SNOHOMISH COUNTY HEALTHY FOREST PROJECT

20-YEAR PLAN

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ACKNOWLEDGMENTS

Snohomish County and Forterra formed a partnership in 2019 to evaluate the health and condition of the county's forested areas, with a focus on urban forests, and develop a plan to help ensure that Snohomish County's vision of a sustainable, healthy region continues to become a reality. Snohomish County now joins Burien, Des Moines, Everett, Issaquah, Kent, Kirkland, Puyallup, Redmond, SeaTac, Seattle, Shoreline, Snoqualmie, Tacoma, and Tukwila as a member of Forterra's Green Cities Network of partners. This network in the Puget Sound region spans three counties (King, Pierce, and Snohomish), collectively serves a population of more than 5 million, and aims to restore and steward more than 14,000 acres of land. As part of this robust network of resources and expertise, the Snohomish County Healthy Forest Project will help ensure a livable and healthy region for all.

These partnerships share three core goals:

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

Land Acknowledgment

We gather and live on the plains, plateaus, mountains, and coastal lands that have been home to Indigenous peoples since time immemorial. We respect their Indigenous and tribal treaty rights, and honor their culture today.

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A special thank-you to our community members and partners who contributed to this plan to ensure it reflects the community's interest in our urban forests

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EXECUTIVE SUMMARY

Access to both vibrant cities and diverse natural settings makes Snohomish County a unique region, one that strikes a balance between natural and urban landscapes. Nature and a healthy ecosystem are important features of Snohomish County, and the Puget Sound is one of the region's most valuable assets. In 2017, Snohomish County launched the Puget Sound Initiative[1] to expand efforts to protect and restore the health of Puget Sound, including the county's lakes, rivers, and streams.

In April 2019, Snohomish County and nonprofit partner Forterra launched the Healthy Forest Project (HFP) to restore the health of county-owned forested open space through a community stewardship model. Healthy urban forests provide a wide variety of ecological and community benefits, such as reducing stormwater runoff, improving air and water quality, enhancing wildlife habitat, providing opportunities for recreation and community building, and much more. The county identified HFP as a priority program under the Puget Sound Initiative and, for the project's first phase, chose 10 pilot sites adjacent to key water bodies or salmon-bearing streams. This selection criteria was purposeful, based on the understanding that healthy forests offer significant benefits to improve local water quality and Puget Sound health.

What Is the Healthy Forest Project?

The Healthy Forest Project is a new community stewardship program to restore and care for the forested parks and natural areas managed by Snohomish County. Partnering with Forterra as part of the Green Cities Network, the county has chosen to focus on 10 pilot sites adjacent to key water bodies or salmon-bearing streams in the project's first phase.

In late 2019, American Forest Management conducted a forest health assessment of the 10 pilot sites in order to document their overall condition, particularly factors that impact forest vitality, such as invasive species cover and species diversity. Forterra utilized the assessment results to develop the recommendations found in this document, which is a road map to restore the health of Snohomish County-owned forested areas. A key finding from the assessment is that, although approximately 56% of acres surveyed are high-value habitat composition, 54% of the acres have medium to high invasive-species cover.[2] As such, the viability of these forested areas is threatened.

This Healthy Forest Project 20-Year Plan explains why now is the time to invest in the restoration and care of the county's HFP pilot sites; provides goals and objectives to enhance the current condition of these sites; and outlines actions to achieve the established goals. This plan is an important step toward implementing the Puget Sound Initiative, and the end results will benefit Snohomish County's community and ecosystem.

Key priorities for this 20-Year Plan include:

- Supporting the active, adaptive management of Snohomish County's forests, especially urban forests, with a goal to continue this practice into the future to ensure lands in active restoration remain ecologically healthy.
- Enrolling approximately 935 acres of forested parkland and natural areas 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.
- Integrating social equity into program planning, so that forest enhancement activities are encouraged and accessible to diverse communities, ideally in or near their own neighborhood.
- Engaging long-term volunteers in this work by providing a high level of training and expertise, rewarding and celebrating service, and recruiting a diverse volunteer base with a variety of skill sets.
- Securing stable, sustainable funding so that the program has the staff and resources necessary for success.

1 See https://www.snohomishcountywa.gov/3838/44334/Puget-Sound-Initiative for more information.

2 "Invasive" is a commonly used term to refer to fast-growing plants brought in from another region that can outcompete native plants. However, terms such as "invasive," "non-native," and "alien" can be problematic. Language is evolving, and restoration practitioners are looking for other words to describe these plants, such as "colonizing" or "aggressive" weeds. At this time, "invasive" is still the most widely used and understood term, so for efficiency, continuity, and understanding, we use it throughout this document.

PHOTO BY SUZIE HOWELL

Snohomish County recognizes the strong connection between access to healthy urban forests and sustainable, livable communities. The HFP can play a key role in helping meet these shared goals. The cost of doing nothing is very high: while Snohomish County has many forests that are in excellent health, some areas have a current trajectory of a complete loss of forest. Taking steps to reverse this trend is crucial for the health of the county's forests — and the county itself. These goals and outcomes can be achieved with the help of an engaged and dedicated community that has an ownership stake in the HFP's success.

CHAPTER 1. INTRODUCTION

THE NEED FOR THE HEALTHY FOREST PROJECT

With continued population growth anticipated throughout the Puget Sound region, Snohomish County's residential and business density is likely to increase in the future. One of the challenges facing the county is how to balance this growth while maintaining a strong economy and exceptional quality of life. In order to preserve access to natural open spaces and the benefits they provide, the protection and enhancement of canopy cover within the county's forested areas, especially urban forested areas, is critical.

Scientists and governmental agencies have begun to recognize the many benefits of having more trees within the urban landscape. Snohomish County's regional forest — including its areas of dense forest, shorelines, open spaces, and wetlands — provides numerous services that benefit its citizens. 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 (U.S. Forest Service 2018). Areas with increased vegetation, leaves specifically, capture more particulates in the tree canopy and clean the air; they also have healthier soils, which clean the water by filtering polluted runoff. As well, the forest enhances the livability and aesthetics of neighborhoods, offers shade on the hottest days, and provides habitat for local wildlife. Finally, in addition to cleaner and cooler air, and improved water quality, Snohomish County's regional forest provides people with access to nature, recreation, and opportunities for community connections, along with physical and mental health benefits.

In the past, urban natural areas in our region were unfortunately often left unmanaged, due to a belief that they would take care of themselves and it was advantageous to keep human impact to a minimum. With further study, however, we have learned that urban forests face unique pressures, needing more care than we once believed. Land-use changes, natural and human disturbances (such as landslides, fires, or soil compaction by heavy machinery), 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. Development also increases forest fragmentation and creates pressure on the forest edges. We now know that we must actively manage urban forests by removing invasive species; planting, regenerating, and watering young trees during times of drought; monitoring for and responding to pests; pruning trees and performing maintenance; and more. The urban forest needs our help and continued support. The Green City Partnerships work with county staff to engage a robust volunteer effort in order to fulfill this important role.

As a result of our past misunderstanding and lack of care, our urban forests are disappearing — not just to development, but also because some areas of forest are unhealthy and need active management. And when we lose urban forests, we lose the services they provide. However, many studies have proven that educating and engaging residents and securing a strong commitment of care can quickly change the health of an urban forest (U.S. Forest Service 2018).

Snohomish County owns approximately 11,704 acres of forested open space, and many of the county's forested areas are degraded and overrun by invasive species. The 10 pilot areas that have been selected for the Healthy Forest Project total 935 acres, all of which are adjacent to a salmon-bearing stream. While the county's ability to maintain optimum health in all of these areas is limited, our local communities represent a tremendous opportunity to help move the needle on Puget Sound health through an organized forest stewardship model. Through the HFP, Snohomish County and nonprofit partner Forterra will partner with communities to recruit, train, and support stewards on active forest management. Ultimately, the county aims to build a network of healthy forests and a strong culture of community stewardship, leadership, and partnership.

Snohomish County and Forterra officially launched the HFP in April 2019. American Forest Management conducted a forest assessment of the county's 10 pilot sites, totaling approximately 935 acres, in late 2019, and Forterra used the results of the assessment to develop the recommendations in this plan. See Table 1 for a list of pilot sites and their acreage, and see Appendix A for a map of the project sites.

One of the key findings of the forest assessment was the presence of invasive species, which can suffocate healthy forests if not managed consistently. Figure 1 shows that 54% of the 935 acres assessed had a medium to high presence of invasive-species cover. Moreover, of the total acreage assessed, approximately 550 acres were comprised of age class 3 trees, which are 50 to 99 years old. On the whole, the results of the forest assessment confirmed that Snohomish County's 10

Table 1: Healthy Forest Project pilot sites and acreage

Site Name	Acres
Evergreen State Fairgrounds	29
Kayak Point Park	370
Lake Stickney Community Park	17
Lord Hill Regional Park	114
McCollum Pioneer Park	9
Meadowdale Beach Park	96
Paradise Valley Conservation Area	164
Picnic Point Park	36
Portage Creek Wildlife Area	96
Smith Island SW site	3

pilot sites are high-quality assets worth preserving, but more resources are needed to ensure their survival. The forest assessment findings for the 10 sites are described in more detail in Chapter 4.

The HFP specifically addresses the need to restore and care for the existing canopy cover and forest health already present in Snohomish County's parks and natural areas, which many in the community have dedicated themselves to preserve and protect. The dominance of non-native plant species is a major cause of biodiversity loss and degradation of urban forests (Soulé 1991; Pimentel et al. 2000; Powell et al. 2013). These invasive weeds lack natural 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. To address the declining health of Snohomish County's forested parks and natural areas, the county has established the HFP.

Together, Snohomish County and Forterra developed this long-term plan, which is a road map to help the county meet its goals. Community input was an important component in establishing plan priorities and the implementation framework, as building a base of community volunteers and lead stewards is key to the HFP's success. The Healthy Forest Project 20-Year Plan addresses county capacity, outlines strategies for community participation, and establishes what is needed long-term to support the HFP's vision and goals.

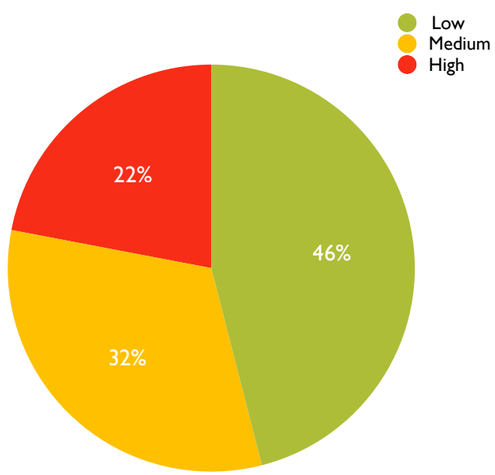


Figure 1: Presence of invasive species across the 10 Healthy Forest Project pilot sites

PHOTO BY SNOHOMISH COUNTY

FORTERRA AND THE GREEN CITIES NETWORK

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 sustainable and livable urban communities. The Green Cities Network of 14 cities is making ecosystem-wide, regional change, and with this plan, Snohomish becomes the first county to make the commitment to apply the Green Cities model to its forested parks. The Green Cities Partnerships in Seattle, Tacoma, Kirkland, Redmond, Kent, Everett, Tukwila, Puyallup, and elsewhere have already seen success, and together, they are establishing one of the largest urban forest restoration networks in the nation (see Appendix C for a map of the Green Cities Network). This coalition of local governments and partner organizations holds annual summits and quarterly meetings where ideas are exchanged and solutions offered. By joining this impressive, innovative network, Snohomish County will contribute to the health and livability of the entire Puget Sound region.

URBAN FOREST BENEFITS

As outlined in the Parks and Recreation Element and Natural Environment Element of Snohomish County's General Policy Plan,[3] there are many environmental and social benefits of caring for Snohomish County's forests, and they affect all aspects of the community. Research indicates that urban forests give people a higher quality of life (Dwyer et al. 1992; Jansson 2013; Zank et al. 2016) and make communities more livable and beautiful. National and state environmental protection agencies are increasingly citing urban forest health as a means to mitigate the harmful impacts of air and water pollutants, greenhouse gas emissions, and urban heat and noise (Wolf and Robbins 2015). Urban forests also provide ecosystem services such as flood prevention, create opportunities to improve physical and mental health, provide opportunities to enjoy nature close at hand, and much more (see Figure 2 and Table 2).

What Is Snohomish County's Vision for Open Space and Natural Areas?

The Parks and Recreation Element and Natural Environment Element of Snohomish County's General Policy Plan specify the goal of providing open space and natural areas with appropriate public access to promote understanding and support of the natural environment and the benefits these lands provide. This element proposes partnering with public and private organizations to assist in habitat improvement, monitoring, and research on county parklands. The Healthy Forest Project 20-Year Plan serves as a direct strategy to address this goal.

3 The plan is online at https://snohomishCountywa.gov/1566/General-Policy-Plan.

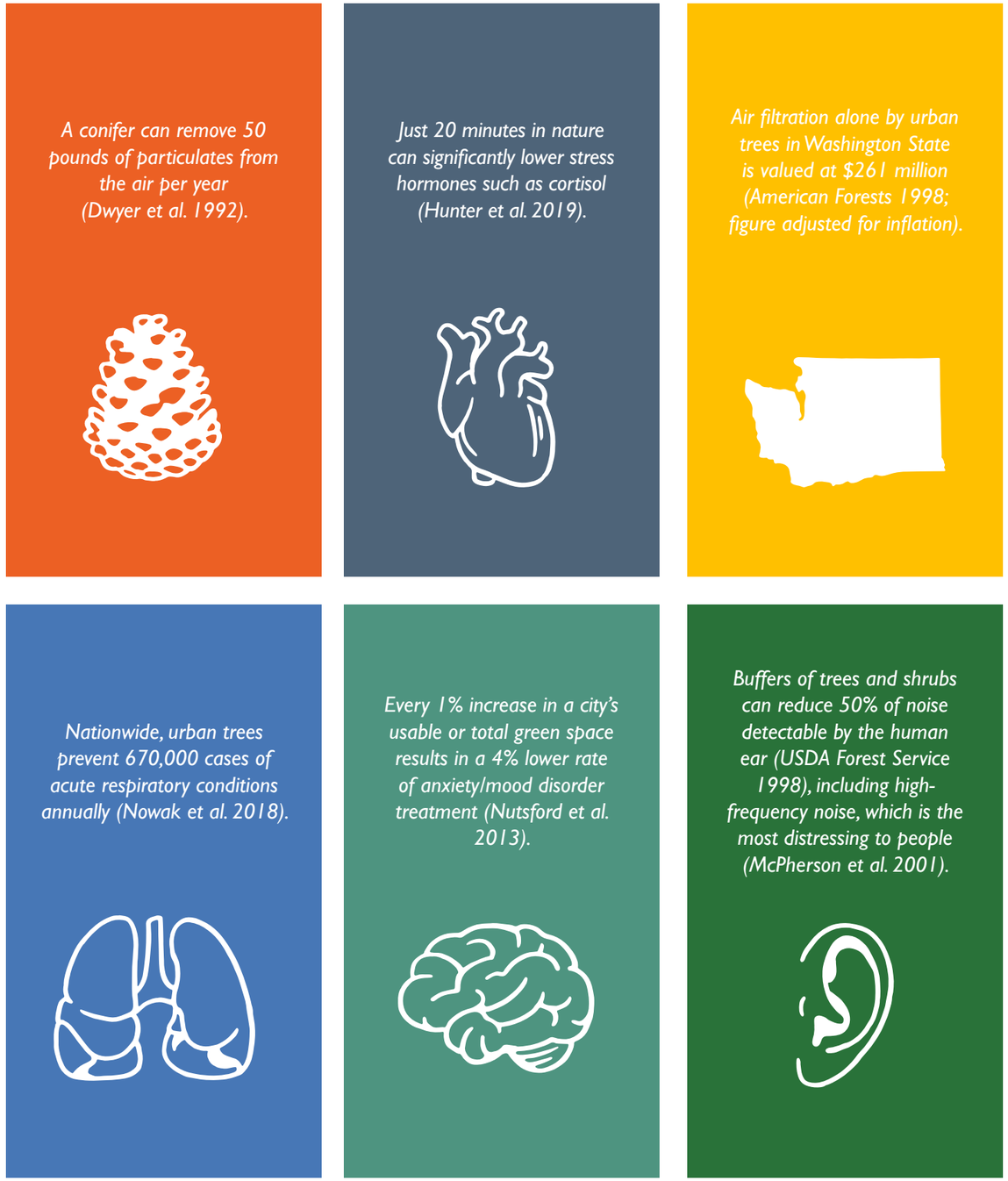


Figure 2: Urban forest fast facts

Table 2: The myriad benefits of urban forests

Boost Local and Regional Economies	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 are often valued at up to 5% more than comparable homes farther from parks (Tyrväinen and Miettinen 2000; Panduro and Veie 2013), and street trees add value to homes as well (Donovan and Butry 2010).
Improve Air Quality	Plant leaves absorb carbon dioxide and produce oxygen through photosynthesis. The surfaces of leaves trap airborne dust and soot (McPherson et al. 1994; Ram et al. 2012), removing millions of pounds of air pollutants annually from the air in a city (American Forests 2001).
Improve Water Quality	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 2007); others are transformed by plants through metabolism or trapped in woody tissues and released when a tree decomposes.
Reduce Stormwater Runoff	Urban forests can reduce annual stormwater runoff by 2%–7%, and a mature tree can store 50–100 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).
Reduce Erosion	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; Li et al. 2014).
Provide Wildlife Habitat	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). Healthy forests along rivers and creeks are critical to salmon habitat (Beechie et al. 2005).
Sustain Scenic Resources and Make Communities More Attractive	Urban forests improve the scenic and visual quality of our cities, and trees are the most important factor in influencing the perception of a community's aesthetic value (Schroeder 1989). 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).

Build Community	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).
Buffer Noise	Tree canopies dampen sound by intercepting sound waves (Fang and Ling 2003). Noise buffers composed of trees and shrubs can reduce 50% of noise detectable by the human ear (U.S. Forest Service 1998), including high-frequency noise, which is the most distressing to people (McPherson et al. 2001).
Foster Physical Wellness and Fitness	People in communities with high levels of greenery or green space are more likely to be physically active (Ellaway et al. 2005; Maas et al. 2006). In fact, people who use parks and open spaces are three times more likely to achieve recommended levels of physical activity than nonusers (Giles-Corti et al. 2005).
Improve Mental Health and Function	The experience of being in nature helps restore the mind after the mental fatigue of work or studies, improving productivity and creativity (Kaplan 1995; Berto 2014; Bratman et al. 2015). A recent study found that just 20 minutes of walking in nature significantly lowers stress hormones (Hunter et al. 2019).
Help Children Develop	Experience with nature helps children develop cognitively, emotionally, and behaviorally by connecting them to environments that encourage intellectual development, imagination, and social relationships (Heerwagen and Orians 2002; Isenberg and Quisenberry 2002). Access to, and regular play in, green settings and green play areas also decrease the severity of attention deficit disorder in children and result in milder symptoms (Taylor et al. 2001; Taylor and Kuo 2014).
Stewardship Activities Benefit Health and Wellness	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 such as planting trees (www.myplate.gov). Strong community relationships are built from sharing personal stories, exchanging information, and working together to achieve common goals (e.g., community forest improvements).
Reduce Energy Use and Combat Climate Change	A 25-foot tree reduces annual heating and cooling costs of a typical residence by an average of 8%–12% (Wolf 1998). Urban forests can also 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).

Economic Benefits

The Puget Sound region's forests provide measurable, valuable services that affect us every day. In 1998, American Forests, a nonprofit citizens' 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 Improvement

Trees and vegetation can directly help reduce air pollution by removing pollutants and reducing air temperature, both of which contribute to smog (Nowak and Heisler 2010). Conifers, specifically, can remove 50 pounds of particulate pollutants from the air per year (Dwyer et al. 1992; Nowak et al. 2013), 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 pollutants through their leaves and branches, and evergreen trees do this work year-round (Nowak et al. 2018). Recent studies have found that conifers 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 2010, in the United States alone, trees removed 17.4 million tons of air pollution, which prevented 850 human deaths and 670,000 cases of acute respiratory symptoms (Nowak et al. 2018).

Forests Clean the Air

Snohomish County has prioritized approximately 935 acres that the Healthy Forest Project will work to maintain and/or restore to a healthy condition. This acreage has the potential to mitigate the emissions of more than 2,600 cars per year once it is restored.

Water Quality Improvement

The Washington Department of Ecology has determined that stormwater runoff is the number one pollution problem in urban areas (Howard 2019). Neighborhoods with fewer trees and more impervious surfaces 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). Runoff washes chemicals (e.g., oil, gasoline, road salts) into local urban streams, where they cause lethal and sublethal toxicity in juvenile salmon and their prey (McIntyre et al. 2015). Trees absorb and filter water through their roots, thus mitigating stormwater damage and pollution, and the loss of trees means the loss of these vital services.

Trees also help soils that have been compacted by human activity 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). Maintaining healthy trees means healthier soils, which increase stormwater interception, increase infiltration, and improve water quality. The HFP understands the important role trees play in improving water quality and will work interdepartmentally with Snohomish County staff to be innovative and creative with forest restoration and tree-planting efforts in order to improve water quality.

Benefits to Wildlife and Salmon

Healthy forests with diverse native tree and plant species offer habitat for wildlife by providing areas to nest, forage for food, and seek shelter. In an urban context, restoration of degraded urban forests has been demonstrated to increase species diversity (Ruiz-Jaén and Aide 2006), and areas with high concentrations of trees can act as wildlife corridors between larger forested areas (Fernandez-Juricic 2000).

Healthy forests along rivers and creeks are especially important for salmon habitat (Beechie et al. 2005). For the duration of their lives, trees adjacent to rivers provide many benefits to salmon, such as stabilizing sediment, shading and cooling water, and providing a source of terrestrial invertebrates that fall from overhanging trees — a major source of food for juvenile salmon.

Once they reach the end of their life span, trees provide the secondary function of adding large wood to rivers, which is critical for salmon habitat (Sedell et al. 1988; Fausch 1993; Cedarholm et al. 1997; Roni and Quinn 2001), and studies have shown that salmon abundance increases with an increase in woody debris (Naiman et al. 2002; Whiteway et al. 2010). The presence of large wood in streams can change the shape of channels and create habitat for salmon at different life stages. By modifying the movement and energy of water flow, large wood can also sort stream sediments, form gravel beds that are preferred for spawning (House and Boehne 1986; Bisson et al. 1987), and cause scouring that creates pools and off-channel habitat, providing an essential rearing refuge from fast-moving water. The slower water also makes it easier for juvenile salmon to capture food (Bisson et al. 1987; Fausch and Northcote 1992).

As well, wood in rivers and streams also provides cover from predators, traps sediments, and increases food availability (Bilby and Bisson 1998; Naiman et al. 2002). By focusing restoration efforts on planting native conifers and increasing riparian buffers, Snohomish County salmon habitat could be greatly improved.

Community Benefits

Physical features, particularly natural spaces, play an important role in creating vital neighborhoods (Sullivan et al. 2004). Since green space is an important element of livable, attractive communities, it provides benefits beyond environmental services. Urban green spaces and parks provide gathering places for people of different backgrounds to integrate and connect with each other. Parks, trails, and natural areas give people who live in urban areas recreational opportunities and a connection to nature. As discussed in more detail below, trees and green spaces are also 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.

Human Health Benefits

Higher percentages of neighborhood green spaces are associated with significantly lower levels of stress, anxiety, and depression (Astell-Burt et al. 2014). When people live more than 1 kilometer (0.6 mile) 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 usable or total green space results in a 4% lower rate of anxiety/mood disorder treatment (Nutsford et al. 2013). It has also been shown that people living near parks and green space have less mental distress, are more physically active, and have extended life spans (U.S. Forest Service 2018). 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 (U.S. 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 (Environmental Protection Agency 2018). According to the EPA, each acre of healthy forest can remove carbon dioxide emissions for approximately 2.4 vehicles per year.

Another way that urban trees mitigate climate change is by combating the "urban heat island effect," which is caused by paved surfaces absorbing and radiating heat from the sun. As our climate changes, urban heat has become a growing environmental concern. The urban heat island effect, combined with the warming effects of climate change, is likely to cause an increase in the frequency and intensity of extreme heat events in the Pacific Northwest and worldwide (Meehl and Tebaldi 2004; Mote and Salathé 2010), affecting vulnerable populations in cities (Huang et al. 2011, Voelkel et al. 2016). Trees in an urban setting are particularly vital for reducing heat stress and combating the heat island effect (Zupancic et al. 2015) because they decrease the size and effect of the urban heat island by absorbing and radiating heat from the sun and producing shade. Trees also have the unique ability to create microclimates that move air and further cool their surroundings through evapotranspiration. On a larger scale, green spaces that are connected and closely spaced can improve the flow of cool air throughout an entire city. Green spaces have been shown to significantly lower ambient temperatures, making hot days more comfortable and reducing energy consumption for artificial cooling (Kurn 1994, Akbari et al. 2001, Makido et al. 2019). A single 25-foot tree reduces a typical residence's annual heating and cooling costs by an average of 8% to 12% (Wolf 1998).

Forests Reduce Heat

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

Environmental Justice

The EPA defines environmental justice as "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."[4]

A number of studies have concluded that the distribution of urban green space is related to measures of socioeconomic status, such as income, race/ethnicity, education, and occupation. These studies regularly report that neighborhoods with higher socioeconomic status enjoy greater access to nearby green space (Gordon-Larsen et al. 2006; Wen et al. 2013; Jennings and Gaither 2015). The EPA affirms that negative environmental factors are concentrated in areas where there are low-income earners, a majority of people of color, immigrant communities, and/or the elderly. Robert Bullard, who is often described as the founder of the environmental justice movement, wrote, "Whether by conscious design or institutional neglect, communities of color in urban ghettos, in rural 'poverty pockets,' or on economically impoverished Native American reservations face some of the worst environmental devastation in the nation" (Bullard 1993). People from these demographics are often not included in environmental decision-making processes, yet they are typically disproportionally impacted by environmental and health hazards such as pollution, lack of canopy cover or green spaces, and the urban heat island effect (Huang et al. 2011).

According to the EPA, environmental justice can be achieved when "all people enjoy the same degree of protection from environmental and health hazards and equal access to the decision-making process to maintain a healthy environment in which to live, learn, and work."[5]

Decreased Crime

Studies have shown that urban forests and healthy green spaces decrease crime (Kuo and Sullivan 2001a). The Chicago Region Trees Initiative (CRTI) has mapped and studied 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 et al. 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 investigation, Kuo and Sullivan studied 98 apartment buildings in an inner-city neighborhood of Chicago and found that regardless of the socioeconomics of the residents of an apartment building, "the greener a building's surroundings are, the fewer total crimes" (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. Trees and natural landscapes are associated with reduced aggression and violence (Kuo and Sullivan 2001b), and less graffiti, vandalism, and littering (Brunson 1999).

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 Healthy Forest Project and will help create community and connect people with their local forests.

More research is still needed to quantify the economic and ecosystem benefits of Snohomish County's forests. That said, drawing from the wide body of knowledge and related studies outlined here, it is known that the cost of doing nothing to restore and maintain the health of the county's urban forest will be high and have negative effects on Snohomish County's environment, economy, and public health. As development throughout the region continues at a rapid pace, preserving and enhancing our remaining forests is now more important than ever.

4 See https://www.epa.gov/environmentaljustice/learn-about-environmental-justice.

5 Ibid.

CHAPTER 2.
THE CHALLENGE: THREATENED FORESTS

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

- Fragmentation and development
- Declining habitat quality
- Invasive species: plants and insects
- Native trees struggling to regenerate
- Harmful use: intentional and unintentional
- Climate change
- Resource limitations

FRAGMENTATION AND DEVELOPMENT

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 were once predominantly forested lands, but habitat fragmentation is a forest threat that is inevitable in developed environments. Fragmentation occurs when contiguous forested areas are divided by infrastructure like roads and buildings. This fragmentation decreases the forest's valuable internal habitat and increases edge effects, because forest edges receive more human interference, are more disturbed, and receive more sunlight than contiguous forests. As well, pollination can be challenging when fragmentation isolates populations of plants, because plants that have barriers between them, or 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, which can hinder seed dispersal.

In order to reap the benefits that forests provide, planning and development must consider how and where to keep dense forest as uninterrupted as possible. Carefully considered planning of greenbelts and parks, tree-related municipal policies, and neighborhood-specific regulations and association agreements can reduce fragmentation and contribute to forest health. Conserving these green spaces is an important first step in preserving the region's natural resources in the face of urbanization.

DECLINING HABITAT QUALITY

The majority of Healthy Forest Project pilot sites (57%) are dominated by high-quality evergreen species (see Figure 3). However, 40% of the sites are dominated by lower-quality deciduous tree species. The remaining 3% of areas surveyed have less than 10% tree canopy and are likely grass or shrubland.

Deciduous trees are short-lived, early-colonizing species that establish in disturbed areas, such as after the logging activity that occurred throughout the Puget Sound in both the 1800s and 1900s. Alders, bigleaf maples, and cottonwoods are the dominant deciduous trees in Snohomish County's forested overstory. Under natural conditions, as they begin to die off, they are typically replaced by longer-lived conifers; however, many of Snohomish County's forests no longer grow under natural conditions. The natural decline of deciduous trees and potential lack of evergreen regeneration may be one of several factors that contribute to the loss of habitat quality in Snohomish County's HFP sites.

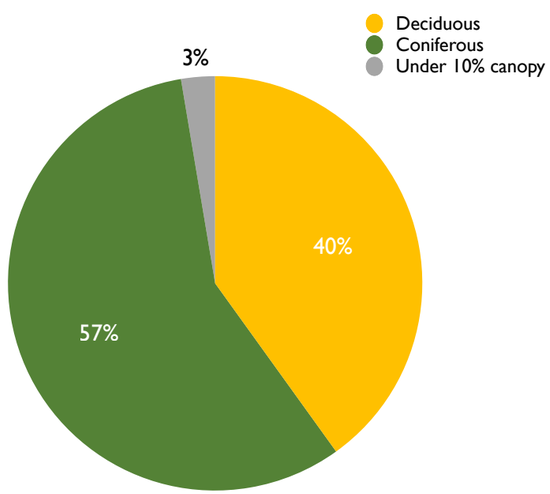


Figure 3: Primary overstory types in the Healthy Forest Project sites

PHOTO BY SNOHOMISH COUNTY

In the pilot sites that are dominated by deciduous trees, there will be a decline in tree canopy in the near future. Many of those 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 will allow invasive plants to become the dominant species in many parts of the county, inhibiting the growth of new trees and plants. Without intervention, such as planting a mix of young coniferous and native deciduous 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 Snohomish County's forest overstory.

