**The Bresemann Forest and Its Urban Environment**

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**Abstract**

A research study was completed, summer 2004, in the Bresemann forest to determine the health of the forest in terms of its plant diversity and distribution. This study looked at its classification as an urban forest in an attempt to determine the effects of its urban surrounding on the diversity and distribution of its plants. The forest was split into three areas dependent upon its differing human activity and possible influence. Based on the data collected the forest composition and age varies within different areas of the forest. Douglas Fir was the dominant species of tree, making up 71% of trees within the designated plots. A conclusion was unable to be made on the health of the Bresemann forest, since there was no baseline data to compare it to. Therefore the data collected in this study is now the baseline data allowing future comparisons of forest health.

## Introduction

With the continuing rise of the human population, the development of land has the potential to also rapidly increase. The United Nations has predicted that by the year 2030 60 percent of the world's population will reside in cities (World 2005). This increase in urban development will continue to fragment habitats and create habitats that "are basically islands in a sea of homes and businesses" (Barnes 1999). The effect of urban development on these habitat fragments is the question that was studied through research within the Bresemann Forest located one block west of the intersection between C Street and Military Road in Spanaway, Washington. Purchased in 1961 from the Bresemann family who operated a furniture factory, it is now owned by Pierce County. Once part of the vast Parkland Prairie, the Bresemann Forest is now considered an urban forest with trees around 100 years, the oldest tree is a Red Cedar at 350 years (MacFarland 2001).

The urban and residential environment surrounding the Bresemann forest has the possibility of changing many different aspects within the forest. This study solely focused on the effect urban development has on the plant diversity, distribution, tree health, and woody debris within the forest. The hypothesis of this study was to find little plant diversity with a high increase in invasive species, mainly Himalayan Blackberry (*Rubus discolor*) and English Ivy (*Hedera helix*), within areas of increasing human impact, the roadside and the residential plots. The health of the trees is also likely to decrease inside the plots with increasing human impact. Amount of woody debris, a critical part of the nutrient cycle, will decrease with the increase in human management. For example, the plots along the trails, both roadside and residential plots, and around the residential neighborhood will have a decrease in woody debris.

## Methods

An inventory of the plants found in the Bresemann forest was conducted using the U.S. Forest Service's method. Each plot had a radius of 7.32 m (24 ft) and their centers were at least 120 m away from the previous plot. These plots were then used to inventory

the number and type of trees, data on each tree included, type, location, and health. Within each of the plot sites there were three vegetation quadrats 1.0 $m^2$ , where all vegetation was recorded. These quadrats were located on the North, Southeast, and Southwest points within the plots, 120$^o$ away from the previous quadrat.

To choose the six sites that were researched, the forest was broken down into three areas: the area along Military Road, the area along residential houses, and the area inside the forest with the least human interaction (Figure 1). In each area two sites were measured to quantify the plant diversity, distribution, tree health, and down woody debris within that area.

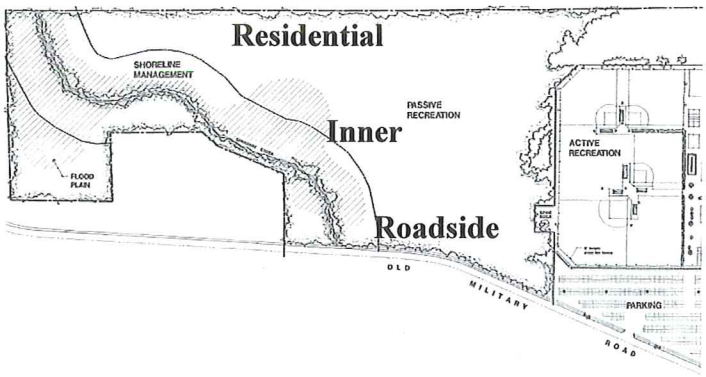


Figure 1: Map of the Bresemann Forest indicating: the roadside plots, residential plots, and the inner plots.

