WASHINGTON PARK ARBORETUM
NATIVE PLANT SYNOPTIC GARDEN

THE COLLABORATIVE EFFORTS OF

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Foreword

The results of this project are from the combined efforts of a team of talented students at the University of Washington. The five members of this team came to this project with diverse experiences and knowledge. The team included Landscape Architecture students and Environmental Horticulture/ Urban Forestry students; including undergraduate and graduate students. Amongst the team were individuals with extensive experience in nursery management, municipal arboriculture, landscape design, and environmental consulting. The team even included an International Society of Arboriculture Certified Arborist and Washington State University Master Gardeners.

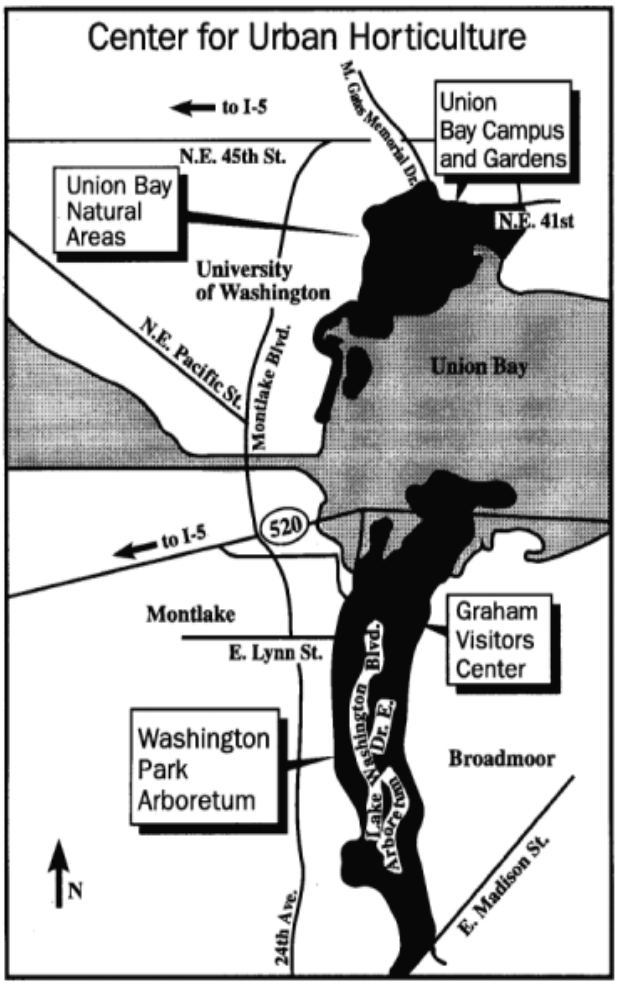
We hope that this project will contribute significantly to the implementation of a Native Plant Synoptic Garden at Washington Park Arboretum. The information contained in this project should be used in conjunction with other previous projects that have focused on the creation of this garden. By combining all this cumulative information, the final stakeholders and designers at Washington Park Arboretum will be able to synthesize and create this world class garden.

Contents

Introduction

Site Location

The Washington Park Arboretum is located in the middle of Seattle's Montlake Neighborhood. Its location amidst a growing metropolitan city underscores the importance of its existence. This large park provides both wildlife habitat as well as such cultural amenities as recreation and education. The location of our design proposal is by the Graham Visitors Center along Arboretum Drive (please refer to the Design section for a descriptive map).



History of Washington Park Arboretum

The Washington Park Arboretum was founded officially in 1934 when an agreement was signed by the University of Washington and the City of Seattle, allowing the university to develop and manage the Arboretum. The Arboretum Foundation was founded soon after, in 1935, as its major support organization (Washington Park Arboretum 2004).

With the help of donations from the Seattle Garden Club in 1936, James F. Dawson and Frederick Law Olmsted Jr. of the Olmsted Brothers landscape firm were hired to design the first planting design. The Arboretum has many historical features such as Azalea Way and Stone Cottage where 500 men were hired through the Public Works Administration during the Great Depression to construct these features. After World War II, Brian O. Mulligan became director of the Arboretum. He modified the original design by siting plants in improved locations and emphasized the importance of designing with a focus (Washington Park Arboretum 2004).

In the late 1970's a master plan update resolved problems and disagreements between the city, university and surrounding Arboretum neighborhood. The University of Washington

reaffirmed its management role in 1980 by establishing the Center for Urban Horticulture (CUH) at Union Bay, which is sited only 1.5 miles from the Arboretum. The CUH provides facilities, programs, and staff that manage the Arboretum. Beginning in the late 1980's, discussion intensified about the future of the Arboretum. Meetings commenced to draft a plan for the rejuvenation of the Arboretum, otherwise known as the Master Plan (Washington Park Arboretum 2004). The Master Plan has now reached a point where implementation of it will begin soon. As a result, research and information pertinent to individual projects within the Master Plan is being assembled.

Project Goals

The main objective of this project is to expand upon the previous work accomplished by Stephen John Van Hoven in his Master's thesis entitled, *A Foundation for a Synoptic Garden of Native Plants of Puget Sound for the Washington Park Arboretum.* In this thesis a clear rationale was described for the implementation of a Native Plant Synoptic Garden at Washington Park Arboretum; the Native Plant Synoptic Garden is already included as part of the overall Washington Park Arboretum Master Plan which was referred to earlier. In his thesis, Mr. Van Hoven suggested future work that must be performed before implementation of this garden commences. For example, he states that before this garden is created at Washington Park Arboretum, a "thorough soil site analysis should be performed including tests for nutrient levels, organic matter, and bulk densities" (Van Hoven, 2003).

With this broad goal in mind, our team ambitiously set out to expand upon the preliminary work of Mr. Van Hoven. In several ways this project contributes significantly to implementation of a Native Plant Synoptic Garden at Washington Park Arboretum. First, we conducted a thorough site analysis for the proposed location of the future garden; included in this was lab analysis for soil nutrient levels and measurements of soil bulk density. Second, our talented team of designers created a "zonal" design for the garden; zonal infers a design that groups plants by community type, but does not plot the specific location of each individual plant. Third, we have compiled an exhaustive list of plants, trees, and shrubs, including cultivars to be selected from by the final design team. This listing includes plant descriptions as well as specific recommendations for placement within our designed zones. The list alone was a monumental task that should be especially useful at the time of final design. Fourth, we set clear parameters for what will be needed during installation of this garden, as well as for aftercare once it is installed. Finally, we began to look at specific budget requirements needed to implement and maintain this garden. This includes a review of such items as current annual operating expenses

for Washington Park Arboretum's grounds maintenance, as well as prices of plants included for selection in the Native Plant Synoptic Garden.

Site Analysis

Completing a site analysis is one of the most important steps in any landscape planning situation. A thorough site analysis looks at all of the main factors that will or could affect the decisions made in the landscape plan. It also considers what factors might affect the final product at some point in the future. The main physical properties observed and measured when doing a site analysis are the existing vegetation, topography, temperature, precipitation, wind speed and direction, exposure to light, and soil characteristics. Climatic factors are a key factor influencing what to do at a site as well as how and when to implement the landscape plan. Site analysis also takes into account plant life that already exists on site that could help enhance the landscape project (Harker et la., 1999).

Recognizing the plant species or vegetation types that are present at a site can determine what could or should be done to alter the site. If there are desirable species within a chosen site that can be included in the landscape plan, efforts should be made to do so; using existing vegetation in a landscape plan can reduce overall costs (Harker et la., 1999). Plants that do not fulfill a specific goal within a landscape plan or that would hinder new plant success can be transplanted to another location or removed altogether. Transplanting would be included as part of the site preparation portion of a landscape plan, and should be done properly to ensure plant health. It is the Washington Park Arboretum's goal to "Maintain a healthy, matrix of native forest habitat for its wooded ambience and wildlife value" (ABGC, 2004). Therefore, plant species that are in poor health or are not aesthetically pleasing should also be removed.

One of the first noticeable physical characteristics observed on a site after the vegetation is the general topography. "Topography is the natural sloping of land that is present in any given piece of land" (Harris et la., 2004). Natural contours of a site dictate where roads and trails are engineered and placed, and plant-community types that are possible for use (Harker et la., 1999). Topography influences all of the other physical factors on a site; the topography directly or indirectly affects wind and light levels, temperatures, and surface and sub-surface water movement. The aspect of the land is also part of the topography; aspect can determine the amount of sunlight and wind a site receives. Aspect also influences the amounts and types of plants and animals present (Harker et la., 1999). Having a basic understanding of the topography is ideal for interpreting site characteristics and implementing any landscape objectives.

Temperature and precipitation affect vegetation types and performance; the overall patterns of temperature and precipitation can directly influence the predominant vegetation within a given region (Harker et la., 1999; Harris et la., 2004). Local influences, however, can also affect the climate or create microclimates; buildings, hardscapes, and large bodies of water can alter temperatures. Buildings can raise temperatures by absorbing the heat from the sun and radiating it; buildings can also lower temperatures by shading the sun and/or blocking the wind (Harris et la., 2004; Reichard, 2003). Wind passing over any type of body of water can directly alter air temperatures and humidity levels adjacent to it (Harker et la., 1999). Data relating to the local climate should be compared to the large-scale regional data to establish if there are any local factors influencing vegetation patterns and temperatures (Harker et la., 1999). Many plants have different optimal temperature requirements at different stages of growth (Harris et la., 2004).

Having a good idea of average temperatures at night, during daytime hours, seasonally, and how the temperatures fluctuate between these times will aide in plant selection and landscape design. Light direction and intensity will also affect the plant selection for a site; some plants need high amounts of sunlight to grow properly and photosynthesize at optimal levels, and some do perfectly fine in shade. "A south facing slope will always be warmer in Western Washington than any other aspect" (Harker et la., 1999), this is because the sun moves from east to west along a southern axis, therefore the sun spends the majority of is time on the south side of all lands in this geographic area (Craul, 1999). Temperature and light can both be affected by hardscape, concrete and steel can absorb or reflect light which can raise temperatures making light levels become more intense during daytime hours; knowing this is very important when composing a landscape plan.

A few other climatic issues and factors that require observation are precipitation/moisture and factors relating to wind. Amounts of rainfall for a given area and the distribution of rain throughout the seasons are very useful in a site analysis (Harris et la., 2004). In a climate such as Western Washington, heavy rain amounts are usually limited to late fall through early spring (Harris et la., 2004). Having an idea of average monthly precipitation is also a necessity to landscape planning because it can help predict how much water is going into the soil and the likelihood of events such as droughts or flooding. Flooding or heavy surface runoff is a major concern because it causes erosion of the topsoil, organic matter, and can create anoxic conditions in the soil which is intolerable by most plant species. For a landscape that will incorporate mostly smaller shrubs and trees, wind direction and levels may be less important; but it is particularly important to forecast potential hazards to these plants and other potential targets if they are larger growing trees and susceptible to wind-throw. Wind speed affects wind throw potential, but it can also lower plant temperatures; this is called wind-chill factor. Plants needing to be at a higher

temperature than the air can easily become stressed or die during colder weather due to the wind chill factor. Also the removal of moisture during freezing temperatures due to the wind can ultimately cause desiccation (Harris et la., 2004). Like temperature and light, it is imperative that the landscape planner collect and utilize precipitation and wind data for the area they are working with.

Soil properties affect plant selection and growth; this would include properties affecting water movement both in and on the soil, and water and nutrient holding capacities. Soil texture is determined by the proportions of the particle sizes within the soil, and can affect water and air movement as well as water and nutrient-holding capacity (Harris et la., 2004). The main constituents in soil textures are sand, silt, and clay; these exist within a soil at different percents, and those percents determine the overall soil texture. For example, if the soil has relatively equal amounts of sand, silt, or clay then the texture is referred to as a loam (Craul, 1999; Harris et la., 2004). Soil pH is another important factor to plant growth and health; soil pH greatly influences the availability of nutrients. Soil reaction, referring to pH, is influenced by the types of vegetation, rainfall, and the texture of soil; texture also affects soil drainage (Harris et la., 2004). If a soil is well drained, many plants can be successful in soils with a wide range of pH. "By considering the native habitat of a particular plant, an approximation of that particular plant's tolerance for pH ranges can be estimated" (Harris et la., 2004).

"The cation exchange capacity (CEC) is the ability of the soil to hold and exchange positively charged forms of plant nutrients" (Young, 1990). Hydrogen (H^+), aluminum (Al^{3+}), calcium (Ca^{2+}), magnesium (Mg^{2+}), potassium (K^+), ammonium (NH_4^+), and sodium (Na^+), are the major cations in most forest soils (Brady et la., 2004). The cation exchange capacity (CEC) is dependent on the amounts of organic matter and clay in the soil, as well as the pH level (Young, 1990). CEC is normally higher in finer-textured soils, especially those containing colloidal clay or humus (Young et la., 1990). CEC also shares a relationship with the pH level; when the pH is really low (acidic), the CEC is low, and when the pH is really high (alkaline), the CEC is also low; but when the pH is more neutral, the CEC is at optimal levels for most plant species (Marschner, 1995). Specifically, cation exchange capacity and pH together help predict what nutrients will be available for plant growth.

Two other characteristics that can be measured in a soil analysis is the amount of lead in the soil and soil bulk density. Measuring lead levels is important because if soil lead levels are too high they can become a health risk, especially to people. "On average, soils have 15 to 40 parts lead per million parts of soil" (UMass., 2004). Bulk density measures the weight of a soil sample with a known volume (Harris et la., 2004). Bulk density, which is influenced by soil texture, can determine the extent of or potential for compaction, water permeability and holding

capacity, and root growth (Craul, 1999; Harris et la., 2004). An in-depth soil analysis is important to a total site analysis and should include measuring properties mentioned above as well as organic matter types and amounts, and any other important soil characteristics deemed necessary for the project. For example, a soil's characteristics can determine which types of plants to use. For instance, areas with naturally hydric soils suggest high water retention and good potential for the establishment of wetland plants (Harker et la., 1999).

Existing Vegetation

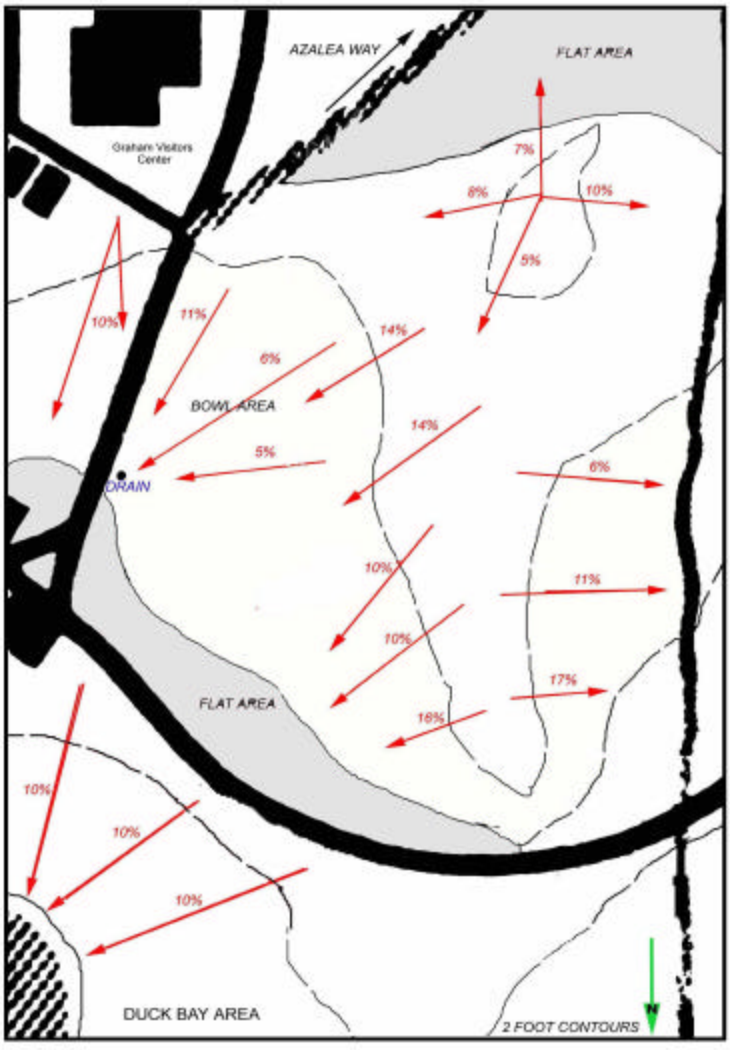
For the purpose of this project, the vegetative goal is to establish specimens with better form and health and meet the overall mission of the Native Plant Synoptic Garden by including greater species diversity as well. There are a number of plant species within the area proposed for the garden. The majority of these plants are native plants, but there are a few non-native species. When deciding which species to retain on site, which to transplant, and which to remove from the Washington Park Arboretum (WPA), the plan should follow the criteria set by the WPA for determining healthy trees and trees that portray an ideal growth form. It is important to understand that not all of the trees within the arboretum are perfect; in fact some of the species are old and in varying states of declining health.

There are five trees of the genus *Quercus* within a portion of the site, and only two of the five are native. Both of these native oaks are located in the area that would become the valley bottom; it may be feasible to retain these two oaks if they are deemed high-quality specimens and essential to the collection (ABGC, 2004). The *Quercus* species that are not desirable or non-native should be removed; it may be possible to relocate these large trees, but transplanting can be very expensive so it may be easier just to remove these trees. However, if any large trees (30+ feet) are transplanted, it is recommended that transplanting be done by a company that has a reputation for successful transplanting of trees this size, and the job should include oversight by the WPA staff arborist. There are also a number of *Rhododendron* specimens around the bowl area, and they should also be evaluated the same way that the oaks are; if they are native and a good representation of the species, then the shrub can either be transplanted to another location, or included in the plan as part of the forested ridge or valley bottom area. There exists a number of native trees and shrubs along the ridge-line to the west of the Graham Visitors Center; again, these plants should be evaluated in the same manner as the *Quercus* and *Rhododendrons.* In addition, there is a *Thuja plicata* to the south of the bowl area that has co-dominant leaders; even though it is a native and could be included as part of the forested ridge, it does not portray the

species well, and is potentially a hazard due to included bark. It should be considered for removal and not incorporated into the final Native Plant Synoptic Garden.

There are a few other existing plants to bear in mind when finalizing plant selection in the new garden. First, near the intersection of Foster Island Drive and Arboretum Drive, there are a few large native tree species that could either be used in the design of the garden or removed. They will also need to be evaluated for health and collection status. Second, there is a *Taxus brevifolia* at the intersection of these two roads; if this specimen is deemed healthy and collection appropriate, it is suggested that it either be included as part of the plan or transplanted to another location. Finally, what little grass is present on site should be removed; it is not desirable within the Native Plant Synoptic Garden plan. If grass is considered anywhere in this garden, it should be included with the knowledge that it will create a need for increased maintenance and will not meet the garden's goal of being relatively self-sustaining.

FIGURE 1:
TOPOGRAPHY MAP



Topography

The basic topography of the site consists of a North to Northeast facing slope. With the large trees on the ridge and also to the south of the site, there should not be significant light problems except for when the sun is in the east; even then, since most native plants are adapted to this pattern it should pose relatively few concerns for general plant health on the site. Next, the ridge slopes down from the ridge-line

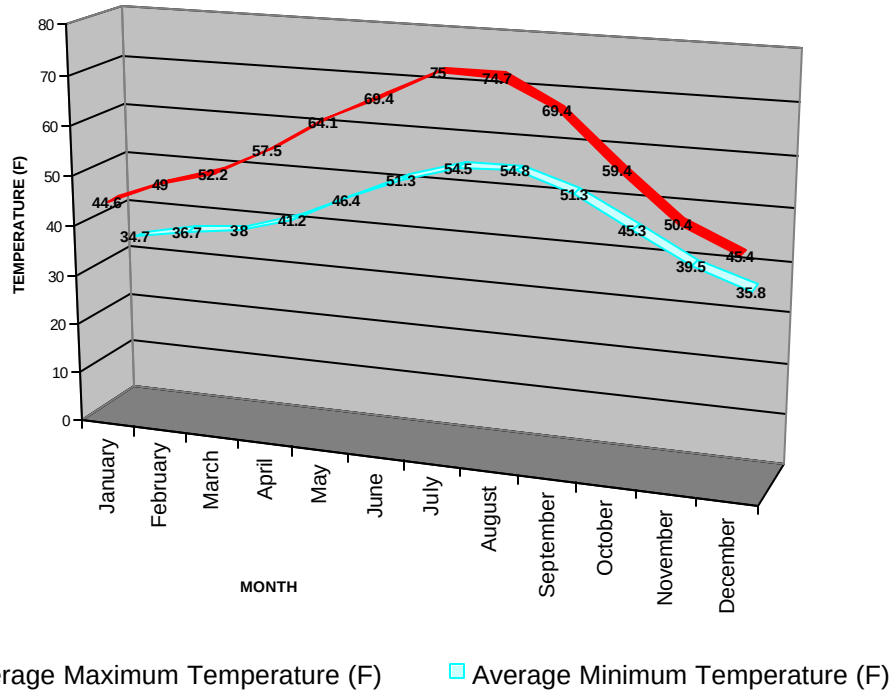
east towards Arboretum Drive. Then, moving North from Azalea Way along Arboretum Drive, the topography slopes down to a small bowl that has a fairly wet compacted soil. Once again, continuing north the slope rises gently again for a short distance then falls at a minimal rate down to the Duck Bay area. There is a drain system within the bowl area that has an outlet near the Duck Bay area; currently this is important in the drainage of the bowl area which otherwise would become saturated with water. Figure one is an enlarged portion of the south part of the Arboretum. The figure is not to scale, but it details the basic topography described.

Climate

Temperature

Using data recorded from the Sea-Tac International Airport by the Western Regional Climate Center, Figure two shows the average monthly temperatures, both minimum and maximum, from the years 1931 to 2000.

FIGURE 2:
AVERAGE TEMPERATURES FOR WESTERN WASHINGTON

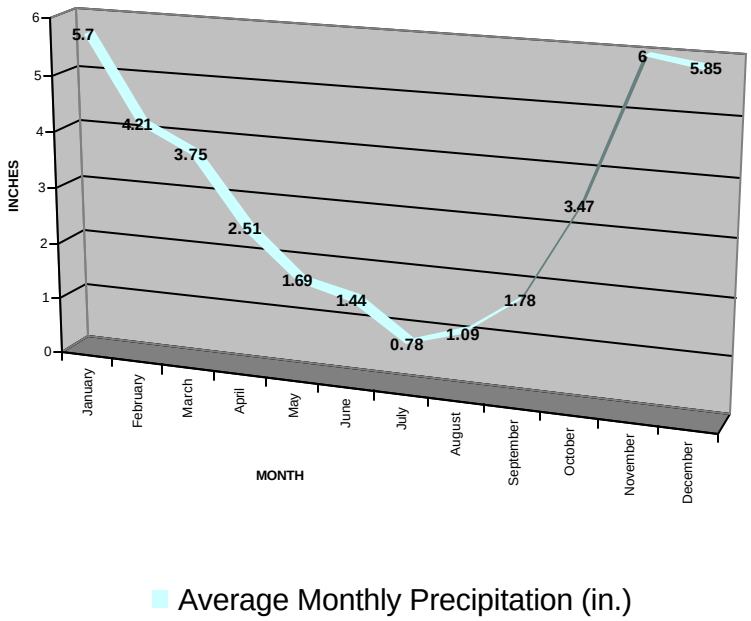


From this data, it is clear to see that the only significant fluctuation in temperatures comes during the summer. By using averages, such as in Figure two, it can serve as an excellent tool for predicting what type of temperatures will be affecting proposed plant species. There can be exceptional years such as 2003, when there were record amounts of days with no rain and days

above 70 degrees. However, with averages for seventy plus years, an exceptional year has little effect on the long-term temperature averages. This chart should serve as a predictor of annual site conditions and be referenced in combination with the information to come on precipitation/moisture. Together they can be very effective at helping to determine appropriate plant selection, aftercare, and management.

Precipitation / Moisture

FIGURE 3:
AVERAGE MONTHLY PRECIPITATION



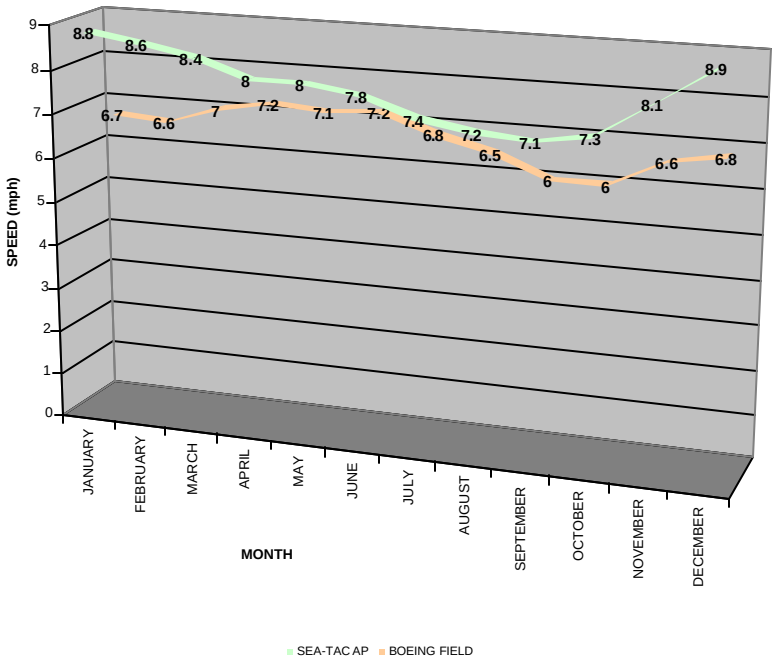
Using data recorded at Sea-Tac International Airport by the Western Regional Climate Center, Figure three shows the average monthly precipitation from the years 1931 to 2000. The average annual precipitation as measured at Sea-Tac Airport is 38.27 inches. Native Plants that will be utilized in the Synoptic Garden are generally adapted to the average precipitation levels seen in figure three. However, during installation, it is highly likely that supplemental irrigation will be needed during particular months due to low rainfall and stress the plants experience during transplanting. With figure three, it can be inferred that the best times for planting and minimizing water stress on this site would be late fall and early spring.

