

# GREEN SHORELINE

## 20-YEAR FOREST MANAGEMENT PLAN

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Restoration Guidelines for Shoreline's Forested Parks and Natural Areas

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# ACKNOWLEDGMENTS

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*The Green Shoreline 20-Year Forest Management Plan is a direct initiative in implementing the strategies and objectives called out in the City of Shoreline's Urban Forest Strategic Plan (UFSP). The vision of the UFSP is: "Shoreline's urban forest is a healthy and cohesive ecosystem that is valued and cared for through community stewardship."*

The **City of Shoreline** and **Forterra** formed a partnership in 2019 to evaluate the health and condition of Shoreline's forested parks and natural areas, and develop a plan to help ensure that Shoreline's vision of a sustainable, healthy city continues to become a reality. With funding from the City of Shoreline and a grant secured through Forterra from The Nature Conservancy, Shoreline joins Seattle, Tacoma, Snoqualmie, Kent, Redmond, Kirkland, Everett, Puyallup, Tukwila, Issaquah, Burien, SeaTac, and Des Moines as members of the **Green Cities Network**. These 14 Green Cities in the Puget Sound region span three counties (King, Pierce, and Snohomish), collectively serve a population of more than 3 million people, and aim to restore and steward more than 13,000 acres of land. As part of this robust network of resources and expertise, the **Green Shoreline Partnership** will contribute toward a livable and healthy region.

The Green City Partnerships share three core goals:

- Improve city residents' quality of life and connection to nature, and provide increased ecosystem benefits by restoring our forested parks and natural areas and enhancing urban forests.
- Galvanize an informed and active community.
- Ensure long-term sustainable funding and community support.



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# EXECUTIVE SUMMARY

*The City of Shoreline envisions itself as a community of families, safe neighborhoods, cultural diversity, active partnerships, quality businesses, natural resources, and responsive government. Trees always have been an important element of this community and are a top priority. The City Council set a goal in 2007 to "Create an Environmentally Sustainable Community."*

The intent of the Green Shoreline 20-Year Forest Management Plan (the 20-Year Plan) is to provide a thorough health assessment of Shoreline's forested parks and natural areas, recommend goals and objectives to enhance the current conditions of these forests, and suggest actions that will provide outcomes that benefit Shoreline's people and ecosystem. This 20-Year Plan is an important step toward implementing the City of Shoreline's Urban Forest Strategic Plan (UFSP).

The 20-Year Plan recommends:

- Supporting the active, adaptive management of Shoreline's urban forest with a vision of continuing this practice into the future to ensure lands in active restoration remain ecologically healthy and the city's forest continues to provide numerous benefits to the City of Shoreline.
- Enrolling all 271 acres of forested parkland and natural areas surveyed in active restoration and maintenance within the next 20 years.
- Maintaining an inclusive and successful volunteer program that encourages participation from a diverse network of individuals, families, schools, businesses, and nonprofits. Centering equity so that the program encourages residents to participate in urban-forest enhancement in their own neighborhood, in ways that are accessible to all.
- Engaging long-term volunteers in this work by providing a high level of training and expertise, rewarding and celebrating service, and engaging a diverse volunteer base with a variety of skill sets.

- Securing stable, sustainable funding so that the program has staff resources as well as the potential to utilize contracted crews when necessary to accomplish long-term forest health, community development, and program administration goals.

## VISION

Shoreline has a vision that its "urban forest is a healthy and cohesive ecosystem that is valued and cared for through community stewardship" (UFSP, 2014). This 20-Year Plan will help make the City of Shoreline's vision a reality.

Urban forests play a vital role in Shoreline's environmental, economic, and public health—as they do in all cities. According to the U.S. Census Bureau, as of 2010, 80% of the U.S. population live in urban areas, and those residents rely heavily on the natural resources found in the urbanized centers. These resources have economic value because of their contributions to stormwater management, ambient-temperature reduction, and reduction of air pollution, and their ability to create social connections within communities, among other benefits.

The City of Shoreline has acknowledged the importance of restoring urban forests through its previous assessments and plans, including the 2018 Citywide Tree Canopy Assessment, the 2017 Parks, Recreation & Open Space Plan, and the 2014 Urban Forest Strategic Plan.

Specifically, through the guided process of developing the 2014 UFSP, city staff, the Shoreline Tree Board, and interested citizens developed a comprehensive set of goals for improving Shoreline's urban forest. Of the key objectives, Shoreline identified these priorities to focus short-term strategies in the 2014 UFSP:

- Maintain climate-appropriate degree of tree cover community-wide.
- Establish a diverse tree population suitable for the urban environment and adapted to the region.
- Acquire a comprehensive understanding of the public tree resource to direct its management.
- Implement a comprehensive urban forest management plan for public trees.
- Develop and maintain adequate staff and funding to implement a citywide urban forestry program.
- Citizens understand and cooperate in urban forest

management, recognizing the urban forest as vital to Shoreline’s environmental, social, and economic well-being.

In order to address these urban forest priorities, the City of Shoreline established initial strategies to:

- Partner with other stewardship programs.
- Support community efforts in invasive-plant removal.
- Expand the annual Arbor Day event to increase public awareness.
- Perform a cost/benefit analysis of a Shoreline Urban Forest Steward Program.

Forterra created this 20-Year Forest Management Plan to provide a strategy for enhancing Shoreline’s urban forest, specifically through active restoration and management of its forested parks and natural areas. The strategies outlined in the 20-Year Plan will directly address many of the priorities and objectives outlined in Shoreline’s 2018 Citywide Tree Canopy Assessment, the 2017 Parks, Recreation & Open Space Plan, and the 2014 Urban Forest Strategic Plan.

The 2017 Parks, Recreation & Open Space Plan specifically laid out priorities and initiatives to address urban forestry needs from 2017 to 2023. This 20-Year Plan will expand on that vision, extending its goals further into the future while providing timely and attainable goals to achieve healthy urban forests citywide. Goals laid out in Tree Canopy Assessment, Parks, Recreation & Open Space Plan, and Urban Forest Strategic Plan all call out the need for improving the health of Shoreline’s forested parks and natural areas. This plan will explain the on-the-ground tactics for achieving those larger city objectives and priorities.

## VALUE

Urban forests provide services to the people and the surrounding ecosystem. They are increasingly recommended by national and state environmental protection agencies to mitigate the harmful impacts of air and water pollutants, harmful emissions, and the negative effects of urban heat and noise (Wolf and Robbins 2015). Protecting, enhancing, and maintaining the trees that comprise Shoreline’s urban forest—in neighborhoods, urban areas, and parks—is critical to the health and welfare of the citizens of Shoreline and will have a positive impact on the entire region.

Although the 20-Year Plan recommends ambitious actions and is only possible with the help of an engaged community and volunteer leaders, it is important for the health of the city’s environment and its people. Shoreline’s trees face the same kinds of pressures and problems as many urban forests:

canopy-cover decline and removal, fragmentation, an influx of invasive species, declining tree health due to age, and resource limitations for management and maintenance. These pressures diminish the benefits provided by the urban forest, thereby diminishing quality of life for Shoreline residents.

The vision outlined in the 20-Year Plan is to have a healthy urban forest in Shoreline that supports—and is supported by—an aware and engaged community. The envisioned urban forest enhancement program, initiated by a collaborative working group called the Green Shoreline Partnership, would restore and maintain forested parklands and natural areas, all while centering equity and fostering appreciation and understanding of the long-term benefits that urban forests provide to the City of Shoreline.

## ASSESSMENT

For this 20-Year Plan, the health of Shoreline’s urban forest was assessed through a detailed health assessment of Shoreline’s 271 acres of forested parklands and natural areas.

The results of this assessment indicate that much of the work in caring for Shoreline’s forested parks and natural areas will require intense invasive-plant removal. Once that is complete, managers and volunteers can help forested parks regenerate by initiating a major planting effort to ensure there are young trees growing to one day replace the mature trees in the current canopy. Finally, maintaining and monitoring sites over the long term will prevent them from returning to a pre-restoration condition.

## IMPLEMENTATION

This plan outlines a 20-year commitment to actively maintain Shoreline’s forested parks and natural areas and begin to restore canopy cover through volunteer initiatives supported by a team of city staff, partner organizations, and consultants. In order to better determine what resources would be necessary, Forterra conducted a cost analysis using the existing Green Cities cost model. This analysis determined the total cost of a forested park and natural area enhancement program for Shoreline to be \$7 million (in 2019 dollars). Though this is a significant investment, the cost of effectively managing these lands without volunteer involvement and solely using skilled field crews is estimated to be more expensive—and does not guarantee long-term success or community ownership. However, working side by side with city staff, volunteers in a 20-year program are forecasted to leverage up to an additional \$2.3 million in value for the City of Shoreline.

This 20-Year Plan builds on work already underway in Shoreline to enhance its forested parks and natural areas. The



PHOTO: HEATHER VAN STEENBURGH

city, through a partnership with Sound Transit, is restoring natural areas and converting grass lawn into forested wetlands at Ronald Bog Park. Also, in partnership with the Mountains to Sound Greenway Trust, the city is restoring forest at Ballinger Open Space. Washington Native Plant Society (WNPS) Master Native Plant Stewards also have been volunteering to steward various Shoreline Parks.

The Green Shoreline Partnership will work to streamline these partner efforts and expand on the restoration work already taking place in Shoreline's forested parks and natural areas. The Partnership will bring all of these efforts under one roof, offering a one-stop shop for volunteers to engage in restoring these spaces. Streamlining partner efforts will also offer clearer opportunities for funding and community engagement.

As the 20-Year Plan is implemented, and as forest restoration efforts gain traction in the community, the Partnership intends to expand its efforts to enhance Shoreline's urban forest beyond its park boundaries. This could occur through a tree-giveaway program for Shoreline residents, engaging school districts in restoration on private lands, or caring for and planting street trees. This future expansion of the program is dependent on successful initial efforts of the Partnership and on community involvement.



# CHAPTER I. INTRODUCTION

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Imagine a city devoid of trees and vegetation. Consider what the air and water might be like without the natural filtration that plants provide. What would it sound like on a windy day? What would spring look like? Would the summer sun be overwhelming without the shade that trees provide?

## **2014 Urban Forest Strategic Plan Mission:**

*“Shoreline is dedicated to protect and manage the vibrant urban forest to enhance its benefit to the environment and its contribution to the livability of the community today and for generations to come.”*

Shoreline is a city known for its iconic parks and shorelines, marine views, family-friendly community, and innovative leadership. Its wealth of trees, in both parks and neighborhoods, defines the city, gives it character, and makes its neighborhoods active and vibrant. This urban forest plays a vital role in the city’s environmental, economic, and public health. Despite its value, Shoreline’s urban forest is declining in health and needs active management in order to survive. By enhancing this urban forest, we can preserve Shoreline’s iconic beauty and increase the forest’s benefits for the people who live, work, and play here.

Shoreline’s urban forest—including its areas of dense forest, natural shoreline, open spaces, and wetlands—provides numerous services that benefit all areas of the city. These services include: absorbing stormwater runoff; returning oxygen back to the air; sequestering carbon; stabilizing shorelines and steep slopes; reducing flooding and erosion; filtering fine and ultrafine particulates from the air; reducing noise pollution; and more (USDA Forest Service 2018). Areas with increased vegetation—leaves, specifically—capture more particulates in the tree canopy and clean the air. These same areas have healthier soils, which clean the water by filtering polluted runoff. The urban forest also enhances the livability of neighborhoods, makes Shoreline more beautiful, offers shade on the hottest days, and provides habitat for local wildlife.

Historically, development has been the largest threat to

both natural areas and tree density in the Puget Sound region’s urban and suburban centers. Our cities once were predominantly forested lands. As the region became urbanized, public agencies and land trusts have worked together to purchase and conserve pockets of dense forest, vital wetlands, farmland, and other important lands. Conserving these green spaces is an important first step in preserving the region’s natural resources in the face of urbanization.

In the past, these areas unfortunately were left unmanaged due to a belief that it was advantageous to keep human impact at a minimum. By studying this urban system, however, we have learned that urban forests encompass the whole and that environments face unique pressures, needing more care than we once believed. Invasive species, litter, pollution, the redirection of creeks, the diversion of stormwater, and the isolation of dense pockets of plants (such as in parks) reduce the forest’s natural ability to thrive within cities and suburban areas. We now know that we must actively manage urban forests: remove invasive species; help regenerate young trees; monitor for and respond to pests; water young trees during times of drought; prune trees and perform maintenance; and more. The urban forest needs our help and continued support. The Green City Partnerships work with city staff to engage a robust volunteer effort in order to fulfill this important role.

Scientists and municipalities also have begun to recognize the many benefits of having more trees within the city landscape. Trees are hugely beneficial to the people who live among them—they provide services such as cleaner and cooler air, improved water quality, community connections, and even mental health benefits. As a result of our past misunderstanding and lack of care, our urban forests are disappearing—not just to development, but also because they are unhealthy. When we lose urban forests, we lose the services they provide. Many studies have proven that educating and engaging residents and securing a strong commitment of care can quickly change the health of a city’s forest (USDA Forest Service 2018).

The 20-Year Plan also addresses the need to care for, maintain, and repeatedly restore the canopy cover already present in Shoreline’s forested parks and natural areas due to a prior lack of active management. The dominance of non-native plant species is a major cause of the loss of biodiversity and the degradation of urban forests (Pimentel et al. 2000; Soulé 1991). These invasive weeds lack natural population control (e.g.,

predators, diseases) and are capable of rapid reproduction—they can quickly blanket the ground and prevent native plants from reseeding (Boersma et al. 2006). At the same time, invasive vines such as English ivy climb into treetops, where they can block light from reaching a tree’s leaves, thus preventing the trees from making food until, eventually, the trees die. This problem is exacerbated by the fact that a significant portion of the Puget Sound region’s forest canopy is now composed of relatively short-lived, mature deciduous trees, such as maples, that are coming to the end of their life spans. As these trees die, new seedlings are not present to replace them, resulting in a loss of forests over time. Shoreline is committed to enhancing the health of its urban forest by removing invasive plants from forested parks and natural areas with the help of the Green Shoreline Partnership.

a coordinated urban forest enhancement program. The Partnership developed this long-term plan to enhance the benefits that the urban forest provides by giving funding and direction, and creating a road map that helps the city meet its goals. The 20-Year Plan determines agency capacity, promotes community participation, and establishes the long-term planning needed to support the Partnership’s vision and goals. It also sets out a framework for implementing stewardship projects throughout the city with input from the community. The Partnership primarily achieves these goals through community engagement and the volunteerism of residents. The plan doesn’t just define the problems, but offers solutions for the recovery and enhancement of Shoreline’s urban forest.

### **What is an Urban Forest?**

*An urban forest encompasses all the trees in a defined urban area, such as a city. Urban forests broadly include the trees in urban parks; on city streets; in residential areas, including private yards and shared residential spaces; in community spaces (such as libraries and public gardens); and in greenways, river corridors, wetlands, nature preserves, and natural areas; shelter belts of trees; and working trees at industrial brownfield sites, among others (USDA Forest Service 2018).*

### **What is Canopy Cover?**

*Imagine you are a bird flying over a city (or a human in an airplane) in the summer months. As you look down on your city, what percentage of the ground is covered (obscured from view) by trees? That amount is called the canopy cover of an area. In 2017, the overall tree canopy cover for the City of Shoreline was 37%.*

## **THE NEED FOR A GREEN SHORELINE PARTNERSHIP**

Shoreline’s degrading urban forests can benefit significantly from intervention to help reverse their decline and prevent major loss of ecological services such as cleaner air. Thanks to funding from the City of Shoreline and The Nature Conservancy, the City of Shoreline and Forterra together created the Green Shoreline Partnership,

### **Priorities of the Partnership**

*The Green Shoreline Partnership’s 20-Year Forest Management Plan is a direct strategy to address four key priorities for supporting the city’s urban forests, as identified within the City of Shoreline’s 2014 Urban Forest Strategic Plan:*

*Priority 4: Develop and implement a comprehensive urban forest management plan for public property. The ecological structure and function of all publicly-owned natural areas are protected and, where appropriate, enhanced. Preserve and enhance local natural biodiversity, where appropriate.*

*Priority 5: Develop and maintain adequate funding to implement a citywide urban forest management plan.*

*Priority 6: Employ and train adequate staff to implement citywide urban forestry plan/program. Ensure all city departments and other public agencies cooperate with common urban forestry goals and objectives.*

*Priority 7: At the neighborhood level, citizens understand and cooperate in urban forest management. The general public understanding the role of the urban forest through education and participation. The urban forest is recognized as vital to Shoreline’s environmental, social, and economic well-being.*

**With continued population growth anticipated throughout the Puget Sound region, Shoreline’s residential and business density will be higher in the future.** One of the challenges facing the city is how to balance this growth while maintaining a strong economy and exceptional quality of life. For example, increasing high-density housing, including condominiums and multifamily developments, often results in residents having less access to open space and natural settings. Studies have proven that this is detrimental to health and wellness (USDA Forest Service 2018). Thus, it is important to protect and enhance Shoreline’s canopy cover, when possible, in order to preserve and enhance the city’s urban forest and the services it provides.

Residents consider urban developments such as condominiums, townhouses, and office parks to be more desirable when they are located near parks and natural areas that are accessible by bike or on foot (Tyrväinen and Miettinen 2000). **Since green space is an important element of livable, attractive communities, it provides benefits beyond environmental services.** Parks, trails, and natural areas give people who live in cities recreational opportunities and a connection to nature and their community that can help sustain an active, urban life. Trees and green space also are associated with a variety of measurable public health benefits by providing people access to nature and low- or no-cost exercise, both of which have links to stress reduction, improved mental health, and increased physical wellness (see Chapter 2).

In 2005, Forterra launched the Cascade Agenda, a 100-year vision for conservation and economic growth in the Pacific Northwest, with a focus on building livable urban communities. As mentioned above, the City of Shoreline also recognizes the need to invest in the care and attention of its urban forest. **The Green Shoreline Partnership can play a key role in helping meet these shared goals.**

In 2019, the Green Cities Network, including Shoreline, is 14 cities strong and making ecosystem-wide, regional change. During the writing of this 20-Year Plan, Snohomish County became the first county to make a commitment to apply the Green Cities model to its forested parks. Similar Green City Partnerships have already seen success in Seattle, Tacoma, Kirkland, Redmond, Kent, Everett, Tukwila, Puyallup, and more. **Together, these partnerships are establishing one of the largest urban forest restoration networks in the nation.** This network of municipalities holds annual summits and quarterly meetings where ideas are exchanged, and solutions offered. The City of Shoreline joins this impressive, innovative network and will contribute to the health and livability of the entire Puget Sound region.



PHOTO: ANDREW WATSON

# CHAPTER 2. INVESTING IN SHORELINE'S URBAN FOREST:

## PUBLIC HEALTH, ECONOMIC, AND ECOSYSTEM BENEFITS

The benefits of caring for Shoreline's urban forest are many, and they affect all aspects of the community. Research indicates that urban forests give people a higher quality of life (Dwyer et al. 1992), provide ecosystem services such as flood prevention, create opportunities to improve physical

and mental health, reduce crime, and provide opportunities to enjoy nature close at hand. They help keep the air and water cleaner, provide habitat for native wildlife, and make communities more livable and beautiful (Table 1).

**A conifer can remove 50 pounds of particulates from the air per year (Dwyer et al. 1992).**



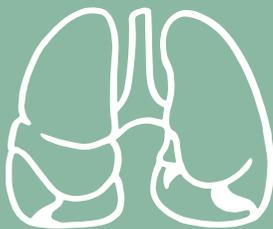
**Just 20 minutes in nature can significantly lower stress hormones such as cortisol (Hunter et al. 2019).**



**Air filtration alone by urban trees in Washington State is valued at \$261 million.**



**Nationwide, urban trees prevent 670,000 cases of acute respiratory conditions annually (Nowak et al. 2018).**



**Every 1% increase in a city's usable or total green space results in a 4% lower rate of anxiety/mood disorder treatment (Nutsford et al. 2013).**



**Buffers of trees and shrubs can reduce 50% of noise detectable by the human ear (USDA Forest Service 1998), including high-frequency noise, which is the most distressing to people (McPherson et al. 2001).**



**TABLE 1 | BENEFITS OF URBAN FORESTS**

<b>Reduce Stormwater Runoff</b>	Urban forests can reduce annual stormwater runoff by 2% to 7%, and a mature tree can store 50 to 100 gallons of water during large storms (Fazio 2010). Green streets, rain barrels, and tree planting are estimated to be three to six times more effective in managing stormwater per \$1,000 invested than conventional methods (Foster et al. 2011).
<b>Improve Water Quality</b>	Plant roots absorb water, much of which is full of pollutants in an urban environment. Some pollutants are filtered and transformed by bacteria and other microorganisms in the soil (Prince George’s County, Md., 2007); others are transformed by plants through metabolism or trapped in woody tissues and released when a tree decomposes.
<b>Reduce Erosion</b>	As the tree canopy slows the speed of rain falling on the earth, rainwater has less energy to displace soil particles. Soils under a canopy and the thick layer of leaf litter are protected from the erosive energy of rainwater (Xiao et al. 1998).
<b>Improve Air Quality</b>	Plant leaves absorb carbon dioxide and produce oxygen through photosynthesis. The surfaces of leaves trap airborne dust and soot (McPherson et al. 1994), removing millions of pounds of air pollutants annually from the air in a city (American Forests 2001).
<b>Provide Wildlife Habitat</b>	Native wildlife has unique requirements for food and shelter. Healthy urban forests under restoration have been demonstrated to increase species diversity (Ruiz-Jaén and Aide 2006).
<b>Reduce Energy Use and Combat Climate Change</b>	A 25-foot tree reduces annual heating and cooling costs of a typical residence by an average of 8% to 12% (Wolf 1998). Urban forests also can lower ambient temperatures of nearby urban areas (Nowak and Heisler 2010), which lowers energy consumption. Trees absorb carbon dioxide and store the carbon in woody tissues, reducing the amount of carbon dioxide in the atmosphere. Each year, an acre of trees absorbs the amount of carbon produced by driving a car for 26,000 miles (Nowak 2011).
<b>Buffer Noise</b>	Tree canopies dampen sound by intercepting sound waves (Herrington 1974). Noise buffers composed of trees and shrubs can reduce 50% of noise detectable by the human ear (USDA Forest Service 1998), including high-frequency noise, which is the most distressing to people (McPherson et al. 2001).
<b>Boost Local and Regional Economies</b>	Urban forestry supports job creation and retention, resulting in added individual income and increased local, state, and federal taxes (California Department of Forestry and Fire Protection 2011). Homes that border urban forests often are valued at up to 5% more than comparable homes farther from parks (Tyrväinen and Miettinen 2000), and street trees add value to homes as well (Donovan and Butry 2010).

**TABLE 1 | BENEFITS OF URBAN FORESTS (CONT.)**

<p><b>Community Building</b></p>	<p>Physical features, particularly natural ones, play an important role in creating vital neighborhood spaces (Sullivan et al. 2004). Urban green spaces and parks provide gathering places for people of different backgrounds to integrate and connect with each other. Greener neighborhoods can encourage social bonding between neighbors and improve social connections. Residents who are more attached to their community have higher levels of social cohesion and social control, and less fear of crime, and their neighborhoods display more signs of physical revitalization (Brown et al. 2003).</p>
<p><b>Make Communities More Attractive</b></p>	<p>Trees are the most important factor in influencing the perception of a community’s aesthetic value (Schroeder 1989). Trees and natural landscapes are associated with reduced aggression and violence (Kuo and Sullivan 2001b), and less graffiti, vandalism, and littering (Brunson 1999).</p>
<p><b>Physical Wellness and Fitness</b></p>	<p>People who use parks and open spaces are three times more likely to achieve recommended levels of physical activity than non-users (Giles-Corti et al. 2005). People in communities with high levels of greenery or green space are more likely to be physically active (Maas et al. 2006; Ellaway et al. 2005).</p>
<p><b>Mental Health and Function</b></p>	<p>The experience of being in nature helps restore the mind after the mental fatigue of work or studies, improving productivity and creativity (Kaplan 1995; Hartig et al. 1991). A recent study found that just 20 minutes of walking in nature significantly lowers stress hormones (Hunter et al. 2019).</p>
<p><b>Child Development</b></p>	<p>Experience with nature helps children develop cognitively, emotionally, and behaviorally by connecting them to environments that encourage intellectual development, imagination, and social relationships (Isenberg and Quisenberry 2002; Heerwagen and Orians 2002). Green settings and green play areas also decrease the severity of attention deficit disorder in children (Taylor et al. 2001).</p>
<p><b>Health and Wellness Benefits of Stewardship Activities</b></p>	<p>Volunteer stewards of all ages who regularly remove invasive species, plant trees, and perform other stewardship activities are likely to gain health benefits from physical exertion. In one hour, a 150-pound person can burn 440 calories from digging, gardening, and mulching, and 330 calories from light gardening like planting trees (<a href="http://www.choosemyplate.gov">www.choosemyplate.gov</a>). Strong community relationships are built from sharing personal stories, exchanging information, and working together to achieve common goals (e.g., community forest improvements).</p>

**ECONOMIC BENEFITS**

The Puget Sound region’s forests provide measurable, valuable services that affect us every day. In 1998, American Forests, the country’s oldest national conservation organization, analyzed Washington State’s urban forests. Its study revealed that these trees removed 38,990 tons of air pollution—a service valued at \$261.6 million in 2019. The study also showed that the trees

created a 2.9 billion-cubic-foot reduction in runoff, a service valued at \$9.2 billion adjusted for inflation (American Forests 1998). Were these forests to be lost, these dollar values become the costs associated with building new infrastructure to carry out equivalent functions.

## AIR QUALITY

A city with abundant and healthy vegetation enjoys significantly higher air quality. Conifers, specifically, can remove 50 pounds of particulate pollutants from the air per year (Dwyer et al. 1992), which is correlated in studies with a reduced incidence of asthma in children and other related respiratory health issues in people of all ages (Lovasi et al. 2008). Trees remove soot and other pollutants through their leaves and branches, and evergreen trees do this work year-round. More recent studies have found that conifers, in particular, are natural filters of ultra-fine particle pollutants, and they actually remediate or decontaminate both air and water in a process called phytoremediation. One study likened trees as the “green liver and lungs” of urban areas (Abd ElAziz et al. 2015). In 2006, the total amount of air pollution removed by urban trees annually within the U.S. was estimated to be 711,000 metric tons (Nowak et al. 2006).

## WATER QUALITY

Neighborhoods with fewer trees have the potential for increased stormwater, pollutants, and chemicals flowing into their water supply and systems, resulting in flood damage, health risks, and increased taxpayer dollars to treat the water (Seitz and Escobedo 2008). Trees absorb and filter water through their roots, and the loss of trees means the loss of these vital services. Trees also help soils that have been compacted by human intervention and no longer absorb water; they do this by sending down roots, which make paths that stormwater can follow in a process called infiltration (Bartens et al. 2008). The Green Shoreline Partnership understands the important role trees play in improving water quality and will work interdepartmentally with city staff to be innovative and creative with tree-planting efforts in order to improve water quality.

### **Forests Clean the Air:**

*Shoreline has 271 acres of forest in parks and natural areas that the Green Shoreline Partnership will help restore to a healthy condition. This acreage has the potential to mitigate the emissions of more than 650 cars per year once it is restored.*

## MENTAL HEALTH

Higher percentages of neighborhood green space are associated with significantly lower levels of depression, anxiety, and stress, and one article found that “greening could be a mental health improvement strategy in the United States” (Beyer et al. 2014). Many of the health benefits of trees and green spaces come from their ability to improve the mood and mental health of the people who live around them. Immersion in natural settings is impactful, but even viewing trees through a window can reduce stress and improve outcomes for everyone from students in a classroom to patients in hospitals (USDA Forest Service 2018). Increasing this benefit is as simple as ensuring an equitable distribution of trees and green spaces that are accessible to residents and encouraging people to look or go outside. Restoring canopy cover, especially near where people live and work and children go to school, has the added benefit of increasing access to these mental health benefits.

## CLIMATE-CHANGE MITIGATION: CARBON AND HEAT

Urban forests also help combat climate change and the effects of air pollution through carbon capture. As they grow, trees capture carbon dioxide through the process of photosynthesis. They store the carbon from absorbed carbon dioxide in the woody mass of their branches and trunks, and release oxygen into the air. It is estimated that Washington State’s urban trees are responsible for the sequestration of more than 500,000 tons of carbon per year (Nowak and Crane 2002). Each acre of healthy, mature, dense Western Washington forest could be responsible for the storage of more than 300 tons of carbon, which translates to the removal of more than 1,100 tons of carbon dioxide from the atmosphere (Smithwick et al. 2002). For example, the average passenger vehicle emits about 4.6 metric tons—the equivalent of over 10,000 pounds—of carbon dioxide per year (U.S. Environmental Protection Agency 2018). According to the U.S. Environmental Protection Agency, each acre of healthy forest can remove carbon dioxide emissions for approximately 2.4 vehicles per year.

Trees in an urban setting combat the “urban-heat-island effect” caused by paved surfaces absorbing and radiating heat from the sun. Trees produce shade, reflect sunlight well above the pavement, and convert sunlight through photosynthesis. Urban forests also create microclimates that move air and further cool their surroundings. They have been shown to significantly lower ambient temperatures, making hot days more comfortable and reducing energy consumption needed for artificial cooling (Kurn and others 1994). A single 25-foot tree reduces a typical residence’s annual heating and cooling costs by an average of 8% to 12% (Wolf 1998).



While invasive plants such as ivy and blackberry also carry out photosynthesis to sequester carbon and create oxygen, they are shorter lived and contain less biomass than mature conifers. This makes them less effective at removing carbon dioxide from the atmosphere and storing it. Additionally, they often do not supply adequate habitat for local native wildlife and are much less effective at providing other ecosystem functions than healthy native Northwest forest communities. Invasive plants typically exclude other plants, so they do not foster the diversity that keeps natural areas healthy and stable.

Urban trees are particularly vital for reducing heat stress and decreasing the size and effect of the urban heat island (Zupancic et al. 2015). Trees have the unique ability to use evapotranspiration to provide micro-cooling. Zupancic also found that green spaces that are connected and closely spaced can improve the flow of cool air throughout an entire city.

surroundings were, the fewer crimes reported” (Kuo and Sullivan 2001b). Troy et al. (2012) found that a 10% increase in tree canopy was associated with a roughly 12% decrease in crime. Expanding public awareness and building a robust volunteer program that has high ownership and valuation of urban forest, parks, neighborhoods, and public spaces are the main tenets of the Green Shoreline Partnership.

More research still is needed to quantify the economic and ecosystem benefits of Shoreline’s urban forest. That said, drawing from the wide body of knowledge and related studies outlined here, we know that the cost of doing nothing to maintain the health of the city’s urban forest will be high and have negative effects on Shoreline’s environmental, economic, and public health. As development throughout the region continues at a rapid pace, preserving and enhancing our remaining urban forest is now more important than ever.

### **Forests Reduce Heat:**

**Every 10% increase in overall urban tree canopy generates a 2°F reduction in ambient heat (Wolf 2008).**

## **DECREASED CRIME**

Studies have shown that urban forest and healthy green spaces decrease crime (Kuo and Sullivan, 2001a). Recently, the Chicago Region Trees Initiative (CRTI) has been mapping and studying this correlation between trees and reductions in crime. According to CRTI Director Lydia Scott: “Communities that have higher tree population have lower crime. (In) areas where trees are prevalent, people tend to be outside, mingling, enjoying their community” (Nolan 2017). The CRTI team used new technology to check that the correlation wasn’t due to socioeconomic or other factors. Another study found that Philadelphia experienced an 18% to 27% reduction in reports of narcotics possession in areas with enhanced vegetation (Kondo and others 2015). Restoration projects led by the community help reclaim such areas as positive public spaces that are welcoming for everyone, and they regularly bring more watchful attention to areas, increasing a sense of public ownership and responsibility.

In a separate study from Kuo and Sullivan, by studying 98 apartment buildings in an inner-city neighborhood of Chicago, they found that regardless of the socioeconomics of the residents of an apartment building, “the greener a building’s



# CHAPTER 3. THE CHALLENGE – A THREATENED URBAN FOREST

## CHALLENGES AND THREATS TO SUSTAINABILITY

Urban forests face unique challenges and pressures that require specific attention. The following section outlines seven primary issues that prevent urban forests from sustaining themselves or pose risks to current and future ecological sustainability:

- Fragmentation and development
- Climate change
- Declining habitat quality
- Invasive species: plants and insects
- Harmful use: intentional and unintentional
- Lack of homeowner education and resource allocation
- Resource limitations on urban forest management and maintenance on public lands

### Fragmentation and Development

Habitat fragmentation is a forest threat that is inevitable in urban environments. Fragmentation occurs when contiguous forested areas are divided by development. This fragmentation decreases the valuable internal habitat of the forest and increases edge effects because these areas receive more human interference, are more disturbed, and receive more sunlight than contiguous forest. Pollination can be challenging when fragmentation isolates populations of plants because plants that are farther from each other have less likelihood of sharing pollen by wind or insects. This can lead to seeds going unfertilized and a lack of tree regeneration. Fragmentation also disrupts the connecting corridors used as habitats for birds, amphibians, and mammals.

Urban forests exist in human-use areas; if the benefits of healthy forest are desired, planning and development must consider how and where to keep dense forest as uninterrupted as possible. Carefully considered urban planning of greenbelts, parks, tree-related municipal policies, and neighborhood-specific regulations and association agreements can reduce fragmentation and contribute to the health of the urban forest. These intact green corridors can serve as the “skeleton” of a city’s green infrastructure, supported by individual trees or small groves of trees.

