, Species, and DBH Classifications

Of the 1,385, Spruce and Pine evaluated for this project, we have recommended chemical treatment for 325 trees, removal of 168 trees, and monitoring of 883 trees. Of the 325 trees in this treatment set, 15 were recommended for treatment of both DTB and ZPM, therefore the cost estimates that follow reflect the foliar fungicide treatment for 324 trees and ZPM treatment for 16 trees. We also identified 8 stumps, as well as 4 trees with girdling cables that, if possible, should be removed before treatment is considered. Since the most recent inventory update, 52 Pine and Spruce have been removed. Below are tables with itemized species breakdowns for each category:

Recommendation Statistics – Tree Counts by Species

Chemical Treatment Recommended	
Treat for Foliar Fungus	324
Treat for ZPM	16

Treat for Foliar Fungus	324
Austrian Pine (DTB)	169
Blue Spruce (RNC)	83
Spruce spp (RNC)	61
Scotch Pine (DTB)	11

Treat for ZPM	16
Austrian Pine	13
Scotch Pine	3

Monitoring Recommended	883
Norway Spruce	265
Austrian Pine	155
Spruce spp	151
Blue Spruce	105
White Pine	99
Scotch Pine	88
Pine spp	20

Removal Recommended	168
Austrian Pine	62
Blue Spruce	62
Spruce spp	20
Norway Spruce	16
Scotch Pine	8

Recommendation Statistics - Tree Counts by DBH Classifications

The tables below show tree counts for each treatment recommendation, as well as recommended removals, by DBH classifications. We will use these counts to develop management options that will be presented in later sections.

	Removals	Fungicide	ZPM
DBH 6" or less	24	85	2
DBH 7-12"	68	127	8
DBH 13-18"	55	96	4
DBH 19-24"	18	15	2
DBH 24-30"	3	1	0
TOTAL	**168**	**324**	**16**

Breakdown of Annual Costs

Removals

During this 2018 Pine and Spruce evaluation in GPD, we have recommended removal of 168 trees primarily due to significant decline associated with foliar fungal pathogens. A small number of trees were also recommended for removal due to overcrowding and severely limited growspace. It should be mentioned that we have not identified any of these declining trees as posing a risk, therefore the removals are not a high priority and can be budgeted over a longer time period, though those in areas of higher visibility may be prioritized over those in low traffic or remote areas. The vast majority of these recommended removals are under 18" DBH and many are under 35' tall, therefore in-house removal of a significant number of these trees could be an option. In the case that GPD may want to contract out these removals, we have included a chart below with a broad estimate of removal costs based on DBH. Lastly, replacement cost estimates for these removed trees will be discussed in the management options section below.

Total Estimated Removal Cost

Size	Count	Estimated Cost per Tree	Estimated Total Cost
DBH 6" or less	24	$150	$3,600
DBH 7-12"	68	$175	$11,900
DBH 13-18"	55	$200	$11,000
DBH 19-24"	18	$225	$4,050
DBH 24-30"	3	$250	$750
			$31,300

Treatments

The charts below illustrate broad annual cost estimates for the treatment recommendations discussed in the narratives section above. Of the 324 total trees in this treatment set, 15 Pines were recommended for treatment of both DTB and ZPM, therefore the annual cost estimates that follow reflect the foliar fungicide treatment for 324 trees and ZPM treatment for 16 trees. Keep in mind that these broad estimates are based on annual costs per tree with a bulk discount that a local contractor would likely grant to an entity such as GPD. Actual prices could vary among various contractor bids. Full tables of trees to be treated are located in the appendices of this report

Pricing Schedule

The below table represents the pricing structure we utilized for creating these estimates. These are annual cost estimates per tree, meaning they include three rounds on fungicide treatment and two rounds on insecticide treatment. As noted above, these prices will vary, but we believe these are competitive realistic rates based on our experience with Plant Health Care.

DBH	ZPM: $/Tree	Fungicide: $/Tree
<6"	$60.00	$85.00
7-12"	$75.00	$100.00
13-18"	$90.00	$115.00
19-24"	$105.00	$130.00
25-30"	$120.00	$150.00

Treatment Methodology Details

Diplodia Tip Blight and Rhizosphaera Needle Cast

Common Contact Fungicide Used: Chlorothanil
Average cost per tree annually: $115 (varies by DBH, see table above)

Treatment for the foliar fungal pathogens Diplodia Tip Blight (DTB) and Rhizosphaera Needle Cast (RNC) takes place as three separate, fungicide sprays in spring, each timed around 2 weeks apart. A drawback of foliar fungicide sprays is that the chemical is sprayed into the air and some level of spray drift is nearly unavoidable. Research of Chlorothanil has linked the chemical to a level of toxicity in both humans and animals, therefore care should be taken during application. Appropriate wind speed restrictions should be spelled out in the bid specifications, as well as marking of the area sprayed with pesticide flags when applicable.

For Pine trees affected with DTB, timely fungicide sprays occur 1) when the sheaths begin to fall off the new candles and the new needles are very soft, 2) a second spray within a 7 to 14 day window, and 3) the third and final round should be completed before the needles are fully elongated and begin to harden.

For Spruce trees affected with RNC, timely fungicide sprays will occur 1) when buds begin to elongate/swell 2) when the needles are half elongated, and 3) before the needles are fully elongated.

The timing for these applications is generally at the same time for both diseases, so they can generally be sprayed at the same time.

Zimmerman Pine Moth

Common Contact Insecticide Used: Permethrin
Average cost per tree annually: $ 90 (varies slightly by DBH, see table above)

Insecticide treatment for Pine trees infested with Zimmerman Pine Moth (ZPM) occurs as two timely insecticide sprays. A drawback of contact insecticide applied as a spray is that some level of spray drift is nearly unavoidable. Research of Permethrin shows very little to no toxicity in humans and animals. Once again, appropriate wind speed restrictions should be spelled out in the bid specifications, as well as marking of the area sprayed with pesticide flags when applicable.

In April, Zimmerman Pine Moth will appear as small larvae between and under the bark. At this time, they begin to emerge from the bark, and then bore into the trunk where they feed and pupate. At this time, the first round of spray should be applied which will prohibit a significant number of the larva from completing their life cycle. In August, as remaining ZPM emerges as adult beetles, they breed and lay eggs in a very short period of time and this is when the 2nd timely insecticide spray needs to be applied in order to control the number of adult beetles and to prevent hatched eggs from completing their life cycle.

Cytospora Canker
Since Cytospora Canker affects stressed trees, it is best managed through maintaining and improving vigor of susceptible trees and therefore reducing the risk of canker infection. Canker infection can be managed through sanitation pruning of affected branch material, preferably during the late winter. If pruning is necessary during the active growing season, it should occur during dry weather and pruning tools should be disinfected between cuts. There are no chemical treatments to control Cytospora Canker.

Management Plan Options

Using the broad annual cost estimates outlined above, we will now discuss management options that will break down costs of recommended removals and replacements, as well as 4 separate treatment set options. Tree removal/ replacement costs were based on the flat rates $185 per tree for removal and $250 per replacement tree, though these numbers could vary depending on a number of factors. The management plan options are based on a six year time frame, from 2019-2024, keeping in mind the likelihood that this plan will be dynamic and will evolve over its six year time frame. It is probable that trees will be added or removed from the treatment set or added to the list of recommended removals over the course of this plan as trees are re-evaluated. It should also be mentioned that the Pine and Spruce trees at both golf courses were included in these estimates, therefore costs would certainly be reduced if treatment does not occur on these properties. Please also note that the failure rates discussed below only apply to trees that were recommended for treatment during this evaluation. The remaining Pine and Spruce population will continue to be monitored and additional trees will be added to recommended removal lists if they decline.

Option 1: No Chemical Treatments

The Park District will not treat any of the Pine/Spruce and will spread the recommended removal list over a 6 year time frame (2019-2024). The estimates for this option include costs for a 1 for 1 replacement for each removed tree. We have also included a 40% failure rate on trees which could have been treated, but were not, and succumbed to insects or foliar fungus. This adds an additional 136 trees to the removal and replacement lists over the coming years.

Estimated cost to remove and replace 136 trees which succumb to diseases/pests	$59,160
Estimated cost to remove and replace all recommended trees	$73,080
Total Cost (6 Years)	**$132,240**
Annual Cost	**$22,040**

With no treatments and all of the 168 trees recommended for removal being removed and replaced, as well as additional 136 trees which are likely to die because of the fungal and insect issues, the annual cost would be $22,040 and the total cost over six years would be $132,240. Keep in mind this cost will likely increase by a reasonable percentage since other Pine and Spruce trees will decline and require removal and more than 40% of the recommended trees left untreated could die as well. The reality could be much worse than these numbers reflect.
Pros: Reduced cost, chance to diversify new tree plantings
Cons: Loss of large amounts of screening and tree canopy

Option 2: Annual Treatment of All Recommended Pine/Spruce Removal and Replacement of 168 Recommended Pine/Spruce Six Year Plan

The Park District will annually treat all of the Pine and Spruce recommended for treatment as a result of this assessment and the Park District will remove and replace all trees recommended for removal over a six year period which will provide the highest level of pathogen and pest control. The annual treatment costs are based on the pricing schedule illustrated above. A line item was added below to reflect the possibility of failed treatments affecting an estimated 15% of the treatment set. Annual estimated fungicide and insecticide treatment costs for all recommended trees is $34,355.

Estimated treatment cost for 340 trees for 1st two years	$68,710
Estimated removal and replacement cost of 50 failed treatment trees (if needed)	$21,750
Estimated cost to treat remaining 290 for 4 years	$117,210
Estimated cost to remove and replace all recommended trees	$73,080
Total Cost (6 Years)	**$280,750**
Annual Cost	**$46,791**

Pros: Retains the most trees and tree benefits, slows rate of removal
Cons: Cost is very high, diversity issues with pine and spruce remain

Option 3: Annual Treatment of All Recommended Pine/Spruce 12" DBH and under Removal and Replacement of 168 Recommended Pine/Spruce Six Year Plan

The Park District will annually treat all of the Pine and Spruce recommended for treatment as a result of this assessment which have a DBH of 12" or less and the Park District will remove and replace all trees recommended for removal over a six year period which will provide a high level of pathogen and pest control for the younger Pine and Spruce population. The annual treatment costs are based on the pricing schedule illustrated above. A line item was added below to reflect the possibility of failed treatments affecting 15% of the treatment set. It is also estimated that 40% of the untreated trees could also die during this period, and require removal and replacement. Annual estimated fungicide and insecticide treatment costs for all recommended trees 12" DBH and under is $20,645.

Estimated treatment cost for 222 trees for 1st two years	$41,290
Estimated removal and replacement cost of 33 failed treatment trees (if needed)	$14,410
Estimated cost to treat remaining 189 trees for 4 years	$82,580
Estimated cost to remove and replace all recommended trees	$73,080
Cost to remove and replace 40% of untreated large trees (50 trees)	$21,750
Total Cost (6 Years)	**$233,110**
Annual Cost	**$38,852**

Pros: Treating trees with the greatest chance of long term survival, slightly lower cost
Cons: Still represents significant loss of mature tree canopy

Option 4: Biennial Treatment of All Recommended Pine/Spruce
Removal and Replacement of 168 Recommended Pine/Spruce
Six Year Plan – 3 Treatments Cycles for Each Recommended Tree

The Park District will alternately treat 50% of the Pine and Spruce recommended for treatment as a result of this assessment every year, resulting in all trees being treated every other year. With a mid-summer re-evaluation of the Pine and Spruce population an important part of this management plan, we believe that a biennial treatment option is a viable one. These trees can then be re-assessed annually without the investment in annual treatment. Also, the Park District will remove and replace all trees recommended for removal over a six year period. The annual treatment costs are based on the pricing schedule illustrated above. A line item was added below to reflect the possibility of failed treatments affecting 25% of the treatment set. Keep in mind that annual vs biennial treatment options may not necessarily increase the failure rate by 10%, however it will likely decrease treatment effectiveness and result in less attractive trees. Biennial estimated fungicide and insecticide treatment costs for all recommended trees is $17,180 per year.