Additionally, urban development, channelization, and the past removal of vegetation along our region's many streams and wetlands have resulted in a loss of native species cover. Large areas of watersheds, 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 Snohomish County HFP has prioritized the restoration of forests in, near, or adjacent to riparian areas – a strategic decision because of the potential ecological and social co-benefits.

INVASIVE SPECIES: PLANTS AND INSECTS

Invasive plants are present throughout Snohomish County, including in the 10 HFP pilot sites. Aggressive, non-native plants cover the ground, restricting seed germination and preventing tree seedlings and other native plants from receiving sunlight and nutrients. Robust Himalayan and evergreen blackberry are the most prevalent invasives in the pilot sites (see detailed information in Chapter 4). The blackberry canes arise out of a root crown, similar to raspberries, but with larger thorns. They often spread by seeds that birds disperse to new locations. Invasive blackberry grows densely in large thickets, choking out native plants and destroying habitat for wildlife species. Blackberry thickets are especially aggressive when established along creeks and gulches, and, in the long term, can cause erosion and be detrimental to water quality and salmon. This impacts the entire ecosystem and can lead to a decline in the health of Puget Sound.

English holly takes second place as the most abundant invasive in HFP sites. English holly is an invasive tree that can grow up to 50 feet tall and 15 feet wide, and can form dense thickets that dominate the tall shrub layer, suppressing germination and growth of native tree and shrub species. Though poisonous to humans, the berries of English holly are regularly eaten and spread by birds.

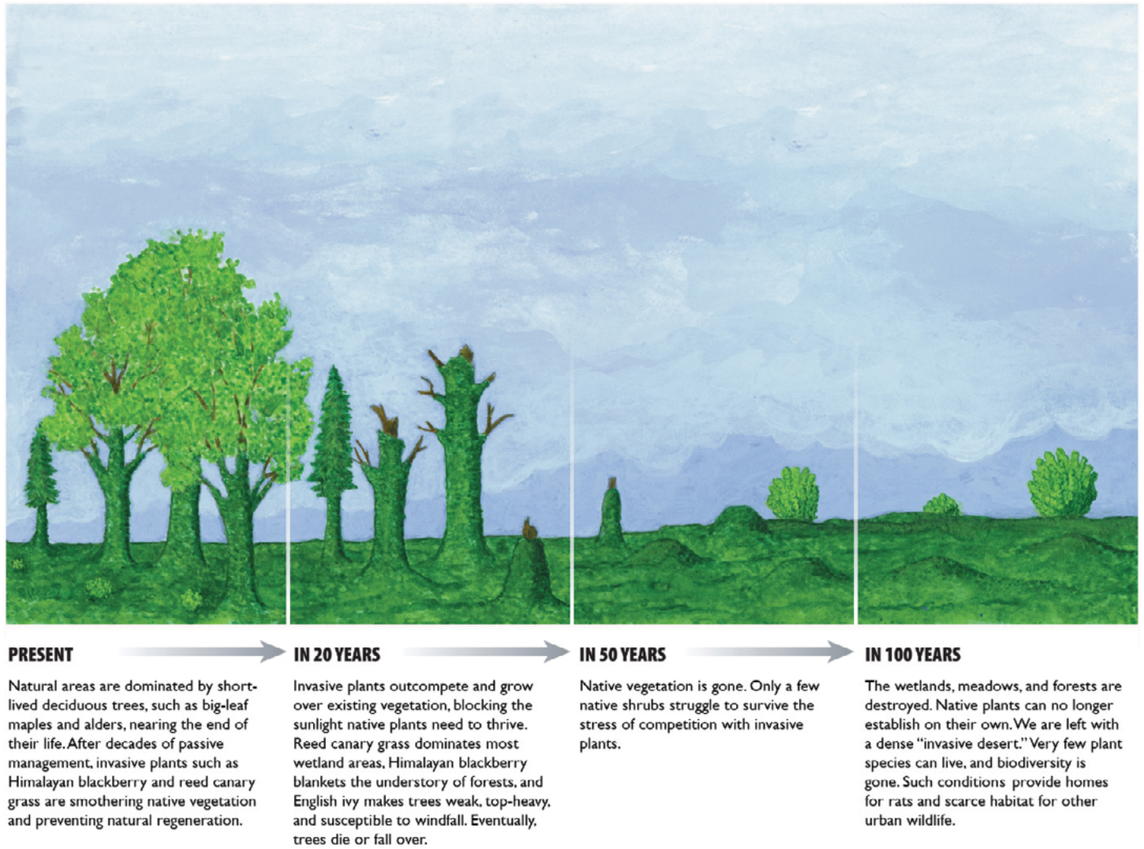


Figure 4: Illustration of the forest's potential if it is not restored

English ivy is the third most widespread invasive present in HFP sites. 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, as well as adds a lot of weight to the tree, leading to blow-over in high winds. 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 the HFP sites, it is important to remove the existing growth as quickly as possible in order to prevent further spread and minimize the potential for much higher management costs in the future.

As invasive species begin to dominate our forests, they exclude other plants, so they do not foster the diversity of food and habitat that keeps natural areas healthy and stable. 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 invasives. In addition, while invasive plants do 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. Other environmental benefits, such as stormwater retention and erosion control, are also 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 engulfed with sprawling thickets of blackberry and ivy, as illustrated in Figure 4.

Non-native, invasive insects can also have catastrophic effects on a region's natural resources and negatively impact the 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 (*Anoplophora chinensis*), which arrived 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 (*Lymantria* spp.), which are invasive moths known to defoliate trees, have been documented in Washington, 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 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).

Snohomish County will need to stay abreast of potential invasive insect outbreaks in the region. Information is available to HFP staff and volunteers through the Washington Invasive Species Council (WISC) and U.S. Department of Agriculture Animal and Plant Health Inspection Service. The Green Cities Network is working with the WISC to develop protocols and monitoring procedures for Forest Stewards to help cities detect invasive species outbreaks, and this could be offered as a training for HFP stewards.

What Is a Forest Steward?

Forest Stewards are trained and dedicated volunteers who commit to a particular park and help lead restoration efforts. They work individually or in small teams to organize and lead volunteer events, and collaborate closely with staff to create restoration work plans, track restoration progress, and help with networking, public awareness, and volunteer recruitment. They may also apply for small grants to manage their sites. Forest Stewards allow the Healthy Forest Project to increase its capacity to reach more restoration sites and engage more people in their local parks.

As the Healthy Forest Project 20-Year Plan is implemented, insect pests and other forest-health threats should be monitored at each project site as part of a detailed stewardship plan. To protect the county's forests from devastating future pest and disease outbreaks, maintaining a diversity of trees and shrubs is also vital. 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 (Levine et al. 2004).

NATIVE TREES STRUGGLING TO REGENERATE

In some forests, especially forests that have experienced disturbance such as logging, native trees have regenerated in high density and are overcrowded. If left to their own devices, young trees would compete with one another for resources, and in some cases, conifers may be outcompeted by hardwoods.

Hardwood species tend to be the first tree species to naturally emerge following disturbances and clear-cuts (King County 2015). Red alder is especially competitive and has established itself in many stands that were once harvested for Douglas-fir (Grotta and Zobrist 2009). Mixed-species forest stands provide more ecological benefits than homogenous stands, as their stratified canopy and vertical/horizontal variation offer year-round shade and the average life span of the stand is longer (King County 2015). Additionally, the presence of both conifer and hardwood tree species along streams and riverbanks creates a beneficial combination of nutrient inputs, shade, and coarse woody debris that persists longer, as the logs of coniferous trees tend to survive longer than deciduous logs in large rivers. Yet in order for conifers to naturally replace a pure alder stand, seedling stock/seed bank levels must be sufficiently high during the last decade of alder dominance (King County 2015).

In stands where Douglas-fir dominated post-disturbance regeneration, densely packed trees grow taller, but are often spindly, with high height-to-diameter ratios. As a result of the forest's dense condition, these trees are stressed, unhealthy, and susceptible to blowdown or other threats, weakening the forest's structural integrity and ecological value. Relative stand density, which is a measure of how crowded trees are within a stand relative to the biological maximum a stand can support (Curtis 1982; Ciecko et al. 2016) would increase over time, resulting in poor forest health and rapidly increasing tree mortality (King County 2015).

A management unit (MU) is a defined geographic area within a park characterized by the vegetation type or conditions present. Open-space areas within the HFP 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-iage values.

Tree canopy composition is one of the variables (along with invasive threat cover) used to determine the tree-iage category

PHOTO BY SNOHOMISH COUNTY

of each MU (see Chapter 4 for detailed information on tree-iage). Each MU is assigned a value (high, medium, or low) for tree canopy composition, based on the percentage of native tree canopy cover, and the percentage of canopy cover made up by evergreens and/or madrones. Canopy cover estimates can also be used to assess stand density. This information can be used to inform whether ecological thinning may help improve the health of forests.

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 Snohomish County's forests. Misuse of parks, harming community trees, and destruction of natural areas is an unfortunate reality of park and forest management. Dogs running off leash outside of designated off-leash areas trample native trees and cause erosion. People degrade native forest vegetation when walking, running, or biking off established trails. Dumped garbage and yard waste is a common problem in parks and natural areas — illegally dumped garbage can leach chemicals into the ground, attract rodents or other pests, and smother understory vegetation. Dumping yard waste in park properties can introduce and spread invasive plants. Encroachments onto public land from adjoining private-property owners can result in detrimental impacts, such as loss 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.

Snohomish County recognizes that homelessness is a social condition and not a crime. Homeless encampments, however, are prohibited inside Snohomish County parks as they can damage these natural areas. The county's Department of Parks, Recreation, and Tourism addresses these issues with sensitivity and in accordance with established procedures. The county will continue to employ best practices for the health and safety of volunteers, the protection of natural spaces, and the just and equitable treatment of the individuals experiencing homelessness.

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. This is an unfortunate perception, as it is often untrue: well-managed green space doesn't encourage crime, but rather, reduces it (U.S. Forest Service 2018). The issue is that management is costly and challenges many communities, especially in an urban setting. When illegal activity takes place, forested areas can become known more for the harmful pursuits they harbor than for the valuable benefits they provide.

PHOTO BY JIM AVERY

Reversing this image takes a concerted effort, but simply bringing more attention and activity to these areas can vastly improve negative perceptions. The Green Cities Network is a valuable resource in this regard, providing tactics and lessons learned to assist in managing homelessness in parks.

CLIMATE CHANGE

The Pacific Northwest region faces climate-change impacts that include warmer temperatures and changes in precipitation (Climate Impacts Group 2009; Mauger et al. 2015). 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). As is currently being experienced in the Puget Sound area, the phenomena of sword fern and bigleaf maple decline may be attributed to changes in climate (Betzen 2018, Green Seattle Partnership 2018).

Restoration and conservation of urban forests and natural areas therefore become increasingly important, as studies have shown that diverse landscapes are more productive and adapt better to climate change (Oehri et al. 2017). The county must integrate climate-adaptation and resilience strategies into general management practices and park-specific stewardship plans. Strategies could include selecting drought-tolerant plant species in planting plans or using seed/plant stock from adjacent U.S. Department of Agriculture (USDA) plant zones.

RESOURCE LIMITATIONS

Snohomish County has existing programs and partnerships that provide education and resources for private landowners, such as the Native Plant Program and LakeWise Certification Program. The county also provides resources to assist landowners and homeowner associations with best management practices for Native Growth Protection Areas and Critical Area Protection Areas. Its partnerships with local organizations, such as the Snohomish Conservation District, Washington State University Extension, and Farmer Frog, also provide educational and technical assistance to landowners. However, more resources are needed to expand these

partnerships in order to meet current demand and the county's rapid population growth. The HFP's focus is on county-owned park sites, which are only one piece of the big picture with respect to Snohomish's forest management. With much of the county's canopy cover existing on residential and private land, more resources are needed to better engage with, and provide education and assistance to, private-property owners on forest care, management, and maintenance.

With respect to public lands, local government resources for tree and forest management and maintenance, such as in parks, have historically been underfunded. As mentioned earlier, it was historically believed that forests and natural areas, even in urban environments, could take care of themselves. Under this incorrect assumption that they were self-sustaining, many parks and natural areas around the Puget Sound were neglected. This passive management approach led to declining health in unsupported forests and other natural areas — and the longer active management is postponed, the more expensive it becomes, as invasive species continue to spread and degrade forest health.

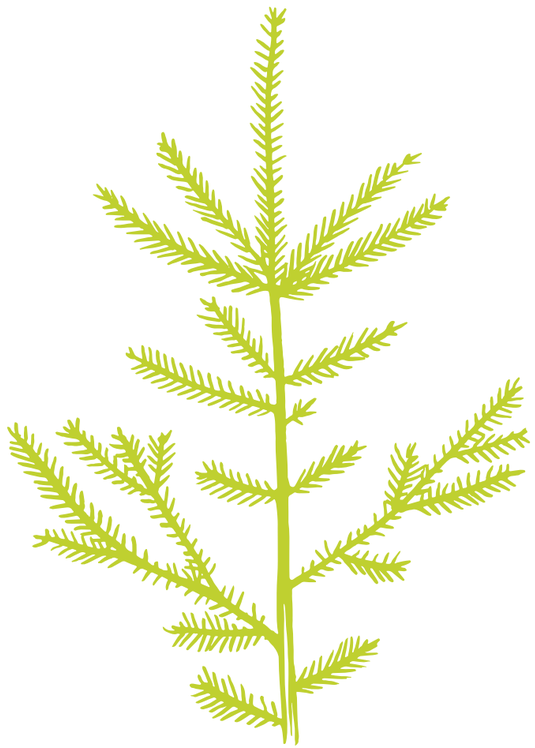
Scientists studying these trends began to realize that forests, especially urban forests, need more active management, and their findings place a renewed emphasis on all of the co-benefits that healthy urban forests provide for communities. A report by the USDA found that the environmental and aesthetic benefits of trees provide financial benefits that are on average more than two times greater than tree care costs (USDA 2011). Another study found that, in most cases, the benefits of urban trees outweigh the costs of installing and maintaining them (Song et al. 2018).

Trees are now recognized as county and community assets — also known as green infrastructure — and need to be maintained as such with attendant planning, policy, and budgeting. The diversity of forest-cover types, land uses, population densities, and land ownerships calls for complex, long-term forest-management plans (Dwyer et al. 2000). Unfortunately, current staffing and funding to actively manage Snohomish County's urban forests are inadequate, and the long-term viability of these areas is in danger.

A key recommendation of this 20-Year Plan is for Snohomish County to establish a dedicated annual budget for management of the HFP pilot sites, and ideally for all county-owned forested sites (see Chapter 5 for a breakdown of the estimated annual budget). This plan is a critical step toward whole-forest management for Snohomish County, providing creative strategies to secure forest restoration and maintenance resources.

What Is Active Management?

Urban forests work differently than other natural areas. Because of development, more light enters the 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 than in other natural areas. Some examples include removing invasive plants, planting native plants, watering, mulching, stabilizing stream banks, removing garbage or yard waste, maintaining trails, or visiting to check for new problems that arise. We refer to these activities as "active management," thus acknowledging that caring for urban natural areas requires a dynamic, hands-on effort to counteract the unique pressures they face.



CHAPTER 3. MEETING THE CHALLENGE

The Healthy Forest Project is a collaborative effort designed to support, coordinate, and track the collective work of multiple entities restoring forested parks and natural areas across the county. As a partnership, it is important to have a common understanding of the purpose and focus of our work. This chapter describes the project's vision, goals, and outcomes, and outlines the foreseen partners, roles, and management structure.

COMMUNITY ENGAGEMENT PROCESS

Community engagement is a critical component of any planning process, but especially for this 20-Year Plan, as community stewardship is key to the HFP's success. Snohomish County and Forterra utilized several community outreach strategies, with the goals of building awareness about the HFP and better understanding community challenges, priorities, and needs. In January 2020, we held an HFP kickoff open-house event at the Adopt-a-Stream Foundation's Northwest Stream Center in Everett, which included a presentation about the HFP, its partner organizations, and their resources, and also featured a volunteer restoration event at which volunteers planted native trees at McCollum Park. Attendees were asked to complete a community survey, and we also posted the survey on the HFP website from December 2019 to February 2020 and shared it on social media platforms to gather additional resident and stakeholder input on priorities for county-owned forests. Additionally, we reached out to local organizations to spread information about the HFP and form partnerships.

Respondents answered questions about which parks they lived closest to and frequented most often, what activities they engaged in while visiting those parks, which environmental and community health issues were most important to them, if they would like to volunteer in their local parks, and, finally, what topics or questions they would like to see addressed in the 20-year Plan.

The top three environmental and community health issues most important to respondents were 1) healthy streams, 2) forest health, and 3) wildlife protection. For the complete community survey and responses, see Appendix L.

This plan incorporates community feedback and priorities in its field, community, and resource objectives, discussed in Chapter 5.

MISSION AND VISION

Snohomish County recognizes the importance of preserving and restoring natural areas, as outlined in existing planning documents: the General Policy Plan, Shoreline Management Program,[6] and Sustainable Operations Action Plan.[7] Both the Natural Environment and Forest Lands sections of the General Policy Plan emphasize the need to identify, protect, and preserve Snohomish County's natural resources. The Shoreline Management Program lays out four goals: (1) preserve and protect shoreline natural resources; (2) preserve and protect ecological functions and processes necessary to maintain shoreline natural resources, protect public health and safety, and preserve beneficial uses of the shoreline; (3) preserve and protect the ecological functions and values of the county's shoreline areas to ensure no net loss; and (4) preserve and protect water quality. Lastly, the county's 2017 Puget Sound Initiative focuses on expanding efforts to protect and restore Puget Sound, especially three core areas: water quality, habitat restoration, and species vitality.

The HFP's mission and vision support the county's existing environmental goals and policies:

Healthy Forest Project Vision: A healthy urban forest that supports a thriving Puget Sound (see Figure 5).

Healthy Forest Project Mission: To restore and maintain the health of Snohomish County's forests through community-led stewardship.

The HFP serves as a catalyst to address Snohomish County's goals through partnerships with private landowners, government agencies, nonprofit organizations, educational institutions, local businesses, and the county community at large.

6 See https://www.snohomishCountywa.gov/DocumentCenter/View/68998/SMP-Policy-Amend-FINAL-20191009.

7 See https://snohomishcountywa.gov/2596/16700/Plans-Policies-Reports.

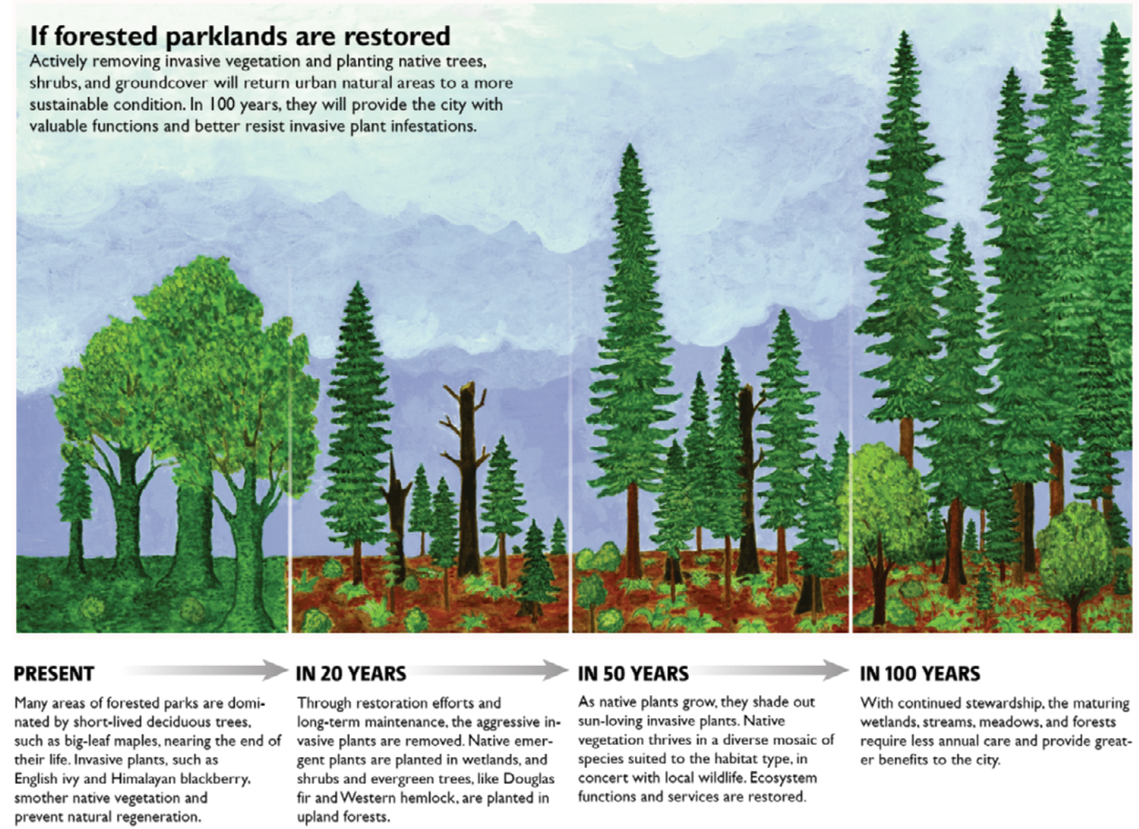


Figure 5: Illustration of the forest if it is restored

GOALS AND OUTCOMES

For the HFP's mission to succeed and to reach its long-term vision, certain goals and outcomes must be achieved during the next 20 years. The HFP developed the following outcomes and goals, along with measurable benchmarks outlined in Table 11 and Appendix E, based on current forest conditions, input from community members and partners, current and forecasted capacity to support restoration efforts, and the experience of other partnerships in the Green Cities Network. Chapter 6, "Adaptive Management," describes the process of monitoring and tracking the program's success against these goals and outcomes in more detail.

1. **Forest Health Outcome:** Improved urban-forest conditions support a healthy Puget Sound, salmon habitat, species diversity, and canopy cover throughout Snohomish County's system of forested parks and natural areas.
   - GOAL: Restore 935 acres of the county's forested parks and natural areas located in 10 priority parks adjacent to creeks, rivers, and shorelines by 2040.
   - GOAL: Remove invasive plants from the county's forested parks and natural areas, and restore them with diverse communities of native trees and understory plants appropriate for each site.
   - GOAL: As prioritized by the county and community, restore sites that provide important ecological, biological, and public benefits equitably across each county district.

2. **Public Benefit Outcome:** Increased livability and quality of life for Snohomish County residents and visitors by enhancing our urban forest and natural areas, which provide healthy air, recreational opportunities, and enjoyment of nature.
   - GOAL: Increase awareness of the benefits of a healthy urban forest.
   - GOAL: Foster healthy living through connections to nature, and enjoyment and appreciation of healthy forested regional parks and natural areas.
   - GOAL: Provide and promote resources for private-property owners to understand the value of healthy native vegetation and the importance of being good stewards of their land and the environment.

3. **Community Stewardship Outcome:** The Snohomish County community across all districts is actively engaged in the management, restoration, and maintenance of the county's forested parks and natural areas, and actively participates in the Forest Steward program.
   - GOAL: Strengthen collaborative partnerships with government agencies, nonprofits, schools, and other partners.
   - GOAL: Create a sustainable Forest Steward program to lead ongoing restoration efforts in priority parks identified in each county district.
   - GOAL: Recruit, retain, and support volunteers, and build community capacity for long-term stewardship of our forested parks and natural areas.
   - GOAL: Host public volunteer restoration events to engage community members in restoration projects across all county districts.

4. **Partnership Management and Resources Outcome:** Sustainable financial resources support the HFP's growth, management, restoration, and long-term maintenance goals.
   - GOAL: Establish financial resources, paid labor, donations and volunteer support to successfully implement the 20-year forest stewardship program.
   - GOAL: Track, report, and celebrate Partnership accomplishments.

HEALTHY FOREST PROJECT ROLES AND RESPONSIBILITIES

This section outlines a management-structure model (see Figure 6) based on that of other Green Cities and modified for the HFP. The structure is intended to support several thousand community volunteers, county and nonprofit staff, and skilled field crews, who will together implement the work needed to achieve this plan's goals.

In the first two years of implementation, the HFP Management Team's primary tasks are to provide guidance on planning and implementation; ensure quality programming and fieldwork; and pursue, secure, and allocate resources. All three program areas (field, community, and resources) should be part of this team's scope, including tracking and reporting each area's progress. Working collaboratively as a Management Team, Forterra and Snohomish County can strategically grow the leadership to include representatives from other stakeholder agencies and nonprofits.

During the first five years, the HFP Management Team will focus 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 Forest Stewards and skilled field crews.

Dedicated resources will support and track fieldwork undertaken by volunteers and skilled field crews (county staff, nonprofits, and other professional contractors). Without advance planning and structure for the HFP, the fieldwork will likely not be as successful, efficient, and organized as it should to achieve this plan's goals and timeline.

Snohomish County

Snohomish County is the HFP's leading entity, responsible for convening partners, with the following county entities working collaboratively to manage the project: Office of Energy and Sustainability; Parks, Recreation, and Tourism Department; and Surface Water Management Division. Parks and Recreation and Surface Water Management currently manage the HFP pilot sites, and will provide tools and materials for work parties. While entity staff are currently at capacity addressing their many duties, they will continue to support HFP projects and events to the best of their ability.

Figure 6: Healthy Forest Project management structure

PHOTO BY JIM AVERY

Forterra

Forterra is the state's largest conservation and community-building organization working to create great communities and conserve great lands. Forterra will continue to be a resource to the county to advance the HFP goals. Forterra will encourage volunteerism throughout the program and 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.

Forterra can also support the HFP through its Green Cities Department. Forterra supports all Green City and County Partnerships through quarterly facilitated focus groups that are open to all program partners; distributes training, grant, and other announcements via the network listserv; and offers technical and general assistance to participating Green City partner agencies.

Volunteers and the Community at Large

Volunteers donate their time to the HFP by helping restore and enhance Snohomish County's pilot sites, leveraging the financial resources of the HFP's 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 HFP Management Team will be to work with community members to provide training, site-planning assistance, support, and encouragement.

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 Snohomish County sites while supporting employment and job-skills development for local residents, especially youth. Ideally, the HFP will secure funding for hiring professional crews in areas where it is appropriate or necessary.

Potential Sponsors

The HFP Management Team should identify potential corporate and local business partners to contribute to the project with funding, volunteer labor, publicity, or a combination. Many businesses are looking for volunteer opportunities for their employees and will often donate to the organizations with which their employees volunteer. Maintaining a list of corporations and local businesses to invite to volunteer events or ask to sponsor events will be an important funding strategy. Sponsorship can include direct funding or other contributions as appropriate; for example, businesses could help defray HFP expenses 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 Snohomish County. Private lands serve as vital connectors between fragmented public green spaces. Many of the pressures on the county'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 can also 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. Landowners who live adjacent to HFP pilot sites 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 county.

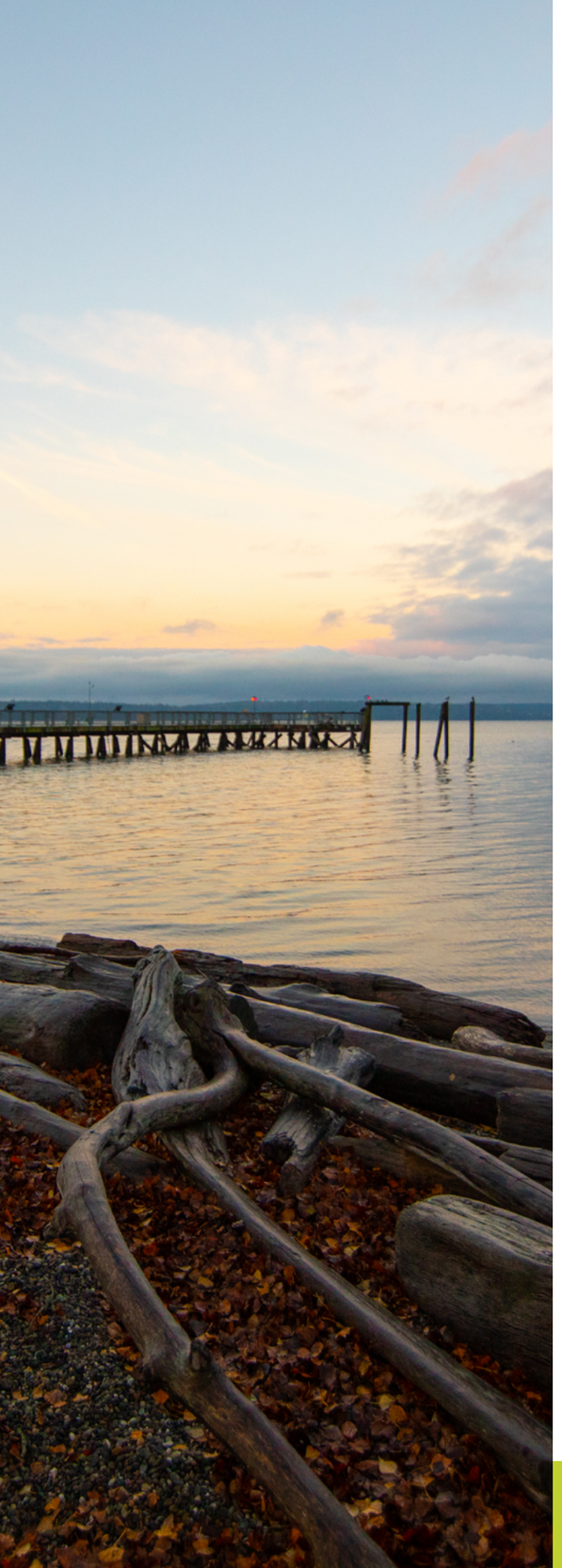
Landowner education, incentive, and stewardship programs, and other complementary programs, will help the HFP foster a community of landowners who care about the well-being of the forest, both on their own lands and in public spaces. Engaging these landowners as invested stakeholders will mobilize an important corps of advocates and volunteers to reverse negative trends and improve the health of their private property and public parks.