Three areas were studied within each plot: trees, understory vegetation, and the woody debris. When looking at trees three variables were studied: tree diversity, tree distribution, and overall tree health. The understory vegetation was measured to determine diversity, density, and the invasive/non-native vs. native ratio. Lastly the downed woody debris looked at the percent of the ground covered by woody debris and its stage of decay.

The classification used by the U.S. Forestry Department was used to determine overall tree health and woody debris. Overall tree health is classified using the numbers one through five:

| | |
|---|---|
| 1 | Live and healthy |
| 2 | Live and unhealthy |
| 3 | Dead with needles and twigs |
| 4 | Dead no needles or twigs |
| 5 | Dead no branches |

The classification of down woody debris follows the same pattern:

| | |
|---|---|
| Log Class 1 | Contains branches, twigs, and needles |
| Log Class 2 | Contains branches, no twigs nor needles |
| Log Class 3 | No branches, twigs nor needles; partly decomposed |
| Log Class 4 | Half way decomposed |
| Log Class 5 | Mostly decomposed |

**Results**

Trees

Within the six plots inventoried there were only three trees identified. Those three trees were: Douglas Fir (*Pseudotsuga menziesii*), Western Yew (*Taxus brevifolia*), and Beaked Hazelnut (*Corylus cornuta*). Douglas Fir dominated the forest, representing 71 percent of the trees(Figures 2-4). The health of the trees ranged from a one to a five and everything in between (Figures 5-7).

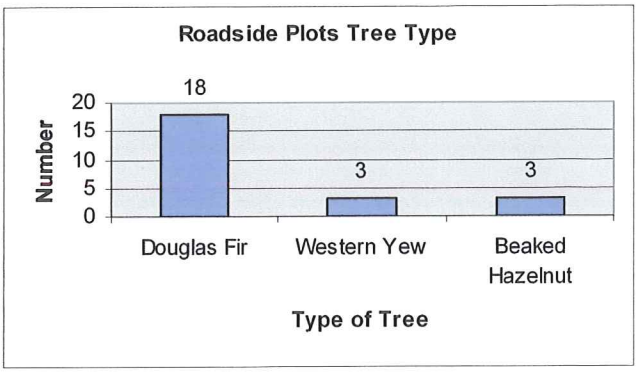


Figure 2: Tree type and number in roadside plots

Vegetation

Each plot had a wide diversity of understory plant vegetation. The roadside plots had the least amount of diversity, being dominated by the native Snowberry (*Symphoricarpos albus)* and the invasive/non-native Himalayan Blackberry (*Rubus discolor*). The residential plots showed the most diversity in understory vegetation. Three species dominated the inner plots: native Trailing Blackberry (*Rubus hispidus*), native Vine Maple (*Acer Circinatum*), and native False Solomon's Seal (*Smilacina Racemosa*) (Figures 8-10).