### Climate Change

The Pacific Northwest region faces climate-change impacts that include warmer winters, hotter and drier summers, and changes in precipitation (Littell et al. 2009). Climate change is expected to negatively impact the health and resilience of forests and natural areas by shifting the habitat conditions of native tree species that are common in Puget Sound lowland forests (Kim et al. 2012). Shifts in growing conditions, such as changes to summer and winter temperatures and soil moisture, can directly affect tree health and vigor, and make trees more susceptible to mechanical or physical failure, insect infestations, and disease (Littell et al. 2010).

Restoration and conservation of urban forests and natural areas therefore become increasingly important. The Green Shoreline Partnership’s restoration efforts are essential to preserve forest and natural-area health, and ensure the critical ecosystem functions these resources provide, such as reducing urban-heat-island effects, sequestering carbon, and mitigating stormwater impacts from increased precipitation. To improve the ability of forests and natural areas to mitigate as well as adapt to climate-change stressors, Green Shoreline Partnership managers will need to integrate adaptation and resilience strategies into general management practices and park-specific stewardship plans.

### Declining Habitat Quality

Several factors contribute to the loss of habitat quality in Shoreline’s urban forest. Compared with the region’s native forest composition, deciduous trees make up much more of Shoreline’s forest canopy than is typical in a healthy Northwest forest. Deciduous trees are early-colonizing species and help establish a forest in disturbed areas, such as after the logging activity that occurred throughout the Puget Sound in both the 1800s and 1900s. Deciduous bigleaf maples, cottonwoods, and alders now dominate the majority of Shoreline’s forested overstory, especially in parks. Under natural conditions, as deciduous trees begin to die off, they are typically replaced by longer-lived conifers; however, Shoreline’s urban forest no longer grows under natural conditions.

The high proportion of deciduous trees in Shoreline’s forest indicates that there will be a pronounced decline in tree canopy in the near future. Many of the deciduous trees—both native and non-native—are nearing the end of their natural

life spans. As they die, more sunlight can reach the ground, resulting in perfect growing conditions for aggressive, invasive plants to flourish. The loss of tree canopy allows invasive plants to become the dominant species in many parts of the city, inhibiting the growth of new trees and plants. Without intervention, such as planting young native trees to create the next generation of canopy, the 20-Year Plan's technical analysis projects that the natural death of these deciduous trees could lead to a loss of much of Shoreline's forest overstory.

Additionally, past removal of vegetation, urban development, and channelization along our region's many streams and wetlands resulted in a loss of native species cover. Large areas of the watershed, such as smaller creeks, wetlands, and other sensitive areas, are now buried under a blanket of invasive species such as Himalayan blackberry, English ivy, and knotweed. The loss of native vegetation along waterways results in significant impacts on stream temperatures and water quality, and negatively affects aquatic species, including threatened salmon. The City of Shoreline has prioritized the restoration of riparian areas in Shoreline and the Partnership should continue to protect and prioritize these areas for their ecological benefit.

### **Invasive Species: Plants and Insects**

Invasive plants now outcompete native understory plants in many of Shoreline's private, park, and undeveloped urban areas. Aggressive, non-native plants cover the ground, preventing tree seedlings and other native plants from receiving sunlight and nutrients. Robust Himalayan and evergreen blackberry bushes spread along the ground in large thickets, and birds disperse the seeds to new locations. Invasive blackberry grows densely, choking out native plants and destroying native habitat for wildlife species. Blackberry thickets are especially aggressive when established along creeks and gulches, which, in the long term, can be detrimental to salmon. This impacts the ecosystem and can lead to a decline in the health of the Puget Sound.

English ivy reaches into the treetops and can kill a healthy deciduous tree within 20 years by spreading up from the understory into the tree canopy. Ivy coats the branches of the tree and absorbs sunlight the tree needs to survive. Once ivy becomes established, an intense investment of time and resources is required to remove it. Where English ivy is in the early stages of blanketing forest floors and trees in Shoreline, the opportunity exists to remove the existing growth and prevent further spread and a much bigger future cost of management. English ivy is the dominant invasive plant in Shoreline's forested parks (see detailed information about the forested parks health assessment in Chapter 6).

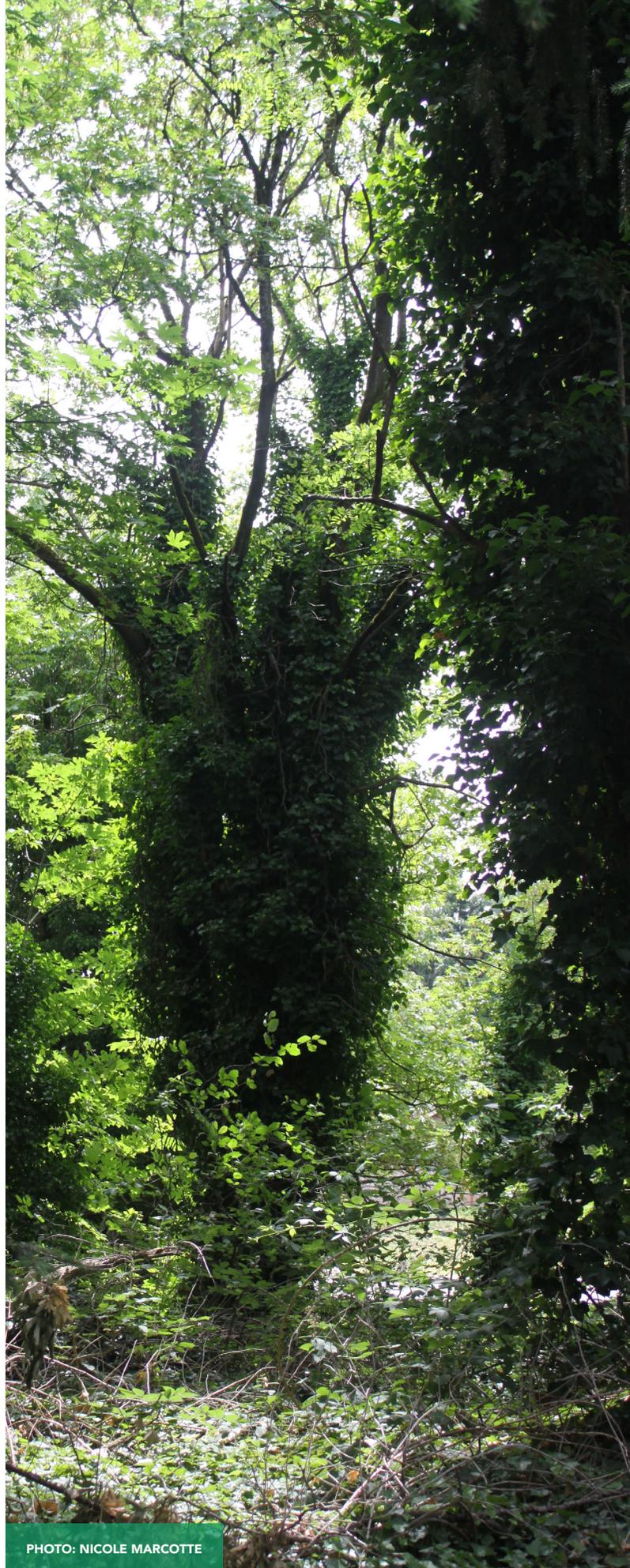
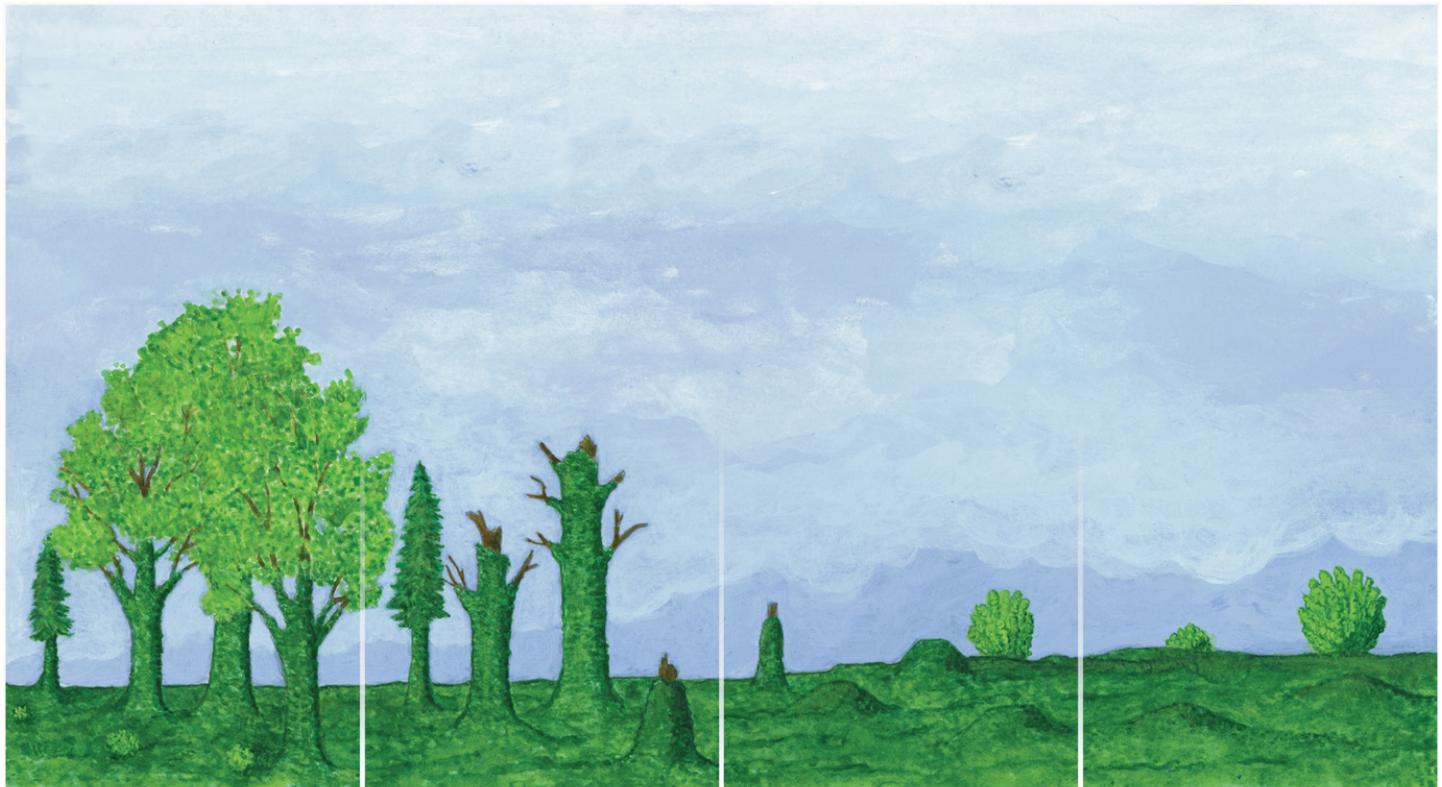


PHOTO: NICOLE MARCOTTE



<b>PRESENT</b>	→	<b>IN 20 YEARS</b>	→	<b>IN 50 YEARS</b>	→	<b>IN 100 YEARS</b>
<p>Natural areas are dominated by short-lived deciduous trees, such as big-leaf maples and alders, nearing the end of their life. After decades of passive management, invasive plants such as Himalayan blackberry and reed canary grass are smothering native vegetation and preventing natural regeneration.</p>		<p>Invasive plants outcompete and grow over existing vegetation, blocking the sunlight native plants need to thrive. Reed canary grass dominates most wetland areas, Himalayan blackberry blankets the understory of forests, and English ivy makes trees weak, top-heavy, and susceptible to windfall. Eventually, trees die or fall over.</p>		<p>Native vegetation is gone. Only a few native shrubs struggle to survive the stress of competition with invasive plants.</p>		<p>The wetlands, meadows, and forests are destroyed. Native plants can no longer establish on their own. We are left with a dense "invasive desert." Very few plant species can live, and biodiversity is gone. Such conditions provide homes for rats and scarce habitat for other urban wildlife.</p>

**Figure 1: Potential of Forest if Not Restored**

As invasive species begin to dominate the urban forest, the diversity of food and habitat available throughout the seasons is diminished. While some animals, such as rats, can live and even thrive in the dense monocultures of blackberry or ivy, quality habitat for most native wildlife is degraded by invasive species. In addition, environmental benefits such as stormwater retention, erosion control, and carbon sequestration are greatly decreased when invasive species displace complex communities of native vegetation that have grown together throughout this region’s history. If the spread of invasive species is not prevented, the result is degraded forests and natural areas overrun with sprawling thickets of blackberry and engulfed in ivy (Figure 1).

Non-native, invasive insects also can have catastrophic effects on a region’s natural resources and do not contribute to the natural ecological processes found in healthy natural open

spaces. Wood-boring beetles have been documented in the northeastern U.S. and California since 1996. The Asian long-horned beetle (*Anoplophora glabripennis*) and the citrus long-horned beetle, which arrive on wood pallets from Asia, are known to attack and kill maple trees and other deciduous hardwoods (Haack et al. 2010). These species arrived in our region in 2001 but have since been eradicated. Outbreaks of Asian and European gypsy moths have been documented here, though successful control efforts have prevented populations from establishing. In areas where full populations have established, such as in the Northeastern and Midwestern United States, gypsy moths—which forage by defoliating trees—have weakened trees and degraded wildlife habitat on millions of forested acres. Weakened trees then succumb to other pests or disease. In the Pacific Northwest, gypsy moths have been known to attack red alder, Douglas-fir, and western

hemlock (Boersma et al. 2006).

To protect Shoreline's forested natural areas, the Green Shoreline Partnership will need to stay abreast of potential invasive insect outbreaks in the region. Information is available to staff and volunteers through the Washington Invasive Species Council and U.S. Department of Agriculture's Animal and Plant Health Inspection Service. The Green Cities Network is working with the Washington Invasive Species Council to develop protocols and monitoring procedures for stewards to help cities with invasive species outbreak detection, and this could be offered as training for Green Shoreline Stewards.

As the Green Shoreline Partnership implements its 20-Year Plan, insect pests and other forest-health threats should be monitored at each project site as part of a detailed stewardship plan. To protect urban forests from devastating future pest and disease outbreaks, it is vital to plant a diversity of trees and shrubs throughout the city. A landscape dominated by just one or a few plant species is more vulnerable, as most pests and tree diseases attack only certain species. A diverse landscape of different plant species will be more resilient to all kinds of future uncertainties.

### **Harmful Use: Intentional and Unintentional**

In addition to the indirect effects of human development, harmful and sometimes illegal activity, especially in parks, has had a direct impact on Shoreline's urban forest. People misuse parks, harm community trees, and destroy spaces meant to benefit them, though this is often unintentional and a byproduct of inequity or miseducation. Dumped garbage and yard waste is a common problem in parks and natural areas throughout the city. Illegally dumped garbage can leach chemicals into the ground, attract rodents or other pests, and smother understory vegetation. Encroachments onto public land from adjoining private-property owners, while not common in Shoreline, can bring with them a number of problems for natural areas: primarily, the removal of native vegetation for the establishment of ornamental landscaping, lawns, or personal views. Almost all community forests also feel the impact of neighbors' access paths, built structures, and domestic animals.

The Green Shoreline Partnership recognizes that homelessness is a social condition and not a crime. Homeless encampments, however, are prohibited inside City of Shoreline parks and their removal must be dealt with sensitively. The Partnership will approach encampments on project-area sites with sensitivity toward all involved, and work in ways consistent with City of Shoreline procedures.

Drawing on the diverse experiences and knowledge of Green Cities, the Partnership will employ best practices for the health and safety of volunteers, and the just and equitable treatment of the individuals experiencing homelessness and their belongings.

In addition, it is important to note that when forested urban areas are left unmanaged, some users may perceive the lands as abandoned and forgotten, and therefore open refuge for illegal activities, such as drug use and crime. This is an unfortunate perception, as it is often untrue: well-managed green space doesn't encourage crime, but rather it reduces it (USDA Forest Service 2018). The issue is that management is costly and challenges many communities, especially in an urban setting and with limited staff capacity. When illegal activity takes place, forested areas can become known more for the harmful pursuits they harbor than for the valuable benefits they provide. Reversing this perception takes a concerted effort, but simply bringing more attention and activity to these areas helps enormously. The Green Cities Partnership uses the entire community to assist in this management through community work parties, educational walks, and events.

### **Lack of Homeowner Education and Resource Allocation**

Another threat to Shoreline's urban forest is that private-property owners lack resources relating to urban forest care, management, and maintenance. With just over half of Shoreline's canopy cover existing on residential and private land, this education and resource allocation is imperative. Homeowners often inherit trees from previous owners, and in the past there were fewer resources for private tree management. Without these resources, many homeowners and landowners choose to remove healthy trees due to the potential expenses associated with aging, large trees. The Green Shoreline Partnership has identified ways to provide homeowner education and training both within the Partnership and through connecting residents with other programs and resources such as the King Conservation District.

### **Resource Limitations on Urban Forest Management and Maintenance on Public Lands**

Historically, resources for tree and forest management and maintenance, such as in parks, have been limited in cities. In the past, it was widely believed that forests and natural areas, even in urban environments, could take care of themselves, which tended to discourage managers from allocating sufficient funds for the care of urban forests. Many Northwest

parks and natural areas were left to benign neglect under the wrong assumption that they were self-sustaining and therefore not susceptible to changing conditions and outside influence. This passive management directly led to declining health in unsupported urban forests and other natural areas. Not surprisingly, the longer active management is postponed, the more expensive it becomes, as existing tree canopy declines or is removed, invasive species spread prolifically, and threats compound.

Fortunately, scientists studying these trends began to realize that urban forests needed more active management. Instead of placing blame on the passive management approaches of the past, it is better to focus on the increasing commitments in many of the world's cities to protect and restore healthy, urban forests. To uphold this new science, the 20-Year Plan recommends investing in—and is committed to—the active management of Shoreline's urban forest. Trees now are recognized as city and community assets—also known as “green infrastructure”—and need to be maintained as such with attendant planning, policy, and budgeting.

Unfortunately, the level of need to care for and actively manage Shoreline's urban forest exceeds current city staffing and funding. The diversity of forest-cover types, land uses, population densities, and land ownerships across urban areas calls for complex, long-term urban-forest-management plans (Dwyer et al. 2000). This 20-Year Plan is one step toward whole-forest management for Shoreline. The Partnership will prioritize this management and be creative in securing

resources to assist with management and maintenance. By pursuing a more structured effort to manage the urban forest, the Partnership seeks to leverage additional partner investment and volunteer engagement to meet this need. By having the community work together, we can help Shoreline's urban forest thrive.

## What is Active Management?

*Urban forests are different than other natural areas. As a result of development, more light enters the urban forest in certain areas. People bring in seeds on their clothes and shoes. And because an urban forest exists in small islands, it may have issues with pollination and regeneration. Meeting these needs and keeping these special forests healthy requires more human intervention. Some examples include removing invasive plants, planting native plants, watering, mulching, stabilizing stream banks, removing garbage or yard waste, maintaining trails, and regular monitoring of new problems that may arise. We refer to these activities as “active management,” thus acknowledging that care for our urban forests requires a dynamic, hands-on community effort to counteract the unique pressures they face.*



PHOTO: JIM AVERY

# CHAPTER 4. UNDERSTANDING THE CHALLENGE IN CONTEXT

To fully understand the challenges and needs of Shoreline’s urban forests, the Partnership referred to community feedback gathered during the process of creating the UFSP related to how and where residents wanted the Partnership to work. The Partnership also obtained feedback from volunteers and stewards currently working in Shoreline’s parks to better understand how the Partnership can support their work into the future. Considering this feedback, the Partnership plans to address resident and volunteer needs to provide healthy forested parklands and natural areas that are accessible and beneficial to all.

We know that people living near parks and green space have less mental distress, are more physically active, and have extended life spans (USDA Forest Service 2018). Higher tree density in urban areas also is associated with decreased risk of depression (Astell-Burt et al. 2014). When people live more than 1 kilometer (0.6 miles) away from green space (or blue space, such as beaches), they report a 42% increase in stress levels (Stigsdotter et al. 2010). Every 1% increase in a city’s useable or total green space results in a 4% lower rate of anxiety/mood disorder treatment (Nutsford et al. 2013).

## What is Environmental Justice?

*Some environmental factors, such as canopy cover and pollution, are disproportionately distributed across populations of people. The U.S. Environmental Protection Agency (EPA) recognizes that negative environmental factors are concentrated in areas where there are low-income earners, a majority of people of color, immigrant communities, and the elderly. As defined by the EPA, environmental justice is “the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.” The EPA says environmental justice is achieved “when everyone enjoys the same degree of protection from environmental and health hazards, and equal access to the decision-making process to have a healthy environment in which to live, learn, and work.”*

The data paints a clear picture: If communities are concerned with mental health and wellness, air pollution, and other environmental health concerns, they should enhance and preserve green spaces across cities and plant more trees—especially in areas where people live and work.

## COMMUNITY ENGAGEMENT PROCESS

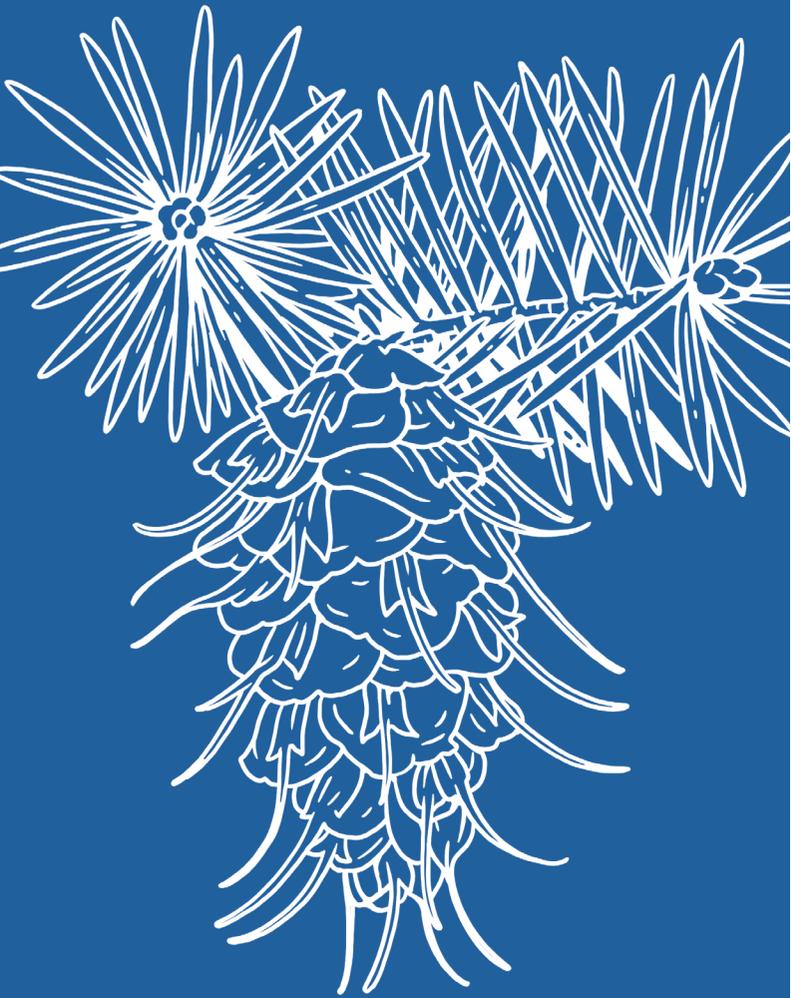
In creating the 20-Year Plan, the Partnership wanted to ensure that community perspectives helped inform our priorities and activities from the outset.

The City of Shoreline conducted extensive community outreach while writing the UFSP in 2014 and hosted numerous open houses as a way for residents to provide input regarding what they would like to see prioritized for their urban forests. Primary feedback from these open houses included:

- Valuing trees for all of their benefits.
- Increasing canopy cover.
- Prioritizing and increasing native plantings throughout the city.
- Allocating a larger budget for tree and forest management.
- Investing in invasive plant removal.
- Supporting volunteers.

In 2016 the City of Shoreline partnered with ETC Institute to conduct a citizen survey to better understand residents’ priorities for parks, recreation, and educational services. From this survey, it was clear that increasing access to and maintaining city parks and natural areas is a high priority for Shoreline residents. Sixty-nine percent (69%) or 14,824 households indicated they have a need for small neighborhood parks. Other most needed facilities include: nature trails (69% or 14,696 households), paved walking/biking trails (68% or 14,439 households), natural areas (63% or 13,521 households), and large community parks (61% or 13,051 households) (ETC Institute, 2016).

Forterra also conducted outreach during the official Partnership kickoff meeting held in March 2019. Attendees at this meeting included volunteers, stewards, and “Friends of” groups already actively working in Shoreline’s parks.



Questions centered around volunteer recruitment, resources, and contracting at their parks. Primary points included:

- Providing venues where dedicated stewards can come together to share information and build positive relationships.
- Increasing steward participation in parks.
- Formalizing tracking and reporting for volunteer involvement and restoration activities.
- Providing easier access to city tools and resources.
- Centralizing volunteer recruitment.
- Branding for the Green Shoreline Partnership.
- Funding for plants, volunteer event supplies, and contractor work on sites.
- Providing professional help for areas with noxious weeds and steep slopes.

Under a unified Green Shoreline Partnership, these needs addressed by residents and volunteers will be directly met through the 20-Year Plan's Community, Field, and Resource Objectives (Chapter 7). Further community feedback regarding the Partnership can be found listed in Appendix N.



PHOTO: HEATHER VAN STEENBURGH



# CHAPTER 5. MEETING THE CHALLENGE

## MISSION AND VISION

The Green Shoreline Partnership has a vision to create a sustainable network of healthy forested parklands and natural areas in Shoreline, supported by an aware and engaged community. The Partnership will be a collaborative effort bringing together Forterra, the City of Shoreline, private landowners, government agencies, nonprofit organizations, educational institutions, local businesses, and the Shoreline community at large. The Partnership's vision is a city with healthy forested parks and natural areas, and an engaged community invested in its urban environment. This vision will serve directly as an adaptive management strategy to address the future impacts of climate change.

A healthy urban forest contains multi-aged canopies of trees throughout the city, where invasive plants pose a low threat and, where appropriate, a diverse assemblage of plants provides a multitude of benefits to the ecosystem (Figure 2). Sustainable urban forests are distributed equitably throughout the city, are not concentrated solely in areas of prosperity, and are supported by both city staff and the community (Endreny 2018).

## OUTCOMES

Achievement of the Green Shoreline Partnership's long-term vision is important and beneficial in a variety of ways.

The Partnership will help preserve, restore, and maintain Shoreline's forested parklands and natural areas with their many benefits, while at the same time educating and engaging the community to support the city in caring for these spaces. Specifically, the Partnership anticipates that during the next 20 years, the following outcomes will occur:

1. All 271 of Shoreline's public forested and natural area parklands enrolled in restoration and active maintenance by 2038.
2. A restoration program with the capacity for long-term stewardship of forested parks and natural areas; increased public awareness of—and engagement in—protecting, restoring, and maintaining healthy habitats.
3. A robust Green Shoreline steward program, with at least one steward in each natural area park and dedicated staff to recruit, train, and retain volunteer stewardship leaders.
4. A successful volunteer program that engages a diverse community of individuals and families, schools, businesses and nonprofit organizations.
5. Protection of critical forest and natural areas that provide important ecological and public benefits.
6. Sustainable funding, operations, and field staff resources to accomplish long-term restoration objectives.

PHOTO: JIM AVERY



## If forested parklands are restored

Actively removing invasive vegetation and planting native trees, shrubs, and groundcover will return urban natural areas to a more sustainable condition. In 100 years, they will provide the city with valuable functions and better resist invasive plant infestations.



### PRESENT

Many areas of forested parks are dominated by short-lived deciduous trees, such as big-leaf maples, nearing the end of their life. Invasive plants, such as English ivy and Himalayan blackberry, smother native vegetation and prevent natural regeneration.

### IN 20 YEARS

Through restoration efforts and long-term maintenance, the aggressive invasive plants are removed. Native emergent plants are planted in wetlands, and shrubs and evergreen trees, like Douglas fir and Western hemlock, are planted in upland forests.

### IN 50 YEARS

As native plants grow, they shade out sun-loving invasive plants. Native vegetation thrives in a diverse mosaic of species suited to the habitat type, in concert with local wildlife. Ecosystem functions and services are restored.

### IN 100 YEARS

With continued stewardship, the maturing wetlands, streams, meadows, and forests require less annual care and provide greater benefits to the city.

**Figure 2: Potential of Forest if Restored**

## GOALS

For the Green Shoreline Partnership’s mission to succeed and for its vision and desired outcomes to become a reality, certain goals must be achieved during the next 20 years. Eight goals, along with measurable benchmarks (Chapter 8 & Appendix E), were developed based on current habitat conditions, current capacity to support restoration efforts, and the experience of other partnerships in the Green Cities Network. Chapter 8, “Adaptive Management,” describes the process of monitoring and tracking the program’s success in more detail. The goals are:

1. Identify priority sites for restoration and active management of already existing urban forest, and work to replace aging canopy cover in those areas by developing stewardship plans for priority sites.
2. Host community events that foster the use, enjoyment of, and connection with Shoreline’s forested parks and natural areas in ways that are relevant to its diverse community, and encourage stewardship, connection, and education.
3. Recruit, retain, and support volunteers in meaningful restoration and enhancement projects in local parks and throughout the city.
4. Support and maintain a stewardship program that empowers a growing number of dedicated participants to take a leadership role in restoration of the city’s parks and community forest.
5. Identify areas where skilled field crews are necessary, and work collaboratively as a Partnership to fund, support, and complete that work.

6. Build collaborative working relationships among government agencies, nonprofits, schools, and other partners.
7. Establish resources to sustain the program for the long term.
8. Celebrate the Partnership's accomplishments.

## PARTNERS

### Partnership Roles and Responsibilities

Based on the experience of the other Green Cities, this section describes a management-structure model that has been modified for the Green Shoreline Partnership (described in Table 2). The structure is intended to support several thousand community volunteers, city and nonprofit staff, and skilled field crews, all of whom will implement the Partnership by performing the work needed to achieve plan goals. In the Partnership's first two years of implementation, a primary task will be planning and prioritizing projects. The Partnership's leadership, or Management Team, will work to achieve plan goals through: guiding the program's planning and implementation; ensuring quality programming and fieldwork; and pursuing, securing, and allocating resources. Working collaboratively as a Management Team, both Forterra and the city can strategically grow the leadership to include representatives from other stakeholder agencies and other environmental nonprofits. All three program areas (community, field, and resources) should be part of this team's scope, including tracking and reporting each area's progress. In the first five years, the focus is on building and supporting a volunteer base, spreading program awareness, and demonstrating restoration and planting results on the ground. As community support becomes established, staff time can be reallocated to the fieldwork component, especially for volunteer management and coordination of the work done by stewards and skilled field crews.

Support staff will help facilitate implementation work by coordinating resources and communication across the Partnership. There will also be a need to seek the necessary funding and resources to help meet program goals. The first-year start-up funding from the City of Shoreline is intended to support the Partnership kickoff and the creation of the 20-Year Plan in 2019. Beyond that time, the city will need to consider ways to fund the work of the Partnership. It is important that the Partnership consider creative ways of funding the work and rely on the Green Cities Network for ideas and tested strategies. Other Green Cities can help provide information

on what has worked for them in securing resources. Partnering organizations, such as Forterra, and businesses can help provide ideas and be an advocate for the city to get the funds to continue this work.

During these initial years, the Green Shoreline Management Team will provide guidance and oversight. If there is enough support from interested Shoreline residents, the Partnership may benefit from establishing a Community Advisory Committee. This committee should include community members and representatives from diverse backgrounds and interests. Potential organizations represented could include advocacy groups, the school district, neighborhood groups, and local corporate sponsors, along with the City of Shoreline and Forterra. The key roles of the Community Advisory Committee could be to advance the Partnership's larger goals, provide guidance regarding budgets and funding, and garner community support.

All of this is designed to provide resources to support and track on-the-ground fieldwork undertaken by volunteers and skilled field crews (city staff, nonprofits, and other professional contractors). Without advance planning and structure for the Green Shoreline Partnership, the fieldwork will not be as successful, efficient, and organized as it should to achieve the Plan's goals during the next 20 years.

### City of Shoreline

The City of Shoreline is the leading entity responsible for convening partners and supporting efforts behind the Green Shoreline Partnership. The City of Shoreline Parks, Recreation & Cultural Services Department currently manages the majority of sites identified within the Green Shoreline project area. While the department currently is at capacity addressing its many duties, its staff will continue to promote additional Green Shoreline Partnership projects and events.

### Forterra

Forterra is dedicated to regional sustainability in all its dimensions—environmental, social, and economic—while securing places across Washington that are keystones of our shared future. This includes the work of the Green City Partnerships Department which support all Green City Partnerships and works to keep all Partnerships connected through the Green Cities Network. The Green Cities Network facilitates quarterly focus groups that are open to all Partnership staff; distributes training, grant, and other announcements via the Network listserv; and offers technical and general assistance to participating Green City partner agencies.

Forterra will continue to be a resource to the city to advance the goals of the Green Shoreline Partnership. Forterra will encourage volunteerism throughout the program, including events like Green Shoreline Day. Forterra also may provide additional skilled field crews, program management, outreach, marketing, development, and greater coordination and connection to the regional Green Cities Network, if needed, through possible future grants or contract funding.