Fog can also play a role in site moisture; “if there is significant amounts of fog during the growing season fog can be an important source of moisture needed for plant growth” (Harris et la., 2004). At Sea-Tac Airport, the average annual amount of days that are foggy is 41, with the majority of those fog days occuring between September and February. Additionally, in the Cascade foothills during the summer and early fall, fog is present in the morning hours and dissipates in the afternoon (WRCC, 2004). Because of the site’s proximity to Lake Washington and the Puget Sound, fog does occur at times. In the summer months when precipitation is low

(see Figure 3) fog can mediate daily water stress; as a result many of Western Washington's plants are adapted to these specific conditions.

Wind

FIGURE 4:
AVERAGE WIND SPEEDS FOR THE SEATTLE AREA



Using data collected at Sea-Tac International Airport and at Boeing Field by the Western Regional Climate Center, Figure four shows the average monthly wind speeds from the years 1992 to 2002. The average annual wind speed is 8 mph at Sea-Tac Airport and 6.7 mph at Boeing Field. The average wind direction for both measuring stations is south, but July through September, the winds generally come from a northerly direction (WRCC, 2004). Believing this to be true for the Arboretum as well, the northerly winds would aide in mitigating high summer temperatures at the northern end of the arboretum. This aid is further enhanced since there is not a lot of wind obstruction north of Arboretum Drive.

Soils

Soil samples taken from portions of the proposed site were sent to the Soil and Plant Tissue Testing Lab at the University of Massachusetts (UMASS) for analysis; a copy of this analysis can be found in Appendix A. Figure five illustrates data collected by group members who took three different soil samples with a soil corer to measure bulk density and the gravimetric water content or percent moisture. Sample A was located within the upper bowl area of the proposed valley bottom area, sample C was also taken at the northern end of the proposed lower valley bottom area, and sample B was taken from the trail along the western ridge of the

proposed forested ridge area. According to Steven Van Hoven's thesis, the soil series of the Washington Park Arboretum is that of an Alderwood series. An Alderwood soil series is characterized by reasonably well-drained gravelly sandy loam soils with hardpan twenty-four to forty inches below the surface. For the proposed synoptic garden area, a hardpan was found at a depth of eight to twelve inches, and as seen in Figure five, the textures differ in the lower portions of the area.

FIGURE 5:
GROUP SAMPLE DATA

SAMPLE	BULK DENSITY (g/cm^3)	TEXTURE	GRAVIMETRIC WATER CONTENT (% MOISTURE)
A	1.04	Silty Clay Loam	34%
B	1.17	Sandy Clay Loam	31.40%
C	1.06	Silty Clay Loam	35.50%

Texture

From field analysis, it was determined that the soil textures of both soils within the proposed valley bottom area were that of a silty clay loam. According to the "Soil Textural Triangle," a silty clay loam has roughly between 50-70% silt content, 0-20% sand, and 30-40% clay content (Craul, 1999; Harris et la., 2004). A silty clay loam can be satisfactory for planting depending on the structure (which can be partly determined by bulk density); structure determines pore space, water and air movement, and water and nutrient holding capacity (Craul, 1999). A silty clay loam is considered a fine-textured soil and can sometimes have slow drainage if structured poorly or impacted by soil compaction (Harris et la., 2004). Aeration within this particular soil type can also be constrained if poorly structured or compacted; soils high in silt and clay have an increased likelihood for compaction (Harris et la., 2004). On the positive side, water holding and nutrient storage are both fairly high in a silty clay loam because the water is held more easily through adhesion to soil particles and cohesion amongst water molecules (Brady et la., 2004). Also, since clay is negatively charged, soils higher in clay adsorb more positively charged ions which include many of the essential nutrients needed by plants (Harris et la., 2004).

The soil sample from the forested ridge section was a sandy clay loam. Sandy clay loam is similar in most ways to a silty clay loam, however some differences exist depending on the percent of each type of particle (sand, silt, clay) in the soil and soil structure. One difference would be sandy soils by themselves are more permeable by water and have greater pore space

(when not compacted); this results in lower water holding and nutrient storage capacity due to the water being able to percolate through sandy soils at a higher rate (Craul, 1999; Harris et la., 2004). This is not to say that increased water percolation and lower nutrient holding capacity is inherently bad. In fact, many of Western Washington's native plants are well adapted to these specific soil conditions. Furthermore, existing plants on site appear to be healthy and not suffering from nutrient deficiencies or water stress that could result in either soil texture; even when factors such as topography and precipitation are included.

Bulk Density

The bulk densities of soil samples collected from the Graham Visitors Center sites were found to be at the lower end of the normal bulk density scale. Three bulk density samples were taken; the results can be seen in figure five. A normal bulk density is roughly between 1.0 g/cm^3 and 1.6 g/cm^3 (Harris et la., 2004). In cases where soils are fine textured and subject to compaction, bulk densities of up to 2.6 g/cm have been recorded (Craul, 1999). In general, desirable bulk density for optimal plant growth is between 1.1 and 1.4 g/cm^3 (Craul, 1999; Harris et la., 2004). Even with our finer-textured soil samples bulk density measurements indicate that soils on site have good structure with adequate pore space. Greater pore space is better for root growth, water and air movement, as well as contribute to good nutrient accessibility (Craul, 1999; Harris et la., 2004; Marschner, 1995). Even Sample B, which was taken in the middle of the trail on the forested ridge, still had a low bulk density which could be a positive sign as far as these soils' resistance to compaction; although that was only under foot traffic, not heavy machinery which would surely compact these soils.

With excellent bulk densities already being recorded on site, it will be imperative that during installation of the Native Plant Synoptic Garden, measures are put in place to maintain this excellent characteristic needed for optimal plant growth.

Water Permeability and Holding Capacity

"In order to manage soils for optimal plant growth it is helpful to have a basic measurement of water holding capacity" (Brady et la., 2004). This can be seen in Figure five by the percent gravimetric water content. Gravimetric water content measures the percent of water in a given volume of soil. On our site, the two silty clay loams had a higher water content then the sandy clay loam; part of this is due to soil texture, but some of it is due to topography and time elapsed since last rainfall. Although the differences between the soil textures' water content

was small, it gives a glimpse into how minor differences in soil texture may affect the water holding capacity of some soils. Other factors that strongly affect soil moisture levels would be canopy cover and topography of the sampling location. Both of these factors need to be noted when making comparisons between soil textures, since they could cause soil moisture measurements to be misinterpreted. To sum it all up, soil moisture retention appears to be good for plant growth. This can be collaborated by the success of the existing vegetation on site.

Soil pH

The University of Massachusetts (UMASS) soils lab measured the pH two different ways: soil pH and buffer pH. "Buffer pH measures a soils resistance to pH change after lime has been added" (UMass, 2004), and can be dependent on organic matter in the soil as well as the soil texture (Marschner, 1995). Plants usually prefer a pH between 5.5 and 8.3; it is commonly agreed upon that a soil pH somewhere between 5.5 and 6.5 is ideal for many plant, shrub, and tree species (Craul, 1999; Harris et la., 2004; Marschner, 1995). The soil tested from near the Graham Visitors Center was found to be 6.1 and the buffer pH was 6.5. From these results, the lab recommended no adjustment because the soil pH is within the desired range.

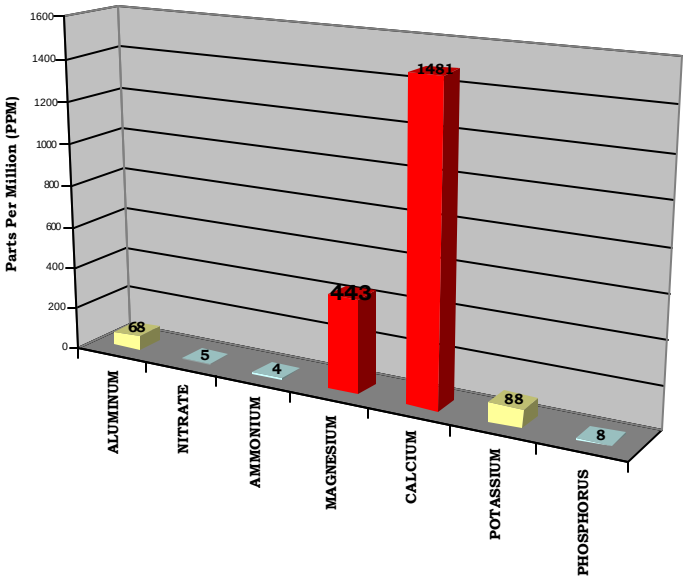
Cation Exchange Capacity

The cation exchange capacity (CEC) was found to be 14.6 Meq/100 grams. A CEC ranging from 5 Meq/100 grams to 25 Meq/100grams is sufficient for plants (Brady et. la., 2004; Craul, 1999), although the UMASS suggests that the range of ideal cation exchange capacities should be between 10 and 15 Meq/100 grams (UMASS, 2004). Either way, the CEC level on site is at an optimal level to promote plant growth. As previously mentioned, the CEC is dependent on organic matter, and the lab at the University of Massachusetts concluded that "The organic matter level of this soil appears to be quite high", and that "When properly fertilized and provided proper drainage it should provide a good growing medium for woody ornamentals which prefer a humus rich soil" (UMASS, 2004). This continues to explain why plants already on the site are doing well.

Macronutrients

As for nutrient levels in the soil, the lab found that there were very high amounts of calcium and magnesium in the soil sampled; this is represented by red in Figure six, and listed in the analysis report in Appendix A. Having high levels of calcium is excellent because calcium is

FIGURE 6:
NUTRIENT LEVELS IN PPM



essential in the proper functioning of plant cell walls and membranes; it aids in the division and elongation of plant cells (Chalker-Scott, 2004; UMASS, 2004). Calcium is typically not a limiting nutrient in the Western Washington region (Chalker-Scott, 2004). If calcium levels were low, leaves of plants would become chlorotic and/or stunted (Chalker-Scott, 2004; Harris, 2004). Although magnesium levels tend to be low for the Puget Sound region (Chalker-Scott, 2004), there are adequate magnesium levels in the soils on site. "Magnesium aids in photosynthesis because magnesium is the main atom within the chlorophyll molecule" (Marschner, 1995), which is a vital substance in photosynthesis. Enzymes and enzyme reactions also require magnesium, and in some reactions, magnesium is used as a "bridging element" between the enzyme and the soil (Chalker-Scott, 2004; Marschner, 1995). Deficiencies of magnesium are generally noticeable after leaves expand fully and then become chlorotic (Marschner, 1995). Magnesium deficiencies in soils can be alleviated by the addition of lime, organic matter, or fertilizers, but which treatment depends on other soil factors; for example pH and soil texture (Harris, 2004).

In Figure six, yellow represents potassium and aluminum which are both at medium levels in the soil. Potassium is one of the most utilized nutrients by plants along with nitrogen, and it is generally characterized by being highly mobile in plants (Marschner, 1995). Potassium stimulates enzymes and is usually associated with stomatal functions (Chalker-Scott, 2004; Marschner, 1995). Plants that become potassium deficient are unable to utilize nitrogen and water efficiently, and can become more susceptible to disease (Marschner, 1995; UMASS, 2004). A potassium deficiency can be fixed by adding a potassium rich fertilizer (Harris, 2004). Having

significant amounts of potassium available in the soil is desirable, and has not been found to be limiting in the Puget Sound region (Chalker-Scott, 2004).

At high levels, aluminum can be detrimental to plants. Aluminum can hinder calcium and magnesium uptake and cause subsequent deficiencies (Marschner, 1995). "Aluminum sensitivity varies greatly with plant type; for instance, rhododendrons can tolerate very high levels of aluminum" (UMass, 2004). The level of aluminum in the soil analysis was found to be 68 ppm, which is in the low to medium range. Typical soils range from 10 to 300ppm, so the soils in the proposed areas are at a tolerable level (UMASS, 2004). If aluminum levels should reach levels that would begin to cause problems, liming can lower the level of aluminum (UMASS, 2004).

"Phosphorus aids plants in using the energy from photosynthesis to power the plants metabolism" (UMASS, 2004). A phosphorus deficiency can limit healthy plant growth and result in weak root systems; signs of a deficiency can be abnormal size and number of leaves. Represented by blue in figure six, phosphorus levels on site were low but do not mean that there is a deficiency problem (Umass, 2004). Phosphorus deficiency does not tend to be a factor affecting plant health in Western Washington (Chalker-Scott, 2004). Most phosphorus tends to accumulate near the soil surface and does not move readily in soil because it is tightly adsorbed to soil particles (Harris et la., Umass, 2004). Since phosphorus tends to be at or near the surface, too much disturbance of the soil surface can lower phosphorus levels (Harris, 2004). Since the soils located at the Graham Visitors Center site are low in phosphorus, it may be necessary to fertilize with a phosphorus enriching fertilizer to help newly planted trees and shrubs grow. Remember though that phosphorous is generally not limiting in Puget Sound soils, so it would be advisable to first monitor shrubs for phosphorous deficiencies symptoms before application. Symptoms would include "distorted, dark green leaves with abaxial reddening or purpling with the symptoms being more common with younger plants that have less developed root systems" (Chalker-Scott, 2004). If necessary a soil analysis of soil immediately within the plant's root zone coupled with simultaneous tissue analysis could be helpful in detecting a true phosphorous deficiency.

Nitrate and ammonium were both found at low levels within the soil sample; they are represented by light blue in Figure six. Nitrate is a soluble nutrient that is made available to plants by mass flow of water within the soil (Harris, 2004). Because of mass flow, nitrate can also be leached through the soil too quickly or to depths that do not allow for roots to absorb it (Harris, 2004). "In contrast ammonium ions do not move freely with soil water, the positively charged ammonium ions are adsorbed onto soil particles" (Harris, 2004). So instead, ammonium is converted into more readily available nitrate by soil organisms. This process is called

nitrification and requires varying time periods for soil organisms to accomplish the transformation (Harris, 2004). As such, the slow process of ammonium transformation to nitrate means that it will be available over an extended period of time. Nitrate and ammonium are common in fertilizers, so their levels can easily be altered when soil analysis or plant symptoms deem it appropriate (Harris, 2004). "Many factors determine which of these two sources of nitrogen is ideal for overall plant success, but generally, similar levels of both nitrate and ammonium prove to be the best catalyst for plant growth and health" (Marschner, 1995).

"A soil with base saturations of 70% calcium, 12% magnesium, and 4% potassium is considered balanced for most plants" (Umass, 2004). The soil analysis determined the base saturations of the soil sample to be 44.7% calcium, 21.9% magnesium, and 1.4% potassium. The calcium and potassium base saturations are both low by the lab's standards, yet plant health of existing plants on site suggest that these measurements should not be a concern. Magnesium base saturation level was almost twice as high as in balanced conditions, but is not a major issue due to how readily plants require magnesium (Harris, 2004; Maschner, 1995). Also, magnesium is immobile in soil pH's at about 6.5 (so leaching should not be a problem), and tends to be generally deficient in Puget Sound soils (Chalker-Scott, 2004); so good magnesium availability on this site's soils is favorable.

The amount of extractable lead from the site soil samples was 2 ppm. The estimated total lead in the soil was found to be 46 ppm, which is in the low range of soil lead content (UMass., 2004). This level is low and indicates that soils on site have not been contaminated by lead containing sources. This is good because high lead levels can be a hazard to human health. Since the site is to be used intensively by the public, typical low lead levels are excellent news; no remedial action will be necessary for lead containment during construction or future use because of these low levels.

Micronutrients

The soil and plant tissue lab also analyzed the soil sample for micronutrients; Figure seven shows the nutrients in parts per million (ppm), and the typical soil range for each micronutrient. The data was derived directly from the soil analysis report which is located in Appendix A.

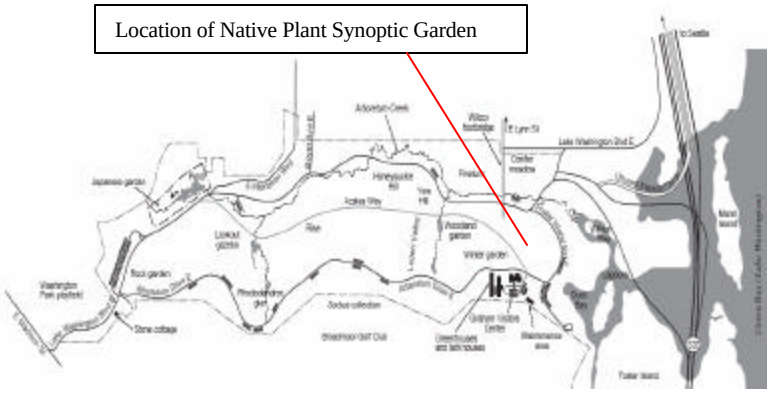
FIGURE 7:
MICRONUTRIENT CONTENT

MICRONUTRIENT	PPM	SOIL RANGE (PPM)
Boron	0.4	0.1 to 2.0
Manganese	3.9	3 to 20
Zinc	1.8	0.1 to 70
Copper	0.9	0.3 to 8.0
Iron	46.3	1.0 to 40

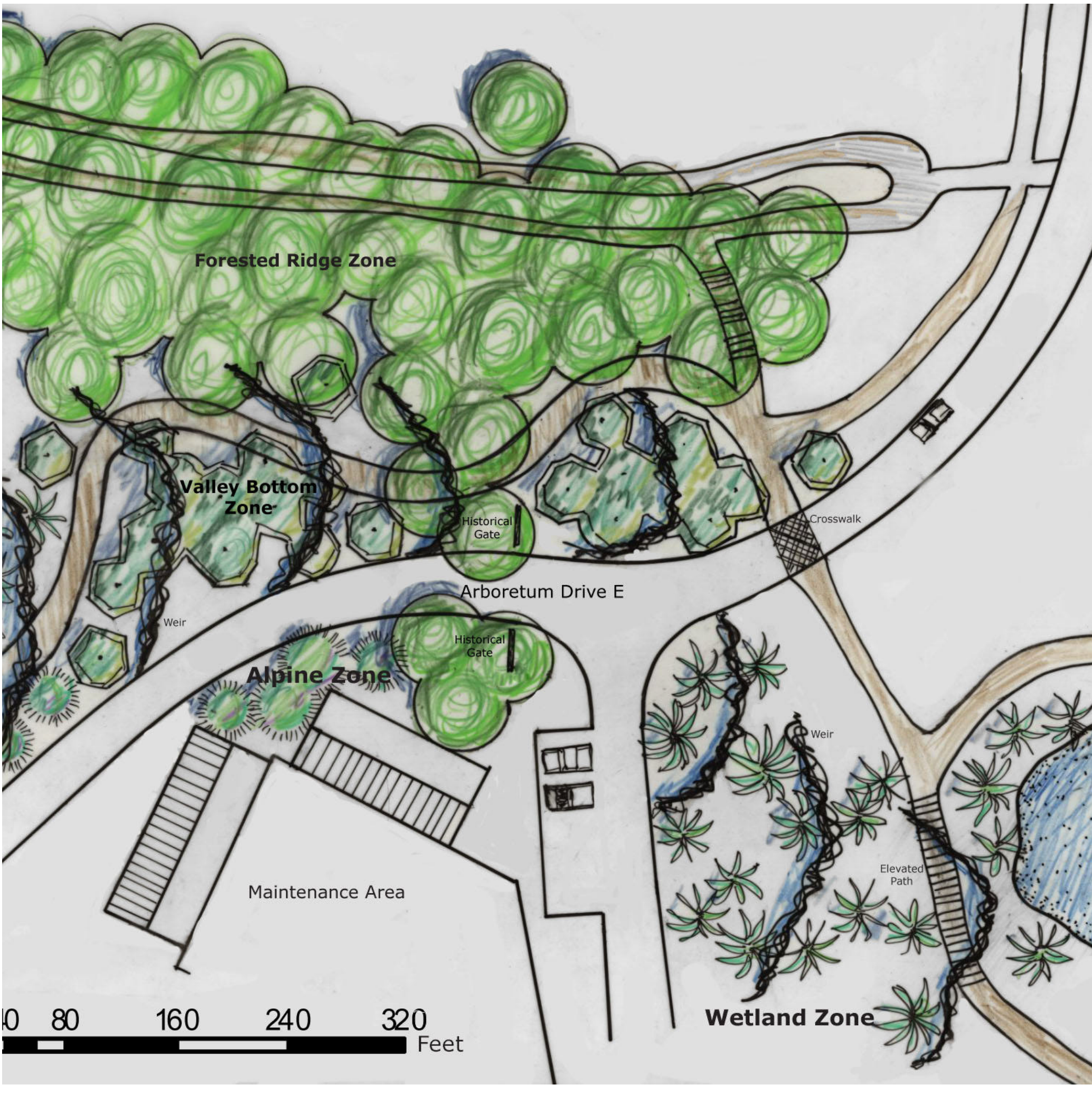
All micronutrients were found to be within the desired range with the exception of iron. Iron was measured slightly higher than the range suggested by the University of Massachusetts lab. "A high iron level is more acceptable than a low one; iron deficiency is one of the more common deficiencies that can be hard to correct and sustain over time" (Harris, 2004).

Although essential to plants, micronutrients such as boron, copper, manganese and zinc are only necessary in small amounts. Boron and copper can both become toxic at generally low levels; but both were found to be on the low end of the acceptable range which is favorable for site conditions (UMass., 2004). Zinc levels on site are within the acceptable range by University of Massachusetts standards, but may be considered low for soils on site. "Zinc deficiency can be a problem in Puget Sound soils with deficiency symptoms most notable in cultivated trees" (Chalker-Scott, 2004; Harris, 2004). Some symptoms of zinc deficiency are shorter branches, smaller leaves, dead branches, and chlorotic foliage (Chalker-Scott, 2004; Marschner, 1995). "Depending on a number of climatic and regional inputs, soil with a zinc deficiency can be amended by applying a zinc based fertilizer or using a foliar spray" (Harris, 2004). Again, it is recommended that if zinc deficiency is suspected, additional soil analysis in conjunction with plant tissue analysis could provide additional information needed prior to implementing remedial treatments.

Design Concept for Synoptic Garden



The design herein presented for the Arboretum's Graham Visitors Center is largely based upon a concept introduced in *A Greenprint for the Future: the Arboretum Master Plan* completed in 2001, and the further development of this concept by Stephen John Van Hoven


Forested Ridge Zone
Valley Bottom Zone
Historical Gate
Crosswalk
Arboretum Drive E
Weir
Historical Gate
Alpine Zone
Weir
Elevated Path
Maintenance Area
Wetland Zone
0 80 160 240 320
Feet

in his masters thesis entitled *A Foundation for a Synoptic Garden of Native Plants of Puget Sound for the Washington Park Arboretum* completed in 2003. The intent of our design, congruent with the ideas developed by these two parties, is to present a brief visual synopsis of the three principal geomorphic landforms present at the arboretum vegetated with a palette of native plants possessing ethnobotanical, ecological, conservational and/or horticultural interest. As emphasized in Van Hoven's thesis, the synoptic garden should be representative of the native plants present in the arboretum's collection, and provide a location for their interpretation (Van Hoven, 2003). Contrary to Van Hoven's proposed location near the Wilcox footbridge, we have selected a site near the Graham Visitors Center. As this is the main visitor entrance to the park, a synoptic garden in this location could provide both a visual introduction to the park's collection as well as an educational garden in close proximity to the main hub of the visitor's center and proposed educational building.

The three principal geomorphic landforms present in the park as identified in the Master Plan are forested ridges, valley bottoms and marshes. In our design, we are proposing dividing the forested ridge vegetative zone into two separate zones, the "Forested Ridge" and the "Alpine Zone", as well as splitting the wetland into an upper and lower wetland. In this manner our design can present a greater diversity of plants each with distinct characteristics and habitat requirements, thus enhancing both the complexity as well as the educational and conservational potential of the synoptic garden. Each vegetative zone contains a variety of native trees and shrubs, both natural "wild" specimens as well as their cultivated counterparts, in order to illustrate each selected species horticultural and ecological importance. In addition, ethnobotanical and other points of interest will be interpreted through signage. In this manner native plants can be viewed in their varied cultivated forms with the intent of showing their application to the home gardener. Furthermore, not only will the users of the garden be exposed to potential native plants for their gardens, but also to each plant's particular ecological and cultural significance.

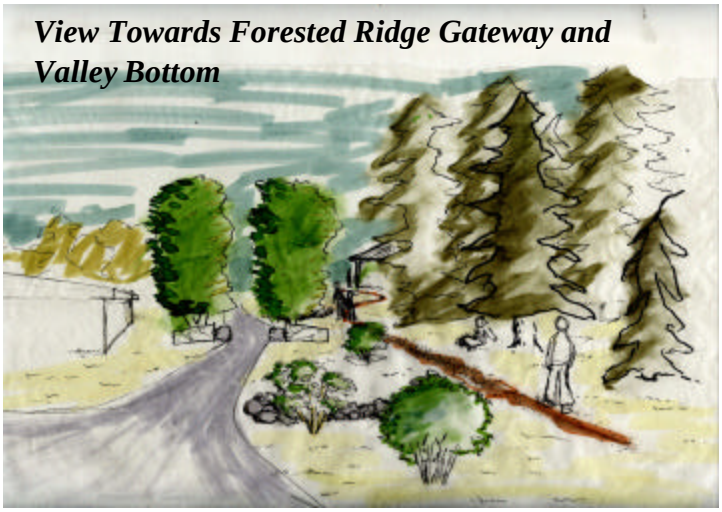
Design Proposal by Zone

Based on our analysis of the site considering topography, aspect, and other site conditions, we have created a site design that is separated into zones. The following sections will present specific characteristics of each zone.

Wetland Zones

We have chosen to create two wetland zones, an upper and lower wetland. The purpose of dividing this vegetation area is to take advantage of two separate areas of the site facilitative to the creation of wetland habitat. The Upper Wetland collects and makes use of rainwater captured on the roof of the visitor's center. The water flows through a series of weirs into the Lower Valley zone. Due to the seasonality of rainwater availability in this region, the plants selected will need to be tolerant of wetland conditions but not obligatory wetland plants. This zone will be of particular use in demonstrating the aesthetic possibilities of rainwater collection for the home gardener, as well as the ecological importance of wastewater management.