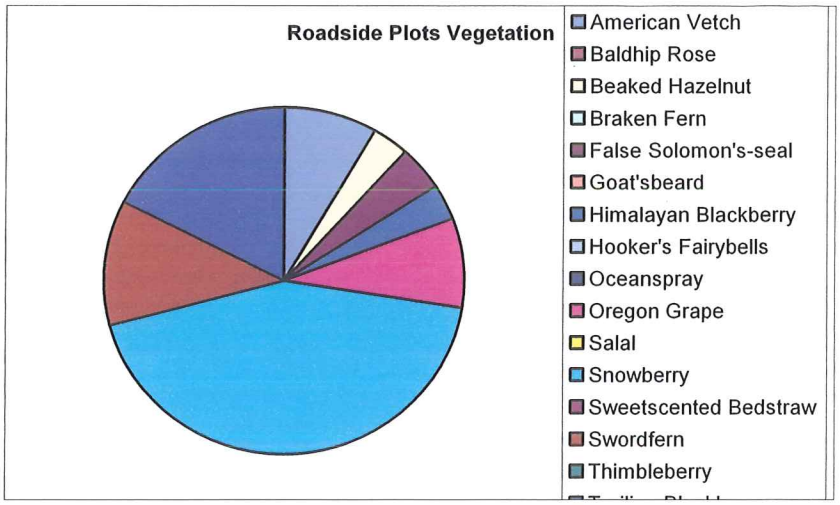


Figure 8: Understory vegetation in the roadside plots

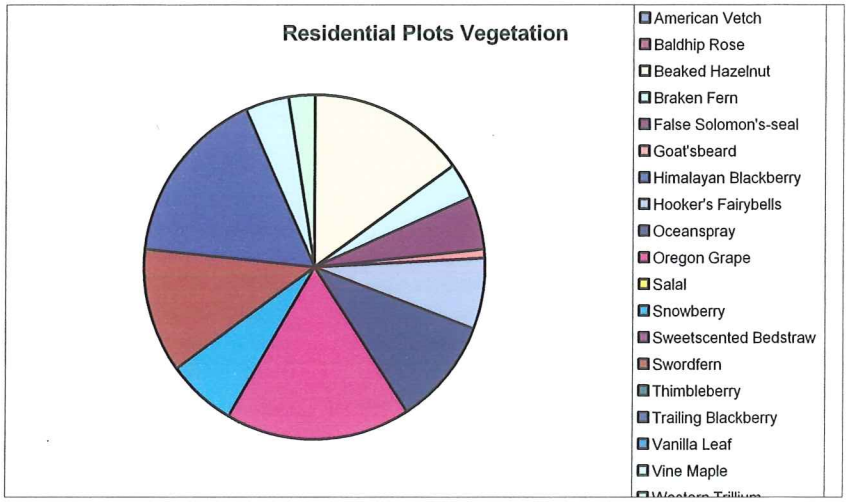


Figure 9: Understory vegetation in the residential plots

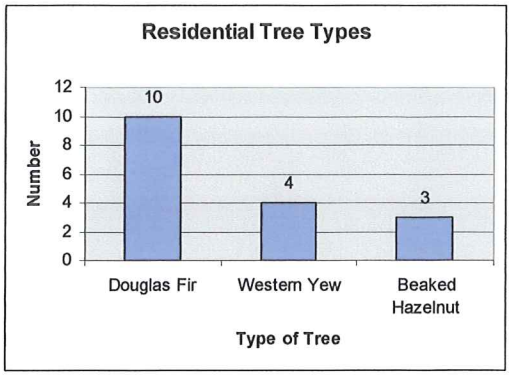


Figure 3: Tree type and number in residential plots

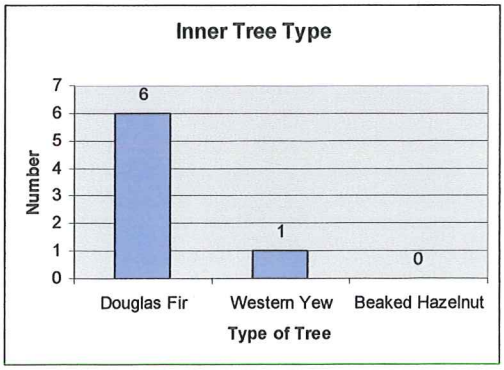


Figure 4: Tree type and number in the inner plots

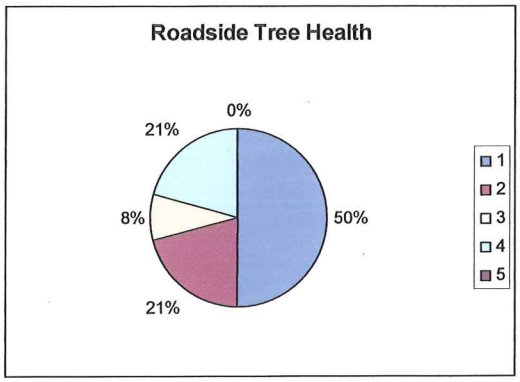


Figure 5: Tree health in roadside plots