### **Other Organizations**

It is the Partnership’s intent to look for opportunities to collaborate with organizations that share common goals. Reaching out to various nonprofit organizations and community groups that serve the Shoreline area and finding arenas for mutually beneficial work will strengthen and leverage community support for the plan. Additional groups may supplement work performed by Green Shoreline partner agencies in the following capacities:

- Recruit, organize, support, lead, and/or train community volunteers.
- Facilitate involvement of Shoreline residents or civic, business, and community organizations.
- Perform restoration work in areas that cannot be served by volunteers or in areas where the Partnership directs such work.

### **Volunteers and the Community at Large**

Volunteers donate their time to the Partnership by helping restore and enhance Shoreline’s urban forest, leveraging the financial resources of Green Shoreline partner agencies, and allowing more areas to be actively cared for. They bolster community interest and support for local parks and natural areas through their advocacy, and build critical local ownership of—and investment in—public spaces. A key responsibility of the Partnership will be to work with community members to provide training, site-planning assistance, support, and encouragement.

### **WNPS Master Native Plant Stewards and Green Shoreline Stewards**

An active and educated group of stewards is essential to expanding the Partnership’s capacity to work in many parks simultaneously, and will help shape the work to fit the needs of particular communities.

In 2017, the Washington Native Plant Society, Central Puget Sound Chapter launched the Native Plant Stewardship Program in the City of Shoreline. The Shoreline Master

Steward Program provided participants of the program with 100 hours of training in exchange for volunteering in the community doing ecological restoration and educational outreach. The City of Shoreline and King Conservation District funded the majority of the program. Through the program, 21 Master Stewards were trained and now are hosting recurring volunteer events at Boeing Creek, Brugger’s Bog, Hamlin Park, Shoreview Park, and Twin Ponds Park.

Additional stewards have been working informally with the City of Shoreline to conduct restoration work at Paramount Open Space and South Woods.

In order to reach the goal of restoring all 271 acres of Shoreline’s forested parklands and natural areas, individual volunteers and groups will be recruited to help stewards with their forest-restoration projects, with an overarching goal of assigning one steward to each of Shoreline’s forested parks. The goal is that these stewards will host three or four work parties annually in their park. These events will be open to the public and assist in the restoration of Shoreline’s 271 acres of forested parkland.

### **Commercial and Nonprofit Field Crews**

Professional field crews and contractors will complement the work of volunteers in achieving forest-enhancement goals. Professional crews typically focus on steep slopes and other sensitive areas not appropriate for volunteers, or projects that require technical expertise beyond the scope of volunteers, such as mature tree care and pruning. Several local training crews, including EarthCorps and Washington Conservation Corps, provide excellent opportunities to get restoration work done on Green Shoreline sites, along with employment and job-skills development for local residents, especially youth. It is the hope of the Partnership to secure funding for hiring professional crews in areas where it is appropriate or necessary.



## Potential Sponsors

Corporate sponsors will have opportunities to support the Partnership with financial donations and beyond. Many businesses offer their employees opportunities to volunteer for various community projects. Corporations and local businesses will be invited to participate in volunteer restoration events, providing a substantial volunteer labor resource. Sponsors also may be asked to make other contributions as appropriate. For example, businesses could help defray expenses of the Partnership by donating event supplies, coffee, and snacks, or in-kind services such as graphic design, advertising, or event planning. In return, these organizations receive the opportunity to engage with the community and contribute to a healthier, more livable urban environment.

## Private Landowners

Private and public lands create a patchwork of natural areas across the City of Shoreline. Private lands serve as vital connectors between fragmented public green spaces. Many of the pressures on Shoreline's forested parks and natural areas are related to actions on adjacent private land, which can either enhance surrounding public spaces or lead to their degradation. Private landowners also can have a powerful impact on stopping canopy decline and increasing canopy cover.

Landscaping choices and lack of maintenance on private property are major sources of invasive plants that spread to public parks. Illegal dumping of yard waste on park property also leads to the spread of invasive plants and smothers healthy plant communities. Shoreline landowners who live adjacent to forested parks will be encouraged to be more active in the stewardship of their land. Efforts to educate landowners about the benefits of native shrubs and trees, and the problems of invasive species such as English ivy, can play a key role in preventing the continued spread of invasive species throughout the city. Working with landowners through education programs, landowner-incentive stewardship programs, and other complementary programs for private property will help the Partnership generate a community of landowners who care about the well-being of the urban forest, both on their own lands and in public spaces. Engaging these landowners as invested stakeholders will mobilize an important corps of advocates and volunteers to reverse negative trends and improve the health of their private property and the public parks.



PHOTO: JIM AVERY



## History of Partner Involvement

The City of Shoreline has been working actively with partners to address urban forestry needs over the years. Through the Green Shoreline Partnership, these partner efforts will be streamlined and brought under one roof in order to more succinctly achieve citywide restoration goals.

### **EarthCorps**

EarthCorps has a long history of working with Shoreline's Parks and Recreation staff developing and implementing vegetation management plans; designing, constructing and maintaining park trails; and leading volunteer events, including the annual Arbor Day event held each fall. The Partnership will work collaboratively with EarthCorps not only as a contractor, but also as a nonprofit member of the team.

### **The Mountains to Sound Greenway Trust**

The Mountains to Sound Greenway Trust has been working at Ballinger Open Space on an urban forest restoration and carbon sequestration pilot project. Using an innovative funding strategy developed by City Forest Credits, a local nonprofit, trees will continue to be planted and maintained at Ballinger Open Space as part of a pilot project to quantify the many benefits of urban forests, funded in part by Bank of America, The Nature Conservancy, Boeing, Carter Subaru, and King County.

### **Restoration Analytics & Design LLC**

Restoration Analytics & Design LLC (RAD) was founded in 2012 and specializes in ecological restoration through stewardship and community engagement, using methods from the best available science. RAD has been working on forest restoration in Shoreline since 2017 with the WNPS Master Native Plant Stewards trained by the Washington Native Plant Society.

### **Touchstone EcoServices**

Touchstone EcoServices is a natural resource consulting firm that has been working with the City of Shoreline on native habitat restoration at Richmond Beach Saltwater Park since 2006. The firm's expertise in wetland and riparian ecosystems includes evaluation of wildlife habitat, wetland delineation and functional assessment, wetland mitigation and monitoring and permitting assistance, and vegetation management plans. Touchstone EcoServices has provided support in creating stewardship plans and managing volunteer-based restoration activities at Richmond Beach Saltwater Park.



PHOTO: JIM AVERY

## **Sound Transit**

Sound Transit is using an area of Ronald Bog Park for a wetland mitigation site to replace wetlands affected by light rail construction. Enhancements to the park, including trail improvements, will be made as part of the project. This work is being funded by Sound Transit, which will maintain it for 10 years as mitigation for the impact of the light rail in Shoreline.

## **The Nature Conservancy**

Forterra secured a grant from The Nature Conservancy to support the Green Shoreline Partnership from January 2019 to June 2020. The grant focuses on engaging the community in hands-on restoration to plant and care for a healthy urban forest. The funds will go toward on-the-ground restoration and tree planting at Green Shoreline parks in the Thornton Creek Watershed.

## **Washington Native Plant Society**

In 2017, Shoreline partnered with the Washington Native Plant Society and King Conservation District to train volunteer WNPS Master Native Plant Stewards. These stewards were trained in best management practices for restoring forested parks and natural areas, and also in leading community volunteers. The WNPS Master Native Plant Stewards adopted several Shoreline parks and have been leading volunteers and conducting restoration activities.

## **King Conservation District**

King Conservation District has funded many forest restoration projects in the City of Shoreline over the years, and has been a key funder of restoration activities taking place at Richmond Beach Saltwater Park.

PHOTO: JIM AVERY



**TABLE 2 | GREEN SHORELINE PARTNERSHIP MANAGEMENT STRUCTURE**

<p><b>CITY COUNCIL</b> Provides policy for larger Partnership goals and resource allocations</p> <p><b>PARK BOARD</b> Provides advisory guidance</p>			
<p><b>GREEN SHORELINE MANAGEMENT TEAM</b> Implements Partnership goals, creates work plans, tracks accomplishments, and manages the Partnership’s resource allocations. The Parks, Recreation &amp; Cultural Services director provides program oversight and direction. The Management Team collaborates regularly with Parks Maintenance, coordinates restoration activities with Public Works staff, and is responsible for enabling the work in four program areas: Field, Community, Resources, and Administration.</p>			
<p><b>FIELD</b></p> <p>Plans, oversees, and tracks fieldwork, best management practices, and restoration training for volunteer sites and professional crews. Coordinates requests for tools, materials, and assistance.</p>	<p><b>COMMUNITY</b></p> <p>Plans outreach and marketing strategies for recruitment and retention of community volunteers and stewards.</p>	<p><b>RESOURCES</b></p> <p>Tracks budget and contracts, explores and pursues grants and fundraising opportunities.</p>	<p><b>ADMINISTRATION</b></p> <p>Plans and oversees Partnership, develops and implements data management procedures, and compiles annual summary report.</p>
<p><b>PUBLIC</b></p> <ul style="list-style-type: none"> <li>• City of Shoreline management and staff</li> <li>• Skilled field crews</li> <li>• Greater Shoreline community volunteers</li> <li>• Green Shoreline Stewards</li> <li>• Schools</li> </ul>		<p><b>NONPROFITS</b></p> <ul style="list-style-type: none"> <li>• Forterra</li> <li>• EarthCorps</li> <li>• Mountains to Sound Greenway Trust</li> <li>• Others</li> </ul>	<p><b>PRIVATE</b></p> <ul style="list-style-type: none"> <li>• Contractors and consultants</li> <li>• Local business partners</li> <li>• Property owners</li> </ul>

# CHAPTER 6. ASSESSING THE URBAN FOREST

Effective and efficient natural-resource management can be accomplished only if planners, field staff, and decision makers have up-to-date environmental information on which to base their actions. Empowered with clear, systematically collected data, the Partnership will be able to understand on-the-ground conditions, identify the strategies and resources needed to accomplish the work, and identify priorities.

## PARKS AND NATURAL AREAS HEALTH ASSESSMENT

### Tree-riage and the Forest Landscape Assessment Tool

The Green Shoreline Partnership conducted a forest health assessment to characterize habitat conditions across Shoreline's forested parks and natural areas, and developed a citywide restoration plan. Although this work will not meaningfully increase canopy cover, it will ensure that the present canopy cover in these areas is not lost. Other efforts by the City of Shoreline are intended to expand the tree canopy. For the purposes of the 20-Year Plan, when looking at forest health, we assessed parks with large portions of forested area, as well as dense forest and natural areas owned by the city. Combined, this land makes up 271 acres, roughly 4% of Shoreline's total land area.

#### How Big is 271 Acres?

*At 271 acres, the combination of Shoreline's forested and natural area parkland represents an area equivalent to 205 regulation American football fields.*

### Methods

The habitat assessment focused on the 271 acres of forested and natural area parkland owned and managed by the City of Shoreline. The parcels included in the Partnership's scope were those that currently support, or have the potential to

support, (1) native lowland-forest communities with tree-canopy cover greater than 25%, and (2) forested and shrub-dominated wetlands or emergent wetlands that do not support a full tree canopy. While landscaped parks and street trees provide important ecological benefits and should be targeted for maintenance and tree planting where desired, they were not included in this assessment (Figure 3). Open water also was not included in the health assessment.

Baseline ecological data was collected during the summer of 2019 using a rapid-assessment data-collection protocol called the Forest Landscape Assessment Tool (FLAT), developed by the Green Cities Research Alliance (<https://www.fs.usda.gov/pnw/tools/forest-landscape-assessment-tool-flat-rapid-assessment-land-management>). FLAT is based on the "tree-riage" model, originally developed by the Green Seattle Partnership. Tree-riage is a prioritization tool, based on the concept of medical triage, that uses habitat composition (e.g., canopy cover or native plant cover) and invasive plant cover as the two parameters to prioritize restoration (Ciecko et al. 2016).

The FLAT adaptation builds on the existing framework of the tree-riage model to characterize additional habitat attributes beyond tree canopy and invasive plant cover. These include tree age and size class, native understory species present, and indicators of threats to forest health, including low tree-canopy vigor, root rot, mistletoe, and bare soils due to erosion. We also documented the presence of regenerating trees (canopy species less than 5 inches in diameter at breast height), which play an important role in the forest's long-term sustainability. In addition, we deemed each contiguous habitat, or stand, "plantable" or "not plantable" based on whether site conditions were appropriate for tree-seedling establishment. Of the stands surveyed, 210 acres were deemed plantable, which comprises 77% of Green Shoreline's total project area. Following a citywide canopy assessment in 2017, the City found that approximately 1,009 acres of land (14% of total Shoreline's total land area) is not presently occupied by tree canopy but is assessed to be suitable for future tree plantings. The total plantable area in the Green Shoreline Partnership's project area indicates the potential to increase canopy cover and achieve overall City of Shoreline's canopy goals.

Rapid-assessment methodologies such as FLAT produce a snapshot of the overall condition at any one site and on a landscape or city scale. The data serves as a high-level baseline from which finer-scale, site-specific restoration planning can

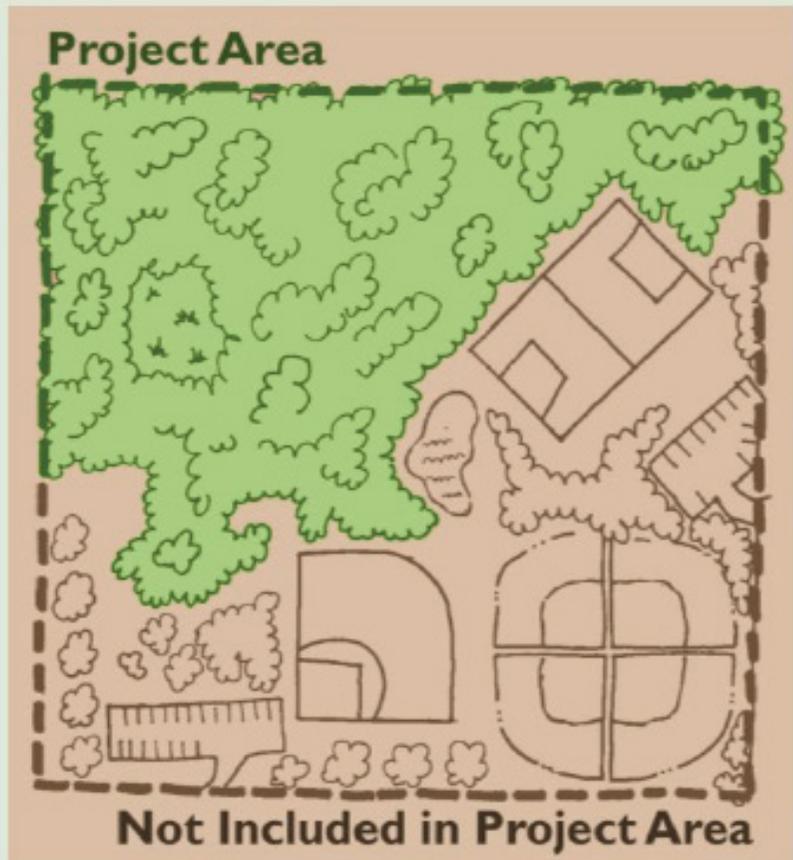
## Defining the Project Area

### Included in the forested parkland project area:

- Forests
- Meadows
- Wetlands
- Streams
- Shorelines
- Buffers

### NOT included in the project area:

- Ball fields
- Playgrounds
- Beaches
- Orchards
- Landscaped gardens
- Open fields
- Mowed stormwater detention ponds
- Hardscaped portions of parks and open spaces e.g., parking lots and hard courts



**Figure 3: How the Green Shoreline Partnership project area was defined**

be conducted. Site-by-site analysis will need to be done as work progresses to help ensure the most appropriate restoration practices and species composition are chosen for each site. Green Shoreline partners will continue to develop more detailed site-level stewardship plans to further assess planting conditions and outline management recommendations as more park sites are prioritized for restoration activities. Many of these stewardship plans have been created through partnerships with King Conservation District, Washington Native Plant Society, and the University of Washington.

Prior to field-data collection, we classified natural areas within the Green Shoreline Partnership project area through digital aerial photo interpretation, dividing each stand into one of five categories: forested, natural, open water, hardscaped, or landscaped. These categorizations were ground-verified in the field and, if necessary, the delineations were corrected and

boundaries were adjusted in GIS. The final delineated stands are referred to as Management Units (MUs). All MUs were assigned unique numbers to be used for restoration planning and data tracking. Since hardscaped and landscaped areas are not suitable for active native-vegetation management, they were removed from the total acreage targeted by the Partnership.

In the field, we surveyed each MU to identify its specific habitat type (e.g., conifer forest, deciduous forest, riparian shrubland, etc.) and to capture information on primary and secondary overstory species and size class, as well as primary and secondary understory species. (Primary refers to those species most abundant in the MU, and secondary refers to the second most abundant species.) See Appendix D for the FLAT-modified data-collection flowchart for the tree-age habitat composition component of the model.

From this data, each MU was assigned a value (high, medium, or low) for habitat composition, according to the following breakdown:

**HIGH:**

MUs with more than 25% native tree-canopy cover, in which evergreen species and/or madrones make up more than 50% of the total canopy.

OR, MUs with more than 25% native tree canopy in partially inundated wetlands that can support 1% to 50% evergreen canopy.

OR, MUs in frequently inundated wetlands that cannot support evergreen/madrone canopy.

**MEDIUM:**

MUs with more than 25% native tree-canopy cover, in which evergreen species and/or madrones make up between 1% and 50% of the total canopy.

OR, MUs with less than 25% native tree canopy in partially inundated wetlands that can support 1% to 50% evergreen/madrone canopy.

**LOW:**

MUs with less than 25% native tree-canopy cover.

OR, forests with more than 25% native tree canopy, in which evergreen species and/or madrones make up 0% of the total canopy.

In addition, each MU was assigned one of the following invasive-cover threat values:

**HIGH:** MUs with more than 50% invasive species cover.

**MEDIUM:** MUs with between 5% and 50% invasive species cover.

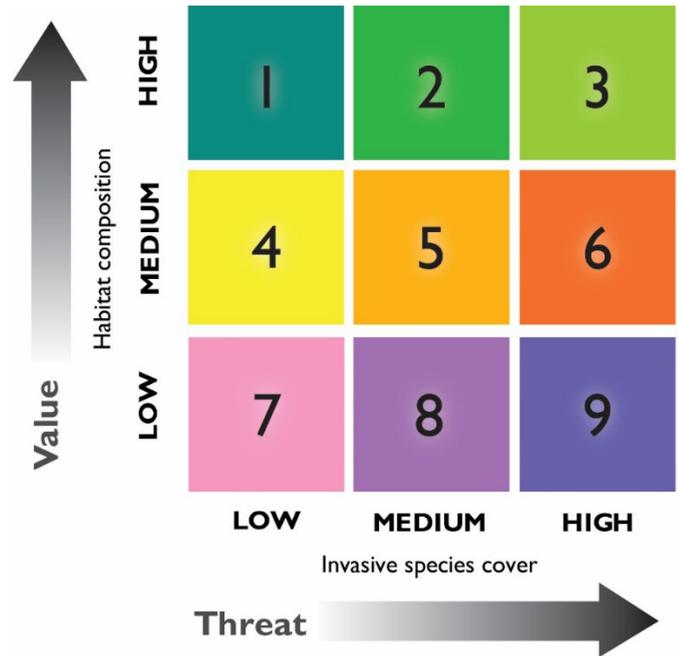
**LOW:** MUs with less than 5% invasive species cover.

**Tree-iage Categories**

After we assigned habitat-composition and invasive-species-cover values, we used a matrix system to assign a tree-iage category or priority rating to each MU (Table 3). Categories range from 1 to 9. One represents high-quality habitat and low invasive-species threat, and 9 represents low-quality habitat and high invasive-species threat. An MU that appears in tree-iage category 3 scored high for habitat value and high for invasive cover threat. MUs scoring low for habitat value and medium for invasive cover threat were assigned to category 8 based on the tree-iage model.

It is important to reiterate that we collected this data to

**TABLE 3 | TREE-IAGE LEGEND**



provide a broad view of the habitat conditions of Shoreline’s forested land and open space. Data collection occurred at the management-unit scale, but because MUs are different sizes (ranging from 0.02 acre to 9.14 acres), we present results here using average conditions associated with each MU. Small pockets within MUs may differ from the average across the stand. When the plan refers to specific data in a given area, the term “MU acre” will be used. Keeping in mind the purpose of the FLAT analysis, this assessment will help prioritize restoration efforts during the next 20 years. The data gathered also will serve as a baseline from which the effectiveness of restoration efforts and the long-term health of Shoreline’s forests and natural areas can be assessed in the future.

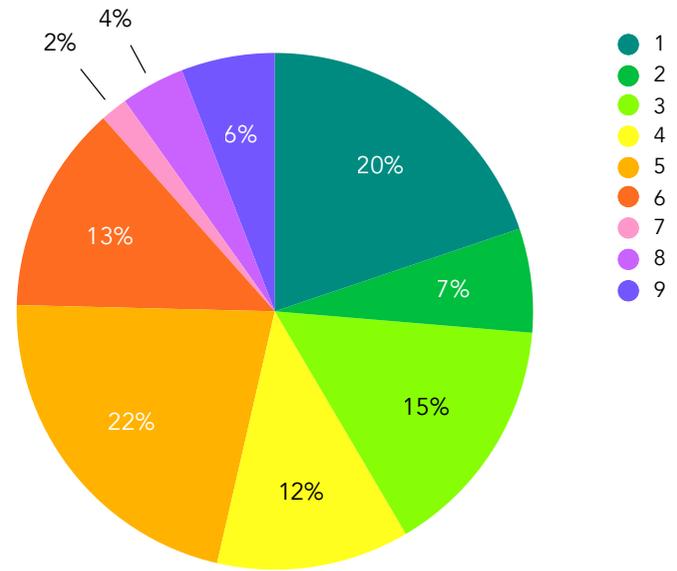
**RESULTS**

**Tree-iage Matrix**

From the data gathered on all MUs during the FLAT assessment, a picture of Shoreline’s forests and natural areas begins to form. Table 4 shows the distribution of acres in each tree-iage category. By summing the acres in each row and column, one can see how much of the total project area (271 acres) currently has low, medium, or high habitat value, and how much currently has low, medium, or high threat from invasive species.

**TABLE 4 | DISTRIBUTION OF ACRES IN EACH TREE-IAGE CATEGORY**

Value ↑	Habitat composition ↑	HIGH	53.72	17.64	41.21
		MEDIUM	32.71	59.07	35.37
		LOW	4.56	10.85	15.90
			LOW	MEDIUM	HIGH
			Invasive species cover →		
			Threat →		



**Figure 4: Acres by Tree-iage Classification**

This data informs the cost model discussed in Chapter 7 and is used to develop high-level cost estimates for the Partnership to consider when planning the next 20 years.

As seen in Table 4, 53.72 of the Green Shoreline Partnership project area is in exceptional condition (tree-iage category 1) with high-value habitat and low invasive-cover threat. All of these acres are in Boeing Creek Park, Cromwell Park, Echo Lake Park, Hamlin Park, Innis Arden Reserve, and Shoreview Park. Looking only at the first axis of the tree-iage matrix, habitat composition, categories 1, 2, and 3 combined represent 42% of the acreage (Figure 4). Of acres surveyed, 47% have medium canopy composition (categories 4, 5, and 6). That leaves a little less than 12% of areas that are in the lowest condition: a 7, 8, or 9 on the tree-iage scale.

The bottom axis of the tree-iage matrix is the threat from invasive species, which is based on the percentage of the MU covered by invasive species (Figure 4). 34% of Shoreline’s forested and natural area parklands have a high invasive species threat (categories 3, 6, and 9). In the project area, 33% falls in the medium category (categories 2, 5, and 8) for invasive species threat. And 33% of land has low invasive species threat (categories 1, 4, and 7). Appendix F lists the tree-iage category acres per MU acre per park.

### Overstory Species

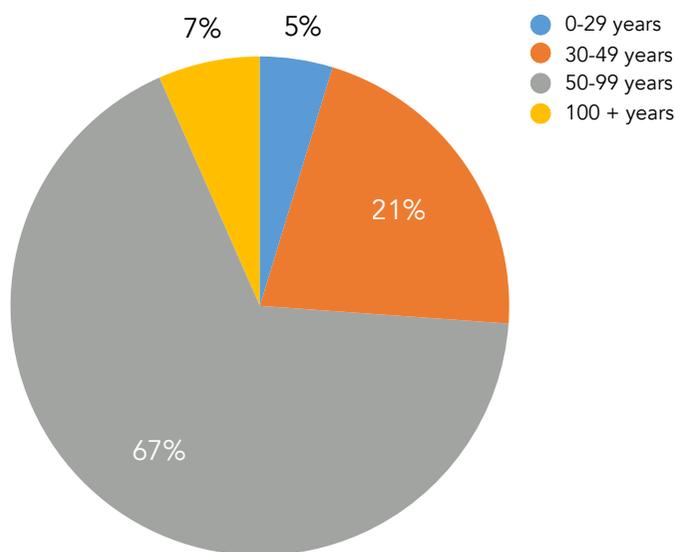
The overall health and long-term management of our urban tree canopy is an important piece in achieving environmental sustainability as a community. The 2019 FLAT results show that 70% of lands surveyed had an overstory that was dominated by coniferous trees, while 30% of lands were dominated by broadleaf trees. Douglas-fir was the dominant overstory tree in more than half (55%) of the surveyed acres, with also a high presence of western redcedar, western hemlock, and western white pine (Figure 6). The high presence of Douglas-fir and the existence of additional coniferous species are of very high value. Coniferous trees often live longer than deciduous species, therefore providing numerous ecological services longer into the future. Conifers also have been known to sequester larger amounts of carbon and lessen stormwater management issues because they keep their foliage year-round.

Bigleaf maple was another dominant overstory species, present in 18% of surveyed acres. Bigleaf maple, although a native species, is characteristic of forest that grew back after logging. In order to increase conifer dominance, the Partnership will help return the forest to a healthier mix by planting more native conifer seedlings.

In Figure 6, primary refers to acres where the species is dominant, secondary is the second most dominant within a given MU, and tertiary is where the species is third most dominant within a given MU, measured in acres of each respective MU.

### Regenerating Overstory Species

The City of Shoreline has identified the importance of age distribution among existing native plants: “Age diversity is key to avoiding mass age-related mortality and to ensure perpetual renewal of the urban forest.” The City has called out a strategy to “develop a regeneration planting plan for the City based on areas needing new planting,” which can be guided by this Plan’s Field Objectives (see Chapter 7).



**Figure 5: Forest Age Class of MU Acres**

Shoreline’s forests are aging, as 67% of forests in the Green Shoreline project area fall within the 50-99 year age class, and 7% in the 100 years and over age class (Figure 5). Only 5% of surveyed forests fall within the 0-29 age class, which indicates that there is little regeneration currently happening in Shoreline’s forested parks and natural areas.

Three MUs, 18 acres of land, had no regenerating species at all, and 31 acres had no secondary regeneration. This poses a large threat of losing canopy cover in Shoreline’s forested parks and natural areas, as well as negatively impacting the overall health of the forest. This lack of regenerating species is potentially due to the inability for natives to reseed because of pressures from invasive species and prior development.

The top five primary regenerating tree species documented were western redcedar, bigleaf maple, Pacific madrone, bitter cherry, and western hemlock. Western redcedar was the most prevalent regenerating tree species in the Green Shoreline project area (Figure 7). Regenerating trees are indicative of the sustainability and future of the forest canopy, as these trees serve as the next generation of dominant overstory in Shoreline’s parks and natural areas. Many of these regenerating species, specifically conifer and evergreen species, are of high value and should be protected through restoration best management practices.

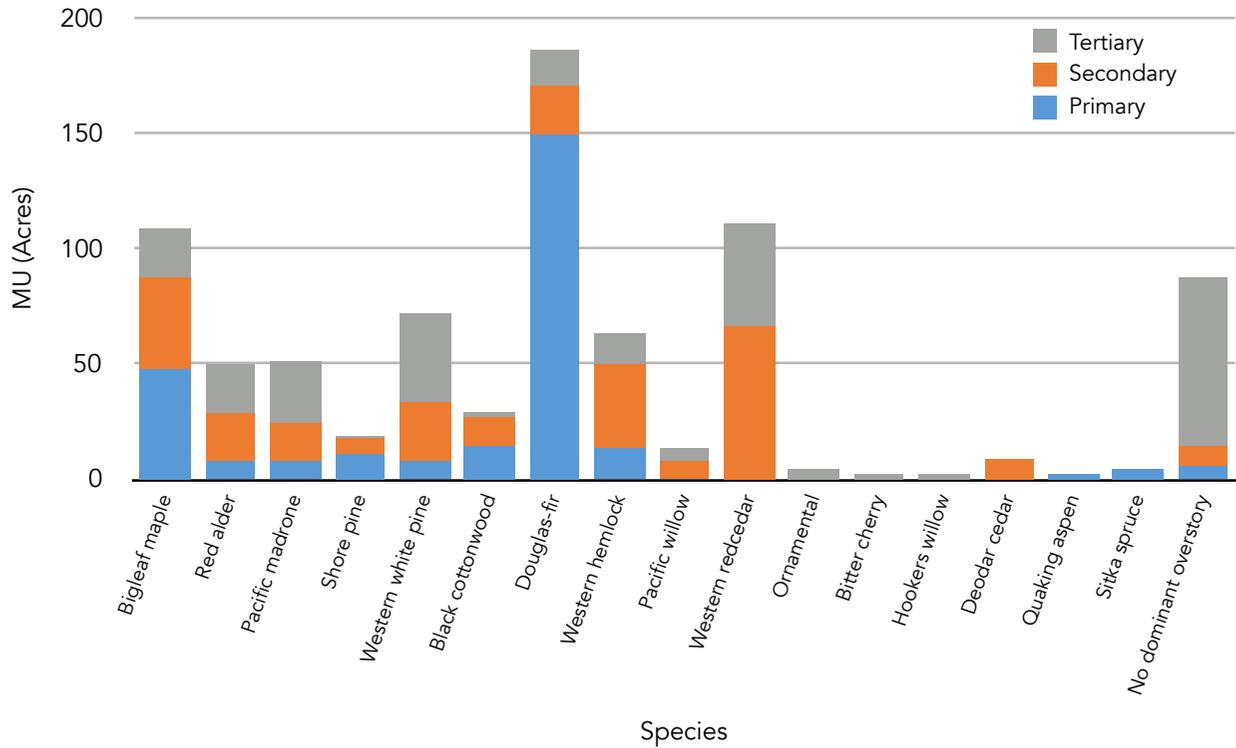
It is important to note that the impacts of climate change are affecting the health of our native plant species, specifically trees. Pests and disease currently are impacting some of the region’s staple native species. For example, experts are observing die-off of western redcedars, noting more prolific impacts due to a pest named the western cedar borer, along with a bark beetle from the beetle family, Scolytidae (Rippey, 2018). With western redcedar as the most common regenerating tree species in Shoreline’s forested parks and natural areas, the Partnership will need to keep a close eye on how these species may be impacted into the future. It is a priority of the Partnership to utilize the best available science to inform site planting lists and restoration activities so that our restoration sites are best adapted to the impending impacts of climate change.

### Native Understory Species

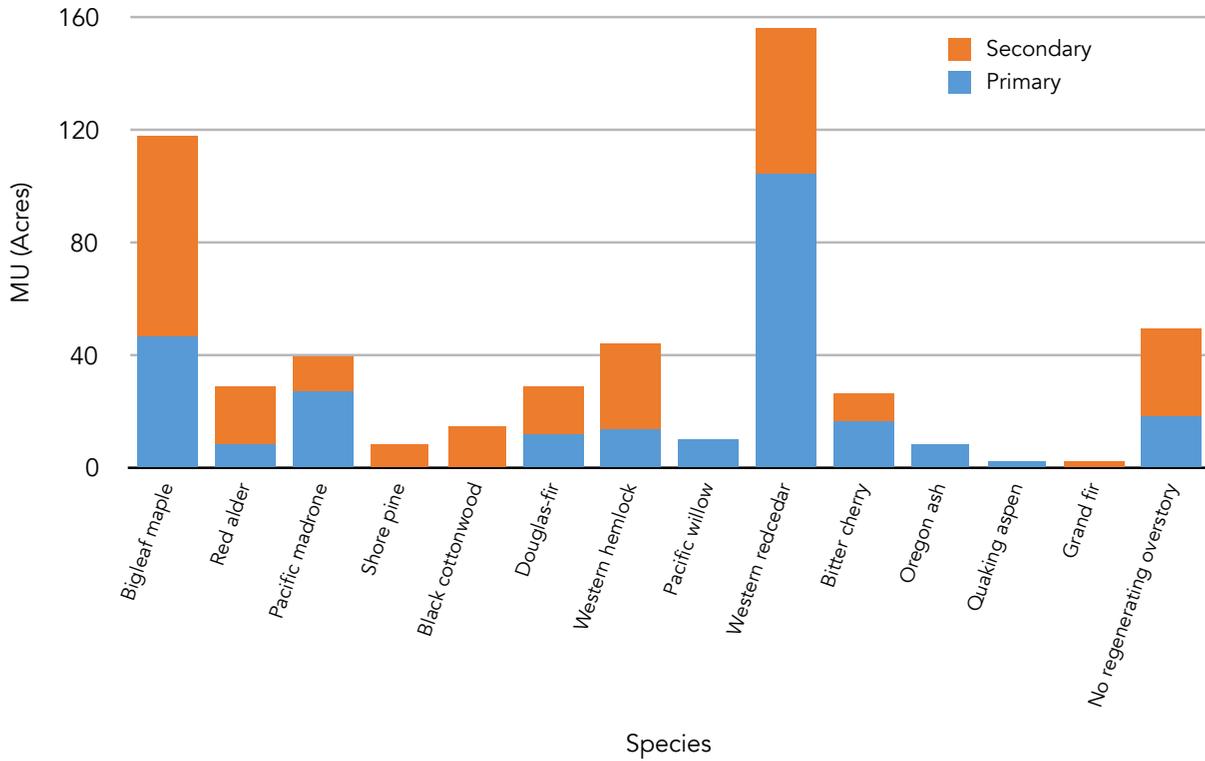
Shoreline’s forested parks and natural areas have a variety of native species in the understory, which contribute to the biodiversity of the urban forest and supports wildlife such as birds and pollinators. Many of these plants produce fruits and seeds that are food for larger animals. Salal, salmonberry, sword fern, native grasses, and snowberry are the most common primary understory plants found in the surveyed sites (Figure 8). For a complete list of native understory species documented during the FLAT assessment, see Appendix H.