Partner Organizations

Collaborating with organizations that share common goals is an important component of HFP success. Reaching out to nonprofits and community groups that serve Snohomish County and finding arenas for mutually beneficial work will strengthen and leverage community support for the plan. Additional groups may supplement work performed by HFP partner agencies in the following capacities:

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

PHOTO BY JIM AVERY



Over the years, Snohomish County has been working actively with the following partners to address ecological restoration needs. Through the HFP, these partner efforts can be streamlined to more efficiently achieve countywide restoration goals.

Adopt-A-Stream Foundation

The Adopt-A-Stream Foundation works to ensure that Pacific Northwest streams continue to provide healthy spawning and rearing habitat for salmon, trout, steelhead, and other wildlife. The foundation also provides stream and wetland technical assistance, as well as materials and opportunities for environmental education. Adopt-A-Stream has done a significant amount of restoration work within the McCollum Pioneer Park pilot site.

Snohomish Conservation District

Snohomish Conservation District has a long-standing history of collaborating with, and providing technical assistance on land- and water-resource concerns to, the agriculture and forestry communities, as well as landowners.

Sound Salmon Solutions

Sound Salmon Solutions currently works closely with the county to create and sustain a community devoted to salmon recovery through collaboration, engagement, education, and celebration.

Washington Native Plant Society (WNPS)

Within Snohomish County, there are two WNPS chapters, the Central Puget Sound chapter in the south and the Salal chapter in the north. In 2000, WNPS trained volunteer Master Native Plant Stewards in Snohomish County, and some of those stewards continue to remain active in the area. The HFP hopes to collaborate with these chapters and create more avenues for Master Native Plant Stewards to get involved.

Washington State University (WSU) Extension

WSU Snohomish County Extension programs connect private landowners and communities with educational programs and technical assistance that protect the environment, enhance quality of life, and advance economic well-being. Such programs include the Forest Stewardship Coached Planning Program, Master Gardeners, Beach Watchers, and many more.

CHAPTER 4. 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. This chapter outlines the results of the 2019 Healthy Forest Project forest assessment, which provides a valuable picture of current forest conditions in the 10 pilot sites referenced in Table 3. These pilot sites offer a variety of forest conditions, are equally distributed across the county's districts, and have a strong connection to supporting salmon habitat and the county's healthy Puget Sound Initiative. The HFP Management Team will use these results to identify implementation strategies and priorities.

PARK CHARACTERIZATIONS

Below are brief descriptions of each park, to put the data in context.

Portage Creek Wildlife Area: Portage Creek is a 157-acre wildlife reserve that is home to a variety of wetland plants and animals. Formerly the site was used for dairy farming and peat mining, though its wetlands and fish-spawning areas have since been restored. Visitors can now enjoy a network of trails that meander along streams, wetlands, and open meadows, as well as a fish ladder for viewing salmon.

Kayak Point Park: Kayak Point is a 480-acre saltwater beach park with 3,300 feet of shoreline located along the shores of Port Susan.

Smith Island: Smith Island is bounded by Union Slough to the east and north, Interstate 5 to the west, and Everett's wastewater treatment plant to the south. Snohomish County owns approximately 400 acres in the island's northeast portion. The area was logged, farmed, and homesteaded in the early 20th century, and in 2018, the county completed the Smith Island Estuary Restoration project, which reestablished historic tidal marshlands that provide critical habitat for threatened Chinook salmon, as well as other salmon species, in the Snohomish River basin.

McCollum Pioneer Park: A 78-acre park that combines open space, wetlands, and woodlands, McCollum houses the WSU Extension Center and Adopt-A-Stream Foundation's Northwest Stream Center facility. The NW Stream Center offers room rentals, an interpretive boardwalk, and a variety of educational programs.

Lake Stickney Community Park: A 24.5-acre park that preserves vital habitat at the northern headwaters of Swamp Creek, Lake Stickney contains diverse forest, wetland, stream, and open-water habitat for fish and wildlife.

Picnic Point Park: Located on the shores of Puget Sound, Picnic Point is a 46-acre park that offers forested areas, as well as beach access and views of Whidbey Island and the Olympic Mountain range.

Meadowdale Beach Park: Meadowdale Beach's 108 acres feature a stream, wooded natural areas, and access to a Puget Sound beach.

Table 3: Healthy Forest Project pilot sites by district

Site Name	Snohomish County District #	Acreage	Puget Sound Health Connection
Evergreen State Fairgrounds	5	29	French Creek tributary
Kayak Point Park	1	370	Puget Sound shoreline
Lake Stickney Community Park	3	17	Swamp Creek/Lake Stickney
Lord Hill Regional Park	5	114	Snohomish River
McCollum Pioneer Park	4	9	North Creek
Meadowdale Beach Park	3	96	Puget Sound shoreline
Paradise Valley Conservation Area	5	164	Bear Creek
Picnic Point Park	2 and 3	36	Puget Sound shoreline
Portage Creek Wildlife Area	1	96	Stillaguamish River/Portage Creek
Smith Island SW site	2	3	Snohomish River/Union Slough

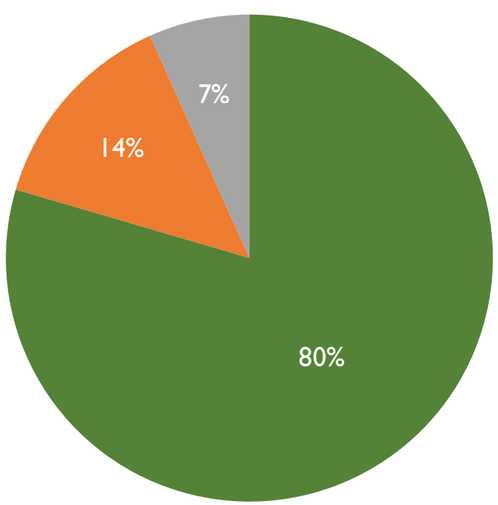


Figure 7: Healthy Forest Project acres by land-cover type

Lord Hill Regional Park: Formerly a homestead, 1,463-acre Lord Hill Regional Park is now an upland nature preserve of evergreen forests and diverse wildlife.

Evergreen State Fairgrounds: Though best known for its annual fall Evergreen State Fair and other events, the Evergreen Fairgrounds also has approximately 30 acres of forested natural areas.

Paradise Valley Conservation Area: Located in the headwaters of the Bear Creek watershed, this 793-acre conservation area plays a vital role in stream health and salmon habitat. A majority of the site is wooded, with several large wetland areas.

METHODS

Forestry consultant American Forest Management conducted a forest health assessment of the HFP's 10 pilot sites during fall 2019, surveying approximately 1,000 acres of forested and natural area parkland owned and managed by Snohomish County. Of those acres, 935 met the HFP scope as areas 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. The remaining surveyed acreage was classified as landscaped,

PHOTO BY SNOHOMISH COUNTY

hardscaped, or open water, and deemed not suitable for restoration (see Figure 7). 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.

TREE-IAGE AND THE FOREST LANDSCAPE ASSESSMENT TOOL

American Forest Management collected baseline ecological data from the pilot sites using a rapid-assessment data-collection protocol called the Forest Landscape Assessment Tool (FLAT), developed by the Green Cities Research Alliance.[8] FLAT is based on the "tree-iage" model, originally developed by the Green Seattle Partnership. Tree-iage is a prioritization tool, based on the concept of medical triage, that uses habitat composition (e.g., tree canopy cover composition) and invasive plant cover as the two parameters to prioritize restoration (Ciecko et al. 2016).

FLAT builds on the existing framework of the tree-iage 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, the presence of parasitic plants such as mistletoe, and bare soils due to erosion. Also documented were the presence of regenerating trees (canopy species less than 5 inches in diameter at breast height) and stocking class (estimated number of trees per acre and spacing), which both play an important role in the forest's long-term sustainability. In addition, each contiguous habitat, or stand, was deemed "plantable" or "not plantable," based on whether site conditions were appropriate for tree-seedling establishment; for example, an area with vegetation too dense to have suitable growing space for restoration plantings would be characterized as not plantable.

Rapid-assessment methodologies such as FLAT produce a snapshot of the overall condition at any one site and on a landscape or county scale. The data serves as a high-level baseline from which finer-scale, site-specific restoration planning can be conducted. Site-by-site analysis of the data can be done as work progresses to help ensure the most appropriate restoration practices and species composition are chosen for each site. HFP partners will 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.

Prior to field data collection, natural areas were classified within the HFP area through digital orthophoto interpretation, dividing

8 See https://www.fs.usda.gov/pnw/tools/forest-landscape-assessment-tool-flat-rapid-assessment-land-management for more information.

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 adjusted in the Geographic Information System (GIS). The final delineated stands are called management units (MUs). All MUs were assigned unique letters to be used for restoration planning and data tracking. Since open water, hardscaped, and landscaped areas are not suitable for active native-vegetation management, they were removed from the total acreage targeted by the HFP (see Figure 8).

In the field, each MU was surveyed to identify its specific habitat type (e.g. coniferous forest, deciduous forest, riparian shrubland) and capture information on the dominant overstory species and tree canopy cover. See Appendix B for detailed tree-iage maps of the HFP project area and Appendix D for the FLAT-modified data-collection flowchart for the tree-iage 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-VALUE HABITAT COMPOSITION:

MUs with more than 25% native tree-canopy cover, in which evergreen species 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 canopy.

MEDIUM-VALUE HABITAT COMPOSITION:

MUs with more than 25% native tree-canopy cover, in which evergreen species 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 canopy.

DEFINING THE PROJECT AREA

Included in the Healthy Forest Project area:

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

NOT included in the Healthy Forest 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

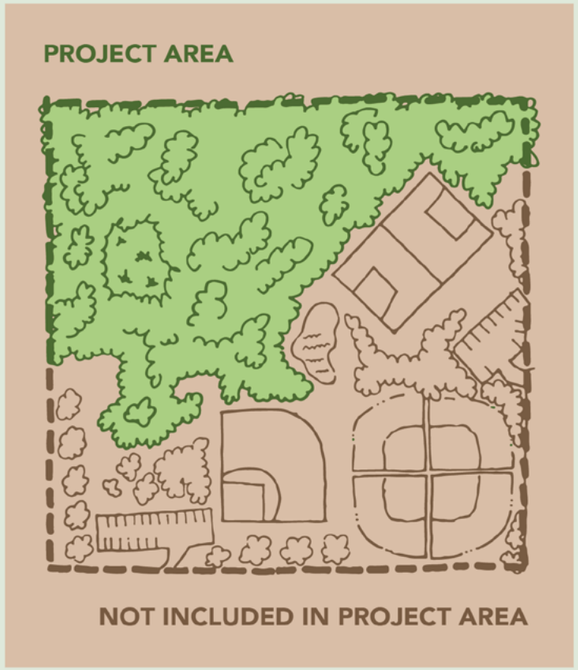


Figure 8: Defining the Healthy Forest Project area

PHOTO BY JIM AVERY

LOW-VALUE HABITAT COMPOSITION:

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

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

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

HIGH INVASIVE THREAT:

MUs with more than 50% invasive species cover.

MEDIUM INVASIVE THREAT:

MUs with between 5% and 50% invasive species cover.

LOW INVASIVE THREAT:

MUs with less than 5% invasive species cover.

TREE-IAGE CATEGORIES

After habitat-composition and invasive-species-cover values were determined, a matrix system was used to assign a tree-iage category, or priority rating, to each MU (see Table 4). 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 this data was collected to provide a broad view of the habitat conditions of Snohomish County's forested land and natural areas. Data collection occurred at the management-unit scale, but because MUs vary in size (ranging from 1 to 20 acres), the results presented here use 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, we use

Table 4: Tree-iage legend

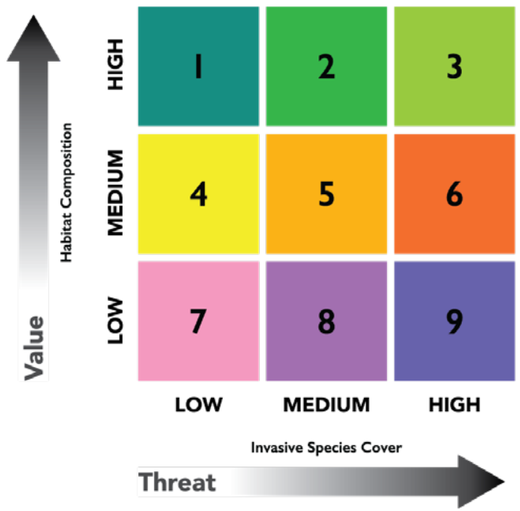
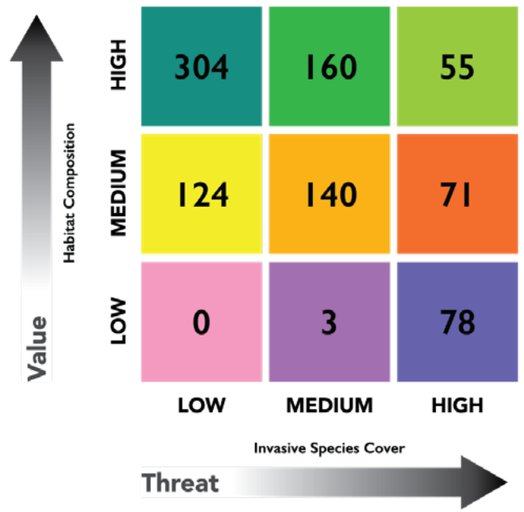


Table 5: Distribution of Healthy Forest Project acres by tree-iage category



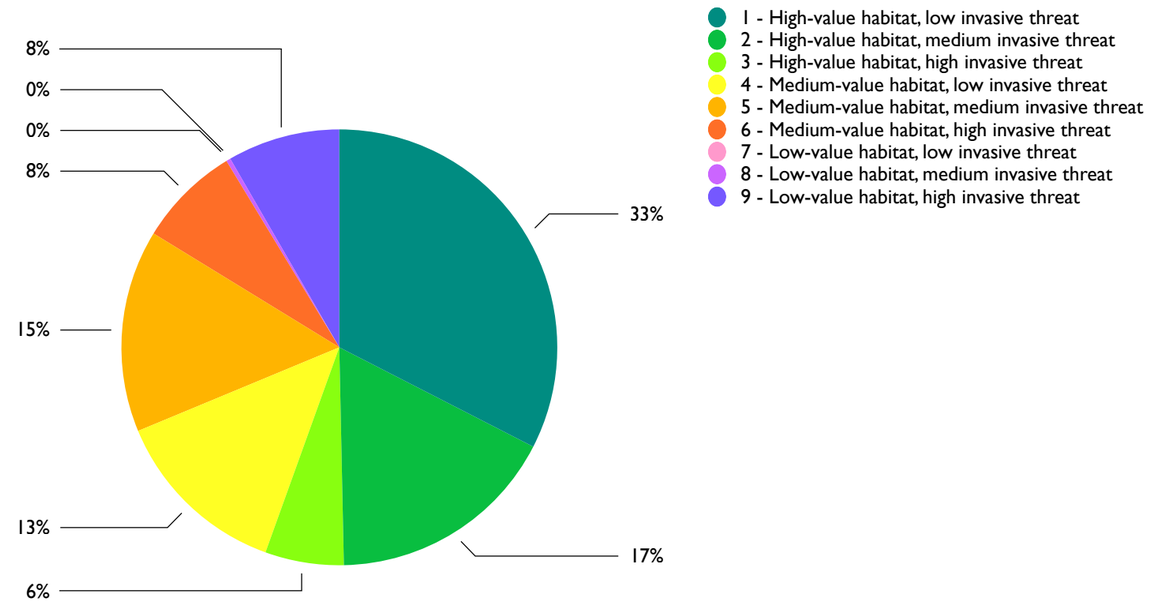


Figure 9: Percentage of Healthy Forest Project acres by tree-iage category

the term "MU acre." Keeping in mind the purpose of the FLAT analysis, this assessment will help prioritize restoration efforts during the next 20 years. The data gathered will also serve as a baseline from which the effectiveness of restoration efforts and the long-term health of Snohomish County'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 Snohomish County's forests and natural areas begins to form. Table 5 shows the distribution of the HFP 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 (935 acres) currently has low, medium, or high habitat value, and how much currently has low, medium, or high threat from invasive species. This data informs the cost model discussed in Chapter 5 and is used to develop high-level cost estimates for the HFP to consider when planning the next 20 years.

As seen in Table 5, 304 acres of the HFP area are in exceptional condition (tree-iage category 1), with high-value habitat and low invasive-cover threat. Kayak Point is the largest contributor to this category, with 201 acres of high-value heathy forest. Other parks with tree-iage category 1 forest include Paradise Valley Conservation Area (59 acres), and Lord Hill Regional Park (30 acres), and Meadowdale Beach (14 acres).

Looking only at the first axis of the tree-iage matrix, habitat composition, categories 1, 2, and 3 combined, we see that 56% of the acreage has high-value habitat composition. Of the acres surveyed, 36% have medium canopy composition (categories 4, 5, and 6), and approximately 8% of areas are a 7, 8, or 9 on the tree-iage scale, the lowest-value habitat composition (see Figure 9).

The second axis of the tree-iage matrix represents the forest threat, or invasive species composition, based on the percentage of the MU covered by invasive species. In the project areas, 46% of parklands have low invasive species threat (categories 1, 4, and 7), 32% fall in the medium category (categories 2, 5, and 8), and 22% have a high invasive species threat (categories 3, 6, and 9). Portage Creek Wildlife Area is highly impacted with 82 acres of high invasive threat. The fact that overall there are so few acres in HFP sites with relatively high invasive species cover is promising, but without management, these invasive plants could spread and further degrade forests or spread to high-value areas.

Appendix F lists the number of acres in each tree-iage category by park.

Overstory Species

Maintaining the overall health of our urban tree canopy and managing it over the long term is an important part of achieving environmental sustainability as a community. The 2019 FLAT results show that 57% of lands surveyed have an overstory dominated by evergreen trees, while 40% are dominated by deciduous trees. The remainder have less than 10% canopy cover.

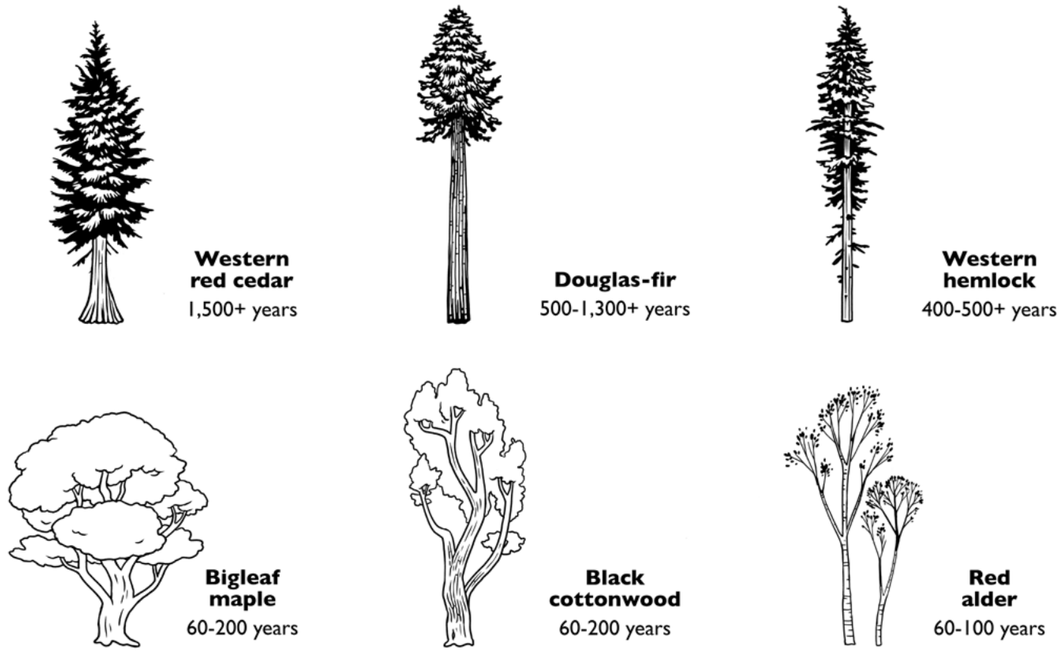


Figure 10: Life span of different tree species

Coniferous trees

Douglas-fir is the most dominant overstory tree in 26% of the surveyed acres. There is also a high presence of western red cedar and western hemlock. Coniferous tree species are of high value and should be promoted through restoration best management practices. Coniferous trees often live longer than deciduous species, with a potential life span of 300 to 1,000-plus years, depending on species and conditions (see Figure 10). Therefore, conifers provide ecological services longer into the future. And because they keep their foliage year-round, conifers also sequester larger amounts of carbon and filter more stormwater.

Deciduous trees

Red alder is also a common overstory species, present in 17% of surveyed acres. Although a native species, red alder is characteristic of a forest that has experienced disturbance (e.g., logging or development). Bigleaf maple and black cottonwood are the second and third most prevalent deciduous trees, each dominating 11% of the lands surveyed. Like coniferous species, deciduous trees also have ecological benefits: they grow fast and thereby provide shade for conifer seedlings to establish, provide valuable habitat for wildlife and ecological diversity, and help build healthy soil by adding organic matter when their leaves drop in the fall. However, most deciduous species, such as bigleaf maple and black cottonwood are short lived, with a life span of 60 to 200 years. As they die, more sunlight reaches the ground, resulting in perfect growing conditions for aggressive, invasive plants to flourish and inhibit the growth of new trees. Additionally, the FLAT results show that the deciduous trees in 25% of the assessed areas are 50 to 99-plus years old, meaning that they are beginning to decline or reaching the end of their lives. In order to create a healthier tree-species mix, we recommend planting a diversity of additional native coniferous seedlings, especially within MUs that lack conifers and conifer diversity.

The six most dominant overstory species found across all the MUs are shown in Figure 11. "Primary" refers to the number of acres where the species occurs as the most dominant species, "secondary" is the second most dominant or codominant species within a given MU, and "tertiary" is where the species is third most dominant within a given MU. For a complete list of native overstory species documented during the FLAT assessment, see Appendix G.

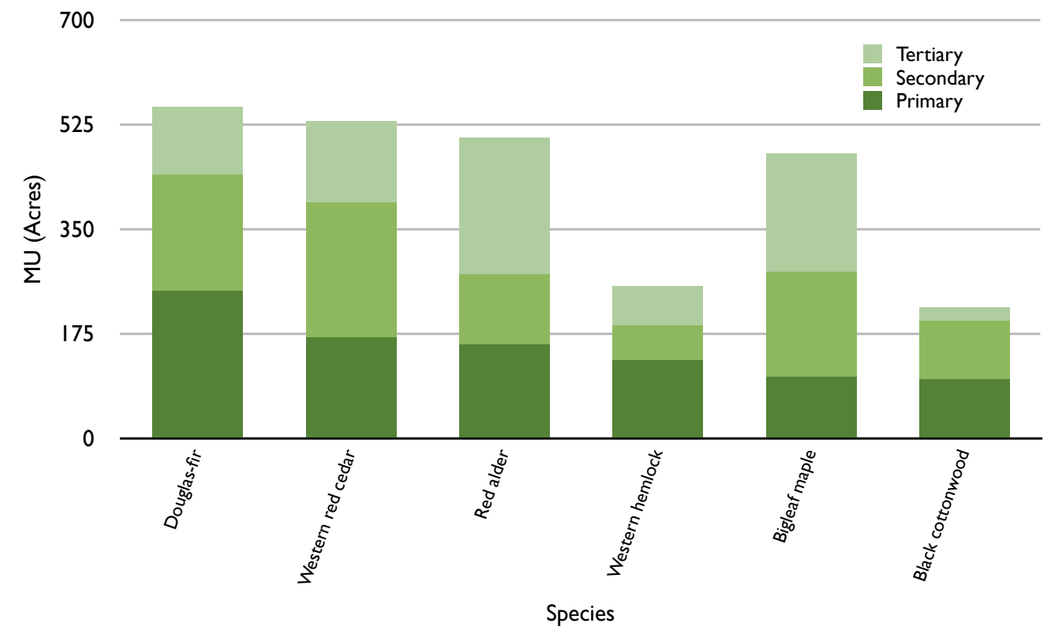


Figure 11: Distribution of the dominant overstory composition across MU acres

Forest Age Class and Regenerating Overstory Species

Forests need regenerating native plants and a diverse age class of trees in order to stay healthy and sustainable. 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 Snohomish County's parks and natural areas. Age diversity is key to avoiding mass age-related mortality and ensuring perpetual renewal of the forest. This plan can help identify areas with homogenously aged tree stands and inform a strategic plan for new plantings.

Of the forested areas surveyed, 60% fall into age class 3 (50–99 years) and 18% are in age class 4 (100 years and older; see Figure 12). In age class 3, 60% (337 acres) of areas surveyed are dominated by evergreen tree species and, in age class 4, 96% (160 acres) are comprised of evergreen species. These large, mature evergreen trees, such as Douglas-fir and western red cedar, are long-lived and typically represent a healthy forest.

In age class 3 and 4, 32% of acres are dominated by short-lived deciduous trees, such as bigleaf maple, cottonwood, and red alder. Since these trees are reaching the end of their life span,

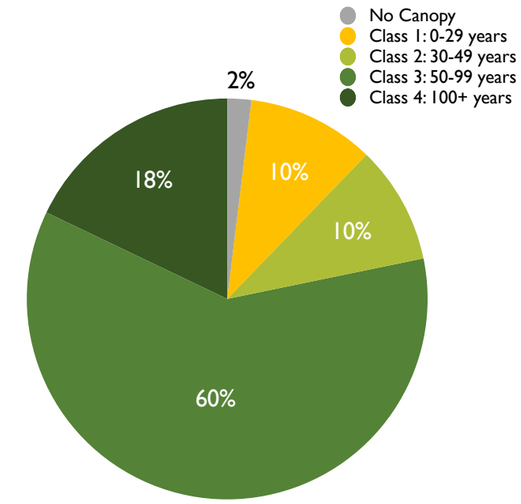


Figure 12: Percentage of forest age class across MU acres

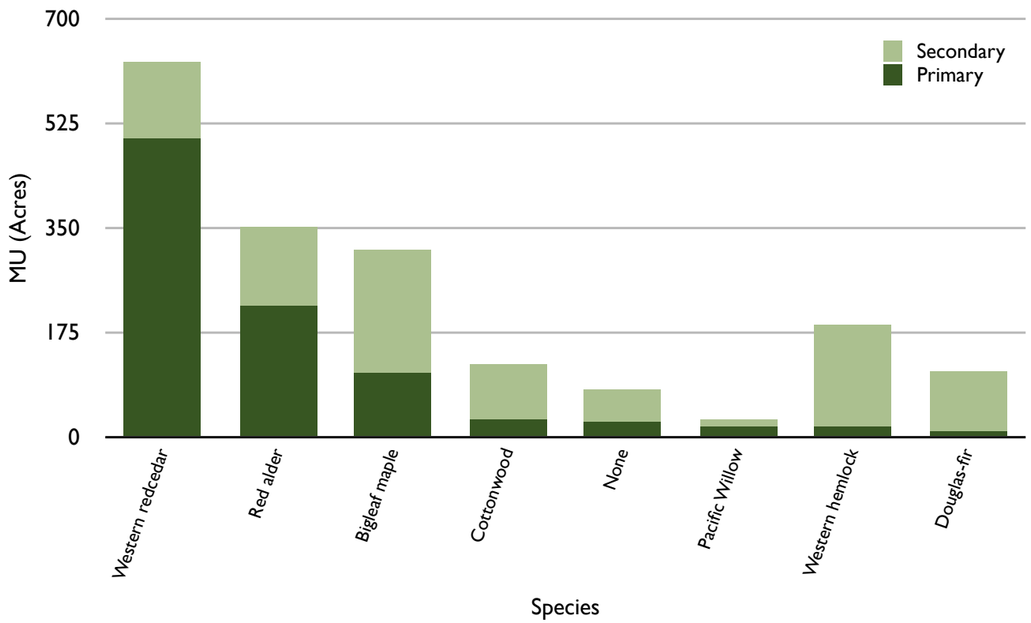


Figure 13: Distribution of regenerating overstory species across MU Acres

these areas may be good candidates for planting a healthy mix of evergreen and broadleaf species to succeed the aging deciduous trees.

Age class 1 (0–29 years) and age class 2 (30–49 years) each make up 10% of the areas surveyed; both classes were dominated by deciduous tree species. These areas may also be good candidates for understory planting of evergreen trees. Lastly, 2% of lands had no canopy at all.

Western red cedar was the most prevalent regenerating tree species in the HFP area, followed by red alder, bigleaf maple, black cottonwood, and Pacific willow (see Figure 13). However, since most of the regenerating species are deciduous, regenerating high-value coniferous tree species should be protected through restoration best management practices.

In some areas, this lack of regenerating conifers could potentially be due to the inability of conifers to reseed because of pressures from invasive species and/or prior disturbance, such as development or soil compaction; however, these areas may also simply be wetland, grassland, or shrubland, where trees naturally do not thrive.

It is important to note that climate change is negatively impacting the health of valuable native plant species, specifically trees. Warming temperatures can stress trees, making them more susceptible to pests and disease. For example, experts are observing the die-off of western red cedars, noting prolific impacts from a wood-boring beetle called the western cedar borer, along with a bark beetle from the beetle family Scolytidae (Rippey 2018). Bigleaf maples also seem to be declining, due to increased development, higher summer temperatures, and more extreme summer droughts, all of which are predicted to increase in the future (Betzen 2018). With western red cedar as the second most dominant species and most common regenerating tree species in Snohomish County's forested parks and natural areas, the HFP will need to keep a close eye on how these native species may be impacted.