Estimated cost to treat all 340 trees over a 2 year time period	$34,360
Estimated removal and replacement cost of 85 failed treatment trees (if needed)	$36,975
Estimated cost to treat remaining 255 trees for 4 years	$51,000
Estimated cost to remove and replace all recommended trees	$73,080
Total Cost (6 Years)	**$195,415**
Annual Cost	**$32,569**

Pros: Less environmental impact through an effort to control pests and pathogens, lower overall cost
Cons: Financial risk must be assumed, Treatments could fail particularly on larger trees, Less control over pests and pathogens due to less frequent treatments.

Option 5: Biennial Treatment of All Recommended Pine/Spruce 12” DBH and under
Removal and Replacement of 168 Recommended Pine/Spruce
Six Year Plan – 3 Treatments Cycles for Each Recommended Tree

The Park District will alternately treat 50% of the Pine and Spruce having a DBH of 12” or less and recommended for treatment as a result of this assessment every year, resulting in all trees 12” DBH or less being treated every other year. With a mid-summer re-evaluation of the Pine and Spruce population an important part of this management plan, we believe that a biennial treatment option is a viable one. These trees can then be re-assessed annually without the investment in annual treatment. Also, the Park District will remove and replace all trees recommended for removal over a six year period. The annual treatment costs are based on the pricing schedule illustrated above. A line item was added below to reflect the possibility of failed treatments affecting 25% of the treatment set. Keep in mind that annual vs biennial treatment options may not necessarily increase the failure rate by 10%, however it will likely decrease treatment effectiveness and result in less attractive trees. Biennial estimated fungicide and insecticide treatment costs for all recommended trees 12” DBH and less is $10,325 per year.

Estimated cost to treat 222 trees 12" and under over a 2 year time period	$20,650
Estimated removal and replacement cost of 55 failed treatment trees (if needed)	$23,925
Estimated cost to treat remaining 167 trees for 4 years	$33,400
Estimated cost to remove and replace all recommended trees	$73,080
Cost to remove and replace 40% of untreated large trees (50 trees)	$21,750
Total Cost (6 Years)	**$172,805**
Annual Cost	**$28,800**

Pros: Less environmental impact through an effort to control pests and pathogens in younger trees with a significant amount of useful life remaining, Lowest cost treatment option
Cons: Financial risk must be assumed, Treatments could fail, Less control over pests and pathogens due to less frequent treatments.

Treatment Options Summary:

	Annual Cost	Total Cost	Risk	Failure: Treated	Failure: Untreated
Option 1: No Treatments	$22,040.00	$132,240.00	Low	NA	40%
Option 2: Treat Reccommended All Trees	$46,791.00	$280,750.00	High	15%	NA
Option 3: Trees 12" and Below	$38,852.00	$233,110.00	Med	15%	40%
Option 4: All Rec Trees / Biennial	$32,569.00	$195,415.00	Med	25%	NA
Option 5: Rec Trees 12' and below / Biennial	$28,800.00	$172,805.00	Med	25%	40%

Recommended Option:

We would strongly recommend either Option 3 or Option 5. These allow for treatment of the younger, healthier trees which will serve the district for the longest time period. We should also mention here that though treatments can likely stop for a time, there is always the possibility of reinfection from surrounding Pine and Spruce trees. Though all options are viable for the park district, depending on what it's needs are, these represent the lowest risk and highest reward.

Summary

Foliar fungal pathogens have been a widespread problem in our region in recent years and Spruce and Pine decline can be observed in many local municipalities and park district tree populations, so GPD is not alone in its battle. As mentioned earlier in the report, the severity of foliar fungal problems among Pine and Spruce can vary greatly depending on weather conditions. We have created the options of this 6 year management plan with the current circumstances in mind, however future weather conditions and impending climate change could significantly alter the presence and severity of DTB and RNC in future years. There may be years when spring treatment is not deemed necessary after a mid-summer re-evaluation and there also could be years when a biennial treatment plan is not enough to keep the pathogens under control. Therefore, we reiterate that this 6 year management plan will be dynamic and will likely evolve with the environmental conditions and circumstances that our region will experience in coming years. Annual evaluations should also include monitoring for less common secondary pests and pathogens.

Conclusion

We encourage GPD to consider some sort of a treatment program to ensure preservation of some of its better condition and higher location value Spruce and Pine trees. If GPD opts to not implement a treatment program, it is recommended that the Pine and Spruce population be monitored on a regular interval and poor condition trees be removed as they decline and become a center of infection, as well as aesthetically displeasing. Going forward, we encourage GPD to choose conifer species which are more resistant to foliar fungi, for example Douglas-fir, Norway Spruce, Concolor Fir, Limber Pine, White Pine, Juniper, or Arborvitae. Matching a tree species environmental requirements and tolerances to its planting site will help the tree to establish more quickly and be more vigorous which will decrease tree stress over the long term, and therefore reduce susceptibility to fungal pathogens. We also encourage planting trees with adequate growing space for their mature size so that air circulation between trees in not impeded and that moist conditions, which are ideal for fungi, are not prevalent. As always, we have been pleased to assist GPD in this Spruce and Pine tree evaluation and we look forward to assisting GPD in the future with its Arboricultural, GIS, and Natural Resources needs.

i-Tree Ecosystem Analysis

GPD_iTree_Eco

Urban Forest Effects and Values

February 2020

Summary

Understanding an urban forest's structure, function and value can promote management decisions that will improve human health and environmental quality. An assessment of the vegetation structure, function, and value of the GPD_iTree_Eco urban forest was conducted during 2019. Data from 9601 trees located throughout GPD_iTree_Eco were analyzed using the i-Tree Eco model developed by the U.S. Forest Service, Northern Research Station.

- Number of trees: 9,601
- Tree Cover: 74.03 acres
- Most common species of trees: Honeylocust, apple spp, Bur oak
- Percentage of trees less than 6" (15.2 cm) diameter: 42.3%
- Pollution Removal: 1.696 tons/year ($22.3 thousand/year)
- Carbon Storage: 2.971 thousand tons ($507 thousand)
- Carbon Sequestration: 57.63 tons ($9.83 thousand/year)
- Oxygen Production: 153.7 tons/year
- Avoided Runoff: 159.6 thousand cubic feet/year ($10.7 thousand/year)
- Building energy savings: N/A – data not collected
- Avoided carbon emissions: N/A – data not collected
- Structural values: $9.44 million

Ton: short ton (U.S.) (2,000 lbs)
Monetary values $ are reported in US Dollars throughout the report except where noted.
Ecosystem service estimates are reported for trees.

For an overview of i-Tree Eco methodology, see Appendix I. Data collection quality is determined by the local data collectors, over which i-Tree has no control.

Table of Contents

I. Tree Characteristics of the Urban Forest

The urban forest of GPD_iTree_Eco has 9,601 trees with a tree cover of Honeylocust. The three most common species are Honeylocust (7.8 percent), apple spp (7.1 percent), and Bur oak (5.4 percent).