### Invasive Species

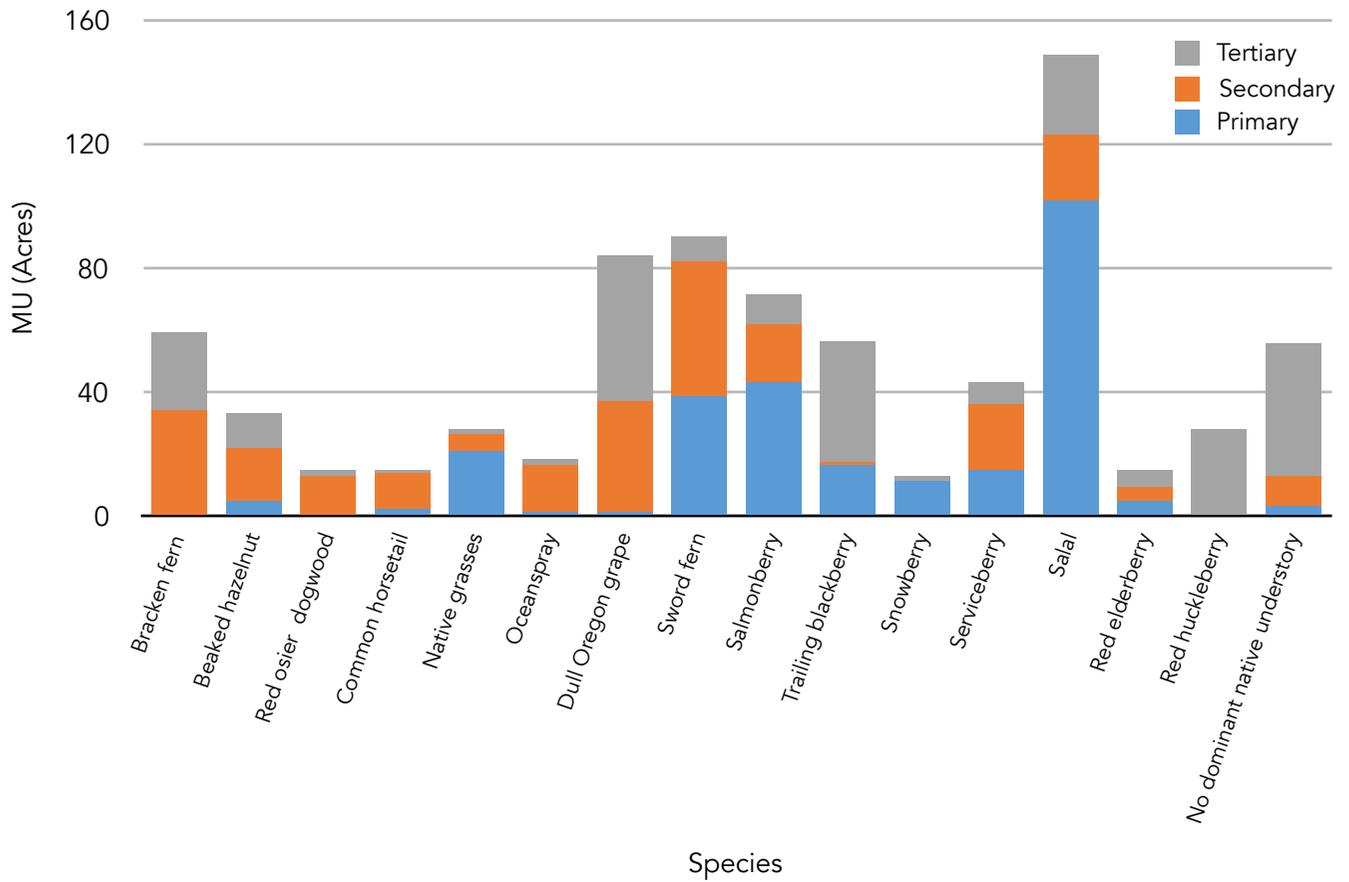
Invasive species pose a very large threat to the understory in Shoreline’s parks and natural areas, but with some intervention, they can be significantly reduced. In the project area, 34% of the acres were categorized as having a high level of invasive cover (more than 50% cover) (Figure 10). This high level of invasive cover poses a large threat to the valuable native species regenerating in Shoreline’s forests, specifically the high number of valuable conifer and evergreen species that are preexisting and regenerating in Shoreline’s forested parks and natural areas.



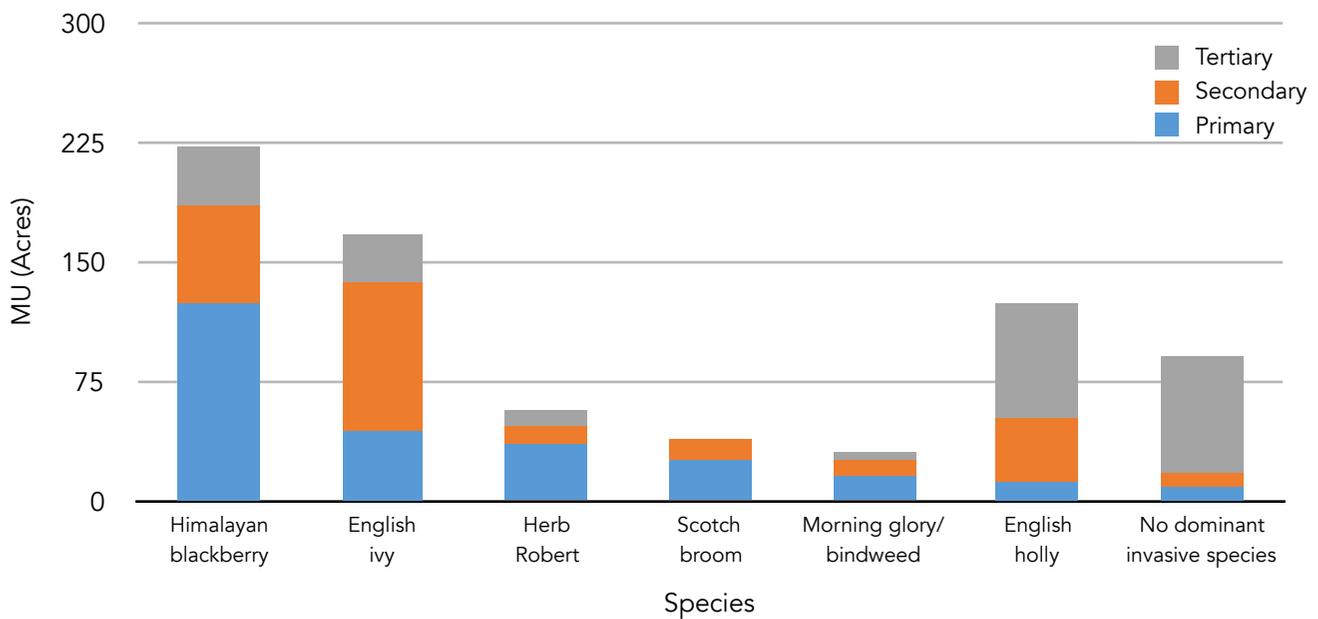
**Figure 6: Distribution of the Dominant Overstory Composition by MU Acres**



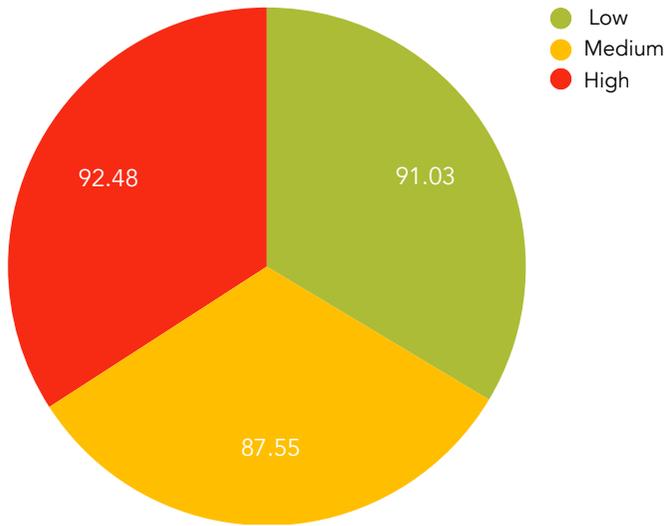
**Figure 7: Distribution of Regenerating Overstory Species by MU Acres**



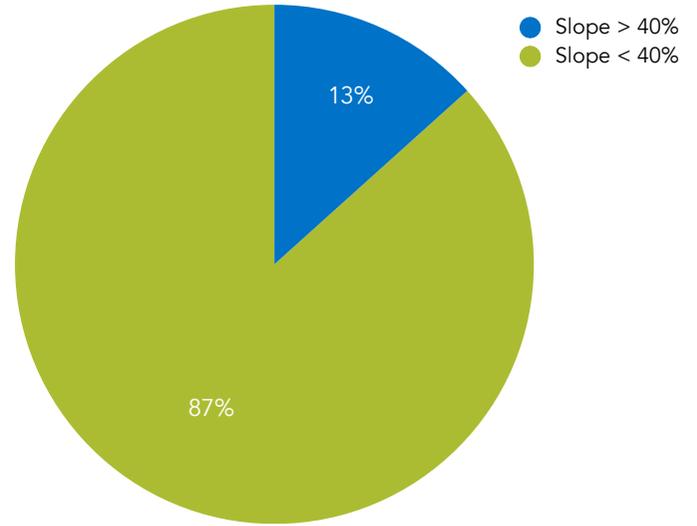
**Figure 8: Distribution of Most Common Native Understory Species across MU Acres**



**Figure 9: Distribution of Most Common Invasive Species across MU Acres**



**Figure 10: Invasive Species Presence across MU Acres**



**Figure 11: Slope of Shoreline's Forested Parkland**

In each MU, the five most abundant invasive species were documented. Figure 9 illustrates the most common invasive plant species across all MUs. Himalayan blackberry, English ivy, and English holly are the biggest threats to Shoreline's forested parks and natural areas. Out of 271 total acres in the project area, Himalayan blackberry was either the primary, secondary, or tertiary invasive species found in 221 acres. English ivy was present on 166 acres, and English holly was present on 124 acres. See Appendix I for a breakdown of all invasive species documented in the FLAT analysis.

## Slope

Slope is another important consideration, as it can make restoration activities more difficult. For safety reasons, volunteers can work only on relatively flat terrain, with even professional crews needing special equipment for very steep work. As a general rule, work on slopes steeper than a 40% grade requires additional professional resources and increases the cost of restoration significantly. According to the FLAT analysis, 13% of the Green Shoreline Partnership project area includes slopes steeper than 40% (Figure 11). Many of these areas have extensive infestations of Himalayan blackberry, which is preventing any native plant regeneration. We suggest that these areas be considered when developing stewardship plans and that professional crews be hired. The cost model in Chapter 7 factors in the need for this specialized experience.



# CHAPTER 7. MOVING FORWARD – THE NEXT 20 YEARS

## FIELD

Green Shoreline will have a primary implementation focus of actively managing the dense forests found in parks and natural areas. Active management of Green Shoreline Partnership sites in parks and other natural areas (Field Objectives 3 to 6) will target removing invasive plants and establishing native vegetation in each site. The citywide habitat assessment of Shoreline’s parks and natural areas will be used to assess progress in acres already enrolled in restoration, characterize baseline ecological site conditions of new acres, prioritize restoration efforts, and guide goal development.

### **Field Objective 1: Prioritize parks and natural open-space sites.**

Tree-iage analysis totaled 271 acres of forested parks and natural open space across 23 Shoreline parks that need various levels of restoration, maintenance, and long-term stewardship. In addition, residents and the City of Shoreline are working together on projects now underway at several sites, including Brugger’s Bog Park, Hamlin Park, Paramount Open Space, Richmond Beach Saltwater Park, Smith Woods, and Twin Ponds Park. The WNPS Master Native Plant Steward program helps connect stewards with park projects, but there are limited resources available to effectively make these efforts collaborative. The goal of the Green Shoreline partnership is to build a comprehensive, citywide framework to coordinate all volunteer sites and projects as part of one single overarching effort.

Restoring and maintaining currently active project areas will continue to be priorities for restoration into the future. The Partnership will prioritize additional sites based on a site’s ecological condition, and community interest and investment (Figure 12). The Partnership also will try to ensure that restoration efforts are distributed throughout the city so they are accessible from every neighborhood. For parks with an interested steward or active volunteer base, sites will be chosen that are appropriate for volunteers (i.e., less than 40% grade), and where tools and restoration materials can be accessed easily. Since community engagement and education are key components in the Partnership’s success, sites with high public visibility and high value to Shoreline residents will be chosen to extend education and program promotion.

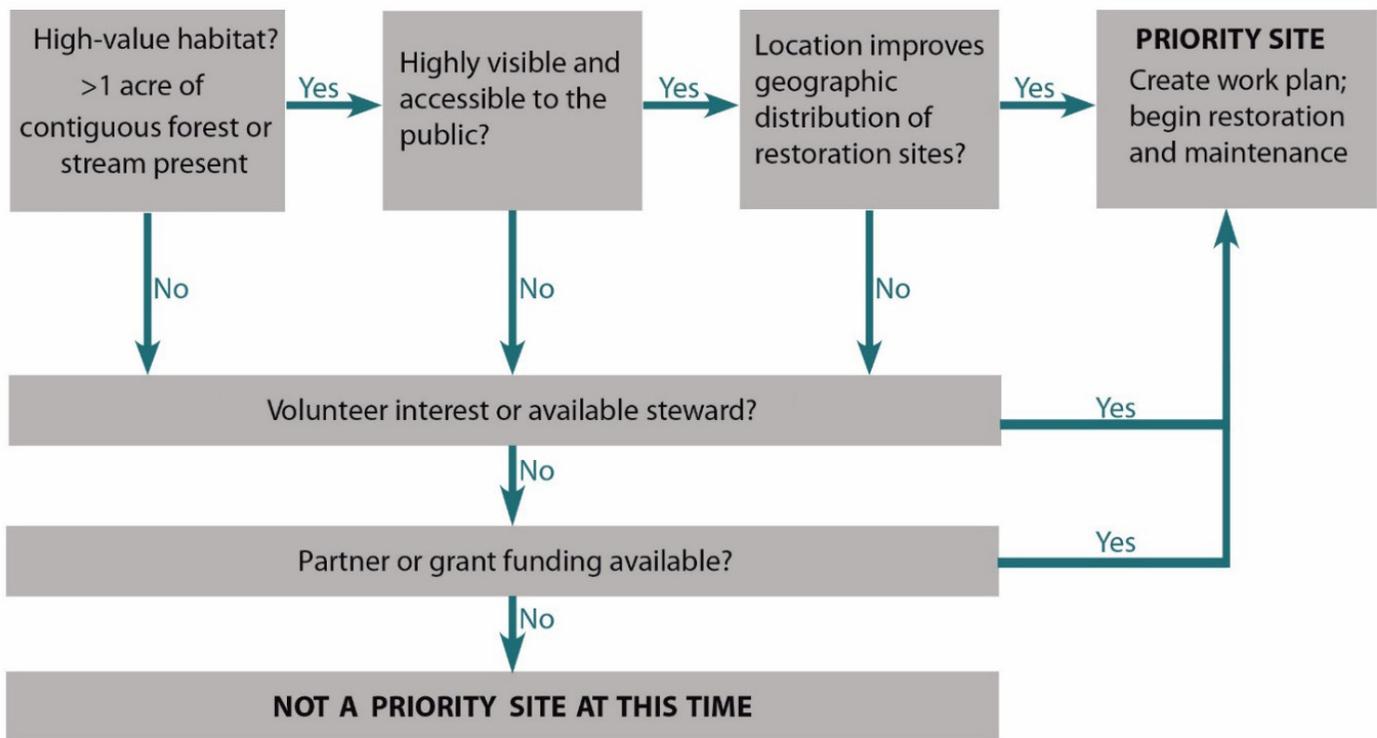
### **Field Objective 2: Prioritize restoration work in management units within sites.**

There are 23 park sites included in the tree-iage analysis, each of which contains management units (MUs) that are assigned one of the nine tree-iage categories. As individual parks are enrolled into active management, forest stands and other natural areas within these sites should be prioritized for annual and multiyear restoration plans. The first priority should be existing projects in order to ensure that prior and current restoration efforts continue moving forward—if they don’t, these areas could revert to pre-work condition. Not only is “backsliding” expensive, it also is particularly discouraging to the public. The second priority is to expand sites already enrolled in restoration by continuing to clear invasive species in areas contiguous with previously cleared sites.

As new sites are brought into restoration, the tree-iage model can be used within parks and sites with multiple MUs as a guide to anticipate needed restoration (Figure 12). For example, MUs with high-quality habitat and few-to-no invasive plants (tree-iage category 1) immediately can be given the protection of annual monitoring and maintenance. Other high-value habitats, including conifer-dominated forests or wetlands made up of a mosaic of native shrubs and emergent plants (tree-iage categories 2 and 3), will be considered high priorities for protection and restoration. Additional factors, such as public access and safety, and the presence of wetlands, streams, or shorelines, also are taken into consideration. Providing maintenance for recently restored sites is a priority as well.

### **Field Objective 3: Identify areas appropriate for professional-crew intervention.**

Not all restoration sites in the Green Shoreline project area are suitable for volunteers. Some require the use of professional, trained field staff. Sensitive areas such as steep slopes, wetlands, and riparian buffers require the expertise of professional crews. In addition, some best management practices (BMPs) require the use of herbicides, such as cut-stump treatments for invasive trees including English holly, English and cherry laurels, or stem injection for knotweed species that aggressively invade critical riparian habitat. A licensed professional staff member must conduct herbicide treatment.



**Figure 12: Decision Tree for Prioritizing Restoration Sites**

Many sites in the identified areas will require this level of expertise – for example, the 13% of targeted sites that have more than a 40% slope. Also, with the need for herbicide intervention, the use of professional crews will be essential to reaching a goal of enrolling all acres in active management. The Partnership will need to assist City of Shoreline staff and others in securing funding for these projects. Crew work already is being done with contracted crews, including EarthCorps, targeting areas and projects not suitable for volunteers. Volunteer work in other units can be used to match these and any other incoming funds. Sites that have support available through the City of Shoreline or otherwise-funded crews will be given priority status for restoration, as well as sites where noxious weed control is mandated by—and has support from—the King County Noxious Weed Control Program ([www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/program-information.aspx](http://www.kingcounty.gov/environment/animalsAndPlants/noxious-weeds/program-information.aspx)).

**Field Objective 4: Implement best practices in restoration and stewardship on all project sites.**

**Best Management Practices**

Restoration ecology is an interdisciplinary science that draws from the fields of ecology, forestry, and landscape horticulture. As more restoration projects are completed in urban environments, field practices are refined and improved. Field experience and best available science will continue to be integrated to improve techniques and restoration success now and in the future. Ongoing restoration projects within the Green Cities Network and other partner natural-resource organizations will inform and guide BMPs for Shoreline’s fieldwork, including site planning, invasive control methods, planting and plant establishment, and volunteer management.

**The Four-Phase Approach to Restoration Fieldwork**

An important BMP, developed by the Green Seattle Partnership, is the four-phase approach to restoration fieldwork, which has proven to be highly successful. It recognizes that restoration activities fall into four major phases, and that, at some sites, it takes several years to move through all of them:

- Phase 1: Invasive plant removal
- Phase 2: Secondary invasive removal and planting
- Phase 3: Plant establishment and follow-up maintenance
- Phase 4: Long-term stewardship and monitoring

These activities are tracked on work logs, and these work logs inform which phase each site is in. The work logs and phases are entered into a database that can be accessed to measure and report progress. As habitat health varies from site to site, and some work is ongoing, not every site will start at Phase 1. Each site, however, will need to receive an on-the-ground assessment before work begins in the appropriate phase.

### **Phase 1: Invasive Plant Removal**

The first phase aims to clear the site of invasive plants, focusing on small areas one at a time in order to ensure thoroughness and minimize regrowth. Specific removal techniques will vary by species (Appendix L) and habitat type, and it may take more than a year to complete the initial removal.

Major invasive-plant reduction will be required on sites with 50% or greater invasive cover (high threat from invasive species: tree-iage categories 3, 6, and 9). Many of these areas will require skilled field crews or special equipment. Given the extent of invasive cover, these sites also will require a large investment of both funding and community volunteers to help ensure restoration success. Areas between 5% and 50% invasive cover (medium threat from invasive species: tree-iage categories 2, 5, and 8) also will require invasive removal. Invasive growth in these spots is patchy. Generally, projects in these sites are appropriate for community volunteers. Areas with 5% invasive cover or less (low threat from invasive species: tree-iage categories 1, 4, and 7) require little or no removal, and Phase 1 work in these areas may simply involve walking through to check that any small invasive growth is caught before it becomes a larger problem.

### **Phase 2: Secondary Invasive Removal and Planting**

Before planting, a second round of invasive removal is done to target any regrowth before it spreads, and to clear the site for young native plants to be established. Staff will develop an appropriate plant palette and work plan for each site on a case-by-case basis.

For example, forested habitats with more than 50% conifer canopy cover (tree-iage categories 1, 2, and 3) will require



PHOTO: JOY WOOD

the least amount of planting but may need to be filled in with ground cover, shrubs, and small trees in the understory. Areas with more than 25% native tree cover but less than 50% conifer cover (tree-iage categories 4, 5, and 6) generally will be filled in with native conifer species. Areas with less than 25% native tree-canopy cover that can support tree canopy cover (tree-iage categories 7, 8, and 9) will require extensive planting with native trees, shrubs, and ground cover. Restoration practices and planting requirements will, of course, vary depending on habitat type and target native-plant population. Most Phase 2 planting projects are appropriate for community volunteers.

**Phase 3: Plant Establishment and Follow-up Maintenance**

This phase repeats invasive plant removal and includes weeding, mulching, and watering newly planted native plants until they are established. Although native plants have adapted to the area’s dry summer climate, installed container plantings and transplanted plants both experience shock, which affects root and shoot health. Therefore, most plants require at least three years of establishment care to help ensure their survival. Sites may stay in phase 3 for many years.

**Phase 4: Long-Term Stewardship and Monitoring**

The final phase is long-term site stewardship, including monitoring by volunteers and professionals to provide information for ongoing maintenance. Monitoring may be as simple as neighborhood volunteers patrolling park trails to find invasive species, or it could involve regular measuring and documentation of various site characteristics and plant survivorship rates. Maintenance typically will consist of spot removal of invasive regrowth and occasional planting where survivorship of existing plants is low. Individual volunteers, or small quarterly or annual work parties, can easily take care of any needs that come up, as long as they are addressed promptly and before problems spread. The number of acres in Phase 4 is programmed to grow every year, with the goal that all 271 acres will be enrolled in the restoration process and graduate to this phase.

Without ongoing, long-term volunteer investment in the monitoring and maintenance of areas in restoration, Shoreline’s natural areas will fall back into an unhealthy state. For that reason, volunteer commitment needs to be paired with city resources. Work plans will integrate the best available science to define optimal plant stock and sizes, watering regimes, soil preparation, and other natural open-space restoration techniques.

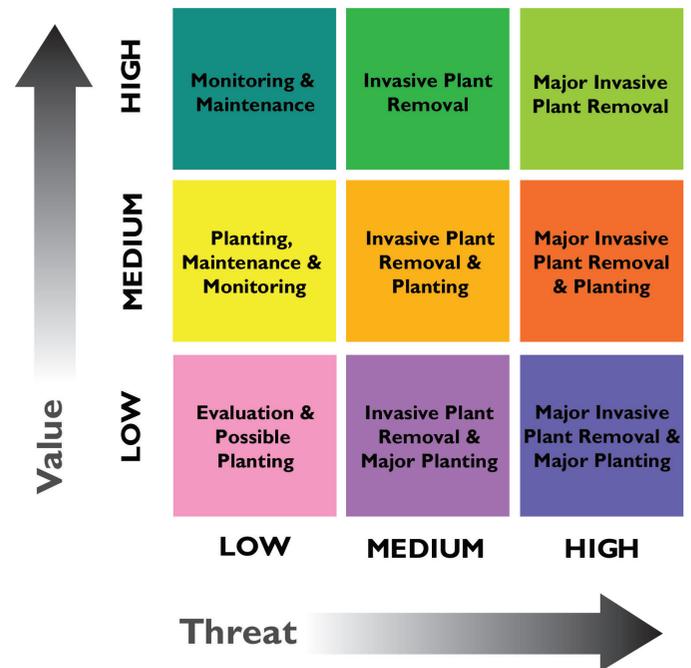
Monitoring will be conducted more frequently in the early phases of the program as the Partnership discovers how the sites respond to restoration. For example, MUs that currently have less than 5% invasive cover and more than 50% native conifer-forest cover or healthy wetland vegetation (tree-iage category 1) would already be in Phase 4 and suitable for enrollment into a monitoring and maintenance plan. Most MUs will need some preliminary restoration in Phases 1, 2, and 3.

In 2012, the Green Cities developed a Regional Standardized Monitoring Program in order to understand the success, value, and effectiveness of restoration activities throughout the partnership. These protocols provide procedures for baseline and long-term data collection that can be replicated to measure changes in site characteristics. The data shows the composition and structure of a site, which can be important indicators of overall habitat health.

**Application to the Tree-iage Categories**

The four-phase approach can be applied to the tree-iage categories as shown in Table 5. Each tree-iage category can be assigned appropriate management strategies.

**TABLE 5 | RESTORATION STRATEGIES AND TREE-IAGE CATEGORIES**



**TREE-IAGE CATEGORY 1:  
High Habitat Composition, Low Invasive Threat**

Acres in project area: 53.72

Condition

This category contains the healthiest forest areas in Shoreline's system of forested parks. Typical stands have more than 50% evergreen canopy. This category includes stands of mature conifers and the mixed conifer/deciduous stands found in forested wetlands. In scrub-shrub or emergent wetland areas, where full conifer coverage would not be appropriate, this category has full cover by native vegetation appropriate to the site. These stands are under low threat because the invasive cover is less than 5%.

Management Strategy: Monitoring and Maintenance

Work is focused on protecting these areas' existing high quality and making sure that invasive plants do not establish themselves.

**TREE-IAGE CATEGORY 2:  
High Habitat Composition, Medium Invasive Threat**

Acres in project area: 17.64

Condition

Similar to category 1, these forest stands contain more than 50% conifer or evergreen broadleaf canopy, or appropriate native wetland vegetation. Forests in this category are at risk because the invasive cover is between 5% and 50%. In these areas, invasive growth is expected to be patchy with diffuse edges. A forest in otherwise good condition but subject to a number of moderate threats may degrade if left untreated. If unattended, this level of invasive coverage could prevent native seedlings from establishing and could compete with existing trees for water and nutrients. The forest would persist in good condition, however, if threats were mitigated in a timely manner.

Management Strategy: Invasive-Plant Removal and Prompt Action

The main activity is removing invasive plants. Typically, these sites also will require site preparation (e.g., mulching) and infill planting. Projects in these areas are appropriate for volunteers. Removing invasive plants from these areas is a very high priority for the first five years.

**TREE-IAGE CATEGORY 3:  
High Habitat Composition, High Invasive Threat**

Acres in project area: 41.21

Condition

As in categories 1 and 2, forest stands in this category have mature conifers, madrones, forested wetlands, or wetland vegetation where appropriate. Category 3 areas have a high threat from greater than 50% invasive cover. A forest in this category is in a high-risk situation and contains many desirable trees or highly valuable habitat or species. If restored, forests in this category can completely recover and persist in the long term.

Management Strategy: Major Invasive-Plant Removal and Prompt Action

Without prompt action, high-quality forest stands could be lost. Category 3 areas require aggressive invasive removal. Soil amendments and replanting are needed in most cases. Restoration efforts in this category are a top priority for the first five years.

**TREE-IAGE CATEGORY 4:  
Medium Habitat Composition, Low Invasive Threat**

Acres in project area: 32.71

Condition

Forests assigned a medium tree-composition value are typically dominated by native deciduous trees but have at least 25% native tree cover. Between 1% and 50% of the canopy is made up of native conifers. In wetland areas not suitable for conifers, these areas have between 1% and 50% cover by appropriate wetland vegetation. Category 4 areas have low levels of invasive plants, covering less than 5% of the MU.

Management Strategy: Planting, Maintenance, and Monitoring

We expect planting in these areas to consist of infilling with native species and establishing conifers to be recruited into the next generation of canopy. Often these sites require some invasive removal and site preparation (e.g., amending with woodchip mulch). Many of these sites may be converted to a conifer forest by the addition of appropriate conifer trees. Addressing category 4 forests is a high priority during the first five years. They offer a high likelihood of success at a minimum investment. These sites are well suited to community-led restoration efforts.



PHOTO: NICOLE MARCOTTE

**TREE-IAGE CATEGORY 5:  
Medium Habitat Composition, Medium Invasive Threat**

Acres in project area: 59.07

Condition

Areas in this category have between 5% and 50% invasive cover. Invasive growth is expected to be patchy with diffuse edges. These areas are estimated to have greater than 25% native canopy cover but less than 50% coniferous or broadleaf evergreen canopy cover. In the case of wetland forests, it is greater than 50% native tree canopy cover. In wetland areas not suitable for conifers, these areas have between 1% and 50% cover by appropriate wetland species. These forest stands contain many desirable native trees that are under threat from invasive plants.

Management Strategy: Invasive-Plant Removal and Planting

These sites will require invasive removal and infill planting. While some restoration work is planned for these areas in the first five years, aggressive efforts are required throughout the life of the Green Shoreline Partnership.

**TREE-IAGE CATEGORY 6:  
Medium Habitat Composition, High Invasive Threat**

Acres in project area: 35.37

Condition

Native deciduous trees typically dominate these areas, which have at least 25% native tree cover. Between 1% and 50% of the canopy is made up of native conifers. In wetland areas not suitable for conifers, these areas have between 1% and 50% cover by appropriate wetland vegetation. Invasive plants cover more than 50% of the MU. A forest that retains important plant elements but already is partially degraded by a high-level risk factor may still have the potential to recover if remediation is prompt. Since these stands are at greater risk than category 5 forests, they also require greater labor investment.

Management Strategy: Major Invasive-Plant Removal and Planting

Extensive invasive removal, site preparation (e.g., amending with woodchip mulch), and replanting with natives are required. Initial invasive removal may be done with the aid of mechanical tools and equipment, and may require professionals. Planting in these areas consists of infilling with native species.

**TREE-IAGE CATEGORY 7:  
Low Habitat Composition, Low Invasive Threat**

Acres in project area: 4.59

Condition

These forests are estimated to have less than 25% native canopy cover in a setting that could support full canopy cover under good conditions. Forested wetlands will have less than 25% trees or shrubs appropriate to the site. Levels of invasive plants are low. Parks in this category may include areas with large canopy gaps (perhaps due to windthrow or die-off of mature deciduous trees), sites of recent landslides, unstable slopes, sites with large amounts of fill, and/or areas dominated by non-native trees.

Management Strategy: Evaluation and Possible Planting

The reasons underlying these sites' low value can differ greatly, and the stands will be addressed on a case-by-case basis. Due to the low levels of invasive plants, restoration may be quite cost-effective in some sites. Sites will be evaluated to determine whether conditions and timing are appropriate to move these areas toward a more native forest and what the appropriate composition of that forest should be. In some cases, it may be desirable to remove non-native trees, especially if they are aggressive. Areas that are ready for conversion to native forest would be a high priority during the first five years.

**TREE-IAGE CATEGORY 8:  
Low Habitat Composition, Medium Invasive Threat**

Acres in project area: 10.85

Condition

Areas estimated to have less than 25% native tree-canopy cover or forested wetlands with less than 25% cover by trees, and 5% to 50% invasive cover fall into this category. Invasive growth in these areas is likely to be patchy with diffuse edges. A forest in this category might be chronically degraded by a variety of threatening processes and might have lost much of its value in terms of habitat quality or species composition.

Management Strategy: Invasive-Plant Removal and Major Planting

Restoration efforts in these areas require a large investment of time and resources. Although some work will be directed here, this is not a priority category for the first five years. The Partnership will support efforts that contain the spread of invasive plants, try out new techniques, or bolster enthusiastic community-led efforts. These sites will require major invasive removal and site preparation, such as mulching and infill planting. Planting within these areas will consist of infilling with native species.

**TREE-IAGE CATEGORY 9:  
Low Habitat Composition, High Invasive Threat**

Acres in project area: 15.90

Condition

Areas estimated to have less than 25% native tree-canopy cover or appropriate forested wetland vegetation and greater than 50% invasive cover fall into this category.