The lower wetland zone is located between the present lower parking lot and Lake Washington. Due to its proximity to the lake, this wetland will have year-round water availability and will be able to feature obligatory wetland species. Elevated boardwalks provide pedestrian access through the wetland, exposing park users to the potentials of gardening with natives in wet conditions. This wetland will furthermore serve to enhance the waterfront habitat and reduce erosion being caused by two drainage pipes currently out-letting at the shoreline.



View Towards Forested Ridge Gateway and Valley Bottom

Valley Bottom and Forested Ridge

The valley bottom vegetative zone is located alongside Arboretum Drive where the topography dips into the shape of a valley. Running through the middle of this zone are a series of weirs created out of used concrete pieces. Utilizing the rainwater captured from the visitor's center roof these weirs create small ponds, providing a source of

habitat diversity for this area. From here the visitor can either continue up a flight of stairs into the forested ridge, or up the path along the ponded weirs.

The forested ridge sits atop the slope to the west of the visitor's center and trails down intersecting the riparian zone terminating across Arboretum Drive. In this manner the forest vegetation flank either side of Arboretum Drive serving to mark the gateway into the park. To further reinforce the sense of entry created, we have relocated the historic gate to this location. These two zones feature vegetation, both trees and shrubs, most characteristic of our region. The planting design and placement should be compatible with the Olmsteadian park-like character of the arboretum, as opposed to a literal design mimicking actual native forest forms.

Alpine Zone

This zone is located along the upper Arboretum Drive, abutting the visitors center and running up to the upper parking lot. This site was chosen for its sunny exposure, as well as its proximity to visitor activity. Alpine plants provide year-round interest, and much appreciated color during our grey winter months. Furthermore, some of these plants, which could include annuals in addition to trees and shrubs, may require more maintenance and thus should be located closer to the surrounding buildings. Though not included in either Van Hoven's Masters thesis or the arboretum master plan, the design of this zone remains consistent with the garden's spirit and intent as conceptualized by these two parties. The addition of a fourth zone into the design will add complexity and further opportunities for conservation and education.

Design Implementation

In order for the Native Plant Synoptic Garden to be implemented, equipment will need to be used, the site will be altered, and plants will need to be obtained and installed. The purpose of this section is to highlight and draw attention to information that will benefit the installation. The desired result is a world class Native Plant Synoptic Garden that lasts many, many years with minimal maintenance. It is information in this section that will help this goal be achieved.

Site Preparation

In order to implement the proposed design, there will be a need to utilize heavy machinery during construction. When heavy machinery such as backhoes, excavators, and dump-trucks are used during construction, there is certainly a high probability for them to alter the site in ways that are not optimal for plant growth and sustainability. For example, the weight of the machinery often causes soil compaction. The effects of compaction can be amplified when soils levels are wet or near the point of saturation. The site analysis for the proposed project area has already shown soil bulk densities around the site to be excellent for plant growth. In order to preserve these optimal bulk densities, and not alter soil structure, careful planning of pathways for equipment use will need to be determined. By limiting the access of equipment to designated paths or areas, soil compaction over the site will be minimized. The soil under these designated pathways should be over-laid with a thick layer of wood chips (6+ inches) in order to minimize compaction directly under paths (Matheny and Clark, 1998). Once the project is finished, the wood chips may either be utilized elsewhere as mulch, or left in place to decompose.

Another consideration will be the need to control erosion on site. Erosion of surface soils poses two immediate concerns. First, sediment runoff into the adjacent wetland areas could impact delicate wildlife and vegetation. Second, surface runoff tends to modify the texture of soils by carrying away finer soil particles and then depositing them in mass elsewhere. This would result in soil compositions that may be less that optimal for plant growth; such as very high concentrations of clay or silt particles. Soil textures that are dominated by silt and clay generally have higher moisture retention, lower gas exchange rates, and may become compacted over time to degrees that restrict root growth (Brady et la., 2004). The problem of erosion would be of particular concern where slopes are greatest, such as the forested ridge area. Possible forms of protection could be a light mulch layer, temporary erosion control fabrics, or a combination of these two methods. These protective measures would mediate the infiltration of water into the soil; especially when precipitation occurs in amounts greater than the ability for quick soil percolation.

Plant Specifications

The Native Plant Synoptic Garden will be constructed on a site that is already occupied by plants, trees, and shrubs accessioned into the collection of the Washington Park Arboretum.

As such, there will be certain plants, trees, and shrubs that will most likely be relocated to new areas within this proposed site, as well as to other parts of the arboretum. There will also be a need to acquire new plants, trees, and shrubs in order to implement the Native Plant Synoptic Garden design. When acquiring these new plants, trees, and shrubs, a document specifying the criteria for which they will be accepted should be included. Through discussions with Washington Park Arboretum's Grounds Supervisor and also their Arborist, it is clear that past installations such as the parking lot revision around the Graham Visitors Center have suffered by not having plant specifications that the contractors must abide by (Zuckerman and Stubecki, 2004). Therefore, criteria for plant acceptance will be necessary for the acquisition of plants included in this project.

There are several characteristics plants should be judged by in order to be accepted for installation into the Native Plant Synoptic Garden. These would include being free of defects, both structurally and from diseases or pests; defects will also pertain to root deformities or structure such as having no girdling or circling roots. Plants should arrive in healthy shape, and not suffering from stress conditions such as wilting leaves indicative of water stress. Finally, plants should be true to species (not mislabeled) and exhibit crown shape and structure that is typical of the species (not improperly pruned during production). All of these considerations have been previously formatted into a document obtained by one of the project team members from Dr. Rita Hummel while attending a training seminar given by Washington State University Extension in Puyallup, Washington (See Appendix C). This document should serve as an example to be used or modified by Washington Park Arboretum's Arborist and Grounds Supervisor in setting guidelines for acceptance of plant materials to be used in the Native Plant Synoptic Garden. Modifications to the document's specifications may also be necessary to meet the unique criteria set forth for Washington Park Arboretum's collection plants.

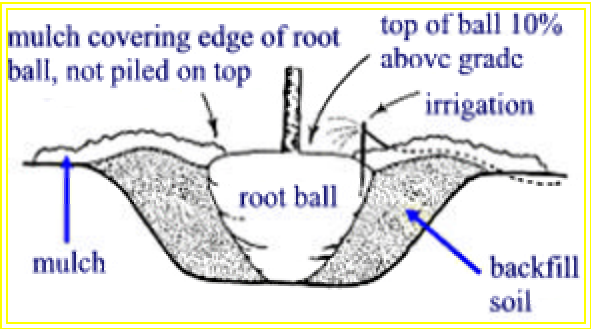
Installation Plan

How plants are installed in the Native Plant Synoptic Garden can determine the long term success or failure of the installation. In addition, the establishment of this garden may require transplanting of trees and shrubs. A considerable amount of research has determined what factors contribute to both transplanting and general planting success. Washington Park Arboretum's grounds staff already consists of an International Society of Arboriculture certified arborist and several horticulturalists. Therefore, it has the advantage of having formally trained

staff for installing or monitoring the installation of plants in the Native Plant Synoptic Garden. As a result, the purpose of this section will simply be to review and draw attention to the currently accepted standards for plant, tree, and shrub transplanting and installation.

Transplanting success is dependent on several factors. Size and quality of the plant or tree to be transplanted can determine failure or success (Harris et la., 2004). Time of year transplanting occurs in can either benefit or hinder plant re-establishment. In temperate climates, transplanting during the fall or early spring is preferred (Harris et la., 2004). Both of these times are optimal because of what is occurring physiologically within the plant, as well as environmental conditions that favor transplanting success such as temperature, moisture, and wind conditions. Special considerations should be made before transplanting during times of extreme weather conditions. For example, extremely hot or cold temperatures may cause dessication due to water stress (Harris et la., 2004). Research also suggests that if time permits, root pruning in stages around the plant or tree can help promote transplanting success. This is primarily due to increased fibrous roots at the time of transplanting (Harris et., 2004). Many methods of transplanting are possible; at the arboretum they are considering purchasing a mechanical tree spade (Zuckerman, 2004). This prospect would help them facilitate all the transplanting that may occur in implementing all of the projects proposed in the Master Plan.

There are several things to remember when planting trees and shrubs. First, "be sure that the location of underground utilities and pipes is known so that they can be avoided" (Harris et. la., 2004). It will be particularly important to not place large, long-lived trees over irrigation lines, which often need routine maintenance. Second, when digging the planting hole, research indicates that the root-ball should be left a little bit above original soil grade to prevent soil subsidence from eventually placing the root collar to low in the soil. If the top of the root-ball is below grade, the roots may become stressed due to poor gas exchange, excessive moisture, and the root collar tissues could become diseased due to excessive moisture from soil buildup around the collar. Also, the width of the planting hole should be dug at least two times the diameter of the root-ball or container (Harris et. la., 2004). For bare-root plants, trees, and shrubs the "hole need only be large enough to take the roots without crowding" (Harris et. la., 2004). The figure to the right, courtesy of Dr. Edward F. Gilman a noted researcher in environmental horticulture, illustrates this concept of keeping the root-ball high and the planting hole wide.



The illustration also shows that a layer of mulch should be placed around

the new planting, being careful to not build it up over the root-ball and not place it against the stem. The backfill soil should be the original soil excavated from the hole, and should be replaced in the hole without amending it with organic material. By following these simple steps, the plant or tree will have the best chance for quick and long lasting establishment. After planting, supplemental irrigation may be necessary depending on climatic conditions at the time. Making low mounded rings around the outside of the planting hole can aid in watering. Water can then be pooled in this zone and allowed to slowly penetrate deep into the soil, encouraging proper root growth. Also, if at the time of planting a soil analysis indicates nutrient deficiencies in the soil, remedial fertilizing can be included during planting.

Staking at the time of planting is generally discouraged nowadays. Research has shown negative consequences to staking such as: plants grow taller but weaker, stems do not develop taper, less vigorous root system development, and often the staking causes damage to the tree by girdling the stem (Harris et. la., 2004). If the need to stake arises, here are a few general rules: staking material should be soft where it comes into contact with the stem, it should allow for stem movement by not being tied tautly, it should be monitored for stem girdling, and it should be removed as soon as the plant no longer needs it.

Here are a few other notes on planting. First, make sure to remove all burlap and wire baskets from around the root-ball. Second, make sure to "break up the roots" by teasing them out and cutting any circling roots. This practice helps prevent roots on the outside of the root-ball from becoming girdling roots. Third, do not apply anti-transpirants at the time of installation; they interfere with photosynthesis (Harris et. la, 2004). Finally, it is important to continue monitoring the plant for symptoms that may indicate stress (Watson et la., 1997).

Plant Selection

How and why particular plants are selected for inclusion into the Native Plant Synoptic Garden will ultimately be the decision of Washington Park Arboretum staff (especially the Collections Manager), other stakeholders, and criteria set forth for what specific plant species are pertinent to the collection. Our proposed design reflects data collected during site analysis and represents one design that accounts for all the variables we discovered. The most important variables for plant selection include soil characteristics throughout the site and climatic conditions.

As such, we have attempted to collect an exhaustive listing of Western Washington Native Plants (including a couple of Eastern Washington plants that would be well adapted to site

conditions), and their cultivars that would be appropriate for inclusion into our proposed design. The resulting list is the cumulative information collected through literature reviews, interviews, and the extensive nursery management experience of one team member. For simplicity, all the ethnobotanical information was found in *Plants of the Pacific Northwest Coast* by Pojar and Mackinnon (additional information in bibliography). When appropriate, additional citations are included within the plant list. The resulting list on the following pages includes recommendations for the plants' placement within the proposed zones. Because of the number of plants available for use, our design proposal does not attempt to plot the exact placement of individual plants. Instead, the list represents a palette of plants from which the final designers will be able to choose from. We have also included in the Appendix section a source list for these plants, as well as a separate list of sizes and prices that references the source list. We hope this will facilitate the selection of plants for use in the Native Plant Synoptic Garden. Before purchasing the plants, please reference the plant specification section.

When choosing plants from the list, a number of plant characteristics should be kept in mind. First, plants should be listed as adapted to the specific zone. Second, mature size and form of the plant, tree, or shrub should be noted so that plants can be appropriately placed and spaced within the zones. Third, because of Washington Park Arboretum's public use, please take note of plants that are listed as poisonous or hazardous in some way (allergenic) (Harris et la., 2004). Fourth, note details about plant specific placement within the particular zone; some are listed as appropriate for a particular zone, but additional information may state that it is better adapted to a drier or wetter spot. Finally, some plants have excellent aesthetic features and may be best suited for placement where that feature can be appreciated (Harris et la., 2004).

The plant list will now follow. Additional information sections continue on page 80.

Washington Native Plant List:
Including Cultivars, Hybrids, and Forms

TREES AND SHRUBS:

Abies amablis- Generally found in mountain regions within the state. Can attain a height of 100-150'. Tolerant of shady sites, but just at home in open sunny sites (Pojar, 1994). Can be used in the "Forested Ridge" since it can get quite large. Ethnobotany: Used by aboriginal people as firewood and enjoyed for the sweet smelling boughs.

'Spreading Star'- Low growing with a spreading habit. Mature growth to 3-4'. Nice blue-green needles. For best needle color and growth this one should be sited in the open parts of the "Valley Bottom".

(Photo: Iseli Nursery, 2004)

'Compacta'- A very compact growing dwarf. Good candidate in the "Alpine Zone" due to its slow growth habits.

'Hoyt's witches broom'

Abies grandis- A large tree over 100-200'. One of the largest growing Abies in the world. Forms a conical shape with age (Mitchell, 1999). Best used in "Forested Ridge" or "Valley Bottom" sites in a good draining soil. Can tolerate moist forest conditions. Ethnobotany: Pitch and wood were used.

'Aurea'- A good gold needle form of the species. Same growth habit as species.

'Compacta'- Needles the same as species. Plant is a good dwarf form. Possible use in the "Alpine Zone".

'Johnsonii'- Columnar growth habit. (Dusek, 2004). Could be used on either side of an entrance or as a tall hedge within the "Alpine Zone", "Forested Ridge", or "Valley Bottom". Should be sited in an open sunny site for best growth form. Not suited for wet soil sites.

'Pendula'- A great weeping form with pendulous branches. Could be used in "Valley Bottom" area or as a transition plant between the "Alpine Zone". Can grow large unless maintained. Not suited for use within the "Alpine Zone".

Abies lasiocarpa - Large, growing to 100' or more this conifer has light grayish to chalk white bark. The unusual cones are a dark purple color. (Krussman, 1985). Best sited in the "Forested Ridge" section. Placement should be with an open sunny position in draining loam soils. Ethnobotany: Medicinal use of pitch and wood.

'Argentea' - Good silver needled form of the species. Site within the "Forested Ridge" area.

'Compacta' - A dense branching form of the species for open areas within the "Valley Bottom" or "Forested Ridge" areas.

'Duflon'

'Glauca' - Similar in growth habit of type, but has silver-blue needles. Place in the "Forested Ridge" area.

'Glauca Compacta' - Good blue foliage, has a dwarf conical form. Can be used in the "Alpine Zone" or "Valley Bottom" areas.

'Green Globe' - A dwarf form with gray-green needles. Can be used as a small hedge/ border. Can be used in the "Alpine Zone".

'Mulligans Dwarf' - A conical compact dwarf plant which is densely branched. Suggested use in the "Alpine Zone".

Abies procera - The Noble Fir can reach a size of 200' plus. Needles lay flat on each side of the branch instead of around (Krussman, 1985). Best placed on "Forested Ridge" area.

'Argentea' - Bluish-white needles on this form. Use in "Forested Ridge" zone.

'Aurea' - A good yellow needled form. Has the same growth habits of the species. Use in "Forested Ridge" zone.

'Beissneri'

'Blaue Hexe' - A round growth habit. Great for smaller areas of the garden (Krussman, 1985). Suitable for the "Alpine Zone" due to its small growth habits.

'Compacta' - A compact growing form. Can be used in the "Alpine Zone".

'Conica'

'Coerulescens'

'Frijsenborg'

'Glauca' - Has a nice glaucous coating on the foliage (Kruckenberg, 1992). Suggested use in the "Forested Ridge" area.

'Glauca Prostrata' - A great blue form that holds its needle color. Grows very broad and flat (Krussman, 1985). Can be sited in the transition zone between the "Alpine Zone" and "Valley Bottom".

(Photo: Oregon State University, 1999-2004)

'Jeddeloh' - A round growing cultivar with greenish-blue foliage (Krussman, 1985). A little to large for the "Alpine Zone", but suitable if sited in open areas of the "Valley Bottom".

'La Graciosa'

'Pendula' - A weeping form of the species. Can be used in the "Alpine Zone" or in the transition area to the "Valley Bottom".

'Sherwoodii' - A golden-yellow needled form (Krussman, 1985). Brightens a landscape. Can be used in the "Forested Ridge" section to brighten up areas near dark foliaged evergreens.

Acer circinatum - Commonly found under a canopy of conifers. Can be grown in open sunny sites as well. It is generally bushier and more compact with sun exposure. Has a good fall color display of pure yellow to flaming red leaves. Ethnobotany: Used in tool making utilizing the dense hard wood.

'Alleyne Cook' - Dwarf upright form of *A. circinatum.* Can be used in the "Alpine Zone" due to its small size.

'Glen Del' - (Hill, 2004).

'Little Gem' - Nice compact shrub that has smaller leaves than the type. Could be placed in any zone except the "Wetland Zone". Tolerant of sunny and shady positions. Fall color best on exposed sunny spots.

(Photo: Oregon State University, 1999-2004)

'Monroe'- Deeply cut leaves that resemble some of the *Acer japonicum* species rather than our local native; was found by the town of Monroe, WA. Could be placed in any zone except the "Wetland Zone". Tolerant of sunny and shady positions. Fall color best on exposed sunny spots.

(Photo: Oregon State University, 1999-2004)

'Pacific Glow' - (Hill, 2004).

'Pacific Fire'- (Hill, 2004).

(Photo by: Collector's Nursery)

'Sunglow' - (Hill, 2004). See photo above.

'Sunny Sister' - (Hill, 2004).

Acer glabrum- Grows as a small tree or shrub in dry areas. Good display of yellow fall color. Best grown on forest edges (Whitney, 1989). Can be planted in "Forest Ridge" zone under larger trees where it will not get to moist. Ethnobotany: Some medicinal uses. (Photo: O.S.U., 1999-2004)

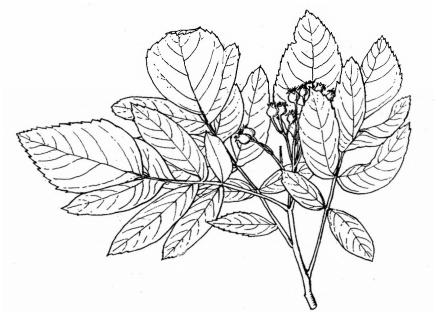
***Alnus rubra*-** A nitrogen fixing tree that can grow in various sites. Prefers moist sites the best. Fast growing tree to 60-80' in height. Some Alnus exist in the "Wetland Zone" already and are suggested to be left there. They will provide shade for the smaller trees and shrubs that require a shady canopy. Ethnobotany: Medicinal uses. Source of red dye.

'Aldered States'- cultivar

***Alnus rubra* f. pinnatisecta-** An interesting cut leaf form of our native alder species. Not common in the nursery trade**.** (Oregon State University, 1999-2004). Can be used in the "Wetland Zone" or "Forested Ridge" areas. Tolerant of moist to semi-dry soils.

(Photo: Oregon State University, 1999-2004)

***Alnus sinnuata*-** The Mountain Alder is a shrubby trees that is usually multi-trunked. Similar leaves to A. rubra (Illustration below, Pojar, 1994).



***Amelanchier alnifolia*-** Produces edible fruit that are loved by birds. Good fall colors. Ranges in height from 10-15'. Ethnobotany: Berries eaten for food and wood used in tool making.

(Photo by: Jake Pool)

'Northline'- A good yield of large blue sweet berries (Thimblefarms, 2003).

'Obelisk'

'Parkhill'- (Hill, 2004).

'Pembina'- (Hill, 2004).

'Regent'- Good foliage and a compact grower (Grant, 1990).

'Smokey'- Another large producer of good berries (Thimblefarms, 2003).

'Success'- Abundant producer of fruit (Grant, 1990).

'Thiessen'- (Hill, 2004).

***Amelanchier alnifolia* var. humptulipenis -** (Hill, 2004).

***Amelanchier alnifolia* var. pumila -** (Hill, 2004). See photo below.

Amelanchier alnifolia semi-integrifolia

Amelanchier alnifolia submollis

Amelasorbus jackii (Amelanchier alnifolia x Sorbus scopulina) see drawing above - A naturally occurring bi-generic hybrid that is highly variable in the wild. Prefers a sunny position in a well-drained, moisture retentive humus rich soil (www.oregonflora.org).
(www.oregonflora.org)

Andromeda polifolia - An evergreen shrub that is low growing. Has attractive leathery foliage. White bell flowers heavily adorn this plant in late May. At home in a wet peaty site (Klinka, 1989).

'Alba' - Pure white flowering form of the species. (Photo below: Fa. C. Esveld)

'Blue Ice' - (Hill, 2004).

'Bluest Form'- (Hill, 2004).

'Chuo Red' - (Hill, 2004).
'Compacta'- Very compact grower (Mentheny, 1991).

(www.florarium.net)

'Congesta'

'Kirigamine'- (Hill, 2004).

'Kirikamima'

'Macrophyllum'- (Mentheny, 1991).

'Minima'- Dwarf type with pink bell-shaped flowers. Suited for alpine gardens (Mentheny, 1991)

'Nana Alba'- Very small growing form with white blossoms.

'Nikko'- (Mentheny, 1991). See photo above.

'Pink Form'

'Pink Ice'- (Hill, 2004).

'Red Winter'

'Shibutsu'

***Andromeda polifolia* var. grandiflora compacta-** (Kruckenberg, !992).

***Andromeda polifolia* var. congesta-** (Kruckenberg, 1992)

***Andromeda polofolia* var. compacta alba-** (Kruckenberg, 1992)

***Andromeda polofolia variegata*-** (Hill, 2004)

***Arbutus menziesii*-** An evergreen broad leaved tree with peeling red bark. Nice white flowers are followed by red berries in fall. Popular with birds. Best in a well drained site with no added nutrients. Thrives on neglect. Use in an open dry location within the "Forested Ridge" zone. Ethnobotany: Medicinal uses. Source of red dye. Berries eaten in small quantities.

***Arctostaphylos columbiana*-** An interesting shrub that grows to 10' in height. Has reddish-brown bark and evergreen foliage. Bell-shaped flowers are held in clusters followed by red berries (Pojar, 1994). Much of the plant is covered in fine hairs. Best placed in a sunny location in well draining soil. Ethnobotany: Berries were seldom eaten.


(Photo from: TAMU Herbarium)

'Oregon Hybrid'- (Hill, 2004).

***Arctostaphylos columbiana X A. nevadensis*-** (Kruckenberg, 1992)

***Arctostaphylos columbiana X A. hookeri*-** (Hill, 2004).

***Arctostaphylos nevadensis*-** An Eastern Washington plant. Has a similar growth habit as A. uva-ursi. Easily identified by pointed leaves instead of rounded leaves. Best used in the "Forested Ridge" or "Alpine Zone" in an open location. Ethnobotany: Medicinal uses.


(Photo from: TAMU Herbarium)

'Cascade'- (Hill, 2004).

'Chipeta'- (Hill, 2004).

'Ponchito'- (Hill, 2004).

***Arctostaphylos nevadensis X A. canescens*-** (Hill, 2004).

***Arctostaphylos uva-ursi*-** Mat forming woody shrub. Grows in open dry sites. Bell-shaped flowers followed by red berries. Plant in the "Forested Ridge" or "Alpine Zone". Ethnobotany: Leaves used in a smoking mixture.

(Photo from: TAMU Herbarium)

'Alaska'- Similar to the species, but grows flat and compact to the ground.

'Big Bear'- Large leaves and fruit. Takes on a red fall color during winter months.

'Massachusetts'- Has pinkish-white flowers and dark green leaves. Resistant to leaf spot.

'Mendocino'- (Hill, 2004).

'Miniature'- (Hill, 2004).

'Mitsch's Selected Form'- (Hill, 2004).

'Point Reyes'- Leaves are close together on the stem.

'Radiant'- Light green leaf form. Good producer of red fruit.

'Rainbow Rock'- (Hill, 2004).

'Thymifolia'- (Hill, 2004).

'Vancouver Jade'- Common in the nursery trade in this region. Great shiny green foliage and red fall color.

'Vulcan's Peak'- (Hill, 2004).

'Wood's Compact'- (Hill, 2004).

'Wood's Red'- One of the largest fruit producing cultivars. Turns a good red color in winter.

'#13'- (Hill, 2004).

Arctostaphylos uva-ursi X A. andersonii **-** (Hill, 2004).

Arctostaphylos X media (A. uva-ursi X A. columbiana)- (Hill, 2004).

Arctostaphylos X media **var. grandiflora**

Betula glandulosa**-** Nice small shrub birch growing to a height of 5-6'. Nice golden fall color. Grows best in soggy sites (Grant, 1990). Great plant for use in the "Wetland Zone".

(Photo: Oregon State University, 1999-2004)

Betula papyrifera**-** A medium tree with papery bark that peels with age. Good fall colors of yellow. Can be used in moist sites in sun or partial shade. Suited for use in the "Wetland Zone" or moist parts of the "Valley Bottom". Ethnobotany: Used to make canoes. Bark made into baskets. Pitch was chewed as a gum. (Photo below: Native Plant Workbook, 2004)

Betula occidentalis**-** Especially at home in a wet site, this shrubby tree will grow to 20-30'. Branches tend to be pendulous. Well suited for use in the "Wetland Zone".

Ceanothus integerrimus**-** Blue flowers and sweet fragrance in the months of May to June. Nice glossy foliage. Can grow to 15' (Kruckenberg, 1992). Best placed in a drier site within the "Forested Ridge" or "Valley Bottom" zones.