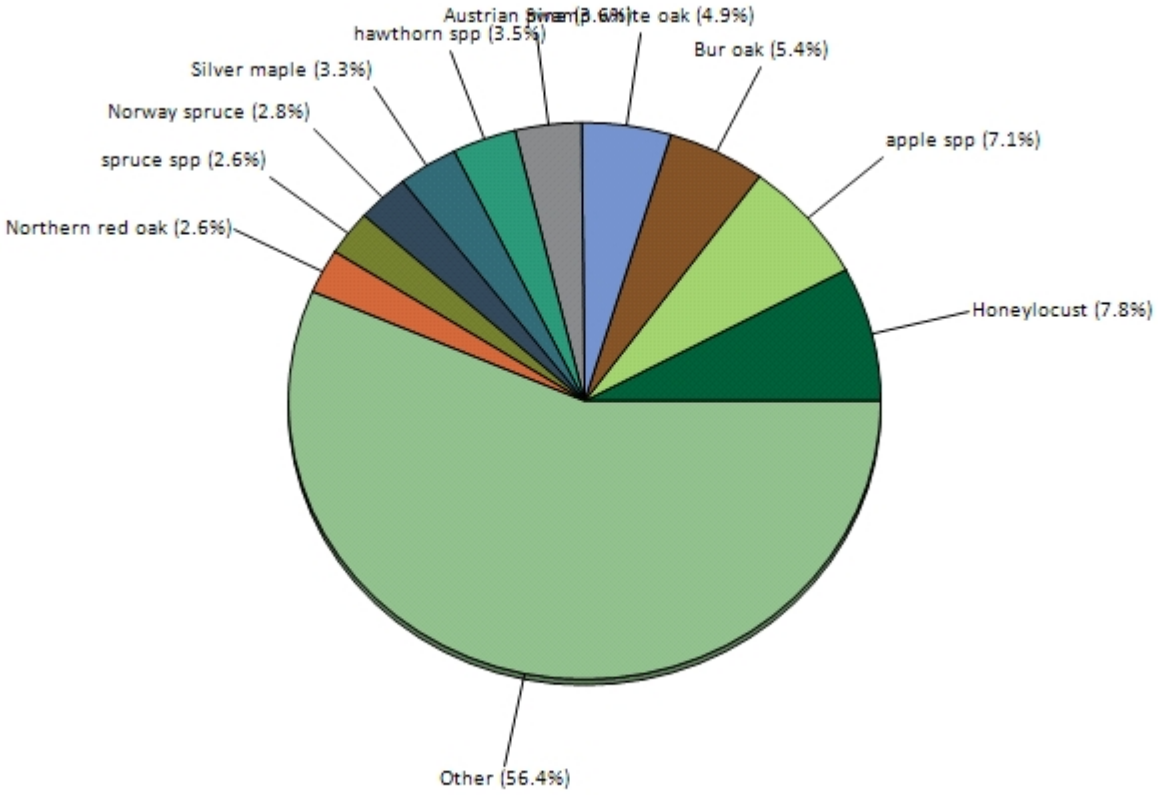


Figure 1. Tree species composition in GPD_iTree_Eco

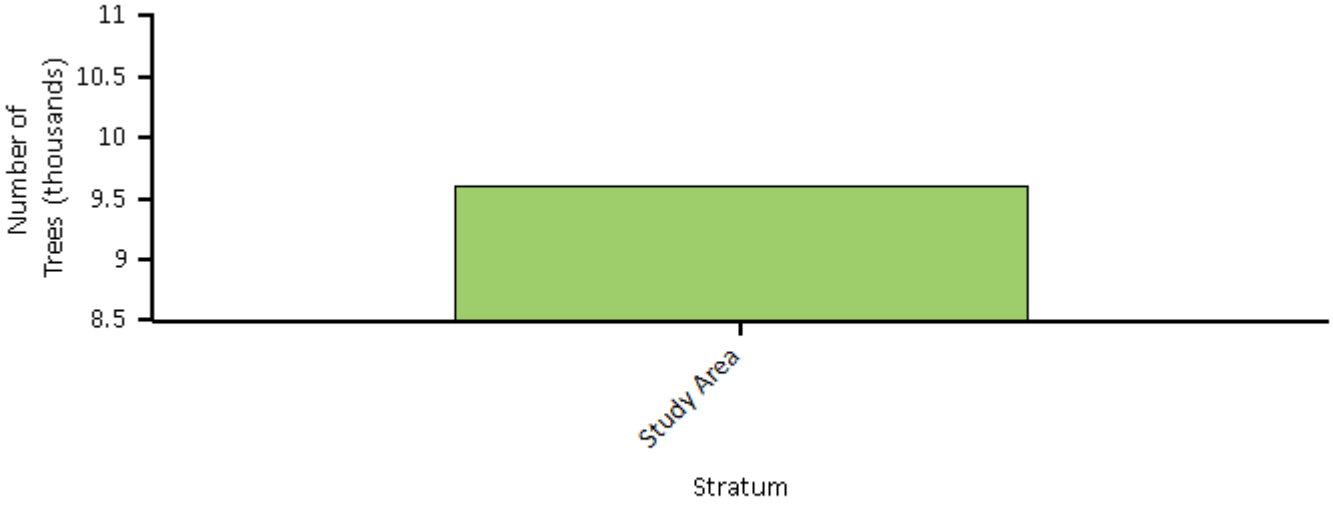


Figure 2. Number of trees in GPD_iTree_Eco by stratum

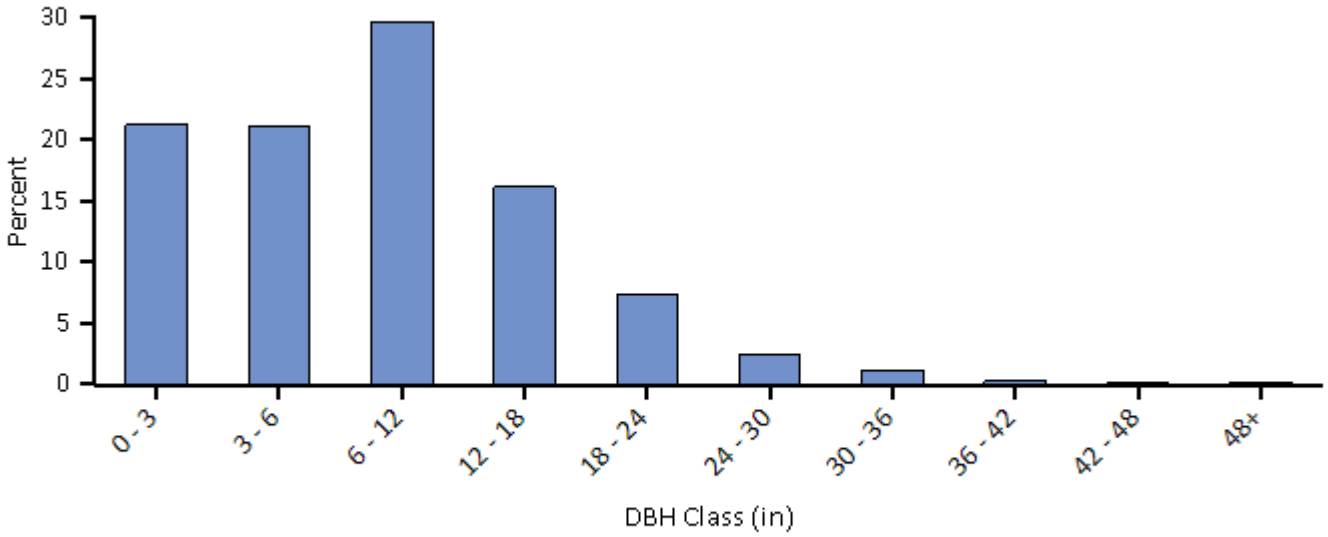


Figure 3. Percent of tree population by diameter class (DBH - stem diameter at 4.5 feet)

Urban forests are composed of a mix of native and exotic tree species. Thus, urban forests often have a tree diversity that is higher than surrounding native landscapes. Increased tree diversity can minimize the overall impact or destruction by a species-specific insect or disease, but it can also pose a risk to native plants if some of the exotic species are invasive plants that can potentially out-compete and displace native species. In GPD_iTree_Eco, about 64 percent of the trees are species native to North America, while 57 percent are native to Illinois. Species exotic to North America make up 36 percent of the population. Most exotic tree species have an origin from North America + (15 percent of the species).

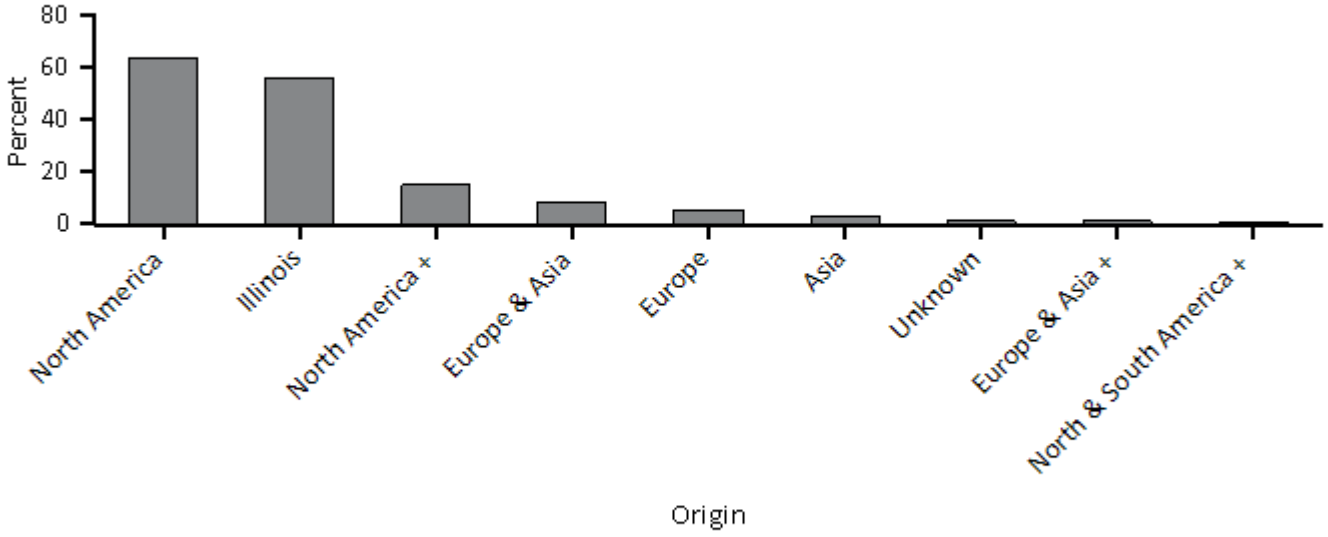


Figure 4. Percent of live tree population by area of native origin, GPD_iTree_Eco

The plus sign (+) indicates the tree species is native to another continent other than the ones listed in the grouping.

Invasive plant species are often characterized by their vigor, ability to adapt, reproductive capacity, and general lack of natural enemies. These abilities enable them to displace native plants and make them a threat to natural areas. Seven of the 111 tree species in GPD_iTree_Eco are identified as invasive on the state invasive species list (Center for Invasive Species and Ecosystem Health 2009). These invasive species comprise 4.5 percent of the tree population though they may only cause a minimal level of impact. The three most common invasive species are Norway maple (2.5 percent of population), Callery pear (0.7 percent), and Amur maple (0.6 percent) (see Appendix V for a complete list of invasive species).

II. Urban Forest Cover and Leaf Area

Many tree benefits equate directly to the amount of healthy leaf surface area of the plant. Trees cover about 74.03 acres of GPD_iTree_Eco and provide 322.6 acres of leaf area.

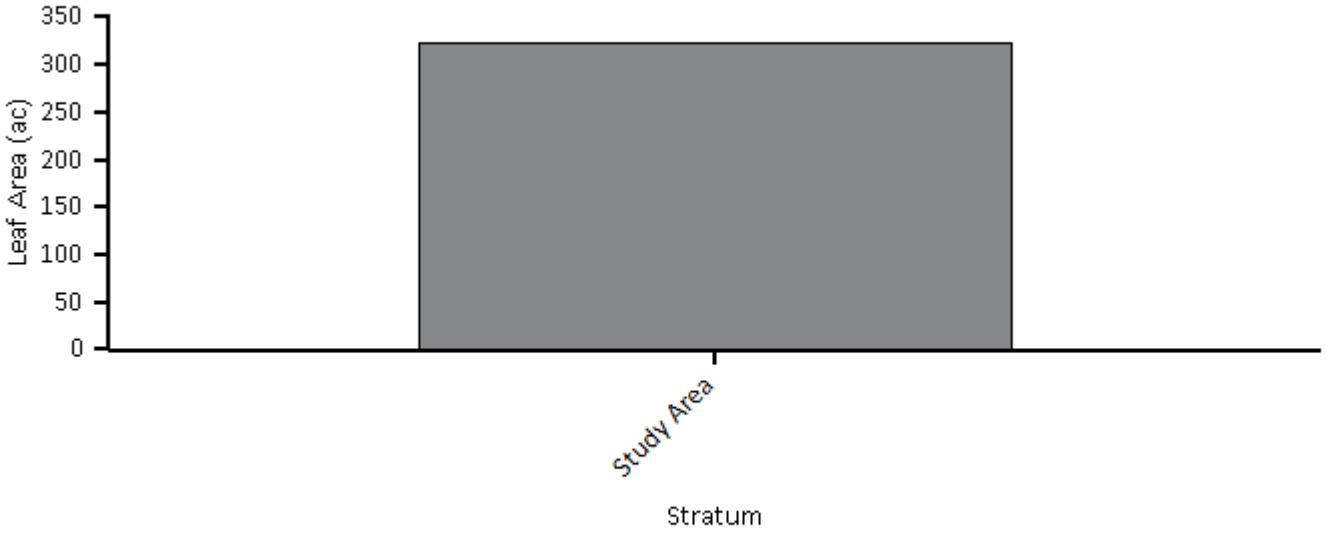


Figure 5. Leaf area by stratum, GPD_iTree_Eco

In GPD_iTree_Eco, the most dominant species in terms of leaf area are Eastern cottonwood, Honeylocust, and Silver maple. The 10 species with the greatest importance values are listed in Table 1. Importance values (IV) are calculated as the sum of percent population and percent leaf area. High importance values do not mean that these trees should necessarily be encouraged in the future; rather these species currently dominate the urban forest structure.

Table 1. Most important species in GPD_iTree_Eco

Species Name	*Percent Population*	*Percent Leaf Area*	*IV*
Honeylocust	7.8	7.5	15.3
apple spp	7.1	4.1	11.2
Eastern cottonwood	2.3	7.9	10.2
Silver maple	3.3	6.8	10.1
Norway maple	2.5	5.5	8.0
Bur oak	5.4	2.2	7.6
Norway spruce	2.8	4.7	7.5
Swamp white oak	4.9	2.2	7.1
Austrian pine	3.6	3.3	7.0
Littleleaf linden	2.4	3.3	5.7

Common ground cover classes (including cover types beneath trees and shrubs) in GPD_iTree_Eco are not available since they are configured not to be collected.

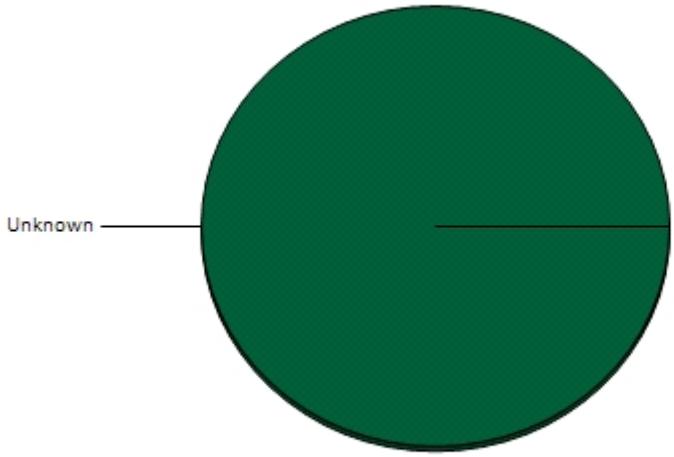


Figure 6. Percent of land by ground cover classes, GPD_iTree_Eco

III. Air Pollution Removal by Urban Trees

Poor air quality is a common problem in many urban areas. It can lead to decreased human health, damage to landscape materials and ecosystem processes, and reduced visibility. The urban forest can help improve air quality by reducing air temperature, directly removing pollutants from the air, and reducing energy consumption in buildings, which consequently reduces air pollutant emissions from the power sources. Trees also emit volatile organic compounds that can contribute to ozone formation. However, integrative studies have revealed that an increase in tree cover leads to reduced ozone formation (Nowak and Dwyer 2000).