Management Strategy: Major Invasive-Plant Removal and Major Planting

Category 9 sites are not likely to get much worse during the next five years. These sites require many years of major invasive removal and site preparation in the form of mulching and infill planting and will almost definitely require the attention of professionals. Although work will be directed to category 9 forests in the future, this is not a priority category for the first five years. The Partnership will support efforts that contain the spread of invasive plants, try out new techniques, or bolster enthusiastic community-led efforts.

## COMMUNITY

By working together, the residents of Shoreline can help prevent the loss of precious resources. With an active and engaged community, Shoreline not only will be “greener,” it will be a better city for everyone who lives and works there.

### **Community Objective 1: Promote community awareness about, and engagement with, trees in neighborhoods and public spaces.**

Through social media, the Green Shoreline website, large community celebrations, community work parties, tree plantings, trainings, and educational walks, the Partnership will help create excitement about—and advocacy around—our shared urban forest.

Through work parties and other volunteer events, participants can assist the Partnership in enhancing the urban forest by planting new trees and restoring and monitoring project sites in parks. Each event should include: a warm welcome; training on the tasks to be accomplished that day; something warm or cool to drink, depending on the weather; a chance to get to know other volunteers; and an invitation to have some fun. Whenever possible, barriers to participation should be addressed, such as making the event child-friendly, having an interpreter at larger events, planning a variety of tasks that accommodate many ability levels, encouraging rest and hydration, and providing meals or snacks. For tree-related walks and trainings, providing verbal explanations in addition

to printed materials can create a more inclusive event.

It is vital that participants are made to feel welcome in all aspects of the work done by the Partnership. Providing opportunities for diverse community members to connect around a cup of coffee or a newly planted western redcedar are foundational to the Partnership's success. Since so much of this work will take place on public land, it is important for events to be inclusive and welcoming to all.

### **Community Objective 2: Promote positive engagement with parks and natural open space.**

This foundational objective drives most of the Green Shoreline Partnership's work. The Partnership is centered in the belief that Shoreline's residents, employees, and visitors deserve great parks and natural areas, and that they shouldn't have to travel far to get to those places. Natural areas are essential—both for their environmental services and their benefits to health and well-being—to the future of the city and its people.

“Strengthening access to nature” was also called out as a recreation program need in the City of Shoreline's Parks, Recreation & Open Space Plan (2014). The efforts of the Green Shoreline Partnership, and the 20-Year Plan, will address this need directly as the Partnership provides further opportunities for Shoreline residents to access their local parks and natural areas.

Restoration and active maintenance are critical for the enjoyment of these natural areas so that trees can thrive and we don't lose our green spaces altogether. Parks that have been viewed as unsafe or neglected will benefit from the added presence and tender care of volunteers. Well-loved parks will benefit from the diversity of voices in the Green Shoreline Partnership. Volunteer projects that build community among neighbors also increase a sense of ownership over public spaces and foster a special connection to them, in addition to just getting people outside. The Partnership will hold events that get more people out into Shoreline's parks and natural areas, and encourage and inspire them to see these places as the incredible public resources that they are.

### **Community Objective 3: Use Partnership efforts to prioritize and contribute to Shoreline's public safety.**

Safety also is a key priority for the Partnership. Active maintenance and regular community events promote more active use of public spaces. As both volunteers and staff frequent a site, care and stewardship become evident and decrease the sentiment that parks are forgotten, abandoned

places. In addition, providing more “eyes” on the park discourages illegal activity. Volunteers will be provided with training and tools for how to avoid dangerous situations and how best to protect themselves, when necessary.

Green Shoreline projects will utilize Crime Prevention Through Environmental Design (CPTED), a set of landscape-design principles aimed at increasing safety. From relatively straightforward trail-planning and maintenance best practices to optimize safe view corridors to complex challenges for activating spaces, these principles will provide valuable insights. Forterra has developed a CPTED training guide, applicable to both city staff and Green Shoreline Stewards, which applies these principles to forest restoration projects.

### **Community Objective 4: Develop and implement a community outreach and engagement plan to equitably serve Shoreline's residential population.**

Creating programs that are culturally relevant, accessible, and enjoyable for the many people who call Shoreline home will be essential to forming a Partnership that equitably serves this community. By continuing to build relationships with local organizations, community groups, and houses of worship, and by continuing to reach out and listen to local residents, the Partnership hopes to provide a variety of ways to equitably engage.

Community building and an ethic of environmental responsibility are at the core of the Green Shoreline Partnership and the Green Cities Network across Puget Sound. Community members are encouraged to participate in caring for our shared public urban forests and natural areas regardless of age, income, ethnicity, or languages spoken at home. Volunteer restoration projects provide an opportunity for neighbors, classmates, families, friends, and strangers to come together to restore health to their parks, build community through shared experiences, and deepen ties to the natural world and each other.

The Green Shoreline Partnership seeks to build a successful volunteer program by strengthening efforts to provide equitable and inclusive opportunities for the entire Shoreline community. Environmental conservation organizations across the country and here in Puget Sound typically have trouble engaging communities of color, recent immigrants, and low-income families (Taylor 2014). Shoreline's population has become increasingly diverse, with 26% of families speaking a language other than English in their home, most of them in addition to English. According to the U.S. Census Bureau, 20.3% of Shoreline residents in 2017 were not born in the U.S.

In addition to seeking opportunities to work with existing

successful community engagement programs, the Green Shoreline Partnership will need to employ creative strategies of its own during the next 20 years in order to equitably engage the city's diverse population.

### **Community Objective 5: Work with local businesses to encourage corporate support for the Partnership.**

Corporate support will be needed for the Partnership to reach its goals. Local businesses already have been involved in restoration projects in Shoreline and should be called on for advice and future assistance. The Partnership will continue to build on these relationships and expand to work with other businesses as well. Corporate support could come in the form of encouraging employees to volunteer, providing in-kind resources, or financial support through grants and donations. In turn, Partnership staff will support Shoreline businesses, both large and small.

### **Community Objective 6: Seek opportunities to engage youth and provide education.**

The Green Shoreline Partnership will work with Shoreline Public Schools to engage youth in outdoor experiences and environmental stewardship. The Partnership hopes that opportunities like this will serve as pilot projects and guides for other potential collaborations with schools.

Studies have shown that students' productivity and creativity is increased when they experience natural surroundings, due to nature's calming effect and its ability to reduce mental fatigue (Kaplan 1995; Hartig et al. 1991). By working with local partners to provide engagement opportunities for youth of all ages, we seek to create a pathway of engagement from elementary school through high school, and job-skills training for the post-high school years. EarthCorps and Washington Conservation Corps are local training crews for young people, who can make a living while contributing to projects that improve local environmental health. All these programs currently are available to Shoreline youth. The Green Shoreline Partnership will link them together, pursue funding opportunities that would provide support for these efforts, and provide additional opportunities for youth and families to volunteer together in their local parks and green spaces, further improving their access to safe and healthy outdoor public places.

PHOTO: JIM AVERY



## **Community Objective 7: Support and maintain a Steward Program to promote and sustain community leadership.**

Teams of WNPS Master Native Plant Stewards currently are working at Boeing Creek, Brugger's Bog, Hamlin Park, Shoreview Park, and Twin Ponds Park. Unofficial Forest Stewards also have been working with support from the City of Shoreline at Paramount Open Space and Smith Woods. In order to achieve the 20-Year Plan's restoration goals, the Partnership will need to actively recruit and support existing stewards, with the intent of having stewards working in all identified forested parks and natural areas by 2038.

The intent of the Green Shoreline Steward Program is to build an educated, engaged, and active volunteer base around management, monitoring, and stewardship of Shoreline's urban forest. The program provides volunteers with an opportunity to take on leadership responsibilities, expand their skill sets, tackle larger challenges associated with restoration and maintenance, and receive support and guidance to complete projects that improve the health of public spaces they care about.

The Green Shoreline Partnership will support current stewards and actively recruit new ones. Trained stewards will work with the Partnership in the following ways:

- Attend regular training events, including a program orientation and skill-specific training as resources allow.
- Serve as key contacts for the Green Shoreline Partnership projects at their site.
- Organize and lead volunteer events and activities with support from Partnership staff.
- Coordinate with staff to develop site restoration plans.
- Request tools, materials, and assistance as needed.
- Track and report progress on activities through the Partnership's work log.

In turn, the Partnership will support stewards through staff time, resources, and guidance in site planning and restoration work.

## **Community Objective 8: Appreciate volunteers and publicly celebrate Partnership successes.**

The Green Shoreline Partnership will celebrate volunteers' achievements and emphasize the crucial role they play in restoring and maintaining Shoreline's urban forest. Stewards

and volunteers are the heart and soul of the Partnership and are valued for their expertise and the rich, diverse perspectives they bring not only to community engagement, but also on-the-ground stewardship practices. The Partnership will seek advice regularly from volunteers on which best management practices work well and which may need reassessment. The Green Shoreline Partnership will host volunteer appreciation activities, such as an annual celebration for Green Shoreline stewards and at community planting events. The Partnership seeks to find a variety of ways to recognize stewards and other volunteers for their valuable efforts.

## **Community Objective 9: Engage and educate residents and private landowners.**

While stewardship of public forest and natural areas is an important step toward protecting wildlife habitat, improving air and water quality, and providing public recreational opportunities, private properties cover a greater portion of Shoreline's land area. Plantings on private lands can either greatly enhance or greatly degrade the condition of the city's urban forest despite best efforts to restore, maintain, and steward it. For instance, English ivy growing as a border plant in a landowner's backyard can quickly escape into a forested or natural-area park either by spreading beyond the property line or by birds dispersing the seeds. Many invasive species also spread when yard waste is illegally dumped.

Alternatively, landowners can be a great resource for their neighborhood parkland by engaging their neighbors, schools, community groups, clubs, and businesses to help support the Partnership's efforts. Private land also can be a main source for enhancing tree canopy and expanding current forest canopy and habitat. Privately owned forest and natural areas in good health, such as homes, private school grounds, or churches, can serve as important buffers to adjacent public lands and help mitigate habitat fragmentation and edge effects.

Potential ways for the Green Shoreline Partnership to engage private landowners as an important constituency include:

- Developing outreach materials to educate them about the problems facing the urban forest, the benefits of removing invasive species from their property and replacing them with native or non-invasive ornamental species, how to care for trees and recognize hazard trees, and how to get involved in the Partnership.
- Providing information about the Green Shoreline Partnership's efforts on the Partnership's website, in park kiosks, and in neighborhood newsletters and local newspapers.
- Connecting them with programs such as the National

Wildlife Federation’s Certified Wildlife Habitat or Schoolyard Habitats.

- Training them in tree care and best management practices through the Green Shoreline Steward Program.

## RESOURCES

For the purposes of this Plan, Forterra attempted to address the known costs associated with continuing the enhancement of Shoreline’s urban forest by restoring forested parkland over a 20-year time frame.

During the next 20 years (2019–2038), the Partnership estimates at least \$7 million in funding (in 2019 dollars) will be needed, as well as volunteer support, to accomplish the proposed goals. The goal of volunteer investment is more than 74,000 hours over the life of the program. This will leverage an additional value of \$2.3 million as a match to the estimated \$7 million in direct costs. Volunteer time is valued at \$31.72 an hour, based on the 2019 Independent Sector valuation of a volunteer hour in Washington state. This is an ambitious plan that relies on additional resources. The following section provides an overview of the components used to develop

these cost estimates, and identifies resource objectives and strategies to achieve the Partnership’s goals.

## Estimating Program Costs

In 2005, the Green Seattle Partnership estimated the costs of restoring 2,500 acres of forested parkland for a 20-year period. It relied on estimates of past costs for removing invasive species, replanting, and ongoing maintenance, as well as staff needs and costs associated with additional fieldwork, materials, planning, program design and management, funding development, outreach and marketing, and field and office overhead. For the Green Shoreline Partnership, a cost model was adapted from the Green Seattle Partnership’s original estimates (inflated to 2019 dollars), adjusted to reflect the experience of the other Green Cities. Given that Shoreline’s park system is comparatively small, the Green Shoreline Partnership will require lower overall field costs, fewer staff, and lower overhead than the Green Seattle Partnership. For the 20-Year Plan, all cost estimates and leverage volunteer values are listed in 2019 dollars.

Using a cost model that enrolls a percentage of acres from each tree-age category every year over 20 years, the average cost per

**TABLE 6 | ESTIMATED COST OF RESTORATION PER TREE-AGE CATEGORY**

Tree-age Category	Acreage	Average Restoration Cost/Acre	Total Cost per Tree-age Category
1	53.72	\$10,300	\$552,600.00
2	17.64	\$21,700	\$382,700.00
3	41.21	\$30,200	\$1,245,900.00
4	32.71	\$18,400	\$601,400.00
5	59.07	\$24,900	\$1,469,100.00
6	35.37	\$38,500	\$1,361,300.00
7	4.56	\$23,900	\$109,900.00
8	10.85	\$35,500	\$385,500.00
9	15.90	\$51,200	\$813,300.00
<b>TOTAL</b>	<b>271.06</b>		<b>\$6,921,700.00</b>



PHOTO: NICOLE MARCOTTE



acre going through the four phases of restoration and ongoing maintenance can be calculated (Table 6). For the Green Shoreline Partnership, the model estimates that enrolling all 271 acres in active management will cost from \$10,300 per acre for tree-age category 1 acres to \$51,200 per acre for tree-age category 9 acres. This estimate includes projected program and administrative staff costs, plus field supplies and support, with a built-in 15% overhead on field expenses and 7% overhead on staff time. These costs per tree-age category are specific for Shoreline and the length of the program, and will need to be adjusted for use in other areas and program durations.

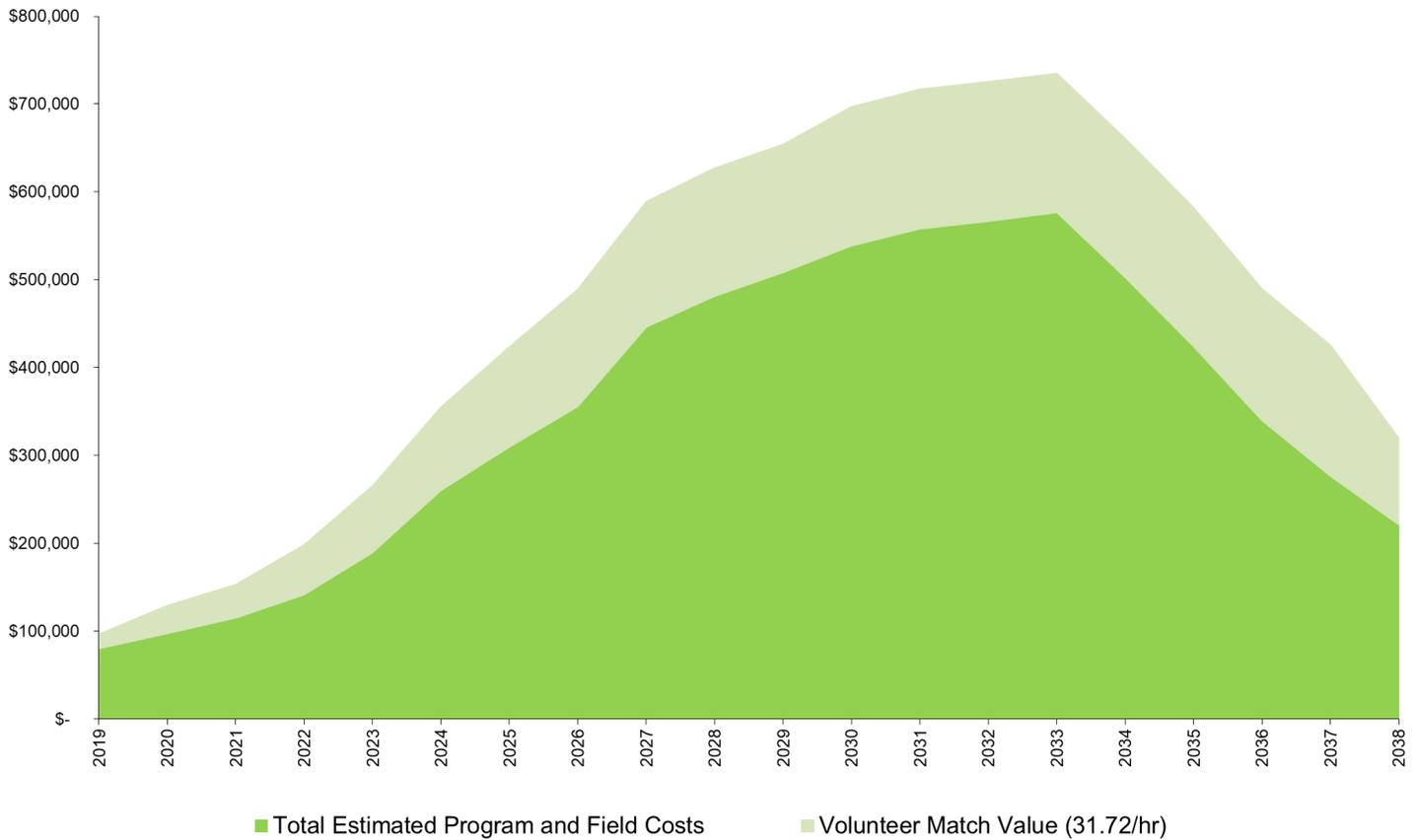
This cost model assessment expands on the City of Shoreline's need for municipal funding and builds on priorities of the UFSP by demonstrating "to City Council the value of the urban forest as an asset of the community to receive recognition as a viable city program." This assessment will help "identify a framework and budget to establish dedicated funding and resources for a city urban forestry program."

The cost per acre for each tree-age category is the total estimated cost from the time it is enrolled until the end of the plan in 2038. For example, the model projects enrolling two new acres in 2019, with a combined first-year program cost of \$80,000 for staff, field expenses, and overhead. The average cost per acre in the first year is higher than in subsequent years due to a higher investment of staff time to set up the program and recruit volunteers. The average annual cost per acre will decrease as the program becomes established and takes on more acres. The cost model accounts for the two acres enrolled in 2019 with subsequent planting, plant establishment, and maintenance during the full 20 years. As more new acres are added each year, the cost model accounts for various phases and maintenance of the total accumulation of acres enrolled.

As noted as a key priority from the City of Shoreline's Parks, Recreation & Open Space Plan, in order to maintain, enhance, and protect the urban forest, a goal was established to restore 10 acres of degraded forest land by 2023. Under the Green Shoreline 20-Year Plan, the Partnership is projected to meet and slightly surpass this goal, with a benchmark of 25 acres under restoration by 2023.

Based on the adjusted estimates, the model forecasts a cost of about \$7 million in 2019 dollars to implement the Green Shoreline Partnership through 2038. Although the total is a high number, the cost of effectively managing these lands solely using commercial crews would be more expensive—and more importantly, would not ensure long-term success from the community taking ownership in the program.

Figure 13 shows the estimated cost per year, along with the value of the match provided by volunteers according to the goals set for our volunteer program.



**Figure 13: 20-Year Projection of Program Costs and Volunteer Match by Year**

**Resource Objective 1: Continue current City of Shoreline funding and build capacity for future growth.**

The cost model projects an estimated cost of \$80,000 in 2020, which peaks at \$576,000 in 2034. In 2019, small portions of the general operating budget for Shoreline’s Parks, Recreation & Cultural Services Department will support activities and events defined by the Green Shoreline Partnership, including sites already in active restoration and management by WNPS Master Native Plant Stewards, additional stewards, and nonprofit partners. Support from Forterra and The Nature Conservancy is set to expire in June 2020, and the City of Shoreline will need to be prepared to secure other funding for the project. Additional funding sources will be needed to reach the targeted 271 acres of active restoration. This is critical in ensuring the success of the Green Shoreline Partnership, while also addressing the UFSP’s goal of securing “funding to provide for a measurable increase in urban forest benefits.” The cost model assessment will be key in demonstrating to the “City Council the value of the urban forest as an asset of the community (and) to receive recognition as a viable city program.”

**Resource Objective 2: Leverage City of Shoreline funds through partnerships and develop long-term funding to support the work.**

There are several partners with the city currently working on restoration projects within the Green Shoreline project area. By bringing in additional partners, strengthening partner relationships, and seeking outside funding to support partners working together, City of Shoreline funds will be leveraged to achieve the 20-Year Plan’s projected outcomes.

Several possible mechanisms could be evaluated for consideration, either separately or in combination, to meet the funding goal, such as:

- Federal, state, and local grants from such entities as King Conservation District, Washington State Recreation and Conservation Office, Washington State Department of Natural Resources, and King County Conservation Futures Program.
- Reallocated and/or increased City of Shoreline departmental funding.

- Establishment of a financial nexus between the restoration and maintenance of forested and natural area parkland and stormwater management or other ecosystem services related to utilities infrastructure.
- Separate state and federal discretionary funding for forest and natural area restoration.
- Market-based mechanisms (e.g., carbon credits and stormwater mitigation), if determined feasible.
- Contributions from local businesses and their employees.

**Resource Objective 3: Provide sufficient staff and resources to support fieldwork, volunteer outreach and management, community engagement, and program administration.**

**Volunteer Management**

Volunteers currently provide more than 1,500 hours of stewardship each year in Shoreline’s parks and natural areas—an amount the Partnership seeks to increase. Many volunteers participate across departments and especially within Parks, Recreation & Cultural Services, but without a database to record this work, there is no way to track restoration or volunteer support. The Green Shoreline Partnership will prioritize data management and tracking in order to successfully convey Partnership successes and accomplishments.

Shoreline’s Parks Department does not currently have a dedicated full-time volunteer coordinator who could manage Green Shoreline volunteers. As the Green Shoreline Partnership approaches its goal of 5,000 volunteer hours at its peak in 2030, experience suggests that at least one employee will need to dedicate at least half time to the partnership, managing and coordinating volunteer restoration efforts. This position would track volunteer time, recognize volunteer achievements, recruit additional volunteers, and also could run the Green Shoreline Steward Program.

Forterra initially will play a major role in volunteer recruitment, along with conducting volunteer events to help incorporate the experience gained through implementing the other Green City Partnerships. As a structure becomes established, the City of Shoreline or another partner can take the lead in volunteer management internally or continue to contract these services with a professional provider.

**Steward Program Management and Training**

In its first full year, the Green Shoreline Partnership will help stewards recruit volunteers, supply plants and resources, and support data tracking efforts. Throughout the 20 years of the Plan, but especially in the first five years, the Partnership will recruit and train additional volunteers who are interested in a higher level of commitment than attending occasional staff-led volunteer events. These stewards will allow the Partnership to increase community leadership on the ground and, therefore, its capacity to reach more restoration sites. Stewards will lead volunteer events, create work plans, track restoration progress, and apply for small grants to manage their sites. This program also will keep regular volunteers interested by providing a challenging and diverse array of work, and increased ownership of the results.

Success will depend on a staff member being able to coordinate the Steward Program, including training new stewards, working with them to develop site plans, providing support and encouragement, coordinating their efforts with other city staff, and keeping track of their accomplishments in relation to Partnership goals. This role could be incorporated into the duties of a volunteer coordinator or filled by a different staff member.

**Recommended Staff Capacity**  
*The Partnership recognizes that adding staff capacity would benefit urban forest management and the Green Shoreline Partnership. A potential full-time or part-time volunteer coordinator position is recommended to manage stewards under the Green Shoreline Partnership and other programs. It would be ideal for this position to be able to assist with all City of Shoreline volunteers and work interdepartmentally. This capacity could be met internally, with additional city staff, or through contracted services.*

**Outreach and Education**

Staff time devoted to education and outreach will be critical in helping increase volunteer capacity and hosting many appreciation and public engagement events each year. In order to reach the broader Shoreline public, a staff person will need to devote a portion of time each week to Green Shoreline Partnership outreach and education. Forterra can help fill some of this role during the program’s first year, or

longer as needed and if resources allow. This person also should coordinate with the City of Shoreline Communications Department for guidance and expertise in how best to equitably engage Shoreline’s residents.

### **Communications and Marketing**

Communications and marketing are linked to the duties of volunteer management, outreach, and education. Forterra will start this work in the first year of the program, and create and implement a communications and marketing plan. This will help the Partnership increase visibility and recruit volunteers, as well as increase the potential for generating additional program funding by reaching a wider audience.

### **Field Restoration**

At current levels, City of Shoreline staffing alone cannot meet the management needs of restoring and maintaining all 271 acres by 2038. Through the Green Shoreline Partnership, partner agencies and community leadership will play a major role in filling the gap. Parks, Recreation & Cultural Services staff will continue to play a lead role in evaluating and managing Shoreline’s forested parks and natural areas, especially as more volunteers are brought in to help with restoration work. In addition to these staff members, the City of Shoreline may contract with skilled crews for some fieldwork on sites that are not appropriate for volunteers, and partner agencies also will either use their own crews or contract out. In the first couple years of the Partnership, training in restoration best management practices and volunteer management will help ensure that all staff are up to speed with the same techniques and approaches being taught to stewards, in addition to crew-specific practices that volunteers are not permitted to perform. This coordination will be one of the functions of the Green Shoreline Management Team.

### **Fund Development and Management**

Stable funding is crucial to supporting the Partnership’s efforts. As has been demonstrated in other Green Cities, thinking creatively about funding sources and how they apply to urban forestry and forest enhancement will benefit the City of Shoreline and the Partnership.

Uniting existing projects can help build a narrative for funders to better understand the important work the city already is doing. Nonprofit partners, such as EarthCorps and Mountains to Sound Greenway that already are working on projects in the Partnership area, could assist the City of Shoreline in applying for grants to cover various portions of the Green Shoreline

Partnership projects. Approval of the 20-Year Plan, in and of itself, could serve as an opportunity to attract funders.

The role of coordinating funding may be large if many small funding sources are compiled, or less intensive if funding is derived from one or a few larger sources. This role may incorporate grantwriting, policy creation, and more.

### **Resource Objective 4: Coordinate efforts by partner staff and volunteers to maximize joint success and share resources.**

Partner agencies—including landowners, the City of Shoreline, Forterra, and others helping to implement the work outlined in the 20-Year Plan—will need to work across ownership boundaries. All partners will need to communicate and coordinate their efforts so the work on the ground and in the community addresses needs in a comprehensive, rather than piecemeal manner. To share resources and avoid duplication, all active partners will meet regularly as a Management Team. The Management Team will hold quarterly meetings in the first year of the Partnership and may meet more often and/or form committees to address certain topics as the Partnership grows. The Management Team also will be in communication with other relevant local groups, such as the Green Cities Network.

### **Resource Objective 5: Deploy skilled field crews, prioritizing those that offer training and job-skills development to Shoreline residents.**

Professional crews will be needed for priority sites that lack sufficient volunteer support or sites with conditions that are unsafe or otherwise inappropriate for volunteers. Some sites containing extreme invasive plant infestations, steep slopes, riparian areas, and wetlands may be better suited to skilled field crews.

The Partnership will seek to contract with organizations that focus on forest-habitat management, prioritizing those that provide training and job-skills development to local residents, especially youth. The following activities will support this objective:

- City and partner staff will work on key management efforts, volunteer support, and training for stewards to increase community capacity.
- Nonprofit and training crews will have priority to be hired, as needed, for fieldwork at difficult sites and occasionally for volunteer management at large events, depending on their expertise. Crews that offer jobs and job training to Shoreline residents will be

further prioritized.

- Private landscaping and habitat restoration companies (commercial crews) will be hired for highly technical projects as budget and need dictate.

### **Volunteer Participation**

*Across 20 years, our goal is for volunteers to provide more than 74,000 hours of work time, valued at \$2.3 million, based on the 2019 Independent Sector valuation of a volunteer hour at \$31.72 in Washington State. To put this number in perspective, if every Shoreline resident contributed just 1.32 hours during the entire 20-year program, the plan would achieve its community engagement goals and restoration goals.*

### **Resource Objective 6: Increase volunteer engagement to leverage support from the community.**

Increased levels of volunteerism will be encouraged. Volunteers who participate in one-day events with a business or community group will be invited to continue their participation in ongoing work parties. Frequent volunteers may be interested in becoming Green Shoreline Stewards to increase their involvement. To do this, there will be a need to keep existing volunteers motivated by showing them how their efforts, in concert with those of many other volunteers, have a significant impact in maintaining and restoring Shoreline's forested parks.

The Partnership provides opportunities for individuals of varying physical ability and time commitment to get involved. There are numerous volunteer activities for those uninterested or unable to participate in physical fieldwork, or require a more flexible schedule. The opportunities include photography, database and administrative work, publicity and marketing, fundraising, sponsor recruitment, community event support, and donating snacks and beverages to work parties.

Diversity within the Partnership will strengthen work efforts and build community. An important component of outreach efforts will involve contacting communities that traditionally have not participated in environmental restoration or stewardship. Outreach to these communities can be increased by working with local groups, youth organizations, schools, and businesses, and looking for ways to collaborate on projects that

offer mutual benefit and culturally relevant ways to participate. Informational signs at park sites can be posted describing the work underway and inviting participation. The existing partnership between the City of Shoreline and Shoreline Public Schools can be strengthened to provide opportunities for students who want to complete community-service requirements within the Green Shoreline project area.

### **Resource Objective 7: Support local businesses.**

The Green Shoreline Partnership offers many opportunities to support Shoreline's economy and local businesses in the following capacities:

- Professional field crews for on-the-ground restoration and stewardship.
- Local businesses to provide refreshments for volunteer and other community events.
- Graphic designers, marketing and outreach specialists, and other professionals to help promote Partnership activities.
- Photographers to help document events.
- Skilled professionals to offer training to staff and volunteers in a wide variety of topics, from plant identification and ecology to ethnobotany, community engagement, and grantwriting.
- Engagement opportunities, including corporate donations and volunteering, for businesses to get their name out in front of the community and offer team-building activities.

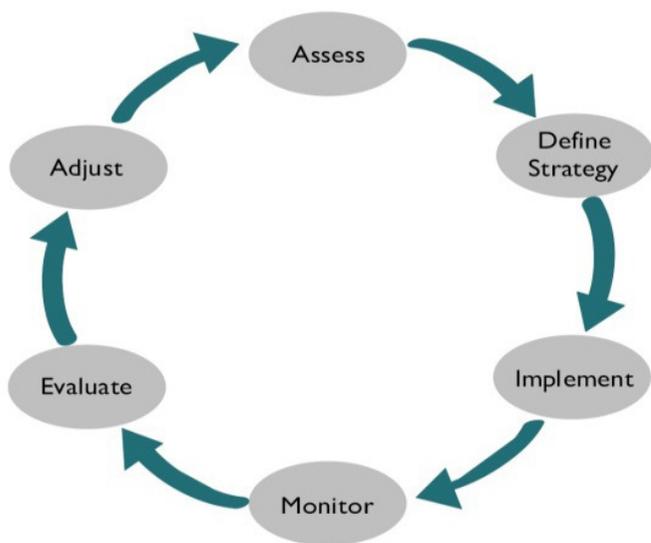


# CHAPTER 8. ADAPTIVE MANAGEMENT

Adaptive management is the process of hypothesizing how an ecosystem works, monitoring the results of actions taken, comparing these observations with expectations, and modifying management plans and procedures to better achieve objectives. The process systematically improves management policies and practices. It is a repeating cycle of six steps (Figure 14):

1. The theory of how the system works
2. Strategy development
3. Implementation
4. Monitoring
5. Evaluation
6. Strategy adjustment

Once we have taken actions, managers use monitoring and evaluation to determine how our actions have affected the system and use that data to adapt our understanding of how the system works. Once an evaluation is complete, new information gathered from monitoring is used to reassess the problem and develop new strategies as needed. Then implementation, monitoring, and evaluation occur, and the cycle begins again. Adaptive management allows staff to track the resources and community support necessary for accomplishing the fieldwork while considering the changing ecological and social realities of the urban forest.



**Figure 14: Adaptive Management Cycle**

## MEASURING SUCCESS

Program monitoring and field monitoring will help pave the way for the Green Shoreline Partnership to improve its program design and performance. Monitoring analyzes and measures the effectiveness of strategies and techniques used. The results from that monitoring inform Partnership planning and methodologies to achieve continuous improvement. Monitoring and evaluation also will provide accountability to funding sources and supporters, and help ensure that goals and benchmarks are met (See Appendix E).

Table 7 illustrates near-term strategic plans and benchmarks for the primary program elements of implementing the 20-Year Plan: field, community, and resources. By measuring progress toward each objective, we can assess the effectiveness of the implementation and program strategies. The effectiveness of the Partnership needs to be tracked throughout the life of the plan, and using adaptive management, adjustments should be made when necessary.