'White Form'- Same growth pattern, but has white flowers. (Photo below: O.S.U., 1999-2004)

Ceanothus prostratus - Nice evergreen groundcover that is covered by pink flowers in May and July. Can make form large mats up to 10'. Grows on the eastern slopes of the cascades; enjoys a well-drained site (Kruckenberg, 1992). Best placed in a drier site in "Forested Ridge" and "Valley Bottom" zones.

(Photo from: Fa. C. Esveld)

'Puget Blue'- (Hill, 2004).

'Ray Hartman'- (Hill, 2004).

***Ceanothus velutinus* var. laevigatus** - Large glossy leaves and sweet scented white flowers set this plant off. Likes an open sunny location. Grows to 8' in height (Kruckenberg, 1992). Best placed in drier position within the "Forested Ridge" or "Valley Bottom" zones. Ethnobotany: Medicinal tea from leaves.

(Photo: Oregon State University, 1999-2004)

'Victoria'- (Hill, 2004).

'Wheeler Canyon'- (Hill, 2004).

'Pershore Zanzibar'- (Hill, 2004).

Chamaecyparis nootkatensis- Can attain a large size of 60-90'. Forms a conical shape with pendulous branches. Use in "Forest Ridge" or "Wetland Zone". Ethnobotany: Wood used to make bows and tools. Medicinal teas from boughs

'Aurea'- Has light yellow foliage that later turns green. Use in "Forest Ridge" or "Wetland Zone".

'Aureovariegata'- Variegated yellow cultivar that lightens in summer and then becomes yellow- brown during winter months. Use in "Forest Ridge" or "Wetland Zone".

'Compacta'- A great compact form that is very dense in habit. Eventually becomes an open globe shape (Krussman, 1985).

'Compacta Glauca'- A dwarf form with blue-green branch-lets (Krussman, 1985).

'Glauca Pendula'- A blue-green colored form that has weeping side branches.

'Green Arrow'- Tall narrow growing type.

'Laura Aurora'- (Hill, 2004).

'Lutea'- A nice golden-yellow form.

'Pendula'- A weeping form that has side branches that extend outward and down. End of branches hang vertical.

(Photo from: Fa. C. Esveld)

'Jubilee'

(Photo: Iseli Nursery, 2004)

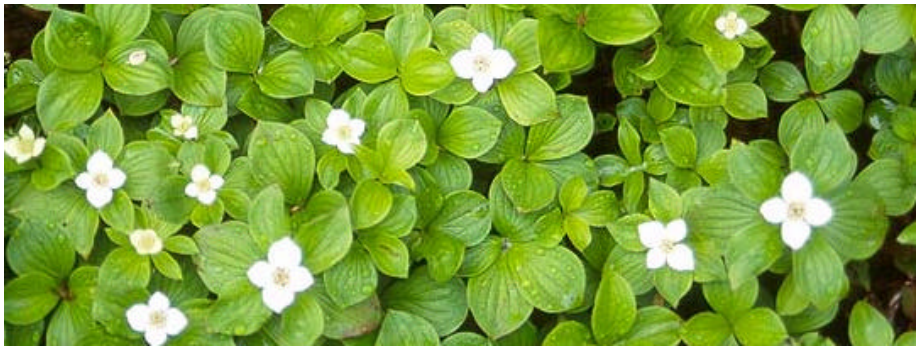
'Strict Weeper'- A heavenly weeping form.

'Torulosa'- (Hill, 2004).

'Van Der Aker'- (Hill, 2004).

'Variegata'- White speckled branches at tip, later changing to blue-green (Krussman, 1985).

Cornus canadensis- A good groundcover dogwood that reaches 6" in height. White flower similar to the relative tree, but smaller. Later produces a bunch of red berries. Grows in shade.
(Photo below: Oregon State University, 1999-2004)

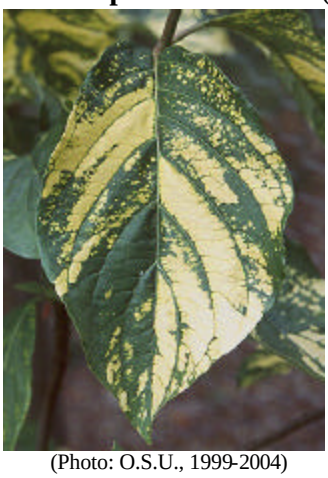


Cornus nuttallii- Large white spring flowers and excellent fall foliage color of reds and yellows. Ethnobotany: Wood was used to make bows, arrows, and other tools. Bark used to make dark-brown dyes and medicinal preparations.

'Barrick'- (Hill, 2004).

'Colrigo Giant'- (Hill, 2004).

'Gold Spot' or 'Eddiei'- (Hill, 2004).



(Photo: O.S.U., 1999-2004)

'North Star'

'Pink Blush'

Cornus nuttallii X Cornus florida

'Eddie's White Wonder'- A hybrid of the Pacific Northwest native dogwood, Cornus nuttallii and Cornus florida, it grows taller and has larger flowers than both of the original parents. More resistant to anthracnose than our native. Has an upright pyramidal growth habit.

(Photo from: Fa. C. Esveld)

Cornus nuttallii X Cornus kousa

***Cornus* x 'Aurora'-** A hybrid flowering dogwood resulting from a multi-cross between Cornus florida, C. kousa, and C. nuttallii. Produces overlapping white flowers in spring and good fall colors (Bluebell Nursery, 2004). Good one for edge of the forest canopy. Best sited in the "Forested Ridge" site.

***Cornus serica*-** Generally a multi-stemmed large shrub. Young bark is red. Typical dogwood leaves. Reaches heights of 10-15'. Grows in wet sites. All cultivars best suited for the "Wetland Zone" or "Valley Bottom" areas due to its ability to handle wet conditions. Will grow on drier sites but does not flourish. Ethnobotany: Medicinal uses and smoking mixtures. Berries were eaten sometimes.

'Aurea'- (Hill, 2004).

'Baileyi- (Hill, 2004).

'Cardinal'- Bright red, "cherry red" stemmed (Dirr, 1990).

'Cheney'- (Hill, 2004).

'Emerald 'n' Silver'- (Hill, 2004).

'Flaviramea'- Yellow stemmed form.

'Harrington'- (Hill, 2004).

'Hedgerows Gold' - (Hill, 2004).

'Isanti'- Compact grower with red stems (Dirr, 1990).

'Kelsey Dwarf'- Very compact grower of 'Kelseyi'.

'Kelseyi'- Compact grower to only 24-30". Not as colorful of stems (Dirr, 1990).

'Peter's Choice'- (Hill, 2004).

'Silver and Gold'- A variegated form that has yellow stems. The leaves have a cream border along their margins (Dirr, 1990).

'Sunshine'- An introduced form from Washington Park Arboretum. Has red stems that set off the yellow colored leaves (Dirr, 1990).

'Variegata'- A nice variegated form with red stems. The leaves have a light green center with a creamy white border.

'Wallowa'- (Hill, 2004).

***Corylus cornuta*-** A large tree or shrub with multiple trunks. Long catkins of yellow in early spring are followed by hazelnuts. A favorite of squirrels and chipmunks. Place in "Forested Ridge" under tree canopy or open sunny areas. Does not perform well in wet sites. Ethnobotany: Nuts were eaten. Shoots used to make rope.

Corylus cornuta X C. avellana

Cupressocyparis X notabilis (Cupressus glabra x Chamaecyparis nootkatensis)- Not widely planted, but another interesting intergeneric hybrid. Has dark grayish green foliage. Height is unkown. The largest specimen is over 40'. Best placed on "Forested Ridge" site. (http://www.na.fs.fed.us/spfo/pubs/silvics_manual/Volume_1/chamaecyparis/nootkatensis.html)

Cupressocyparis X ovensii (Cupressus lusitanica x Chamaecypais nootkatensis)- Yet another hydrid. Takes on C. nootkatensis appearance with flattened drooping sprays of foliage that are dark green. Best placed on "Forested Ridge" site. (http://www.na.fs.fed.us/spfo/pubs/silvics_manual/Volume_1/chamaecyparis/nootkatensis.html)

Cupressocyparis X leylandii (Cupressus macrocarpa x Chamaecyparis nootkatensis)- Interesting intergeneric hydrid of our native C. nootkatensis. Grows to a large size of 60-100' Very popular tree throughout the United States with many named cultivars. Best placed on "Forested Ridge" site.

Euonymus occidentalis- Not common to Washington forest. Low growing shrub with evergreen leaves (Pojar, 1994). Place on a dry slope in a transition area between "Alpine Zone" and adjacent areas.

Garrya fremontii- Grows on brushy slopes. Tassel flowers in spring (Kruckenberg, 1992). Tassel flowers not as long as the hybrid between G. fremontii and G elliptica. Best suited in an open sunny spot that is well drained in the "Forested Ridge" zone.

Garrya x issaquahensis

(Photo by: Jake Pool)

'Carl English'- (Hill, 2004). Best suited in a open sunny spot that is well drained in the "Forested Ridge" zone.

***Garrya* cv. 'Pat Ballard'** (G. elliptica x G. fremontii)- Hardier than G. elliptica. Long string of flowers (Bellevue Botanical Garden, 2004). Best suited in an open sunny spot that is well drained in the "Forested Ridge" zone.

(Photo by: Jake Pool)

Gaultheria shallon- An evergreen understory shrub that spreads. Produced dark blue-black fruit. Can grow 2-6' in height. Place in any zone other than "Wetland Zone", under trees and shrubs or in open areas. Ethnobotany: Berries used for food. Young leaves chewed to supress hunger.

'**Actifolia**'- A small leaved form.

'Snoqualmie Pass'- Similar to species, but only grow 18" in height. For sun or shade (Heronswood Nuresery, 2004)

Gaultheria x wisleyensis (G. mucronata x G. shallon)- A product of a cross between South American Gaultheria. An evergreen shrub growing to 3' by 3'. Flowers from May to June. The plant prefers acid soils. It grows in full shade or semi-shade (Kelly, 1995). Place all cultivars in any zone other than "Wetland Zone".

(Photo by: James Manhart)

'Jingle Bells'

'Pixie Pink'- A dwarf shrub that tends to sucker. White flowers with light pink blush followed by purplish fruit (Kelly, 1995).

'Wisley Pearl'- Forms a dense growing mound of small salal like leaves. Good show of small white flowers producing maroon-purple berries in fall (Kruckenberg, 1992).

'Ruby'- (Hill, 2004)

Holodiscus discolor- A multi-stemmed shrub that is covered with creamy white plumes of flowers in spring. Flowers turn brown and carry through the winter. Can grow in a variety of conditions, but does best in open dry sunny spots. Height up to 12'. Best sited in "Forested Ridge" zone or edges of the "Valley Bottom" zone. Ethnobotany: Wood used to make hunting tools such as, bows, arrows, spears, and harpoon shafts. Also, made into medicinal teas.

(Native Plant Workbook, 2004)

Juniperus communis- Grows only to about 15' tall and wide. Has spreading branches, sometimes becomes almost prostrate. Tolerant of many soil sites other than wet sites. (Krussman, 1985). Best placed in open sites in any zone other than the "Wetland Zone". Shady positions tend to cause leggy growth. Place all cultivars in zones that have a well-drained sunny spot for best growth and color. Ethnobotany: Used for medicinal purposes.

'Aurea' - A delightful specimen reaching only 3 to 4' at maturity. The golden foliage on upturned branches looks like tiny candles. It works well both as a columnar specimen or for contrast in the alpine garden. Can be used in the "Alpine Zone".

'Berkshire'- A dwarf form that is slow growing and has a spreading habit.

'Compressa' - A small replica of the Irish Juniper, it grows only 2" a year and reaches an ultimate height of 3-4'. Dense, tiny green juvenile leaves on a columnar form. Because of its slow growth, great for even the smallest rock garden and most effective when planted in groups of three or more. Place in the "Alpine Zone".

(Photo: Oregon State University, 1999-2004)

'Depressa Aurea' - A dwarf form that has yellow tipped growth in spring. Has a spreading habit (Dirr, 1978).

(Photo: Oregon State University, 1999-2004)

'Gold Cone'- Narrow growth form with golden foliage (Kelly, 1995).

'Golden Schapp's'

'Hortmann'- Has a arching growth habit with branches that weep downward.

'McKay's Weeper'

'Pioneer'

(Photo: Oregon State University, 1999-2004)

'Repanda'- Nice low growing form (Kelly, 1995). (Photo below: O.S.U., 1999-2004)

***Juniperus communis* var. depressa**

'Amidak'- Dense, low spreading shrub that can reach 1' tall and 5' wide. Needles are dark green with silvery blue lines on the upper surface (Kruckenberg, 1992). Best suited in open areas of the "Valley Bottom" due to its spread size.

***Juniperus occidentalis*-** Nice upright tree to 20' or more. More of a shrub than a tree in our region. Needles are a gray-green color. Best place in a well drained sunny spot in any zone.
(Photo below: Oregon State University, 1999-2004)

***Juniperus scopulorum*-** Usually a narrow tree with upright facing branches (Dirr, 1978). Place all cultivars in zones that have a well-drained sunny spot for best growth and color. Ethnobotany: Used for medicinal purposes.

'Argentea' - A silver-green form of the species.

'Blue Arrow' - Good upright grower with blue-green foliage.

'Blue Creeper' - Low spreading growth habit. 6-8' wide and only 2 foot high. Good bright blue foliage. Place in the "Alpine Zone" to brighten up the area year around.

'Blue Heaven' - Great blue foliage and upright growth habit. Can get up to 25' (Dirr, 1978).

'Cologreen' - Dark green foliage and upright growth to 25-30'

'Columnaris' - A upright grower that tend to be much taller than wider.

'Gray Gleam' - Nice silver gray foliage and slow growth to 15-20'.

'Green Ice' - Broad upright grower with ice-green new growth.

'Horizontalis' - Nice outward spreading branches of silver-blue adorn this upright grower.

'Medora' - Slender upright form with blue-green foliage.

'Moonglow' - Grows upright and has bright silver-green foliage. Can get up to 20' (Kelly, 1995).

'Pathfinder' - Nice bluish gray foliage on an upright pyramidal tree. Grows to 20-30'.

'Sky Rocket' - One of the narrowest growth habits of the species. Has bluish-green foliage. A 15' plant usually not more than 2' wide (Dirr, 1978).

'Sparkling Rocket'

'Tabletop' - Grows wider than taller. 6' high and 8' wide with silver-gray foliage.

'Tolleson's Blue Weeping' - Nice arching branches of silver-blue droop downward. Interesting form.

'Variegata' - Some of the growth is white and spread out on the shrub.

'Viridiflora' - Bright green foliage that is an upright grower.

'Wichita Blue' - Holds a good blue-green color on the foliage. A conical upright grower.

Larix lyalli - One of our high alpine larches. Not often seen in cultivation and slow growing. Whorls of soft green needles come out in spring then followed by bright yellow fall color before the needles drop (Kruckenberg, 1992). Needs an exposed site in full sun. Place in "Forested Ridge" area.

***Larix occidentalis*-** Another one of the native larches. A tall narrow grower to over a 100'. The needles turn yellow to brown in the fall before they drop (Kruckenberg, 1992). Needs an exposed site in full sun. Place in "Forested Ridge" area.

***Ledum groemlandicum* -** Small shrub to 2-3'. Nice white flowers in mid-spring (Kelly, 1995). Grows best in wet sites. Place in "Wetland Zone" or "Valley Bottom". Ethnobotany: Leaves used to make a tea.

(UW Library Digital Collection, 2004)

'Compacta'- Dense growth to only 1 foot high. Even the flowers are compact (Kelly, 1995).

***Ledum glandulosum*-** Similar as *L. groenlandicum*, but has a more compact growth habit (Kruckenberg, 1992). Place in "Wetland Zone" or "Valley Bottom". Ethnobotany: Leaves used to make a tea.

***Ledum glandulosum* var. columbianum**- Coastal variety of the species (Kruckenberg, 1992). Place in "Wetland Zone" or "Valley Bottom". Ethnobotany: Leaves used to make a tea.

***Linnaea borealis*-** A creeping woody plant found in conifer forests of our region. Creeping stem roots to form large expansive colonies. Best placed in the shady canopy of the "Forested Ridge".

***Lonicera ciliosa*-** A woody climbing vine that produces bright orange blossoms from May to June. Can grow in either sun or shade. Has red to orange berries in late summer. Not poisonous. Can be planted at the base of trees and shrubs to allow it to grow on. Best planted next to shrubs that do not require proper form. Place in the "Forested Ridge", "Valley Bottom", and "Wetland Zone". Ethnobotany: Stems used in weaving. Flowers contain sweet sugar that was sucked out.

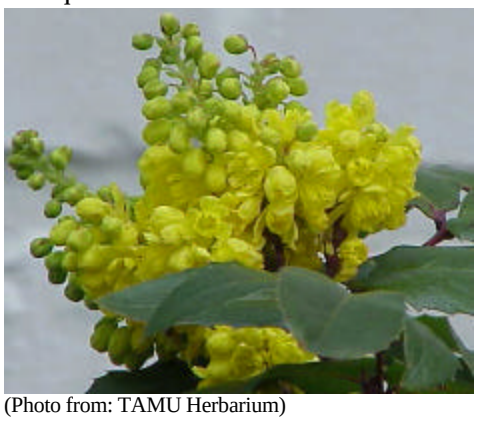
(Photo from: Fa. C. Esveld)

Lonicera hispidula- A nice summer bloomer of pinkish-purple blossoms followed by red berries. Not poisonous. A woody vine that can reach heights of 5-20' in height (Kruckenberg, 1992). Place in an open sunny site in the "Forested Ridge" or "Valley Bottom" areas.

***Lonicera hispidula* var. vacillans**

Lonicera involucrata- The Black Twinberry is at home in moist forest and stream banks. Yellow flowers produce black fruit in pairs. Berries are possibly poisonous. Can grow 5-10'. Can grow in the "Wetland Zone" and "Valley Bottom". Ethnobotany: Medicinal use of bark. Berries used to make black dyes.

Mahonia aquifolium- A short or tall shrub growing to a height of 4-10'. Produces large plumes of yellow flowers in winter followed by blue berries. All cultivars can be placed in the "Forested Ridge" or "Valley Bottom", but not placed in too shady of a spot. Ethnobotany: Berries eaten in low quantities. Bark and roots used to make yellow dyes.



(Photo from: TAMU Herbarium)

'Apollo'- Low growing type with orange-yellow flowers instead of yellow (Kelly, 1995).

'Compactum'- A dwarf type. Grows around 24-30". Nice bronze colors in winter.

'Compacta John Muir'

'Eureka'- Bright golden yellow flowers.

'Golden Abundance'- Very vigorous grower, flowering, and berries.

'Mayhen strain'- A nice dwarf form that comes true from seed. Leaves are separated farther apart than usual.

'Smaragd'- A nice intermediate form with dark emerald green foliage that turns brozy-purple during the winter (Kelly, 1995).

Mahonia nervosa- Nice low growing native that stays evergreen and spreads by under ground suckers. Grows to a height of 12"-24" (Kruckenberg, 1992). Place in the "Forested Ridge" or "Valley Bottom", but not placed in to shady of a spot. Will grow in a shady spot, but tends to inhibit flowering and fruiting. Ethnobotany: Berries eaten in low quanitities. Bark and roots used to make yellow dyes.

Mahonia repens- Another evergreen groundcover type that is even lower growing. Grows under 12" in height (Kruckenberg, 1992). Place in the "Forested Ridge" or "Valley Bottom", but not placed in to shady of a spot. Will grow in a shady spot, but tends to inhibit flowering and fruiting. Ethnobotany: Berries eaten in low quanitities. Bark and roots used to make yellow dyes.

X Mahoberberis (Mahonia x Berberis)- This group is the result of an intergeneric cross. More of a collector plant than for commercial trade (Dirr, 1990). All cultivars would do well in an open site in the "Forested Ridge" or "Valley Bottom" areas.

> ***X M. aquicandidula*** (M. aquifolium X B. candidula)- Glossy green leaves that are compound pinnate. Foliage turns a bright red in winter, sometimes red-purple. Grows 3-6' (Dirr, 1990)
>
> ***X M. aquisargentii*** (M. aquifolium X B. sargentiana)- Grows to 6' with glossy single or compound pinnate leaves on the same plant (Dirr, 1990).
>
> ***X M. miethkeana***
>
> ***X M. neubertii*** (M. aquifolium X B. vulgaris)- Dull green leaves that are pinnate. Grows to 6' (Dirr, 1990).

Malus fusca- A native crab apple in this state. Produces small yellow-red fruit. Known for its good fall colors of yellows and reds. Tolerant of moist and dry soil types. Best placed in a sunny position for maximum fruit production, but can be grown in partially shaded sites. Usually grows as a small tree ranging in height of 15-30'. (Kruckenberg, 1992). Can be used in the "Forested Ridge", "Valley Bottom", and "Wetland Zone". Will flower and fruit in a semi-sunny position. Ethnobotany: Fruits eaten. Bark used in medicinal preparations.

Menziesia ferruginea- Commonly referred to as Fool's Huckleberry. Grows in moist forest areas and can reach 6' in height. Produces small bell shaped yellow flowers. Has great fall color of red and yellow (Whitney, 1989). Likes moist site and would do well in the "Valley Bottom" and "Wetland Zone". Ethnobotany: Leaves were eaten. Leaves and twigs used to make a tea.

Myrica californica- Evergreen leaves with aromatic scent when broken. Tolerant of shade or sun. Grows to a height of 6-12' (Kruckenberg, 1992).

Myrica gale- Bushy low growing shrub to 5'. Foliage has a pleaseing fragrance (Kruckenberg, 1992). Like wet site and can be placed in the "Valley Bottom" or "Wetland Zone".

Oplopanax horridum - Named rightly as devil's club. Sharp thorns all the way up the stem and even spines on the leaves. Large flower spikes of white are followed by red fruit. Goes well in wet areas and gives a tropical look to the landscape. Can grow to 10 feet in the right conditions. Likes spots with continuous water, so place in the "Wetland Zone". Ethnobotany: Heavily used by most aboriginal people. Medicinally important. Mix with other plants to make a dye. Wood used to make fishing lures. (Native Plant Workbook , 2004)

Oemleria cerasiformis- The indian plum has a shrubby growth habit and suckers. The plant is covered by clusters of whitish-yellow flower early in the spring, then followed by bluish-purple berries (Kruckenberg, 1992). Nice native for the background of natural beds. Place in any zone, except the "Alpine Zone". Ethnobotany: Berries eaten. Twigs and bark had medicinal uses.

Paxistima myrsinites- An interesting Buxus look alike. Mountain Lover forms dense evergreen shrubs that grow to 2-3'. Can grow in open to forested sites (Kruckenberg, 1992). Place in the "Forested Ridge" or a sunny edge of the "Valley Bottom" area.

(Photo: Oregon State University, 1999-2004)

Philadelphus lewisii- Good display of four-petaled white flowers from May to June. Nice sweet smell. Can grow in varied conditions from dry area to stream banks (Kruckenberg, 1992). All cultivars flower best with lots of sun. Place in the "Forested Ridge" area in open spots. Ethnobotany: Wood used to make bows, arrows, and various tools. Leaves and flowers to wash skin.

(Photo: Oregon State University, 1999-2004)

'Blizzard'- (Hill, 2004)

'Cheyenne'- (Hill, 2004)

'Fallbrook'- (Hill, 2004)

'Goose Creek'- (Hill, 2004)

'Mount Tahoma'- (Hill, 2004)
'Waterton'- (Hill, 2004)

***Philadelphus lewisii* var. gordonianus** - A coastal variation of the species.

Physocarpus capitatus- Arching shrub with peeling brown bark. Likes wet sites along streams and lakes, but can grow in drier areas. Produces clusters of white flowers in spring. Place in the "Forest Ridge", "Valley Bottom", or "Wetland Zone". Ethnobotany: Bark used in medicines.

Picea engelmannii- Large narrow pyramidal growth habit can reached heights of 100'. Likes deep rich soils and does well with extra moisture (Whitney, 1989). Best to place all cultivars in the "Forested Ridge" site unless they are dwarf forms, then place in "Alpine Zone". Ethnobotany: Inner bark and young shoots eaten. Pitch chewed and used in medicines. Roots twined together to make waterproof hats and other uses.

'Blue Softie'- (Hill, 2004)

'Bravo'- (Hill, 2004)

'Bush's Lace'- (Hill, 2004)

'Compacta' - (Hill, 2004)

'Hoodie' - (Hill, 2004)

'Snake' - (Hill, 2004)

'Snake II' - (Hill, 2004)

'Stanley Mountain'- (Hill, 2004)

'Swan Creek' - (Hill, 2004)

'Vanderwolf Blue' -(Hill, 2004)

Picea sitchensis- The Sitka Spruce has very prickly needles. Generally will grow over 100' and has a straight upright growth habit. Branches grow out horizontally with secondary branches weeping downward (Kruckenberg, 1992). Place in "Forested Ridge" area or in the "Wetland Zone". Ethnobotany: Inner bark and young shoot eaten. Pitch chewed and used in medicines. Roots twined together to make waterproof hats and other uses.

'Compacta'- Good dwarf form that attains an ultimately 3-6' height. Wide spreading branches (Krussman, 1985). Can be placed in the "Alpine Zone".

'Microphylla' - A very dwarf form that is upright growing. Only will grow to 1' in 10 years. Needles have a fine appearance (Krussman, 1985). A great candidate for the "Alpine Zone".

'Papoose'- A dwarf form that has unusual coloring in that the needles are green on one side and silver-blue on the other. The needles look like puffballs at the tips of branches. Good choice for the alpine garden. Slow grower. Another great candidate for the "Alpine Zone".

(Photo: Oregon State University, 1999-2004)

'Sugar Loaf' - A compact dwarf plant that grows only about 3" a year. The leaves are blue-green. Best placed in the "Alpine Zone".

'Virgata' - (Hill, 2004)

Pinus albicaulis- The Whitebark Pine is not widely used compared to its eastern counterpart. Not a large tree. Only growing to 30-50' in height. Bark has a nice white color on younger parts of the tree (Kruckenberg, 1992). Plant in the "Forested Ridge" zone. Ethnobotany: Bark used in teas and to make baskets. Pitch chewed for medicinal purposes and used to waterproof items.