Pollution removal[1] by trees in GPD_iTree_Eco was estimated using field data and recent available pollution and weather data available. Pollution removal was greatest for ozone (Figure 7). It is estimated that trees remove 1.696 tons of air pollution (ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), particulate matter less than 2.5 microns (PM2.5)[2], and sulfur dioxide (SO2)) per year with an associated value of $22.3 thousand (see Appendix I for more details).

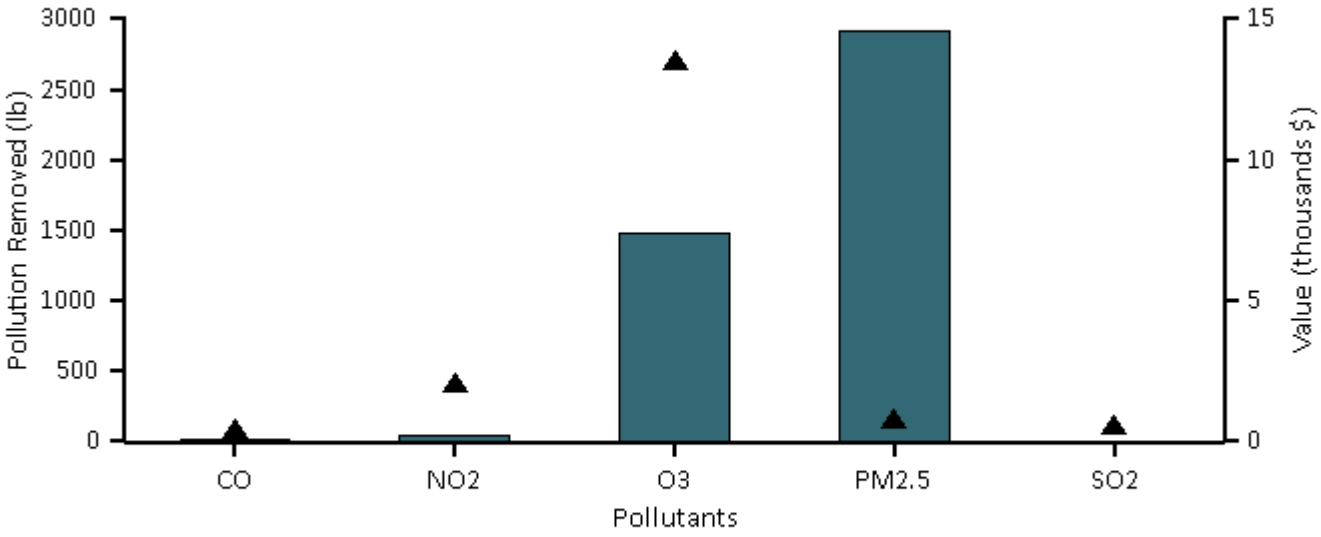


Figure 7. Annual pollution removal (points) and value (bars) by urban trees, GPD_iTree_Eco

[1] Particulate matter less than 10 microns is a significant air pollutant. Given that i-Tree Eco analyzes particulate matter less than 2.5 microns (PM2.5) which is a subset of PM10, PM10 has not been included in this analysis. PM2.5 is generally more relevant in discussions concerning air pollution effects on human health.

[2] Trees remove PM2.5 when particulate matter is deposited on leaf surfaces. This deposited PM2.5 can be resuspended to the atmosphere or removed during rain events and dissolved or transferred to the soil. This combination of events can lead to positive or negative pollution removal and value depending on various atmospheric factors (see Appendix I for more details).

In 2019, trees in GPD_iTree_Eco emitted an estimated 1.138 tons of volatile organic compounds (VOCs) (0.7896 tons of isoprene and 0.3485 tons of monoterpenes). Emissions vary among species based on species characteristics (e.g. some genera such as oaks are high isoprene emitters) and amount of leaf biomass. Thirty- seven percent of the urban forest's VOC emissions were from Eastern cottonwood and Norway spruce. These VOCs are precursor chemicals to ozone formation.[3]

General recommendations for improving air quality with trees are given in Appendix VIII.

[3] Some economic studies have estimated VOC emission costs. These costs are not included here as there is a tendency to add positive dollar estimates of ozone removal effects with negative dollar values of VOC emission effects to determine whether tree effects are positive or negative in relation to ozone. This combining of dollar values to determine tree effects should not be done, rather estimates of VOC effects on ozone formation (e.g., via photochemical models) should be conducted and directly contrasted with ozone removal by trees (i.e., ozone effects should be directly compared, not dollar estimates). In addition, air temperature reductions by trees have been shown to significantly reduce ozone concentrations (Cardelino and Chameides 1990; Nowak et al 2000), but are not considered in this analysis. Photochemical modeling that integrates tree effects on air temperature, pollution removal, VOC emissions, and emissions from power plants can be used to determine the overall effect of trees on ozone concentrations.

IV. Carbon Storage and Sequestration

Climate change is an issue of global concern. Urban trees can help mitigate climate change by sequestering atmospheric carbon (from carbon dioxide) in tissue and by altering energy use in buildings, and consequently altering carbon dioxide emissions from fossil-fuel based power sources (Abdollahi et al 2000).

Trees reduce the amount of carbon in the atmosphere by sequestering carbon in new growth every year. The amount of carbon annually sequestered is increased with the size and health of the trees. The gross sequestration of GPD_iTree_Eco trees is about 57.63 tons of carbon per year with an associated value of $9.83 thousand. See Appendix I for more details on methods.

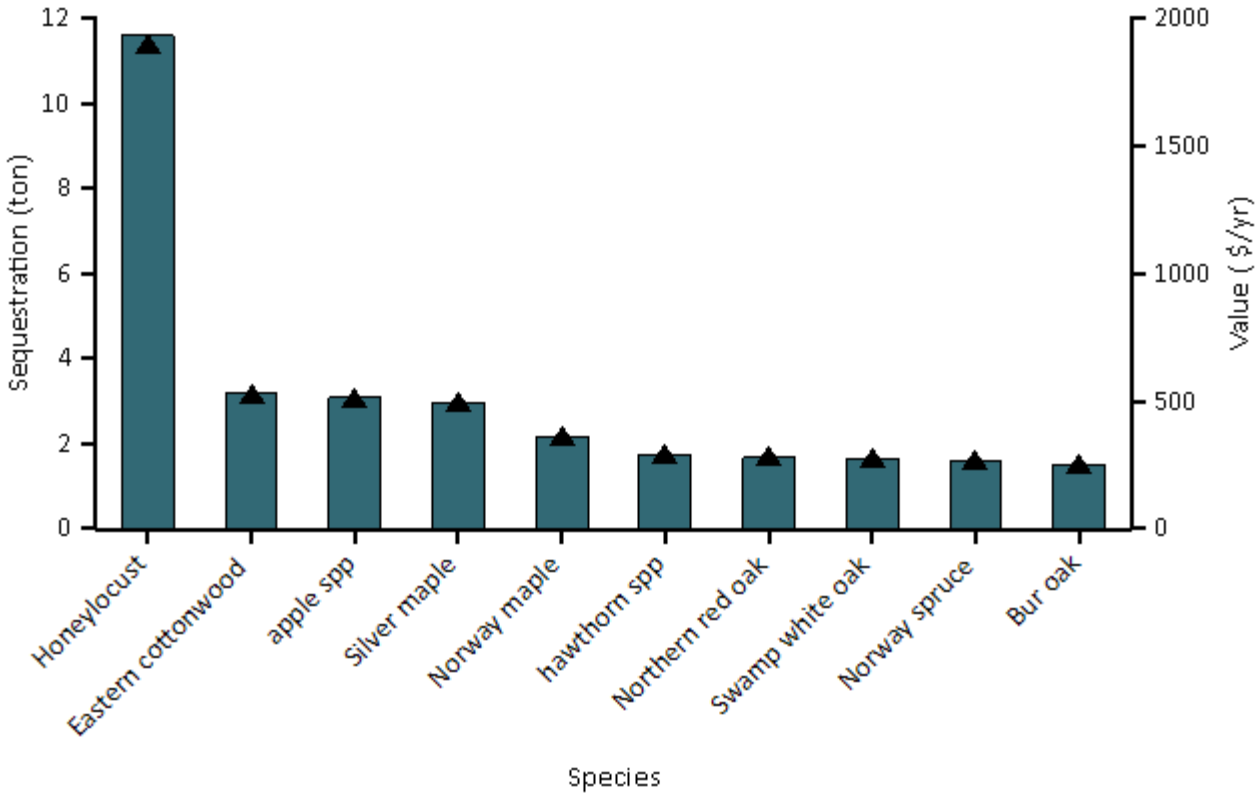


Figure 8. Estimated annual gross carbon sequestration (points) and value (bars) for urban tree species with the greatest sequestration, GPD_iTree_Eco

Carbon storage is another way trees can influence global climate change. As a tree grows, it stores more carbon by holding it in its accumulated tissue. As a tree dies and decays, it releases much of the stored carbon back into the atmosphere. Thus, carbon storage is an indication of the amount of carbon that can be released if trees are allowed to die and decompose. Maintaining healthy trees will keep the carbon stored in trees, but tree maintenance can contribute to carbon emissions (Nowak et al 2002c). When a tree dies, using the wood in long-term wood products, to heat buildings, or to produce energy will help reduce carbon emissions from wood decomposition or from fossil-fuel or wood-based power plants.

Trees in GPD_iTree_Eco are estimated to store 2970 tons of carbon ($507 thousand). Of the species sampled, Honeylocust stores and sequesters the most carbon (approximately 22.7% of the total carbon stored and 19.7% of all sequestered carbon.)

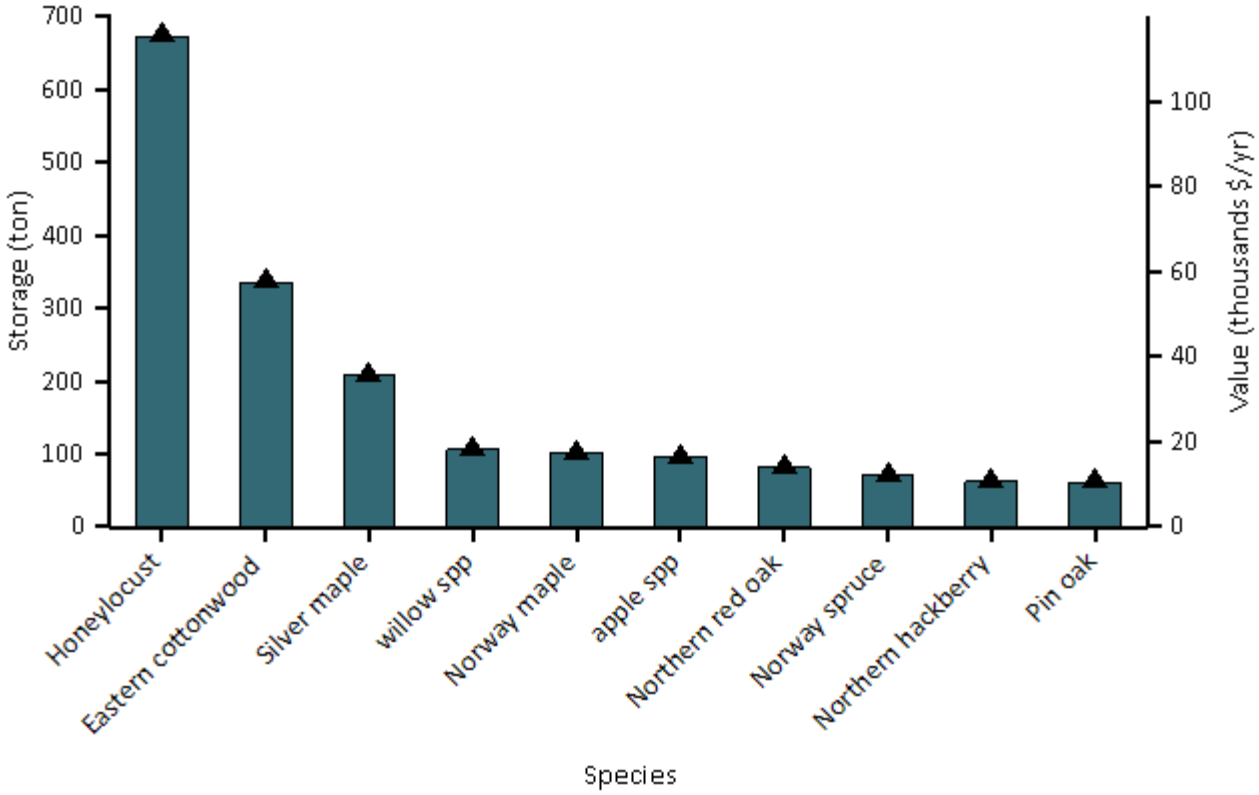


Figure 9. Estimated carbon storage (points) and values (bars) for urban tree species with the greatest storage, GPD_iTree_Eco

V. Oxygen Production

Oxygen production is one of the most commonly cited benefits of urban trees. The annual oxygen production of a tree is directly related to the amount of carbon sequestered by the tree, which is tied to the accumulation of tree biomass.