**TABLE 7 | NEAR-TERM STRATEGIC PLAN AND BENCHMARKS, 2019-2023**

<b>FIELD</b>				
<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
<ul style="list-style-type: none"> <li>Enroll 2 acres into restoration</li> <li>Develop stewardship plans for two priority sites</li> <li>Develop tracking plan and database</li> <li>Prioritize community tree-planting events</li> </ul>	<ul style="list-style-type: none"> <li>Continue work on previously enrolled 2 acres</li> <li>Enroll 3 new acres into restoration</li> <li>Develop stewardship plans for any new sites</li> </ul>	<ul style="list-style-type: none"> <li>Continue work on previously enrolled 5 acres</li> <li>Enroll 4 new acres into restoration</li> <li>Develop stewardship plans for any new sites</li> </ul>	<ul style="list-style-type: none"> <li>Continue work on previously enrolled 9 acres</li> <li>Enroll 6 new acres into restoration</li> <li>Develop stewardship plans for any new sites</li> </ul>	<ul style="list-style-type: none"> <li>Continue work on previously enrolled 15 acres</li> <li>Enroll 10 new acres into restoration</li> <li>Develop stewardship plans for any new sites</li> </ul>
<b>COMMUNITY</b>				
<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
<ul style="list-style-type: none"> <li>Host kickoff community planting events</li> <li>Publicize in local media</li> <li>Develop basic branded outreach and promotional items</li> <li>Host first annual Green Shoreline Day</li> <li>Recruit and manage 500 volunteer hours</li> </ul>	<ul style="list-style-type: none"> <li>Recruit and manage 1,000 volunteer hours</li> <li>Recruit two new stewards and support all active stewards</li> <li>Host trainings for stewards and open them to the public</li> <li>Plan and host signature community planting event</li> <li>Create updated branded outreach and promotional items</li> <li>Host volunteer appreciation event</li> </ul>	<ul style="list-style-type: none"> <li>Recruit and manage 1,200 volunteer hours</li> <li>Recruit two new stewards and support all active stewards</li> <li>Host trainings for stewards and open them to the public</li> <li>Host signature community planting event</li> <li>Host volunteer appreciation event</li> </ul>	<ul style="list-style-type: none"> <li>Recruit and manage 1,800 volunteer hours</li> <li>Recruit two new stewards and support all active stewards</li> <li>Host trainings for stewards and open them to the public</li> <li>Host signature community planting event</li> <li>Host volunteer appreciation event</li> </ul>	<ul style="list-style-type: none"> <li>Recruit and manage 2,400 volunteer hours</li> <li>Recruit two new stewards and support all active stewards</li> <li>Host trainings for stewards and open them to the public</li> <li>Host signature community planting event</li> <li>Host volunteer appreciation event</li> <li>Publicize first five years of work</li> <li>Update community engagement plan</li> </ul>
<b>RESOURCES</b>				
<b>2019</b>	<b>2020</b>	<b>2021</b>	<b>2022</b>	<b>2023</b>
<ul style="list-style-type: none"> <li>Convene agency partners for preliminary coordination meetings</li> <li>Develop 20-Year Forest Management Plan</li> </ul>	<ul style="list-style-type: none"> <li>Establish Management Team of working partners</li> <li>Seek additional partners</li> <li>Identify and pursue funding to support field, community, and administrative work, if needed</li> </ul>	<ul style="list-style-type: none"> <li>Seek additional partners</li> <li>Identify and pursue funding to support field, community, and administrative work, if needed</li> <li>Expand business engagement</li> </ul>	<ul style="list-style-type: none"> <li>Identify and pursue funding to support field, community, and administrative work, if needed</li> <li>Expand capacity for volunteer and community events</li> </ul>	<ul style="list-style-type: none"> <li>Identify and pursue funding to support field, community, and administrative work, if needed</li> <li>Explore options for a more formalized management structure, if needed</li> <li>Review 20-Year Plan benchmarks to make sure the Partnership is utilizing the best available science for establishing program goals</li> </ul>

## PROGRAM EVALUATION

At the close of each year, Green Shoreline Partnership staff will collect data and track progress toward the annual workplan goals and benchmarks using the Centralized Data Repository (CEDAR) database. This database will record information pertinent to these measurements throughout the year, including field and volunteer metrics, so that progress can be summarized easily at year's end. Metrics such as volunteer attendance, retention, and basic demographic information will be used to measure program effectiveness and reach. Field-based metrics will track the number of acres enrolled and the status of those acres. Successes and lessons learned will be shared throughout the Partnership. Progress will be celebrated and effectiveness evaluated.

## FIELD MONITORING

As the field program proceeds, the Partnership will continue to conduct routine monitoring of planting and restoration sites to track the condition and health of restored sites, and gauge progress. On forested land, success will rely on developing and refining effective strategies to remove and control invasive plants and keep newly planted natives healthy. Refining plantings may need to occur if areas change due to climate, development, or other conditions. Newly planted street or community trees will need to be monitored for disease, drought, and other potential threats. Maintenance of these street trees includes regular pruning, removal of aggressive weeds, watering in the dry season, and more.

To monitor fieldwork, new acres will be tracked as they are brought into active restoration and mapped in GIS (Geographic Information System). Volunteer and skilled field crew time will be devoted to revisiting sites that have been previously worked on and assessing their ongoing needs as they move through the four phases of restoration. One component of monitoring is to track plant survival rates. Plant survivorship thresholds are outlined in site-level stewardship plans and may vary depending on site conditions or habitat type. These forests and natural areas always will be subject to pressure from their surroundings. Although the work needed decreases dramatically each year that an area goes through the program, Phase 4 of restoration continues indefinitely.

As the Partnership enrolls more acres in restoration and plants more community trees, tracking successes can become complicated. Managing data entry and paperwork as the program grows has proven to be expensive in other Green Cities. CEDAR's assistance in tracking these projects will greatly reduce the need for staff management and streamline the process of project reporting. Thanks to funding from The Nature Conservancy, the Green Shoreline Partnership is able to use this database.

## RESOURCE DISTRIBUTION

It is assumed that Green Shoreline Partnership funding will continue to be housed entirely within current active partners—the City of Shoreline, Forterra, and The Nature Conservancy—for at least the first year of the program (through December 2020). After that, partner staff will continue to oversee program funding and generate additional public funding, both from the City of Shoreline and non-city sources. Staff also will seek donations from outside sources throughout the duration of the Partnership's 20-year span. The Partnership will allocate funds for the three program areas—field, community, and resources—in proportions that will change over time to help ensure that the program's basic goals are achieved. As it grows from single-site efforts to a systemwide program, the emphasis will shift from funding program development to fieldwork support.

At the front end, resources will be directed toward recruiting and supporting stewards, demonstrating on-the-ground results and success in the field, and hosting highly visible community events that foster engagement with Green Shoreline sites. These activities will ramp up during the first five years (2019–2023) as volunteer efforts grow. Once a strong volunteer program is established, some resources can shift to provide more field support for restoration projects.

As funding allows in the future, the field management budget can expand from funding Partnership staff time and supporting volunteers to include additional skilled field crews.

As visibility and recognition of the Green Shoreline Partnership increase, elevated levels of public and private funding can support increased volunteer participation. The role of volunteers will continue beyond 2038, since parks and natural areas will need ongoing volunteer support and stewardship.

## REPORTING AND KNOWLEDGE SHARING

The Green Shoreline Partnership's progress will be reported annually to the Shoreline City Manager's office, as well as the Shoreline City Council, Shoreline Parks, Recreation & Cultural Services/Tree Board, partners, Green Shoreline Stewards and other volunteers, and the public. Annual work plans will be adjusted in response to available funding, monitoring results, and emerging knowledge of successful restoration techniques.

Partnership staff will utilize creative outreach strategies and network with regional restoration and arborist groups, which will provide an opportunity for staff to share information and learn from other agencies. As a member of the Green Cities Network, the Green Shoreline Partnership will have

opportunities to share successes and challenges with other cities dedicated to a similar goal and vision (including Issaquah, Snoqualmie, Tukwila, SeaTac, Burien, Des Moines, Seattle, Tacoma, Kirkland, Redmond, Kent, Everett, and Puyallup). Written materials, including this 20-Year Plan, will be posted on the Green Shoreline Partnership website ([www.GreenShoreline.org](http://www.GreenShoreline.org)), and all parties using these resources will be given the opportunity to provide feedback on the Partnership's methods and materials.

## LOOKING TO THE FUTURE

City leaders are considering ways to preserve the health of Shoreline's urban forest for generations to come. Restoring Shoreline's forested parklands and natural areas, along with the successful completion of the 20-Year Plan is an important first step in this process. There are additional opportunities that could assist the city in the future:

- Connect and stay up to date with the Green Cities Network and the Green Cities Toolbox in order to explore available tools, best management practices, resources, and funding as they become available.
- Expand the Green Shoreline Partnership model beyond parks to restore, plant trees, and care for other public landscapes, thus encompassing Shoreline's entire urban forest.
- Build upon efforts to increase the City of Shoreline's canopy cover, and to address further objectives outlined in the UFSP and Tree Canopy Assessment.
- Establish a residential tree give-away program to increase tree canopy on private property.
- Increase staff capacity to meet the needs of a growing city and Green Shoreline Partnership in order to retain, and potentially expand the benefits Shoreline currently receives from its urban forest.



PHOTO: JIM AVERY

# CHAPTER 9. REFERENCES AND FURTHER READING

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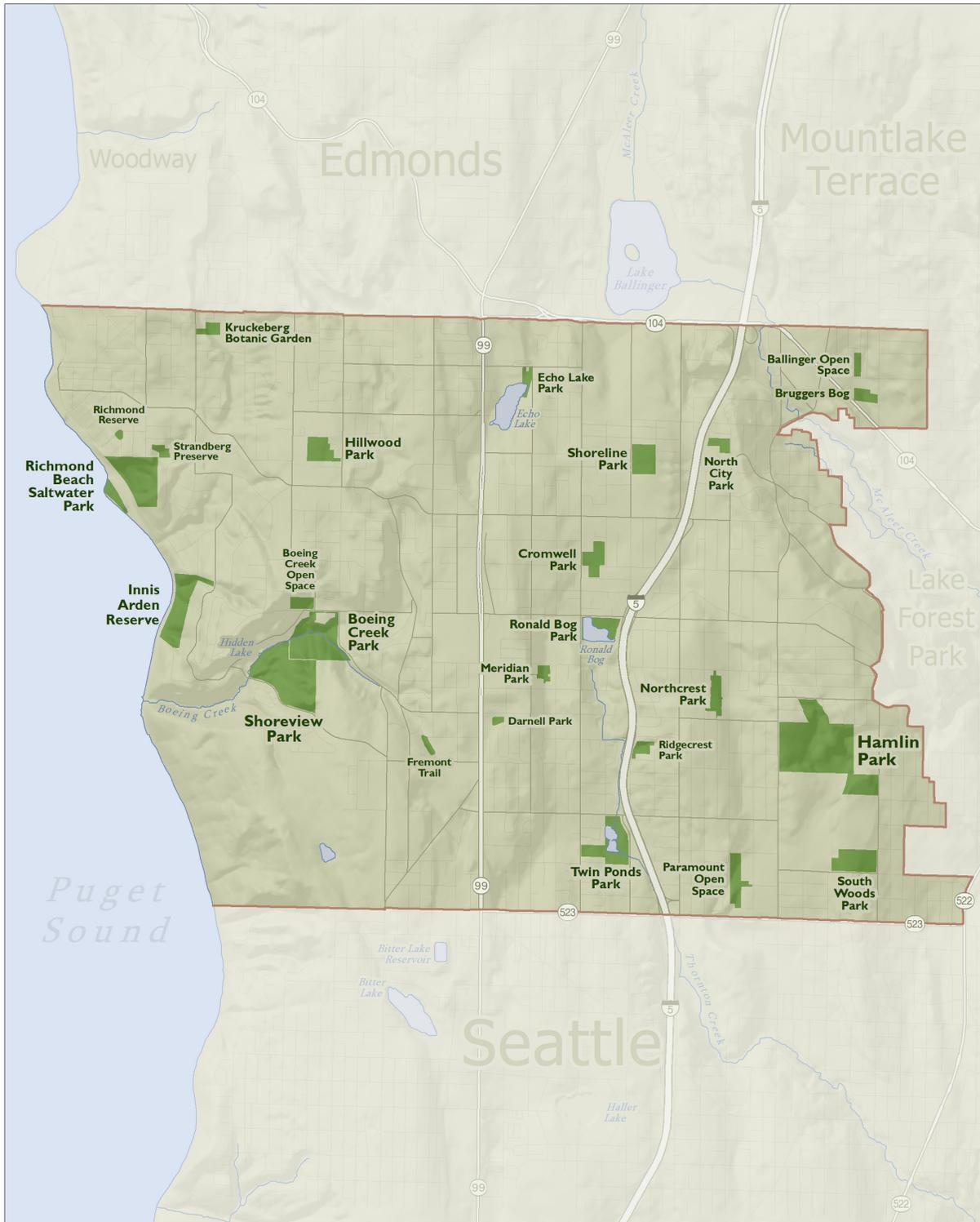
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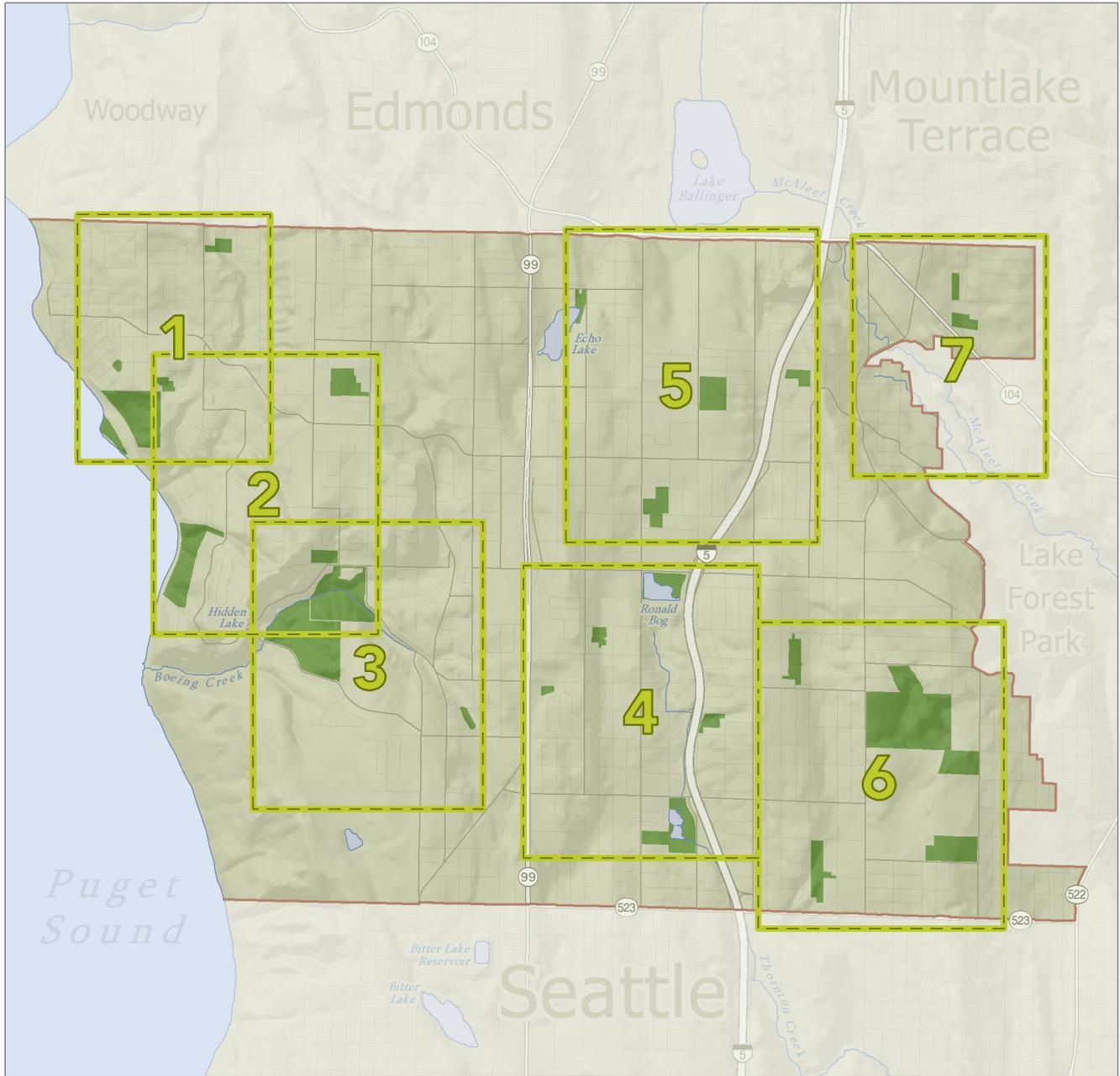


# CHAPTER 10. APPENDICES

## APPENDIX A: DETAILED TREE-IAGE MAPS OF GREEN SHORELINE SITES



Map created by FORTERRA in partnership with the City of Shoreline.

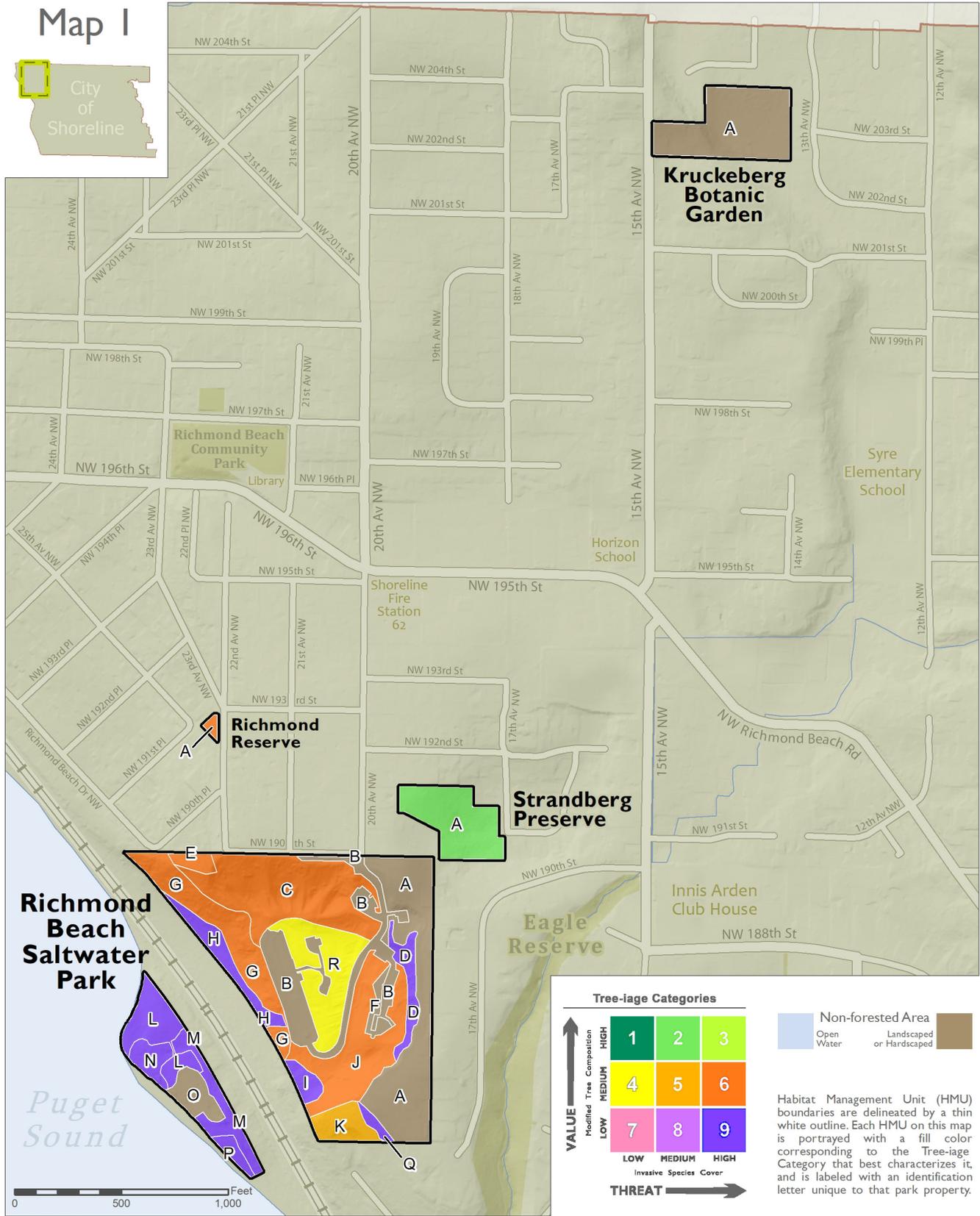


### Key to Individual Site Maps

Site Name	Map Number	Site Name	Map Number	Site Name	Map Number
Ballinger Open Space	7	Hillwood Park	2	Richmond Reserve	1
Boeing Creek Open Space	3, 2	Innis Arden Reserve	2	Ridgecrest Park	4
Boeing Creek Park	3	Kruckeberg Botanic Garden	1	Ronald Bog Park	4
Bruggers Bog	7	Meridian Park	4	Shoreline Park	5
Cromwell Park	5	North City Park	5	Shoreview Park	3
Darnell Park	4	Northcrest Park	6	South Woods Park	6
Echo Lake Park	5	Paramount Open Space	6	Strandberg Preserve	1
Fremont Trail	3	Richmond Beach Saltwater Park	1	Twin Ponds Park	4
Hamlin Park	6				

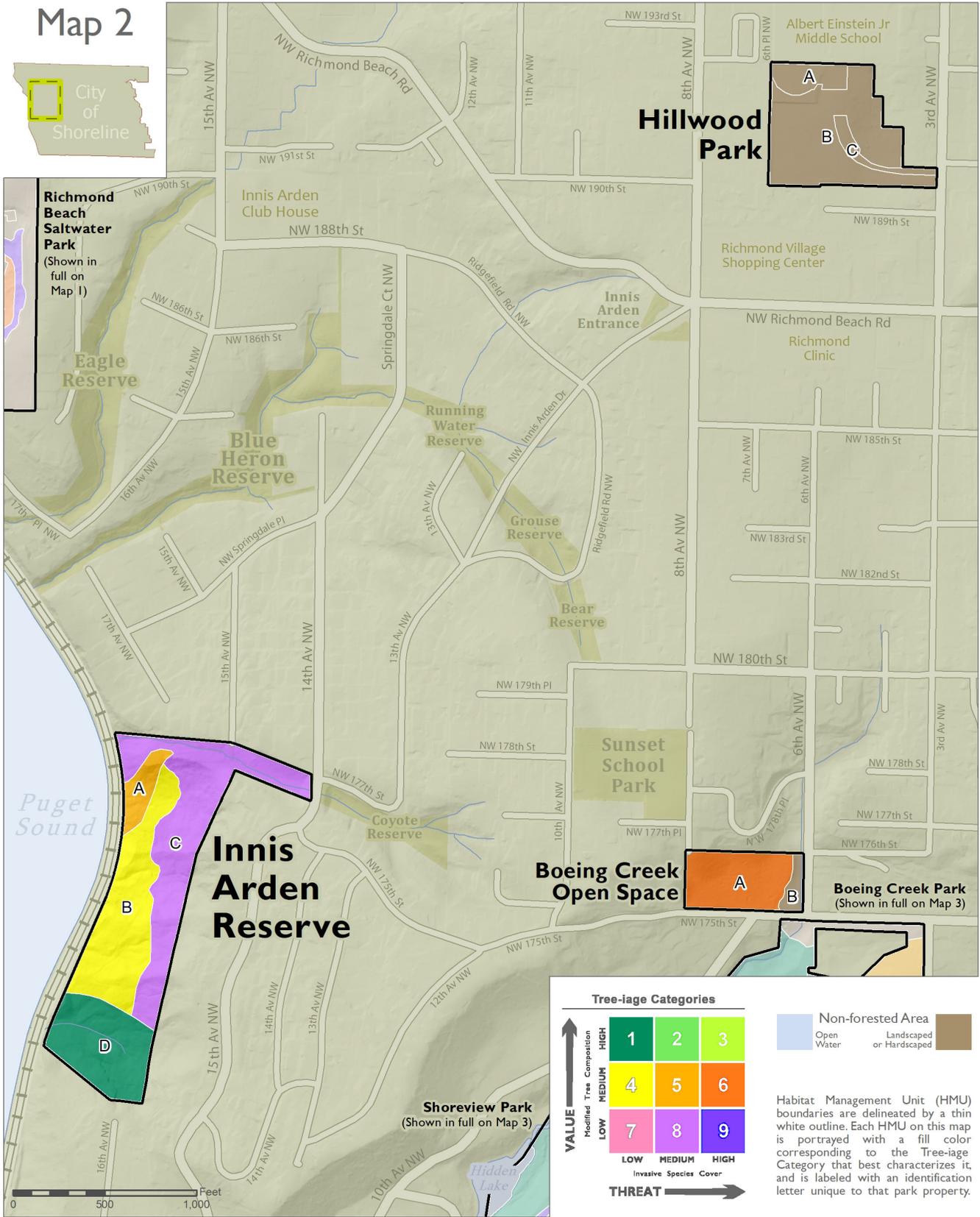
Map created by FORTERRA in partnership with the City of Shoreline.

# Map I



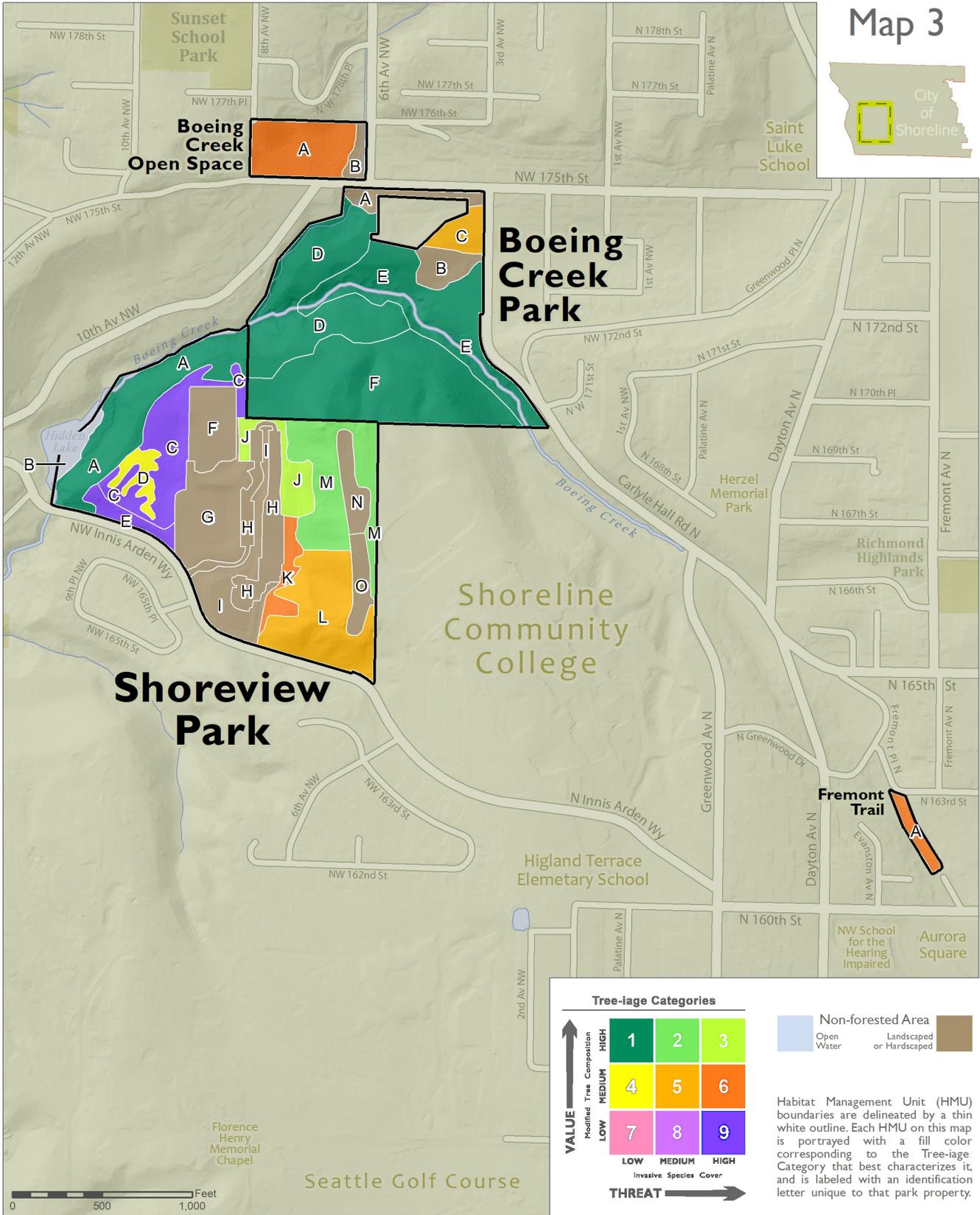
Map created by FORTERRA in partnership with the City of Shoreline. Tree-age field assessment conducted by American Forest Management, Inc., September 2019.

# Map 2



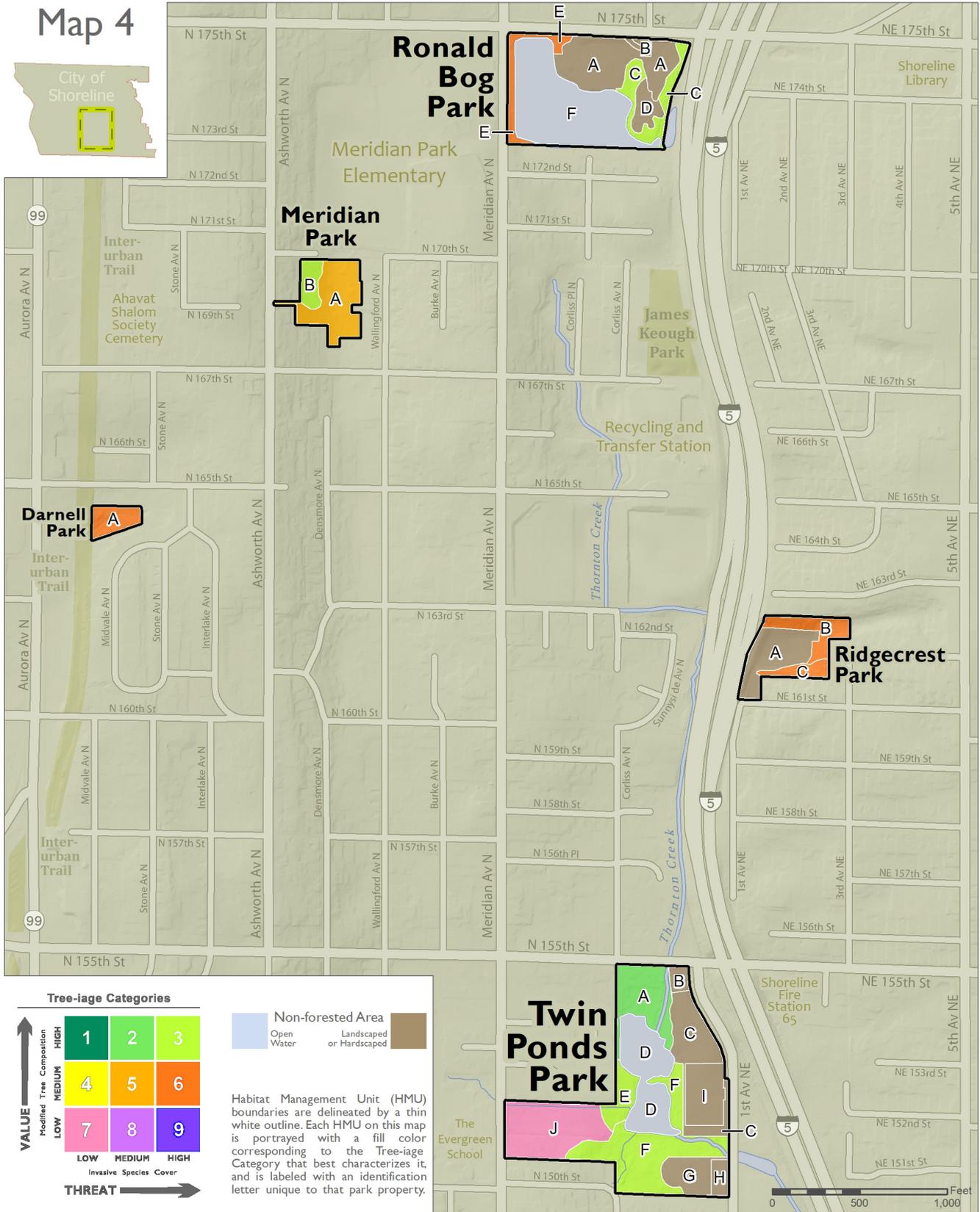
Map created by FORTERRA in partnership with the City of Shoreline. Tree-age field assessment conducted by American Forest Management, Inc., September 2019.