'Flinek'- A dwarf form of the species (Krussman, 1985). Best planted in the "Alpine Zone".

'Nana' - Small dwarf form of the species. Best planted in the "Alpine Zone".

'Noble's Dwarf' - (Hill, 2004).

***Pinus contorta* var. contorta**- Usually a bushy pine to 25-30'. Generally has a contorted shape. Common to coastal areas, but does occur in Puget Sound Prairies. Can take wet locations. Plant in the "Wetland Zone" or "Forested Ridge" areas. Ethnobotany: Roots twisted into rope. Pitch and bark used in medicines. Pitch used to waterproof canoes.

'Chief Joseph'- Dwarf evergreen tree with a conical growth habit. Green needles in summer and golden-yellow needles in the winter months. A larger tree for the transition area between the "Alpine Zone" and the "Valley Bottom" areas.

(Photo below: Oregon State University, 1999-2004)

'Compacta'- Nice dense growing type with dark green needles (Krussman, 1985). Plant in the "Alpine Zone".

'Frisian Gold'- Very dwarf habit. Largest know specimen only 2' by 2'. Has a yellow-green appearance with second year growth golden-yellow (Krussman, 1985). Plant in the "Alpine Zone".

'Spaan's Dwarf'- This interesting dwarf form of the shore pine that grows along the coast of Oregon and Washington has an unusual growth habit and very short needles. Best grown in the "Forested Ridge" area.

'Wilson's Weeper'- (Hill, 2004)

***Pinus contorta* var. latifolia**- The tall growing variation. Reaching heights of 60-80'. Tall, straight, and narrow in growth habit (Kruckenberg, 1992). Best placed in the "Forest Ridge" zone. Ethnobotany: Roots twisted into rope. Pitch and bark used in medicines. Pitch used to waterproof canoes.

'Taylor's Sunburst'- A broadly conical tree that is medium height. Needles are yellow-green with the spring growth appearing as bright gold candles. A real eye catcher.

***Pinus contorta* var. murrayana**- This variation grows 50-70' in height. The only real difference is the bark never takes on a furrowed appearance (Krussman, 1985).

Pinus monticola- The white pine grows to a height of 120'. Grows in moist to dry locations. Best sited in the "Forest Ridge" area. Ethnobotany: Same as *P. albicaulis.*

'Minima'- A dwarf form with blue-green needles (Krussman, 1985).

'Pendula'- A great pendulous variety. Heavily weeping top and branches. Can be staked for additional height or left alone to grow as a ground cover. Would be an interesting plant to train along pathways on a post system.

'Skyline'- Similar growth habit of type, but has good blue-green needles (Krussman, 1985). Best sited in "Forested Ridge" area.

Pinus ponderosa- Long needle pine that grows in dry areas. Grows 100'-200' in height (Dirr, 1990). Best in the "Forested Ridge" zone.

'Black Hill'- (Hill, 2004).

'Dixie'- A nice round dwarf cultivar. Needles have a yellowish-green appearance. Place in the "Alpine Zone".

(Photo: Oregon State University, 1999-2004)

'Pendula' - The main trunk is upright, but has branches that weep (Krussman, 1985). Like a sunny site. Place in the "Alpine Zone" where it will not cover alpine plants.

'The Sphinx'- (Hill, 2004).

Potentilla fruiticosa - At least 80 cultivars known. To many to list here. Generally a bushy shrub that gets about 3-4' high and usually wider. The species has 1" yellow buttercup flowers in June. A tough plant for the sunny border (Dirr, 1990). Place cultivars in any sunny well drained site in the "Forested Ridge" or "Valley Bottom".

'Red Ace'- Similar growth habit as type, but has a unique color. Many other good forms in this color.

'Tangerine'- Same growth habit as species with a nice two-toned flower.

(Photos from: Fa. C. Esveld)

Prunus virgiiana - Common throughout the woods. It can either grow as a large shrub or tree. Grows 25-35'. White spring flowers are followed by reddish-purple berries (Kruckenberg, 1992). Loved by birds. Place in the "Forested Ridge" zone under the canopy of larger trees. Ethnobotany: Peeled bark used for baskets and wrapped around tools to secure parts, such as harpoons and arrows.

'Melanocarpa' - One of our natives that came back from Europe improved. Bushy shrub that is covered by white flowers and later purple fruit. Heavy producer. Place in a sunny spot for best fruit production. Not suitable in wet sites.

'Schubert'- Nice dense habit. The leaves come out the standard green, but change to a reddish-purple later in the season (Grant, 1990). Place in a sunny spot for best fruit production. Not suitable in wet sites.

'White Fountain'- Produces a profusion of white flower. Place in a sunny spot for best fruit production. Not suitable in wet sites.

Pseudotsuga meniesii- Our main timber tree in this region. Can grow to 300' in the wild. Has dark green needles. Good furrowed bark. Place in the "Forested Ridge" area. Ethnobotany: Bark used for fire wood. Wood used to make tools. Pitch used in medicinal preparations.

'Aureavariegata' - Yellow needled form of the type. . Place in the "Forested Ridge" area.

'Dusek's Broom'- A dwarf witches broom with densely packed branches and a rounded habit (Dusek, 2004). Good for the "Alpine Zone".

'Dusek's Weeper' - One of the many weeping forms (Dusek, 2004). Can grow large, so best placed in the "Forested Ridge" zone.

'Elegans'- Upright habit to 25-35' in height. Branches tend to be pendulous and densely needled (Krussman, 1985). Place in the "Forest Ridge".

'Fastigiata' - Spire like growth and densely branched. Needles are greenish-gray (Krussman, 1985). Place in the "Forested Ridge" area.

'Flecheri'- Great dwarf form with blue-green foliage. Only grows to 6' and has compact spreading top too (Krussman, 1985). Can be placed in the "Alpine Zone".

'Fournier's Greenspire'- With a pyramid shape, this is a very compact, dwarf variety. The stems seem to contort slightly. Has regular green needles. Best planted in the "Alpine Zone".

'Fretsii'- Only grows to 15' with broad conical growth habit. Branches tend to spread outward (Krussman, 1985). Can be placed in an open site in the "Valley Bottom" or "Forest Ridge".

'Glauca Fastigata' - Good glaucous coloring on blue-green needles. Narrow growth habit.

'Glauca Pendula' - Nice glaucous needles and has pendulous branches too (Krussman, 1985).

'Graceful Grace'- (Hill, 2004)

(Photo: Iseli Nursery, 2004)

'Hendricks Park'- Dwarf form. Best sited in the "Alpine Zone".

'Hess Select' – 'Hillside Gold'

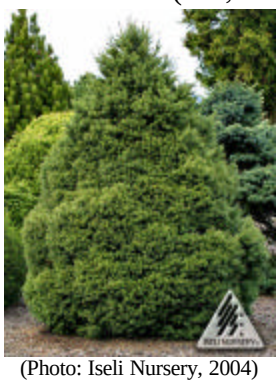
'Hillside Pride' - (Hill, 2004).

'Hupp's Weeping'- (Hill, 2004).

'Idaho Gem'- (Hill, 2004).

'Idaho Weeper'- (Hill, 2004).

'Little Jon' - (Hill, 2004).



(Photo: Iseli Nursery, 2004)

'Loggerhead' - (Hill, 2004).

'Mossman Pendula' - (Hill, 2004).

'Pumila'- This plant has a dwarf globe habit. Leaves are blue-green. Grows about 3" per year (Dusek, 2004). Great one for the "Alpine Zone".

'Salmon Creek' - (Hill, 2004).

'Seattle Mountain' - (Hill, 2004).

'Shorty's Weeper'- An upright form with weeping branches. Can grow 2' a year. Originally found in Ridgefield, WA (Dusek, 2004). Best planted in "Forested Ridge", due to its rapid growth habit.

'Skyline'- Good blue-green needle color. Growth same as type (Dusek, 2004).

'Tempelhof Compact'- Nice compact dwarf form with a rounded habit. Densely branched (Krussman, 1985). Can be placed in the "Alpine Zone".

'Wind Surfer'- (Hill, 2004).

***Pseudotsuga menziesii* var. glauca**- A blue needled form found in the Rocky Mountain area. Slow growing. Eventually forms a conical, compact, narrow crown (Krussman, 1985). Best sited in a sunny location in the "Forested Ridge" for best needle color.

(Photo: Oregon State University, 1999-2004)

Quercus garryana - One of the farthest growing northern oaks. Common to dry areas and grass lands in our area. Produces acorns that are loved by squirrels and other wildlife. Grows around 50-75' in height (Whitney, 1989). Best sited in a well-draining soil within the "Forested Ridge" zone. Ethnobotany: Acorns were eaten after soaking. Bark used for medicine preparation.

Quercus garryana var. breweri- A shrub form of the Garry Oak. Place in the "Forested Ridge" zone. Several exist there already and seem to handle the semi-shady positions. Ethnobotany: Acorns were eaten after soaking. Bark used for medicine preparation.

Rhamnus purshiana - Growing in the under-story of larger trees usually. Small whitish-green flower produces clusters of purple-black fruit. Loved by many birds. Plant it away from walking areas, due to the fruit can stain cement and cloths. Plant in the "Forested Ridge" or "Valley Bottom" areas. Ethnobotany: Bark used as a laxative and medicinally. (Photo: Oregon State University, 1999-2004

Rhamnus purhiana **var. arbuscula**- A bush form that is found in eastern Washington (Kruckenberg, 1992).

Rhododendron albiflorum- Grows in moist forests at montane to sub-alpine elevations. Generally a small shrub, but in some areas grows to 5' in height. Usually flowers in late June to July (Strickler, 1993). Ethnobotany: Leaves used in a medicinal tea. Buds chewed for medicinal purposes.

(Photo by:Thayne Tuason)

'Albion'- (Hill, 2004).

Rhododendron macrophyllum - The best flowering shrub native to the state. Large pink blossoms typical of rhododendrons. The growth habit tends to be leggy. Like to grow in the understory of coniferous forest. Place in the "Forested Ridge" or "Valley Bottom" zones.

'Albion Ridge'-(Hill, 2004).

'Seven Devils'-(Hill, 2004).

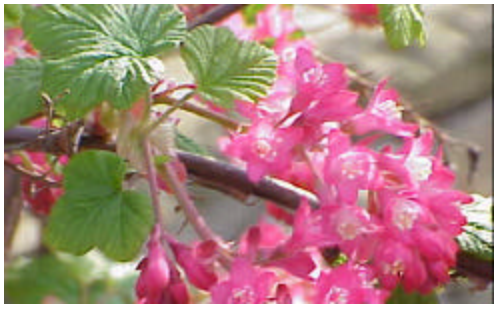
Ribes bracteosum - An aromatic currant that tends to grow in moist sites. Interesting blue berries have a whitish coating. Flowers not of much interest (Kruckenberg, 1992). Plant in the "Valley Bottom". Ethnobotany: Berries eaten for food by most local aboriginal peoples.

Ribes lacustre - Straight brown fuzzy looking prickles cover this shrub. Grows well in swampy conditions, but just at home in drier locations. Branches tend to root, forming large colonies. Heavy crops of black gooseberries. Grows to 5' in height (Kruckenberg, 1992). Best planted in the "Wetland Zone", but can be grown in the "Valley Bottom". Ethnobotany: Berries eaten for food.


(Native Plant Workbook, 2004)

Ribes viscossimum - A shrub from more montane areas, growing 2-4' in height. Interesting fuzzy bluish-black berries that are very stick when touched. The whole plant has the same gummy substance excreting from it. Place in the "Alpine Zone", "Forested Ridge", or "Valley Bottom".

Ribes sanguineum - Great red flowers adorn this shrub in spring. Likes a sunny position in the garden, but flowers in partial shade also. All cultivars best suited for open spots in the "Forested Ridge" and "Valley Bottom". Ethnobotany: Berries eaten for food.



'Albescens'- (Hill, 2004).

'Brocklebankii'- A great yellow leaved sport that fades to green during summer. Pale pink flowers (Dirr, 1990).

'Claremont' - (Hill, 2004).

'Crocker-Kline White' - (Hill, 2004).

'Elk River Red'- More vigorous than species and produced even more red flowers than usual.

'Gibson' - (Hill, 2004).

'Hannaman White' - (Hill, 2004).

'Henry Hennaman'- (Hill, 2004).

'Inverness White'- (Hill, 2004).

'King Edward VII'- Nice compact grower to 6' and has good red flowers (Dirr, 1990).

'Mesa Red' - (Hill, 2004).

'Pokey's Pink' - (Hill, 2004).

'Pulborough Pink' - (Hill, 2004).
'Spring Showers'- (Hill, 2004).

'Spring Snow'- (Hill, 2004).

'Strybing Pink' - (Hill, 2004).

'Tranquillon Ridge' - (Hill, 2004).

'Variegatum'- (Hill, 2004).

'White Icicle'- A great pure white flower form.
(Photo above: Oregon State University, 1999-2004)

Rosa gymnocarpa- Known as the Baldhip Rose. Not as prickly as the other native roses. Good crops of hairless red rose hips after pink flowers in spring. Bushy habit to 5' tall (Kruckenberg, 1992). Place in the "Forested Ridge" or "Valley Bottom". Ethnobotany: Leaves used to make a tea. Dried leaves and bark used to smoke. Rosehips eaten.

Rosa nutkana - Nice large pink blossoms followed by large rose hips. Armed with large prickles. Can grow in varied conditions (Kruckenberg, 1992). Place in the "Forested Ridge" or "Valley Bottom". Ethnobotany: Young shoots and rosehips eaten. Bark used in a tea and for medicines.

Rosa woodsii- Smaller pink flowers than R. nutkana. Small leaved (Kruckenberg, 1992). Place in the "Forested Ridge" or "Valley Bottom".

(Photo from: TAMU Herbarium)

Rubus parviflorus- Maple like leaves that are soft to the touch. Makes large suckering colonies. Nice white blossoms followed by red tart fruit (Kruckenberg, 1992). Can grow in the "Forested Ridge" or "Valley Bottom". Ethnobotany: Thimbleberries and young shoot were eaten. Leaves used to make berry picking containers.

Rubus spectablis- Great plant for wet areas. Tolerant of shade. Suckering colonies armed with thorned stems. Pink flowers and yellow, orange, red, to purple fruit (Kruckenberg, 1992). Can be placed in the "Wetland Zone" or "Valley Bottom". Ethnobotany: Young sprouts and berries eaten.

'Double Flower Form'- Similar growth habit with double flowers (Thimblefarms, 2003)

Salix hookeriana- Grows as a tree or large shrub. Nice display of catkins in early spring. Oval leaf shape. Prefers to grow by wet sites. Grows to a height of 15-20' (Kruckenberg, 1992). Can be placed in the "Wetland Zone" or "Valley Bottom". Ethnobotany: Inner bark used to make fishing line and nets. Bark used in baskets.

Salix scouleriana- A willow that can grow in dry or wet areas. Leaves are oval with a tapered base. Catkins are showy compared to other willows. Mature height from 6-36' (Kruckenberg, 1992). Can be placed in the "Wetland Zone" or "Valley Bottom".

Shepherdia canadensis- Interesting leaves that are light green on the upper side, but a fuzzy silver with brown spots on the undersides. Can tolerate poor soil sites and requires little care (Kruckenberg, 1992). Best suited for drier sunny sites in the "Forested Ridge" or "Valley Bottom". Ethnobotany: Fruit eaten and made into "Indian ice-cream".

(Photo: Oregon State University, 1999-2004)

Sorbus sitchensis- The Sitka Mountain Ash generally grows at higher altitudes. It flowers white and is followed by large clusters of red fruit. (Grant, 1990). Very popular to local birds and wildlife. Best sited in "Forested Ridge". Ethnobotany: Berries eaten seldom.

Spirea douglasii- Great plant for wet and boggy sites. Intense pink flower display. The growth habit is dense and sucker to form large colonies. Best used in wild areas of the landscape. Plant in the "Wetland Zone". Ethnobotany: Twigs used to make a tool to collect dentalia shells.

Spirea X pyramidata (S. douglasii x S. betulifolia)- An interesting cross with the Birchleaf Spirea. Plant in the "Wetland Zone".

Symphoricarpos albus- A tough shrub for almost any situation. Grows to a height of 2-5'. "A favorite for restoration" (Kern Ewing). Produces crops of inedible white fruit. A good plant for wildlife. All cultivars can be planted in the "Forested Ridge", "Valley Bottom", and "Wetland Zone". Ethnobotany: Very seldom eaten. Considered poisonous.

'Aureovarigatus'- Cream-yellow variegation of typical plant.

'Constance Spry' - Produces a good crop of large round berries.

'Tilden Park'- A bushy selection with bright clean foliage, and a reliably heavy crop of large berries. Named after the botanical park it was found in.

'Variegatus'- Variegated form of the species.

(Photo from: Fa. C. Esveld)

Taxus brevifolia- A good shade tolerant conifer species that produces red berry fruits (Klinka, 1989). Ethnobotany: Hard wood was used for making many tools. Fleshy seed was eaten. Needles used for smoking.

'Nana'- A dwarf form of the species. Growth requirements the same as species (Dusek, 2004). Can grow in "Alpine Zone" in a shady spot if possible.

Thuja plicata- The Western Red Cedar is a dense growing tree with a pyramidical growth habit. Branches arch outward with secondary branches sagging downward. Grows well in wet areas and likes extra moisture (Dirr, 1990). Ethnobotany: One of the most important trees in the region to local aboriginal people. Bark was peeled and made into cloths, blankets, hats, towels and baskets. Young roots made into baskets. Branches made into rope and fish traps.

'Doone Valley'- A slow upright growing conical bush with orange, bronze and green variegation (Dusek, 2004).

'Excelsa' - A columnar form. The branches spread horizontally (Krussman, 1985). Fast growing type, best used in the "Forested Ridge" zone.

'Holly Turner'- A nice weeping form of our native red cedar. Produces far spreading lateral branches that weep downwards. Never forms a leader (Heronswood Nursery, 2004)

'Gruene Kegel'- A flat dwarf growth habit. Foliage is dark green with purple overtones in the winter (Dusek, 2004). Can be used in edges of the "Forested Ridge" area.

(Photo: Oregon State University, 1999-2004)

'Rogers Aurea Sport'- A dwarf form with bright golden-yellow color. The slow growing irregular habit is then shaded with a bronzy hue at the end of the season. Can be used in the "Alpine Zone".

'**Rogersii'**- A round shaped dwarf form. Yellowish tip growth on young shoots. Grows no more than 5' in height (Krussman, 1985). Can be used in the "Alpine Zone".

'Spring Grove'- Fast growing cultivar to 20' forming a conical shape of green foliage year around. Place in the "Forested Ridge" zone.

'Stoneham Gold'- A semi-dwarf upright shrub growing only to 7' at the most. New growth is a bronze-yellow later changing to the typical green; except for the ends stay a golden yellow (Dirr, 1990). Place in the "Forested Ridge" zone.

(Photo: Oregon State University, 1999-2004)

'Sunshine'- A yellow form of the Western Red Cedar. Upright growing with an open growth habit. Brightens up a landscape (Dusek, 2004). Place in the "Forested Ridge" zone.

'Watnong'- A broad upright spreading form with dense branching. Attains a 50' height. A fast grower. (Heronswood Nursery, 2004) Place in the "Forested Ridge" zone.

'Zebrina' - A yellow variegated form. Some plants are zebra striped, while others display a gradual blending of colors. In winter, the green takes on a bronze appearance which blends very nicely with the gold. Can grow to 40' in height. (Heronswood Nursery, 2004). Place in the "Forested Ridge" zone.

(Photo: Oregon State University, 1999-2004)

Tsuga heterophylla - A good tree for a shady spot. Has short soft needles and arching branches. Place in the "Forested Ridge" site. Dwarf form best sited in open areas. Ethnobotany: Wood used for making tools. Plant used to make dyes, medicines, tanning, and cleansing.

'Argenteovariegata' - New shoots are silvery-white (Krussman, 1985).

'Conica' - A dwarf form to 10' in height. Dense branches are downward facing (Krussman, 1985).

'Dumosa' - A densely branched compact dwarf growing a little over 3'. Short branching pattern (Krussman, 1985).

'Iron Springs'- Found in Iron Springs, WA. A good shade tolerant tree, has a neat conical habit with many horizontal branches. The needles are shorter than the type (Dusek, 2004).

'Ray Godfrey' - (Hill, 2004).

'Thorsen's Weeping' - A prostrate mat grower. Foliage is green and has typical needles of the species.

Tsuga mertensiana - Mountain hemlock is a slow-growing tree. Suited for smaller areas, but will eventually attain a large size usually 75-125' (Kruckenberg, 1992). All cultivars should be planted in sunny spots for best needle color. Can be used in the "Alpine Zone", but eventually will get large over a long period of time.

'Argentea' - Silver needles with a similar growth habit of the type (Krussman, 1985).

'Blue Star' - A great blue needled form of the type (Krussman, 1985).

'Bump's Blue'- (Hill, 2004).

'Elizabeth'- (Hill, 2004).

'Glauca' - Blue-green needle type (Krussman, 1985).

'Glauca Fastigata'- Blue-green needles and a narrow growth habit.

'Van Winkle'- (Hill, 2004).

Tsuga x jeffreyi (Tsuga heterophylla x T. mertensiana)- A interesting cross that occurs where these two species meet in the wild. Needles similar to T. mertensiana, but the branching style of T. heterophylla. Generally a small tree. (Dusek, 2004). Best used in an open site in the "Forest Ridge" zone.

Vaccinum alaskense - A subalpine grower that is seen in coniferous forests. Produces blueberries that are darker than most native vaccinium (Pojar, 1994). Can be planted in the "Valley Bottom" and "Forested Ridge". Ethnobotany: Berries were eaten.

Vaccinum membranaceum - A mountain native that produces tasty blueberries. Grows 3-5' tall. Likes wet sites and would do well in the "Wetland Zone" or "Valley Bottom". Ethnobotany: Berries were eaten.

Vaccinium ovatum- A good shade tolerant shrub with evergreen leaves. Produces edible blueberry like fruit. Can grow under coniferous forest or out in open sites on drier sites (Kruckenberg, 1992). Can be used in the "Forested Ridge" or "Valley Bottom" sites. Gets to large for use in the "Alpine Zone". Ethnobotany: Berries were eaten.

'Thunderbird'- Attractive new growth, this evergreen huckleberry produces large crops of tasty fruit compared to the species (Thimblefarms, 2003)


(Thimblefarms, 2003)

'Thundercloud'

'6624'

Vaccinium ovatum x V. mortinia- An interesting cross with a South American Vaccinum.

Vaccinium oxycoccus - Our native cranberry. An evergreen creeping shrub that enjoys boggy sites. Best suited for the "Wetland Zone" where water is present year around. Does not want to dry out. Ethnobotany: Berries were eaten.

Vaccinium parvifolium - A deciduous shrub that grows well in shade. Produces red berries enjoyed by people and birds alike. Grows to 6-10' tall. Commonly seen growing on stumps. Ethnobotany: Berries were eaten. Leaves and bark used medicinally.

(Photo: Oregon State University, 1999-2004)

Unnamed dwarf selections - Likely a product of a witch's broom (Dusek, 2004). Pretty common site to see this abnormal growth on the standard species.

Reported variegated form - Seen in the wild, but not known in the nursery trade.

Viburnum edule - Good shrub for wet areas. Produces white clusters of flowers in spring followed by translucent red berries. Berries persist to winter when birds will finally eat them. Grows 2-10' in height (Kruckenberg, 1992). Can be placed in every zone except the "Alpine Zone". Does well in wet sites of the garden. Ethnobotany: Berries used for food. Bark used for medicinal purposes.

Viburnum ellipticum - An oval leaved Viburnum that prefers dry sites. Fruit and growth habit similar to V. edule (Kruckenberg, 1992). Best sited in drier spots of the garden. Suggested use in the "Forested Ridge" and "Valley Bottom".

(Photo: Oregon State University, 1999-2004)

PERENNIALS:

Achlys triphylla - Vanilla leaf is a great groundcover in a humus rich site. Up to 8" broad leaves are three lobed and display the white flower spikes. Can form nice colonies. Interesting addition is the leaves bead water, giving it added interest. Best suited for the "Valley Bottom" and "Wetland Zone". Ethnobotany: Leaves dried and hung to keep insects away.

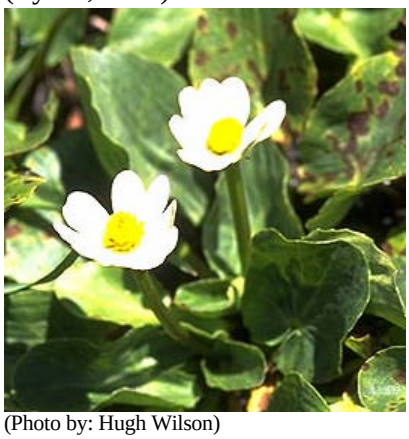
Aruncus sylvester- Goat's beard is common in wet sites along seeps and streams. The foliage is about 20" tall, but can have white flower spikes 3-6 feet in height (Pojar, 1994). Can be used in the "Valley Bottom" and "Wetland Zone". Ethnobotany: Roots and leaves used medicinally.

Asarum caudatum - Wild Ginger is a great spreading groundcover for shady humus sites. Glossy heart shaped leaves hug the ground. In spring maroon three lobed flowers are hidden under the leaves. Recommend to plant along a moist rock wall to be able to enjoy flowers up close. Best suited for the "Forested Ridge" or "Valley Bottom" zones. Ethnobotany: Roots were eaten. Leaves used in medicinal teas and other medicines.

(Photo by: Jake Pool)

'Alba' - Same growth pattern as species, but flowers are white.

Caltha biflora- White flowers in spring. Similar in growth to C. paulustris ssp. Asarifolia (Lyons, 1997). Best suited for the "Wetland Zone". Ethnobotany: Plant was cooked and eaten.



(Photo by: Hugh Wilson)

Caltha paulustris ssp. asarifolia - Great plant for wet seepage areas. Yellow flowers produced in spring (Pojar, 1994). Creeping stem helps to make a sizable colony. Best suited for the "Wetland Zone".