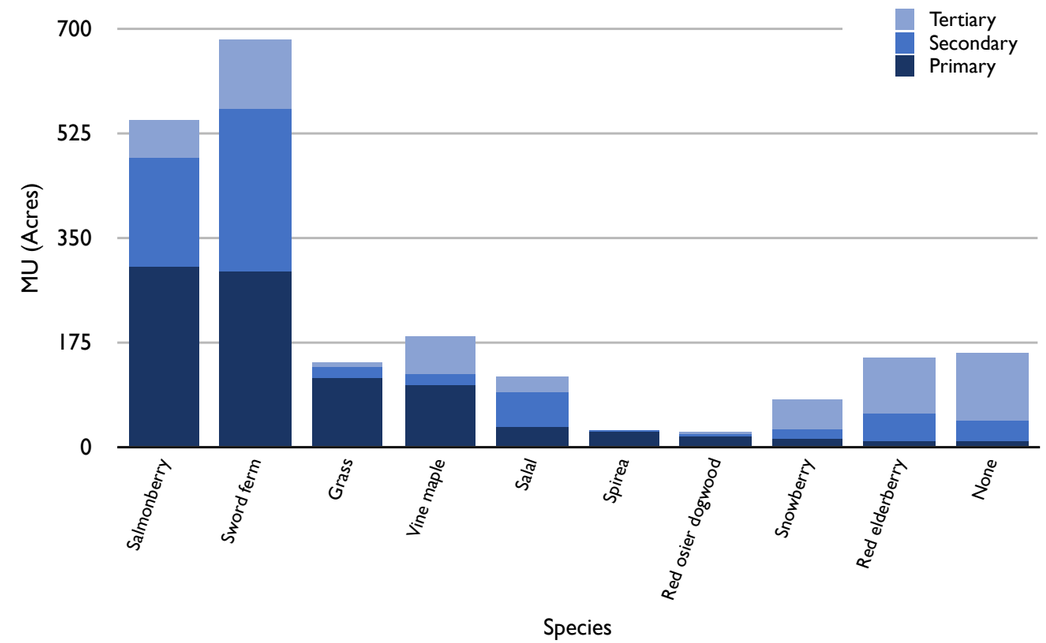


Figure 14: Distribution of the most common native understory species across MU acres

The HFP will prioritize using the best available science to inform site planting and restoration activities so that our restoration sites are best adapted to the impending impacts of climate change, now and into the future.

Native Understory Species

Snohomish County's forested parks and natural areas have a variety of native species in the understory, which contribute to the biodiversity of the forest and support wildlife such as birds and pollinators. Many of these plants produce fruits and seeds that are food for larger animals. Salmonberry, sword fern, grasses (which are not necessarily all native species), vine maple, and salal are the most common primary understory plants found in the surveyed sites (see Figure 14). For a complete list of native understory species documented during the FLAT assessment, see Appendix H.

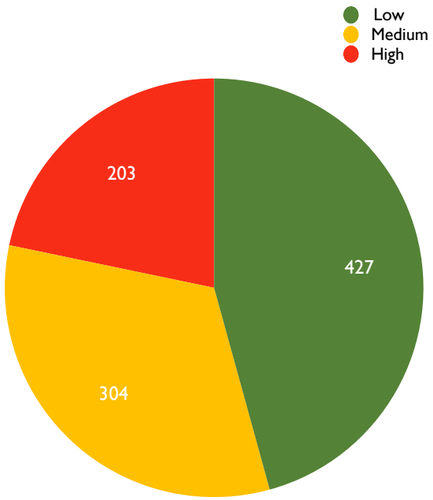


Figure 15: Invasive plant species presence across MU acres

Invasive Species

In the project area, 22% of the acres were categorized as having a high level of invasive cover and 32% categorized as having medium invasive cover (see Figure 15). Although these are fairly low percentages, invasive species still pose a significant threat to the understory — the 507 acres of high and medium invasive cover will still require a significant effort to control. However, controlling invasive plants and ensuring ongoing maintenance can help prevent the future impacts and costs of major restoration efforts, protecting the valuable conifer and evergreen species that are preexisting and regenerating in Snohomish County's forested parks and natural areas.

In each MU, the five most abundant invasive plant species were documented. Figure 16 illustrates the most common invasives across all MUs. Himalayan blackberry, English holly, and English ivy are the biggest threats to Snohomish County's forested parks and natural areas. Of the 935 acres in the project area, Himalayan blackberry was the primary, secondary, or tertiary invasive found in 382 acres (41%). English holly was present on 228 acres (24%), and English ivy on 106 acres (11%). See Appendix I for a list of all invasive species documented in the FLAT analysis.

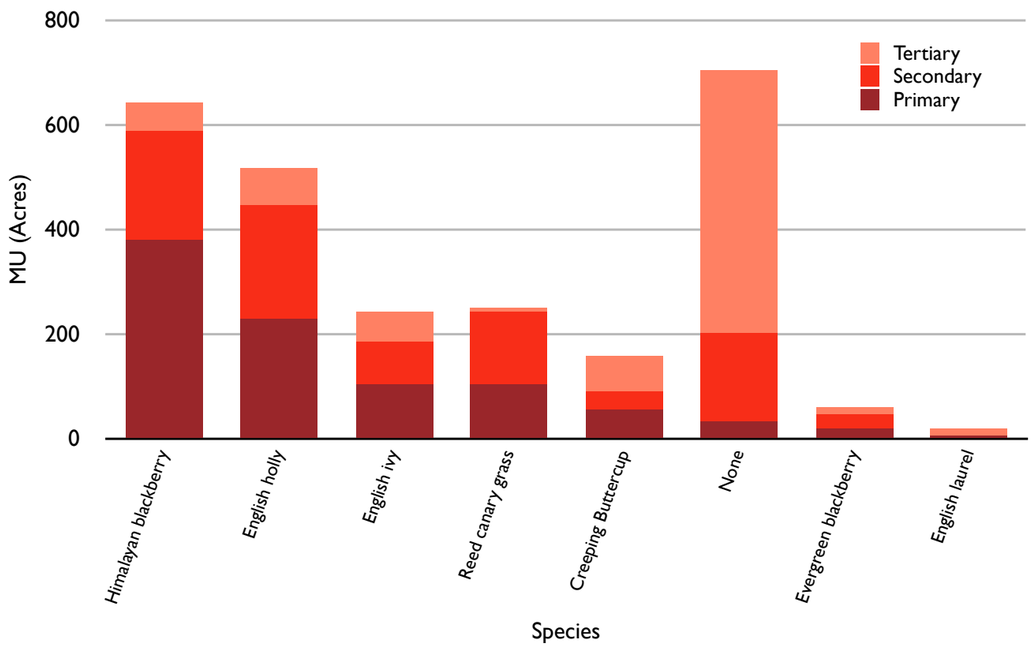


Figure 16: Distribution of the most common invasive species across MU acres

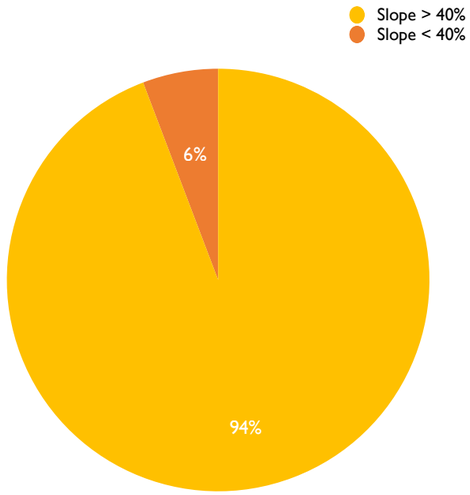


Figure 17: Slope across MU acres

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. Professional crews can work on steeper slopes, but must use specialized equipment. As a general rule, work on slopes steeper than a 40% grade requires additional professional resources and significantly increases the cost of restoration. According to the FLAT analysis, although only 6% of the HFP area includes slopes steeper than 40% (see Figure 17), the majority of these sites are classified as high or medium invasive cover, so the impact of slope on restoration costs will be high. These areas should be prioritized when developing stewardship plans, and professional crews should be hired; the cost model in Chapter 5 factors in the need for this specialized experience.

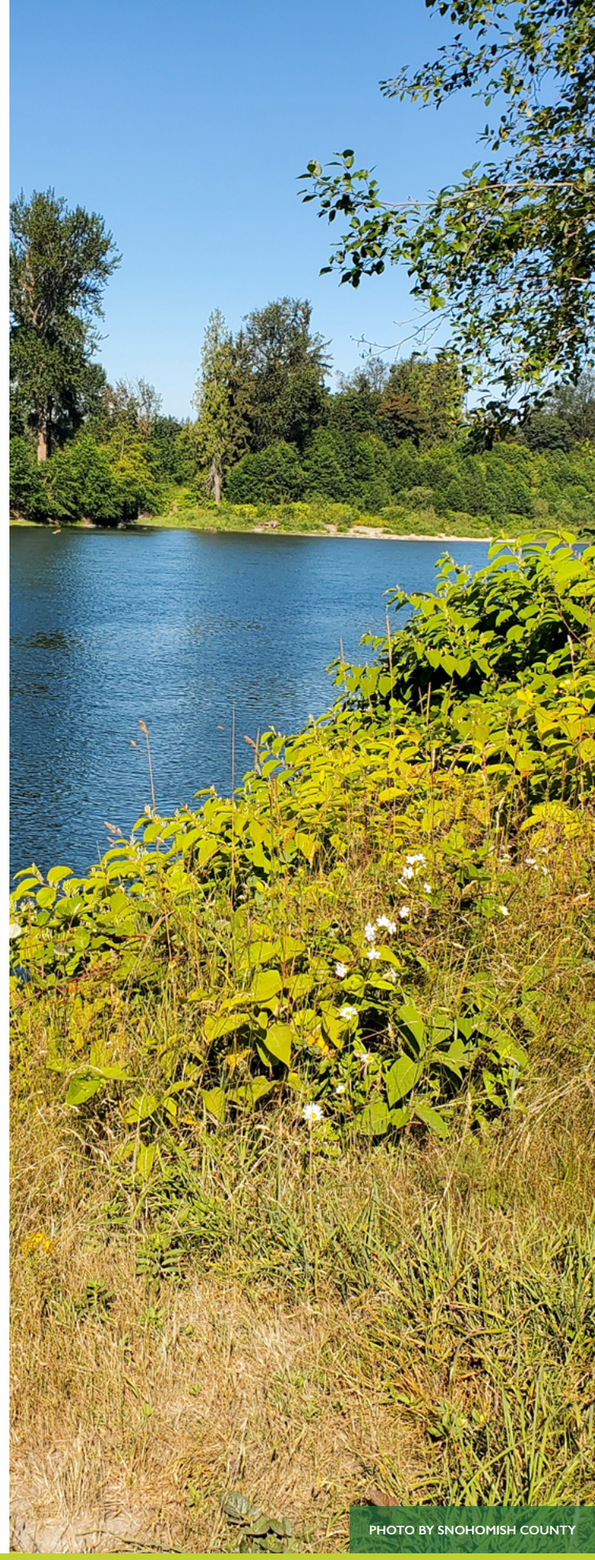


PHOTO BY SNOHOMISH COUNTY

CHAPTER 5. MOVING FORWARD — THE NEXT 20 YEARS

The primary focus of Healthy Forest Project implementation will be active management of the 10 pilot sites. The HFP will use the forest assessment results as a baseline to assess, prioritize, and measure the progress of restoration efforts. This chapter describes the HFP's implementation strategies, divided into three program areas: fieldwork, community, and resources.

FIELD OBJECTIVES AT THE HFP PILOT SITES

The following objectives will guide the Healthy Forest Project's fieldwork to meet on-the-ground forest restoration goals.

Field Objective 1: Prioritize parks and sites within parks for restoration.

As individual park sites 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 HFP sites with existing projects, in order to ensure that prior and current restoration efforts continue moving forward so that these areas don't revert to pre-work condition — not only is "backsliding" expensive, it is also particularly discouraging to the public. The second priority should be to expand HFP sites already enrolled in restoration by continuing to clear invasive species in areas contiguous with previously cleared sites.

As new sites are enrolled into the program, the tree-iage model can be used within parks with multiple MUs as a guide to anticipate needed action (see Figure 18). For example, MUs with high-quality habitat and few to no invasive plants (tree-iage category 1) can be enrolled in the program under the assumption that these sites will receive annual monitoring and maintenance. Other high-value habitats, including conifer-dominated forests or wetlands with medium to high invasive cover (tree-iage categories 2 and 3), are considered high priorities for protection and restoration. Additional factors, such as public access and safety, and the presence of wetlands, streams, or shorelines, are also important in the decision-making process for site prioritization. Providing maintenance for recently restored sites is a priority as well.

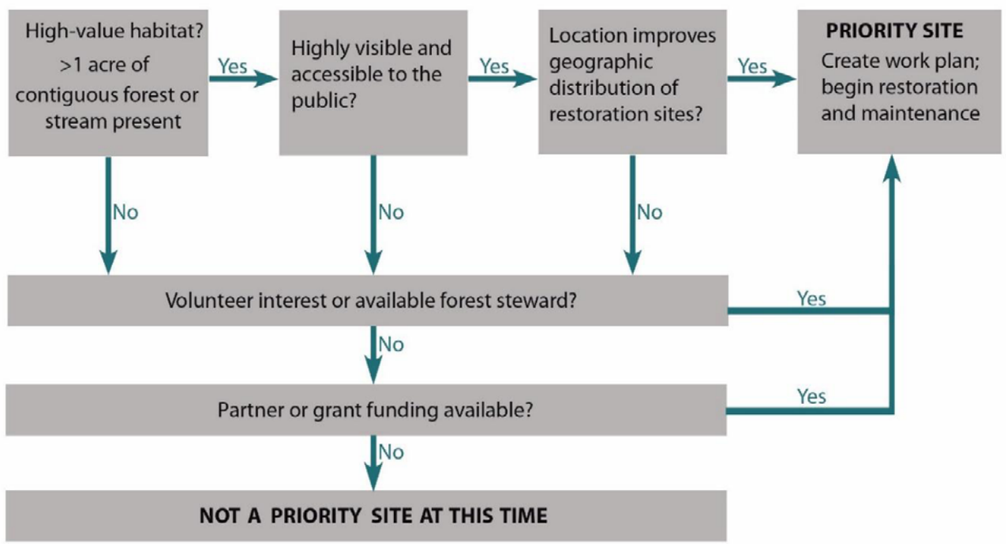


Figure 18: Decision tree for prioritizing restoration sites

Field Objective 2: Identify areas that require professional crew/staff support.

Not all HFP restoration sites are suitable for volunteers. Sensitive areas such as steep slopes, wetlands, and riparian buffers require the expertise of professional crews. In addition, some best management practices require the use of herbicides, such as stem injection for invasive trees like English holly and English laurel, or stem injection for knotweed species that aggressively invade critical riparian habitat. A licensed professional staff member must conduct these herbicide applications. With the need for herbicide intervention, the use of professional crews will be essential to reach the goal of enrolling all acres in active management.

Many sites within MUs will require this level of expertise — for example, the 6% of targeted sites that have more than a 40% slope. Additionally, paid staff and crews can be used to assist and speed up the restoration process on volunteer sites, for example, by using power equipment to cut a large stand of blackberry so volunteers can follow up and dig out the roots. Securing funding for these professional crews is a priority for the HFP's success. Crew work is already being done with contracted crews such as the Washington Conservation Corps, targeting areas and projects not suitable for volunteers. Volunteer work in other MUs can be used as a match for incoming funds. MUs that have support available through Snohomish County or otherwise-funded crews will be given priority status for restoration, as well as sites where noxious weed control is mandated by the county and/or state.

Field Objective 3: Implement restoration best practices on all project sites.

Best Management Practices (BMPs)

Best available science related to restoration continues to evolve, and integration of improved techniques and field experience is vital to 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 Snohomish County'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:

- **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

The amount of time it takes to move through these phases is very site dependent. MUs that start out with low invasive cover and high-value canopy cover will quickly move into Phase 4, while sites with high invasive cover and low-value tree canopy may take considerable effort and several years to move through each phase of restoration.

The Green Cities Network developed a work log to track restoration fieldwork, and the work logs help determine which phase each site is in. The county should enter the work logs and phases into a database, such as the Green City Partnerships' CEDAR (Centralized Data Repository) tracking system or Cartegraph, to easily measure and report progress.

Phase 1: Invasive Plant Removal

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

Major invasive-plant reduction will be required on MUs 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 will also require a large investment of both funding and community volunteers to help ensure restoration success. MUs with between 5% and 50% invasive cover (medium threat from invasive species: tree-iage categories 2, 5, and 8) will also require invasive removal. Invasive growth in these spots is patchy. Generally, projects in these sites are appropriate for community volunteers. MUs 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 at these sites may simply involve walking through to check that any small invasive growth is caught and removed before it becomes a larger problem.

PHOTO BY JIM AVERY

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 prepare the site for young native plants to be installed.

HFP program staff will work with Forest Stewards, county staff, and professional crews, whenever feasible, to develop an appropriate plant palette and work plan for each MU 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 the least amount of overstory planting, but may need to be filled in with ground cover, shrubs, and small trees in the understory. MUs with more than 25% native tree cover but less than 50% conifer cover (tree-iage categories 4, 5, and 6) will generally be planted with native conifer species. MUs 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 vary, depending on the habitat type and target native-plant population. Most Phase 2 planting projects are appropriate and fun for community volunteers.

Phase 3: Plant Establishment and Follow-up Maintenance

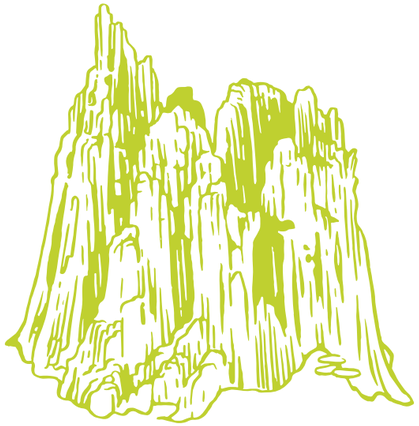
This phase repeats invasive plant removal, or weeding, along with mulching and watering newly planted native plants until they are established. Although native plants have adapted to the Puget Sound area's dry summer climate, recently installed plants may experience transplant shock, which affects root and shoot health. Therefore, most plants require at least 3 to 5 years of establishment care to help ensure their survival. MUs may stay in Phase 3 for many years, depending on the site conditions.

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 will typically consist of spot removal of invasive regrowth and occasional planting where survivorship of existing plants is low. Individual volunteers 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 935 acres will be enrolled in the restoration process and graduate to this phase. The ultimate measure of the HFP's success is that all 935 acres reach Phase 4.

Without ongoing, long-term volunteer investment in the monitoring and maintenance of MUs in restoration, Snohomish County's natural areas will revert back into an unhealthy state. For that reason, monitoring and maintenance cannot be overlooked, and volunteer activities need to be paired with county 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 HFP discovers how the sites respond to restoration. In 2012, the Green Cities Network developed Regional Standardized Monitoring Protocols in order to understand the success, value, and effectiveness of restoration activities. These protocols provide procedures for baseline and long-term data collection by staff or volunteers to measure changes in site characteristics and overall success. The protocols can be found in the Green Cities Toolbox on Forterra's website.[9] (For more information on the Green Cities Toolbox, see Appendix M.)



9 See https://forterra.org/subpage/green-cities-toolbox-restoration-monitoring for more information.

PRIORITIZING RESTORATION BASED ON TREE-IAGE CATEGORIES

The four-phase approach can be applied to the tree-iage categories, as shown in Table 6. Each tree-iage category can be assigned appropriate management strategies.

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

Acres in HFP: 304

Condition

This category represents the healthiest forested areas in Snohomish County's HFP sites. Typical MUs have more than 50% conifer or evergreen broadleaf canopy. This category includes sites 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 MUs are under low threat because the invasive cover is less than 5%.

Management Strategy: Monitoring and Maintenance

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

Table 6:
Restoration strategies and tree-iage categories

Habitat Composition (Value)	LOW Invasive Species Cover	MEDIUM Invasive Species Cover	HIGH Invasive Species Cover
HIGH	Monitoring & Maintenance	Invasive Plant Removal	Major Invasive Plant Removal
MEDIUM	Planting, Maintenance & Monitoring	Invasive Plant Removal & Planting	Major Invasive Plant Removal & Planting
LOW	Evaluation & Possible Planting	Invasive Plant Removal & Major Planting	Major Invasive Plant Removal & Major Planting

Threat

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

Acres in HFP: 160

Condition

Similar to category 1, these MUs contain more than 50% conifer or evergreen broadleaf canopy, or appropriate native wetland vegetation. Sites 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.

If unattended, this level of invasive coverage could prevent native seedlings from establishing and could compete with existing trees for water and nutrients. The sites 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 MUs also will require site preparation (e.g., mulching) and infill planting. Projects in these areas are typically appropriate for volunteers. Removing invasive plants from these MUs is a very high priority for the first five years.

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

Acres in HFP: 55

Condition

As in categories 1 and 2, MUs in this category have mature conifers, madrones, forested wetlands, or wetland vegetation where appropriate. Category 3 sites have a high threat from greater than 50% invasive cover.

A site in this category is in a high-risk situation and contains many desirable trees or highly valuable habitat or species. If restored, MUs in this category can completely recover and persist in the long term.

Management Strategy: Major Invasive-Plant Removal and Prompt Action

Acres in category 3 should be high priority. Without prompt action, high-quality forest stands could be lost. Category 3 MUs 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 HFP: 124

Condition

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

Management Strategy: Planting and Monitoring

We expect planting in these MUs to consist of infilling with native species and establishing conifers or evergreen broadleaf to become the next generation of canopy. Often these sites require some invasive removal and site preparation (e.g., amending with woodchip mulch). Many of these MUs may be converted to a conifer forest by the addition of appropriate conifer trees.

Addressing category 4 MUs is a high priority during the first five years. They offer a high likelihood of success at a minimum investment. These sites are typically well suited to community-led restoration efforts.

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

Acres in HFP: 140

Condition

MUs in this category have between 5% and 50% invasive cover. Invasive growth is expected to be patchy with diffuse edges. These sites 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, there is greater than 50% native tree canopy cover. In wetland areas not suitable for conifers, there is between 1% and 50% cover by appropriate wetland species. These MUs contain many desirable native trees that are under threat from invasive plants.

Management Strategy: Invasive-Plant Removal and Planting

These MUs will require invasive removal and infill planting. While some restoration work is planned for these areas in the first five years, aggressive efforts will be spread out throughout the life of the Healthy Forest Project.

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

Acres in HFP: 71

Condition

Native deciduous trees typically dominate these MUs, 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 sites have between 1% and 50% cover by appropriate wetland vegetation. Invasive plants cover more than 50% of the MU.

An MU that retains important native plant communities but has a high level of invasive cover may recover if remediation is prompt. Since these sites are at greater risk than category 5 MUs, 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 species 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 HFP: 0

Condition

These MUs 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. MUs 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 that have been disturbed (e.g., by clearing or grading), and/or areas dominated by non-native trees.

Management Strategy: Evaluation and Possible Planting

The reasons underlying these MUs' low value can differ greatly, so the sites will be addressed on a case-by-case basis. Because of the low levels of invasive plants, restoration may be quite cost effective in some category 7 sites. MUs will be evaluated to determine whether conditions and timing are appropriate to move them 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. Sites 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 HFP: 3

Condition

These MUS are estimated to have less than 25% native tree-canopy cover or less than 25% cover by trees in forested wetlands, and 5% to 50% invasive cover. Invasive growth in these MUs is likely to be patchy with diffuse edges. A site 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 MUS 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 HFP will support efforts in these MUs 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 sites will consist of infilling with native species.

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

Acres in HFP: 78

Condition

MUs 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. A site in this category is the most degraded and has lost most of its value in terms of habitat quality or species composition.

Management Strategy: Major Invasive-Plant Removal and Major Planting

Category 9 MUs require the most time and money to restore and 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 MUs in the future, this is not a priority category for the first five years unless there is strong community interest or specific funding in place. The HFP will support efforts in these MUs that contain the spread of invasive plants, try out new techniques, or bolster enthusiastic community-led efforts.

PHOTO BY JIM AVERY

PLANNING RESTORATION IN A CHANGING CLIMATE

While forest ecosystem and socioeconomic services are increasingly being recognized and valued, forests themselves are progressively more under threat. As our climate changes, Puget Sound forests may be increasingly impacted by warmer and drier summers, flooding and high winds from increased winter storm events, and shoreline erosion (Kim et al. 2012). To maximize our forests' ability to withstand and adapt to climate-change impacts, we need to consider future conditions in our restoration planning and BMPs (see Table 7).

Successful restoration requires planted, or naturally regenerated, seedlings that are well suited to site conditions (St. Clair and Howe 2009; see Table 8). The 2009 Washington Climate Change Impacts Assessment projected sea level rise, temperature increase, and changes in precipitation patterns for Washington State (Mote and Salathé 2009). Our region is projected to experience an increase of 5° to 6°F in annual minimum temperature and an increase of approximately 2° to 3°F in annual extreme minimum temperature by the 2080s (Kim et al. 2012). With this increase in temperature, plant hardiness zones are expected to shift in the Puget Sound area. These shifting zones have implications for plant selection for forestry, horticulture, and restoration purposes, as well as for invasive-plant risks (Bradley et al. 2012; Widrlechner et al. 2012).

As species ranges shift, locally adapted seeds may be maladapted to future conditions. This may mean shifting tree composition toward long-lived, climate-resilient, drought-tolerant native species, such as Douglas-fir, shore pine, madrone, and Oregon white oak (Fischer et al. 2018). Sourcing native seeds or seedling stock that is genetically adapted to warmer, drier climates may also help grow climate-resilient forests (Fischer et al. 2018). As well, some forest habitats, such as madrone forests, stands of moisture-loving western red cedar and western hemlocks, and others, may require special management considerations in order to support a diverse array of ecosystems (Fischer et al. 2018).

COMMUNITY OBJECTIVES AT HFP PILOT SITES

By working together, the residents of Snohomish County can help prevent the loss of important natural resources. The following objectives will guide the Healthy Forest Project community engagement goals to support restoration efforts and connect people to their local forested parks and natural areas.

Table 7: Responses to expected climate changes in the Puget Sound lowlands

Climate Change	Response
Warming in all seasons	• Plant species and seeds adapted to warmer climates.
Drier summer conditions, due to less snow and summer rain, and earlier snowmelt	• Remove invasive species to reduce drought stress on native plants. • Increase planting distance between trees to relieve competition and reduce drought stress. • Plant more drought-tolerant species and genotypes. • Plan for wildfire response and recovery.
Heavier winter rains, more winter runoff	• Riparian buffers and erosion control around salmon-bearing creeks become even more important to keep sediment out of rivers and protect juvenile fish.

PHOTO BY JIM AVERY

Table 8: Tools and actions to address Puget Sound–area climate-change considerations

Climate-Change Considerations	Actions	Tools
Native tree species' geographic ranges are shifting. Conditions in their current geographic ranges may no longer be suitable by the time those trees reach maturity.	Identify tree species that are suitable for specific sites given future climate change scenarios.	Species Potential Habitat Tool: specieshabitattool.org/spht/
Locally adapted seeds may be maladapted to future climate conditions. Even if sites can still support a particular species, there may be other seeds that will be better adapted to a future climate.	Identify seeds that have the right climate adaptations for specific sites in the future, and work with local nurseries to source those seeds.	Seedlot Selection Tool: seedlotselectiontool.org/sst/
Changes to climate will not be uniform across the landscape. Try to learn as much as possible about the predicted changes at selected sites and expect ongoing and increased weather variability.	Help people understand and plan for the effects of climate change in their area. Analyze specific changes in selected sites.	University of Washington Climate Impacts Group Analysis Tools: cig.uw.edu/resources/analysis-tools/

Community Objective 1: Promote positive community engagement with parks and natural areas.

This foundational objective drives most of the HFP's work. The HFP is centered in the belief that Snohomish County'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 county and its people. The HFP, and this 20-Year Plan, will directly address this objective by providing additional opportunities for Snohomish County 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 green spaces are not lost altogether. Parks that may be 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 HFP. 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. HFP events will get more people into Snohomish County's parks and natural areas, and encourage and inspire them to see these places as the incredible public resources that they are.

Community Objective 2: Build a Forest Steward program to promote and support community leadership.

In order to achieve the 20-Year Plan's restoration goals, the HFP will need to actively recruit and support Forest Stewards, with the intent of having stewards working in all identified forested parks and natural areas by 2040.

The HFP's intent is to build an educated, engaged, and active volunteer base around management, monitoring, and stewardship of Snohomish County's forest. The program will provide 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 HFP will actively recruit, train, and support Forest Stewards, who will work with the HFP in the following ways:

- Serve as key contacts for the restoration projects at their park site.
- Organize and lead volunteer events and activities with support from HFP staff.
- Coordinate with staff to develop site restoration plans.
- Request tools, materials, and assistance as needed.
- Track and report progress on activities through the HFP's work log.

In turn, stewards will receive orientation training, skill-specific training, resources, and guidance in site planning and restoration work.

Community Objective 3: Seek opportunities to engage youth and integrate environmental learning into events and activities.

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 (Hartig et al. 1991; Kaplan 1995). Partnering with Snohomish County schools is a great opportunity for the HFP to engage youth in outdoor experiences and environmental stewardship.

By working with local partners to provide engagement opportunities for youth, the HFP seeks to create a pathway of engagement from elementary school through high school. Volunteer events are also a way for youth to earn community service hours and gain valuable hands-on experience. For post-high school youth, there are several regional or state conservation corps programs, where young people can make a living while learning restoration skills and contributing to projects that improve local environmental health. Some examples include Washington Service Corps, Washington Conservation Corps, EarthCorps, and the Student Conservation Association. All these programs are currently available to Snohomish County youth. The HFP can 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.

Community Objective 4: Develop and implement community outreach and engagement practices to equitably serve Snohomish County's diverse populations.

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

Community building and an ethic of environmental responsibility are at the core of the HFP and the Green Cities Network across Puget Sound. Community members are encouraged to participate in caring for our shared public forests and natural areas regardless of age, income, ethnicity, physical ability, 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 HFP seeks to build a successful volunteer program by strengthening efforts to provide equitable and inclusive opportunities for the entire Snohomish County community. The 2018 U.S. census found that 15% of Snohomish County residents are foreign born, and 20% of residents speak a language other than English at home. Approximately 33% of Snohomish County residents identify as people of color. Environmental conservation organizations here in Puget Sound and across the country typically have trouble engaging communities of color, recent immigrants, and low-income families (Taylor 2014).

In addition to seeking opportunities to work with existing successful community organizations and programs, the HFP will employ creative strategies of its own during the next 20 years in order to equitably engage the county's diverse population.

Community Objective 5: Appreciate volunteers and publicly celebrate HFP successes.

The HFP will celebrate volunteers' achievements and emphasize the crucial role they play in restoring and maintaining Snohomish County's forests. Forest Stewards and other volunteers are the heart and soul of the HFP 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 HFP will regularly seek advice from volunteers on which BMPs work well and which may need reassessment. The HFP will host volunteer appreciation activities, such as an annual celebration for Forest Stewards and recognition at community planting events. The HFP seeks to find a variety of ways to recognize stewards and other volunteers for their valuable efforts.

Community Objective 6: Prioritize safety and use restoration to contribute to public safety.