# Map 3



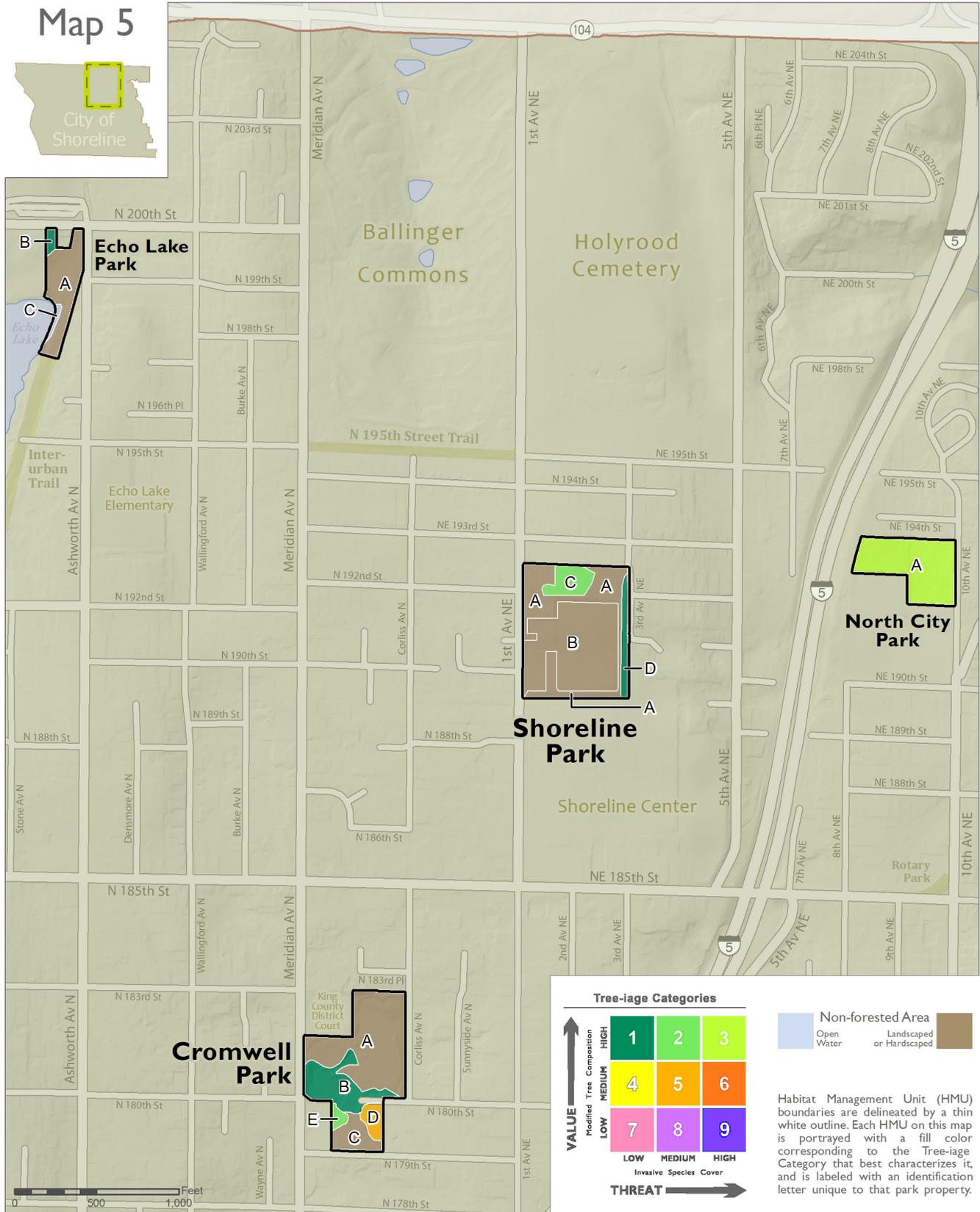
Map created by FORTERRA in partnership with the City of Shoreline. Tree-age field assessment conducted by American Forest Management, Inc., September 2019.

# Map 4



Map created by FORTERRA in partnership with the City of Shoreline. Tree-age field assessment conducted by American Forest Management, Inc., September 2019.

# Map 5



**Tree-age Categories**

VALUE Modified Tree Composition	HIGH	1	2	3
	MEDIUM	4	5	6
	LOW	7	8	9
		LOW	MEDIUM	HIGH
		Invasive Species Cover		
		THREAT		

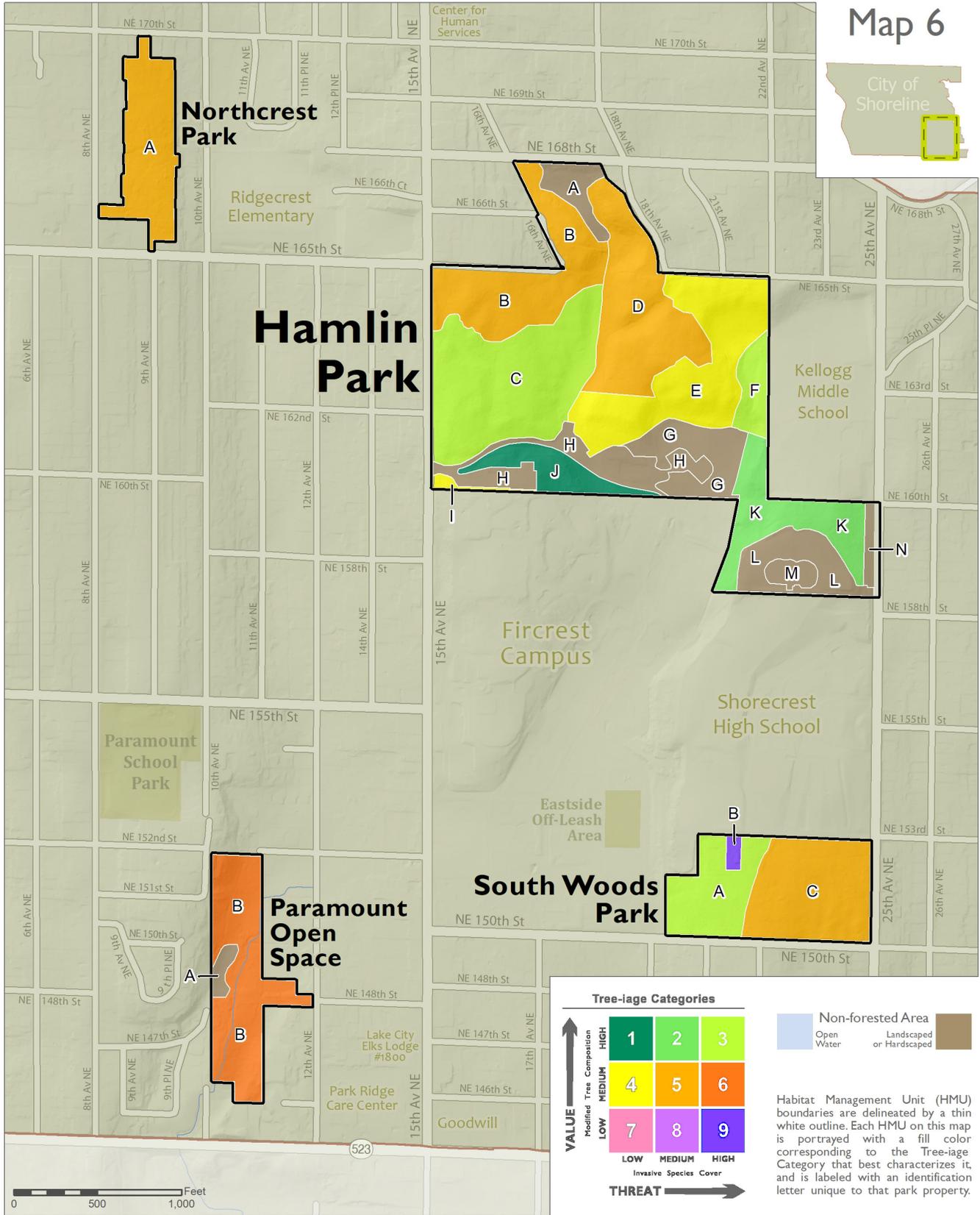
**Non-forested Area**

- Open Water
- Landscaped or Hardscaped

Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to the Tree-age Category that best characterizes it, and is labeled with an identification letter unique to that park property.

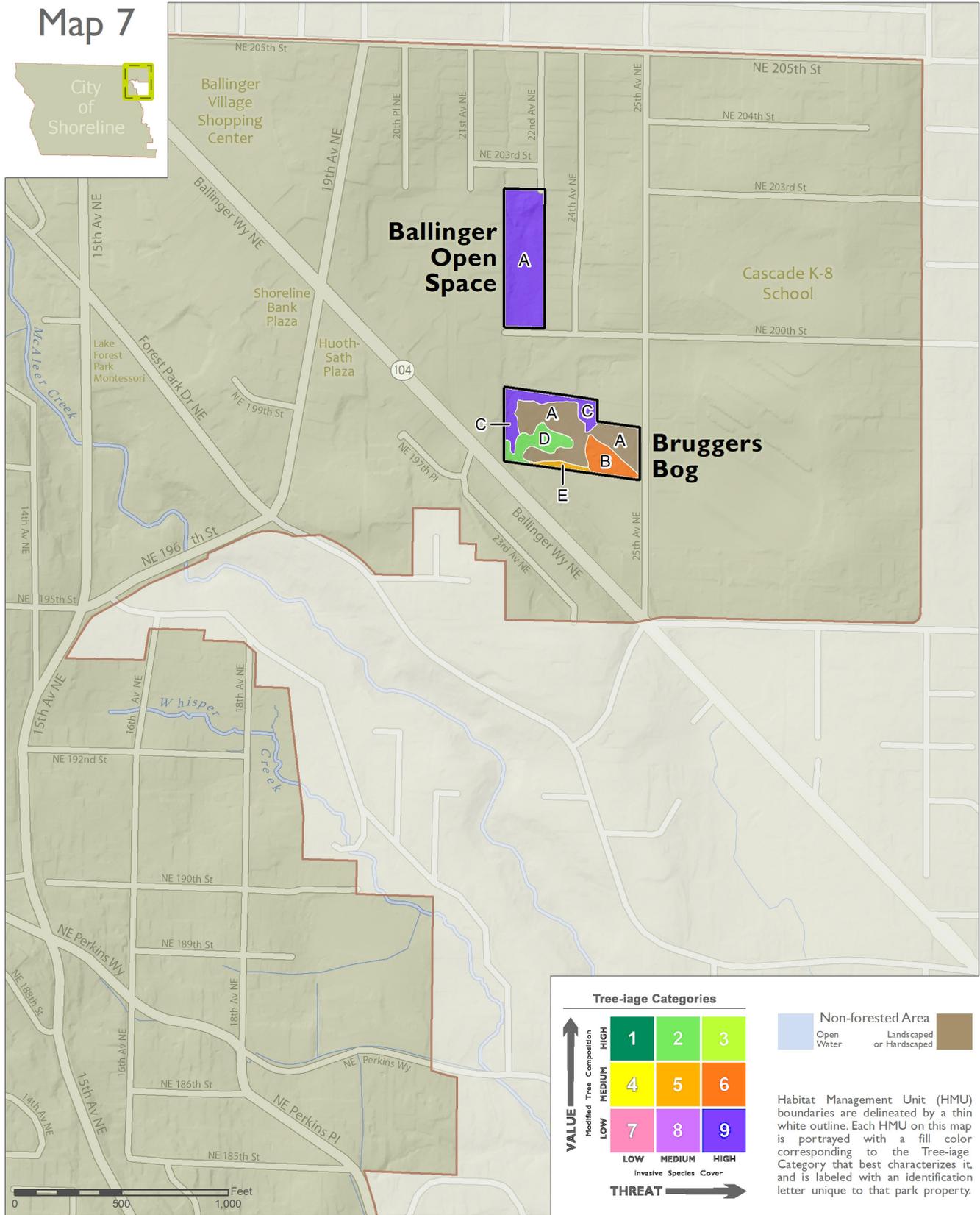
Map created by FORTERRA in partnership with the City of Shoreline. Tree-age field assessment conducted by American Forest Management, Inc., September 2019.

# Map 6



Map created by FORTERRA in partnership with the City of Shoreline. Tree-age field assessment conducted by American Forest Management, Inc., September 2019.

# Map 7



**Tree-age Categories**

VALUE Modified Tree Composition	HIGH	1	2	3
	MEDIUM	4	5	6
	LOW	7	8	9
		LOW	MEDIUM	HIGH
		Invasive Species Cover		
		THREAT		

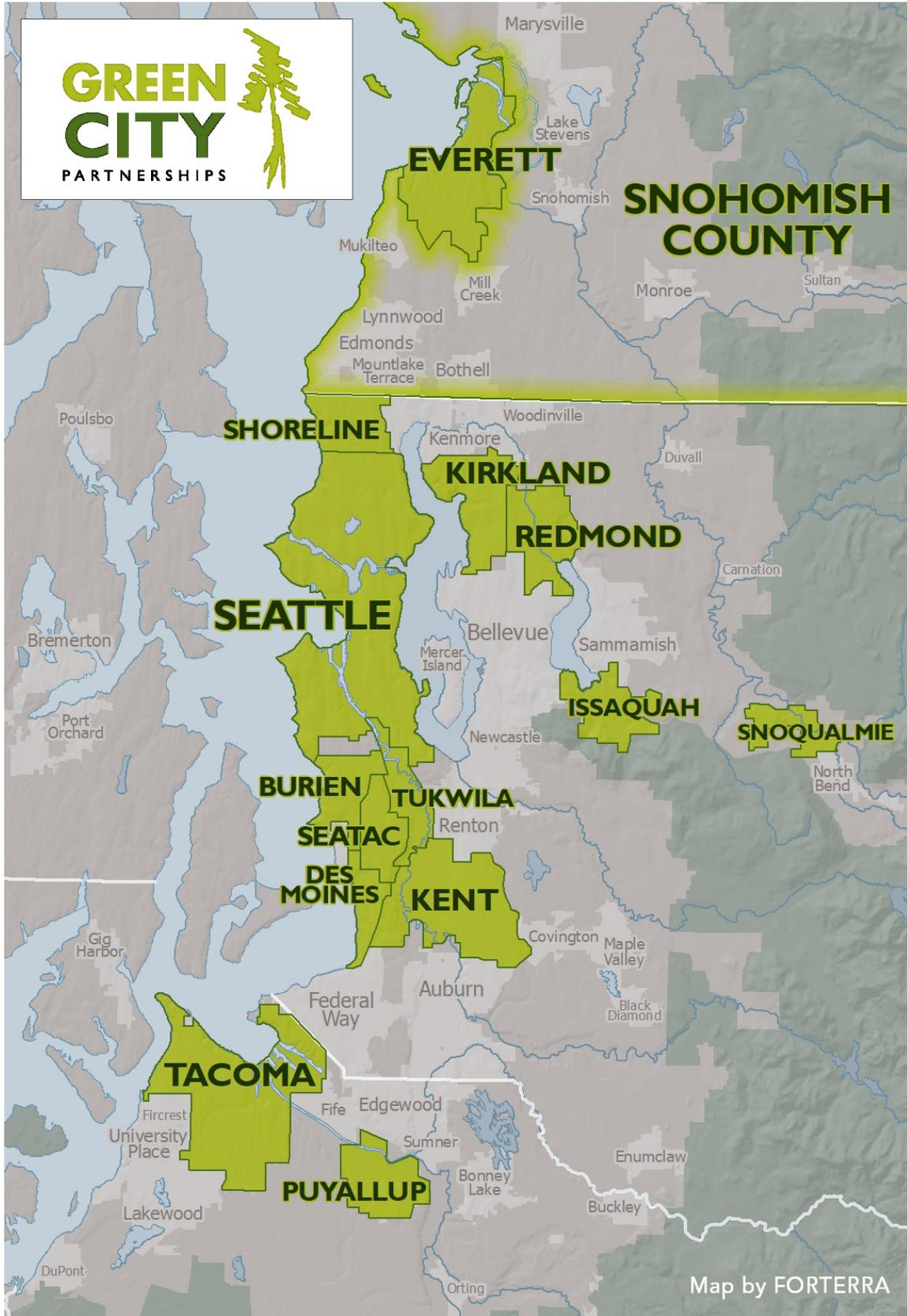
**Non-forested Area**

- Open Water
- Landscaped or Hardscaped

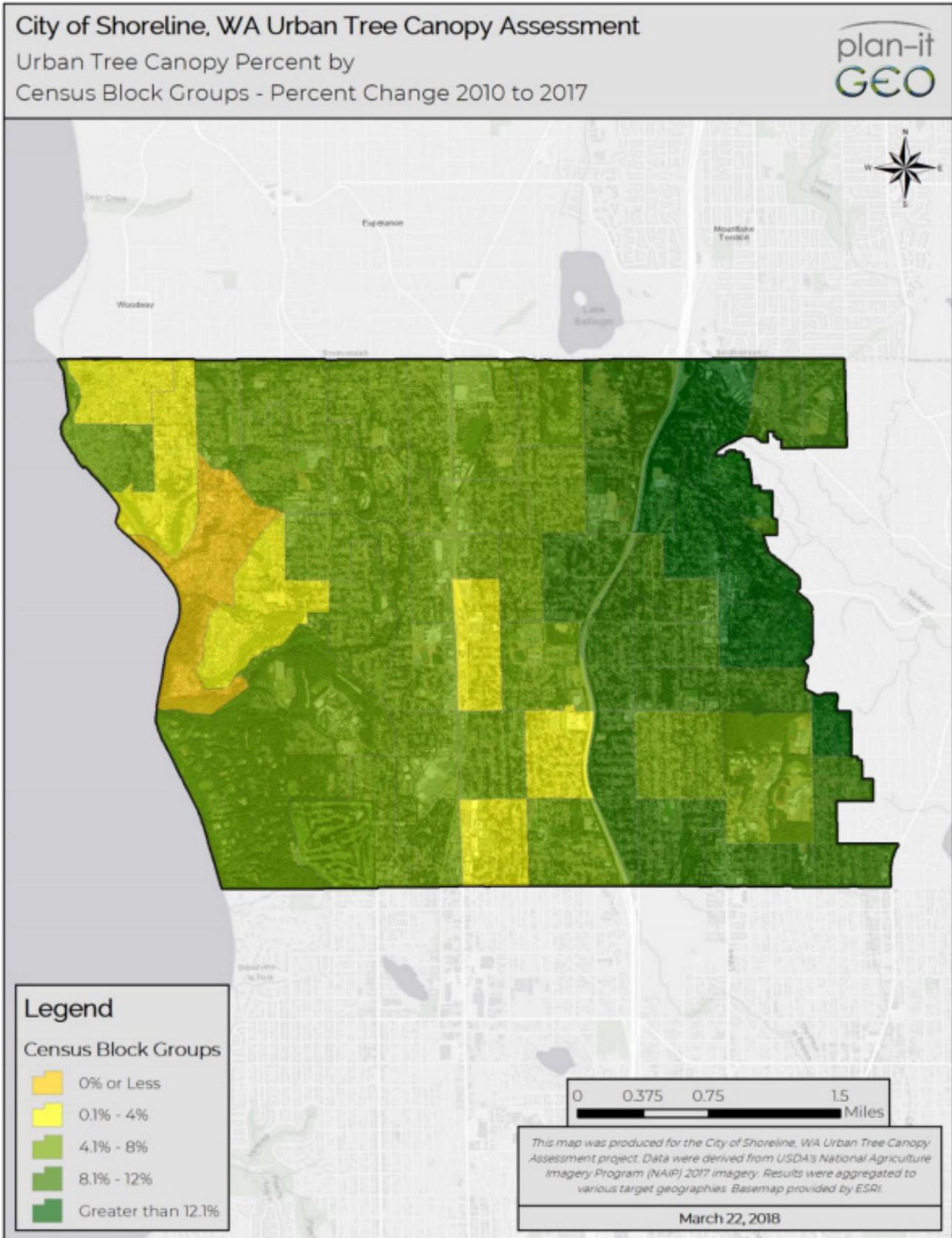
Habitat Management Unit (HMU) boundaries are delineated by a thin white outline. Each HMU on this map is portrayed with a fill color corresponding to the Tree-age Category that best characterizes it, and is labeled with an identification letter unique to that park property.

Map created by FORTERRA in partnership with the City of Shoreline. Tree-age field assessment conducted by American Forest Management, Inc., September 2019.

# APPENDIX B: GREEN CITIES NETWORK MAP AS OF 2019



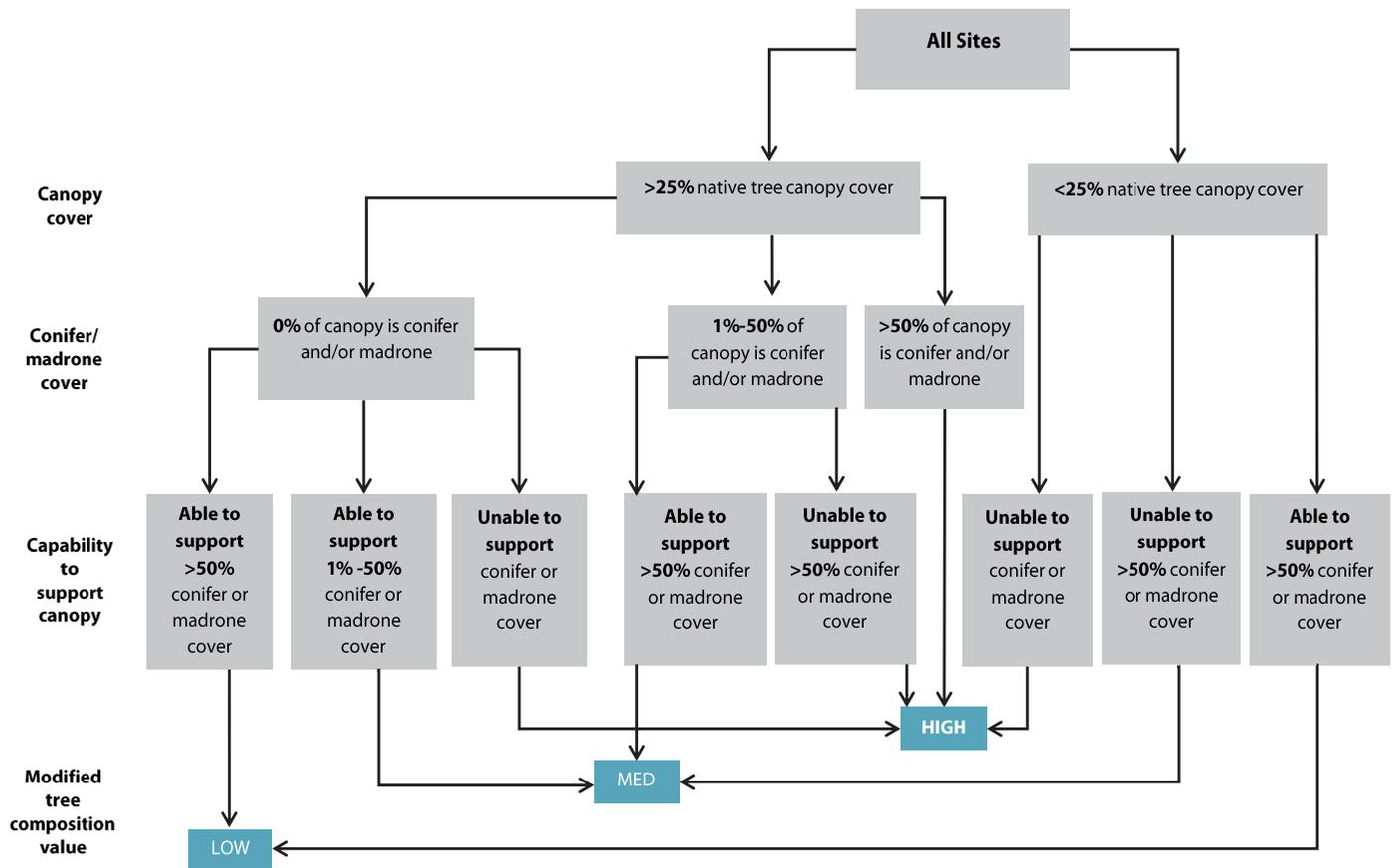
# APPENDIX C: CITY OF SHORELINE CANOPY ASSESSMENT MAP



# APPENDIX D: FOREST LANDSCAPE ASSESSMENT TOOL (FLAT)

## Forest Landscape Assessment Tool (FLAT)

Habitat Quality/Management Unit Composition



## APPENDIX E: LONG-TERM STRATEGIC PLAN AND BENCHMARKS

FIELD		
2024–2028	2029–2033	2034–2038
<ul style="list-style-type: none"> <li>Enroll 12 to 20 new acres in initial restoration per year</li> <li>Prioritize sites in areas of social vulnerability and increase number of parks represented in restoration efforts</li> <li>Continue maintenance and restoration on all previously enrolled acres</li> <li>Conduct 5-year monitoring and BMP review</li> </ul>	<ul style="list-style-type: none"> <li>Add approximately 25 to 30 new acres in initial restoration per year</li> <li>Continue to diversify and add to parks with acres enrolled</li> <li>Revise park-level stewardship plans to reflect restoration</li> <li>Conduct 10-year monitoring and BMP review</li> </ul>	<ul style="list-style-type: none"> <li>Enroll all remaining acres in initial restoration</li> <li>Access and enroll any additional sites, and acquisitions, if needed</li> <li>Revise site stewardship plans as needed</li> <li>Conduct 15-year monitoring and BMP review</li> </ul>
COMMUNITY		
2024–2028	2029–2033	2034–2038
<ul style="list-style-type: none"> <li>Recruit and manage 4,600 volunteer hours annually</li> <li>Support up to 10 active stewards</li> <li>Host annual signature community planting event</li> <li>Host annual volunteer appreciation event</li> <li>Host annual community appreciation event</li> </ul>	<ul style="list-style-type: none"> <li>Recruit and manage 5,000 volunteer hours annually</li> <li>Support 12 to 15 active stewards</li> <li>Host annual signature community planting event</li> <li>Host annual volunteer appreciation event</li> <li>Host annual community appreciation event</li> </ul>	<ul style="list-style-type: none"> <li>Recruit and manage 4,700 volunteer hours annually</li> <li>Support 12 active stewards</li> <li>Host annual signature community planting event</li> <li>Host annual volunteer appreciation event</li> <li>Host annual community appreciation event</li> </ul>
RESOURCES		
2024–2028	2029–2033	2034–2038
<ul style="list-style-type: none"> <li>Evaluate needs, costs, and resources based on first five years of work</li> <li>Identify and pursue funding to support field, community, and administrative work, if needed</li> <li>Develop annual work plan and write annual report of accomplishments</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate and update methods</li> <li>Identify and pursue funding to support field, community, and administrative work, if needed</li> <li>Develop annual work plan and write annual report of accomplishments</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate and update methods</li> <li>Identify and pursue funding to support field, community, and administrative work, if needed</li> <li>Ensure proper funding base is in place for long-term maintenance, monitoring, and community engagement</li> <li>Develop annual work plan and write annual report of accomplishments</li> </ul>

## APPENDIX F: MANAGEMENT-UNIT ACRES PER TREE-AGE CATEGORY

SITE NAME	TREE-AGE CATEGORY									ACRES PER SITE
	1	2	3	4	5	6	7	8	9	
BALLINGER OPEN SPACE									2.63	2.63
BOEING CREEK OPEN SPACE						3.86				3.86
BOEING CREEK PARK	29.90				1.38					31.28
BRUGGERS BOG		1.36			1.36	1.36			0.82	4.90
CROMWELL PARK	2.21	2.21			1.73					6.15
DARNELL PARK						0.84				0.84
ECHO LAKE PARK	0.16									0.16
FREMONT TRAIL						0.66				0.66
HAMLIN PARK	3.26	6.54	17.87	12.77	21.81					62.25
INNIS ARDEN RESERVE	10.85			10.85	1.25			10.85		33.80
MERIDIAN PARK			0.65		2.49					3.14
NORTH CITY PARK			3.96							3.96
NORTHCREST PARK					7.31					7.31
PARAMOUNT OPEN SPACE						9.67				9.67
RICHMOND BEACH SALTWATER PARK				8.08	0.92	15.03			6.02	30.05
RICHMOND RESERVE						0.11				0.11
RIDGECREST PARK						1.73				1.73
RONALD BOG PARK			1.87			0.90				2.77
SHORELINE PARK	0.61	1.89								2.50
SHOREVIEW PARK	6.72	0.58	1.88	1.02	11.28	1.22			6.02	28.72
SOUTHWOODS PARK			5.60		9.55				0.41	15.56
STRANDBERG RESERVE		2.58								2.58
TWIN PONDS PARK		2.48	9.37				4.60			16.45
<b>TOTAL ACRES</b>	<b>53.72</b>	<b>17.64</b>	<b>41.20</b>	<b>32.71</b>	<b>59.07</b>	<b>35.37</b>	<b>4.60</b>	<b>10.85</b>	<b>15.90</b>	<b>271.06</b>

## APPENDIX G: OVERSTORY SPECIES DOMINANCE BY MU ACRES

SCIENTIFIC NAME	COMMON NAME	PRIMARY SPECIES BY MU ACRES	SECONDARY SPECIES BY MU ACRES	TERTIARY SPECIES BY MU ACRES
<i>Acer macrophyllum</i>	Bigleaf maple	47.80794	39.17204835	21.66032209
<i>Alnus rubra</i>	Red alder	7.924246	20.99107623	20.45029374
<i>Arbutus menziesii</i>	Pacific madrone	7.864969	16.26214421	27.40542694
<i>Cedrus deodara</i>	Deodar cedar		8.693318664	
<i>Picea sitchensis</i>	Sitka spruce	4.598229		
<i>Pinus contorta</i>	Shore pine	10.55838	6.933817683	1.220001937
<i>Pinus monticola</i>	Western white pine	7.312986	26.13993948	38.13077429
<i>Populus balsamifera</i>	Black cottonwood	14.20521	12.18805689	2.1866528
<i>Populus tremuloides</i>	Quaking aspen	2.209451		
<i>Prunus emarginata</i>	Bitter cherry			2.479916869
<i>Pseudotsuga menziesii</i>	Douglas-fir	149.6317511	21.29781479	15.11438586
<i>Salix hookeriana</i>	Hookers willow			2.180175043
<i>Salix lasiandra</i>	Pacific willow		8.073525825	5.116782056
<i>Thuja plicata</i>	Western redcedar		66.9530792	43.69546704
<i>Tsuga heterophylla</i>	Western hemlock	12.93355591	36.42147452	13.36123451
	Ornamental			4.776795271
	No dominant overstory	6.02339	7.9438	73.2918

## APPENDIX H: UNDERSTORY SPECIES DOMINANCE BY MU ACRES

SCIENTIFIC NAME	COMMON NAME	PRIMARY SPECIES BY MU ACRES	SECONDARY SPECIES BY MU ACRES	TERTIARY SPECIES BY MU ACRES
<i>Acer circinatum</i>	Vine maple	0.614859	0.651484	0
<i>Amelanchier alnifolia</i>	Serviceberry	14.62758	21.47965	7.474294
<i>Blechnum spicant</i>	Deer fern	0	2.479917	0
<i>Cornus sericea</i>	Red osier dogwood	0.820959	12.57158	1.359216
<i>Corylus cornuta</i>	Beaked hazelnut	4.707279	17.55097	10.85038
<i>Equisetum arvense</i>	Common horsetail	2.630315	10.85038	1.00466
<i>Gaultheria shallon</i>	Salal	101.5901	21.65198	25.17731
<i>Holodiscus discolor</i>	Oceanspray	1.220002	14.91109	1.884899
<i>Mahonia aquifolium</i>	Tall Oregon grape	0	1.884899	0
<i>Mahonia nervosa</i>	Dull Oregon grape	1.522402	35.55101	47.25853
<i>Oemlaria cerasiformis</i>	Oso berry	0.840652	3.246258	0
<i>Philadelphus lewisii</i>	Mock orange			0.660297
<i>Polypodium glycyrrhiza</i>	Licorice fern	0	1.02203	0
<i>Polystichum munitum</i>	Sword fern	38.53534	43.77394	7.969475
<i>Pteridium aquilinum</i>	Bracken fern		34.31395	24.57385
<i>Rosa nutkana</i>	Nootka rose	0.623172	5.277314	0
<i>Rosa pisocarpa</i>	Swamp rose	0.347361		2.209451
<i>Rubus spectabilis</i>	Salmonberry	43.07697	18.31515	10.45473
<i>Rubus ursinus</i>	Trailing blackberry	16.43824	1.030033	39.22044
<i>Salix hookeriana</i>	Hooker's willow	2.209451		
<i>Salix lasiandra</i>	Pacific willow			0.651484
<i>Salix purpurea</i>	Purple osier willow	0	2.209451	0
<i>Sambucus racemosa</i>	Red elderberry	4.598229	4.389532	5.597755
<i>Spiraea douglasii</i>	Hardhack	1.359216	2.25947	0
<i>Symphoricarpos albus</i>	Snowberry	10.95297	0.660297	1.740906
<i>Urtica dioica</i>	Stinging nettle			11.27763
<i>Vaccinium parvifolium</i>	Red huckleberry			27.66021
	Native grasses	20.95964	5.616268	1.175
	No dominant understory	3.39537	9.373434	42.86959

## APPENDIX I: INVASIVE SPECIES DOMINANCE BY MU ACRES

SCIENTIFIC NAME	COMMON NAME	PRIMARY SPECIES BY MU ACRES	SECONDARY SPECIES BY MU ACRES	TERTIARY SPECIES BY MU ACRES
<i>Calystegia sepium</i>	Morning glory/bindweed	14.99289252	10.73211	4.855815
<i>Buddleia davidii</i>	Butterfly bush			6.015126
<i>Cytisus scoparius</i>	Scotch broom	25.49254572	13.9755	0.550143
<i>Geranium robertianum</i>	Herb Robert	35.8827153	11.34979	10.65963
<i>Hedera helix</i>	English ivy	43.23393167	93.15271	30.4053
<i>Ilex aquifolium</i>	English holly	11.27872828	40.26294	72.58322
<i>Phalaris arundinacea</i>	Reed canary grass	6.144840154	2.831659	9.301086
<i>Polygonum x sp.</i>	Knotweed	1.865449031	8.679746	9.424996
<i>Prunus laurocerasus</i>	English laurel		14.76498	4.421056
<i>Ranunculus repens</i>	Creeping buttercup			4.598229
<i>Rubus armeniacus</i>	Himalayan blackberry	124.1	61.53041	36.77412
<i>Sorbus aucuparia</i>	European mountain ash		4.285436	9.197885
		8.078459817	9.504823	72.28349

## APPENDIX J. GREEN CITIES TOOLBOX INFORMATION

Available at [forterra.org/service/green-cities-toolbox](http://forterra.org/service/green-cities-toolbox), the Green Cities Toolbox is a wealth of information for cities and stewards.

