



Citywide Habitat Assessment

Interim Report—March 2006

Seattle
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Introduction

The Seattle metropolitan area contains approximately 8,000 acres of public parks and open spaces, which support a wide array of native plants and wildlife. For the past six years, Seattle Urban Nature Project (SUNP) has surveyed and monitored these habitats in the city to help citizens and natural resource managers better understand the state of Seattle's forests.

The Citywide Habitat Assessment (CHA) is a new effort by SUNP to implement long-term monitoring of Seattle's forests. This project will help resource managers and the public to better understand the condition of various forest types in the city and will generate recommendations for action to restore and protect Seattle's public lands in the future.

Population growth in the Seattle area has led to increased development pressure on remaining open space, resulting in fewer intact forests and greater habitat fragmentation. Seattle's open spaces provide important recreational opportunities and vital ecosystem services to residents. The parks and open spaces of Seattle are subject to intense pressures from the urban environment such as heavy recreational use, pollution and invasion by exotic species.

Forested areas provide numerous benefits to city residents including improved water quality and filtration of pollutants from the air. In Seattle, the many diverse habitats present in urban forests harbor more than 250 different bird and animal species (Miller 1994). Forests and wetlands within the city clean and store stormwater runoff, retain sediment, provide groundwater recharge and discharge services, and provide important habitat for a variety of species (Guntenspergen and Dunn 1998). Streams in Seattle and King County are also home to populations of Chinook and other salmon species, which are dependent upon urban forests for spawning habitat (King County 2005). In a Chicago area study, the economic benefits of the above services were assessed at over \$400 per tree (McPherson 1997).

SUNP 1999-2000 Survey

In 1999 and 2000, Seattle Urban Nature Project (SUNP) conducted a citywide vegetation inventory on 8,000 acres of public lands and open space in Seattle. This effort was the first of its type and is unique in that it spanned administrative boundaries. The purpose of this effort was to provide city managers and citizens with information about the city's natural resources.



Madrone tree overlooking Mount Rainier in West Seattle

Open space was delineated into one of 33 habitat types described in the Seattle Department of Parks and Recreation's publication "Urban Wildlife and Habitat Management Plan" (Miller 1994). Each individual section of habitat, called a polygon, was mapped to create a Geographic Information System (GIS) layer depicting the location of these habitats throughout the city. A list of plants present in each polygon was recorded, with percent coverage estimated for each species. The data collected in the survey is a management resource utilized by city agencies, community groups and local non-profit organizations involved in restoration, acquisition, and conservation of natural areas within the city. The survey also provides baseline information for monitoring habitat conditions in the future.

Citywide Habitat Assessment

In 2005, SUNP launched a citywide habitat monitoring program known as the Citywide Habitat Assessment (CHA). This assessment builds on the data collected during the 1999-2000 survey. The aim of the project is to implement a long-term monitoring program using a repeatable, accurate methodology that measures specific indicators of forest function and health. Measuring the same plots over time will provide the ability to monitor declines or improvements in the state of Seattle's urban forests.

Specifically, SUNP will look at the differences in the structure, function and composition of each of the forest types delineated in the original survey. This information will help public agencies and community groups within the city to better manage Seattle's urban forests. The ability to assess the health of these forests over the long-term will help managers to:

1. Reduce decline or loss of habitats and species;
2. Determine whether the desired condition of Seattle's habitats has been achieved;
3. Identify successes and limitations of management strategies and allow for changes to these strategies;



Bird nest found in Lakeridge Park, Southeast Seattle

4. Make the best use of limited resources by identifying which habitats need the most attention.

In order to achieve the objectives outlined above, SUNP is installing permanent monitoring plots in the eight forested habitat types identified in the 1999-2000 survey. Together these habitat types make up slightly more than 2,700 acres in Seattle. The habitat types and their acreage are listed in Table 1.

Table 1. Forest types and acreage of each type present in Seattle's urban forests. SUNP (2000)

Habitat	Acres
Conifer/Madrone Mixed Forest	52.3
Conifer/Deciduous Mixed Forest	361.5
Conifer Forest	293.6
Deciduous/Madrone Mixed Forest	50.4
Deciduous Forest	1865.5
Madrone Forest	24.3
Palustrine Forested Wetland	69.3
Riparian Forest	21.3
Total	2738.2

During the 2005 field season, two of the habitat types were sampled: Conifer/Deciduous Mixed Forest and Conifer/Madrone Mixed Forest. The remaining forest types are scheduled to be sampled during the 2006 field season. This interim report provides results and analysis for the two forest types surveyed in 2005.

Methods

In this assessment, between .25% and 2% of each habitat's acreage will be sampled, depending on the total number of acres of each type present in Seattle. A minimum of 5 plots will be sampled for the smallest habitat types to allow for statistical comparisons. For example, staff sampled 5 plots in the Conifer/Madrone Mixed Forest (1% of 52 acres) and 18 plots in the Conifer/Deciduous Mixed Forest (.5% of 366 acres). Plots were randomly selected from all polygons of a targeted forest type greater than .3 acres in size.