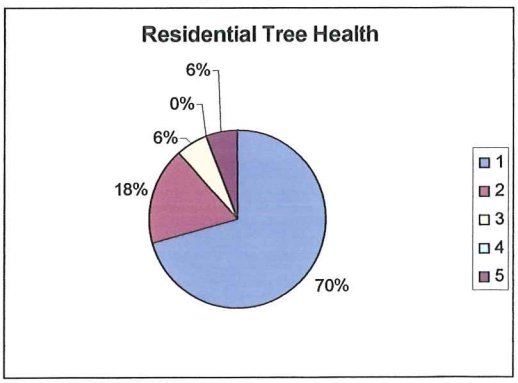


Figure 6: Tree health in residential plots

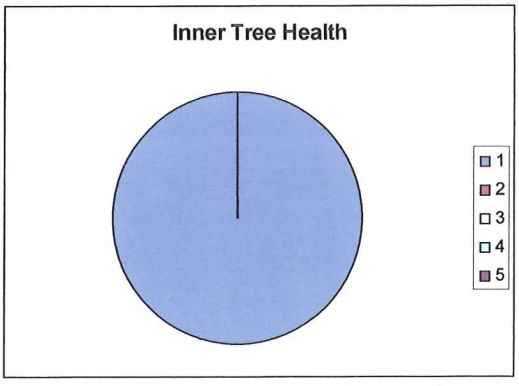


Figure 7: Tree health in inner plots

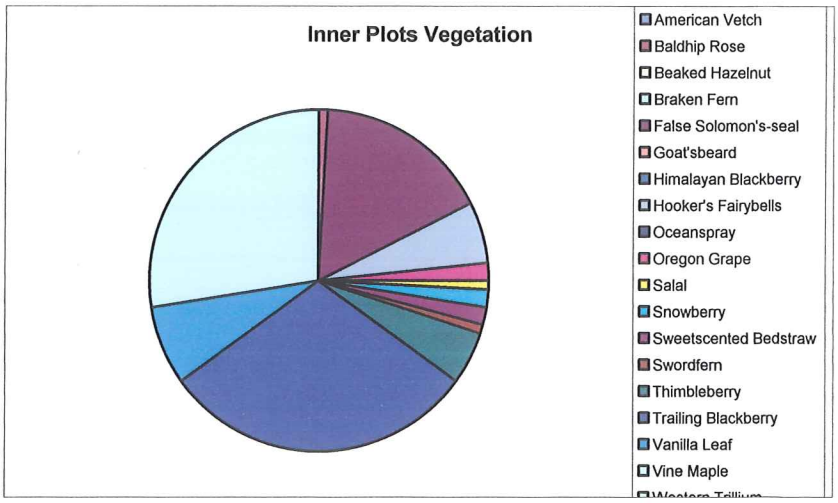


Figure 10: Understory vegetation in the inner plots

Woody Debris

The inner plots had the most evenly distributed woody debris, however neither plot contained Log Class 1. Both Log Class 1 and no debris dominated the roadside plots and the residential plots (Figure 11-13).