### The Green Cities Toolbox covers these topics:



#### **Restoration, planning, and implementation.**

Tools and expertise to plan and implement restoration at the park or site-level. Includes step-by-step guides for site planning, best management practices for invasive plant removal, native plant installation, mulching, and maintenance.



#### **Native plants.**

Native plant identification and propagation resources such as image libraries, keys, databases, and how-to guides.



#### **Invasive species.**

Resources on the identification and management of aggressive non-native plants and insects.



#### **Restoration monitoring.**

Protocols and instructions for implementing short- and long-term monitoring of restoration sites.



#### **Community engagement and volunteer management.**

Best practices for engaging youth, families, and diverse communities in stewardship activities as well as tips for recruiting, managing, and retaining volunteers and running successful community restoration events.



#### **Site safety.**

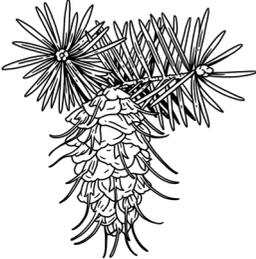
Information on Crime Prevention Through Environmental Design (CPTED) and other safety issues to consider in community-based stewardship.



#### **City-specific volunteer resources.**

For current stewards and volunteers, visit your Green City Partnership webpage for reporting forms, maps, and other documents specific to your Green City.

## APPENDIX K. COMMON PLANTS REFERENCED IN THIS PLAN

INVASIVE PLANTS		NATIVE PLANTS	
	<p><b>Himalayan blackberry</b> <i>Rubus armeniacus</i></p>		<p><b>Douglas-fir</b> <i>Pseudotsuga menziesii</i></p>
	<p><b>English holly</b> <i>Ilex aquifolium</i></p>		<p><b>Red alder</b> <i>Alnus rubra</i></p>
	<p><b>Reed canary grass</b> <i>Phalaris arundinacea</i></p>		<p><b>Bigleaf maple</b> <i>Acer macrophyllum</i></p>
	<p><b>English ivy</b> <i>Hedera helix</i></p>		<p><b>Black cottonwood</b> <i>Populus balsamifera</i></p>
	<p><b>Bindweed</b> <i>Convolvulus arvensis</i></p>		<p><b>Western redcedar</b> <i>Thuja plicata</i></p>

## APPENDIX L: INVASIVE PLANT MANAGEMENT RESOURCES

The species below are some of the most common invasive plants found in Shoreline’s parks and natural areas. For the methods of removal described below, “small infestation” refers to an area from which you can effectively and reasonably remove all necessary plant material (usually all above- and below-ground plant parts).

For more information on invasive plant identification and removal and disposal methods, visit the King County Noxious Weeds website: [kingcounty.gov/services/environment/animals-and-plants/noxious-weeds.aspx](http://kingcounty.gov/services/environment/animals-and-plants/noxious-weeds.aspx), or go to [kingcounty.gov](http://kingcounty.gov) and search: Noxious Weeds

### Invasive Trees

Here is the complete list of target woody invasive trees and shrubs:

SCIENTIFIC NAME	COMMON NAME
<i>Acer platanoides</i>	Norway Maple
<i>Acer psuedoplatanus</i>	Sycamore Maple
<i>Aesculus hippocastanum</i>	Horse Chestnut
<i>Buddleia davidii</i>	Butterfly bush
<i>Clematis vitalba</i>	Traveler’s Joy
<i>Cotoneaster spp.</i>	Cotoneaster
<i>Crataegus monogyna</i>	English Hawthorne
<i>Ilex aquifolium</i>	English Holly
<i>Populus alba</i>	Silver Poplar
<i>Populus nigra</i>	Black Polar (Lombardy)
<i>Prunus domestica</i>	Domestic cherry
<i>Prunus spinosa</i>	Sloe

SCIENTIFIC NAME	COMMON NAME
<i>Prunus avium</i>	Wild Cherry
<i>Prunus cerasifera</i>	Thundercloud plum
<i>Prunus laurocerasus</i>	Cherry Laurel, English Laurel
<i>Prunus lusitanica</i>	Portuguese Laurel
<i>Pyracantha spp.</i>	Firethorn
<i>Robinia pseudoacacia</i>	Black Locust
<i>Sorbus acuparia</i>	Mountain Ash
<i>Tamarix ramosissima</i>	Saltcedar
<i>Ulex europaeus</i>	Gorse
<i>Ulmus parvifolia</i>	Chinese Elm
<i>Ulmus procera</i>	English Elm
<i>Ulmus pumila</i>	Siberian Elm

Do not cut down or pull out an invasive tree unless you also remove all of its roots. If roots are left behind, they will send up suckers that will grow into many more trees, greatly multiplying the problem. Small, young plants may be hand pulled. Plants that are less than 1 inch in diameter may be taken out successfully with a Pullerbear™.

For any tree more than 1 inch in diameter, remove the lower branches to provide access to the ground around the tree. Do not leave freshly cut or pulled holly stems or branches in direct contact with the soil, as the cuttings can easily re-root. Make sure they are left to dry out on top of an onsite compost pile. Place invasive tree branches and stems on their own compost piles, separate from cut and pulled blackberry and ivy, as they decompose at different rates.

### **Bittersweet Nightshade (*Solanum dulcamara*)**

Hand-pull the stem close to the ground and pull or dig up the roots, taking care not to break the slender roots. This method is most effective with young plants and small infestations. Manual control works best after rain or in loose soils. Recommended tools include shovels, spades, and hand tillers to loosen soil. When substantial manual removal is used in wet areas, take care to prevent soil erosion. Wear gloves when handling Bittersweet nightshade, as it can be toxic to people, pets, and livestock.

Fruiting plants and root balls should be collected and disposed of in the garbage. Composting root balls is not recommended. Stems can be left on site to dry out and decompose if they are in a dry area where they will not move into waterways or onto moist soil.

### **English Ivy (*Hedera helix*) and Clematis (*Clematis vitalba*)**

Create “lifesavers” or “survival rings” to preserve existing trees and reduce the seed source. Start by cutting vines at shoulder height, then again at the base of the tree. Then, remove all ivy or clematis from the tree, from shoulder to base. Grub out the roots in a radius at least 5 feet away from the tree. Do not attempt to pull vines above shoulder height out of the tree. They will die and decompose on their own, and pulling them down from high branches can possibly damage the tree.

Remove dense ground patches of ivy and clematis by clipping edges of the swaths, then continue clipping, digging, and rolling the tangled mat up into an ivy/clematis log. The rolling method works better for ivy because it grows along the ground and the vines and roots are more flexible. Clematis can grow up trees, down trees, and back up trees again, which requires

following all vines to make sure the plant isn’t making contact with the ground. Take care to cut around or gently lift ivy/clematis mats over existing native plants. If the ivy or clematis vines grow into thick woody stems that are too large to dig out, Forest Stewards can request herbicide treatment through the online form. Ivy and clematis can be composted on site.

#### **Quick Tips for Removing Ivy/Clematis**

**“Lifesaver” Tree Ring:** Cut ivy at shoulder height and again at base of tree. Do not attempt to pull vines out of tree. Roll ivy back away from tree in logs. Clear at least 5 feet back from each tree trunk.

**Ivy Bundle:** For small clumps of ivy, pull all vines out, wrap into a tight bundle, and dispose on compost pile or hang on a branch where it will not come into contact with the ground.

**Ivy Log:** For large contiguous swaths of ivy, clip edges of 5- to 10-foot-wide sections, roll into a log, clip root connections at the end of the roll, and roll on top of the compost pile to decompose. Ivy logs fit nicely on windrow compost piles.

### **Garlic Mustard (*Alliaria petiolate*)**

**IMPORTANT:** Garlic mustard is designated as a regulated noxious weed in King County. Please report to the City of Shoreline all locations of garlic mustard that you identify, or report them online at [kingcounty.gov/weeds](http://kingcounty.gov/weeds) (Report a Weed)—even if you remove the weed.

Hand-pulling individual garlic mustard plants is effective if the entire root is removed. Flowering or seeding plants must be put in a bag and discarded in the garbage. Carefully and thoroughly clean off boots, clothes and tools before leaving the area to avoid carrying the tiny seeds to new sites. Larger populations of garlic mustard will have to be managed by professional crews.

### **Hedge Bindweed/Morning Glory (*Calystegia sepium*)**

Hand-pull at least three times per year (early growing season, mid-summer, and late summer) for at least three growing season cycles. If keeping up with all the bindweed takes more time than you have available, you may need to prioritize

clearing all the bindweed from the native plants first, or at minimum, clipping all the bindweed away at their base as they are trying to establish. Covering bindweed with sheet mulch can help weaken the bindweed, slow re-growth, and make pulling more effective. Bindweed can be composted on site unless it is blooming. Shade is the best way to control bindweed. Plant conifers and other native plants for long-term bindweed suppression success.

### **Herb Robert a.k.a. Stinky Bob (*Geranium robertianum*)**

Hand-pulling individual plants is effective if the entire root is removed. Try to remove plants before the seeds form to avoid further distribution of seeds. Flowering or seeding plants must be put in a bag and discarded in the garbage. If Stinky Bob is growing in a monoculture, then sheet mulching can be an effective way to smother seeds and root fragments that are left behind. Carefully and thoroughly clean off boots, clothes, and tools before leaving the area to avoid carrying the tiny seeds to new sites.

### **Himalayan Blackberry (*Rubus armeniacus* syn. *Rubus discolor*)**

Blackberries have a large root mass in the first 6 to 18 inches of soil, and often have smaller roots that spread from the main root mass. All roots should be dug up as completely as possible. Blackberry canes and roots can be composted on site.

Before initiating blackberry removal during early and primary nesting season (February to the end of July), make sure to watch for nesting activities. Phase removal over time, if possible, to minimize eliminating all habitat.

### **Knotweed (*Polygonum cuspidatum* and other species)**

Foliar herbicide application is the most effective way to eradicate knotweed. It must be performed by professional crews during dry periods from July to September.

Residents are highly discouraged from removing knotweed patches as disturbance promotes growth and dispersal. Hand removal of knotweed is impractical and could actually exacerbate the problem.

Any fragments of the plant should be disposed of in the garbage. Do not compost this plant on site.

### **Poison Hemlock (*Conium maculatum*)**

**IMPORTANT:** Poison hemlock is designated as a regulated noxious weed in King County. Please report to the City of Shoreline all locations of poison hemlock that you identify, or report them online at [kingcounty.gov/weeds](http://kingcounty.gov/weeds) (Report a Weed).

If attempting to manually control poison hemlock, please note that all parts of this plant are toxic. You must wear gloves and long sleeves, and wash hands thoroughly after handling plants. Pull or dig up the entire plant, including the root. All parts of the plant should be disposed of in the garbage. Adding a layer of mulch to the area after it has been cleared will reduce germination of seeds still present in the soil.

Removal of this plant is not appropriate for a volunteer event. Forest Stewards may request professional crew support to remove poison hemlock.

### **Reed Canary Grass (*Phalaris arundinacea*)**

Manual removal of reed canary grass is impractical except for the smallest of patches (1 to 4 square feet). Hand dig when the ground is soft. Be sure to remove all roots and rhizomes because any left in the soil will re-sprout. Roots and rhizomes can be composted on site away from wet areas so long as they are not in contact with the soil. Monitor the site for regrowth.

For areas where reed canary grass is dominant, one long-term control strategy is to shade it out. Shade won't eradicate the species, but it will control it and allow for a more structurally and genetically diverse site. Install sheet mulch with several layers of cardboard or burlap and 6 inches of wood chip mulch. Do not install sheet mulch in areas where standing water is 6 inches or more in depth at any point in the year. Leave sheet mulch in place for at least one growing season. Monitor the edges of the mulch site for shoots coming up from lateral growth of rhizomes. Efficacy can be increased by removing above-ground plant material at—or just after—flowering. Conduct this removal with hand tools, and time it prior to laying down the sheet mulch. Any removed above-ground plant material that hasn't gone to seed can be left on site.

After at least one growing season, the area should be planted with native species. Plant layout should be dense over the entire site, or in a clump-gap or row pattern. Fast-growing species adapted to wet areas—such as black cottonwood, red alder, and several types of willow—should be installed initially. Once they become established, a second planting of shade tolerant species—such as western red cedar; thicket-forming species like red-osier dogwood, snowberry, and Nootka rose; and fast growing conifers like Douglas and grand fir (placed along southerly and westerly edges)—should be planted.

### **Scotch Broom (*Cytisus scoparius*)**

Hand-pull small plants and use Pullerbear™ to extract smaller plants when the soil is moist in spring. Note that disturbing the soil may cause germination of seeds in the soil. The area should be monitored to control any new seedlings.

Cutting can be effective on older Scotch broom plants that have a stem diameter of 2 inches or more. Cut plants in late summer to early fall as close to the ground as possible and monitor for new growth. Scotch broom can be composted on site.

### **Yellow Archangel (*Lamium galeobdolon*)**

Manual removal is generally not effective. Plants grow densely, sprout from root or stem fragments, grow easily among desirable vegetation, and are labor-intensive to hand-pull. For very small populations (less than 10 square feet), try continuous hand-pulling and revisit the site monthly. Sift through the soil to ensure removal of all root and stem fragments. This removal is easiest in fall through early spring. All plant debris should be disposed in the garbage.

Dense infestations may be controlled by sheet mulching. It is crucial to control any escaping plants, so regularly check for holes in the covering material. Stem fragments and roots can re-sprout if left in contact with wet ground.

### **Yellow Flag Iris (*Iris pseudacorus*)**

Manual removal can be effective for small infestations, especially for very young plants not yet established. Manual removal of larger plants is difficult and may require sturdier tools or saws to remove the entire rhizome. Monitor the location after you have removed the plants—new leaves will show you where you missed any sections of rhizome. Precautions should be taken to protect your skin, as resins in the leaves and rhizomes can cause irritation. Dispose of all plant parts in the garbage. In most cases, controlling this species will require multiple methods over several years, potentially including cutting and herbicide treatment by professional crews.



PHOTO: JORG HEMPEL

## APPENDIX M. GLOSSARY OF TERMS

### Adaptive Management

A structured, repeating process of decision-making aimed at better understanding a management system through monitoring, evaluation, and development of new management strategies. The Green Shoreline Partnership utilizes an adaptive management approach to inform its administrative and restoration practices over time.

### Biomass

The amount of living matter (as in a unit area or volume of habitat).

### Canopy Cover

The percentage of a forest floor or specific geographic area covered by tree crowns. Assessed using aerial orthophotographs (see definition below) and ground-based techniques, it can be calculated for all trees in a given geographic area or specific individual tree species. Canopy cover has been shown to be an important ecological indicator for distinguishing plant and animal habitats, as well as assessing on-the-ground conditions in urban areas.

### Climate Change

Change in global or regional climate patterns—in particular, change apparent from the mid- to late 20th century onward and attributed largely to increased levels of atmospheric carbon dioxide produced by the use of fossil fuels.

### Conifers

Cone-bearing trees, most of which are evergreen, with needle or scale-like leaves. Examples include pine, fir, hemlock, and spruce. The dominant conifers found in Shoreline's urban forest are Douglas-fir, western redcedar, and western hemlock.

### Deciduous

A tree or shrub that loses its leaves or needles during the fall and winter months (in contrast to an evergreen plant). Examples found in Puget Sound forests include bigleaf maple, red alder, and snowberry.

### Ecosystem

The interactive community or relationships of living (biotic) organisms such as plants, animals, and microbes with nonliving (abiotic) components such as air, water, soils, and weather.

### Edge Effects

Change in habitat quality and plant species that occurs in the transition zone between two disparate habitat types. Urbanized forests and natural areas that are fragmented and isolated experience negative ecological changes at the abrupt transition between the built and natural environments. These include: an increased susceptibility to encroachment by invasive plants; loss of plant-species diversity; loss of contiguous habitat for birds, amphibians, and mammals; and impacts from human activity.

### Evapotranspiration

The process by which water is transferred from the land to the atmosphere by evaporation from the soil and other surfaces and by transpiration from plants.

### Forest Restoration

Actions and management to reestablish or enhance processes that support a healthy forest's structure, ecological functions, and biodiversity levels. Restoration actions may include removal of non-native invasive plants, applying mulch, and planting native trees, shrubs, and ground cover. In an urban environment, the natural ecological processes may never be fully restored. Therefore, forests will need ongoing management with long-term maintenance and monitoring.

### Geographic Information System (GIS)

A computer program used for visualizing, storing, and analyzing data related to positions on the earth's surface. The Green City Partnerships use GIS to map and assess land cover, habitat types, and canopy cover. It is also used to track and assess acres enrolled in restoration.

### Green Cities Network

The combined regional group of Green City Partnerships, which currently include Seattle, Kirkland, Tacoma, Redmond, Kent, Everett, Puyallup, Tukwila, Snoqualmie, Burien, SeaTac, Des Moines, Issaquah, and Snohomish County, makes up the Green Cities Network. The Network is not a formally defined

entity. Rather, it is made up of the city partners, Forterra staff, other nonprofits, and participating volunteers who contribute to achieving the goals of each Green City. Network participants are invited to share best management practices, current relevant research, and funding opportunities.

## Green City Partnership

A public-private venture involving a local municipality (e.g., parks departments, public works, utilities, and other government agencies), community groups, and Forterra. The vision of each Green City Partnership is to create a healthy, livable city with sustainable urban forests and natural areas that connect people to nature through community-based stewardship.

## Hazard Tree

A tree that has a structural defect that makes it likely to fail in whole or in part.

## Infiltration

The process by which water on the ground surface enters the soil.

## Invasive Plants

Introduced non-native plant species with traits that allow them to thrive outside their natural range and outcompete native plants. Invasive plants are typically adaptable and aggressive, with high reproductive capacity, and are likely to cause economic and/or environmental harm.

## Madrone

*Arbutus menziesii* (aka Pacific madrone, madrona) is a broadleaf evergreen tree native to western North America, particular to Puget Sound lowland forests. The bark is a rich orange-red color that when mature naturally peels away in thin sheets, leaving a smooth, greenish appearance. The Pacific madrone is in decline, especially in urban areas, and is a difficult species to reestablish. The species is found on drier slopes along shorelines or in areas with well-drained sandy or rocky soils. Areas with madrone trees offer important habitat that often supports unique plant communities.

## Management Unit (MU)

A defined geographic area within a park characterized by the vegetation type or conditions present. Open-space areas within the Green Shoreline Partnership sites were grouped into MUs based on one of five categories: forested, natural (non-forested), open water, hardscaped, or landscaped. Forested and other natural areas were further subdivided based on tree-age values.

## Mechanical Tree Failure

Refers to the breakage of tree trunks and branches and the uprooting of trees caused by factors such as excessive force from high winds, structural weaknesses, pests, and diseases.

## Mulch

A protective covering, usually of organic matter such as leaves, straw, bark, or wood chips, placed around plants to prevent weed growth, moisture evaporation, and the freezing of roots. Covering the ground with mulch is a maintenance practice used in urban forest restoration following invasive plant removal and native plant installation.

## Natural Areas

Undeveloped parkland with less than 25% tree cover, in contrast to “forested areas,” which have more than 25% tree cover.

## Orthophotograph

An aerial photograph that has been adjusted for topographic relief, lens distortion, and camera tilt. As it is an accurate representation of the earth’s surface, it can be used to measure true distances, and often is used with Geographic Information Systems (GIS).

## Overstory

The uppermost layer of branches and foliage that forms the forest canopy. Common overstory trees found in Puget Sound forests include Douglas-fir, western redcedar, western hemlock, and bigleaf maple.



PHOTO: HEATHER VAN STEENBURGH



## Photosynthesis

A process used by plants and some algae to convert light energy from the sun, carbon dioxide, and water into carbohydrates that provide sustenance for those organisms. Photosynthesis takes place in the chloroplast cells of leaves. The primary byproduct of photosynthesis is oxygen.

## Phytoremediation

The treatment of pollutants or waste (as in contaminated soil or groundwater) by the use of green plants that remove, degrade, or stabilize the undesirable substances (such as toxic metals).

## Riparian

Pertains to the terrestrial area along the banks of a river, stream, or lake.

## Runoff

Runoff refers to unfiltered rainwater that reaches nearby water bodies by flowing across impervious surfaces such as roads, parking lots, driveways, roofs, and even compacted soils in landscapes. Where the landscape is undeveloped or soils are not compacted, rainwater soaks into forest and meadow soils where it is filtered by natural processes, slowly feeding into underground aquifers, streams, and lakes. The filtration process removes pollutants such as motor oils, gasoline, fertilizers, and pesticides.

## Scrub-Shrub Wetland

A forested wetland classification that includes areas dominated by woody vegetation less than 6 meters (20 feet) tall. The species present include willow, red osier dogwood, and hardhack.

## Seed Bank

The natural storage of dormant and viable seeds present in the soils of an ecosystem. Soil seed banks play a critical role in the natural regeneration of many plant communities. In urbanized or highly disturbed forests and natural areas, the native seed bank is often destroyed due to soil degradation and colonization by invasive plants.

## Stand

A forest stand is a contiguous community of trees sufficiently uniform in composition, structure, age, size, class, distribution, spatial arrangement, condition, or location to distinguish it from adjacent communities.

## Stormwater Runoff—see Runoff.

## Tree Canopy

The uppermost layer of the forest, formed by the leaves and branches of dominant tree crowns. The tree canopy forms the forest overstory.

## Tree-Canopy Vigor

Vigor refers to a tree's active, healthy growth. Plants with low tree-canopy vigor have stunted growth, premature leaf drop, late spring-leaf development, sparse foliage, light-green or yellow foliage, twig and branch die-off, or other abnormal symptoms. A combination of factors (e.g., flooding, shifts in environmental conditions, or physical damage) reduces a tree's vigor. Stress on a tree can make it vulnerable to diseases and insects that accelerate its decline.

## Tree-iage

A prioritization tool, modeled after traditional medical triage, used to assess urban habitat conditions and inform restoration-management planning. The tool uses measurements of habitat quality and invasive plant threat to assign each management

unit a tree-iage category from 1 to 9. Category 1 represents high-quality habitat and low invasive species threat, and Category 9 represents low-quality habitat and high invasive species threat.

## Understory

The vegetation that grows below the forest canopy. Understory plants consist of saplings of canopy trees, together with smaller understory trees, shrubs, and herbs. Examples of understory plants found in Puget Sound forests include vine maple, beaked hazelnut, tall Oregon grape, salal, and sword fern.

## Urban-Heat-Island Effect

The increase in surface and atmospheric temperatures of urbanized landscapes caused by the replacement of vegetation and natural areas with impermeable surfaces such as roads, buildings, and other built infrastructure. Lack of vegetation in the built environment results in: elevated energy consumption (due to increased demand for cooling and electricity); an increase in greenhouse gases and air pollutants; water quality impairment (due to the heating of stormwater runoff entering streams and lakes); and human health problems, such as respiratory illness, heat exhaustion, heat stroke, and heat-related mortality.

## Urban Natural Areas—see Natural Areas.

PHOTO: ANDREW WATSON



## APPENDIX N: COMMUNITY FEEDBACK

### Green Shoreline Day – November 16, 2019 – Volunteer Feedback Survey

#### **Why did you decide to attend Green Shoreline Day?**

- I love the ability to contribute and volunteer locally. While I volunteer regularly it's usually for parks I do not spend a significant amount of time in, this was great as I live in the Briarcrest neighborhood and enjoy Hamlin park regularly, so it was a great opportunity to contribute to something I value so much.
- Contributing to restoring our environment and making the park look better.....its a mess! Full of invasive blackberries and scotch broom.
- I live within walking distance of one of the parks and I was excited that one of this larger events was being held at this particular park.
- I am looking for volunteer opportunities for my 13 year old son. On Facebook I saw your event and decided to give my kids a quality family time. And we loved the event and staff was so helpful. My son came back home with lots of new stuff about plants/tree. Big thanks to your supporting staff!!!
- I am a regular on the Richmond Beach Saltwater Park restoration team. I just showed up as usual.

#### **What type of impact do you feel you made at Green Shoreline Day?**

- I know the new plants will contribute to a better ecosystem for the park.
- Regular volunteers are the foundation upon which continuing good works are accomplished. Just. Show. Up.
- Participation - we need to encourage people to get involved. Our society relies on Government too much. It starts with us.
- We all participated in what will be the next forest community. Trees and plants definitely have a lifespan and we need to steward and foster the next generation of forest and plants in these green spaces. In light of climate change that affects us all, carbon sequestration by plants that are adapted to grow in our region (native plants) are nearly just as important as reducing our carbon footprint.

- With these types of events we could help our community by improving environment. Kids could learn how our surroundings are important for our healthy lifestyle.

#### **Please provide any additional comments or stories about Green Shoreline Day that you'd like to share.**

- I think you should host one in the spring or summer when the weather is warmer as well as the fall one.
- We appreciated the visit by the City Manager. It was a nice boost to the leaders of our team, to get this acknowledgement.
- We need a long term plan for the park. This is a huge project with the majority of the park filled by invasive plants.
- Seeing so many folks from our community, of all ages, come out and get the work done, was inspiring.
- On that day my kids learn a lot more about trees. Now they know the name of the tree. While coming back home they were discussing with tree name so some new name added in vocabulary!!!!

### Green Shoreline Kickoff Meeting – March 30, 2019 – Volunteer Feedback

#### **Forest Steward Support Needs**

Venues where dedicated stewards can come together to share information and build positive relationships – a “stewardship family”

- Want regular meetups with stewards
- More workshops, trainings, and opportunities for stewards to come together. (This point was mentioned by all groups we received feedback from)

Need more stewards and to coordinate leadership succession at sites and get next generation of volunteers involved

- Boeing Creek – Need new Forest Steward
- WNPS Master Native Plant Stewards trying to connect with Shoreline Community College to help steward Boeing Creek

More formal tracking for progress reporting needs

- Common space to access materials and accomplishments
- Online access to reports, data, tools
- Easier access to city’s resources and easier tool requests

**Volunteer Recruitment Needs**

Support getting more volunteers

Online access to all events

Centralized volunteer recruitment

- One person contact for high schools, churches, boy scouts, etc.

Shoreline Walks – highlight walks on Green Shoreline events

Want support in recruitment and outreach to schools, troops, businesses, etc.

Brugger’s Bog: Looking for more long term connection to schools

- Schools could build site into curriculum, for example students could develop stewardship plans and formal plant lists that then could be utilized in restoration at the site

Better branding opportunities

- Branded signs for work parties and other events
- T-shirts
- Brochures/Promotional Materials
- Booth in Farmers Market

**Resource Needs**

Native plants for restoration projects

- Brugger’s Bog in need of plants
- Richmond Beach – plant sources they’ve used:
  - King Conservation District
  - Go Natives!
  - Stormlake Growers

Snacks for supporting larger events

Funding for crew/contractor work

**Contractor Work Needs**

Help with professional consultation with restoration management experts to address particularly difficult issues that current resources are struggling with or not tending to  
Professional help with herbicide and work on steep slopes

- Shoreview Contractor Wants:
  - Brushcutter to assist with major removal or cut back
  - Injecting woody invasives
  - Knotweed and holly removal
- Saltwater Park and Innis Arden:
  - Invasive plant issues with Scotch broom, knotweed, and butterfly bush along streets
  - City is working with King County to address Noxious weeds
- Richmond Beach:
  - Wetland work
  - Morning glory and knotweed problems
  - Backshore Scotch broom problem
    - Scotch broom has taken over public beach and creating a “hiding” area

Need management plans that include strategic use of chemicals

Knotweed concerns

- Knotweed on WSDOT property
- Laurel management needed
- Black locust management needed

Plan needed for larger Norway maple management

**Concerns for Park Use**

Concerns of dogs in parks, especially near creeks

Potential need for signage

Initially parks were a focus of active recreation, while today we are integrating more passive recreation in parks

Communication between Parks Staff and Contractors needed:

- Contractors are mowing and often don’t have information about restoration work at parks so they run over native plants



PHOTO: HEATHER VAN STEENBURGH

### **Ideas for Parks**

Richmond Beach – would love education sign by historic shovel from site

- Can be a great way to engage more volunteers and to connect with the Historical Society

Should consider utilizing more fruit trees in parks to help with food insecurity issues

- There is always a tug of war between ecological restoration and use of parks

Groups to Connect with:

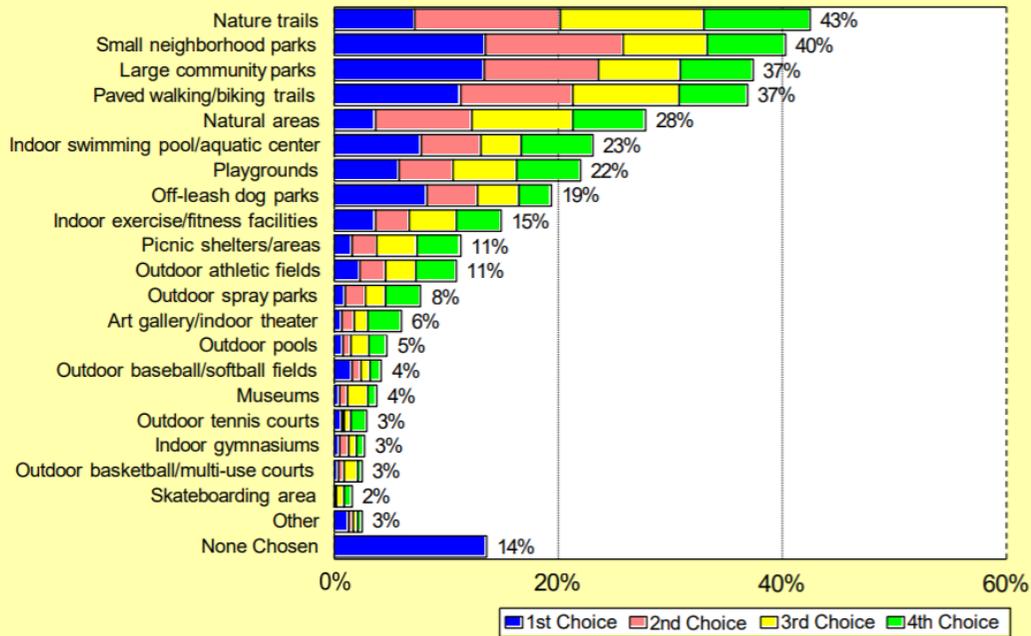
- AmeriCorps
- Sierra Club

### **Additional Community Feedback**

In 2016, ETC Institute partnered with the City of Shoreline to conduct a citizen survey to better understand residents' priorities for parks, recreation, and educational services. The 2010 U.S. Census reports there were 21,561 households in the City of Shoreline. Surveys were sent out to a random selection of 2,500 households throughout the City of Shoreline. A goal was set to obtain a minimum of 500 completed surveys within the City of Shoreline boundaries. Of the households that were requested to participate in the survey, 830 respondents participated. The full results for the sample of 830 households can be found here <http://www.shorelinewa.gov/home/showdocument?id=38543>, while most important facilities and top priorities for investments are highlighted on the following page.

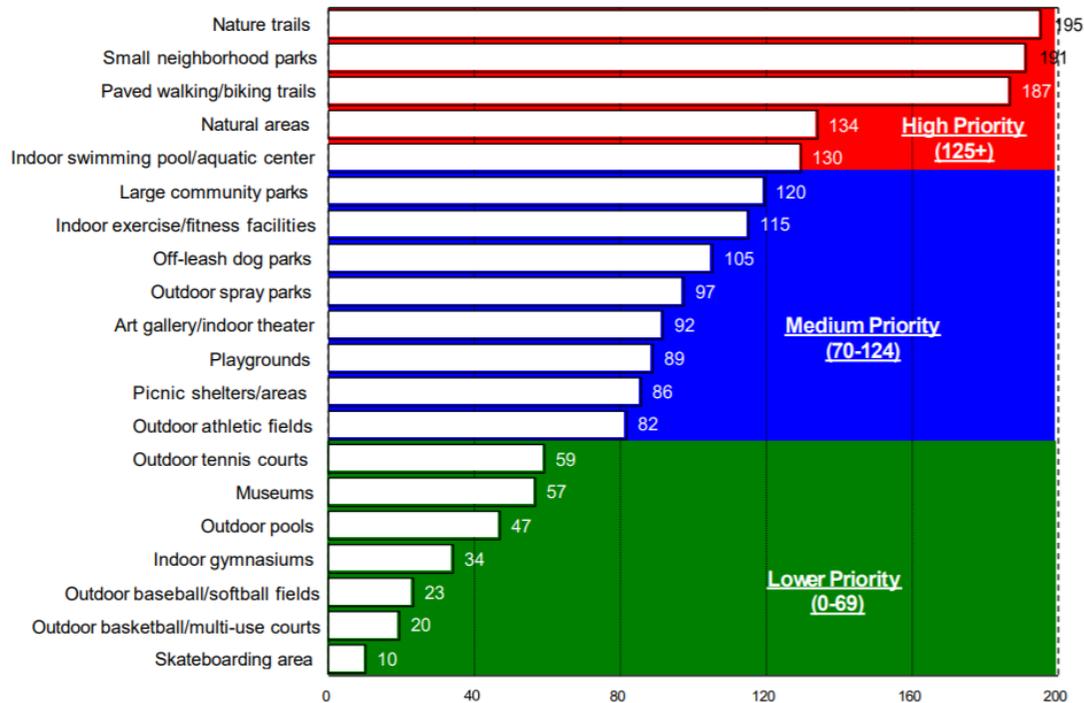
## Q9. Parks and Recreation Facilities That Are Most Important to Households

by percentage of respondents who selected the item as one of their top four choices



Source: ETC Institute (2016)

## Top Priorities for Investment for Facilities Based on the Priority Investment Rating



Source: ETC Institute (2016)