The sampling unit for this survey consisted of a 164 foot (50 meter) x 26.2 foot (8 meter) plot. Plots are marked with a wooden stake and GPS coordinates are recorded. Data recorded on the plot includes the species, height and diameter of all live and dead trees present. All coarse woody debris (CWD) greater than 5 inches in diameter is also recorded. Plant species are identified within each plot and percent cover is recorded for each species.

Two categories of information were examined during this study - forest structure and species composition. More information about the importance of these categories is presented below.

Forest Structure: To evaluate forest conditions, it is important to know the species composition, density and size of the trees that make up the forest. A young, crowded forest with many trees of the same size and species exhibits distinctly different characteristics than a mature forest possessing greater structural diversity. The number and types of seedlings and saplings currently present can help us to determine the future structure and composition of the forest.

Tree structure influences the cover and diversity of shrubs and herbaceous plants. Increased structural and species diversity of the herbaceous, shrub, and tree layers provides the greatest opportunity to support a variety of native wildlife. A healthy and diverse forest also helps reduce the likelihood that invasive species will establish and thrive.

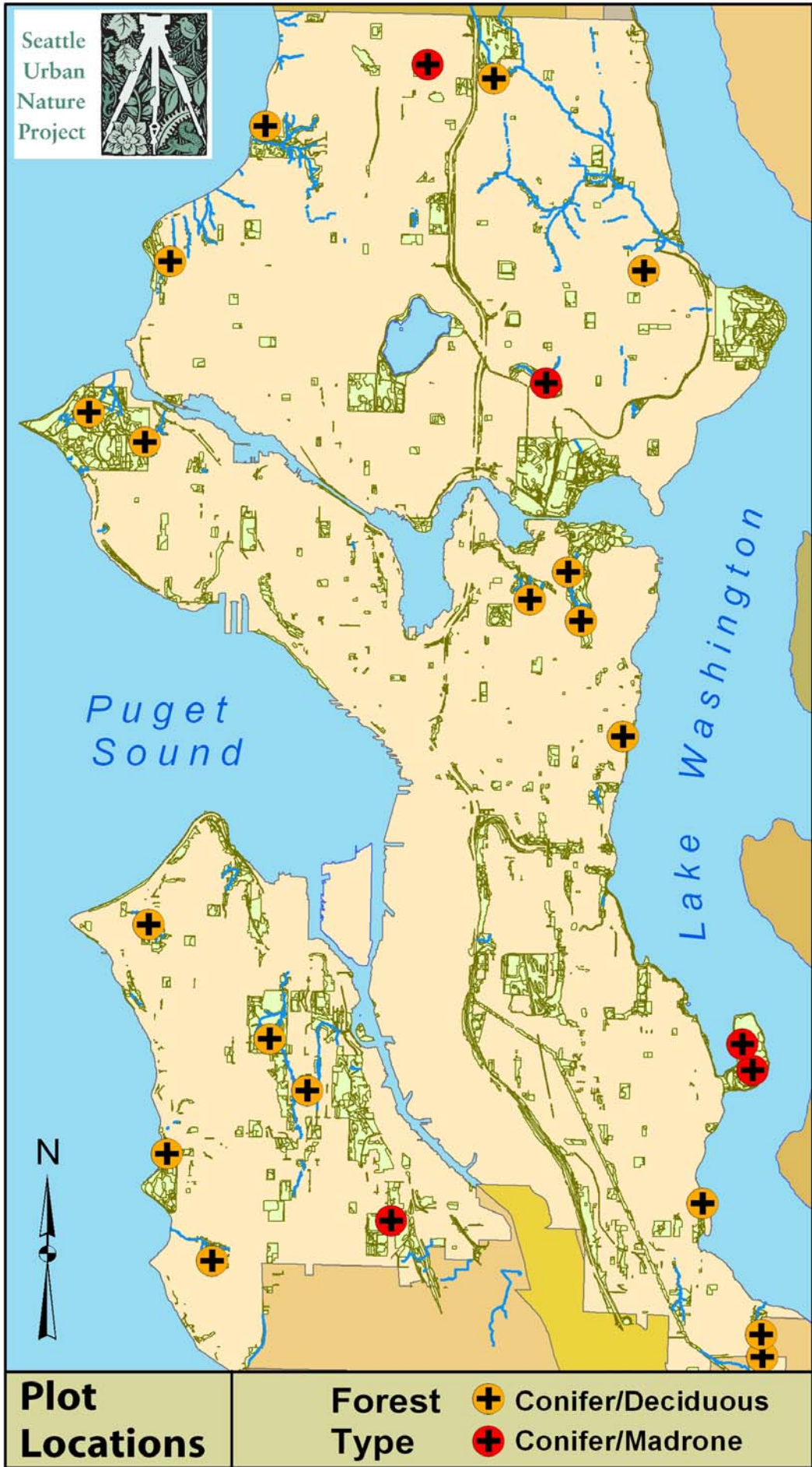
Both standing dead trees (snags) and fallen logs or stumps (coarse woody debris or CWD) are other important components of forest structure. These features provide crucial habitat for animals, birds, insects, mosses, and fungi, as well as providing a store of nutrients and organic material for soil structure and development. CWD plays a vital role in forest processes by acting as nurse logs for seedlings of plants such as western hemlock (*Tsuga heterophylla*) and red huckleberry (*Vaccinium parvifolium*). CWD also retains sediment, reduces erosion, and shapes the geomorphology of streams by creating banks, pools and slowing stream flows (Stevens 1997).