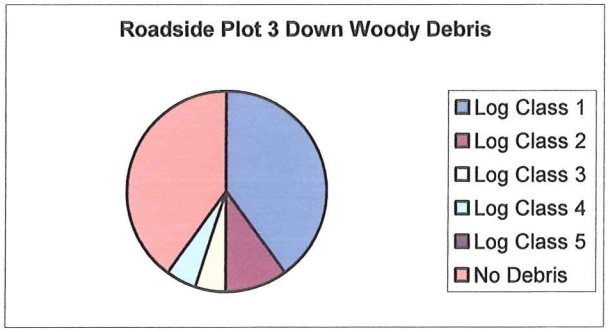


Figure 11: Woody debris in a roadside plot

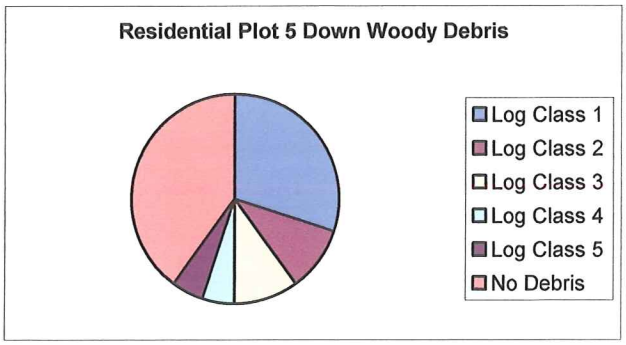


Figure 12: Woody debris in residential a plot

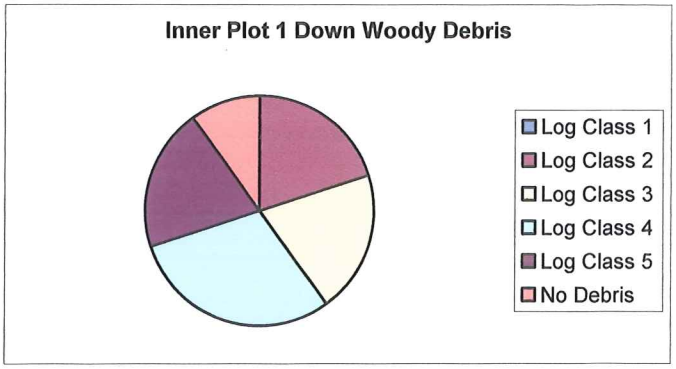


Figure 13: Woody debris in an inner plot

**Discussion**

There was one main tree species within the forest, the Douglas Fir, at 71 percent. This is one of the most common trees in the Pacific Northwest and it was no surprise to see it dominating this area. The trees within the plots also appeared to be around the same age, 90-100 years old, this is not necessarily typical of an undisturbed forest. Within an undisturbed forest variance among age is typical and healthy. Since this whole area was logged around 100 years ago, these trees appear to be the seedlings planted afterwards. However, since no cores were taken from the tree, the age of the trees are just rough estimates based on the trunk size and height, which may vary greatly depending on differing growing conditions from year to year.

A decrease in the number of trees occurred from the roadside plots to the residential plots, and the inner plots (Figures 2-4). This decrease may be caused by the faster maturation of the residential and inner plots in the Understory Reinitiation stage of development. The Understory Reinitiation stage is stage four out of five in forest reclamation and is characterized by gaps in the canopy that allows light to penetrate to the ground. Canopy gaps are caused by a tree that has fallen or has died. By allowing light to penetrate the bottom, understory vegetation that is less shade tolerant is able to establish.

The health of the trees helps to determine the amount of stress and type of conditions that the trees are living in. Health was determined by leaf/needle color, visible damage to the leaf/needles, canopy cover, sap visible on the tree, scars, and insects. The trees in the inner plots are the healthiest, with all trees being categorized as a one. The next healthiest trees are the ones within the residential plots and lastly the ones within the roadside plots (Figures 5-7). The trees within the inner plot have the least amount of human induced stress, as they are buffered from the potential effects of the road and the houses on either side. Hiking trails are the only human induced impact that is visible and even then it took some off trailing to get to the inner plots. The decrease in health of the trees from the inner plots to the residential plots and then to the roadside plots may be caused by the increase in human impact. The road offers the highest amount of human impact due to the constant traffic and absence of vegetation, whereas the residential area has little traffic and still maintains a minimal to moderate amount of natural vegetation. However, with no previous data to compare our data with, it is impossible to know whether the health and diversity of trees has changed due to the increasing human impact and urban development.

The vegetation seems to be less affected by the increasing/changing human impact from area to area. Each maintains a somewhat diverse mix of vegetation, but once again with nothing to compare this data to it is impossible to know whether the area is losing, gaining, or maintaining the same amount of plant diversity. Even though the residential plots contain the highest amount of diversity, the numbers are so miniscule indicating little difference between the vegetation diversity. This may mean that the human impact is minimal on vegetation diversity and distribution, but before any conclusions are made another study and a more in-depth study should be conducted.