Camassia leichtlinii- A great lily for open moist sites in meadows. Can grow to 2 feet in height and is topped by flowers from cream to deep blue (Dusek, 2004). All cultivars and species can be used in the "Alpine Zone" or open sunny spots in the "Valley Bottom". Prefers a well-drained soil.

'Alba' - White flowering form.

'Blue Danube'- Sea lavender blue flowers (Thimblefarms, 2003).

'San Juan'- Dark blue flowers compared to type (Thimblefarms, 2003).

'Semi-plena' - Semi-double form with light cream colored flowers.

Camassia quamash - Flower from light blue to dark purple. White forms do occur. Very impressive when planted in masses. Meadows can look like a sea of blue when it flowers in its native habitat. Grows in moist meadows to dry prairies. All cultivars and species can be used in the "Alpine Zone" or open sunny spots in the "Valley Bottom". Ethnobotany: Bulbs were eaten.

(Photo by: James Reveal)

'Blue Melody' - Variegated foliage with typical blue flower.
'Orion' - Nice dark violet blue flower (Thimblefarms,2003).

'San Juan' - Darker blue than species (Thimblefarms,2003).

Dodeecatheon jeffreyi - Shooting Star grows in wet meadows in higher elevations. Interesting group of flowers that have petals that bend backward exposing the centers. Flowers are usually reddish-purple with lighter colored centers (Lyons, 1997).

Goodyera oblongfolia - Rattlesnake plantain is a wonderful plant in deep coniferous sites. The white variegated foliage can vary a lot from plant to plant. The leaves are a real eye catcher.

(Photo by: Jake Pool)

Iris tenax - A good iris for normal soils. Purple and white flowers are produced from April to June. Ethnobotany: Leaves braided to make traps.

Iris tenax var. gormanii - A pale yellow flowered form of the species.

Lilium columbianum - A brown spotted orange flowering lily found in conifer forests to open meadow sites. The flowers fold all the way behind their base. Can grow 2 to 6 feet. Ethnobotany: Bulbs eaten for food.

Maianthemum dilatatum - Glossy heart shaped leaves and nice short white flower spikes. Form large expansive colonies in the woodland forest. Likes moist forest conditions. Best planted in the "Wetland Zone" or wet sites in the "Valley Bottom". Ethnobotany: Leaves and roots used for medicinal purposes.

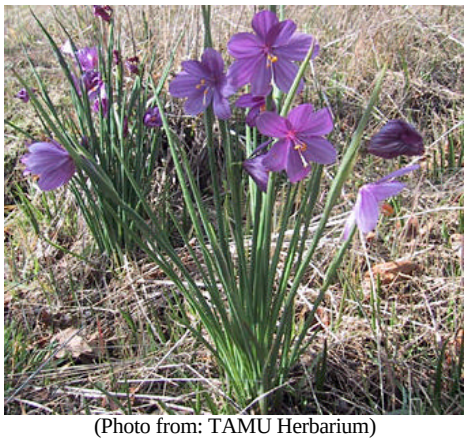
'Variegated Form'- Very slow growing. Leaves and stems are half-white and green. Has not been brought to the nursery trade.

(Photo by: Jake Pool)

Oxalis oregana- Makes a nice groundcover of clover leaves and produces a nice white flower that is often veined purple. Can become rampant, but is excellent for use under the shady forest shrubs and trees. Use in the "Wetland Zone" and "Valley Bottom". Ethnobotany: Leaves were eaten for food.

Sisyrinchium californicum - Yellow-eyed grass is common to wet meadows. Easy to grow. Plants have little yellow star shaped flowers produced on miniature iris like foliage. Does re-seed when happy. Plant in sunny spots in the "Wetland Zone" and "Valley Bottom".

Sisyrinchium douglasii- Douglas blue-eyed grass has grass-like leaves. The flowers appear in March through May. Colors for species are usually purple-blue. Can be grown in the "Alpine Zone" or sunny positions in the "Valley Bottom".



(Photo from: TAMU Herbarium)

'Pink Form'- Pink flowering form.

'White Form'- White flowering form.

Sisyrinchium macounii- Blue-eyed grass is seen more often than S. californicum. Grows in wet areas. Similar growth habit as S. californicum. Site in the sunny areas of the "Wetland Zone".

Smilacina racemosa- A large growing perennial that can reach heights of 40". Clusters of white flowers are followed by red berries in the fall (Kruckenberg, 1992). Likes a moist soil in open woods. Best suited for the "Valley Bottom", but can handle wetter sites in the "Wetland Zone". Ethnobotany: Roots used for medicinal preparations.


(Photo from: TAMU Herbarium)

Smilacina stellata - Great little groundcover for the woodland setting. Arching stems have small star shape flowers on the ends, later produces little green berries striped red. Can spread using underground rhizomes. Grows 8-20" in height. Plant in the moist forest sites of the "Valley Bottom' and "Wetland Zone". Ethnobotany: Berries eaten for food.

Tiarella trifoliata - Foam flower is an easy to grow native that produces foamy looking white flowers. Re-seeds and forms colonies in the shady forest. Site in the "Forested Ridge" and "Valley Bottom". Not well suited for wet sites.


(Photo by: James Manhart)

Trientalis latifolia - Western Starflower is a good groundcover species that occurs in shady woods. Grows only 4-8" in height. Whorls of 5 leaves help display pink to white flowers of 1-4 (Ross, 1988). Seems to like drier forest sites. Place in the "Forested Ridge" and "Valley Bottom".

Trillium ovatum - A great spring flowering native. White three petaled flowers are produced around Easter time if not earlier. Flowers later change to purple with age. Likes the shade of the forest and humus soil. Many types of double forms exist, but many not named properly. All types can be grown in the "Forested Ridge", "Valley Bottom, and "Wetland Zone". Best placed within view of paths.

'Edith'- A complete double flowering type. Gardenia form. Has a vigorous growth habit. Flowers open white with a cream center, ages to a deep pink. Originally found in Boston Harbour, WA (Dusek, 2004).

Trillium o. 'Del Norte' (T. ovatum X T. rivale)- Produces a plant with large pink T. rivale like flowers. A reverse of this cross is reported also, but no description known of. (Dusek, 2004).

Trillium o. var. hibbersonii- Is a dwarf form of the species. Flowers a light pink and then fades to white. Found on Vancouver Island. Grows in exposed sites (Case, 2001). Could be placed in the "Alpine Zone".

Trillium o. var. maculosum- Has a unique leaf mottling, not usually seen on the species (Case, 2001).

Trillium parviflorum- A sessile form that resides in the southern part of the state. Has spicy sweet scented flowers. Similar growth as T. ovatum (Dusek, 2004). Can be grown in the "Alpine Zone", though not accurate as an alpine plant. Also can be placed in the "Valley Bottom" zone with partial shade. (Photo above: Jake Pool)

Vancouveria hexandra- Does well in shady forest settings and can form colonies. White flowers that are inside-out in June. Interesting groundcover for the "Forested Ridge" and "Valley Bottom" zones.

Xeropphyllum tenax- Bear grass is common in the alpine regions, but can be grown at lower altitudes. Produces 2-3' white flower spikes from June to August. Does not flower every year, but worth the wait. Place in the "Alpine Zone" or possibly suited for use in the "Forested Ridge" area in a sunny location. Ethnobotany: Leaves woven into hats, baskets, and capes.

ALPINES:

NOTE: All alpine plants listed in this section are best suited for use within the "Alpine Zone" and were selected for that sole purpose.

Anemone drummondii- Compact grower with 1" white flowers that have a blue backing (Nicholls, 2002).

Anemone occidentalis- Commonly called Old Man of the Mountain. Large fuzzy seed head produced after large white flowers. Almost all parts of this plant are hairy. Nice looking plant in the morning dew or rain.

(Photo by: James Manhart)

Antennaria media- Very compact grower with white blooms. Makes a nice wooly mat (Dusek, 2004)

***Arenaria* sp.**

'Blue Cascade'- Mat forming. Blue foliage that is needled shaped. Flowers white (Mt. Tahoma Nursery, 2004).

Arenaria obtusiloba- Nice tight mat grower. Flowers white with a violet blush (Lupp, 2004).

Arenaria rubella

'Popcorn'- A double white flowering plant. Forms a mat of needle like foliage (Mt. Tahoma Nursery, 2004).

Cassiope mertensiana- Makes large spreading mats of evergreen thread growth. White bell-shaped flowers (Nicholls, 2002).

(Photo by: James Manhart)

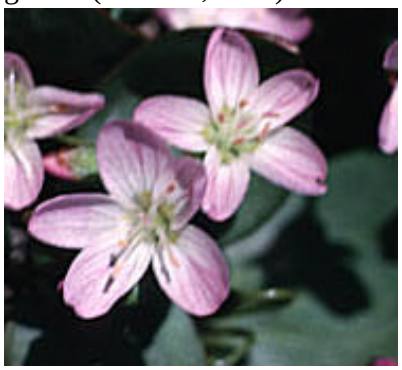
'Mendenhall'- Thick green foliage with large white flowers compared to type (Mt. Tahoma Nursery, 2004).

'Pink'- Pink flowering form (Mt. Tahoma Nursery, 2004)

Cassiope mertensiana x C. lycopodiodes

'Muirhead'- Gray-green foliage with lots of white blossoms twice a year. Once in April and then in the fall (Lupp, 2004)

Claytonia lanceolata - Nice white or pale pink flowers in spring. Prefers a moist site in the alpine garden (Strickler, 1993).



(Photo by: James Reveal)

Claytonia megarhiza var. nivalis - Slow grower that produces a rich pink flower (Nicholls, 2002).

Douglasia laevigata var. ciliolata - Large pink to red flowers. Mound forming plant (Nicholls, 2002).

Douglasia laevigata var. laevigata - Dense mat former that produces large pink flowers in spring time.

'Packwood'- Forms dense mounds instead of mats (Mt. Tahoma Nursery, 2004).

Douglasia laevigata X D. montana - Heavy bloomer of pink flowers. Makes a tight mat plant (Mt. Tahoma Nursery, 2004).

Dryas drummondii- Great evergreen prostrate mat grower. Produces numerous light yellow flowers. Performs well in gravelly sites.

'Grandiflora' - Large yellow blooms that are accented by attractive foliage (Mt. Tahoma Nursery, 2004).

Dryas octopetula - White flowering mat form. Evergreen leaves.

(Photo by: Thomas Schopke)

'Minor'- miniature form of the type (Mt. Tahoma Nursery, 2004).

Dryas X suendermannii (Dryas drummondii x Dryas octopetala)- White flowering. Hardier and easier to grow than Dryas drummondii (Mt. Tahoma Nursery, 2004).

Empetrum nigrum- Crowberry is found most often in coastal areas, but does occur in montane areas as well. Leaves similar to heathers, but easily identified when the black berries are present. Does require male and female plants for best berry crops (Kruckenberg, 1992). Ethnobotany: Berries eaten for food.

***Empetrum nigrum* f. hermaphroditum**- Same growth habit of E. nigrum, but produces hermaphrodite flowers on the same plant. Does not require multiple male and female plants. Ethnobotany: Berries eaten for food.

Erigeron aureus- Bright yellow flowers with common aster shape. Dwarf perennial for the alpine garden. One of many great varieties of Erigeron.

> **'The Giant'**- Exceptionally large blooms of golden yellow. Much larger than the normal type (Mt. Tahoma Nursery, 2004).

Erigeron aureus X E. compositus

> **'Goat Rocks'**- A natural hybrid. Lemon yellow flowers on top of gray foliage (Mt. Tahoma Nursery, 2004).

Erigeron linearis- Just like a grass plant till it flowers. Produces yellow blossoms. Easy to grow. Height is 2-4" (Nicholls, 2002).

> **'Rimrock'**- A silver leaved form with bright yellow blossoms (Mt. Tahoma Nursery, 2004).

Kalmia microphylla- Dark green foliage on a dense growing shrub that produces rose-purple flowers. Grows to a height of 1-2' (Klinka, 1989). Ethnobotany: Leaves used to make a medicinal tea.

(Photo by: James Manhart)

***Lewisia columbiana* var rupicola**- Fleshy foliage with pink blossoms that are veined (Mt. Tahoma Nursery, 2004).

Lewisia tweedyi- Large pink to apricot flowers (Strickler, 1993). Considered by some as a hard to grow plant in lowland gardens (Dusek, 2004).

Loiseleularia procumbens- Alpine Azalea is usually found in the North Cascades area. A great mat forming plant with many branches. Pink bell shaped flowers are produced in early summer. An easy to grow plant for the alpine garden (Kruckenberg, 1992).

***Lupinus lepidus* var. lobii** – Low growing lupine. Suitable for rock gardens. Generally considered short-lived. Allow to re-seed to preserve in the garden setting (Kruckenberg, 1992).

Penstemon cardwellii- A low shrub to 6-24". Flowers are a nice purple color held up on 6" stems. Forms large colonies by rooting branches (Nicholls, 2002).

(TAMU Herbarium, 2004)

'Floyd McMullen'- A dwarf cultivar with purple flowers. Grows to only 2.5" in height (Nicholls, 2002).

'Roseus'- A dwarf cultivar with pink flowers (Nicholls, 2002).

Penstemon confertus- A yellow flowering penstemon.

(www.BioLab.de)

'Dwarf Form'- Compact mat former that flowers yellow (Mt. Tahoma Nursery, 2004).

Penstemon davidsonii- Purple flowering mat former. Brightens mountain cliffs in summer.

'Albus'- White flowering form (Mt. Tahoma Nursery, 2004).

***Penstemon davidsonii* var. davidsonii**- Blooms from June to August

'Mt. Adams Dwarf'- Very small grower that produces lavender-blue flowers (See above photo, Mt. Tahoma Nursery, 2004).

***Penstemon davidsonii* var. menziesii**- Evergreen carpet of foliage. During the spring to mid-summer, plants produce flowering stems of lilac-purple flowers (Nicholls, 2002).

'Broken Top Mountain'

'Microphyllus'- A very dwarf form of the species (Nicholls, 2002).

'Pink'- A pink flowering form (Lupp, 2004)

'Prostrate Form'- Low mat form of the type

'Tatoosh Treasure'- Red-purple flowering form (Mt. Tahoma Nursery, 2004).

'Tolmiei Peak'- Lavender flower form (Nicholls, 2002).

Penstemon davidsonii X P. rupicola

'Dragontail'- A product of a natural cross between the two type. Large violet-pink flowers with tiny blue-green leaves (Mt. Tahoma Nursery, 2004).

Penstemon procerus

(Photo by:James Manhart)

'Nisqually Cream'- Cream colored form (Mt. Tahoma Nursery, 2004).

***Penstemon procerus* var. formosus**

Penstemon procerus ssp. tolmiei

'Alba'- White flower with light yellow coloring (Nicholls, 2002).

'Hawkeye'- Pink and white blossoms adorn this plant (Mt. Tahoma Nursery, 2004).

'Old Snowy'- Compact grower with pure white blossoms (Mt. Tahoma Nursery, 2004). Both Hawkeye Peak and Old Snowy Mountain are within 8 miles of each other.

'Tolmiei Peak'

***Penstemon rupicola*-** Mat forming penstemon that is found in rock crevices and ridge tops.

(Photo: James Manhart)

'Diamond Lake'- Long pink flowers (Nicholls, 2002).

'Myrtle Hebert'- Low growing type with dark pink flowers (Nicholls, 2002).

'White Form'- White flowering form (Mt. Tahoma Nursery, 2004).

***Penstemon rupricola X P. cardwelli*-** Commonly found where the two species grow together.

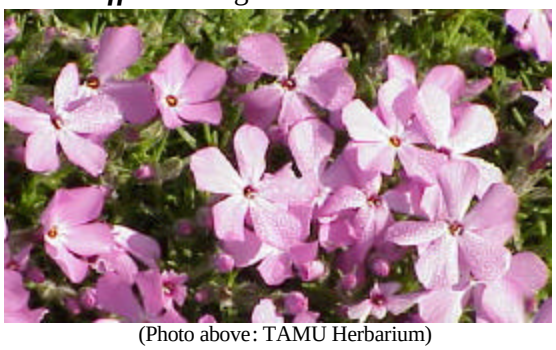
Penstemon rupicola X ?

'Puyallup Pink'- Pastel pink blossoms of unknown hybrid origin (Mt. Tahoma Nursery, 2004).

Penstemon washingtonensis- Mat forming plant with dark blue flowers. Fragrant (Nicholls, 2002).

Petrophytum caespitosum- Tiny white flowers on a mat forming plant. Likes to grow in crevices (Lupp, 2004).

Phlox diffusa- Large lavender blossoms form on needle foliage plant (Ross, 1988).



(Photo above: TAMU Herbarium)

'Goat Rocks Pink'- Pink flowering form that makes compact mats (Mt. Tahoma Nursery, 2004).

Phlox hendersonii- White to pale blue blossoms form on a dense mounding plant (Kruckenberg, 1992).

***Phlox hoodii* var. canescens** - Dense and hairy foliage produce single white fragrant blossoms (Dusek, 2004).

Phyllodoce empetriformis- Dwarf growing shrub with red-purple blooms in late spring (Mentheny, 1991).

(Photo from: TAMU Herbarium)

Phyllodoce aleutica ssp. glanduliflora (P. caerula x P. glanduliflora)

'Flora Slack'- Prostrate growing shrub with violet-red flowers (Mt. Tahoma Nursery, 2004).

Phyllodoce X intermedia (P. empetriformis x P. glanduliflora)

'Anna Barbara' - White flowered form (Mentheny, 1991)

'Drummondii'- Dark purple flowers (Mentheny, 1991).

Potentilla fruiticosa- Generally found in montane areas of the state. Bright yellow flowers light screen areas of the mountains. Grows to a height of 1.5'.

'Cascade Cushion'- Dwarf form that flowers a rich yellow (Mt. Tahoma Nursery, 2004).

***Salix arctica*-** Nice dwarf for the alpine garden. Prostrate habit and only attaining a height of 2' at most. Prefers additional water, but can take a drier sight. Long upright facing catkins (Kruckenberg, 1992).

***Salix reticulata*-** Dwarf willow commonly used in alpine gardens. Leaves have hairy undersides and a overall dark green appearance (Kruckenberg, 1992).

***Salix cascadensis*-** Another dwarf willow that has smaller leaves than S. artica (Kruckenberg, 1992).

***Sedum divergens*-** A narrow leaved form that is easy to grow with yellow flowers (Dusek, 2004). Ethnobotany: Leaves eaten for food.

***Sedum spathulifolium*-** Produces yellow flower cluster on a mat spreading succulent plant (Strickler, 1993). Ethnobotany: Leaves eaten for food.


(Photo from: TAMU Herbarium)

***Sedum stenopetalum*-** A narrow leaved type from eastern Washington. Bright yellow flowers (Dusek, 2004). Ethnobotany: Leaves eaten for food.


(Photo from: TAMU Herbarium)

***Silene acaulis*-** Nice mat forming plant (Lupp, 2004)


(Photo from: TAMU Herbarium)

'Tatoosh'- Heavy bloomer that is non-stop during growing season (Mt. Tahoma Nursery, 2004).

'White Rabbit'- White flowering form (Mt. Tahoma Nursery, 2004).

Spirea densiflora- Dwarf growing spirea with pink blossoms (Strickler, 1993).

Trillium petiolatum- A trillium found in Eastern Washington. Very low growing type. Petioles, leaves, and flowers literally come out of the ground. No stem evident. Found on exposed sites. Produces red-maroon flowers. A hard to please species, but very interesting (Dusek, 2004). Even though this is a trillium, best suited for the "Alpine Zone". Not at home in forest situations.

Plant Source List and Price List located in Appendix

Aftercare and Management

"The performance of plants in the landscape depends on how well the species are adapted to the specific environment in which they are to grow, the quality of the planting stock, preparation of the site, planting methods, and later care" (Harris, 2004). One of the most important of these is the aftercare because aftercare is such a long-term portion, and long-term maintenance is almost always required to help plants strive and survive within their new home. The goal of tree care and landscape management is healthy and safe plants. When trees and other plants are growing vigorously and possess good structure, they are attractive, safe, and function appropriately. Healthy and structurally sound plants are better able to resist environmental stress, noninfectious disorders, diseases, insects, and pests, as well as unwise cultural practices. "Such plants provide a high level of environmental function with minimal costs" (Harris, 2004). Maintenance is an essential ingredient in conserving the integrity of the design and the vitality of the plantings. Without a consistent schedule of care, a garden/site can become overgrown and sometimes unsalvageable and will require greater effort and more time to maintain (Varsi, 1994).

Maintenance can be defined as the routine, week-to-week operations involved in the upkeep of a garden, such as weeding and pruning (Varsi, 1994). Management is concerned with the long-term planning and policies regarding the organization of staff and equipment to achieve efficient maintenance. Too often, the emphasis in a garden is on the design or installation without adequate consideration for continuing maintenance (Varsi, 1994); even though the maintenance will continue as long as the garden exists. As Gael Varsi detailed in the 1994 paper about the Joseph Witt Winter Garden, there are nine key steps in a maintenance/management plan: "staff participation, an inventory of resources to be maintained, a list of tasks, a description of the tasks, the determination of standards, a setting of task frequencies, the scheduling of tasks, the implementing of the program, and monitoring of the work and schedules". These key ideas should also be followed when determining a management plan for the Native Plant Synoptic Garden once the garden has been finalized. It is very important that the aftercare and maintenance practices are monitored daily to ensure that they are being implemented properly and with detailed care to keep the synoptic garden healthy and aesthetically pleasing.

"Types of maintenance required in a garden are relative to the mission or intent of the garden" (Varsi, 1994). The proposed synoptic garden would and should require low levels of maintenance as it aims to be self-sustaining. This is because all of the plants recommended for the proposed synoptic garden have been selected for the specific environmental conditions of each area, including the cultivars; the plants are predominantly native species of Western Washington forests, therefore in a general sense they should be better adapted for self-

sustainment in the arboretum setting (Note: This does not imply that Native Plant Species will always be self-sustaining, since a setting such as the arboretum is not their natural habitat). There may only be one semi-high maintenance part of this synoptic garden, and that is the weir that runs from the Graham Visitors Center down to Duck Bay. The reason it could become a high maintenance area is that leaf and other debris could hinder water movement down the weir and create flooding of portions outside of the step area. The types of maintenance required within the synoptic garden depend on which specific portion of the garden is being looked at; for example the marsh area would require different maintenance than would the upland portion of the garden. However, there are some maintenance practices that would be common to all portions of the synoptic garden: general monitoring of plants and soil, irrigation needs, mulching, weeding, practicing integrated pest management, planting of new plants, removal of unhealthy plants, and trail maintenance.

Irrigation

According to our site analysis, drier and hotter months are characteristic of summer months in the Seattle area. With this in mind, supplemental irrigation will be needed at least during the first few years for plant establishment in the Native Plant Synoptic Garden. At the time of transplanting, plants will not have established their root systems out into the area adjacent to the planting hole. This will result in the plant or tree having limited access to soil retained water. Therefore, it is likely that depending on plant species and its characteristic water use, supplemental water will need to be provided. As noted in the installation section, watering should be provided in a way that promotes percolation of water deep into the soil. Because soils across the site have clay in their texture, they will be better at holding and retaining moisture longer; this should be helpful in extending times between watering periods. Since the proposed design is made up of zones with native plants that are adapted to various climatic conditions, monitoring of the plants, trees, and shrubs by the arboretum's grounds staff will serve as the best judge for when plants need additional water.

Currently, Washington Park Arboretum and our site specifically has irrigation lines with quick couplers installed sporadically across the site. Plants are monitored for water stress and when needed, grounds crews supply supplemental irrigation through sprinklers attached to hoses or through hand watering (Zuckerman and Stubecki, 2004). As described in the Washington Park Arboretum Master Plan, rejuvenation of the entire arboretum calls for the installation of new

mainlines running North to South. The most likely scenario for this project would be to add additional quick-couplers throughout the site for easier access to water when needed. This would eliminate the need to set up hoses that are several hundred feet in length just to reach specific plants and areas.

Weeding

Weeds are often characterized as plants that are unwanted, aggressive or harmful to people and animals (WSU and OSU, 2002). Weeds will always be a problem to some degree or another. Weeds come in the form of winter and summer annuals, biennials, and perennials; therefore weeds can appear at anytime of the year. Anytime soil is disturbed, it presents an opportunity for weed seeds to germinate and grow. For example, disturbance may bring an otherwise deeply buried seed up to an optimal area in the soil for germination and successful growth. This is particularly true for some weedy species due to the long viability of their seeds. For example, "lotus seed in Manchurian lakebeds have germinated 1,000 years after the seed was produced" (WSU and OSU, 2002). The soil will always serve as a seed bank for unwanted species, so what solutions are their for eliminating or reducing weeds? First, when installing plants and trees for the Native Plant Synoptic Garden it is important to quickly apply a mulch over the soil surrounding the new planting. "An appropriate mulch applied correctly" will help prevent weed seeds from blowing in from neighboring areas and finding a suitable place for germination (Harris et. la., 2004). Second, plant so that the canopy of shrubs and trees overlap to a certain extent; this will reduce the light available below for optimal growth of many weed species. Third, always minimize soil disturbance as much as possible (Harris et. la., 2004). Fourth, target weeds that are intolerable and elimininate them early in their growth through mechanical means such as hand pulling or hoeing, or consider chemical control if absolutely necessary. Chemical control may be best suited in helping to prepare a site for initial planting by using a non-selective herbicide to kill all unwanted weeds. Weed suppression after chemical control is best accomplished by minimizing future soil disturbance. Finally, it can't be overemphasized enough, eradicate weeds while they are young and definitely before they produce seed. Weed species are known to be extremely prolific seed producers and letting them seed will only result in an exponential increase to the soil seed bank.