For this report, all sampled forests of a particular type were combined together for analysis, regardless of age. As a result, the results presented portray the full range of variation for each habitat type and include characteristics for both young and mature forests.

Species composition: In most habitats in Seattle, invasive non-native plant species occupy niches that have historically been filled by native flora. Introduced species do not necessarily provide the same habitat functions (food, water, shelter) in supporting native fish and wildlife species. Many invasive species become dominant to the exclusion of all other species on a site, thereby reducing overall biodiversity and ecosystem function in these urban forests, making them more susceptible to greater loss or damage resulting from disease, pests, and other disturbances. Ecosystems with impaired functions contribute less value to the social, biological, and economic goals of the City of Seattle.

Knowing the extent and type of invasive species present can be an important step towards managing and tracking their impacts. For this analysis, we measured occurrences of all invasive and non-native plant species occupying each sample plot. Many invasive species referenced in this report have a legal designation assigned by the King County Noxious Weed Control Program. Class "A" weeds have limited distributions in King County and eradication of these species is required. Class "B" weeds must be controlled and contained by law. Obnoxious weeds

(continued on pg 5)



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Map 1.

Locations of sampled plots in the Conifer/Madrone Mixed Forest and Conifer/Deciduous Mixed Forest types

and Noxious Weeds of Concern are wide-spread, unregulated species, which impact and degrade native plant and animal habitat (King County 2005).

Further information about the methods used in this survey is available in our report: "Methodology to Assess Habitat Conditions on Public Land in Seattle" (SUNP 2006). Please contact us at info@seattleurbannature.org for additional information.

Results and Findings

Seattle's forests range from undisturbed mature native communities to more disturbed areas dominated by young trees. Examples of undisturbed forests are those found in Seward or Schmitz parks, which have large, old trees, a high conifer component and a closed forest canopy. Examples of highly disturbed areas include power line corridors, undeveloped streets and rights of way, or small patches of open space surrounded by development. Although both extremes were sampled in this study, the majority of Seattle's forests (and sampled plots) lie in habitats between these extremes.

Conifer/Deciduous Mixed Forest Type

Conifer/deciduous mixed forest comprises approximately 13% of Seattle's forested land, making it the second most abundant forest type in the city (Table 1). These forests are defined as areas of greater than 25% tree cover whose canopy is made up of less than 70% of either deciduous or conifer species (Miller 1994). Therefore, these forests have mixed tree compositions with significant presence of both conifer and deciduous trees. Eighteen plots were sampled in this forest type in the fall of 2005. The results show that the forests in this category are generally dominated by deciduous trees, with 67% of sampled plots having more deciduous trees in their canopy than conifer trees.



Overstory

The overstory refers to trees greater than five inches in diameter at breast height (dbh) that make up the forest canopy.

Average tree density:

Native: 99 trees/acre (range from 10-200 trees/acre)

Non-native: 7 trees/acre (range from 0-40 trees/acre)

Average tree diameter (dbh): 19 inches (range from 12 to

28 inches)

Average tree height: 80 feet

Tree composition: On average, native conifer trees make up 45% of the overstory composition, which ranges from 5 to 88%. Native deciduous trees comprise 53% of the overstory and Pacific madrone (*Arbutus menziesii*) average 2%.

Species composition: The tree species most frequently found in the overstory are: big-leaf maple (*Acer macrophyllum*) (83%), western red cedar (*Thuja plicata*) (72%), Douglas-fir (*Pseudotsuga menziesii*) (39%), red alder (*Alnus rubra*) (33%) and western hemlock (33%) (Figure 1).

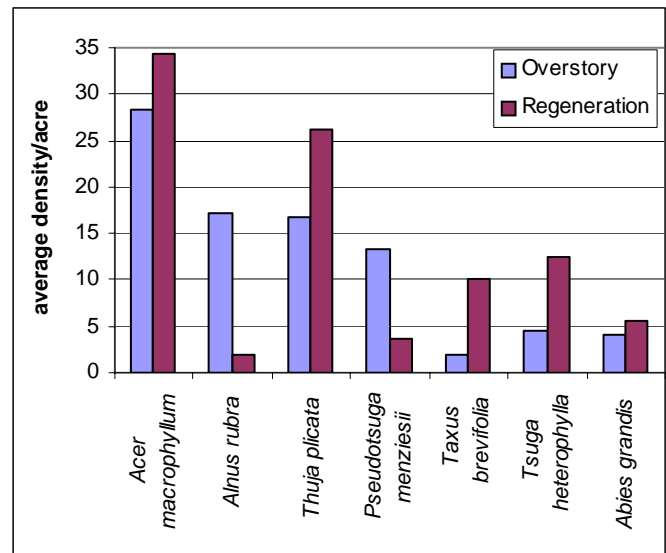


Figure 1. Average density/acre for selected overstory and regenerating native trees in Seattle's conifer/deciduous mixed forests. Graph excludes regenerating tree data from two high density outlier plots.