Trees in GPD_iTree_Eco are estimated to produce 153.7 tons of oxygen per year.[4] However, this tree benefit is relatively insignificant because of the large and relatively stable amount of oxygen in the atmosphere and extensive production by aquatic systems. Our atmosphere has an enormous reserve of oxygen. If all fossil fuel reserves, all trees, and all organic matter in soils were burned, atmospheric oxygen would only drop a few percent (Broecker 1970).

Table 2. The top 20 oxygen production species.

Species	*Oxygen (ton)*	*Gross Carbon Sequestration (ton/yr)*	*Number of Trees*	*Leaf Area (acre)*
Honeylocust	30.24	11.34	750	24.21
Eastern cottonwood	8.28	3.11	222	25.41
apple spp	8.04	3.01	685	13.19
Silver maple	7.73	2.90	314	21.93
Norway maple	5.68	2.13	241	17.62
hawthorn spp	4.55	1.71	335	3.87
Northern red oak	4.36	1.64	248	7.85
Swamp white oak	4.31	1.62	467	7.16
Norway spruce	4.16	1.56	272	15.10
Bur oak	3.94	1.48	514	7.12
Northern hackberry	3.42	1.28	173	7.21
River birch	3.39	1.27	133	5.96
Austrian pine	3.34	1.25	348	10.76
Littleleaf linden	3.21	1.21	228	10.80
Sugar maple	2.91	1.09	156	6.94
willow spp	2.74	1.03	61	4.10
Black walnut	2.56	0.96	106	9.02
Pin oak	2.55	0.95	41	3.11
Kentucky coffeetree	2.39	0.89	194	5.46
Blue spruce	2.30	0.86	231	5.74

VI. Avoided Runoff

Surface runoff can be a cause for concern in many urban areas as it can contribute pollution to streams, wetlands, rivers, lakes, and oceans. During precipitation events, some portion of the precipitation is intercepted by vegetation (trees and shrubs) while the other portion reaches the ground. The portion of the precipitation that reaches the ground and does not infiltrate into the soil becomes surface runoff (Hirabayashi 2012). In urban areas, the large extent of impervious surfaces increases the amount of surface runoff.

Urban trees and shrubs, however, are beneficial in reducing surface runoff. Trees and shrubs intercept precipitation, while their root systems promote infiltration and storage in the soil. The trees and shrubs of GPD_iTree_Eco help to reduce runoff by an estimated 160 thousand cubic feet a year with an associated value of $11 thousand (see Appendix I for more details). Avoided runoff is estimated based on local weather from the user-designated weather station. In GPD_iTree_Eco, the total annual precipitation in 2015 was 34.6 inches.

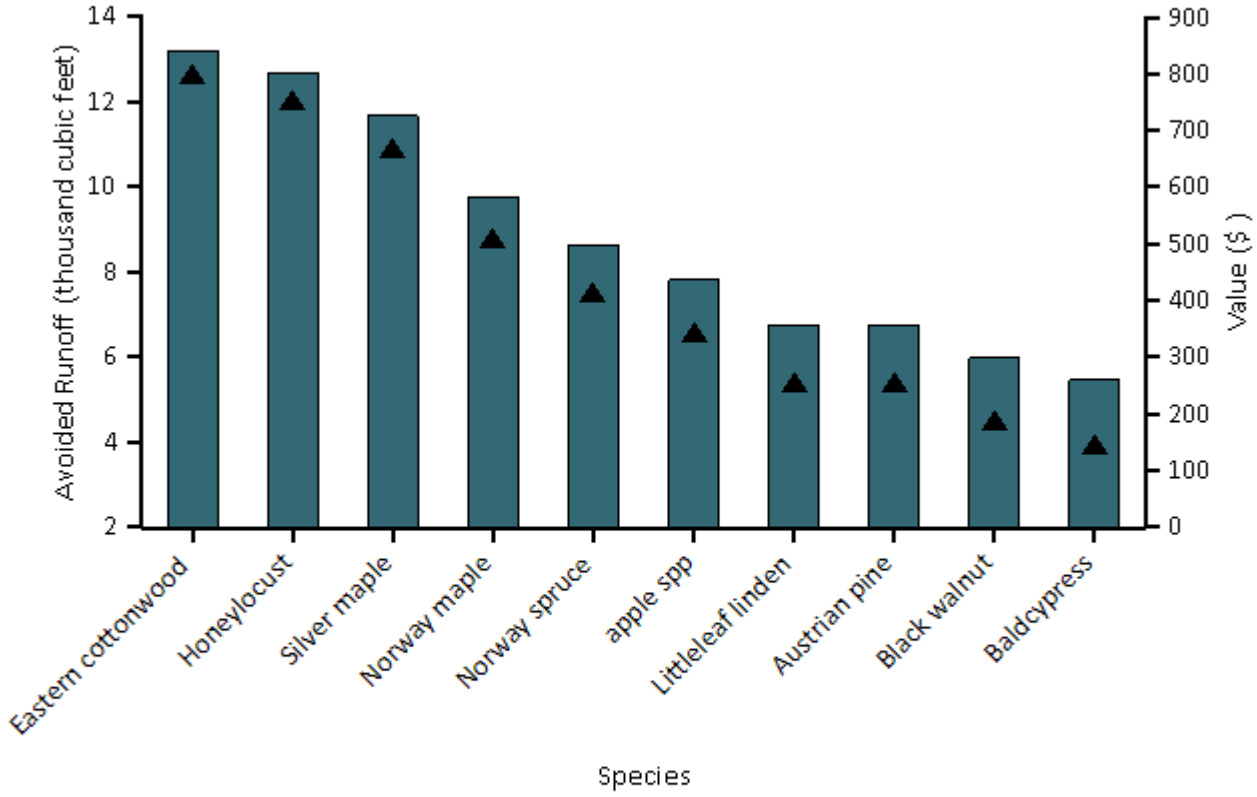


Figure 10. Avoided runoff (points) and value (bars) for species with greatest overall impact on runoff, GPD_iTree_Eco

VII. Trees and Building Energy Use

Trees affect energy consumption by shading buildings, providing evaporative cooling, and blocking winter winds. Trees tend to reduce building energy consumption in the summer months and can either increase or decrease building energy use in the winter months, depending on the location of trees around the building. Estimates of tree effects on energy use are based on field measurements of tree distance and direction to space conditioned residential buildings (McPherson and Simpson 1999).

Because energy-related data were not collected, energy savings and carbon avoided cannot be calculated.

Table 3. Annual energy savings due to trees near residential buildings, GPD_iTree_Eco

	Heating	*Cooling*	*Total*
MBTU[a]	0	N/A	0
MWH[b]	0	0	0
Carbon Avoided (pounds)	0	0	0

[a]MBTU - one million British Thermal Units

[b]MWH - megawatt-hour

Table 4. Annual savings [a]($) in residential energy expenditure during heating and cooling seasons, GPD_iTree_Eco

	Heating	*Cooling*	*Total*
MBTU[b]	0	N/A	0
MWH[c]	0	0	0
Carbon Avoided	0	0	0

[b]Based on the prices of $114.866666666667 per MWH and $12.6129344675397 per MBTU (see Appendix I for more details)

[c]MBTU - one million British Thermal Units

[c]MWH - megawatt-hour

[5] Trees modify climate, produce shade, and reduce wind speeds. Increased energy use or costs are likely due to these tree-building interactions creating a cooling effect during the winter season. For example, a tree (particularly evergreen species) located on the southern side of a residential building may produce a shading effect that causes increases in heating requirements.

VIII. Structural and Functional Values

Urban forests have a structural value based on the trees themselves (e.g., the cost of having to replace a tree with a similar tree); they also have functional values (either positive or negative) based on the functions the trees perform.

The structural value of an urban forest tends to increase with a rise in the number and size of healthy trees (Nowak et al 2002a). Annual functional values also tend to increase with increased number and size of healthy trees. Through proper management, urban forest values can be increased; however, the values and benefits also can decrease as the amount of healthy tree cover declines.

Urban trees in GPD_iTree_Eco have the following structural values:

- Structural value: $9.44 million
- Carbon storage: $507 thousand

Urban trees in GPD_iTree_Eco have the following annual functional values:

- Carbon sequestration: $9.83 thousand
- Avoided runoff: $10.7 thousand
- Pollution removal: $22.3 thousand
- Energy costs and carbon emission values: $0

(Note: negative value indicates increased energy cost and carbon emission value)

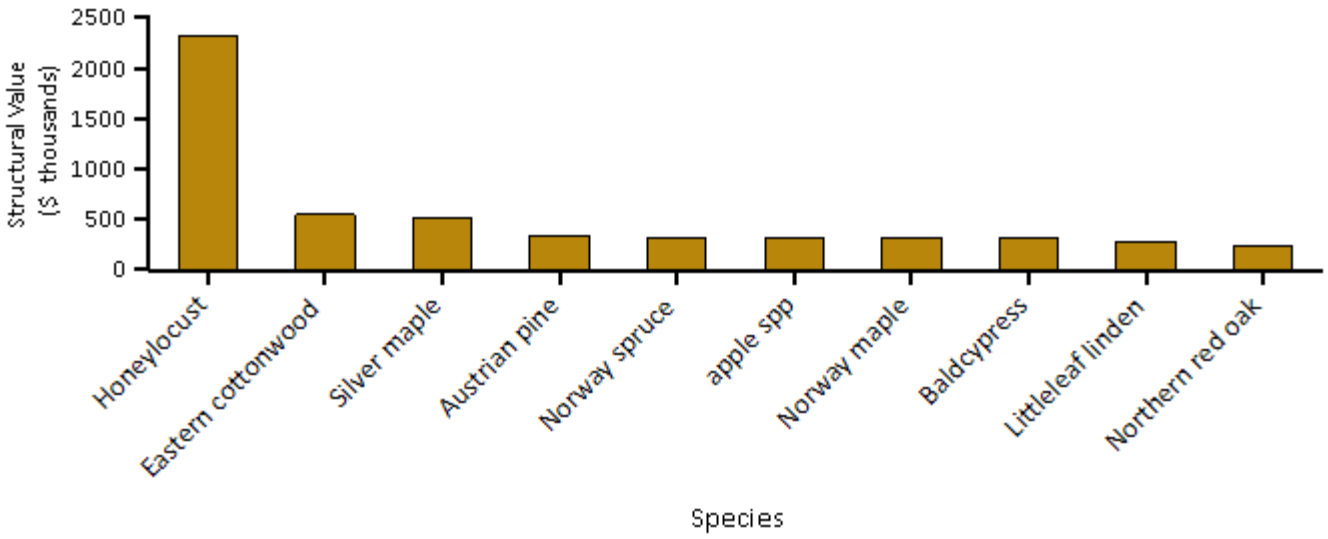


Figure 11. Tree species with the greatest structural value, GPD_iTree_Eco

IX. Potential Pest Impacts

Various insects and diseases can infest urban forests, potentially killing trees and reducing the health, structural value and sustainability of the urban forest. As pests tend to have differing tree hosts, the potential damage or risk of each pest will differ among cities.Thirty-six pests were analyzed for their potential impact and compared with pest range maps (Forest Health Technology Enterprise Team 2014) for the conterminous United States to determine their proximity to Cook County. Eight of the thirty-six pests analyzed are located within the county. For a complete analysis of all pests, see Appendix VII.