The type and amount of woody debris is important when looking at the health of the forest. When decomposed, woody debris reinvests the nutrients it once used to grow and develop back into the forest's ecosystem. This is a very important part of the forest's lifecycle and if removed will leave the forest nutrient deprived. Log Class 1 and no debris dominated both the roadside and residential plots. The increased human management and use along the trails may cause the loss of woody debris in the plots that boarder the roadside and residential plots. Woody debris that falls or even before it falls in these areas may be removed to avoid potential harm to surrounding property, people, and trails. This risk management could cost the forest essential nutrients that are needed for its survival.

**Conclusion**

With the lack of previous data no real conclusions can be made, only speculations and possible connections. This data, however, is a good set of baseline data that will allow future comparisons and connections. It does appear that there is an increase in stress on the trees from the inner plots to the roadside plots that may be indicating the increasing human impact between those three areas. Little difference was found between the vegetation within each of the plots, showing little to no affect of increasing human impact. There was an increase in woody debris from the inner to the roadside plots. A continuation of this study is needed to find the potential impact that the urban environment has on isolated habitats found inside. It is important that more research is conducted in this area, as the impacts of urban development are only likely to increase in the years to come.

## Bibliography


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**Roadside Plots**

**Plot 7**

| Tree Type | |
|---|---|
| Douglas Fi | 6 |
| Western Y | 1 |
| Beaked Ha | 0 |
| Total | 7 |

| Tree Health | |
|---|---|
| 1 | 4 |
| 2 | 2 |
| 3 | 1 |
| 4 | 0 |
| 5 | 0 |

| Woody Debris | |
|---|---|
| Log Class | 70% |
| Log Class : | 5% |
| Log Class : | 5% |
| Log Class - | 0% |
| Log Class : | 0% |

**Plot 3**

| Tree Type | |
|---|---|
| Douglas Fi | 12 |
| Western Y | 2 |
| Beaked Ha | 3 |
| Total | 17 |

| Tree Health | |
|---|---|
| 1 | 8 |
| 2 | 3 |
| 3 | 1 |
| 4 | 5 |
| 5 | 0 |

| Woody Debris | |
|---|---|
| Log Class | 40% |
| Log Class : | 10% |
| Log Class : | 5% |
| Log Class - | 5% |
| Log Class : | 0% |

**Residential Plots**

**Plot 2**

| Tree Type | |
|---|---|
| Douglas Fi | 6 |
| Western Y | 4 |
| Beaked Ha | 0 |
| Total | 10 |

| Tree Health | |
|---|---|
| 1 | 7 |
| 2 | 1 |
| 3 | 1 |
| 4 | 0 |
| 5 | 1 |

| Woody Debris | |
|---|---|
| Log Class | 40% |
| Log Class : | 10% |
| Log Class : | 5% |
| Log Class - | 5% |
| Log Class : | 0% |

**Plot 5**

| Tree Type | |
|---|---|
| Douglas Fi | 4 |
| Western Y | 0 |
| Beaked Ha | 3 |
| Total | 7 |

| Tree Health | |
|---|---|
| 1 | 5 |
| 2 | 2 |
| 3 | 0 |
| 4 | 0 |
| 5 | 0 |

| Woody Debris | |
|---|---|
| Log Class | 30% |
| Log Class : | 10% |
| Log Class : | 10% |
| Log Class - | 5% |
| Log Class : | 5% |

**Inner Plots**

**Plot 1**

| Tree Type | |
|---|---|
| Douglas Fi | 3 |
| Western Y | 1 |
| Beaked Ha | 0 |
| Total | 4 |

| Tree Health | |
|---|---|
| 1 | 4 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 5 | 0 |

| Woody Debris | |
|---|---|
| Log Class | 0% |
| Log Class : | 20% |
| Log Class : | 20% |
| Log Class - | 30% |
| Log Class : | 20% |

**Plot 2**

| Tree Type | |
|---|---|
| Douglas Fi | 3 |
| Western Y | 0 |
| Beaked Ha | 0 |
| Total | 3 |

| Tree Health | |
|---|---|
| 1 | 3 |
| 2 | 0 |
| 3 | 0 |
| 4 | 0 |
| 5 | 0 |

| Woody Debris | |
|---|---|
| Log Class | 0% |
| Log Class : | 15% |
| Log Class : | 25% |
| Log Class - | 25% |
| Log Class : | 5% |