Tree regeneration

Regeneration of native tree species varies substantially between survey plots. Trees five inches or less in diameter are considered to be regenerating.

Average tree density:

Native: 187 trees/acre (range from 10-1,240 trees/acre).

This average includes two very dense plots with 1,240 and 560 trees/acre respectively. If these two plots are excluded, the average density is 98 trees/acre.

Non-native: 323 trees/acre (range from 0-1140 trees/acre)

Tree composition: Native conifer trees average 12% of all regenerating trees across all plots. Native deciduous trees average 25% while non-native deciduous trees make up 8%. The regenerating layer is dominated by non-native evergreen trees, making up 55% of all regenerating trees measured (Figure 2).

Species composition: Native trees most frequently found regenerating are: big-leaf maple (78%), western red cedar (56%), western hemlock (33%), and red alder (28%). Non-native evergreen invasive trees make up the largest component of the regenerating layer in conifer/deciduous mixed forests. They include the following three species:

English holly (*Ilex aquifolium*), cherry laurel (*Prunus lauro-cerasus*), and Portugal laurel (*Prunus lusitanica*). Both English holly and cherry laurel are designated by the King County Noxious Weed Control Program as Obnoxious Weeds (King County 2005).

The seeds of these species, along with Portugal laurel, are dispersed by birds and animals, and are now widespread in King County. English holly is present in 83% of our plots and averages 303 stems/acre in those plots. Cherry laurel is the second most common invasive tree species, found on 67% of assessment plots with an average of 46 stems/acre. Portugal laurel is found in only one of the plots and at low density. When averaged across all 18 plots, these three species average 283 stems/acre and comprise 55% of all tree regeneration (Figure 2).

Several species of non-native deciduous trees were also found during our survey. The most prevalent species is European mountain ash (*Sorbus aucuparia*) which is found in 33% of sampled plots at an average density of 20 stems/acre. Horse chestnut (*Aesculus hippocastanum*) is found in 28% of the plots and averages 26 stems/acre. There is also a variety of horticultural cherry species found in the forest. Sweet cherry (*Prunus avium*) in particular is rather dense in the two plots (11% of plots) where it was identified, averaging 110 stems per acre. Another invader, oneseed or English hawthorn (*Crataegus monogyna*), is also found in two plots (11% of plots) and averages 50 stems/acre on those plots.

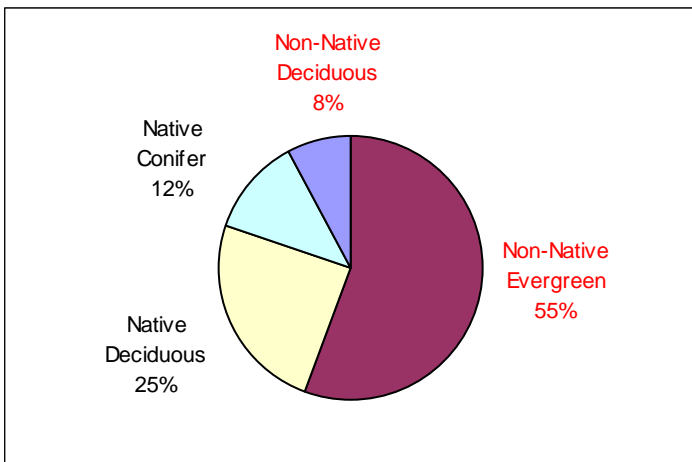


Figure 2. Tree composition of regenerating trees in Seattle's conifer/deciduous mixed forests

Snags and Coarse Woody Debris

Average snag density: 17 stems/acre (range from 0 to 40 stems/acre). Five plots (28%) have no snags present.

Average snag diameter (dbh): 13 inches (average/plot range from 6 to 26). 33% of snags have diameters greater than 10 inches while 17% were measured at or above 20 inches in diameter.

Average snag height: 31 feet (average/plot range from 7 to 60 feet)

Coarse woody debris (downed wood) data was converted to volume (ft³)/acre measurements for analysis. The average volume of coarse woody debris across all plots is 1396 ft³/acre (range from 63 to 6221 ft³/acre). The average diameter measures 13 inches with an average length of 12 feet. The majority of plots (56%) have less than 500 ft³/acre of coarse woody debris.

Shrubs and herbaceous vegetation

The cover of shrubs, herbs and grasses varies considerably between the plots sampled during the survey (Figure 3). Native shrub cover ranges from 16% to 139%, averaging 72% across all plots. Percentages greater than 100 are possible where more than one species of shrub or herbaceous vegetation are present and overlapping. Cover is dominated by beaked hazelnut (*Corylus cornuta*) with an average percent cover of 23%. Native shrubs most commonly found in our plots are: beaked hazelnut and creeping blackberry (*Rubus ursinus*) at 83% frequencies, Indian plum (*Oemleria cerasiformis*) (78%), low Oregon grape (*Mahonia nervosa*) (72%), salal (*Gaultheria shallon*), salmonberry (*Rubus spectabilis*), and red huckleberry (*Vaccinium parvifolium*) (50% each), oceanspray (*Holodiscus discolor*) and red elderberry (*Sambucus racemosa*) (44% each), and bald-hip rose (*Rosa gymnocarpa*) (39%).