Safety is also a key priority for the HFP. 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, having more presence in 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.

The HFP 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 along trails to complex challenges for activating spaces, these principles will provide valuable insights. Forterra has developed a CPTED training guide, applicable to both county staff and Forest Stewards, which applies these principles to forest restoration projects.

Community Objective 7: Work with local businesses to encourage support for the HFP.

Local business support will be needed for the HFP to reach its goals. Local businesses have already been involved in restoration projects in Snohomish County and should be called on for advice and future assistance. The HFP will continue to build on these relationships and expand to work with other businesses as well. Local business support could come in the form of encouraging employees to volunteer, or providing in-kind resources and/or financial support through grants and donations.

Community Objective 8: 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 Snohomish County's land area. Plantings on private lands can either greatly enhance or greatly degrade the condition of the county's forests, despite best efforts to restore, maintain, and steward them. 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 landowners illegally dump yard waste in parkland.

Alternatively, landowners can be a positive resource for their neighborhood parkland by engaging their neighbors, HOAs, schools, community groups, clubs, and businesses to help support HFP efforts. Private land can also be a primary way to enhance and expand the county's current forest canopy and habitat. Privately owned forest and natural areas in good health, such as HOA landscapes and Native Growth Protection Areas, or areas around homes, 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 HFP to engage private landowners as an important constituency include:

- Developing educational materials that explain the problems facing the forest, the benefits of removing invasive species from their property and planting with native or noninvasive ornamental species, and how to get involved in the HFP.
- Developing and promoting educational content for e-newsletters, social media, and blogs with tips and information about how people can apply restoration practices to private lands.
- Providing public trainings for landowners to learn about BMPs for invasive removal and landscaping with native plants.
- Connecting landowners with partner organizations and programs such as WSU Extension, Snohomish Conservation District, and National Wildlife Federation's Certified Wildlife Habitat or Schoolyard Habitats.
- Encouraging HOAs to adopt forest-friendly landscaping and control invasive plants in their Native Growth Protection Areas.

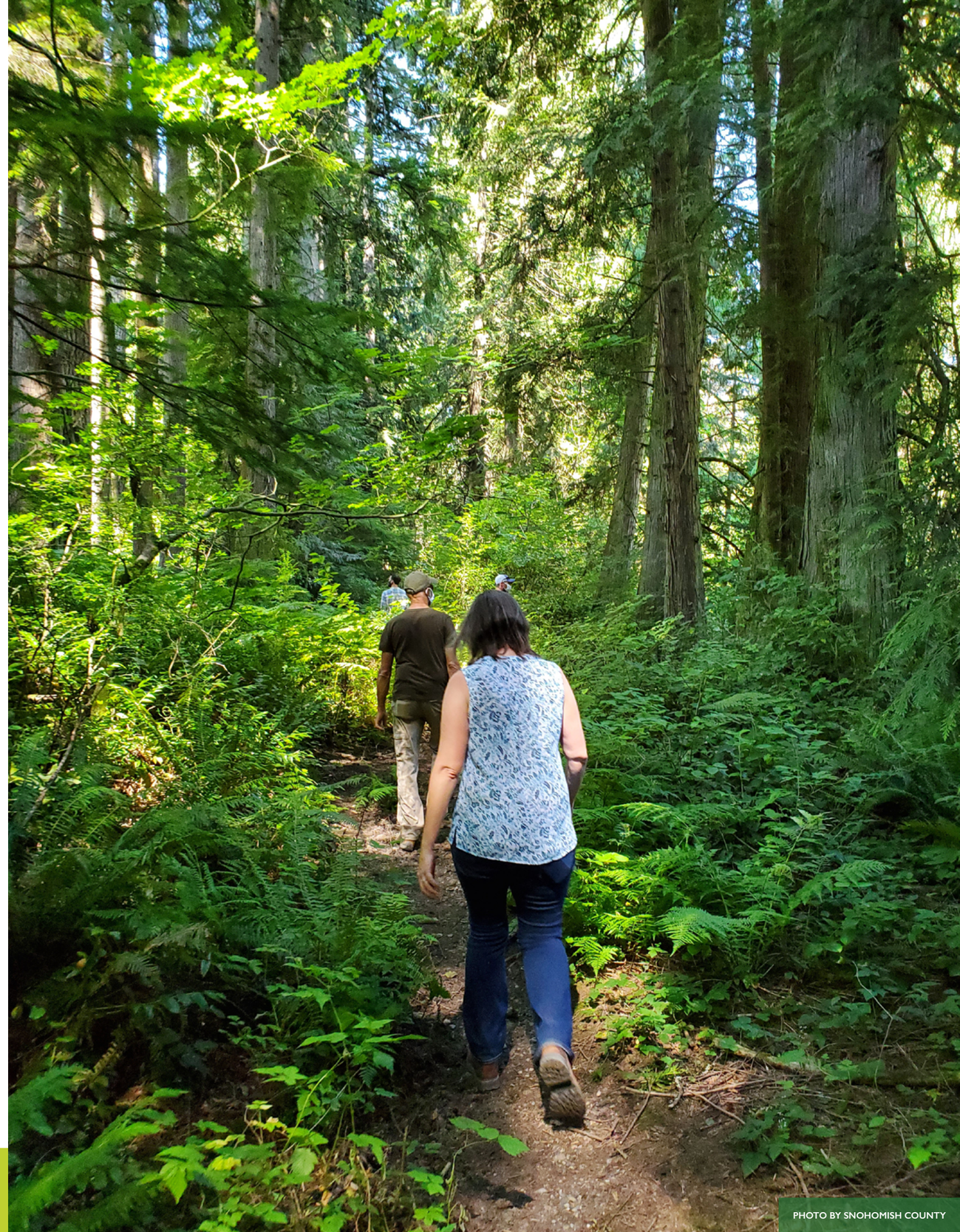


PHOTO BY SNOHOMISH COUNTY

RESOURCES AND BUDGET ANALYSIS

For the purposes of this plan, Forterra attempted to address the known costs associated with continuing the enhancement of Snohomish County's forests by restoring forested parkland over a 20-year time frame.

During the next 20 years (2021–2040), a minimum of $12.8 million in funding (in 2021 dollars), as well as volunteer support, will be needed for the Healthy Forest Project to accomplish its proposed goals. The goal of volunteer investment is approximately 161,100 hours over the life of the program. This will leverage an additional value of more than $5.1 million as a match to the estimated $12.8 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). Figure 19 shows the estimated cost per year, along with the financial value of the match provided by volunteers, according to the goals set for our volunteer program.

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 HFP's goals.

Estimating Program Costs

In 2005, the Green Seattle Partnership estimated the costs of restoring 2,500 acres of forested parkland over a 20-year period. It relied on estimates of past costs for removing invasive species, replanting, and ongoing maintenance, as well as staff costs associated with additional fieldwork, materials, planning, program design and management, funding development, outreach and marketing, and field and office overhead. For the Healthy Forest Project, Forterra adapted a cost model from the Green Seattle Partnership's original estimates (inflated to 2021 dollars) and adjusted it to reflect the experience of the other Green Cities. For this 20-Year Plan, all cost estimates and leveraged volunteer values are listed in 2021 dollars.

Using a cost model that enrolls a percentage of acres from each tree-iage category every year over 20 years, the average cost per acre going through the four phases of restoration and ongoing maintenance can be calculated. For the HFP pilot sites, the model estimates that enrolling all 935 acres in active management will cost from $4,500 per acre for tree-iage category 1 acres to $33,000 per acre for tree-iage category 9 acres (see Table 9). 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-iage category are specific for Snohomish County and the length of the program, and will need to be adjusted for use in other areas and program durations.

The cost per acre for each tree-iage category is the total estimated cost from the time it is enrolled until the end of the plan in 2040. For example, the model projects enrolling three new acres in 2021, 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 cost model accounts for the three acres enrolled in 2021 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 (see Table 10).

Based on the adjusted estimates, the model forecasts a cost of approximately $12.8 million in 2021 dollars to implement the HFP through 2040, an average of $630,000 per year. While this is a large investment, if Snohomish County does not act now, the cost of restoration and maintenance in the future will be significantly larger. More importantly, this investment also supports residents to be active and engaged in their community through long-term stewardship of the county's forested parks and natural areas.

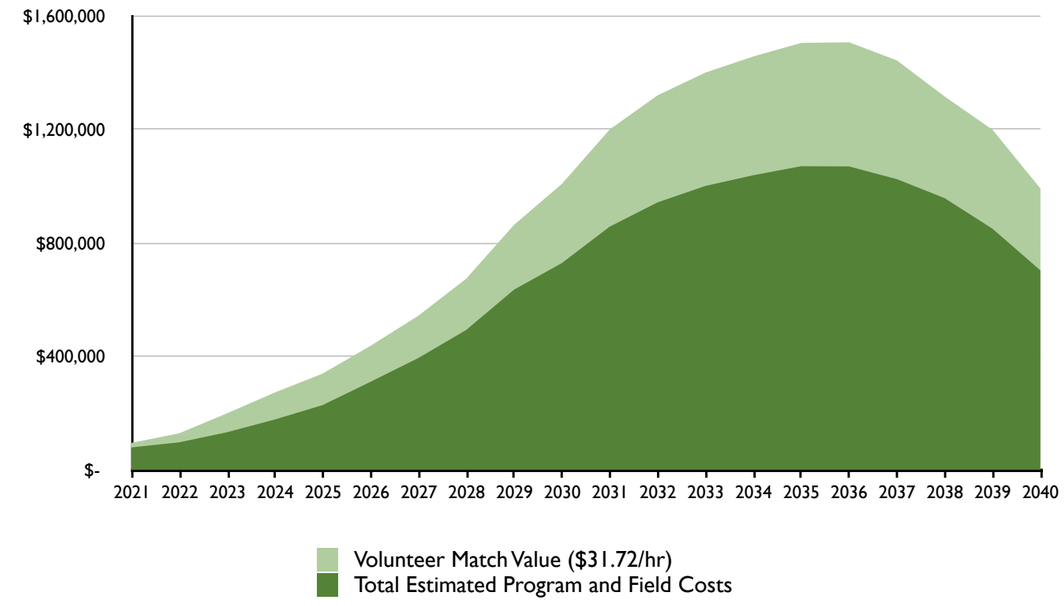


Figure 19: 20-year projection of program costs and volunteer match by year

Table 9: Estimated cost of restoration per tree-iage category

Tree-iage Category	Acreage	Average Restoration Cost/Acre	Total Cost per Tree-iage Category
1	304	$4,500	$1,368,000
2	160	$14,000	$2,240,000
3	55	$20,000	$1,100,000
4	124	$11,000	$1,364,000
5	140	$16,000	$2,240,000
6	71	$26,000	$1,846,000
7	0		
8	3	$23,000	$69,000
9	78	$33,000	$2,574,000
TOTAL	**935**		**$12,801,000**

Table 10: Detailed breakdown of projected program costs and volunteer match per enrolled acres

Year	New Acres Enrolled	Cumulative Acres	Total Estimated Program & Field Costs	Volunteer Match Value (31.72/hr)
2021	3	3	$79,704	$15,860
2022	5	8	$97,588	$31,720
2023	10	18	$133,106	$66,612
2024	15	33	$178,052	$95,160
2025	20	53	$228,890	$111,020
2026	25	78	$310,887	$126,880
2027	35	113	$394,819	$149,084
2028	45	158	$493,623	$180,804
2029	55	213	$635,874	$228,384
2030	65	278	$729,661	$279,136
2031	80	358	$858,104	$342,576
2032	80	438	$943,523	$377,468
2033	80	518	$1,001,494	$399,672
2034	80	598	$1,039,255	$418,704
2035	80	678	$1,071,047	$434,564
2036	75	753	$1,070,259	$437,736
2037	65	818	$1,025,528	$418,704
2038	55	873	$958,292	$358,436
2039	40	913	$850,481	$348,920
2040	22	935	$703,612	$288,652

RESOURCE OBJECTIVES AT HFP PILOT SITES

Additional funding is critical to ensure the HFP's success, while also addressing aims laid out in the county's General Policy Plan. The following objectives will guide the project's resource goals to identify, protect, and preserve Snohomish County's natural resources.

Resource Objective 1: Continue current Snohomish County funding and build capacity for future growth.

The cost model projects an estimated cost of $79,704 in 2021, which peaks at $1,071,047 in 2035. Snohomish County has not identified a funding source to continue the HFP beyond 2021; additional funding sources will be needed to reach the targeted 935 acres of active restoration. The estimated costs and annual benchmarks will be key in meeting the HFP's goals.

Resource Objective 2: Leverage Snohomish County funds through partnerships and develop long-term funding to support the work.

County funding alone will not be enough to secure the $12.8 million needed over the next 20 years to meet the HFP's goals. There are several partners currently working with the county on restoration projects within the HFP pilot sites. By bringing in additional partners, strengthening partner relationships, and seeking outside funding to support partners working together, Snohomish County 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 the Washington State Recreation and Conservation Office and the Washington State Department of Natural Resources
- Contributions from local businesses and their employees
- 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
- State and federal discretionary funding for forest and natural area restoration
- Carbon credits
- Other funding mechanisms (e.g. impact fees, levies, green infrastructure funding, a special-purpose district tax and other taxes), if determined feasible

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

Volunteer Management

The Healthy Forest Project will engage current volunteers and seek to increase volunteer engagement. Volunteers currently provide more than 2,700 hours of stewardship each year in Snohomish County parks and natural areas — an amount the HFP seeks to increase. The project will prioritize data management by using a database to successfully track and report Partnership volunteer successes and accomplishments.

Snohomish County does not currently have a dedicated full-time volunteer coordinator who could manage the HFP. As the HFP approaches its goal of 13,800 volunteer hours at its peak in 2036, experience suggests that at least one employee will need to dedicate at least half of their time to managing and coordinating volunteer restoration efforts. This position would track volunteer time, recognize volunteer achievements, and recruit additional volunteers, and could also manage and support the HFP Forest Steward Program.

Forterra will initially 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, Snohomish County, or another partner, can take the lead in volunteer management internally or continue to contract these services with Forterra or another volunteer-services provider.

Forest Steward Program Management and Training

The HFP will recruit, train, and support Forest Stewards. Forest Stewards are trained volunteers committed to a particular park. They work individually or in small teams to organize and implement restoration projects. Forest Stewards will lead volunteer events, work closely with staff to create restoration work plans, track restoration progress, and may apply for small grants to manage their sites. These stewards will allow the HFP to increase its capacity to reach more restoration sites and engage more people in their local parks.

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

Recommended Staff Capacity

The Healthy Forest Project recommends adding a dedicated full- or part-time volunteer coordinator position to manage Forest Stewards under the HFP and other programs. This capacity could be met internally, with the addition of new 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 several appreciation and public engagement events each year. In order to reach the broader Snohomish County public, a staff person will need to devote a portion of time each week to HFP 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 should also coordinate with the Snohomish County Communications staff, particularly on how best to equitably engage Snohomish County'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 program's first year by creating and implementing communications and marketing tools. This will help the HFP 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, Snohomish County staffing alone cannot meet the management needs of restoring and maintaining all 935 acres of the HTP pilot sites by 2040. Partner agencies, organizations, and community leadership will play a major role in filling the gap. County staff will continue to play a lead role in evaluating and managing Snohomish County's forested parks and natural areas, especially as more volunteers are brought in to help with restoration work. In addition to these staff members, Snohomish County and partner organizations may contract with skilled crews for some fieldwork on sites that are not appropriate for volunteers.

In the first few years of the HFP, training in restoration BMPs and volunteer management will help ensure that all staff are up to speed with the same techniques and approaches being taught to Forest Stewards, in addition to crew-specific practices that volunteers are not permitted to perform. This coordination will be one of the functions of the HFP Management Team.

Fund Development and Management

Stable funding is crucial to supporting the HFP's efforts. As has been demonstrated in other Green Cities, thinking creatively about funding sources and how they apply to park forestry and forest enhancement will benefit Snohomish County and the HFP.

Uniting existing projects can help build a narrative for funders to better understand the important work the county is already doing. Nonprofit partners could assist Snohomish County in applying for grants to cover various portions of HFP activities. Approval of this 20-Year Plan, in and of itself, could serve as an opportunity to attract funders.

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

To achieve the goals outlined in this plan, partners — including landowners, Snohomish County, Forterra, and others — 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 HFP and may meet more often and/or form committees to address certain topics as the project grows. The Management Team will also 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 Snohomish County 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. Nonprofits will have priority to be hired, as needed, for fieldwork at difficult sites. Crews that offer jobs and training to Snohomish County residents will also be prioritized. Private landscaping and habitat restoration companies (commercial crews) will be hired for highly technical projects as budget and need dictate.

PHOTO BY JIM AVERY

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 Forest 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 Snohomish County's forested parks.

The HFP 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 who 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 HFP will strengthen work efforts and build community. An important component of outreach efforts will involve contacting communities that have not traditionally 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. Partnerships with schools can also be developed to provide opportunities for students who want to complete community-service requirements with the HFP.

Resource Objective 7: Support local businesses.

The HFP offers many opportunities to support Snohomish County's economy and local businesses in the following capacities:

- Hire professional field crews for on-the-ground restoration and stewardship.
- Purchase refreshments, snacks, and supplies for volunteer and other community events from local businesses.
- Hire graphic designers, marketing and outreach specialists, and other professionals to help promote HFP activities.
- Hire photographers to help document events.
- Hire 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 grant writing.
- Provide engagement opportunities, including local business donations and volunteering, for businesses to get their name out in front of the community and offer team-building activities.

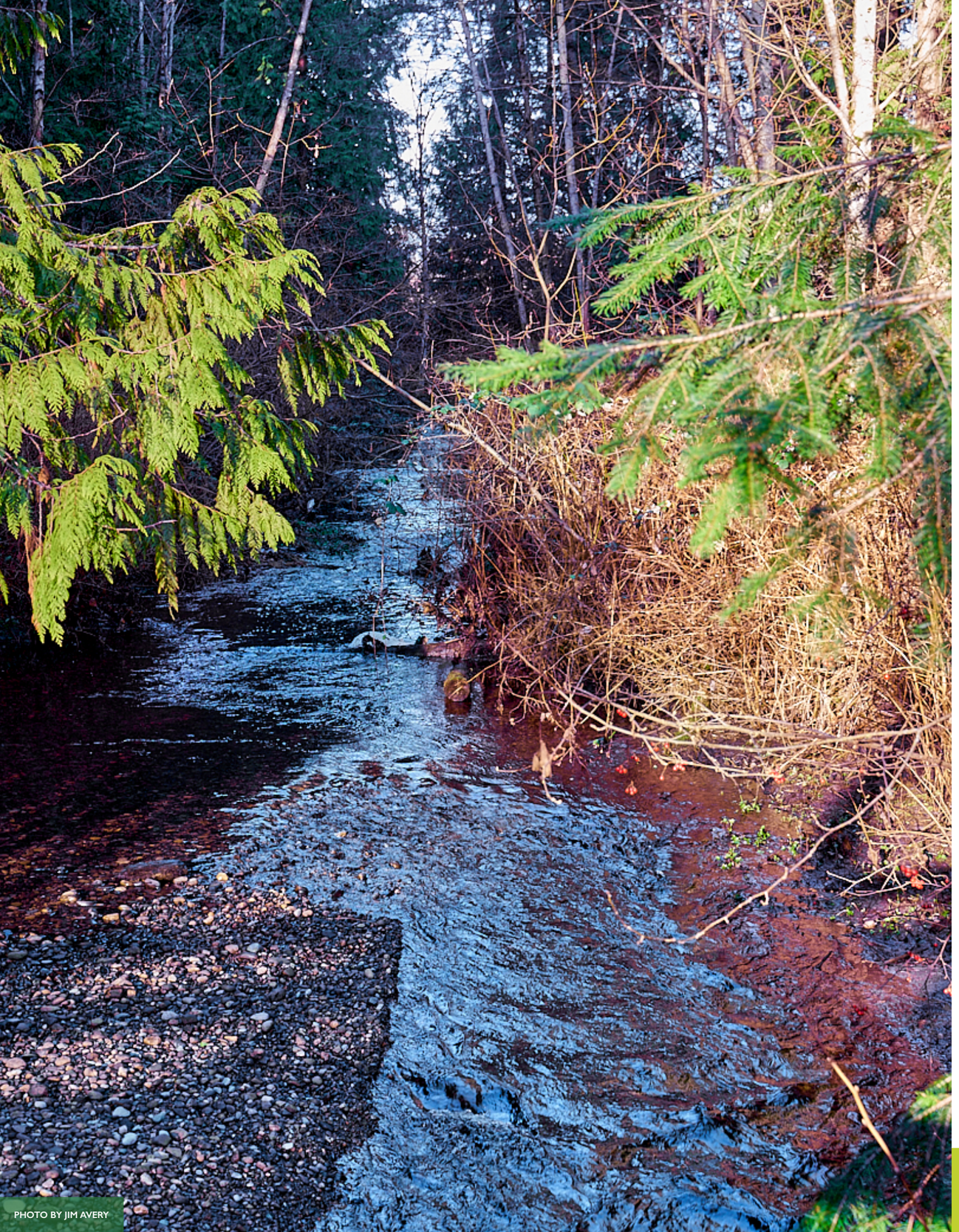


PHOTO BY JIM AVERY

CHAPTER 6. ADAPTIVE MANAGEMENT

This chapter describes how the HFP will apply an adaptive management approach to track and monitor progress, distribute resources, and report on the project's success.

Adaptive management is the process of hypothesizing how a system works, monitoring the results of actions taken, comparing these observations with expectations, and modifying management plans and procedures to better achieve objectives. The 6-step cycle systematically improves management policies and practices.

Once actions have been taken, 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 (see Figure 20). 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 forests.

MEASURING SUCCESS

Program monitoring and field monitoring will help the HFP improve its program design and performance. Monitoring analyzes and measures the effectiveness of strategies and techniques. The results from that monitoring inform HFP planning and methodologies to achieve continuous improvement. Monitoring and evaluation also provide accountability to funding sources and supporters, and help ensure that goals and benchmarks are met.

Table 11 illustrates near-term strategic actions and benchmarks for the three primary program elements of implementing the 20-Year Plan: fieldwork, community, and resources (see Appendix E for actions and benchmarks from 2026 to 2040). By measuring progress toward each objective, the HFP can assess the effectiveness of the implementation and program strategies. The effectiveness of the HFP needs to be tracked throughout its life, using adaptive management and making adjustments when necessary.

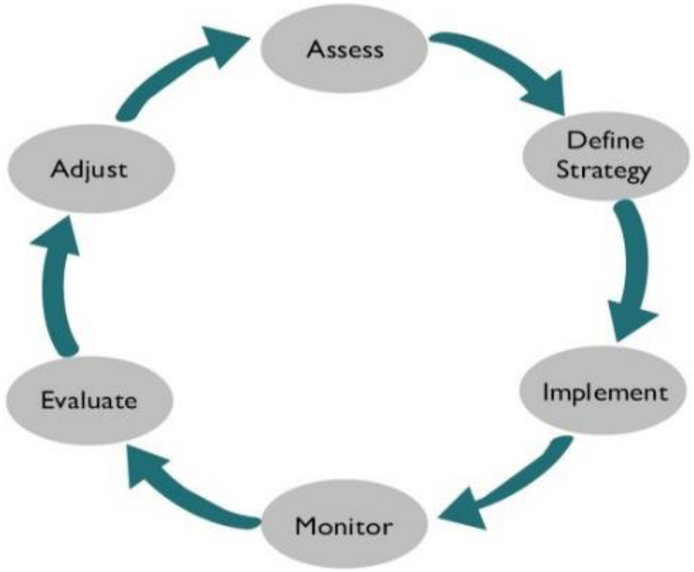


Figure 20: Adaptive management cycle

Table 11: Near-term actions and benchmarks (2021–2025)

FIELD

2021	2022	2023	2024	2025
• Enroll 3 acres into restoration • Develop stewardship plans for 2 priority sites • Develop tracking protocols and database • Prioritize community tree-planting events	• Continue work on previously enrolled 3 acres • Enroll 5 new acres into restoration • Develop stewardship plans for any new sites	• Continue work on previously enrolled 8 acres • Enroll 10 new acres into restoration • Develop stewardship plans for any new sites	• Continue work on previously enrolled 18 acres • Enroll 15 new acres into restoration • Develop stewardship plans for any new sites	• Continue work on previously enrolled 33 acres • Enroll 20 new acres into restoration • Develop stewardship plans for any new sites

COMMUNITY

2021	2022	2023	2024	2025
• Host kickoff community planting events • Publicize in local media • Develop basic branded outreach and promotional items • Host first annual Healthy Forest Project Day • Recruit and manage 500 volunteer hours	• Recruit and manage 1,000 volunteer hours • Recruit 5 new Forest Stewards • Create updated branded outreach and promotional items	• Recruit and manage 2,100 volunteer hours • Recruit 5 new Forest Stewards and support all active stewards (maintain at least 10 active stewards)	• Recruit and manage 3,000 volunteer hours • Recruit new Forest Stewards as needed and support at least 15 active stewards	• Recruit and manage 3,500 volunteer hours • Recruit new Forest Stewards as needed and support at least 15 active stewards • Publicize first 5 years of work • Evaluate community engagement needs for next 5 years of growth
	• Host annual Forest Steward orientation • Host annual trainings for stewards and open them to the public • Host Healthy Forest Project Day, the annual signature community planting event • Host volunteer appreciation event/activity • Host signature community planting event • Arrange local media coverage of at least 2 Partnership activities and accomplishments per year • Secure at least 1 new corporate/local business partner (for sponsorship/donations/volunteers) each year • Advertise events and trainings (via monthly e-newsletter, social media, local media, schools, businesses, HOAs, etc.)			

RESOURCES

2021	2022	2023	2024	2025
• Convene agency partners for preliminary coordination meetings • Develop 20-Year Plan	• Seek additional partners	• Seek additional partners • Expand business engagement	• Expand capacity for volunteer and community events	• Explore options for a more formalized management structure, if needed • Review 20-Year Plan benchmarks to make sure the project is utilizing the best available science and adaptive management to reach program goals • Celebrate 5-year program accomplishments
	• Develop annual work plan and write annual report of accomplishments • Present annual accomplishments to partners, volunteers, and county leadership • Identify and pursue annual funding to support field, community, and administrative work as needed			

PROGRAM EVALUATION

At the close of each year, HFP staff will compile data to measure and track progress toward the annual work-plan goals and benchmarks using the Centralized Data Repository (CEDAR) database. This is a database customized specifically for the Green Cities Network and the Healthy Forest Project to record field restoration and volunteer metrics, so that progress can be summarized easily at any point in the year. The data can be used to analyze and evaluate volunteer attendance, retention, and basic demographic information to measure program effectiveness and reach. Field-based metrics will also be collected, such as the area and types of invasive plants removed, acres enrolled in restoration, the number of plants installed and watered, and the area mulched and maintained. Throughout the HFP, staff will share successes and lessons learned with the county, celebrate progress, and evaluate effectiveness.

FIELD MONITORING

As the field program proceeds, the HFP will continue to conduct routine monitoring of planting and restoration sites to track their condition and health, and gauge progress. On forested land, adaptive management will rely on developing and refining effective strategies to remove and control invasive plants and keep newly planted natives healthy. Planting refinement may be needed if areas change due to climate, development, or other conditions.

To monitor fieldwork, new acres will be tracked as they are brought into active restoration and mapped in GIS. Volunteer and skilled-field-crew time will be devoted to revisiting sites that have been previously worked on to assess their ongoing needs as they move through the four phases of restoration. Although the work needed decreases dramatically each year that an area is involved in the program, Phase 4 of restoration continues indefinitely, as these areas will always be subject to pressure from their surroundings.

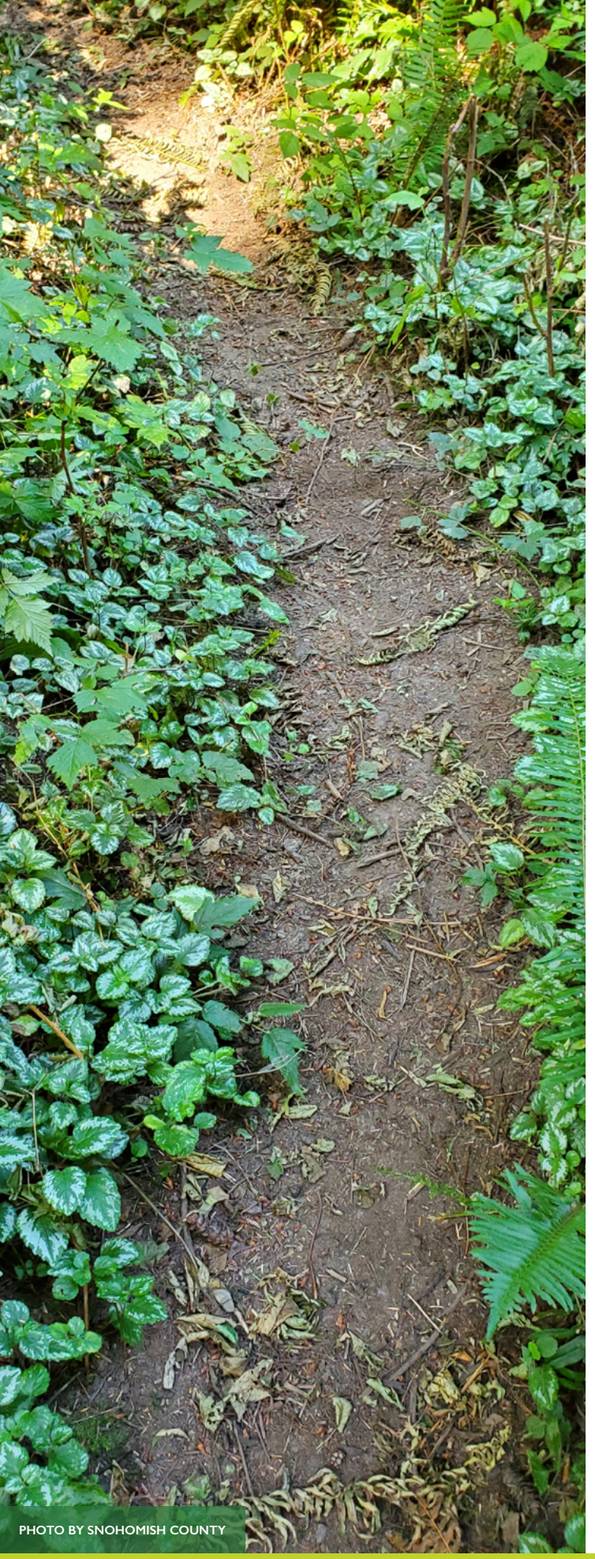


PHOTO BY SNOHOMISH COUNTY

As the HFP enrolls more acres in restoration and plants more 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 allows Forest Stewards and staff to directly enter volunteer and restoration data online, greatly reducing the need for staff management and streamlining project reporting.