## ROAD PLOTS

**Plants Present** | **Percent dominance of monitored plants present** | **ROAD**

| Name | Plot #7, Site #1 | Site #2 | Site #3 | Plot #3, Site #1 | Site #2 | Site #3 | OVERALL |
|---|---|---|---|---|---|---|---|
| American Vetch | 0 | 0 | 0 | 0 | 0.5 | 0 | 0.083333 |
| Baldhip Rose | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Beaked Hazelnut | 0 | 0.2 | 0 | 0 | 0 | 0 | 0.033333 |
| Braken Fern | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| False Solomon's-seal | 0 | 0 | 0 | 0.25 | 0 | 0 | 0.041666 |
| Goat'sbeard | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Himalayan Blackberry | 0 | 0.1 | 0.1 | 0 | 0 | 0 | 0.033333 |
| Hooker's Fairybells | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oceanspray | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oregon Grape | 0.3 | 0 | 0.2 | 0 | 0 | 0 | 0.083333 |
| Salal | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Snowberry | 0.3 | 0.7 | 0.6 | 0.1 | 0.3 | 0.6 | 0.433333 |
| Sweetscented Bedstraw | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Swordfern | 0.3 | 0 | 0 | 0.4 | 0 | 0 | 0.116666 |
| Thimbleberry | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trailing Blackberry | 0.1 | 0 | 0.1 | 0.25 | 0.2 | 0.4 | 0.175 |
| Vanilla Leaf | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vine Maple | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Western Trillium | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Totals:** | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## HOUSE PLOTS

**Plants Present** | **Percent dominance of monitored plants present** | **HOUSES**

| Name | Plot #2, Site #1 | Site #2 | Site #3 | Plot #5, Site #1 | Site #2 | Site #3 | OVERALL |
|---|---|---|---|---|---|---|---|
| American Vetch | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Baldhip Rose | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Beaked Hazelnut | 0 | 0.5 | 0 | 0 | 0.4 | 0 | 0.15 |
| Braken Fern | 0.2 | 0 | 0 | 0 | 0 | 0 | 0.033333 |
| False Solomon's-seal | 0 | 0.3 | 0 | 0 | 0 | 0 | 0.05 |
| Goat'sbeard | 0 | 0 | 0 | 0 | 0.05 | 0 | 0.008333 |
| Himalayan Blackberry | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hooker's Fairybells | 0.05 | 0 | 0.35 | 0 | 0 | 0 | 0.066666 |
| Oceanspray | 0.6 | 0 | 0 | 0 | 0 | 0 | 0.1 |
| Oregon Grape | 0 | 0.15 | 0.6 | 0.3 | 0 | 0 | 0.175 |
| Salal | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Snowberry | 0 | 0 | 0 | 0 | 0.4 | 0 | 0.066666 |
| Sweetscented Bedstraw | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Swordfern | 0 | 0 | 0 | 0.7 | 0 | 0 | 0.116666 |
| Thimbleberry | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Trailing Blackberry | 0.1 | 0 | 0.05 | 0 | 0.15 | 0.7 | 0.166666 |
| Vanilla Leaf | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vine Maple | 0.05 | 0.05 | 0 | 0 | 0 | 0.15 | 0.041666 |
| Western Trillium | 0 | 0 | 0 | 0 | 0 | 0.15 | 0.025 |
| **Totals:** | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## CONTROL PLOTS