Only two invasive shrubs were identified in our assessment plots, Himalayan blackberry (*Rubus discolor*) and spurge laurel (*Daphne laureola*). Himalayan blackberry is prevalent in the mixed forest occurring in 61% of our plots with an average cover of 5%. This species is listed by the King County Noxious Weed Control Program as an Obnoxious Weed (King County 2005). Spurge laurel is found on only one plot at low percent cover (1%).

Combined native grass and herb cover ranges from 1% to 69%, with an average of 36%. The most prevalent native herbaceous vegetation found in our sample plots is: sword fern (*Polystichum munitum*) (100%), bracken fern (*Pteridium aquilinum*) (44%), fringecups (*Tellima grandiflora*) (39%), and Columbia brome (*Bromus vulgaris*) (28%) (Figure 3).

The most prevalent weedy herbaceous plant is English ivy, by measurement of both frequency and average percent cover. English ivy occurs in 16 of 18 plots and averages 28% cover where present (Figure 3). The vine was recorded climbing up the trunk or into the canopy of 22% of all trees and snags greater than 5 inches dbh, as well as onto 21% of all measured coarse woody debris. Ivy is an aggressive invader which has been shown to out-compete native plants for light and water, as well as substantially decrease the ability of trees to naturally regenerate. When it grows into the canopy it not only creates extra weight and resistance, it also decreases tree vigor by impeding photosynthesis, and increases tree susceptibility to wind-fall or ice damage. Several cultivars of English ivy are listed by the King County Noxious Weed Control Program as Noxious Weeds of Concern (King County 2005).

Several other herbaceous weeds were found at low frequencies and covers. Herb Robert (*Geranium robertianum*) is found in 33% of plots at a very low cover, suggesting that in this forest type herb Robert is persistent but is not necessarily able to substantially establish and spread. Wild clematis (*Clematis vitalba*), a climbing woody vine, is present in 28% of our plots at an average percent cover of 6%. Because wild clematis requires high light for growth and reproduction (Bungard et al. 1998) it is often associated with deciduous forests or forest edges and clearings. This species is listed by the King County Noxious Weed Control Program as a Noxious Weed of Concern (King County 2005). Other listed herbaceous weeds found at low frequencies (1-3 plots) include: hedge false bindweed (*Calystegia sepium*), a King County Obnoxious Weed, garlic mustard (*Alliaria petiolata*), a King County Class A Noxious Weed, Japanese knotweed (*Polygonum cuspidatum*), a King County Noxious Weed of Concern, deadly nightshade (*Solanum dulcamara*), a King County Obnoxious Weed, and tansy ragwort (*Senecio jacobaea*), a King County Class B Noxious Weed. Other unlisted weeds with the potential to be invasive include wall lettuce (*Mycelis muralis*), found in 4 plots (22%) and nipplewort (*Lapsana communis*), found in 3 plots (17%). A complete species list for this forest type can be found at: www.seattleurbannature.org

Conclusion

The habitats that make up conifer/deciduous forests in Seattle are relatively abundant and well distributed across the city (Map 1). 15 of the 18 plots sampled in this forest type are located in well established park systems, with the remaining three plots occurring in less formal green spaces.

The native trees that dominate these forests are bigleaf maple, western red cedar, Douglas fir and red alder. The understory is mainly comprised of sword fern, beaked hazelnut and creeping blackberry, with a variety of additional native shrub and herb species present.

Some of the greatest threats to the structure and function of this forest type include high densities of non-native evergreen trees and the continued invasion of English ivy and Himalayan blackberry.

Conifer/Madrone Forest Type

Conifer/madrone mixed forests make up only 1.9% of all forest land in Seattle, found mostly in Seward Park. These forests are defined as areas of greater than 25% tree cover whose canopy is made up of less than 70% of either Pacific madrone or coniferous species. These forests are generally dominated by a mix of conifer and madrone trees with a lesser deciduous tree component. Because of the scarcity of this type of forest within the city limits,

only five plots were established and sampled. While it is difficult to draw overarching conclusions that typify this forest type, our survey yielded some interesting information about the structure and composition of these forests in Seattle.



Overstory

The overstory refers to trees greater than five inches in diameter at breast height (dbh), which make up the forest canopy.

Average tree density:

Native: 128 trees/acre (range from 90-160 trees/acre)

Non-native: 6 trees/acre (range from 0-10 trees/acre)

Average tree diameter (dbh): 17 inches (range from 11 to 23 inches)

Average tree height: 76 feet

Tree composition: On average, Pacific Madrone comprises 24% of the canopy. The remainder of the canopy is 42% coniferous and 34% deciduous (Figure 4).