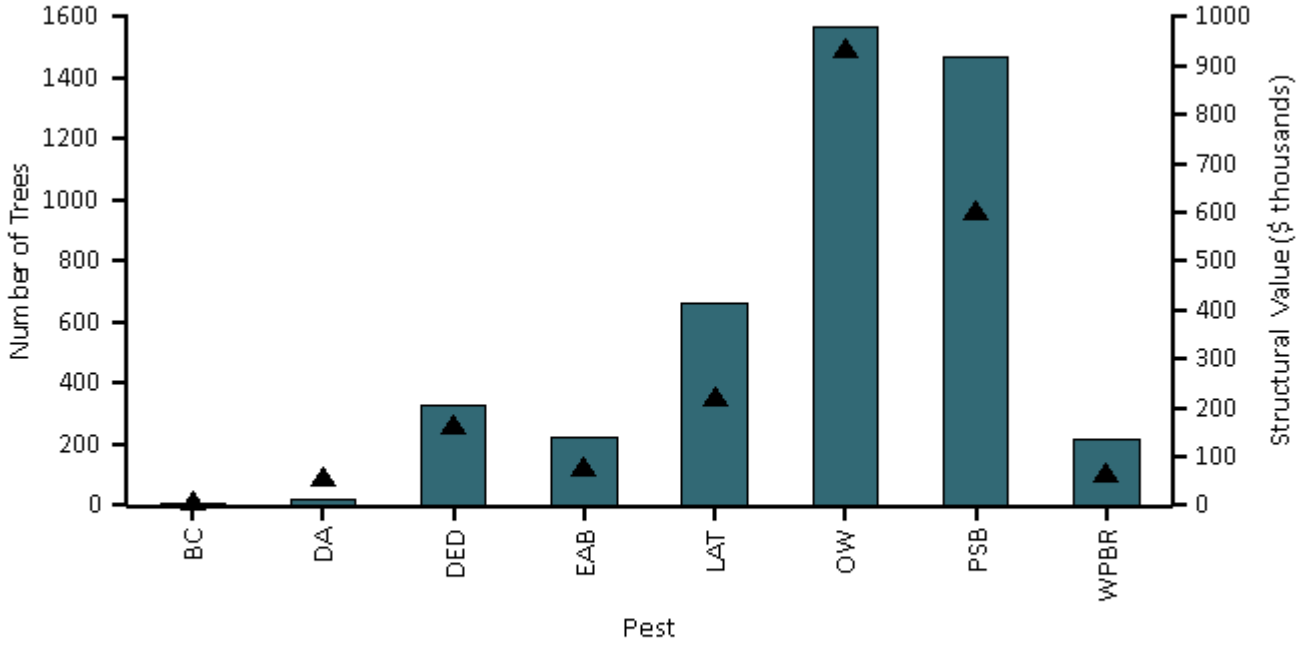


Figure 12. Number of trees at risk (points) and associated compensatory value (bars) for most threatening pests located in the county, GPD_iTree_Eco

Butternut canker (BC) (Ostry et al 1996) is caused by a fungus that infects butternut trees. The disease has since caused significant declines in butternut populations in the United States. Potential loss of trees from BC is 0.1 percent ($2.58 thousand in structural value).

Dogwood anthracnose (DA) (Mielke and Daughtrey) is a disease that affects dogwood species, specifically flowering and Pacific dogwood. This disease threatens 0.9 percent of the population, which represents a potential loss of $12 thousand in structural value.

American elm, one of the most important street trees in the twentieth century, has been devastated by the Dutch elm disease (DED) (Northeastern Area State and Private Forestry 1998). Since first reported in the 1930s, it has killed over 50 percent of the native elm population in the United States. Although some elm species have shown varying degrees of resistance, GPD_iTree_Eco could possibly lose 2.6 percent of its trees to this pest ($205 thousand in structural value).

Emerald ash borer (EAB) (Michigan State University 2010) has killed thousands of ash trees in parts of the United States. EAB has the potential to affect 1.2 percent of the population ($139 thousand in structural value).

Quaking aspen is a principal host for the defoliator, large aspen tortrix (LAT) (Ciesla and Kruse 2009). LAT poses a threat to 3.6 percent of the GPD_iTree_Eco urban forest, which represents a potential loss of $415 thousand in structural value.

Oak wilt (OW) (Rexrode and Brown 1983), which is caused by a fungus, is a prominent disease among oak trees. OW poses a threat to 15.5 percent of the GPD_iTree_Eco urban forest, which represents a potential loss of $977 thousand in structural value.

The pine shoot beetle (PSB) (Ciesla 2001) is a wood borer that attacks various pine species, though Scotch pine is the preferred host in North America. PSB has the potential to affect 10.0 percent of the population ($920 thousand in structural value).

Since its introduction to the United States in 1900, white pine blister rust (Eastern U.S.) (WPBR) (Nicholls and Anderson 1977) has had a detrimental effect on white pines, particularly in the Lake States. WPBR has the potential to affect 1.0 percent of the population ($137 thousand in structural value).

Appendix I. i-Tree Eco Model and Field Measurements

i-Tree Eco is designed to use standardized field data and local hourly air pollution and meteorological data to quantify urban forest structure and its numerous effects (Nowak and Crane 2000), including:

- Urban forest structure (e.g., species composition, tree health, leaf area, etc.).
- Amount of pollution removed hourly by the urban forest, and its associated percent air quality improvement throughout a year.
- Total carbon stored and net carbon annually sequestered by the urban forest.
- Effects of trees on building energy use and consequent effects on carbon dioxide emissions from power sources.
- Structural value of the forest, as well as the value for air pollution removal and carbon storage and sequestration.
- Potential impact of infestations by pests, such as Asian longhorned beetle, emerald ash borer, gypsy moth, and Dutch elm disease.

Typically, all field data are collected during the leaf-on season to properly assess tree canopies. Typical data collection (actual data collection may vary depending upon the user) includes land use, ground and tree cover, individual tree attributes of species, stem diameter, height, crown width, crown canopy missing and dieback, and distance and direction to residential buildings (Nowak et al 2005; Nowak et al 2008).

During data collection, trees are identified to the most specific taxonomic classification possible. Trees that are not classified to the species level may be classified by genus (e.g., ash) or species groups (e.g., hardwood). In this report, tree species, genera, or species groups are collectively referred to as tree species.

Tree Characteristics:

Leaf area of trees was assessed using measurements of crown dimensions and percentage of crown canopy missing. In the event that these data variables were not collected, they are estimated by the model.

An analysis of invasive species is not available for studies outside of the United States. For the U.S., invasive species are identified using an invasive species list (Center for Invasive Species and Ecosystem Health 2009)for the state in which the urban forest is located. These lists are not exhaustive and they cover invasive species of varying degrees of invasiveness and distribution. In instances where a state did not have an invasive species list, a list was created based on the lists of the adjacent states. Tree species that are identified as invasive by the state invasive species list are cross-referenced with native range data. This helps eliminate species that are on the state invasive species list, but are native to the study area.

Air Pollution Removal:

Pollution removal is calculated for ozone, sulfur dioxide, nitrogen dioxide, carbon monoxide and particulate matter less than 2.5 microns. Particulate matter less than 10 microns (PM10) is another significant air pollutant. Given that i-Tree Eco analyzes particulate matter less than 2.5 microns (PM2.5) which is a subset of PM10, PM10 has not been included in this analysis. PM2.5 is generally more relevant in discussions concerning air pollution effects on human health.

Air pollution removal estimates are derived from calculated hourly tree-canopy resistances for ozone, and sulfur and nitrogen dioxides based on a hybrid of big-leaf and multi-layer canopy deposition models (Baldocchi 1988; Baldocchi et al 1987). As the removal of carbon monoxide and particulate matter by vegetation is not directly related to transpiration, removal rates (deposition velocities) for these pollutants were based on average measured values from the literature (Bidwell and Fraser 1972; Lovett 1994) that were adjusted depending on leaf phenology and leaf area.

Particulate removal incorporated a 50 percent resuspension rate of particles back to the atmosphere (Zinke 1967). Recent updates (2011) to air quality modeling are based on improved leaf area index simulations, weather and pollution processing and interpolation, and updated pollutant monetary values (Hirabayashi et al 2011; Hirabayashi et al 2012; Hirabayashi 2011).

Trees remove PM2.5 when particulate matter is deposited on leaf surfaces (Nowak et al 2013). This deposited PM2.5 can be resuspended to the atmosphere or removed during rain events and dissolved or transferred to the soil. This combination of events can lead to positive or negative pollution removal and value depending on various atmospheric factors. Generally, PM2.5 removal is positive with positive benefits. However, there are some cases when net removal is negative or resuspended particles lead to increased pollution concentrations and negative values. During some months (e.g., with no rain), trees resuspend more particles than they remove. Resuspension can also lead to increased overall PM2.5 concentrations if the boundary layer conditions are lower during net resuspension periods than during net removal periods. Since the pollution removal value is based on the change in pollution concentration, it is possible to have situations when trees remove PM2.5 but increase concentrations and thus have negative values during periods of positive overall removal. These events are not common, but can happen.

For reports in the United States, default air pollution removal value is calculated based on local incidence of adverse health effects and national median externality costs. The number of adverse health effects and associated economic value is calculated for ozone, sulfur dioxide, nitrogen dioxide, and particulate matter less than 2.5 microns using data from the U.S. Environmental Protection Agency's Environmental Benefits Mapping and Analysis Program (BenMAP) (Nowak et al 2014). The model uses a damage-function approach that is based on the local change in pollution concentration and population. National median externality costs were used to calculate the value of carbon monoxide removal (Murray et al 1994).

For international reports, user-defined local pollution values are used. For international reports that do not have local values, estimates are based on either European median externality values (van Essen et al 2011) or BenMAP regression equations (Nowak et al 2014) that incorporate user-defined population estimates. Values are then converted to local currency with user-defined exchange rates.

For this analysis, pollution removal value is calculated based on the prices of $1,380 per ton (carbon monoxide), $5,509 per ton (ozone), $1,088 per ton (nitrogen dioxide), $341 per ton (sulfur dioxide), $208,629 per ton (particulate matter less than 2.5 microns).

Carbon Storage and Sequestration:

Carbon storage is the amount of carbon bound up in the above-ground and below-ground parts of woody vegetation. To calculate current carbon storage, biomass for each tree was calculated using equations from the literature and measured tree data. Open-grown, maintained trees tend to have less biomass than predicted by forest-derived biomass equations (Nowak 1994). To adjust for this difference, biomass results for open-grown urban trees were multiplied by 0.8. No adjustment was made for trees found in natural stand conditions. Tree dry-weight biomass was converted to stored carbon by multiplying by 0.5.