| Plants Present | Percent dominance of monitored plants present | | | | | | CONTROL |
|---|---|---|---|---|---|---|---|
| **Name** | **Plot #1, Site #1** | **Site #2** | **Site #3** | **Plot #2, Site #1** | **Site #2** | **Site #3** | **OVERALL** |
| American Vetch | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Baldhip Rose | 0 | 0.05 | 0 | 0 | 0 | 0 | 0.008333 |
| Beaked Hazelnut | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Braken Fern | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| False Solomon's-seal | 0.2 | 0 | 0 | 0.15 | 0.05 | 0.6 | 0.166666 |
| Goat'sbeard | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Himalayan Blackberry | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hooker's Fairybells | 0 | 0 | 0 | 0.15 | 0 | 0.2 | 0.058333 |
| Oceanspray | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Oregon Grape | 0 | 0 | 0 | 0 | 0 | 0.1 | 0.016666 |
| Salal | 0 | 0.05 | 0 | 0 | 0 | 0 | 0.008333 |
| Snowberry | 0 | 0.05 | 0 | 0 | 0.05 | 0 | 0.016666 |
| Sweetscented Bedstraw | 0 | 0 | 0 | 0 | 0.1 | 0 | 0.016666 |
| Swordfern | 0 | 0.05 | 0 | 0 | 0 | 0 | 0.008333 |
| Thimbleberry | 0 | 0 | 0 | 0 | 0.3 | 0 | 0.05 |
| Trailing Blackberry | 0.3 | 0.5 | 0.45 | 0.2 | 0.25 | 0.1 | 0.3 |
| Vanilla Leaf | 0 | 0 | 0.45 | 0 | 0 | 0 | 0.075 |
| Vine Maple | 0.5 | 0.3 | 0.1 | 0.5 | 0.25 | 0 | 0.275 |
| Western Trillium | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| **Totals:** | 1 | 1 | 1 | 1 | 1 | 1 | 1 |

## ROAD PLOTS

| Plants Present Name | ROAD OVERALL |
|---|---|
| American Vetch | 0.083333333 |
| Baldhip Rose | 0 |
| Beaked Hazelnut | 0.033333333 |
| Braken Fern | 0 |
| False Solomon's-seal | 0.041666667 |
| Goat'sbeard | 0 |
| Himalayan Blackberry | 0.033333333 |
| Hooker's Fairybells | 0 |
| Oceanspray | 0 |
| Oregon Grape | 0.083333333 |
| Salal | 0 |
| Snowberry | 0.433333333 |
| Sweetscented Bedstraw | 0 |
| Swordfern | 0.116666667 |
| Thimbleberry | 0 |
| Trailing Blackberry | 0.175 |
| Vanilla Leaf | 0 |
| Vine Maple | 0 |
| Western Trillium | 0 |

## HOUSE PLOTS

| Plants Present Name | HOUSES OVERALL |
|---|---|
| American Vetch | 0 |
| Baldhip Rose | 0 |
| Beaked Hazelnut | 0.15 |
| Braken Fern | 0.033333333 |
| False Solomon's-seal | 0.05 |
| Goat'sbeard | 0.008333333 |
| Himalayan Blackberry | 0 |
| Hooker's Fairybells | 0.066666667 |
| Oceanspray | 0.1 |
| Oregon Grape | 0.175 |
| Salal | 0 |
| Snowberry | 0.066666667 |
| Sweetscented Bedstraw | 0 |
| Swordfern | 0.116666667 |
| Thimbleberry | 0 |
| Trailing Blackberry | 0.166666667 |
| Vanilla Leaf | 0 |
| Vine Maple | 0.041666667 |
| Western Trillium | 0.025 |

## CONTROL PLOTS

| Plants Present Name | CONTROL OVERALL |
|---|---|
| American Vetch | 0 |
| Baldhip Rose | 0.008333333 |
| Beaked Hazelnut | 0 |
| Braken Fern | 0 |
| False Solomon's-seal | 0.166666667 |
| Goat'sbeard | 0 |
| Himalayan Blackberry | 0 |
| Hooker's Fairybells | 0.058333333 |
| Oceanspray | 0 |
| Oregon Grape | 0.016666667 |
| Salal | 0.008333333 |
| Snowberry | 0.016666667 |
| Sweetscented Bedstraw | 0.016666667 |
| Swordfern | 0.008333333 |
| Thimbleberry | 0.05 |
| Trailing Blackberry | 0.3 |
| Vanilla Leaf | 0.075 |
| Vine Maple | 0.275 |
| Western Trillium | 0 |