Monitoring

By the monitoring of plants, trees, and shrubs in the Native Plant Synoptic Garden, plant health will be increased and monitoring will allow for prevention or quick remedial actions to hazardous situations. Currently the Grounds Staff of the Washington Park Arboretum inspect all plants at least once a week (Zuckerman and Stubecki, 2004). Special attention is given to monitoring for signs or symptoms of abiotic and biotic stress in new plants. Some forms of abiotic stress may be nutrient deficiencies, water deficit, sunscald, thermal injury, girdling or kinked roots, mechanical injuries, and wind damage (Costello et. la., 2003). Some forms of biotic stress would be stresses induced by pathogens, nematodes, insects, mites, rodents, birds, and parasitic plants (Costello et. la., 2003). Both abiotic and biotic stresses can cause damage that compromises the structural integrity of a tree or shrub and may result in mechanical flaws that present a hazard to potential targets (Matheny and Clark, 1994). It is especially because of potential hazards that monitoring of the Native Plant Synoptic Garden will need to be done regularly. Because plants, trees, and shrubs are living organisms they inherently are unpredictable and it is common place for limbs to drop or other hazards to present themselves spontaneously. With the many trails throughout the arboretum and within the site, monitoring for potential hazards must occur daily. In the course of monitoring for potential hazards, it is likely that inspections by multiple staff members over time will also result in observations that do not pose immediate hazards, but require remedial actions. For example, in monitoring crown structure the arborist may discover discoloration in the leaves that is indicative of chlorosis or possibly nitrogen deficiencies. It would then be appropriate to consider some form of remedial action such as increasing or adding mulch if that would correct the deficiency over time, or simply applying the appropriate fertilizer (Note: It is generally advisable to obtain a soil nutrient analysis before making amendments to the soil; symptoms of nutrient deficiencies can also be a sign of physiological problems within the woody plant and not a lack of a particular nutrient in the soil).

There are a couple other reasons for monitoring that may overlap with what has been previously said, yet are unique for Washington Park Arboretum. First, because the purpose of the arboretum is to display a vast and diverse collection of plants from around the world, it has an increased risk of introducing exotic diseases or pests acquired along with new collection specimens. Also, even if pests are not introduced directly by the arboretum, the diversity of species within the collection means that commonplace and exotic diseases and pests may be more easily contracted or spread within the collection. Therefore, monitoring for these situations will be extremely important in order to quickly recognize a devastating pest or disease such as Asian

Longhorned Beetle (Anoplophora glabripennis) or Sudden Oak Death (Phytophthora ramorum). Since the plants, trees, and shrubs in the Native Plant Synoptic Garden are natives of Western Washington or cultivars of those natives, it is fair to say that regionally or locally observed disease and pest problems can alert the Washington Park Arboretums Ground's staff to problems that could affect this particular collection. Second, when the Native Plant Synoptic Garden Plants are first introduced, they will very likely undergo stress as they establish root systems and acclimate to site conditions. This will be an important time to be vigilant about monitoring for plant stress and taking remedial actions when necessary. Through personnel interview, it has been confirmed that the Arboretum's Grounds Staff agrees with this need for monitoring and already has a plan in place which includes increased monitoring of new plants for the first three years after introduction. For example, symptoms such as water stress are quickly diagnosed and measures are taken to alleviate the problem. Finally, through monitoring it may be determined that a plant, tree, or shrub needs to be removed all-together from the Native Plant Synoptic Garden because of poor performance, hazardous condition, or a pest or disease that could threaten other plants in the collection.

Mulching

Mulching around plants, trees, and shrubs provides many benefits. First, by using mulches it may be possible to eliminate the need for additional fertilizers (Harris et. la., 2004). As mulch decomposes, it contributes plant desirable nutrients into the soil; since it does decompose, additional mulch will need to be added to maintain a proper depth for optimal benefits to the plants (Watson et. la., 1997). Second, organic mulches should be applied to a depth of three to four inches, "but even a thin layer of these mulches can quite effectively reduce surface puddling, erosion, and mud splashing from rain" (Harris et. la., 2004). Third, mulch applied correctly can benefit the soil by "increasing aeration, temperature, and moisture conditions near the surface which encourage rooting and biological activities that enhance soil structure" (Harris et. la., 2004).

For the Native Plant Synoptic Garden mulches should be used around plantings of trees, shrubs, and plant beds. The arboretum already receives a fairly constant supply of wood chips by allowing commercial landscape and tree care companies to dispose of the chips at the arboretum. This supply of wood chips should be utilized in order to achieve the benefits previously stated. Furthermore, as discussed in site preparation, wood chips would be an ideal mulch to be applied

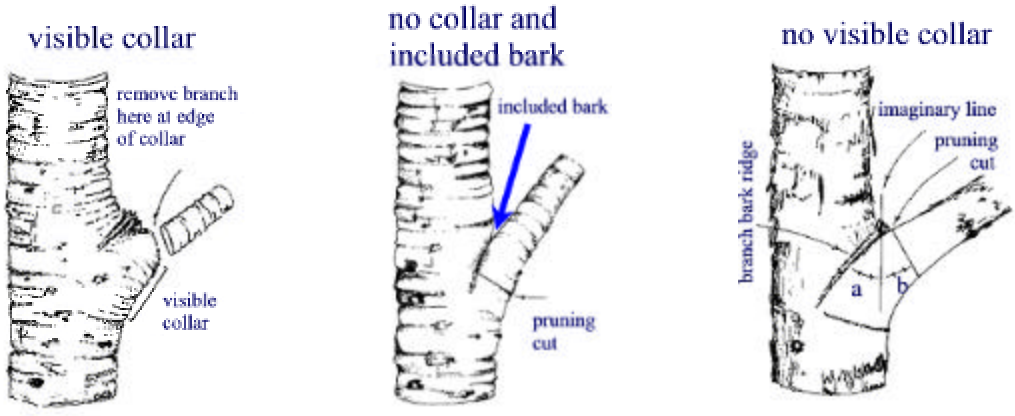
to the pathways used during construction of the Native Plant Synoptic Garden for mediation of soil compaction.

Pruning

Design of the Native Plant Synoptic Garden within the Washington Park Arboretum is unique in that the site will benefit from the oversight of a highly skilled group of horticulturists and a dedicated arborist. Therefore, in this section we will only highlight some of the current research pertaining to pruning. By personnel communication, it is clear that the grounds staff consistently monitors the collection (Zuckerman and Stubecki, 2004). It is through monitoring that the need for occasional pruning will be discovered.

There are several reasons to prune as well as some basic guidelines for how pruning is to be done. Pruning is often done to correct structural defects (Gilman, 2002). One of these defects may be branch junctions that form with included bark. On a small shrub this may not result in physiological problems or pose the risk of a hazard to potential targets, but on a large growing tree they can certainly result in these associated problems. If selection and placement of plants is done carefully, then the hazards that structural defects may pose in the future can be mitigated early on. If though, over time, pruning is necessary to remove dead, hazardous, or diseased branches, a few general guidelines should be followed.

To illustrate a few pruning guidelines, figures have been included courtesy of Dr. Edward F. Gilman (University of Florida Professor and researcher specializing in pruning).



* Illustrations by Dr. Edward F. Gilman

First, efforts should be made to "prevent all branches from growing larger than half the trunk diameter" (Gilman, 2004). Second, no matter what type of pruning is being performed, "maintain a live crown ratio of greater than sixty percent" (Gilman, 2004). Efforts should be made early on to establish proper crown structure for the species, thus eliminating the need to prune large branches later on. Pruning large branches (greater than one inch) increases the risk for diseases to enter the plant tissue (Chalker-Scott, 2004). Finally, when pruning, cuts should be made based on the figures provided. These figures represent three distinct morphological differences that may be exhibited at the time a branch needs to be removed. In absolutely no circumstance should flush cuts be made, since they substantially reduce the ability for a woody plant to effectively compartmentalize the wound (Gilman, 2002).

Zone Specific Maintenance

Forested Ridge

Along the west side of the proposed synoptic garden is the forested ridge section. This portion of the garden would require the general maintenance as previously mentioned, but may also require some pruning being that there will be an abundance of tree species there. The pruning that would need to be done would be the removal of dead, diseased, injured, broken, crossing, interfering, and crowded limbs. A dense top may be thinned, if deemed necessary (by the WPA Certified Arborist) to allow for the passage of light and air. Light is needed by the interior foliage of a plant and by other plants beneath it (Harris, 2004). Pruning could also be used to improve aesthetics, as well as structure. Depending on the number of deciduous trees that would be present in this area, there may have to be leaf litter removal during the late summer and early fall, but some of the leaf litter should be left to improve organic matter levels in the soil. During the dry months, this area or portions of it may need to be watered to maintain plant quality and reduce stress.

Alpine Zone

There are two separate portions of the alpine zone, one near the Graham Visitors Center and one near the Maintenance buildings. There may be high maintenance needs along the road

edges of this zone due to foot and car traffic. Weeding will be a priority in this portion as well as occasional mulching. Some aesthetic pruning is optional here as well just to give the zones more of a true alpine appearance. Due to some of the alpine plant species being dependent on snowmelt as a water source, there may need to be some form of regular irrigation available to these areas (Also, refer to monitoring section for additional information).

Wetland Zone

There are two separate portions of wetland zones, one near the Graham Visitors Center and the other near Duck Bay. In the Graham Visitors center wetland zone, there should be care taken to remove debris altering water movement from the roof runoff system and down to the next step area, and each subsequent portion of the weir. Debris that could become a problem is leaf litter from surrounding trees or from off the rooftop, branches from surrounding trees, and garbage. Weeding may be necessary during establishment, at least until desired species fill in. The same maintenance will be required within the Duck Bay wetland zone; leaf litter debris may need to be removed from this area at a greater volume due to the hardwood trees nearby as well as being at the bottom of the weir. Overall this system should work as an adequate water supply for the wetland zone; there should not be a substantial need for additional water sources.

Valley Bottom

There may be some pruning required within the valley bottom area, as well as leaf litter clean-up along paths, within the weir, and in the beds. Weeding will be the most time consuming maintenance of this section due to the types and anticipated abundance of plants within the valley bottom section. There will need to be some mulching early on in the management process, away from the wet areas. The paths may need extra attention and upkeep to discourage users from straying off the designated paths. There may be plants in this section that need additional watering at times (See section on monitoring).

Budget

The synoptic garden is only a small portion of a large-scale rejuvenation plan for the Washington Park Arboretum. Due to the magnitude of the rejuvenation plan and the number of stakeholders involved (Seattle Parks Department, Washington Park Arboretum Foundation, Private Donors, Arboretum and Botanical Garden Committee, and other financially vested parties), it was determined that a thoroughly itemized budget detailing all maintenance costs and expenditures was impractical. Instead, our goal was to provide current general budget details, to review proposed costs of implementing and maintaining portions of the WPA Master Plan, and to provide recommendations when necessary. Additionally, we have already included a substantial listing of specific plant costs.

One of the main factors that will influence the short and long-term budget for the entire rejuvenation project, including the synoptic garden, is the inflation rate. The Master Plan was last updated in 2003, and as shown in Table 1, the inflation rate can fluctuate between 1% to just over 3% (Inflation Data, 2004). Therefore, anticipated costs of implementation for the Native Plant Synoptic Garden, as well as the entire Master Plan that it is included in, will need to be re-calculated over time for inflation. There is no guarantee whether the inflation rate will be higher or lower than past months, so it is important to recognize this fact.

TABLE 1: Month by Month Breakdown of inflation rates.

Current Inflation Rate													
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Ave
2004	1.93%												
2003	2.60%	2.98%	3.02%	2.22%	2.06%	2.11%	2.11%	2.16%	2.32%	2.04%	1.77%	1.88%	2.27%
2002	1.14%	1.14%	1.48%	1.64%	1.18%	1.07%	1.46%	1.80%	1.51%	2.03%	2.20%	2.38%	1.59%
2001	3.73%	3.53%	2.92%	3.27%	3.62%	3.25%	2.72%	2.72%	2.65%	2.13%	1.90%	1.55%	2.83%
2000	2.74%	3.22%	3.76%	3.07%	3.19%	3.73%	3.66%	3.41%	3.45%	3.45%	3.45%	3.39%	3.38%

Table at InflationData.com.

Under the Graham Visitors Center Gardens project description, which is included in the Washington Park Arboretum Master Plan Implementation document, it states that the estimated total cost of this project to be $1,679,000; “which is calculated in 2003 dollars” (ABGC, 2004). This estimated total will need to be recalculated over time, including current inflation rates up till the year implementation of the project is anticipated to start. This value does not represent any road moving costs or new building costs. A portion of Lake Washington Boulevard and Arboretum Drive are proposed to be moved, and a plant garden is planned where the roads once were. This concept has already been included in our proposed design. The estimated total costs

of these projects are $4, 037,000 and $4,818,000 respectively, and again these numbers are in terms of 2003 dollars (ABGC, 2004).

In a meeting with the Grounds Maintenance Supervisor, David Zuckerman, we obtained the 2003/2004 Washington Park Arboretum Budget Plan which is included as Appendix C. Mr. Zuckerman explained that the budget represents the entire Washington Park Arboretum's maintenance costs, and that operating costs are not itemized for different areas within the arboretum. As a result, any added personnel and equipment costs would be shared as part of the budget for the entire rejuvenation project. The annual grounds maintenance budget for 2003 and 2004 is just over $230,000 according to the Washington Park Arboretum Budget Plan. Projected annual maintenance and operating costs for the Native Plant Synoptic garden and its surrounding gardens (around Graham Visitors Center) is $461,000 in 2003 dollars (ABGC, 2004). This is more than double the current operating budget projected for the upcoming year. However, it should be noted that much of that budget will be devoted to maintenance and operation of intensive plant, tree, and shrub beds around the Graham Visitors Center; this area accounts for $319,000 of the $461,000 and therefore does not fairly represent costs incurred directly from the Native Plant Synoptic Garden. Also, the projected $461,000 is only a portion of the entire maintenance and operating budget that is projected for implementation of the entire Washington Park Arboretum Master Plan (ABGC, 2004).

Maintenance amounts include wages and benefits of all maintenance employees. The estimated cost of maintenance for these three portions is double the total 2003/2004 Washington Park Arboretum annual budget. The projected significant raise in annual maintenance costs are due to the added gardens that require more intense maintenance than the current gardens do, and the assumption that there will be a significant addition of full time staff to carry out the maintenance. There were around twenty full time employees maintaining the Arboretum in early 2004; however, the Master Plan calls for an additional sixty full time employees to implement and maintain Washington Park Arboretum after implementation of the Master Plan (ABGC, 2004).

Money from endowments is the major resource from which future funding for these projects will be generated. The Arboretum currently relies on interest from endowments, which compounds at 5% and is used to pay the staff and cover operating costs (AGBC, 2004). Other major funding for the rejuvenation project will come from contributions made from the public to the Arboretum Foundation. The Foundation's primary goal during implementation of the Master Plan is to raise funds. These donations/funds could come from private investors, the city/county/state legislature, or directly from Washington Park Arboretum users.

Being funded by such a large number of contributors is another major variable in determining a budget. Since the Washington Park Arboretum is a public park, everyone in the community as well as the state is essentially a stakeholder in the park, and as stakeholders have a vested interest in the types of projects that are planned and completed within the arboretum. For this reason, major plans can take years to implement; everyone involved, be it employees or stakeholders, must come to agreement on if, what, how, why, where, and when something should be done in the arboretum. Traditionally, feasibility of a particular project within a setting such as the Washington Park Arboretum depends on the availability of current funds and the probability of additional funding.

The maintenance budget is dependent mainly on four major factors: time, rates of inflation, availability of funds, and the vested interests of stakeholders. Attracting and soliciting donations can be the key to the success of a project such as the Native Plant Synoptic Garden. Having highly trained gardeners and arborists is one way to ensure stakeholders that proper maintenance techniques are being utilized to achieve optimal levels of plant health and aesthetics; this is one example of how and why donations may be secured. Rising costs in part due to inflation, coupled with changing maintenance practices will ultimately determine the overall maintenance budget. To ensure long-term success of the Native Plant Synoptic Garden and Master Plan implementation, it may be essential to consult an economist. An economist can follow inflation rate trends and precisely calculate future costs, revenue, and interest from endowments and donations. "A certified economist is an invaluable resource for preparing and finalizing an accurate maintenance budget" (Young et la, 1990).

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Appendix A

SOIL ANALYSIS REPORT FOR DECIDUOUS TREES, SHRUBS AND VINES 02/04/04

SOIL AND PLANT TISSUE TESTING LAB
WEST EXPERIMENT STATION
UNIVERSITY OF MASSACHUSETTS
AMHERST, MA 01003

LAB NUMBER: S040129-206
BAG NUMBER: 56455

SOIL WEIGHT: 5.67 g/5cc
CROP:

CENTER FOR URBAN HORT - U OF W
BOX 354115-LINDA CHALKER SCOTT
SEATTLE, WA 98195-4115

COMMENTS:

SAMPLE ID: # 1GVC

RECOMMENDATIONS FOR DECIDUOUS TREES, SHRUBS AND VINES:

SOIL PH ADJUSTMENT:

Soil pH is in the desired range. No adjustment required.

FERTILIZER:

The organic matter level of this soil appears to be quite high. When properly fertilized and provided proper drainage it should provide a good growing medium for woody ornamentals which prefer a humus rich soil.

PREPLANT PREPARATION: In the early fall preceeding planting incorporate 1 part finished compost or composted manure into 10 parts soil along with 3 cups bone meal and 2 cups wood ash per cubic yard of backfill; OR in early spring incorporate 1 part finished compost or composted manure into 10 parts soil along with 2 cups 9-5-4 plus 2 cups bone meal per cubic yard of backfill.

ESTABLISHED PLANTINGS: In the early fall topdress with 1/2 inch finished compost along with 2 cups bone meal per 100 square feet and gently scratch into the soil surface; OR in early spring topdress 1.5 cups 10-6-4 fertilizer per 100 square feet. For plantings in a lawn setting use fertilizer recommendations for established turfgrass.

SOIL pH 6.1 NITROGEN: NO3-N = 5 ppm NH4-N = 4 ppm
BUFFER pH 6.5

NUTRIENT LEVELS:	PPM	Low	Medium	High	Very High
Phosphorus (P)	8	XXXXXXXXXXX			
Potassium (K)	88	XXXXXXXXXXXXXXXXXXXX			
Calcium (Ca)	1481	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			
Magnesium (Mg)	443	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			

CATION EXCH CAP 14.7 Meq/100g
PERCENT BASE SATURATION K= 1.4 Mg=21.9 Ca=44.7
MICRONUTRIENT LEVELS ALL NORMAL

EXTRACTABLE ALUMINUM: 68 ppm (Soil range: 10-250 ppm)

The lead level in this soil is low.

SOIL ANALYSIS REPORT FOR WOODY ORNAMENTAL PLANTINGS 02/04/04

SOIL AND PLANT TISSUE TESTING LAB
WEST EXPERIMENT STATION
UNIVERSITY OF MASSACHUSETTS
AMHERST, MA 01003

LAB NUMBER: S040129-206
BAG NUMBER: 56455

SOIL WEIGHT: 5.67 g/5cc
CROP:

CENTER FOR URBAN HORT - U OF W
BOX 354115-LINDA CHALKER SCOTT
SEATTLE, WA 98195-4115

COMMENTS:

SAMPLE ID: # 1GVC

RECOMMENDATIONS FOR WOODY ORNAMENTAL PLANTINGS

Recommendations for fertilizer and soil pH adjustment will be made by a UMass Extension Specialist, Call Lab to make arrangements (413)545-2311.

Soil type (from questionnaire):

MICRONUTRIENT		PPM	SOIL RANGE	MICRONUTRIENT		PPM	SOIL RANGE
Boron	(B)	0.4	0.1-2.0	Copper	(Cu)	0.9	0.3-8.0
Manganese	(Mn)	3.9	3 - 20	Iron	(Fe)	46.3	1.0- 40
Zinc	(Zn)	1.8	0.1- 70				

SOIL PH 6.1 ALUMINUM (AL): 68 PPM (Soil Range: 10-300)
BUFFER PH 6.5

NUTRIENT LEVELS:	PPM	LOW	MEDIUM	HIGH	VERY HIGH
PHOSPHORUS (P)	8	XXXXXXXXXXX			
POTASSIUM (K)	88	XXXXXXXXXXXXXXXXXXXX			
CALCIUM (CA)	1481	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			
MAGNESIUM (MG)	443	XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX			
AMMONIUM (NH4-N)	4	XXXXXXXX			
NITRATE (NO3-N)	5	XXX			

CATION EXCH CAP 14.7 MEQ/100G
PERCENT BASE SATURATION K= 1.4 MG=21.9 CA=44.7

EXTRACTED LEAD (PB) 2 PPM. ESTIMATED TOTAL LEAD IS 46 PPM.

Appendix B*

Specifications for Acceptance of Nursery Trees at the Time of Delivery

Purpose: To obtain vigorous, healthy trees which can be easily trained into attractive trees with structurally strong roots and crowns.

Specifications: (The buyer should choose and/or modify the appropriate sections depending on the species, the landscape site, and the intended function of the tree.)

I. All trees shall be true to type or name as ordered or shown on the plans and shall be individually tagged or tagged in groups by species and cultivar (variety).

II. All trees shall be healthy, have a form typical for the species or cultivar, be well-rooted, and be properly trained. These characteristics are described in sections III through VII.

III. All trees shall comply with Federal and State laws requiring inspection for plant diseases and pest infestations. Inspection certificates required by law shall accompany each shipment of plants. Clearance from the County Agricultural Commissioner as required by law, shall be obtained before planting trees delivered from outside the County in which they are to be planted.

IV. The rootball of all trees shall be moist throughout and the crown shall show no signs of moisture stress.

V. Tree crown: (round headed) broadleaved, decurrent trees

A. Crown has a single, straight trunk that has not been headed or that could be pruned to a leader

1. Potential lateral scaffolds (height of lowest scaffold depends on landscape use)

a. Small-growing trees (crape myrtle, flowering fruit trees): At least 50 mm (2 in.) apart vertically, which could be trained in the landscape to 3 to 7 branches 100 mm (4 in.) or more apart vertically. Large-growing trees (ash, oak, callery pear): At least 150 mm (6 in.) apart vertically, which could be trained in the landscape to 5 to 9 branches 450 mm (18 in.) or more apart vertically.

b. Radially distributed around the trunk

c. Not more than two-thirds ($\frac{2}{3}$) the diameter of the trunk, measured 25 mm (1 in.) above the branch

d. Free of included bark in attachments (bark embedded between the trunk and a lateral)

2. No laterals below the lowest potential scaffold should be larger than one-fourth ($\frac{1}{4}$) the trunk diameter at point of attachment

These specifications have in part been adapted from the *Standard Specifications,* January 1981, of the California Department of Transportation, Sacramento.

** Dr. Rita Hummel (Washington State University Associate Scientist; Horticulture and Ornamentals Research). This document was distributed by Dr. Hummel during a Washington State University Extension training seminar.*

3. Each tree must be able to comply with A1 and A2 above without having or having had to remove, now or within the previous growing season (at least six months), more than 25 percent of the branches of size similar to or larger than those of the potential scaffold branches.

B. The minimum acceptable length of the most recent season's shoots should be specified, for example, shoots of small-growing trees (that is, red maple, red oak, ginkgo) might be 300 mm (12 in.); for large-growing trees the minimum acceptable length might be 450 mm (18 in.) and preferably 0.6 to 1.0 m (24–36 in.).

C. It would be desirable to have

1. The tree stand upright without support.
2. Small ($< \frac{1}{4}$ diameter of trunk) temporary branches along the trunk below the scaffolds

VI. Tree crown: broadleaved or coniferous, excurrent (central trunk) trees

A. Crown has a single, straight trunk with no double leaders (codominant stems) or vigorous, upright branches competing with the leader

B. Radial and vertical distribution of branches to form a symmetrical crown

VII. Roots: container, boxed, or balled & burlapped trees regardless of species or mature size

A. Check that the tree is free of roots visibly circling the trunk, and free of "knees" (roots) protruding above the soil.

B. If in a tapered container, slip the root ball out; the root-ball periphery should be free of circling roots larger than 6 mm ($\frac{1}{4}$ in.) in diameter and a bottom mat of roots 6 mm ($\frac{1}{4}$ in.) or larger (the acceptable diameter of circling peripheral roots depends on species and size of the root ball).

C. Untie the tree trunk from the stake; the trunk should not touch the top rim of the container.

D. Tip the root ball or container on its side and with a small jet of water expose the roots within 50 mm (2 in.) of the trunk to a depth of 65 mm (2.5 in.) below the topmost root attached to the trunk. The trunk and main root(s) should be free of circling roots and kinks. Replace soil washed from around the trunk with a similar soil mix (less than ten [10] percent of the total root-ball volume should need to be added).

E. If the trees pass the above inspections, further inspect the roots by removing the soil from the roots of not less than two (2) trees nor more than two (2) percent of the total number of trees of each species or variety from each source. The trunk and main roots shall be free of circling and kinked roots. Circling roots at the periphery of the root ball shall not be reason for rejecting a tree unless the circling roots are large for the species and shoot growth is not acceptable for the species (*see* VII-B).

VIII. In case the sample trees inspected are found to be defective, the buyer reserves the right to reject the entire lot or lots of trees represented by the defective samples. Any plants rendered unsuitable for planting because of this inspection will be considered as samples and will not be paid for.