RESOURCE DISTRIBUTION

As the HFP continues beyond 2021, Snohomish County staff will continue to oversee program funding and generate additional public funding, both from Snohomish County and non-county sources. Staff will also seek donations from outside sources throughout the duration of the project's 20-year span. The HFP will allocate funds for the three program areas — community, fieldwork, 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 supporting fieldwork.

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 HFP sites. These activities will ramp up during the first five years (2021–2025) as volunteer efforts grow. Once a strong volunteer program is established, some resources can shift to provide more field support for restoration projects. Additionally, as visibility and recognition of the HFP increase, elevated levels of public and private funding can support increased volunteer participation.

Funding is an immediate need for the HFP Management Team to address, as the county's two-year start-up funding only supports the HFP kickoff, 2019 forest assessment, creation of the 20-Year Plan, and establishment of a Forest Steward program in 2021. While the county has committed to the HFP beyond 2021, a dedicated revenue source needs to be established. Green Cities Network partners should be used as valuable resources for successful funding mechanisms and tested strategies. Partner organizations that support the HFP can help provide ideas and be advocates for the county to obtain the funds to continue this work.

The HFP should use adaptive management to regularly evaluate and adapt the distribution of funding and resources for field operations and volunteer recruitment and support. As funding allows in the future, the field management budget can expand from funding HFP staff time and supporting volunteers to include skilled field crews to help meet restoration and maintenance demands.

The role of volunteers and funding for the HFP will continue beyond 2040, since parks and natural areas will need ongoing volunteer support and stewardship. At this point, the program could be expanded to include parks not included in the original assessment.

REPORTING AND KNOWLEDGE SHARING

The Healthy Forest Project will report its progress annually to the Snohomish County Office of Energy and Sustainability, as well as the County Council, Surface Water Management Division, Parks, Recreation, and Tourism Department, relevant commissions, Forest 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.

Project staff should consider utilizing creative outreach strategies and networking with regional restoration practitioners so staff can share information and learn from other agencies. As a member of the Green Cities Network, the HFP team will have opportunities to share successes and challenges with other Forterra partner organizations dedicated to a similar goal and vision, including the cities of Burien, Des Moines, Everett, Issaquah, Kent, Kirkland, Puyallup, Redmond, Seattle, SeaTac, Shoreline, Snoqualmie, Tacoma, and Tukwila. Forterra will post written materials, including this 20-Year Plan, on the HFP website[10], and all parties using these resources will be given the opportunity to provide feedback on the HFP's methods and materials.

10 www.SnoCoHealthyForest.org

LOOKING TO THE FUTURE

County leaders are considering ways to preserve the health of Snohomish County's forests for generations to come. Restoring the county's forested parklands and natural areas, along with the successful completion of the 20-Year Plan, are important first steps in this process. There are additional actions that could assist Snohomish in the future:

- Connect and stay up to date with the Green Cities Network and the Green City Toolbox in order to explore available tools, best management practices, resources, and funding as they become available.
- Expand the HFP model beyond parks to restore, plant trees in, and care for other public landscapes, thus encompassing all of Snohomish County's public forests.
- Build upon previous efforts to maintain and increase Snohomish County's canopy cover.
- Establish a residential tree give-away program to increase tree canopy on private property.
- Increase staff capacity to meet the needs of a growing county and the Healthy Forest Project in order to retain, and potentially expand, the benefits Snohomish County currently receives from its public forests.

CHAPTER 7. GLOSSARY OF TERMS USED IN THIS PLAN

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 Healthy Forest Project 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).

Broadleaf

Any tree within the diverse botanical group of angiosperms that has flat leaves and produces seeds inside of fruits. It is one of two general types of trees, the other being conifers, trees with needle- or scale-like leaves and seeds borne in woody cones. Broad-leaved trees are sometimes known as hardwoods.

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 scalelike leaves. Examples include pine, fir, hemlock, and spruce.

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 comprise Burien, Des Moines, Everett, Issaquah, Kent, Kirkland, Puyallup, Redmond, Seattle, SeaTac, Shoreline, Snoqualmie, Tacoma, and Tukwila — and now, Snohomish County. Convened by Forterra, the network is made up of city and county partners, Forterra staff, other nonprofits, and participating volunteers who contribute to achieving the goals of each Green Partner. 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 place with sustainable urban forests and natural areas that connect people to nature through community-based stewardship.

Hardwoods — see Broadleaf

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 that offers unique habitat particular to Puget Sound lowland forests. The Pacific madrone is in decline, especially in urban areas, and is a difficult species to reestablish.

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 is often 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 red cedar, western hemlock, and bigleaf maple.

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 by-product 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.

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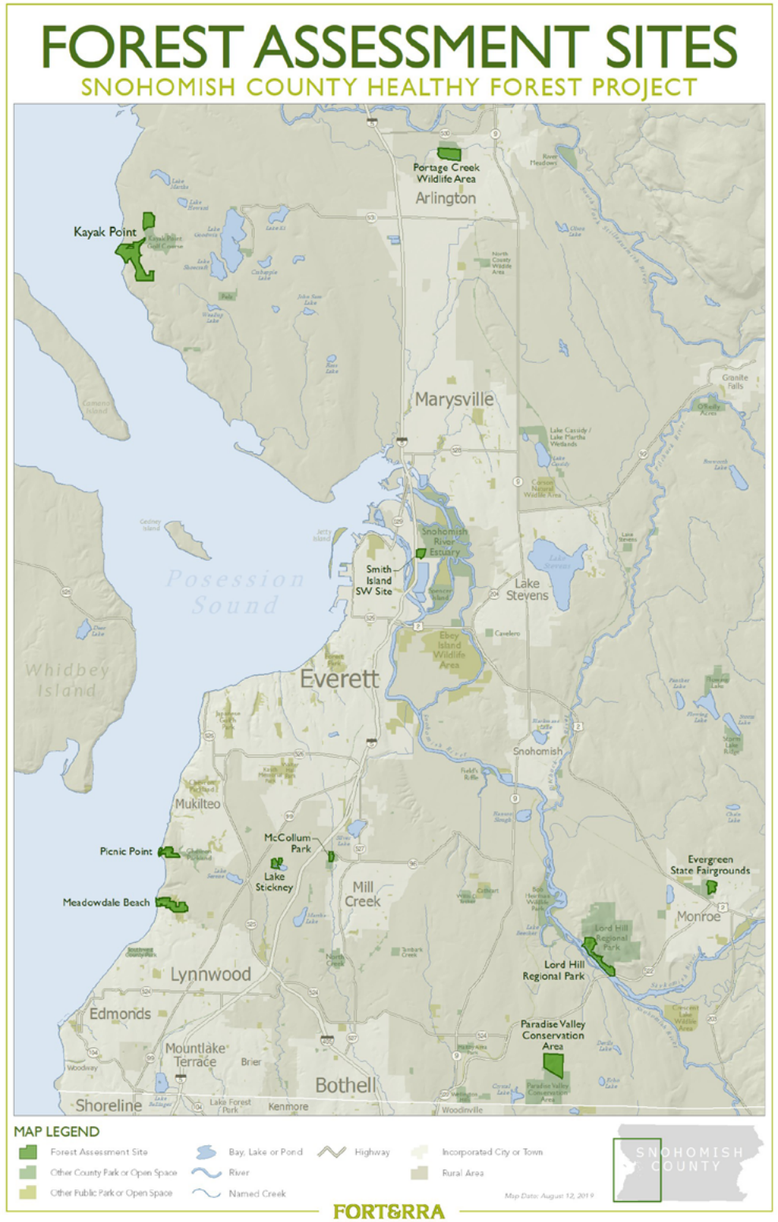
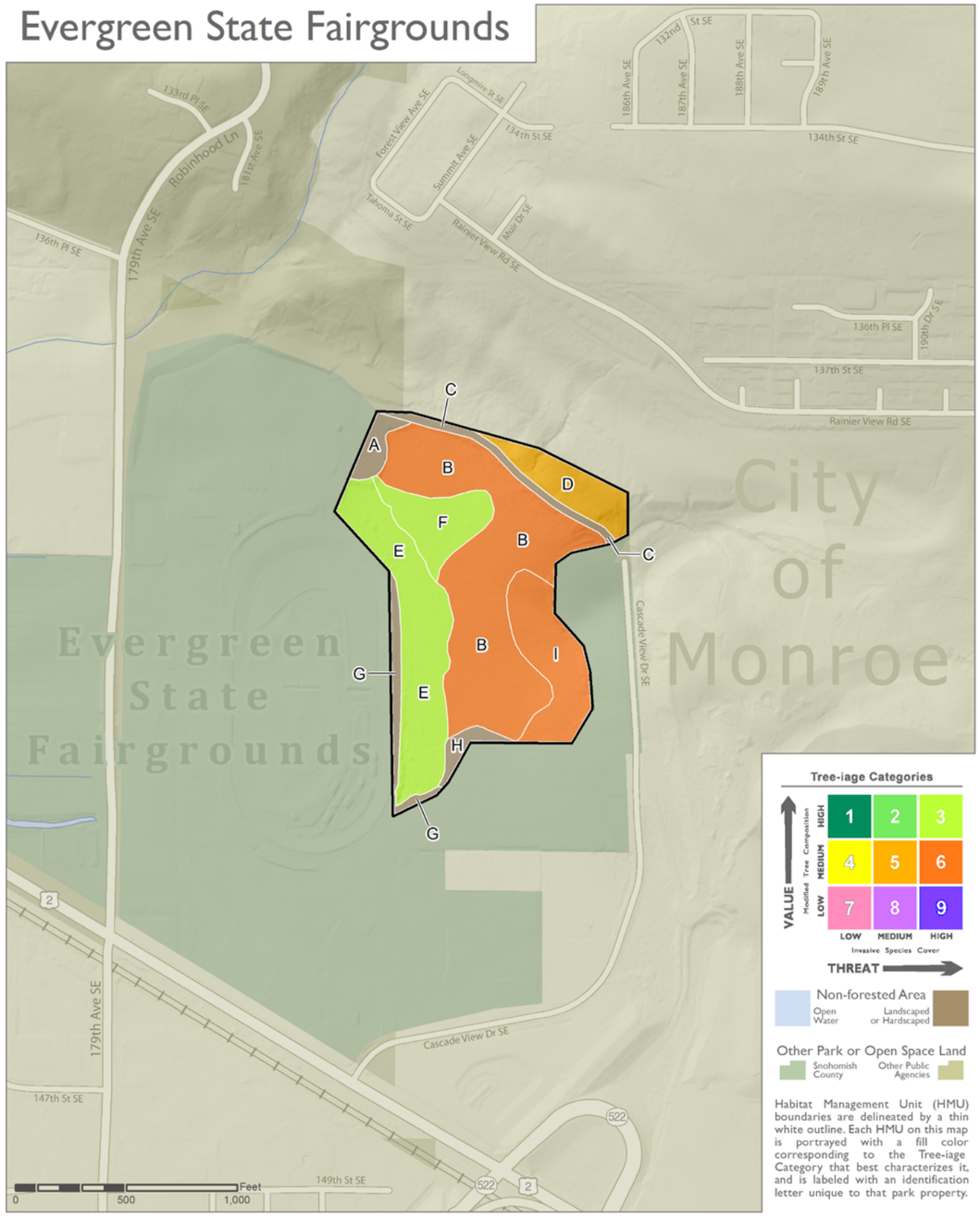
CHAPTER 9. APPENDICES

APPENDIX A: MAP OF HEALTHY FOREST PROJECT SITES

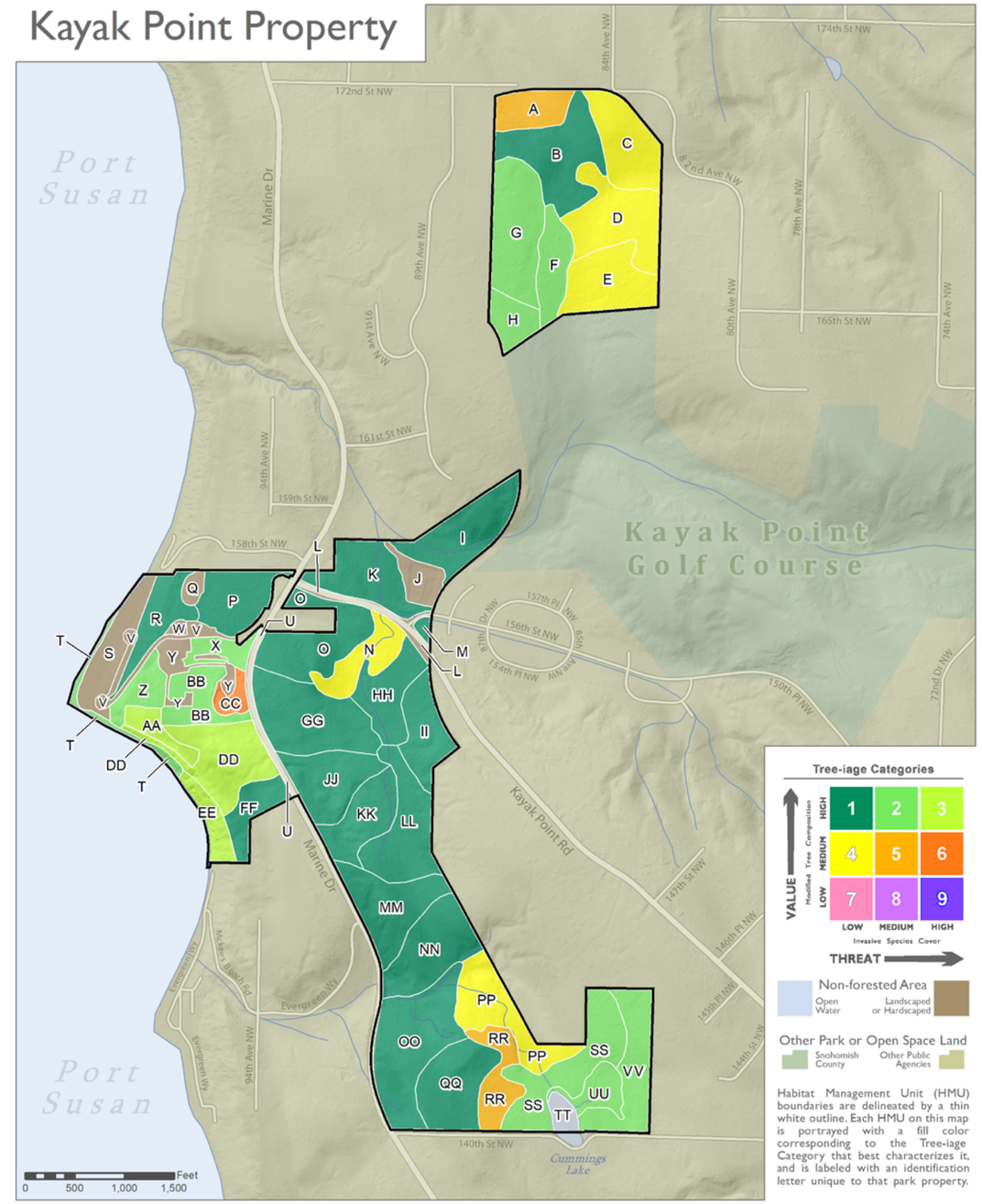


Evergreen State Fairgrounds



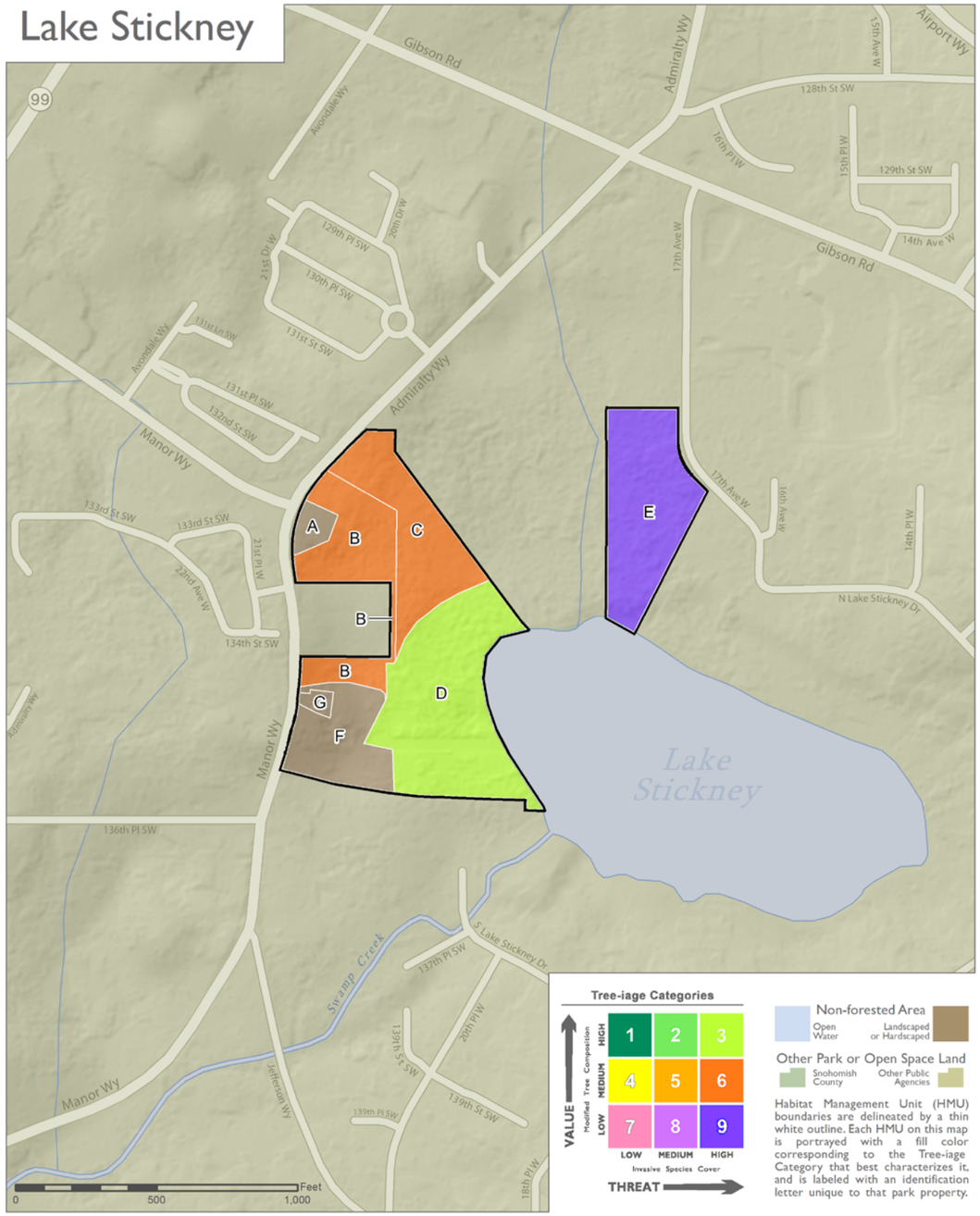
Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

Kayak Point Property



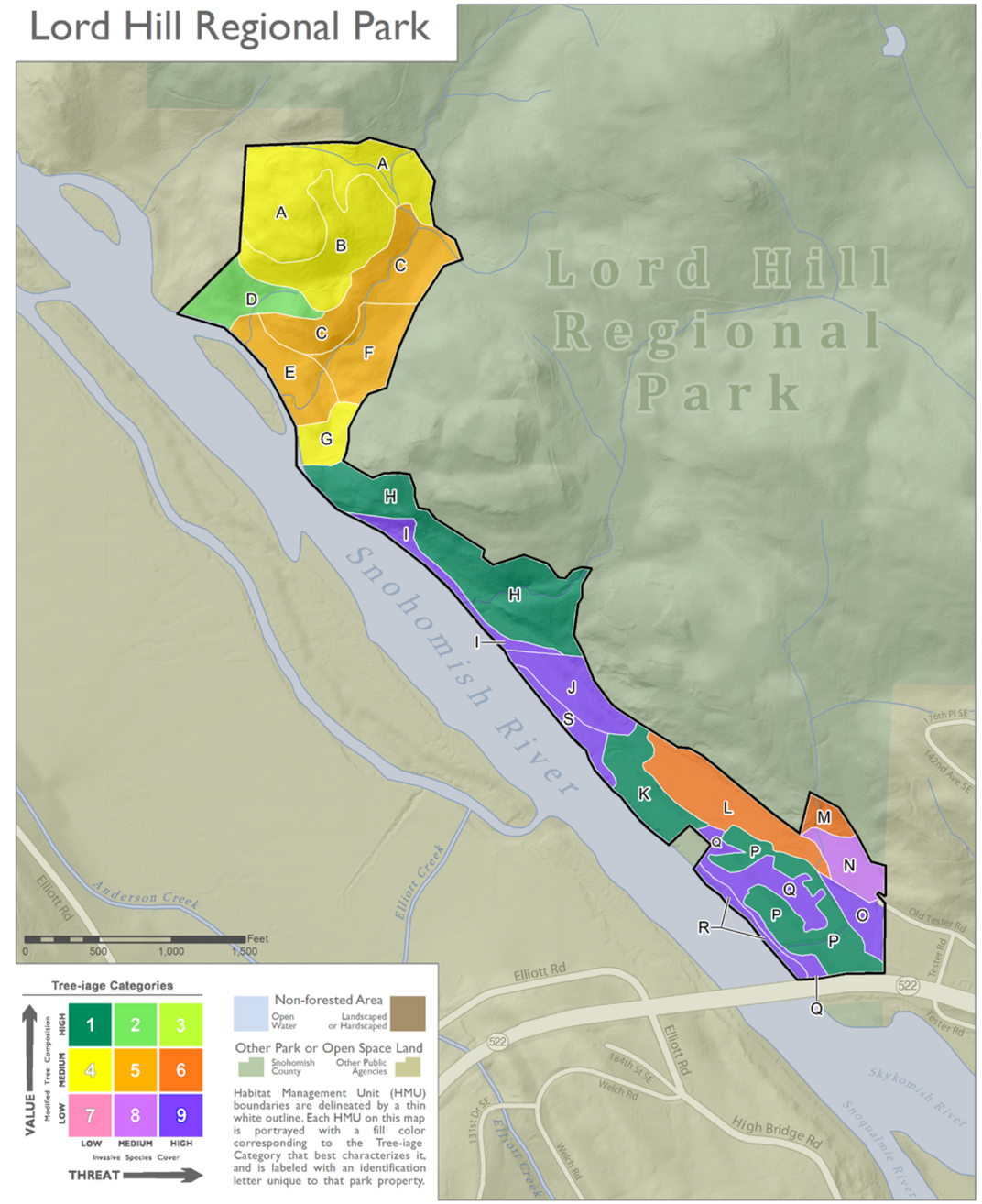
Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

Lake Stickney



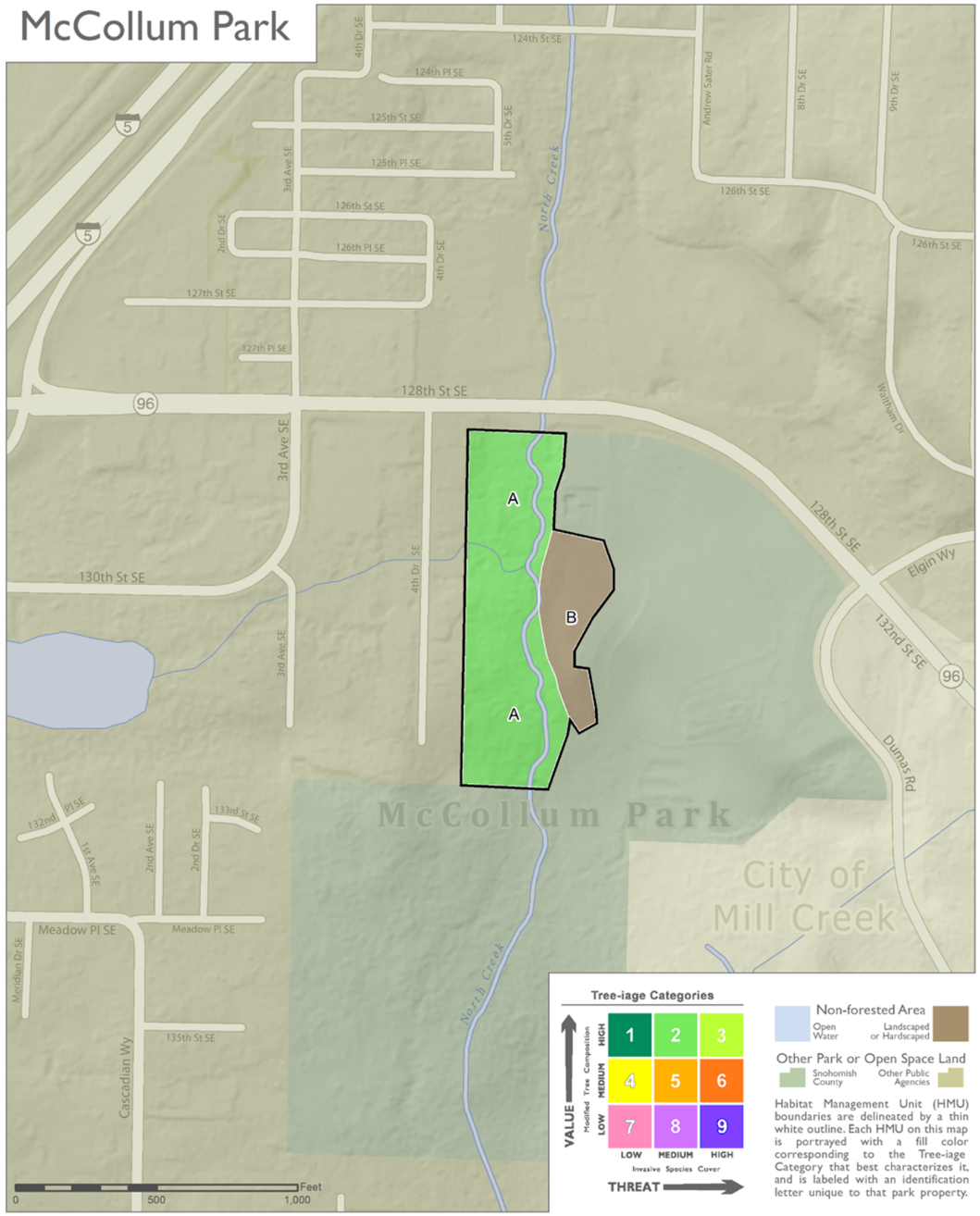
Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

Lord Hill Regional Park



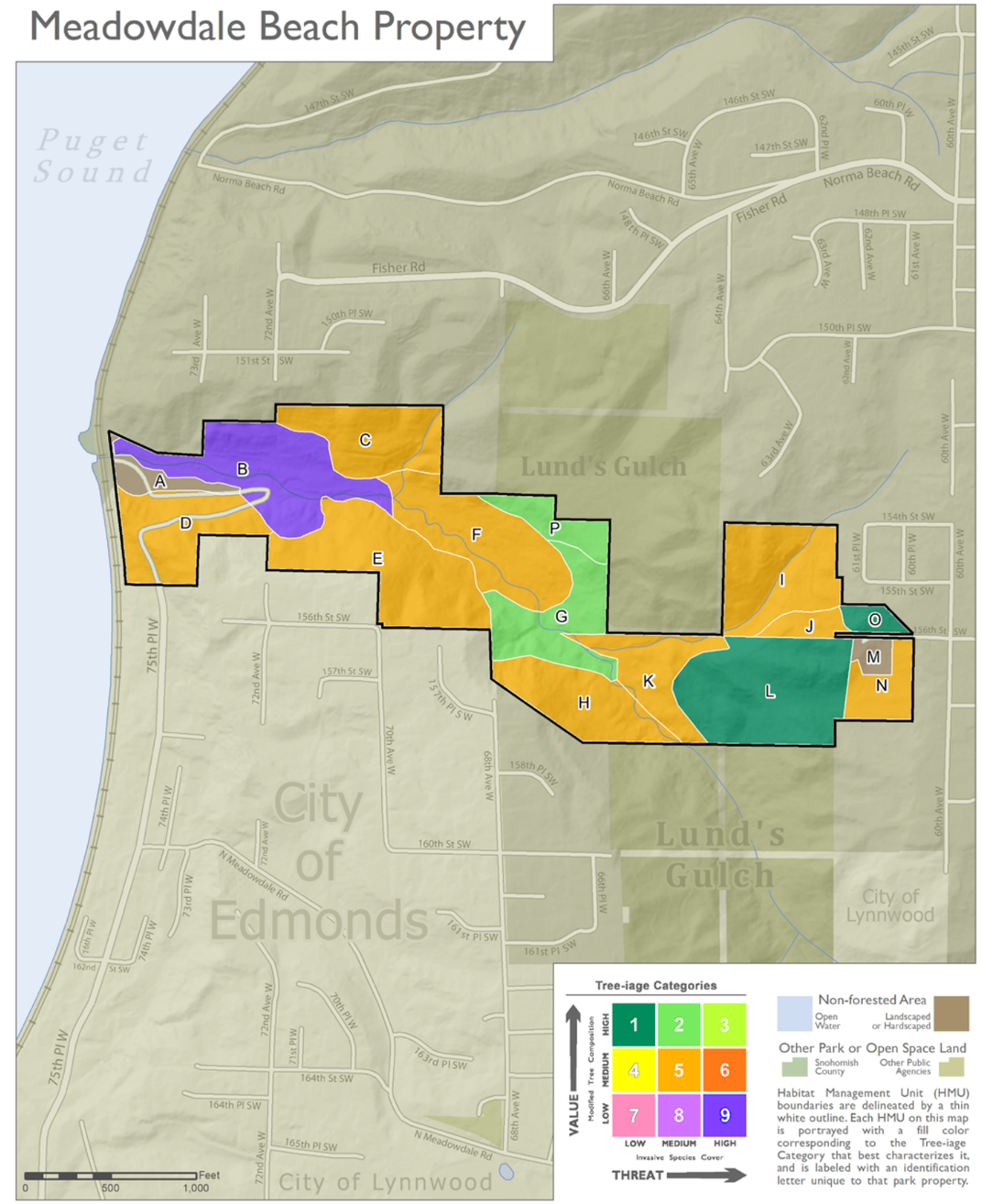
Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