Species composition: The species most frequently encountered in our plots are: Pacific madrone (100%), Douglas-fir

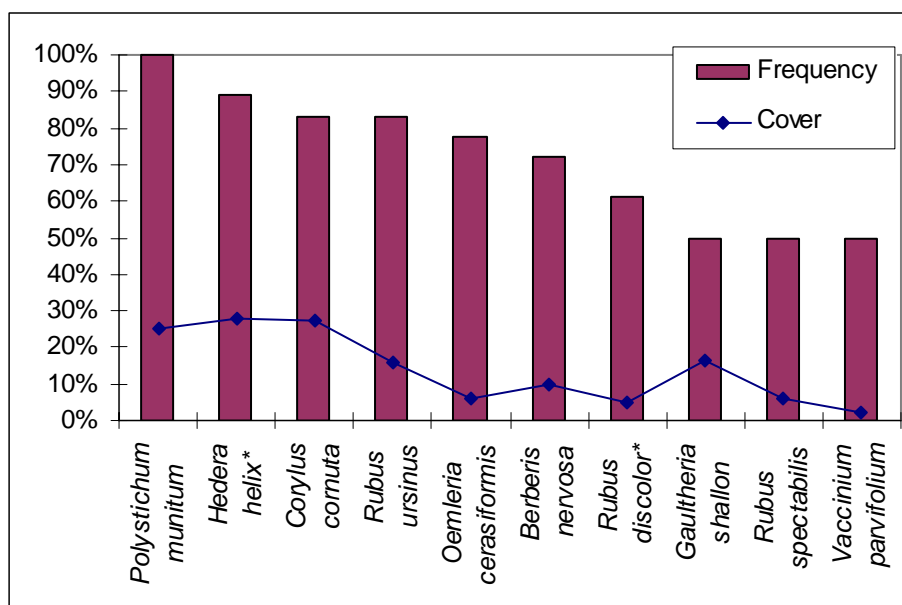


Figure 3. Average frequency and cover of the 10 most common shrub and herb species found in the conifer/deciduous forest type. Species denoted by * have been given a legal designation by the King County Noxious Weed Program.

(80%), big-leaf maple (80%), western red cedar (60%), and red alder (40%). Other notable species that occur in only one plot include Pacific dogwood (*Cornus nuttallii*), bitter cherry (*Prunus emarginata*) and western hemlock. Single trees of several non-native horticultural species also occur at low densities on one plot.

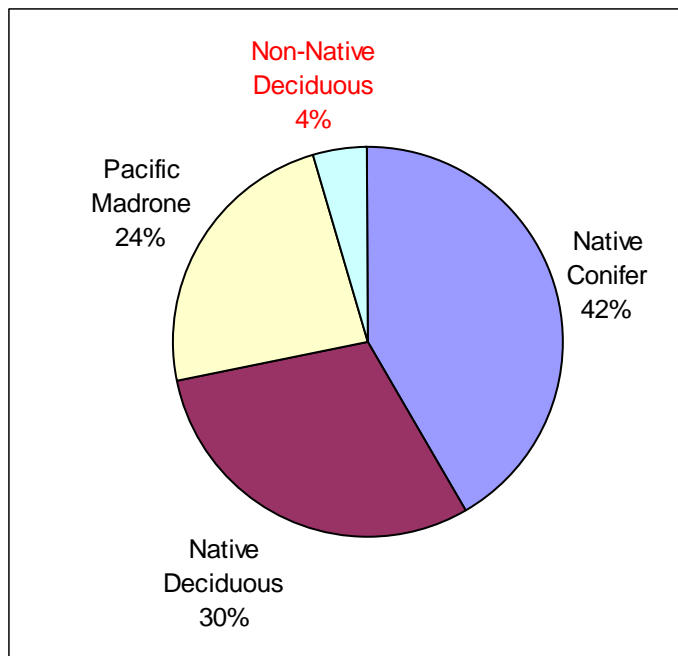


Figure 4. Tree composition of overstory trees in Seattle's conifer/madrone mixed forests

Tree regeneration

Regeneration of native tree species varied substantially between survey plots. Trees greater than five inches or less in diameter are considered to be regenerating.

Average tree density:

Native: 118 trees/acre (range from 10-390 trees/acre). The average density is highly variable for this forest type, in part due to the presence of 360 stems/acre of cascara (*Rhamnus purshiana*) seedlings sampled in one plot (Westcrest Park). With these trees excluded, the average native tree regeneration is 46 trees/acre for all plots.

Non-native: 264 trees/acre (range from 50-910 trees/acre)

Tree composition: 3% of regeneration is Pacific madrone, 5% is native conifer and 24% is native deciduous. The remaining 68% of the regeneration is made up of non-native species: 40% deciduous and 28% evergreen (Figure 5).

Species composition: Pacific madrone seedlings are found in only two (40%) of five plots. The only other regenerating tree species found with any consistency within sampled plots is big-leaf maple, found in 60% of plots. All other species occur in only a single plot. These species include: red alder, Pacific dogwood, bitter cherry, Douglas-fir, western red cedar, and western hemlock.

A considerable number of invasive evergreen trees are present in this forest type and the risk of increased densi-

ties in the future is likely without active management. English holly is the only tree species other than Pacific madrone that occurs in all five plots. The average density across these plots is 84 stems/acre, or 22% of all regenerating trees. Cherry laurel and Portugal laurel were each found in 60% of plots at an average of 23 and 17 stems/acre, respectively. When all three non-native species are combined, their cumulative averages account for 21% of all trees and 28% of tree regeneration (Figure 5).