Carbon sequestration is the removal of carbon dioxide from the air by plants. To estimate the gross amount of carbon sequestered annually, average diameter growth from the appropriate genera and diameter class and tree condition was added to the existing tree diameter (year x) to estimate tree diameter and carbon storage in year x+1.

Carbon storage and carbon sequestration values are based on estimated or customized local carbon values. For international reports that do not have local values, estimates are based on the carbon value for the United States (U.S. Environmental Protection Agency 2015, Interagency Working Group on Social Cost of Carbon 2015) and converted to local currency with user-defined exchange rates.

For this analysis, carbon storage and carbon sequestration values are calculated based on $171 per ton.

Oxygen Production:

The amount of oxygen produced is estimated from carbon sequestration based on atomic weights: net O2 release (kg/yr) = net C sequestration (kg/yr) × 32/12. To estimate the net carbon sequestration rate, the amount of carbon sequestered as a result of tree growth is reduced by the amount lost resulting from tree mortality. Thus, net carbon sequestration and net annual oxygen production of the urban forest account for decomposition (Nowak et al 2007). For complete inventory projects, oxygen production is estimated from gross carbon sequestration and does not account for decomposition.

Avoided Runoff:

Annual avoided surface runoff is calculated based on rainfall interception by vegetation, specifically the difference between annual runoff with and without vegetation. Although tree leaves, branches, and bark may intercept precipitation and thus mitigate surface runoff, only the precipitation intercepted by leaves is accounted for in this analysis.

The value of avoided runoff is based on estimated or user-defined local values. For international reports that do not have local values, the national average value for the United States is utilized and converted to local currency with user-defined exchange rates. The U.S. value of avoided runoff is based on the U.S. Forest Service's Community Tree Guide Series (McPherson et al 1999; 2000; 2001; 2002; 2003; 2004; 2006a; 2006b; 2006c; 2007; 2010; Peper et al 2009; 2010; Vargas et al 2007a; 2007b; 2008).

For this analysis, avoided runoff value is calculated based on the price of $0.07 per ft^3.

Building Energy Use:

If appropriate field data were collected, seasonal effects of trees on residential building energy use were calculated based on procedures described in the literature (McPherson and Simpson 1999) using distance and direction of trees from residential structures, tree height and tree condition data. To calculate the monetary value of energy savings, local or custom prices per MWH or MBTU are utilized.

For this analysis, energy saving value is calculated based on the prices of $114.87 per MWH and $12.61 per MBTU.

Structural Values:

Structural value is the value of a tree based on the physical resource itself (e.g., the cost of having to replace a tree with a similar tree). Structural values were based on valuation procedures of the Council of Tree and Landscape Appraisers, which uses tree species, diameter, condition, and location information (Nowak et al 2002a; 2002b). Structural value may not be included for international projects if there is insufficient local data to complete the valuation procedures.

Potential Pest Impacts:

The complete potential pest risk analysis is not available for studies outside of the United States. The number of trees at risk to the pests analyzed is reported, though the list of pests is based on known insects and disease in the United States.

For the U.S., potential pest risk is based on pest range maps and the known pest host species that are likely to

experience mortality. Pest range maps for 2012 from the Forest Health Technology Enterprise Team (FHTET) (Forest Health Technology Enterprise Team 2014) were used to determine the proximity of each pest to the county in which the urban forest is located. For the county, it was established whether the insect/disease occurs within the county, is within 250 miles of the county edge, is between 250 and 750 miles away, or is greater than 750 miles away. FHTET did not have pest range maps for Dutch elm disease and chestnut blight. The range of these pests was based on known occurrence and the host range, respectively (Eastern Forest Environmental Threat Assessment Center; Worrall 2007).

Relative Tree Effects:

The relative value of tree benefits reported in Appendix II is calculated to show what carbon storage and sequestration, and air pollutant removal equate to in amounts of municipal carbon emissions, passenger automobile emissions, and house emissions.

Municipal carbon emissions are based on 2010 U.S. per capita carbon emissions (Carbon Dioxide Information Analysis Center 2010). Per capita emissions were multiplied by city population to estimate total city carbon emissions.

Light duty vehicle emission rates (g/mi) for CO, NOx, VOCs, PM10, SO2 for 2010 (Bureau of Transportation Statistics 2010; Heirigs et al 2004), PM2.5 for 2011-2015 (California Air Resources Board 2013), and CO2 for 2011 (U.S. Environmental Protection Agency 2010) were multiplied by average miles driven per vehicle in 2011 (Federal Highway Administration 2013) to determine average emissions per vehicle.

Household emissions are based on average electricity kWh usage, natural gas Btu usage, fuel oil Btu usage, kerosene Btu usage, LPG Btu usage, and wood Btu usage per household in 2009 (Energy Information Administration 2013; Energy Information Administration 2014)

- CO2, SO2, and NOx power plant emission per KWh are from Leonardo Academy 2011. CO emission per kWh assumes 1/3 of one percent of C emissions is CO based on Energy Information Administration 1994. PM10 emission per kWh from Layton 2004.
- CO2, NOx, SO2, and CO emission per Btu for natural gas, propane and butane (average used to represent LPG), Fuel #4 and #6 (average used to represent fuel oil and kerosene) from Leonardo Academy 2011.
- CO2 emissions per Btu of wood from Energy Information Administration 2014.
- CO, NOx and SOx emission per Btu based on total emissions and wood burning (tons) from (British Columbia Ministry 2005; Georgia Forestry Commission 2009).

Appendix II. Relative Tree Effects

The urban forest in GPD_iTree_Eco provides benefits that include carbon storage and sequestration, and air pollutant removal. To estimate the relative value of these benefits, tree benefits were compared to estimates of average municipal carbon emissions, average passenger automobile emissions, and average household emissions. See Appendix I for methodology.

Carbon storage is equivalent to:

- Amount of carbon emitted in GPD_iTree_Eco in 5 days
- Annual carbon (C) emissions from 2,100 automobiles
- Annual C emissions from 862 single-family houses

Carbon monoxide removal is equivalent to:

- Annual carbon monoxide emissions from 0 automobiles
- Annual carbon monoxide emissions from 1 single-family houses

Nitrogen dioxide removal is equivalent to:

- Annual nitrogen dioxide emissions from 28 automobiles
- Annual nitrogen dioxide emissions from 13 single-family houses

Sulfur dioxide removal is equivalent to:

- Annual sulfur dioxide emissions from 543 automobiles
- Annual sulfur dioxide emissions from 1 single-family houses

Annual carbon sequestration is equivalent to:

- Amount of carbon emitted in GPD_iTree_Eco in 0.1 days
- Annual C emissions from 0 automobiles
- Annual C emissions from 0 single-family houses

Appendix III. Comparison of Urban Forests

A common question asked is, "How does this city compare to other cities?" Although comparison among cities should be made with caution as there are many attributes of a city that affect urban forest structure and functions, summary data are provided from other cities analyzed using the i-Tree Eco model.

I. City totals for trees

City	*% Tree Cover*	*Number of Trees*	*Carbon Storage (tons)*	*Carbon Sequestration (tons/yr)*	*Pollution Removal (tons/yr)*
Toronto, ON, Canada	26.6	10,220,000	1,221,000	51,500	2,099
Atlanta, GA	36.7	9,415,000	1,344,000	46,400	1,663
Los Angeles, CA	11.1	5,993,000	1,269,000	77,000	1,975
New York, NY	20.9	5,212,000	1,350,000	42,300	1,676
London, ON, Canada	24.7	4,376,000	396,000	13,700	408
Chicago, IL	17.2	3,585,000	716,000	25,200	888
Baltimore, MD	21.0	2,479,000	570,000	18,400	430
Philadelphia, PA	15.7	2,113,000	530,000	16,100	575
Washington, DC	28.6	1,928,000	525,000	16,200	418
Oakville, ON , Canada	29.1	1,908,000	147,000	6,600	190
Boston, MA	22.3	1,183,000	319,000	10,500	283
Syracuse, NY	26.9	1,088,000	183,000	5,900	109
Woodbridge, NJ	29.5	986,000	160,000	5,600	210
Minneapolis, MN	26.4	979,000	250,000	8,900	305
San Francisco, CA	11.9	668,000	194,000	5,100	141
Morgantown, WV	35.5	658,000	93,000	2,900	72
Moorestown, NJ	28.0	583,000	117,000	3,800	118
Hartford, CT	25.9	568,000	143,000	4,300	58
Jersey City, NJ	11.5	136,000	21,000	890	41
Casper, WY	8.9	123,000	37,000	1,200	37
Freehold, NJ	34.4	48,000	20,000	540	22

II. Totals per acre of land area

City	*Number of Trees/ac*	*Carbon Storage (tons/ac)*	*Carbon Sequestration (tons/ac/yr)*	*Pollution Removal (lb/ac/yr)*
Toronto, ON, Canada	64.9	7.8	0.33	26.7
Atlanta, GA	111.6	15.9	0.55	39.4
Los Angeles, CA	19.6	4.2	0.16	13.1
New York, NY	26.4	6.8	0.21	17.0
London, ON, Canada	75.1	6.8	0.24	14.0
Chicago, IL	24.2	4.8	0.17	12.0
Baltimore, MD	48.0	11.1	0.36	16.6
Philadelphia, PA	25.1	6.3	0.19	13.6
Washington, DC	49.0	13.3	0.41	21.2
Oakville, ON , Canada	78.1	6.0	0.27	11.0
Boston, MA	33.5	9.1	0.30	16.1
Syracuse, NY	67.7	10.3	0.34	13.6
Woodbridge, NJ	66.5	10.8	0.38	28.4
Minneapolis, MN	26.2	6.7	0.24	16.3
San Francisco, CA	22.5	6.6	0.17	9.5
Morgantown, WV	119.2	16.8	0.52	26.0
Moorestown, NJ	62.1	12.4	0.40	25.1
Hartford, CT	50.4	12.7	0.38	10.2
Jersey City, NJ	14.4	2.2	0.09	8.6
Casper, WY	9.1	2.8	0.09	5.5
Freehold, NJ	38.3	16.0	0.44	35.3

Appendix IV. General Recommendations for Air Quality Improvement

Urban vegetation can directly and indirectly affect local and regional air quality by altering the urban atmosphere environment. Four main ways that urban trees affect air quality are (Nowak 1995):

- Temperature reduction and other microclimate effects
- Removal of air pollutants
- Emission of volatile organic compounds (VOC) and tree maintenance emissions
- Energy effects on buildings

The cumulative and interactive effects of trees on climate, pollution removal, and VOC and power plant emissions determine the impact of trees on air pollution. Cumulative studies involving urban tree impacts on ozone have revealed that increased urban canopy cover, particularly with low VOC emitting species, leads to reduced ozone concentrations in cities (Nowak 2000). Local urban management decisions also can help improve air quality.