McCollum Park



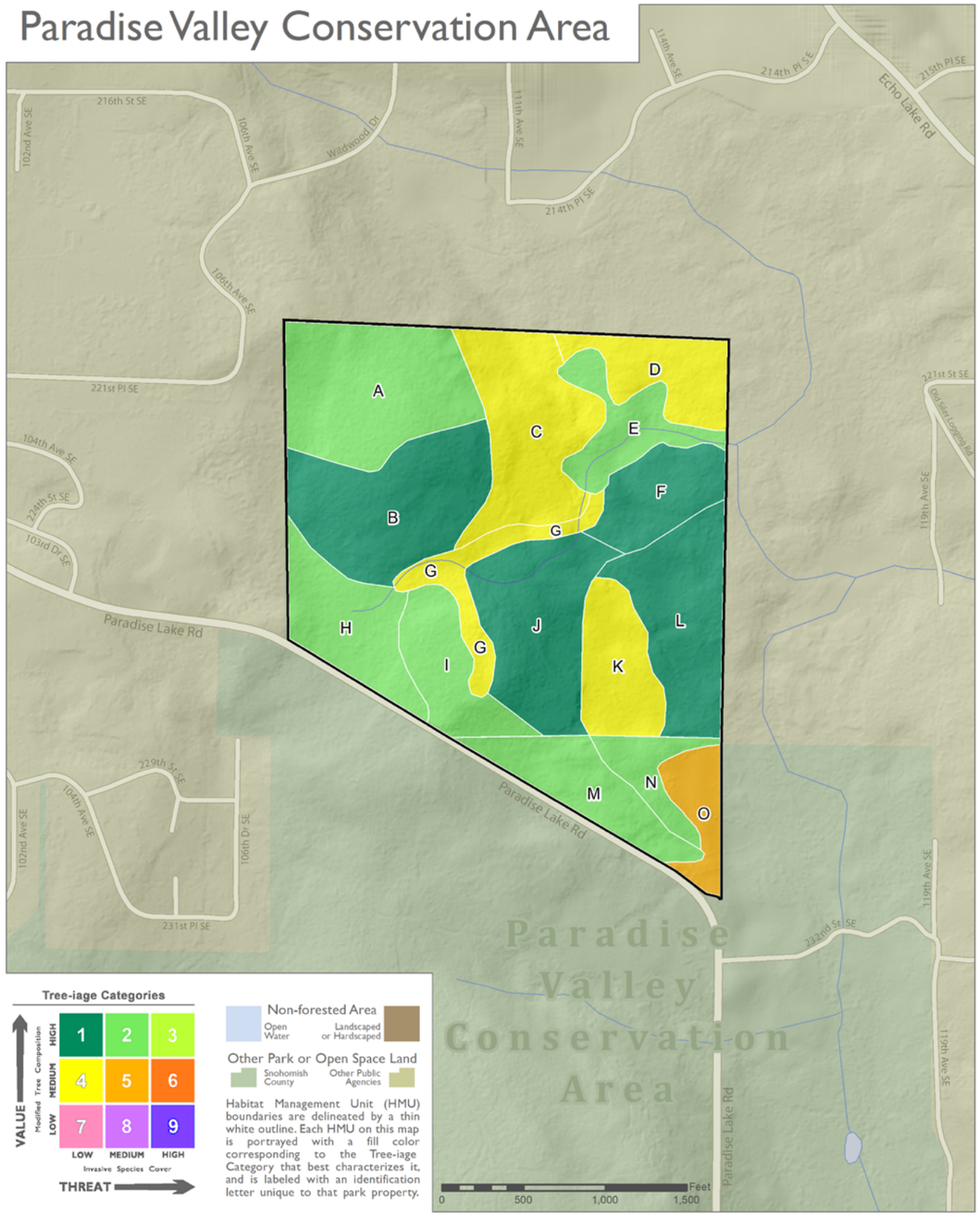
Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

Meadowdale Beach Property



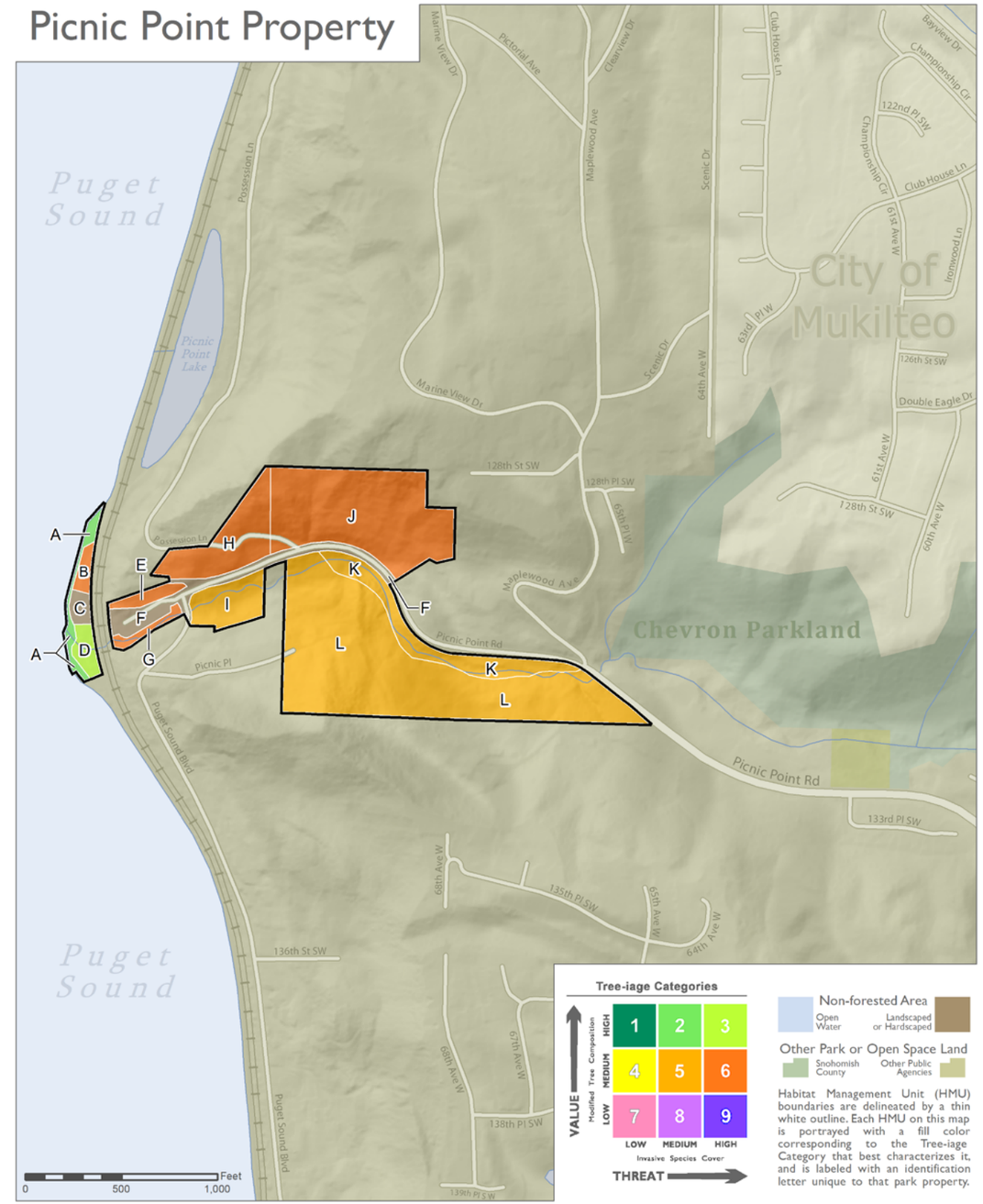
Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

Paradise Valley Conservation Area



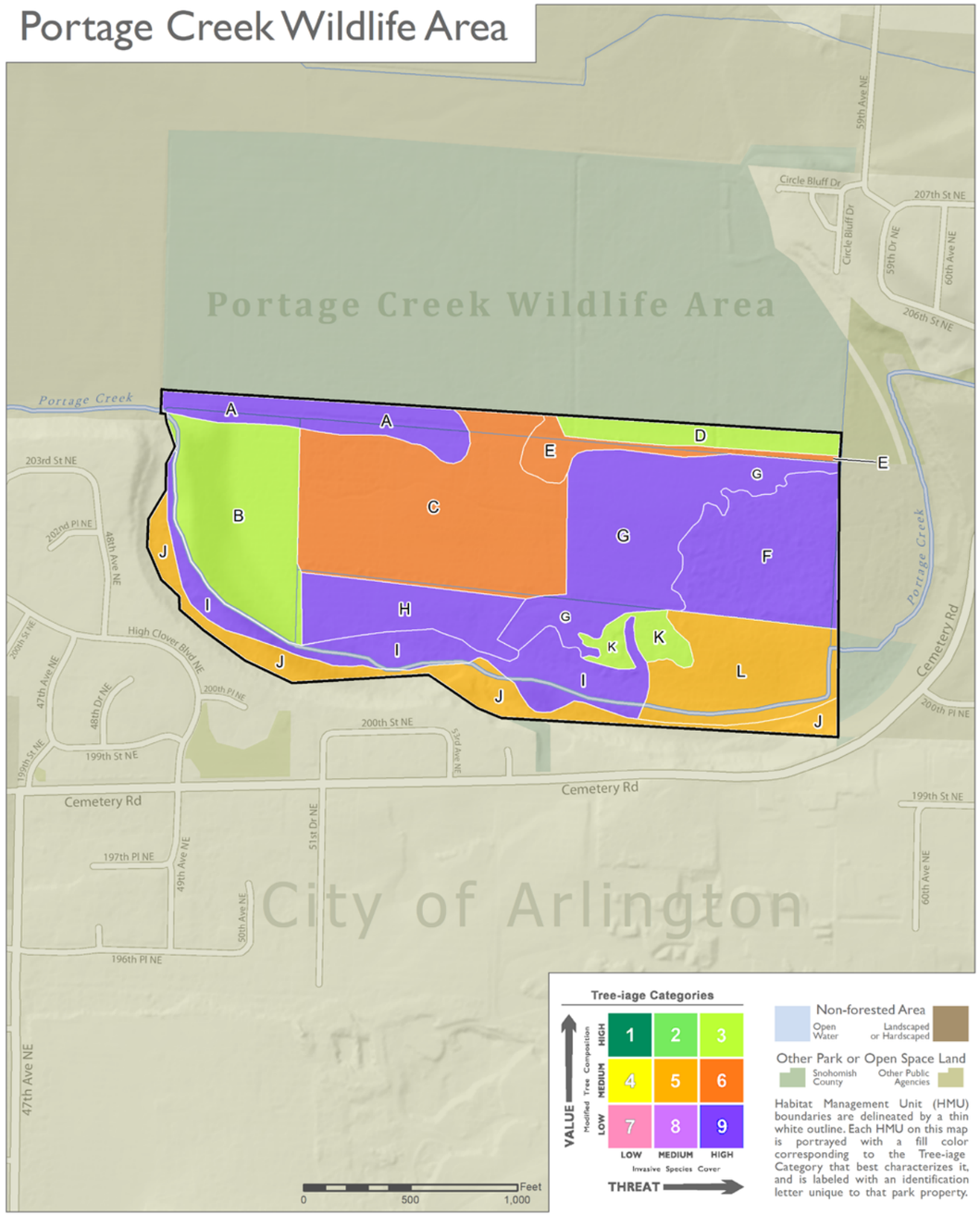
Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

Picnic Point Property



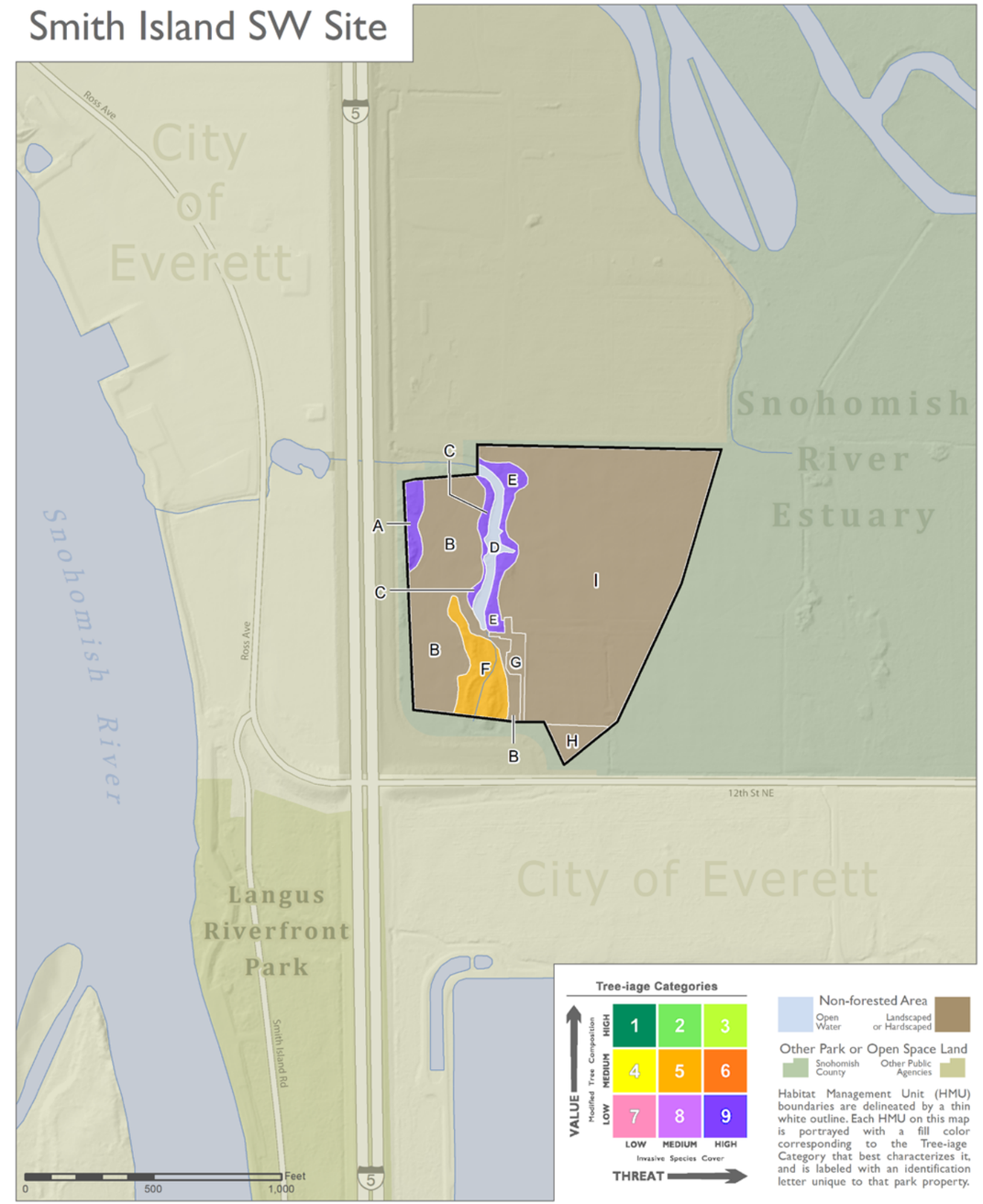
Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

Portage Creek Wildlife Area



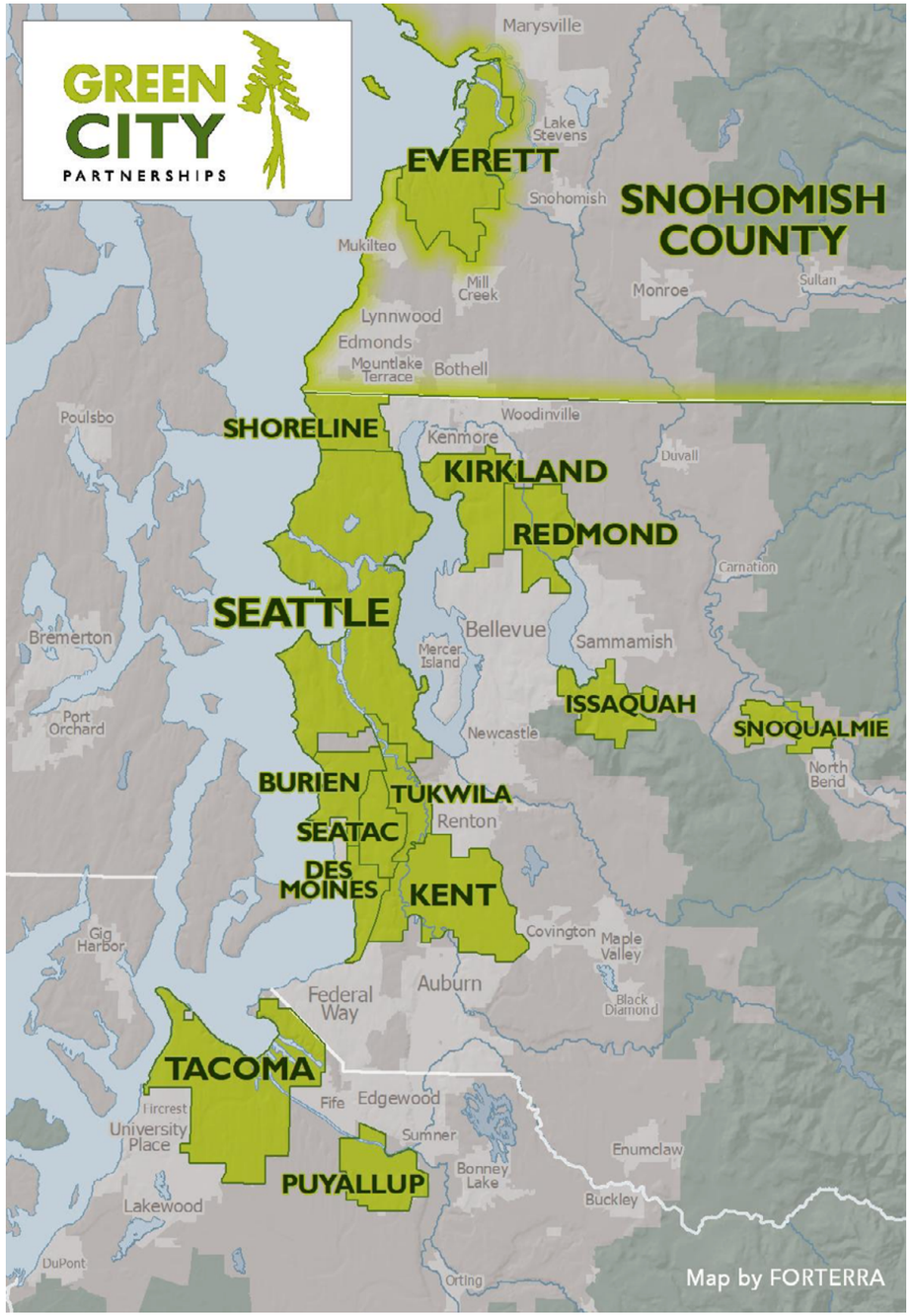
Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

Smith Island SW Site



Map created by FORTERRA in partnership with Snohomish County. Tree-iage field assessment conducted by American Forest Management, Inc., December 18, 2019.

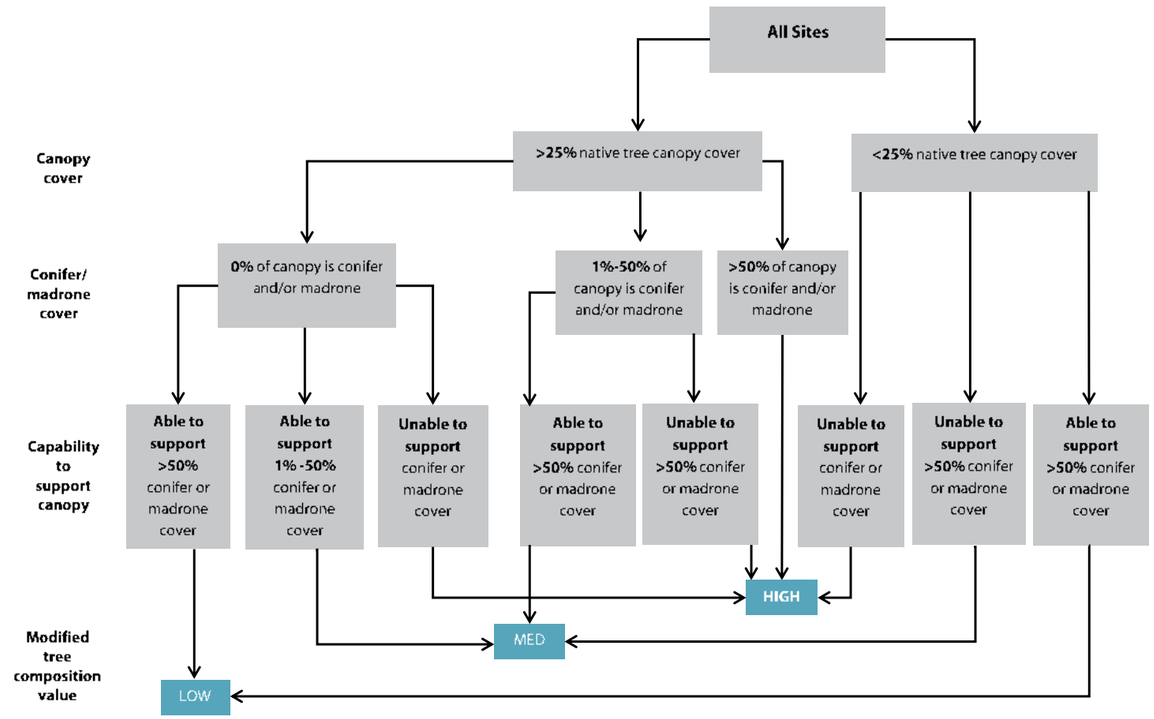
APPENDIX C: GREEN CITIES 2021 NETWORK MAP



APPENDIX D: FLAT-MODIFIED DATA-COLLECTION FLOWCHART

Forest Landscape Assessment Tool (FLAT)

Habitat Quality/Management Unit Composition



APPENDIX E: LONG-TERM ACTIONS AND BENCHMARKS (2026–2040)

FIELD

2026–2030	2031–2035	2036–2040
Enroll new acres in initial restoration per year: • 2026: 25 new acres • 2027: 35 new acres • 2028: 45 new acres • 2029: 55 new acres • 2030: 65 new acres Conduct 5-year monitoring and BMP review	Enroll new acres in initial restoration per year: • 2031: 80 new acres • 2032: 80 new acres • 2033: 80 new acres • 2034: 80 new acres • 2035: 80 new acres Continue to diversify forest tree species and add to parks with acres enrolled Conduct 10-year monitoring and BMP review	Enroll new acres in initial restoration per year: • 2036: 75 new acres • 2037: 65 new acres • 2038: 55 new acres • 2039: 40 new acres • 2040: 22 new acres Assess and enroll any additional sites and acquisitions, if needed Conduct 15-year monitoring and BMP review

- Continue maintenance and restoration on all previously enrolled acres
- Revise and update site stewardship plans as needed
- Ensure that restoration activities are equitably dispersed throughout the county

COMMUNITY

2026–2030	2031–2035	2036–2040
Recruit and manage: • 2026: 4,000 volunteer hours • 2027: 4,700 volunteer hours • 2028: 5,700 volunteer hours • 2029: 7,000 volunteer hours • 2030: 8,800 volunteer hours Recruit, train, and support 10 to 12 active Forest Stewards	Recruit and manage: • 2031: 10,800 volunteer hours • 2032: 11,900 volunteer hours • 2033: 12,600 volunteer hours • 2034: 13,200 volunteer hours • 2035: 13,700 volunteer hours Recruit, train and support 12 to 15 active Forest Stewards	Recruit and manage: • 2036: 13,800 volunteer hours • 2037: 13,200 volunteer hours • 2038: 11,300 volunteer hours • 2039: 11,000 volunteer hours • 2040: 9,100 volunteer hours Recruit, train and support 15 active Forest Stewards

- Update branded outreach and promotional items
- Host annual Forest Steward orientation
- Host annual trainings for Forest Stewards and open them to the public
- Host Healthy Forest Project Day, the annual signature community planting event
- Host annual volunteer appreciation event/activity
- Arrange local media coverage of at least 2 Partnership activities and accomplishments per year
- Evaluate community engagement for next 5 years of growth
- Secure at least 1 new corporate/local business partner (for sponsorship/donations/volunteers) each year
- Advertise events and trainings (via monthly e-newsletter, social media, local media, schools, businesses, HOAs, etc.)

RESOURCES

2026–2030	2031–2035	2036–2040
Celebrate 10-year program accomplishments Evaluate needs, costs, and resources based on first 5 years of work	Celebrate 15-year program accomplishments Consider updating the forest assessment and plan after 10 years, and expanding the program to additional parks	Celebrate 20-year program accomplishments Ensure proper funding base is in place for long-term maintenance, monitoring, and community engagement

- Evaluate overall program and adapt goals/metrics as needed
- Develop annual work plan and write annual report of accomplishments
- Present annual accomplishments to partners, volunteers, and county leadership
- Identify and pursue annual funding to support field, community, and administrative work as needed

APPENDIX F: MANAGEMENT-UNIT ACRES PER TREE-IAGE CATEGORY

Site Name	Tree-iage Category									Acres Per Site*
	1	2	3	4	5	6	7	8	9	
Evergreen State Fairgrounds			9.37		2.32	16.89				**29**
Kayak Point Park	200.91	75.35	21.87	56.21	13.16	2.35				**370**
Lake Stickney Community Park			6.33			6.33			4.26	**17**
Lord Hill Regional Park	29.91	4.88		27.33	21.33	9.5		3.18	18.04	**114**
McCollum Pioneer Park		8.89								**9**
Meadowdale Beach Park	14.09	9.54			61.22				11.07	**96**
Paradise Valley Conservation Area	58.73	60.78		40.09	4.81					**164**
Picnic Point Park		0.63	0.62		21.22	13.61				**36**
Portage Creek Wildlife Area			16.34		14.91	22.16			43.08	**96**
Smith Island SW site					1.33				1.64	**3**
Total Acres per Tree-iage Category*	**304**	**160**	**55**	**124**	**140**	**71**		**3**	**78**	**935**

*Figures are rounded

APPENDIX G: OVERSTORY SPECIES DOMINANCE BY MU ACRES

Botanical Name	Common Name	Primary	Secondary	Tertiary
Pseudotsuga menziesii	Douglas-fir	245	194	113
Thuja plicata	Western red cedar	170	223	137
Alnus rubra	Red alder	158	115	230
Tsuga heterophylla	Western hemlock	129	62	64
Acer macrophyllum	Bigleaf maple	101	177	199
Populus trichocarpa	Black cottonwood	99	97	24
Salix lucida	Pacific willow	12	11	
Abies grandis	Grand fir	11		
Arbutus menziesii	Pacific madrone	2		
Populus tremuloides	Quaking aspen	1		
Betula papyrifera	Paper birch		6	4
Pinus monticola	Western white pine		3	9
Picea sitchensis	Sitka spruce		20	
Prunus emarginata	Bitter cherry		6	

APPENDIX H: UNDERSTORY SPECIES DOMINANCE BY MU ACRES

Botanical Name	Common Name	Primary	Secondary	Tertiary
Rubus spectabilis	Salmonberry	302	181	65
Polystichum munitum	Sword fern	293	274	117
Grass species	Grass	113	20	8
Acer circinatum	Vine maple	101	21	62
Gaultheria shallon	Salal	31	62	24
Spiraea douglasii	Spirea	24	5	
Cornus sericea	Red osier dogwood	16	7	2
Symphoricarpos albus	Snowberry	13	17	50
Sambucus racemosa	Red elderberry	10	46	95
Oemleria cerasiformis	Indian plum	9	14	12
Corylus cornuta	Beaked hazelnut	6		
Rubus ursinus	Trailing blackberry	3	12	55
Vaccinium ovatum	Evergreen huckleberry	3		
Rosa pisocarpa	Swamp rose	1	5	
Holodiscus discolor	Oceanspray	1		14
Elymus mollis	Dune grass	1		
Blechnum spicant	Deer fern		53	110
Epilobium angustifolium	Fireweed		49	22
Equisetum arvense	Horsetail		35	75
Fragaria chiloensis	Beach strawberry		22	
Mahonia aquifolium	Tall Oregon grape		17	3
Amelanchier alnifolia	Serviceberry		16	13
Mahonia nervosa	Dull Oregon grape		9	
Pteridium aquilinum	Bracken fern		8	29
Oplopanax horridus	Devil's club		8	1
Rosa nutkana	Nootka rose		6	33
Rubus parviflorus	Thimbleberry		6	14
Salix scouleriana	Scouler's willow		2	
Typha latifolia	Cattail		1	13
Vaccinium parvifolium	Red huckleberry		1	
Urtica dioica	Nettle			7

APPENDIX I: INVASIVE SPECIES DOMINANCE BY MU ACRES

Botanical Name	Common Name	Primary	Secondary	Tertiary
Rubus armeniacus	Himalayan blackberry	382	207	54
Ilex aquifolium	English holly	228	219	69
Hedera helix	English ivy	106	77	58
Phalaris arundinacea	Reed canary grass	105	137	10
Ranunculus repens	Creeping buttercup	56	34	66
Rubus laciniatus	Evergreen blackberry	20	25	13
Prunus laurocerasus	English laurel	5	3	14
Geranium robertianum	Herb Robert		43	80
Lamiastrum galeobdolon	Yellow archangel		11	
Calystegia sepium	Hedge bindweed		5	2
Cytisus scoparius	Scotch broom		3	1
Clematis vitalba	Clematis			28
Cirsium arvense	Canada thistle			19
Crataegus monogyna	European hawthorn			5
Tanacetum vulgare	Common tansy			5
Polygonum x spp.	Knotweed			4
Vinca minor	Common periwinkle			3

APPENDIX J. COMMON PLANTS REFERENCED IN THIS PLAN

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

APPENDIX K: MANAGEMENT TECHNIQUES FOR INVASIVE TREES AND PLANTS

The species in this appendix are some of the most common invasive plants found in Snohomish County HFP parks and natural areas.[11]

Invasive Plants

Below is a complete list of invasive plants found in areas surveyed for the Healthy Forest project.