Non-native deciduous trees were also found on several plots. One plot in particular has an abundance of an unidentified horticultural cherry species (*Prunus spp.*) which dominated the overall results. This plot has 720 cherry stems/acre, all of them small seedlings beneath one large parent tree, which make up 63% of all trees sampled in the plot. With these trees excluded as outliers, the average density of regenerating non-native deciduous trees for all plots is 13 stems/acre (3% of all regeneration), composed mainly of English hawthorn trees.

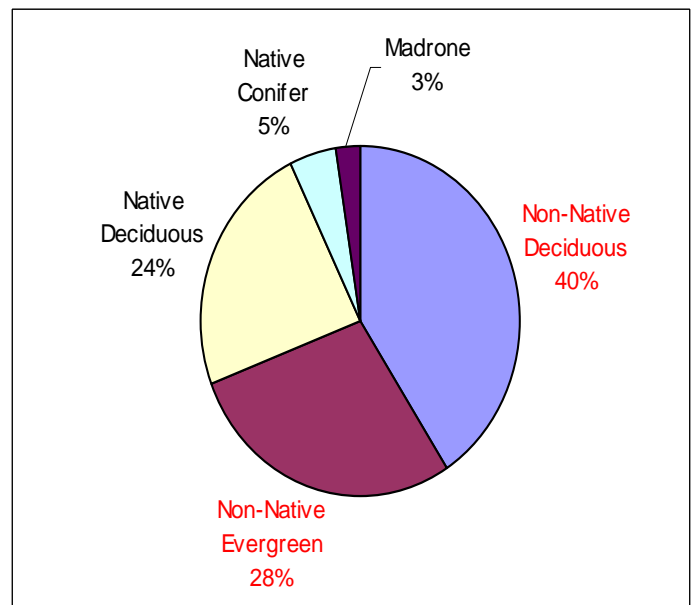


Figure 5. Tree composition of regenerating trees in Seattle's conifer/madrone mixed forests

Snags and Course Woody Debris

Average snag density: 32 stems/acre (range from 0 to 100 stems/acre). One plot has 100 stems per acre, comprising 63% of all snags measured, whereas another contains no measurable snags.

Average snag diameter (dbh): 10 inches (range from 7 to 11) the majority (75%) measuring 10 inches or less in diameter. The largest snag measured is 27 inches dbh and approximately 50 feet tall.

Average snag height: 25 feet (average/plot range from 6 to 40).

An average of 246 ft³/acre of CWD was measured in our assessment plots, with ranges from 24 to 756 ft³/acre. The average diameter and length of measured downed wood is 8 inches by 11 feet long with most of the pieces (80%)

measuring less than 10 inches in diameter.



Woody debris in Taylor Creek, Southeast Seattle

Shrubs and herbaceous vegetation

A variety of shrub and herbaceous species occur in conifer/madrone mixed forests (Figure 6). Three native shrub species are present in all assessment plots: salal, creeping blackberry, and low Oregon grape. Salal averages 23% cover across all plots while the blackberry and Oregon grape each average 12%. Beaked hazelnut is found in 4 of 5 plots and averages 26% cover where present. Other common species include: oceanspray, snowberry (*Symphoricarpos albus*), indian plum, bald-hip rose, and red huckleberry. Overall, native shrub cover averages 89% across all plots.

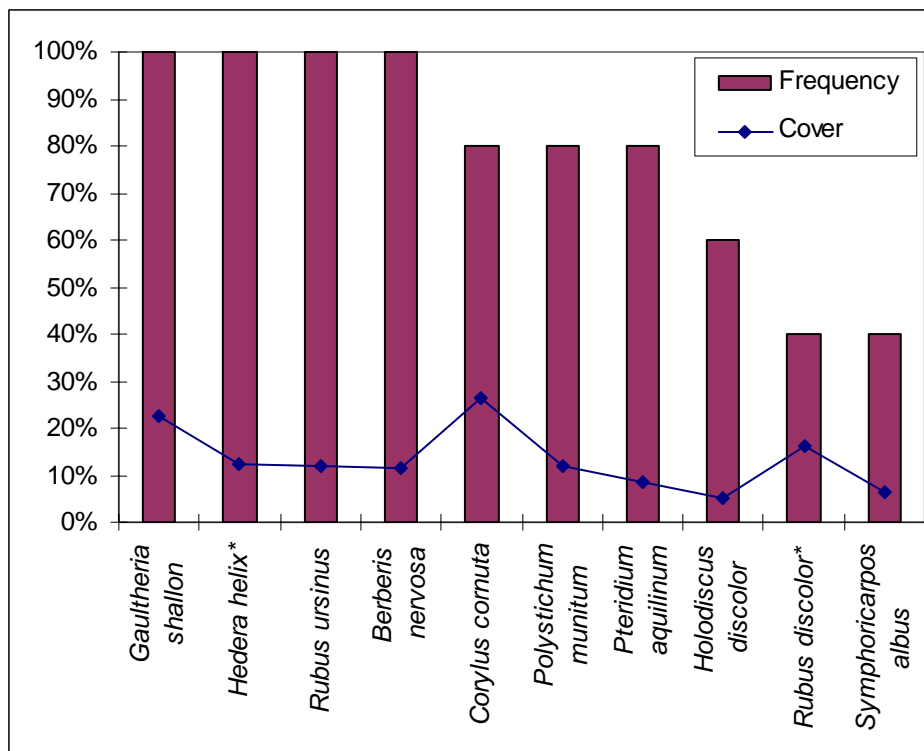


Figure 6. Average frequency and cover where present of the 10 most common shrub and herb species in the conifer/madrone forest type. Species denoted by * have been given a legal designation by the King County Noxious Weed Program.