Urban forest management strategies to help improve air quality include (Nowak 2000):

Strategy	*Result*
Increase the number of healthy trees	Increase pollution removal
Sustain existing tree cover	Maintain pollution removal levels
Maximize use of low VOC-emitting trees	Reduces ozone and carbon monoxide formation
Sustain large, healthy trees	Large trees have greatest per-tree effects
Use long-lived trees	Reduce long-term pollutant emissions from planting and removal
Use low maintenance trees	Reduce pollutants emissions from maintenance activities
Reduce fossil fuel use in maintaining vegetation	Reduce pollutant emissions
Plant trees in energy conserving locations	Reduce pollutant emissions from power plants
Plant trees to shade parked cars	Reduce vehicular VOC emissions
Supply ample water to vegetation	Enhance pollution removal and temperature reduction
Plant trees in polluted or heavily populated areas	Maximizes tree air quality benefits
Avoid pollutant-sensitive species	Improve tree health
Utilize evergreen trees for particulate matter	Year-round removal of particles

Appendix V. Invasive Species of the Urban Forest

The following inventoried tree species were listed as invasive on the Illinois invasive species list (Center for Invasive Species and Ecosystem Health 2009):

Species Name[a]	*Number of Trees*	*% of Trees*	*Leaf Area (ac)*	*Percent Leaf Area*
Norway maple	241	2.5	17.6	5.5
Callery pear	71	0.7	1.4	0.4
Amur maple	58	0.6	4.0	1.2
Siberian elm	53	0.6	4.4	1.4
Black locust	5	0.1	0.2	0.1
European buckthorn	4	0.0	0.0	0.0
White poplar	1	0.0	0.1	0.0
Total	**433**	**4.51**	**27.67**	**8.58**

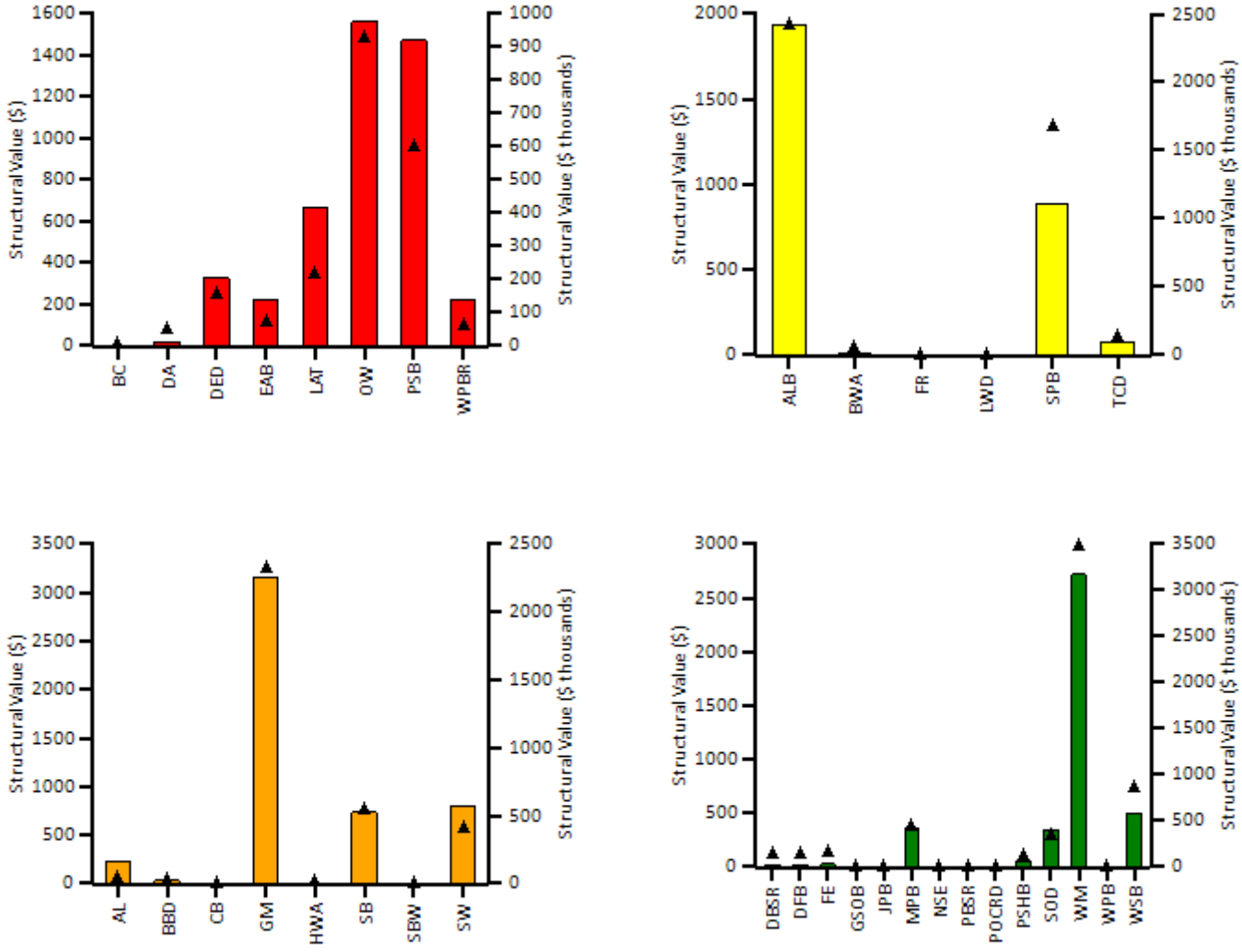
[a]Species are determined to be invasive if they are listed on the state's invasive species list

Appendix VI. Potential Risk of Pests

Thirty-six insects and diseases were analyzed to quantify their potential impact on the urban forest. As each insect/ disease is likely to attack different host tree species, the implications for {0} will vary. The number of trees at risk reflects only the known host species that are likely to experience mortality.

Code	Scientific Name	Common Name	Trees at Risk (#)	Value ($ thousands)
AL	Phyllocnistis populiella	Aspen Leafminer	61	156.26
ALB	Anoplophora glabripennis	Asian Longhorned Beetle	1,934	2,418.08
BBD	Neonectria faginata	Beech Bark Disease	41	22.54
BC	Sirococcus clavigignenti juglandacearum	Butternut Canker	5	2.58
BWA	Adelges piceae	Balsam Woolly Adelgid	47	15.83
CB	Cryphonectria parasitica	Chestnut Blight	0	0.00
DA	Discula destructiva	Dogwood Anthracnose	82	11.98
DBSR	Leptographium wageneri var. pseudotsugae	Douglas-fir Black Stain Root Disease	112	21.49
DED	Ophiostoma novo-ulmi	Dutch Elm Disease	253	205.35
DFB	Dendroctonus pseudotsugae	Douglas-Fir Beetle	112	21.49
EAB	Agrilus planipennis	Emerald Ash Borer	116	139.20
FE	Scolytus ventralis	Fir Engraver	133	32.30
FR	Cronartium quercuum f. sp. Fusiforme	Fusiform Rust	0	0.00
GM	Lymantria dispar	Gypsy Moth	3,247	2,254.70
GSOB	Agrilus auroguttatus	Goldspotted Oak Borer	0	0.00
HWA	Adelges tsugae	Hemlock Woolly Adelgid	20	2.57
JPB	Dendroctonus jeffreyi	Jeffrey Pine Beetle	0	0.00
LAT	Choristoneura conflictana	Large Aspen Tortrix	347	415.25
LWD	Raffaelea lauricola	Laurel Wilt	0	0.00
MPB	Dendroctonus ponderosae	Mountain Pine Beetle	374	412.42
NSE	Ips perturbatus	Northern Spruce Engraver	0	0.00
OW	Ceratocystis fagacearum	Oak Wilt	1,488	977.48
PBSR	Leptographium wageneri var. ponderosum	Pine Black Stain Root Disease	0	0.00
POCRD	Phytophthora lateralis	Port-Orford-Cedar Root Disease	0	0.00
PSB	Tomicus piniperda	Pine Shoot Beetle	957	919.86
PSHB	Euwallacea nov. sp.	Polyphagous Shot Hole Borer	96	61.81
SB	Dendroctonus rufipennis	Spruce Beetle	753	526.39
SBW	Choristoneura fumiferana	Spruce Budworm	0	0.00
SOD	Phytophthora ramorum	Sudden Oak Death	289	400.86
SPB	Dendroctonus frontalis	Southern Pine Beetle	1,337	1,102.47
SW	Sirex noctilio	Sirex Wood Wasp	564	573.51
TCD	Geosmithia morbida	Thousand Canker Disease	106	100.78
WM	Operophtera brumata	Winter Moth	2,979	3,172.67
WPB	Dendroctonus brevicomis	Western Pine Beetle	0	0.00
WPBR	Cronartium ribicola	White Pine Blister Rust	97	136.63
WSB	Choristoneura occidentalis	Western Spruce Budworm	738	585.95

In the following graph, the pests are color coded according to the county's proximity to the pest occurrence in the United States. Red indicates that the pest is within the county; orange indicates that the pest is within 250 miles of the county; yellow indicates that the pest is within 750 miles of the county; and green indicates that the pest is outside of these ranges.



Note: points - Number of trees, bars - Structural value

Based on the host tree species for each pest and the current range of the pest (Forest Health Technology Enterprise Team 2014), it is possible to determine what the risk is that each tree species in the urban forest could be attacked by an insect or disease.

Spp. Risk	Risk Weight	Species Name	AL	ALB	BBD	BC	BWA	CB	DA	DBSR	DED	DFB	EAB	FE	FR	GM	GSOB	HWA	JPB	LAT	LWD	MPB	NSE	OW	PBSR	POCRD	PSB	PSHB	SB	SBW	SOD	SPB	SW	TCD	WM	WPB	WPBR	WSB
	13	Eastern white pine																																				
	12	willow spp																																				
	11	Norway spruce																																				
	11	Scots pine																																				
	10	River birch																																				
	10	Paper birch																																				
	9	Austrian pine																																				
	9	Northern red oak																																				
	9	Pin oak																																				
	9	pine spp																																				
	8	Bur oak																																				
	8	Swamp white oak																																				
	8	Douglas fir																																				
	8	Shingle oak																																				
	8	Chinkapin oak																																				
	8	English oak																																				
	8	White oak																																				
	7	American elm																																				
	7	Siberian elm																																				
	7	Green ash																																				
	7	oak spp																																				
	7	European larch																																				
	7	Sawtooth oak																																				
	6	Blue spruce																																				
	6	elm spp																																				
	6	birch spp																																				
	5	spruce spp																																				
	5	White ash																																				
	5	Blue ash																																				
	5	Eastern hemlock																																				
	5	Black ash																																				
	4	European alder																																				
	4	dogwood spp																																				
	4	Boxelder																																				
	4	American basswood																																				
	4	White fir																																				
	4	Butternut																																				

	4	White poplar																																							
	3	apple spp																																							
	3	hawthorn spp																																							
	3	Silver maple																																							
	3	Norway maple																																							
	3	Littleleaf linden																																							
	3	Eastern cottonwood																																							
	3	Sugar maple																																							
	3	Red maple																																							
	3	Eastern hophornbeam																																							
	3	Callery pear																																							
	3	cottonwood spp																																							
	3	American beech																																							
	3	European beech																																							
	3	Sweetgum																																							
	3	Staghorn sumac																																							
	3	Witch hazel																																							
	3	American hazlenut																																							
	3	basswood spp																																							
	2	Ohio buckeye																																							
	2	Black walnut																																							
	2	London plane																																							
	2	Amur maple																																							
	2	maple spp																																							
	2	fir spp																																							
	2	Horse chestnut																																							
	2	Hedge maple																																							
	2	Japanese maple																																							
	2	Katsura tree																																							
	2	Yellow buckeye																																							
	1	Black cherry																																							

Note:
Species that are not listed in the matrix are not known to be hosts to any of the pests analyzed.

Species Risk:

- Red indicates that tree species is at risk to at least one pest within county
- Orange indicates that tree species has no risk to pests in county, but has a risk to at least one pest within 250 miles from the county
- Yellow indicates that tree species has no risk to pests within 250 miles of county, but has a risk to at least one pest that is 250 and 750 miles from the county
- Green indicates that tree species has no risk to pests within 750 miles of county, but has a risk to at least one pest that is greater than 750 miles from the county

Risk Weight:

Numerical scoring system based on sum of points assigned to pest risks for species. Each pest that could attack tree species is scored as 4 points if red, 3 points if orange, 2 points if yellow and 1 point if green.

Pest Color Codes:

- Red indicates pest is within Cook county
- Red indicates pest is within 250 miles county
- Yellow indicates pest is within 750 miles of Cook county
- Green indicates pest is outside of these ranges

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