Botanical Name	Common Name
Calystegia sepium	Hedge bindweed
Cirsium arvense	Canada thistle
Clematis vitalba	Clematis
Cotoneaster spp.	Cotoneaster
Crataegus monogyna	European hawthorn
Cytisus scoparius	Scotch broom
Geranium robertianum	Herb Robert
Hedera helix	English ivy
Ilex aquifolium	English holly
Lamiastrum galeobdolon	Yellow archangel
Phalaris arundinacea	Reed canary grass
Polygonum cuspidatum	Japanese knotweed
Prunus laurocerasus	English laurel
Ranunculus repens	Creeping buttercup
Rubus armeniacus	Himalayan blackberry
Rubus laciniatus	Evergreen blackberry
Tanacetum vulgare	Common tansy
Vinca minor	Common periwinkle

Invasive Trees

Invasive trees found in HFP areas include English holly, English laurel, and European hawthorn. 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 trees may be hand-pulled. Stems up to 3 inches in diameter may be taken out successfully with a weed-pulling device, such as a weed wrench or Pullerbear™.

For any tree more than 1 inch in diameter, remove the lower branches to provide access to the ground around the tree before you remove the roots. Do not leave freshly cut or pulled holly stems or branches in direct contact with the soil, as the cuttings can easily re-root; rather, leave them to dry on top of their own on-site compost pile, separate from cut and pulled blackberry and ivy, as they decompose at different rates.

Invasive trees that are too large for the roots to be removed by hand should be treated with an herbicide, using best management practices to prevent regrowth and spread. However, volunteers are prohibited from undertaking this task; it must be done by a licensed applicator.

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

English ivy can usually be easily removed by hand, and since it has no thorns, ivy removal can be done by volunteers of all ages. Create "lifesavers" or "survival rings" to preserve existing trees and reduce the seed source: cut ivy or clematis vines at shoulder height, cut them again at the base of the tree, then remove the cut vines 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; pulling them down from high branches can possibly damage the tree.

Remove dense ground patches of ivy and clematis by clipping the edges of the swaths, then continue clipping, digging, and rolling the tangled mat up into 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

11 For more information on invasive plant identification and removal and disposal methods, visit the Snohomish County Noxious Weeds website, https://snohomishCountywa.gov/722/Noxious-Weeds; go to kingcounty.gov and search on "noxious weeds"; or visit kingCounty.gov/services/environment/animals-and-plants/noxious-weeds.aspx.

trees, and back up trees again, which requires following all the vines to make sure the plant is not 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 from the county. Ivy and clematis can be composted on-site.

Quick Tips for Removing Ivy and Clematis

"Lifesaver" tree ring: *Cut ivy at shoulder height and again at the tree base. Do not attempt to pull vines out of the tree. Roll ivy back away from the tree and into a log shape. 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 a 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 vines into a log, clip root connections at the end of the roll, and place the log on top of the compost pile to decompose. Ivy logs fit nicely on windrow compost piles.*

Hedge Bindweed/Morning Glory (*Calystegia sepium*)

Hand-pull at least three times per year (early growing season, midsummer, 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 it from the native plants first, or at minimum, clipping it away at their base as they are trying to establish. Covering bindweed with sheet mulch is also effective: mulch can help weaken the bindweed, slow regrowth, and make pulling more effective. Unless it is blooming, bindweed can be composted on-site. Shade is the best way to control it: plant conifers and other native plants for long-term bindweed suppression.

Herb Robert, aka 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 prevent them from spreading further. Flowering or seeding plants must be put in a bag and discarded in the garbage. If Herb Robert is growing by itself, 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 and Evergreen Blackberry (*Rubus armeniacus* and *Rubus laciniatus*)

Blackberry, one of the more common invasive plants in HFP project sites, can be manually removed by volunteers; however, its thorns can make the process slow and painful. 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.

Many species of birds nest in blackberry thickets. Before initiating blackberry removal during the early and primary nesting season (February to the end of July), make sure nesting activities have finished. Phase removal over time, if possible, to minimize habitat loss.

Knotweed (*Polygonum cuspidatum* and other species)

Application of a foliar herbicide 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. Removing knotweed by hand is impractical and could actually exacerbate the problem.

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

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, making sure to remove all roots and rhizomes because any left in the soil will resprout. 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 aboveground 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 aboveground 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, shade-tolerant species — such as western red cedar; thicket-forming species like red-osier dogwood, snowberry, and Nootka rose; and fast-growing conifers such as Douglas and grand fir (placed along southerly and westerly edges) — should be secondarily planted.

Scotch Broom (*Cytisus scoparius*)

Hand-pull or use a Pullerbear™ tool to extract smaller plants when the soil is moist in spring. Note that disturbing the soil may cause seeds to germinate, so 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 as close to the ground as possible in late summer to early fall, and monitor for new growth. Scotch broom can be composted on-site.

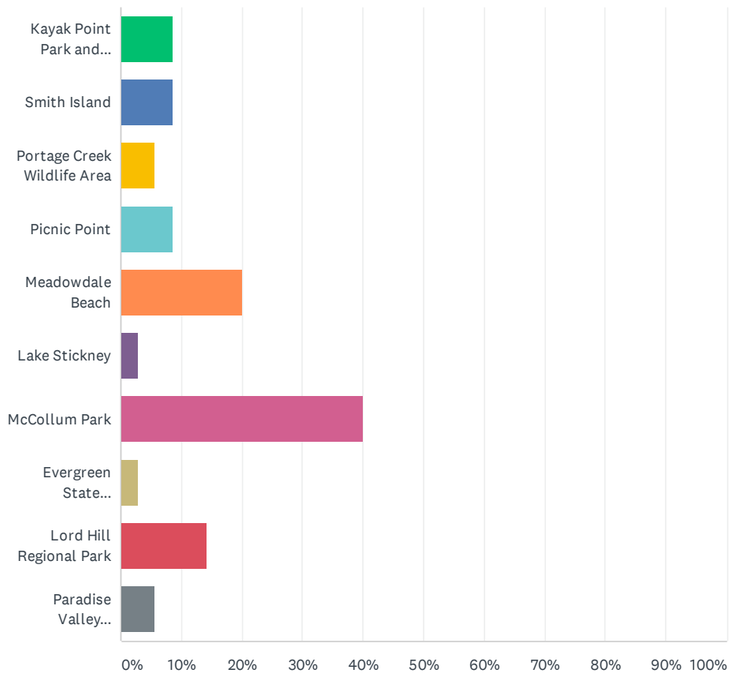
Yellow Archangel (*Lamiastrum galeobdolon*)

Manual removal of yellow archangel 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. However, 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 is easiest in fall through early spring. All plant debris should be disposed of 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 resprout if left in contact with wet ground.

Q1 Which Snohomish County park do you live closest to?

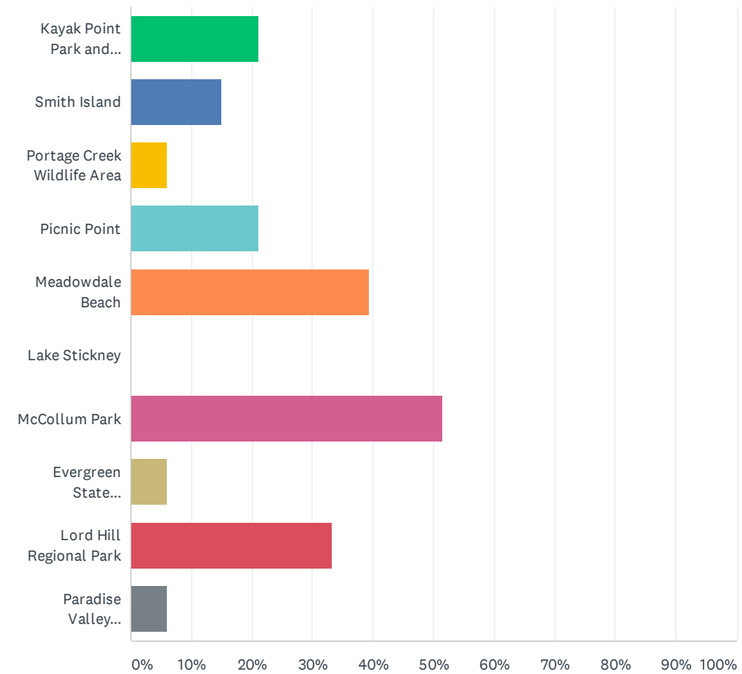
Answered: 35 Skipped: 3



ANSWER CHOICES	RESPONSES	
Kayak Point Park and Campground	8.57%	3
Smith Island	8.57%	3
Portage Creek Wildlife Area	5.71%	2
Picnic Point	8.57%	3
Meadowdale Beach	20.00%	7
Lake Stickney	2.86%	1
McCollum Park	40.00%	14
Evergreen State Fairgrounds Park	2.86%	1
Lord Hill Regional Park	14.29%	5
Paradise Valley Conservation Area	5.71%	2
Total Respondents: 35		

Q2 Which Snohomish County park(s) do you visit most frequently (please check your top three)?

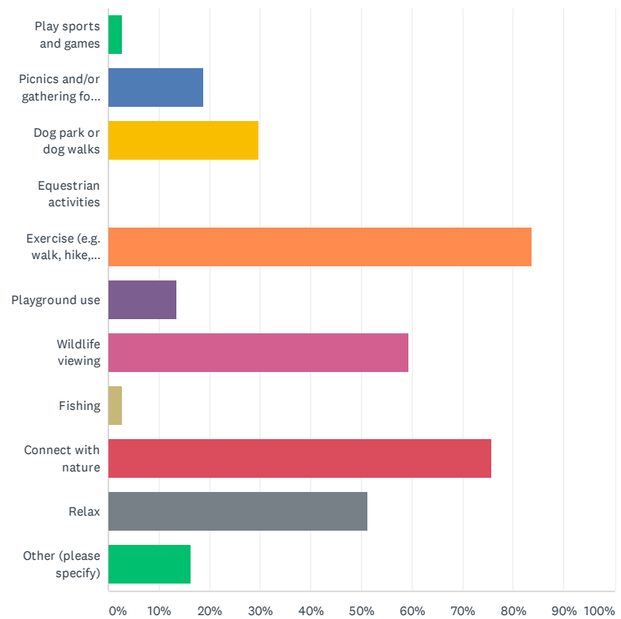
Answered: 33 Skipped: 5



ANSWER CHOICES	RESPONSES	
Kayak Point Park and Campground	21.21%	7
Smith Island	15.15%	5
Portage Creek Wildlife Area	6.06%	2
Picnic Point	21.21%	7
Meadowdale Beach	39.39%	13
Lake Stickney	0.00%	0
McCollum Park	51.52%	17
Evergreen State Fairgrounds Park	6.06%	2
Lord Hill Regional Park	33.33%	11
Paradise Valley Conservation Area	6.06%	2
Total Respondents: 33		

Q3 What activities do you participate in when visiting one of Snohomish County's forested or natural area parks (Please check your top four activities)?

Answered: 37 Skipped: 1

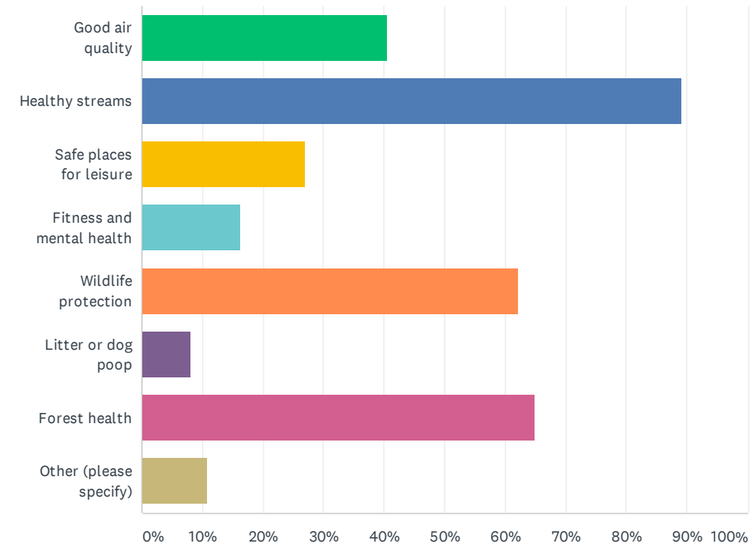


ANSWER CHOICES	RESPONSES	
Play sports and games	2.70%	1
Picnics and/or gathering for meals	18.92%	7
Dog park or dog walks	29.73%	11
Equestrian activities	0.00%	0
Exercise (e.g. walk, hike, cycle, swim, etc.)	83.78%	31
Playground use	13.51%	5
Wildlife viewing	59.46%	22
Fishing	2.70%	1
Connect with nature	75.68%	28
Relax	51.35%	19
Other (please specify)	16.22%	6
Total Respondents: 37		

#	OTHER (PLEASE SPECIFY)	DATE
1	Birding	3/17/2020 7:45 AM
2	Bob Heirman Wildlife Park	3/16/2020 11:08 PM
3	Taking grandkids to park	1/31/2020 12:59 PM
4	Native plant, lichen, and fungi identification	1/25/2020 8:30 AM
5	Try identifying mushrooms	1/25/2020 7:48 AM
6	bimonthly beach clean-up at Picnic Point w/WSU BeachWatchers	1/13/2020 11:28 AM

Q4 Please select the top three environmental and community health issues that are most important to you.

Answered: 37 Skipped: 1



ANSWER CHOICES	RESPONSES	
Good air quality	40.54%	15
Healthy streams	89.19%	33
Safe places for leisure	27.03%	10
Fitness and mental health	16.22%	6
Wildlife protection	62.16%	23
Litter or dog poop	8.11%	3
Forest health	64.86%	24
Other (please specify)	10.81%	4
Total Respondents: 37		

#	OTHER (PLEASE SPECIFY)	DATE
1	Climate Crisis	2/20/2020 2:13 PM
2	Especially healthy streams. Also, clean up of campsites, including drug equipment.	1/31/2020 12:39 PM
3	Hard question, these are all vital!	1/31/2020 12:32 PM
4	public access to 'healthy' natural environments	1/13/2020 11:28 AM

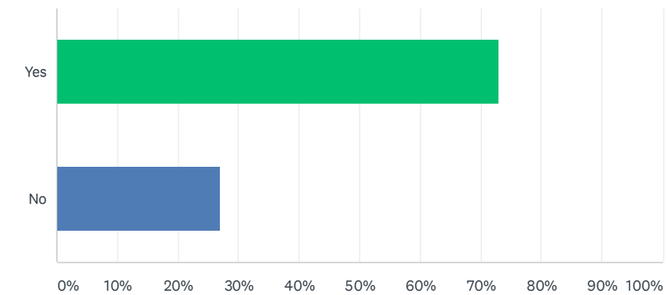
Q5 What topics or questions would you like to see addressed in the Healthy Forest Project?

Answered: 19 Skipped: 19

#	RESPONSES	DATE
1	How to best conserve native landscapes. I own 6 acres on Camano Island, and some of it is just infested w/ english ivy. I have done "life saving" cuts on dozens of ceders, firs, oaks. I would just really love some info on how to best get rid of the stuff.	3/17/2020 7:45 AM
2	I would like to see Bob Heirman Wildlife park included in this project. There is quite a bit of it that has not yet been overgrown with blackberries and I think aggressive reforestation of the areas not yet overgrown could allow trees to establish before the blackberries get to those spots.	3/16/2020 11:08 PM
3	Improve the health of the environment by using natural or organic methods of caring for the land.	3/10/2020 3:59 PM
4	Tree preservation during development. Planting street trees in neighborhoods.	2/20/2020 2:13 PM
5	I'm interested in volunteer projects (tree planting, etc)	2/12/2020 9:33 AM
6	Please, how healthy forests are vital to healthy streams and how healthy streams are vital to healthy forests. You do not have one without the other typically.	1/31/2020 12:39 PM
7	Preservation of tree canopy in urban as well as rural, creating parkways the "show" our county as tree friendly, codes to protect our trees.	1/31/2020 12:32 PM
8	Water quality, dam removal	1/31/2020 12:24 PM
9	How can we help you?	1/31/2020 12:18 PM
10	Stream health	1/31/2020 12:04 PM
11	Urban campings effects	1/25/2020 7:48 AM
12	Education of general public @ limiting use of pesticides/herbicides.	1/22/2020 9:17 AM
13	Improved riparian areas to improve salmon and fish health, and by extension improve Puget Sound Health. Carbon sequestration to fight the climate crisis.	1/15/2020 9:22 AM
14	public access to 'healthy' natural environments	1/13/2020 11:28 AM
15	How does the snohomish county parternship work alongside the Everett partnership? Will there be a struggle to get volunteers and can you volunteer for both?	1/10/2020 8:22 AM
16	To keep high speed mountain bike traffic at a minimum at Lord Hill Park.	1/9/2020 10:13 AM
17	Are you also looking at other properties the County owns, such as mitigation sites that are forested? Public Works owns many pieces of property that are forested and could use neighborhood stewardship to make sure they stay forested and aren't trashed. Everything is connected so it would be great to connect this project to these forested areas and any others still intact in this county. Otherwise, the parks forests and open space just become fragmented.	1/8/2020 8:41 AM
18	Ecosystem restoration to the greatest extent possible for each site.	1/7/2020 12:23 PM
19	Littering is the biggest thing I see around the parks and other areas that needs to be addressed.	1/6/2020 2:35 PM

Q6 Have you ever volunteered for a park restoration volunteer event or work party (e.g. removed invasive plants, applied wood-chip mulch, planting native trees and shrubs)?

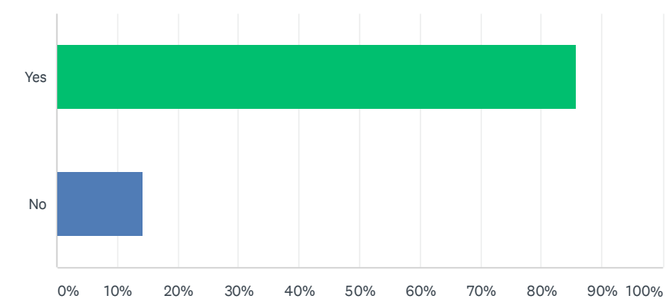
Answered: 37 Skipped: 1



ANSWER CHOICES	RESPONSES	
Yes	72.97%	27
No	27.03%	10
TOTAL		37

Q7 Are you interested in volunteering to restore forests with Snohomish County Healthy Forest Project?

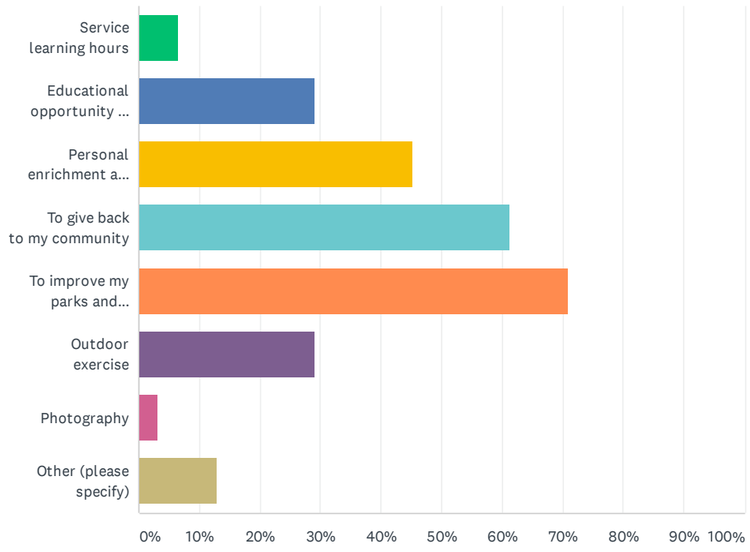
Answered: 35 Skipped: 3



ANSWER CHOICES	RESPONSES	
Yes	85.71%	30
No	14.29%	5
TOTAL		35

Q8 If yes, why do you, or would you, participate in a forest restoration volunteer event? Choose all that apply.

Answered: 31 Skipped: 7

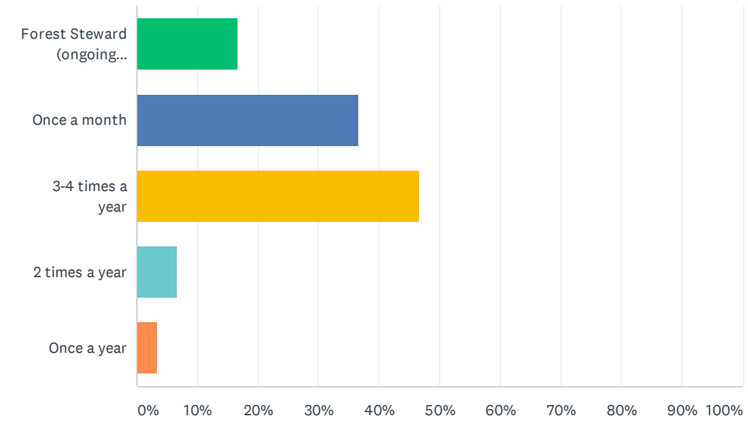


ANSWER CHOICES	RESPONSES	
Service learning hours	6.45%	2
Educational opportunity for children	29.03%	9
Personal enrichment and responsibility	45.16%	14
To give back to my community	61.29%	19
To improve my parks and natural resources	70.97%	22
Outdoor exercise	29.03%	9
Photography	3.23%	1
Other (please specify)	12.90%	4
Total Respondents: 31		

#	OTHER (PLEASE SPECIFY)	DATE
1	To steward the return of the lands to a native state.	3/16/2020 11:14 PM
2	To restore to health some of the damage done by poorly planned/regulated development	1/31/2020 12:40 PM
3	increase knowledge base for my own property	1/22/2020 9:19 AM
4	Interested in organizing events for Sno-Isle Sierra Club members	1/15/2020 9:24 AM

Q9 If you're interested in volunteering, how often do you think you would be able to volunteer?

Answered: 30 Skipped: 8



ANSWER CHOICES	RESPONSES	
Forest Steward (ongoing commitment - includes training and support)	16.67%	5
Once a month	36.67%	11
3-4 times a year	46.67%	14
2 times a year	6.67%	2
Once a year	3.33%	1
Total Respondents: 30		

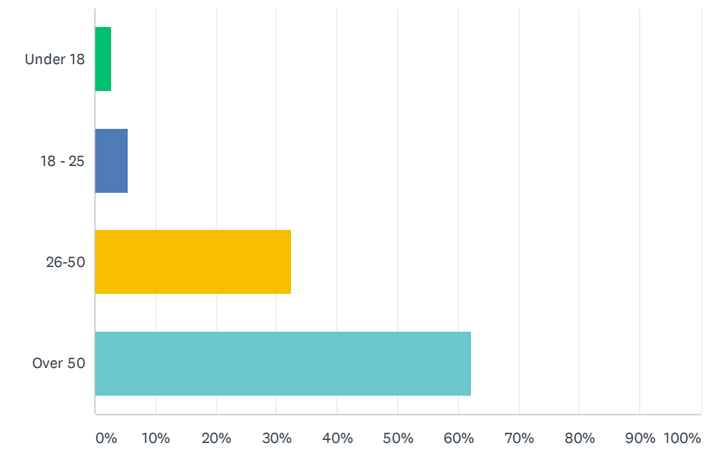
Q10 What would make volunteering easier or more appealing and accessible for you?

Answered: 15 Skipped: 23

#	RESPONSES	DATE
1	The biggest barrier I have is work, and my own landscaping needs, as I am in the middle of a big project trying to transform some of my property back into a native wildlife bastion. With Covid 19, I will be working more as I am a nurse too.	3/17/2020 7:47 AM
2	Being allowed to operate with enough flexibility so that I can get the job done without feeling like a second grader.	3/16/2020 11:14 PM
3	On-line advocacy is preferrable for me.	3/10/2020 4:03 PM
4	Having work party dates scheduled well ahead of time so I can plan for them.	2/26/2020 4:55 PM
5	Tasks for small children	2/20/2020 2:14 PM
6	Local, lots of notice ahead of time, clear directions and clear understanding of length, timing and breadth of project.	2/12/2020 9:34 AM
7	Carpooling	1/31/2020 1:02 PM
8	Keeping my family healthy	1/31/2020 12:33 PM
9	e-mail me events	1/31/2020 12:24 PM
10	Weekend opportunities	1/31/2020 12:22 PM
11	Having a contact person to help coordinate efforts (I'm a scoutmaster for Troop 221)	1/31/2020 12:19 PM
12	A more open timeframe 10-6 for example	1/25/2020 7:49 AM
13	Would like info on co-organizing events for our group.	1/15/2020 9:24 AM
14	Making it easy for families to participate	1/12/2020 9:03 AM
15	Suddenly being 30 years younger.	1/7/2020 10:55 AM

Q11 What is your age?

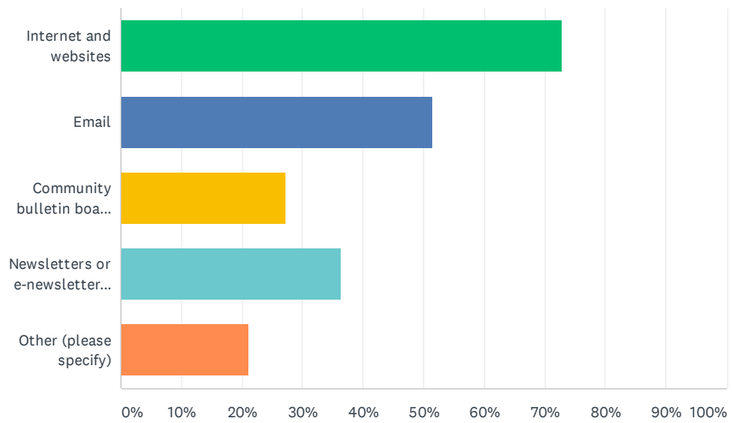
Answered: 37 Skipped: 1



ANSWER CHOICES	RESPONSES	
Under 18	2.70%	1
18 - 25	5.41%	2
26-50	32.43%	12
Over 50	62.16%	23
Total Respondents: 37		

Q12 What sources of information do you use to look for volunteer opportunities?

Answered: 33 Skipped: 5



ANSWER CHOICES	RESPONSES	
Internet and websites	72.73%	24
Email	51.52%	17
Community bulletin boards (e.g. library, community centers)	27.27%	9
Newsletters or e-newsletters from other organizations	36.36%	12
Other (please specify)	21.21%	7
Total Respondents: 33		

#	OTHER (PLEASE SPECIFY)	DATE
1	Adopt a Stream	3/16/2020 11:18 PM
2	text me the info	2/12/2020 9:35 AM
3	Paper	1/31/2020 1:00 PM
4	Facebook	1/31/2020 12:11 PM
5	Social media	1/25/2020 8:32 AM
6	newspapers, recommendations from other volunteer organizations	1/13/2020 11:38 AM
7	Events in community calendars online	1/12/2020 9:04 AM

Q13 Across the County, what organizations or community groups do you recommend we reach out to?

Answered: 24 Skipped: 14

#	RESPONSES	DATE
1	Not sure...	3/17/2020 7:49 AM
2	Adopt a Stream	3/16/2020 11:18 PM
3	Everett Office of Neighborhoods,	2/20/2020 2:15 PM
4	Lake Forest Park Stewardship	2/12/2020 9:35 AM
5	LWV, Sierra Club	1/31/2020 1:03 PM
6	Scouts, churches, schools, corporations.	1/31/2020 12:49 PM
7	WSU Extension, beach watchers, scouts, teen environmental clubs	1/31/2020 12:34 PM
8	Mountains to Sound Greenway	1/31/2020 12:26 PM
9	Sno-King water watch is my affiliation	1/31/2020 12:23 PM
10	Scouting	1/31/2020 12:20 PM
11	Cities, scouts, high school clubs (honor society, etc.)	1/31/2020 12:17 PM
12	High schools	1/31/2020 12:11 PM
13	Foretta	1/31/2020 12:06 PM
14	Washington Native Plant Society Trout Unlimited	1/25/2020 8:32 AM
15	Mill Creek Community Association, Everett Public Schools, Mill Creek Elementary	1/23/2020 10:10 AM
16	Sierra Club, other environmental organizations.	1/15/2020 9:25 AM
17	WSU Extension, SCD,	1/13/2020 11:38 AM
18	Girl Scouts of Western Washington	1/12/2020 9:04 AM
19	Boeing, Marysville and other smaller cities,	1/10/2020 8:24 AM
20	Evergreen mountain bike Edmonds school district/ meadowdale highschool bike club Edmonds backyard wildlife	1/9/2020 8:37 PM
21	Lord Hill Equestrians	1/9/2020 10:16 AM
22	Pilchuck Audubon Society	1/8/2020 8:41 AM
23	League of Women's Voters, Livable Snohomish County	1/7/2020 3:52 PM
24	School aged children and the elderly	1/6/2020 2:39 PM

Q14 Additional comments?

Answered: 6 Skipped: 32

#	RESPONSES	DATE
1	I was set to volunteer with the Skagit and Island Land Trusts, but with the covid pandemic, this has all been delayed. I really just want to focus on preserving as much native land and wildlife as possible.	3/17/2020 7:49 AM
2	I think there might be a sizable pool of retired guys that would be interested in this sort of thing but don't want to be shackled by not being allowed to operate on a free form basis.	3/16/2020 11:18 PM
3	Instead of giving huge tax breaks to mega-corporations to move 10's of thousands of employees here, they should pay a mitigation fee to partially offset the damage done to our natural resources, traffic flow, housing costs, etc. When you get up in the morning and the air is unhealthy to breathe, and the water is unsafe to drink, other issues become insignificant. Yes, that is a political statement. County planners and elected officials: What is more important to us long term NW folks? More strip malls and increased tax density, or maintaining at least part of the quality of life that is tied to our forests, streams, mountains, air, Puget Sound, etc.	1/31/2020 12:49 PM
4	I live in King County	1/31/2020 12:23 PM
5	How large of a forested area was the criteria based on, for picking the parks on this particular list?	1/9/2020 10:12 PM
6	Thank you! This is awesome	1/9/2020 10:16 AM

APPENDIX M. GREEN CITIES TOOLBOX INFORMATION

The Green Cities Toolbox[12] provides a wealth of information for Green Cities and Forest Stewards.

Find in-depth information on 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 and 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. Reporting forms, maps, and other documents specific to your Green City.

12 Available at forterra.org/service/green-cities-toolbox.

Snohomish County

FORT&RRA

For more information about the Healthy Forest Project, please visit snocohealthyforest.org.