Himalayan blackberry is present in 40% of plots at relatively high cover (24%) in one plot. This suggests that while this species may not currently pose a significant threat, it has the potential to establish and proliferate in this forest type. Another potentially invasive shrub species found during our assessment was spurge laurel. Although this species only occurs in one plot at a low cover, it is able to establish in this type of forest and should be monitored.

Native grass and herb species range from 13% to 29%, averaging across all plots at 19%. The species with the highest average cover across all plots is sword fern at 10%, which is present in 4 out of 5 plots. Bracken fern is also present in four (80%) plots, while pink honeysuckle (*Lonicera hispidula*) occurs in two plots (40%). Other species found in only one of five plots (20%) include Columbia brome, licorice fern (*Polypodium glycyrrhiza*), and stinging nettle (*Urtica dioica*).

Like English holly, English ivy is present in all five of our plots. It occurs in negligible amounts in three plots, moderate cover (18%) in one plot, and high cover (43%) in the last, averaging 12% across all plots. All other herbaceous weeds are present at both low frequencies and covers. The following species are found in only one plot: Herb Robert (1.25%), wall lettuce (0.5%), and nipplewort (0.5%). A complete species list for this forest type can be found at: www.seattleurbannature.org

Conclusion:

Making up less than two percent of all forest land in Seattle, the conifer/madrone forest type is a rare occurrence in the city. In fact, during SUNP's initial habitat survey, only 12 polygons were given this forest designation. Of the 52 acres of forest in this habitat type, more than 70% (39 acres) are found in Seward Park. Two plots are located in Seward Park, with plots also established in Westcrest and Ravenna parks. One plot is located in a forest adjacent to Ingraham High School in northwest Seattle.

Pacific madrone are found in all sample plots at an average density of 42 trees/acre. Other dominant native trees include Douglas fir, bigleaf maple, and western red cedar. The understory is dominated by salal, creeping blackberry and low Oregon grape.

These forests are being threatened by the invasion of non-native tree species like English Holly, cherry laurel, and horticultural cherry species.

English ivy and Himalayan blackberry appear to pose a substantial threat to the diversity and function of conifer/madrone mixed forests. However, due to their relatively low cover throughout this forest type, early eradication efforts could provide constructive returns.

Summary/Conclusions

Conifer/Deciduous Mixed Forest Type

- ◆ 18 plots were sampled in conifer/deciduous mixed forests in Seattle. The overstory of these forests is composed of 53% deciduous trees, 45% conifer trees and 2% Pacific madrone trees.
- ◆ The regenerating tree layer is composed of 55% non-native evergreen trees, 25% native deciduous trees, 8% non-native deciduous trees and 12% native conifer trees. **Invasive evergreen trees such as English holly and cherry laurel currently make up more than half of all regenerating trees in this forest type and pose a serious threat to the future composition of this forest.**
- ◆ Native shrub cover averages 72% across all plots with the following species being the most prevalent: beaked hazelnut, creeping blackberry, low Oregon grape, Indian plum, salal, salmonberry and red elderberry. Himalayan blackberry is present in over 60% of plots, with an average cover of 5%.
- ◆ Native herb and grass cover average 36% across all plots. Sword fern, bracken fern, fringecups and Columbia brome are the most prevalent native species found.
- ◆ **English ivy is present on 89% of all plots at 28% average cover.** It was recorded climbing up the trunk or into the canopy of 22% of all trees and snags in the overstory. English ivy suppresses native plants on the forest floor, reduces tree regeneration and poses a significant risk to existing trees.

Conifer/Madrone Forest Type

- ◆ 5 plots were sampled in the conifer/madrone forest type in Seattle. The overstory of these forests is composed of 42% conifer trees, 34% deciduous trees and 24% Pacific madrone trees.
- ◆ The regenerating tree layer is composed of 40% non-native deciduous trees, 28% non-native evergreen trees, 24% native deciduous trees, 5% native conifer trees and 3% Pacific madrone. **English holly, cherry laurel and Portugal laurel are evergreen invasive species present in the majority of sampled plots.**
- ◆ Native shrub cover averages 89% across all plots. Salal, creeping blackberry, low Oregon grape, oceanspray, snowberry, Indian plum, bald-hip rose and red huckleberry are the most prevalent native shrub species present in this forest type.
- ◆ Native herb and grass cover average 19% across all plots. Sword fern, bracken fern and pink honeysuckle are the most commonly found native species.
- ◆ **English ivy is present in all plots at an average cover of 12%. It poses a significant risk to this rare forest type.**

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