IX. The buyer shall be notified when plants are to be shipped at least ten (10) days prior to the actual shipment date.

Appendix C*

WPA 03/04 BUDGET PLAN
Projected Income and Expenses
DRAFT

Last Revision: 10/6/03	Total of Expense Items	Arboretum State 10-3910	Arboretum Found. 65-8003	Larsen Endowment 63-3278	Lange Endowment 65-3393	Eggert Endowment 65-3394	Arb Enhcmt Gift 63-4668	GVC Rental Rev 10-9301	WPA ED Revenue 09-9170	Witt Gift 65-7259
Balance Carry Forward		-2,111	55,346	9,545	9,614	16,834	60,668	(321)		5,494
03-04 Budget / Income		169,390	150,000	17,209	10,175	16,688	2,630	78,500	5,500	
Total Expected Funds Available		167,279	205,346	26,754	19,789	33,522	63,298	78,179	5,500	5,494
1. Educational										
A. Education Prgrm Salaries/Benfts										
Coordinator - Berry @ .75FTE	37,380		37,380							
Program Asst - Zuege @ .75FTE	21,830		21,830							
B. Operating Costs										
Tours	-									
Saplings	425								425	
Explorer Packs	-									
Volunteers	-									
Marketing & Publicity	-									
AF-Funded Prgrm Trnsprtn										
Supplies & Equipment	3,000								3,000	
Other Education Expenses	1,750								1,750	
C. Honoraria	325								325	
D. Services	-									
E. School Transporation	731		731							
Sub-Total	**65,441**	**-**	**59,941**	**-**	**-**	**-**	**-**	**-**	**5,500**	**-**
2. Grounds Maintenance										
A. Grounds Maint Salaries/Bnfts										
Zuckerman (Grnd Svpr 1)	35,078	35,078								
Stener (Grdnr 2) 9 mnths FY03/04	18,900	18,900								
Vacant (Grdnr 2) 9 mths mid- range	18,900	18,900								
Powell (Plant Tech 2) 7 mths FY03/04	19,887	19,887								
Bonham (Grdnr 2)	27,942	27,942								
Bilotta (Hrly Grdnr) (Incl. Benefits)	5,439						5,439			
B. Arborist and Tree Care										
Stubecki (Arborist) Sal/Bnfts	39,100		39,100							
Ground Support (Hedberg): 1106 hrs	12,100		12,100							
Equipment and Contract Support	15,000		15,000							
Add'l Tree Care										
C. Seasonal Gardeners (include benfts)	18,000		18,000							
1645 hours @ $10/hr										
Fall: B. Hodges @ 475.5 hrs @$10/hr										
Winter:										
Spring:										
D. Interim Garenders										
Mike McLean 406 hrs @ $10	4,442						4,442			
Ryan Garrrison 581 hrs @ $10	6,356						6,356			
E. Horticultural Operations										
Pest Management Supplies	3,852			3,852						
Small Equipment/Tools										
Supplies										
F. Large Equipment Maint./Repair										
Fuel/Gas for Vhcls										
Equipment Repair/Phys Plant										
Equipment Rental										
G. Hazard Tree Removal	5,494									5,494
H. AF Hort Program FY02/03	2,392		2,392							
AF Hort Program FY03/04 ($20K)										
03- Contractual Svs	6,418		6,418							
04- Motorpool Rentals/Vhcls	9,700		9,700							
05-Supplies & Materials	3,882		3,882							
Sub-Total	**230,490**	**120,707**	**84,200**	**3,852**	**-**	**-**	**16,237**	**-**	**-**	**5,494**
3. Curation and Records										
A. Curation/Records Salaries/Benfts										
Registra/Collections Mgr - Hitchin	37,608	35,497					2,111			
Asst. Records - Ferguson	13,784					13,784				
03- Contractual Svs	8,447					8,447				
04- Travel	117					117				
05-Supplies & Materials	3,766					3,766				
B. Documentation Eq & Supplies	4,339					4,339				
Documentation Upgrades	3,500					3,500				
C. Plant Acquisition										
D. Plant Distribution / Index Seminum	793					793				
Sub-Total	**72,354**	**35,497**	**-**	**-**	**-**	**34,746**	**2,111**	**-**	**-**	**-**
4. Plant Production and Nursery										
Propagator - Selemon (Part.)	3,817	3,817		-						
Supplies	4,052			4,052						
Sub-Total	**7,869**	**3,817**	**-**	**4,052**	**-**	**-**	**-**	**-**	**-**	**-**

* David Zuckerman (Grounds Supervisor-Washington Park Arboretum) This document provided courtesy of Mr. Zuckerman.

Plant Price List

Latin Name	Cultivar	Sizes: 2-6"	Sizes: 1-2'	Sizes:2-3'	Sizes: 4-5'	Sources
Abies amablis						
	'Spreading Star'		$30	$60		orPh
	'Compacta'					
	'Hoyt's witches broom'					
Abies grandis			$3	$17		waSN, waWB, canTf
	'Aurea'	$15	$30			orPh
	'Compacta'	$15	$30			orPh
	'Johnsonii'	$15	$30			orPh
	'Pendula'					
Abies lasiocarpa				$25		waWB, canTf
	Argentea'					
	'Compacta'	$30	$60			orPh
	'Duflon'	$30	$60			orPh
	Glauca'					
	'Glauca Compacta'					
	'Green Globe'	$25	$60			waGr, orPh
	'Mulligans Dwarf'	$24	$30			waGr, orPh
Abies procera			$2	$12		waBR, waWB
	'Argentea'					
	'Aurea'					
	'Beissneri'					
	'Blaue Hexe'	$30	$60			orPh
	'Compacta'					
	'Conica'					
	'Coerulescens'					
	'Frijsenborg'					
	Glauca'					
	'Glauca Prostrata'	$15	$30	$60		orPh
	'Jeddeloh'					
	'La Graciosa'	$15	$30			orPh
	'Pendula'					
	'Sherwoodii'	$30				orPh
Acer circinatum		$3	$5	$16	$50.00	waBR, waGr, waSN, canTf
	'Alleyne Cook'			$40		waGr
	'Glen Del'					
	'Little Gem'		$30			canTf
	'Monroe'					
	Pacific Fire'					
	'Pacific Glow'					
	'Sunglow'	$20				waCol
	'Sunny Sister'	$20				waCol
Acer glabrum			$1	$2		wa4C
Amelasorbus jackii						
Alnus rubra				$2	$3	waBR, waSN, waWB
	'Aldered States'					
Alnus rubra f. pinnatisecta						
Alnus sinnuata						
Amelanchier alnifolia			$3	$5		waBR, waSN, canTf
	'Northline'		$12			canTf
	'Obelisk'					
	'Parkhill'					
	'Pembina'					
	'Regent'					
	'Smokey'		$12			canTf
	'Success'					
	'Thiessen'					
Amelanchier a. var. humptulipenis						
Amelanchier alnifolia var. pumila						
Amelanchier a. semi-integrifolia						
Amelanchier alnifolia submollis						
Andromeda polifolia			$9			canTf
	Alba'					
	'Blue Ice'					
	'Bluest Form'					
	'Chuo Red'		$6			orSR
	Compacta'					
	Congesta'					
	'Kirigamine'					
	'Kirikamima'					
	'Macrophyllum'		$6			orSR
	Minima'					
	'Nana Alba'		$6			orSR
	'Nikko'					
	'Pink Form'					
	'Pink Ice'					
	'Red Winter'					
	'Shibutsu'					

Plant Price List

A. p. var. grandiflora compacta						
Andromeda polifolia var. congesta						
Andromeda p. var. compacta alba						
Andromeda polofolia variegata						
Arbutus menziesii		$4	$10			waBR, waSN, waWB
Arctostaphylos columbiana			$8	$9		wa4C
	'Oregon Hybrid'					
A. columbiana X A. nevadensis						
A. columbiana X A. hookeri						
Arctostaphylos nevadensis						
	'Cascade'					
	'Chipeta'		$10			orSR
	'Ponchito'					
A. nevadensis X A. canescens						
Arctostaphylos uva-ursi		$2				waSN, wa4C, canTf
	Alaska'					
	'Big Bear'					
	'Massachusetts'					
	'Mendocino'					
	'Miniature'					
	'Mitsch's Selected Form'		$6			orSR
	'Point Reyes'					
	'Radiant'					
	'Rainbow Rock'		$7			orSR
	'Thymifolia'		$6			orSR
	'Vancouver Jade'	$3	$8			orSR, canTf
	'Vulcan's Peak'		$6			orSR
	'Wood's Compact'		$7			orSR
	Wood's Red'					
	'#13'					
A. uva-ursi X A. andersonii						
A. uva-ursi X A. columbiana	Arctostaphylos X media					
A. X media var. grandiflora						
Betula glandulosa			$8			canTf
Betula papyrifera		$1		$3		waBR, wa4C
Betula occidentalis		$0.50		$1		wa4C
Ceanothus integerrimus		$1	$6	$11		waWB, wa4C
Ceanothus prostratus		$1				wa4C
	'Puget Blue'					
	'Ray Hartman'					
C. velutinus var. laevigatus		$0.50	$1	$11		waWB, wa4C
	'Victoria'					
	'Wheeler Canyon'					
	'Pershore Zanzibar'					
Chamaecyparis nootkatensis		$0.50	$1			wa4C
	'Aurea'	$15		$50		orPh
	'Aureovariegata'	$25		$50		orPh
	'Compacta'	$8	$25			orPh, orSR
	'Compacta Glauca'					
	'Glauca Pendula'					
	'Green Arrow'		$20			orSR
	'Laura Aurora'					
	'Lutea'					
	'Pendula'		$12	$50		orPh, canTf
	'Jubilee'					
	'Strict Weeper'					
	'Torulosa'					
	'Van Der Aker'	$20				waCol
	'Variegata'					
Cornus canadensis			$4			waBR, orSR
Cornus nuttallii		$1	$1	$6	$30	waBR, waWB, wa4C, canTf
	'Barrick'					
	'Colrigo Giant'					
	'Gold Spot' or 'Eddiei'					
	'North Star'					
	'Pink Blush'					
Cornus nuttallii X Cornus florida						
	'Eddie's White Wonder'			$70		canTf
Cornus nuttallii X Cornus kousa						
Cornus serica			$3	$4		waBR
	'Aurea'					
	'Baileyi					
	'Cardinal'					
	'Cheney'					
	'Emerald 'n' Silver'					
	'Flaviramea'		$8			canTf
	'Harrington'					
	'Hedgerows Gold'	$8				waCol

Plant Price List

	'Isanti'					
	'Kelsey Dwarf'					
	'Kelseyi'		$8			canTf
	'Peter's Choice'					
	'Silver and Gold'					
	'Sunshine'					
	'Variegata'					
	'Wallowa'					
Corylus cornuta			$3	$8	$13	waBR, waSN, wa4C
Corylus cornuta X C. avellana						
Cupressocyparis X notabilis	Cup. glabra x Cham nootka.					
Cupressocyparis X ovensii	Cup. lusitanica x Cham. n.					
Cupressocyparis X leylandii	Cup. macrocarpa x Cham. n.					
Euonymus occidentalis						
Garrya fremontii						
Garrya x issaquahensis						
	'Carl English'					
	'Pat Ballard'					
Gaultheria shallon		$4	$9	$16		waBr, waSN, waWB, canTf
	'Actifolia'					
	'Snoqualmie Pass'	$8				waHw
Gaultheria x wisleyensis	G. mucronata x G. shallon					
	'Jingle Bells'					
	'Pixie Pink'					
	'Wisley Pearl'					
	'Ruby'					
X Gaulnettya						
Holodiscus discolor		$3	$6	$15		waSN, waWB, wa4C, canTf
Juniperus communis						
	'Aurea'		$25			waGr
	'Berkshire'	$8				waCol, waGr
	'Compressa'	$7	$20	$50		waCol, waGr, orPh
	'Depressa Aurea'					
	'Gold Cone'	$6	$8			waCol, orSR, canTf
	'Golden Schapp's'	$8				waCol
	'Hortmann'	$8				waCol
	'McKay's Weeper'					
	'Pioneer'					
	'Pioneer'					
	'Repanda'					
J. communis var. depressa						
	'Amidak'	$10				waGr
Juniperus occidentalis						
Juniperus scopulorum						wa4C
	'Argentea'					
	'Blue Arrow'					
	'Blue Creeper'					
	'Blue Heaven'					
	'Cologreen'					
	'Columnaris'					
	'Gray Gleam'					
	'Green Ice'					
	'Horizontalis'					
	'Medora'					
	'Moonglow'					
	'Pathfinder'					
	'Sky Rocket'					
	'Sparkling Rocket'					
	'Tabletop'					
	'Tolleson's Blue Weeping'					
	'Variegata'					
	'Viridiflora'					
	'Wichita Blue'					
Larix lyalli						
Larix occidentalis						
Ledum groemlandicum		$5				canTf
	Compacta'					
Ledum glandulosum						
L. glandulosum var. columbianum						
Linnaea borealis		$2				waSN, waWB
Lonicera ciliosa		$1	$8			wa4C, canTf
Lonicera hispidula		$2	$8	$14		waBR, waWB, canTf
Lonicera hispidula var. vacillans			$1			wa4C, canTf
Lonicera involucrata		$3	$6	$2		waSN, wa4C, canTf
Mahonia aquifolium		$3	$6	$2		waSN, wa4C, canTf
	'Apollo'					
	'Compactum'					
	'Compacta John Muir'					

Plant Price List

	'Eureka'					
	'Golden Abundance'					
	Mayhen strain'					
	'Smaragd'					
Mahonia nervosa		$2	$4			waBR, waSN, waWB
Mahonia repens		$6	$10			waWB, canTf
X Mahoberberis	Mahonia x Berberis					
	aquisargentii					
	miethkeana					
	neubertii					
Malus fusca		$1	$3	$5	$15	waBR, waSN, wa4C
Menziesia ferruginea			$8			wa4C, canTf
Myrica californica		$3	$6			waBR, waSN, canTf
Myrica gale		$1		$2		wa4C
Oplopanax horridum			$9			canTf
Oemleria cerasiformis		$1	$3		$11	waSN, wa4C, canTf
Paxistima myrsinites			$8			wa4C, canTf
Philadelphus lewisii		$3	$5			waBR, waSN, wa4C
	'Blizzard'					
	'Cheyenne'					
	'Fallbrook'					
	'Goose Creek'					
	'Mount Tahoma'		$15			waCol
	'Waterton'					
P. lewisii var. gordonianus			$8			canTf
Physocarpus capitatus			$3	$2		waSN, wa4C
Picea engelmannii						
	'Blue Softie'		$30	$60		orPh
	'Bravo'					
	'Bush's Lace'		$30	$60		
	'Compacta'		$30			
	'Hoodie'					
	'Snake'					
	'Snake II'					
	'Stanley Mountain'		$30			orPh
	'Swan Creek					
	'Vanderwolf Blue'					
P. engelmannii var. mohinorensis						
Picea sitchensis			$3	$6	$14	waBR, waSN, waWB, wa4C
	'Compacta'					
	'Microphylla'					
	'Papoose'	$8	$30	$35		waGr, orSR
	'Sugar Loaf'	$25	$30			waGr
	'Virgata'			$50		orPh
Pinus albicaulis			$30			orPh
	'Flinek'					
	'Nana'					
	'Noble's Dwarf'					
Pinus contorta var. contorta		$0.50	$3	$6	$30	waSN, wa4C, canTf
	'Chief Joseph'		$40			orPh
	'Compacta'					
	'Frisian Gold'					
	'Spaan's Dwarf'		$30	$60.00		waGr, orPh
	'Wilson's Weeper'					
Pinus contorta var. latifolia						
	'Taylor's Sunburst'					
Pinus contorta var. murrayana						
Pinus monticola						
	'Minima'					
	'Pendula'					
	'Skyline'			$60		orPh
Pinus ponderosa		$1	$2			wa4C
	'Black Hill'					
	'Dixie'					
	'Pendula'					
	'The Sphinx'					
Potentilla fruiticosa		$1	$2			wa4C
	'Red Ace'					
	'Tangerine'					
Prunus virgiiana			$3			waBR, waSN
	'Melanocarpa'	$1	$2			wa4C
	'Schubert'	$1	$2			wa4C
	'White Fountain'					
Pseudotsuga menziesii			$3	$6	$19	waSN, wa4C, canTf
	'Aureavariegata'		$30			orPh
	'Dusek's Broom'	$30				orPh
	'Dusek's Weeper'					
	Elegans'					

Plant Price List

	'Fastigiata'					
	'Flecheri'	$30	$60			orPh
	'Fournier's Greenspire'		$30	$35		waGr
	'Fretsii'					
	'Glauca Fastigata'					
	'Glauca Pendula'		$30	$60		orPh
	'Graceful Grace'		$30			orPh
	'Hendricks Park'	$16	$20			waGr
	'Hess Select'					
	'Hillside Gold'					
	'Hillside Pride'					
	'Hupp's Weeping'		$30			orPh
	'Idaho Gem'					
	'Idaho Weeper'		$30	$60		orPh
	'Little Jon'		$30			orPh
	'Loggerhead'		$30	$60		orPh
	'Mossman Pendula'					
	'Pumila'	$15				waGr
	'Salmon Creek'					
	'Seattle Mountain'					
	'Shorty's Weeper'		$30.00			waGr
	'Skyline'					
	'Tempelhof Compact'		$30			orPh
	'Wind Surfer'					
Pseudotsuga menziesii var. glauca				$20		waGr
Quercus garryanna		$3	$6	$18	$23	waBR, waSN, waWB wa4C, canTf
Quercus garryana var. breweri						
Rhamnus purshiana		$1	$4	$6	$16	waBR, waSN, waWB, wa4C, canTf
Rhamnus purhiana var. arbuscula						
Rhododendron albiflorum			$10			wa4C, canTf
	'Albion'					
Rhododendron macrophyllum		$3	$8	$25		waBR, waSN, canTf
	'Albion Ridge'					
	'Seven Devils'					
Ribes bracteosum		$1	$2			wa4C
Ribes lacustre		$1	$8			waWB, wa4C, canTf
Ribes sanguineum			$4	$5		waBR, waSN, canTf
	'Albescens'					
	'Brocklebankii'		$25			waHw
	'Claremont'					
	'Crocker-Kline White'					
	'Elk River Red'			$7		waBR
	'Gibson'					
	'Hannaman White'					
	'Henry Hennaman'					
	'Inverness White'					
	'King Edward VII'		$8	$7		waBR, canTf
	'Mesa Red'					
	'Pokey's Pink'					
	'Pulborough Pink'					
	'Spring Showers'					
	'Spring Snow'					
	'Strybing Pink'					
	'Tranquillon Ridge'					
	'Variegatum'					
	'White Icicle'		$9			canTf
Ribes viscossimum			$9			canTf
Rosa gymnocarpa		$1	$3	$6		waSN,wa4C, canTf
Rosa nutkana		$1	$2	$6		waBR, waSN, wa4C, canTf
Rosa woodsii		$3	$8			waBR, canTf
Rubus parviflorus		$1	$2	$6		waBR, waSN, wa4C canTf
Rubus spectablis		$1	$2	$6		waBR, waSN, wa4C, canTf
	Double Form'		$8			canTf
Salix hookeriana		$1	$3			waSN, wa4C
Salix scouleriana		$1	$3			waSN, wa4C
Shepherdia canadensis		$1	$2			wa4C
Sorbus sitchensis			$5		$30	waBR, canTf
	'Sunrise'					
Spirea douglasii			$3			waBR, canTf
Spirea X pyramidata	S. douglasii x S. betulifolia					
Symphoricarpos albus		$2	$3			waBR, waSN, canTf
	'Aureovarigatus'					
	'Constance Spry'					
	'Foliis Variegatis'	$9				waHw
	'Taff's Silver Edge'	$10				waHw
	'Taff's Variegated'					
	'Tilden Park'					
	'Variegatus'					

Plant Price List

Taxus brevifolia			$8	$12		waWB
	'Nana'					
Thuja plicata			$3	$5	$10	waBR, waSN, canTf
	'Doone Valley'		$24			waGr
	'Excelsa'	$15		$40	$50	waGr
	'Holly Turner'		$10	$25		waHw, orPh
	'Gruene Kegel'	$15	$25			waGr, orPh
	'Rogers Aurea Sport'					
	'Rogersii'		$25			orPh
	'Spring Grove'	$15				waGr
	'Stoneham Gold'			$25		waGr, orPh
	'Sunshine'		$24			waGr
	'Watnong'		$10			waHw
	'Zebrina'		$11			waGr, waHw, orPh
Tsuga heterophylla		$1	$3	$6		waSN, wa4C, canTf
	'Argenteovariegata'					
	'Conica'					
	'Dumosa'					
	'Iron Springs'		$25	$60		waGr, orPh
	'Ray Godfrey'		$13			
	'Thorsen's Weeping'		$30			orPh, orSR
Tsuga mertensiana		$1		$25		wa4C, canTf
	'Argentea'					
	'Blue Star'					
	'Bump's Blue'					
	'Elizabeth'		$30			orPh
	'Glauca'					
	'Glauca Fastigata'					
	'Van Winkle'					
Tsuga x jeffreyi	T. heterophyllaXT. mertensia					
Vaccinum alaskense		$4	$9			waWB, canTf
Vaccinum membranaceum		$4	$8			waBR, waWB, canTf
Vaccinium ovatum		$5	$8	$12		waBR, waSN, waWB, wa4C, canTf
	'Thunderbird'					
	'Thundercloud'					
	'6624'					
Vaccinium ovatum x V. mortinia						
Vaccinium oxycoccus						
Vaccinium parvifolium		$4	$8			waBR, waSN, waWB, canTf
	Unnamed dwarf selections					
	Reported variegated form					
Viburnum edule			$8	$14	$26	waWB, canTf
Viburnum ellipticum		$2				wa4C
Perennials						
Achlys triphylla		$2	$8			canTf
Aruncus sylvester		$2	$8			waSN, wa4C, canTf
Asarum caudatum		$2				waSN, canTf
	'Alba'					
Caltha biflora		$6				canTf
Caltha paulustris ssp. Asarifolia						
Camassia leichtlinii		$4	$8			waWB, canTf
	'Alba'		$8			canTf
	'Blue Danube'		$9			canTf
	'San Juan'		$8			canTf
	'Semi-plena'		$15			canTf
Camassia quamash		$2				waSN, canTf
	'Blue Melody'	$4				canTf
	'Orion'	$3				canTf
	'San Juan'	$3				canTf
Dodecatheon jeffreyi		$4	$8			waCol, waWB, canTf
Goodyera oblongfolia						
Iris tenax		$3	$7			waWB, canTf
Iris tenax var. gormanii						
Lilium columbianum		$4	$13			waWB, canTf
Maianthemum dilatatum		$2				waSN, waWB, canTf
	'Variegated Form'					
Oxalis oregana		$2				waSN, waWB, canTf
Sisyrinchium californicum		$4				waWB
Sisyrinchium douglasii		$5				canTf
	'Pink Form'					
	'White Form'					
Sisyrinchium macounii		$5				canTf
Smilacina racemosa		$2	$8			waSN, waWB, canTf
Smilacina stellata		$2				waSN, canTf
Tiarella trifoliata						
Trientalis latifolia		$3				canTf

Plant Price List

Trillium ovatum		$8	$14			waWB, orSR, canTf
	'Edith'					
Trillium o. 'Del Norte'	T. ovatum X T. rivale	$10				canTf
Trillium o. var. hibbersonii		$25				canTf
Trillium o. var. maculosum						
Trillium parviflorum		$8				canTf
Vancouveria hexandra		$2	$8			waSN, waWB, canTf
Xeropphyllum tenax		$7				waWB, orSR, canTf
Alpines						
Anemone drummondii		$5				waMT
Anemone occidentalis						
Antennaria media		$5				waMT
Arenaria sp						
	'Blue Cascade'	$5				waMT
Arenaria obtusiloba		$5				waMT
Arenaria rubella						
	'Popcorn'	$6				waMT
Cassiope mertensiana						
	'Mendenhall'	$8				waMT
	'Pink'					
C. mertensiana x C. lycopodiodes		$6				waMT
	'Muirhead'					
Claytonia lanceolata						
Claytonia megarhiza var. nivalis		$7				waMT
Douglasia laevigata var. ciliolata		$6				waMT
Douglasia laevigata var. laevigata		$6				waMT
	'Packwood'	$6				waMT
Douglasia laevigata X D. montana		$6				waMT
Dryas drummondii						
	'Grandiflora'	$5				waMT
Dryas octopetula		$5				orSR
	'Minor'	$5				waMT. orSR
Dryas X suendermannii		$5				waMT
Empetrum nigrum		$5				orSR
E. nigrum f. hermaphroditum		$5				orSR
Erigeron aureus		$5				orSR
	'The Giant'					
Erigeron aureus X E. compositus						
	'Goat Rocks'	$5				waMT
Erigeron linearis						
	'Rimrock'	$6				waMT
Kalmia microphylla		$7				waMT, orSR
Lewisia columbiana var rupicola		$5				waMT
Lewisia tweedyi		$8				waMT, orSR
Loiseleularia procumbens						
Lupinus lepidus var. lobii						
Penstemon cardwellii		$4				canTf
	'Floyd McMullen'					
	'Roseus'					
Penstemon confertus						
	'Dwarf Form'	$5				waMT
Penstemon davidsonii		$8				canTf
	'Albus'					
P. davidsonii var. davidsonii						
	'Mt. Adams Dwarf'	$5				waMT
P. davidsonii var. menziesii		$8				canTf
	'Broken Top Mountain'	$6				orSR
	'Microphyllus'	$6				orSR
	'Pink'					
	'Prostrate Form'					
	'Tatoosh Treasure'	$5				waMT
	'Tolmiei Peak'					
P. davidsonii X P. rupicola						
	'Dragontail'	$5				waMT
Penstemon procerus		$1				wa4C
	'Nisqually Cream'	$6				orSR
Penstemon procerus var. formosus						
Penstemon procerus ssp. tolmiei						
	'Alba'					
	'Hawkeye'	$5				waMT
	'Old Snowy'	$5				waMT
	'Tolmiei Peak'					
Penstemon rupicola						
	'Diamond Lake'	$6				orSR
	'Myrtle Hebert'	$6				orSR
	'White Form'	$5				waMT

Plant Price List

P. rupricola X P. cardwelli						
Penstemon rupicola X ?						
	'Puyallup Pink'	$5				waMT
Penstemon washingtonensis		$5				waMT, orSR
Petrophytum caespitosum		$5				orSR
Phlox diffusa		$6				waMT, canTf
	'Goat Rocks Pink'	$6				waMT
Phlox hendersonii		$6				waMT
Phlox hoodii var. canescens		$6				waMT
Phyllodoce empetriformis		$6				waMT
Phy. aleutica ssp. glanduliflora						
	'Flora Slack'	$6				waMT
Phyllodoce X intermedia	P. empetriformisXP. Gland..					
	'Anna Barbara'					
	'Drummondii'					
Potentilla fruiticosa						
	'Cascade Cushion'	$6				waMT
Salix arctica						
Salix reticulata						
Salix cascadensis						
Sedum divergens						
Sedum spathulifolium		$3				canTf
Sedum stenopetalum						
Silene acaulis		$3				canTf
	'Tatoosh'	$5				waMT
	'White Rabbit'	$5				waMT
Spirea densiflora		$1	$2			wa4C
Trillium petiolatum		$12				canTf